



Master Transportation Study

Leitrim Community

FINAL REPORT



Prepared for the Leitrim Owners Group
by IBI Group

March 2017

Document Control Page

CLIENT:	Leitrim Owners Group
PROJECT NAME:	Leitrim Community Development
REPORT TITLE:	Leitrim Community Master Transportation Study
IBI REFERENCE:	103500
VERSION:	3.0
DIGITAL MASTER:	J:\103500_LeitrimMTS\5.2 Reports\5.2.4 Transportation\5.2.4.5 Traffic Impact\2017-03-08-Final Report\TTR_LeitrimMTS_2017-03-08_Final.docx\2017-03-15
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HISTORY:	1.0. Draft Results Memo – December 2016 2.0. Draft MTS Report – January 2017 2.1. Final Draft MTS Report – February 2017 3.0. Final Report – March 2017

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1 Introduction

The Leitrim Owners Group (LOG) is comprised of four separate developers/ owners in the Leitrim Community: Tartan Land Consultants, The Regional Group, Claridge Homes and Urbandale Corporation. IBI Group had previously been retained by each individual developer/ owner to provide a Transportation Impact Study in support of each individual development application. In 2016, IBI Group and the LOG, in agreement with City of Ottawa staff, initiated the Leitrim Community Master Transportation Study (MTS) to support development applications for each owner in a unified document.

The City of Ottawa completed the Bank Street Environmental Assessment (EA) in 2014, which formed the basis for future modifications along the Bank Street corridor. The purpose of the MTS is to determine the appropriate timing/ staging of EA recommended modifications based on more precise and up-to-date development data provided by the LOG.

The extent of the study area and key study area intersections are shown in **Exhibit 1**.

1.1 Study Objectives

The primary objective of the MTS is to assess existing and future traffic operations along the Bank Street corridor between Leitrim Road and the Urban Boundary, and to determine the scope and timing of mitigation measures required to accommodate traffic generated by the proposed developments. The specific study objectives included:

- Determine the impact of the following proposed developments on the Bank Street corridor in support of the corresponding development application:
 - Barrett Lands Development (3100 Leitrim Road);
 - Barrett Extension Lands Development (4660 Bank Street);
 - Findlay Creek Stage 2 Phase 4C Development (4798 Bank Street);
 - OPA 76 Areas 9a and 9b Development (4791, 4789 and 4771 Bank Street);
 - OPA 76 Area 8A Development - Idone Lands (4840 Bank Street); and,
 - Remer Lands Development (4800 Bank Street).
- Confirm the timing of the Bank Street EA recommended roadway modifications using current development projections;
- Identify any interim deficiencies in the road network and develop interim recommendations to mitigate these deficiencies prior to implementation of the Bank Street EA recommended modifications; and,
- Provide a preliminary cost estimate of recommended roadway modifications, both interim and ultimate.

1.2 Study Methodology

The MTS approach and methodology was based on the City of Ottawa Transportation Impact Assessment Guidelines (October 2006). City of Ottawa staff were consulted to confirm the following study parameters and assumptions:

- Study Area Limits
- Future Horizons
- Existing Traffic Counts
- Traffic Growth Rate Assumptions
- Future Road Network Assumptions
- Trip Generation Rates and Trip Distribution Assumptions
- Intersection Capacity Analysis Methodology

Existing peak hour turning movement counts were provided by the City of Ottawa. Future traffic volumes were estimated by applying a growth factor to existing traffic counts.

EXHIBIT 1 – Study Area

Local trip generation rates were developed and used to estimate future peak hour development traffic volumes. The intersection capacity analysis was completed using Synchro v9.0 analysis software. Roundabout analysis was completed using SIDRA analysis software. Both programs use the methodology from the Highway Capacity Manual 2010 (HCM). The criteria for evaluating intersection capacity were based on the City Guidelines.

The primary guiding document for future infrastructure requirements along Bank Street was the Bank Street Widening Class Environmental Assessment Study, completed by AECOM in 2014.

1.3 Reference Material

The following reference material was used in the preparation of this report:

- City of Ottawa Transportation Impact Assessment Guidelines (2006)
- City of Ottawa Transportation Master Plan (May, 2013) - **TMP**
- City of Ottawa 2014 City-Wide Development Charge Projects (2014) – **2014 DC Study**
- City of Ottawa Environmental Study Report – Bank Street Widening Class Environmental Assessment Study (July, 2014) – **Bank Street EA**
- TRANS Committee 2011 NCR Household OD Survey (January, 2013) – **OD Study**
- Ministry of Transportation Ontario: Geometric Design Guidelines (1985) – **MTO Design Guide**
- Transportation Association of Canada: Design Guide for Canadian Roads (1999) – **TAC Design Guide**
- OPA 76 Areas 9a and 9b Community Transportation Study (April 2014), IBI Group – **OPA Lands CTS**
- Barrett Lands Subdivision Community Transportation Study (March 2014), IBI Group – **Barrett Lands CTS**
- Barrett Extension Lands Community Transportation Study (August 2016), IBI Group – **Barrett Ext CTS**
- Remer Lands Community Transportation Study (May, 2016), IBI Group – **Remer Lands CTS**

2 Proposed Developments

2.1 Site Characteristics

The LOG intends to develop over 4,000 residential units and approximately 40 acres of commercial lands within the Leitrim Community. The majority of this land is currently undeveloped. The subject lands are concentrated along Bank Street from Leitrim Road to the Urban Boundary, approximately 500m south of Blais Road.

The proposed development lands comprise several individual subdivisions corresponding to different land owners. The most recent draft plans for each subdivision were amalgamated into a single plan as shown in **Exhibit 2**. The names of each subdivision and their corresponding statistics have been summarized in **Table 1**.

Table 1: Development Area Characteristics

DEVELOPMENT	# OF UNITS	COMMERCIAL SIZE (acres)
Barrett Lands	797	-
Barrett Lands Extension	150	-
Findlay Creek Stage 2 Phase 4C	240	-
Transport Canada Lands	231	-
OPA 76 Areas 9a and 9b	1,319	17 ¹
Remer and Idone Lands	1,155	26 ¹
Total	4,202	

Notes:

1 - Approximate area.

The proposed development lands are expected to develop at a rate of approximately 300 units per year between 2017 and 2031. The precise order of development is not known at this time, however it is expected that all access intersections will be constructed by 2019.

2.2 Internal Road Network

A brief summary of the proposed internal road networks for each subdivision has been provided in this section.

2.2.1 Barrett Lands and Barrett Lands Extension

The Barrett Lands Subdivision development, located at 3100 Leitrim Road, proposes a total of four access roads: one all-movements access onto the proposed Kelly Farm Drive extension, two onto Leitrim Road and one onto Bank Street at the existing Rotary Way intersection. Street 1 (Barrett Farm Drive) is a proposed minor east-west collector road through the site that will connect Bank Street to Kelly Farm Drive.

The Barrett Land Extension development, located at 4660 Bank Street, proposes only one direct connection to the adjacent road network via a new intersection with the future Kelly Farm Drive extension. A secondary access will be provided through the Barrett Lands community immediately to the north, ultimately connecting to Leitrim Road. This secondary access will connect internally to the proposed Street 1 (Barrett Farm Drive).

Street 1 will be constructed with a 24m right-of-way (ROW), capable of supporting transit service. The remaining streets within the Barrett Lands will be local roadways constructed to an 18m ROW. The existing 24m ROW on Kelly Farm Drive will be maintained throughout the development.

EXHIBIT 2 – Proposed Development Lands

2.2.1 Findlay Creek Stage 2 Phase 4C and Transport Canada Lands

The Findlay Creek Stage 2 Phase 4C (3100 Leitrim Road) and Transport Canada Lands (4798 Bank Street) will be accessible from both north and south of Cedar Creek Drive. Cedar Creek Drive connects to existing Findlay Creek Phases to the north, and a new eastbound approach will be constructed at Blais Road for a direct connection to Bank Street. This new connection, Street 14, will be constructed as a collector roadway along the southern part of the development area before curving southwest into the Remer Lands Development.

Street 14 will have a 26m wide ROW and will be capable of supporting transit service. Both Cedar Creek Drive and Sora Way will have a 20m ROW. Single loaded local streets will be constructed with a 14m wide ROW. Double loaded local streets will be constructed with a 16.5m ROW.

2.2.2 OPA 76 Areas 9a and 9b

The OPA Areas 9a and 9b development comprises two separate subdivisions owned by Urbandale and Claridge. The municipal addresses of each subdivision are: 4791 and 4789 Bank Street respectively. The primary access to the development area will be Street 1, a proposed east-west collector road that will connect to the existing signalized intersection at Bank Street and Findlay Creek Drive. There will also be a north-south collector road within the development that connects Street 1 to Rotary Way to the north. Both collector roads will have a 24m wide ROW, capable of supporting transit service.

A second access to Bank Street, designated Street 2, will be provided opposite the Findlay Creek Commercial Centre approximately 300m south of Street 1. Street 2 will be designated a local road. All local roadways in the development will have 18m wide ROW.

Vehicular access to Analdea Street from the east/ within the community is prohibited, which prevents vehicles from within the community using Analdea Street to access/ egress Bank Street. The connection is blocked by signs and a gate; however, pedestrians and cyclists are permitted to cross. The intersection analysis later in this report shows that the proposed accesses to Bank Street at Street 1, Street 2 and Rotary Way will be sufficient to accommodate future development traffic.

The most recent mixed-use commercial blocks are not available at this time. The potential for right-in right-out access off Bank Street to either commercial block will be reviewed during the site plan application.

2.2.1 Remer and Idone Lands

The Remer and Idone Lands development will be located at 4800 and 4840 Bank Street respectively. The Remer Lands development proposes two new access intersections, both of which will provide direct access to Bank Street, and two commercial blocks that will have direct access to Bank Street. The Idone Lands development will be located directly south of the Remer Lands, and will share the Remer Lands accesses. A commercial block is also proposed within the Idone Lands that will have direct right-in right-out access to Bank Street.

Street 14 (as discussed in the Findlay Creek Stage 2 Phase 4C lands) is a proposed east-west collector roadway that will extend from Blais Road west of Bank Street, within the Remer Lands property. This collector road will generally run along the northern part of the Remer Lands, before curving southwest to tie into Street 6, the other proposed major collector road proposed within this development.

Street 6 will intersect with Bank Street approximately 400m south of Street 14. Both collector roads will have a 24m wide Right-of-Way (ROW) and will be capable of supporting transit service. Proposed local streets in the development will be constructed with an 18m wide ROW.

The existing Kelly Farm Drive collector road will extend south from its current terminus within the Findlay Creek development to the south limit of the Idone Lands. This road will temporarily end at this point, but may be extended further south to serve future developments as required.

EXHIBIT 3 – Potential Transit Routes

2.3 Transit, Pedestrian and Cycling Facilities

The extension of existing transit routes and/ or the addition of new routes can ensure adequate coverage for proposed developments in the Leitrim Community. Transit service can be extended along Bank Street, Findlay Creek Drive and Kelly Farm Drive to serve all development on the west side of Bank Street. A new service route can be added to service proposed developments on the east side of Bank Street via the OPA Street 1 access that connects to Rotary Way.

Potential transit service routes have been highlighted in **Exhibit 3**. The implementation of transit service to the area will be developed and refined further with OC Transpo staff during the approvals process for each proposed development.

It is expected that as the Leitrim Community builds out, existing gaps in the pedestrian and cycling network along Bank Street will be filled, based on the recommended designs in the Bank Street EA. Internal collector roadways and some local roadways will also provide sidewalks to facilitate connections to local parks, pathways and community attractions. No dedicated cycling facilities are planned within any of the proposed developments at this time.

2.4 Transportation Demand Management

The City of Ottawa is committed to implementing Transportation Demand Management (TDM) measures on a City-wide basis in an effort to reduce the automobile dependence of Ottawa residents, particularly during the weekday peak travel periods. TDM initiatives are aimed at encouraging individuals to use non-auto modes of travel during the peak periods.

The developments included in this MTS will conform to the City's TDM principles by providing direct connections to adjacent pedestrian, cycling and transit facilities. The collector roads have been designed with sufficient right-of-way width to accommodate the routing of buses through the developments. Sidewalks and appropriate pedestrian connections have been provided on collector and local roadways where necessary to facilitate access to local parks, pathways and local attractions.

3 Existing Transportation Network

3.1 Existing Road Network

3.1.1 Roadways

Bank Street is the main arterial roadway in the study area from which all proposed developments will access the area road network. **Table 1** provides a summary of all existing roadways within the study area.

TABLE 1 – Existing Road Network Details

ROADWAY	POSTED SPEED LIMIT	CLASSIFICATION	RIGHT-OF-WAY (ROW) WIDTH	CROSS-SECTION	APPLICABLE SEGMENT
Bank Street	70 km/h	Arterial Road	44.5 m <i>Note: An additional 5.0m on the rural side may be required to construct a rural cross-section.</i>	2-Lanes (South of Leitrim Road)	Leitrim Road to the southern urban development boundary
Leitrim Road	60 km/h	Arterial Road	35.5m <i>Note: An additional 5.0m on the rural side may be required to construct a rural cross-section.</i>	2-Lane, Undivided	Leitrim urban area- west limit to Leitrim urban area- east limit
Rotary Way	50 km/h	Collector Road	26 m	2-lane Undivided	Bank Street to Analdea Drive
White Alder Avenue	50 km/h	Rural Collector Road	26 m	2-lane Undivided	Bank Street to Findlay Creek Drive
Analdea Drive	50 km/h	Rural Collector Road	26 m	2-lane Undivided	Analdea Drive to Rotary Way
Findlay Creek Drive	50 km/h	Collector Road	30 m	2-Lane, Undivided	Albion Road to Bank Street
Blais Road	50 km/h	Rural Collector Road	26 m	2-Lane, Undivided	Bank Street to Hawthorne Road

Notes: The above information was referenced from the Ottawa Official Plan (November 2013)

Exhibit 4 presents the existing lane configurations, auxiliary lane storage lengths and type of traffic control for intersections analysed in this report, as confirmed on site.

3.1.2 Study Area Intersections

The following existing intersections have been analysed as part of this study:

- Bank Street and Leitrim Road
- Bank Street and Rotary Way
- Bank Street and White Alder Avenue/ Analdea Avenue
- Bank Street and Findlay Creek Drive
- Bank Street and Findlay Creek Shopping Centre Access
- Bank Street and Blais Road

All study area intersections are signalized except for Blais Road. The Bank Street intersections with Rotary Way, Findlay Creek, Findlay Creek Centre and Blais Road are all T-intersections. The existing lane configurations with existing storage lengths are shown in **Exhibit 4**.

EXHIBIT 4 – Existing (2016) Lane Configurations and Intersection Controls

3.2 Existing Pedestrian and Bicycle Facilities

At the time of this study, only small pockets of pedestrian facilities existed along Bank Street between Leitrim Road and Blais Road. Pedestrian crosswalks and concrete pedestrian refuge areas at corners were noted at the following signalized intersections:

- Bank Street and Leitrim Road;
- Bank Street and Rotary Way;
- Bank Street and White Alder Avenue/ Analdea Drive;
- Bank Street and Findlay Creek Drive; and
- Bank Street and Findlay Creek Centre.

Sidewalks have been constructed on the west side of Bank Street that links pedestrian facilities between all three access points to the Findlay Creek Centre. There were no other formal pedestrian facilities noted within the study area.

The following infrastructure currently exists along the section of Bank Street from Leitrim Road to Blais Road for cyclists:

- Paved shoulders are provided along the entire section of Bank Street from Leitrim Road to Blais Road.
- A northbound pocket bike lane is provided at Bank Street and Rotary Way intersection to separate cyclists continuing through the intersection with northbound right turning vehicles.
- A pocket bike lane is provided on the north leg of the Bank Street and Analdea Drive intersection for southbound cyclists.
- An exclusive bike lane is provided in the southbound direction that begins approximately 220m north of Findlay Creek Drive and ends at the Findlay Creek Shopping Centre access intersection.

There are currently no other formal cycling facilities within the study area. All existing bike lanes transition to paved shoulders where no formal facility exists.

3.3 Existing Transit Service and Facilities

3.3.1 Transit Facilities

Existing bus stops for daily service are located on Bank Street, Findlay Creek Drive and Kelly Farm Drive, as shown in **Exhibit 5**. These bus stops provide access to Route 144, which is meant to service the Findlay Creek Village Community. There is a bus stop for weekly service, Route 204, located adjacent to the Ottawa-Carleton Hindu Temple entrance located south of Blais Road, where the proposed Remer Street 6 access will be located

The Leitrim Park-and-Ride lot is located approximately 5 km northwest of the site and provides access to the City-wide rapid transit network via Transitway Route 99. The Park-and-Ride lot currently has capacity for approximately 200 vehicles, but will be expanded to accommodate up to 1,200 vehicles in the future.

EXHIBIT 5 – Nearest Bus Stop Locations



3.3.2 Transit Service Routes

Transit service is currently provided along Bank Street and through the Findlay Creek Subdivision. Transit service on Kelly Farm Road, within Findlay Creek, provides bus service to both the Leitrim Park & Ride as well as South Keys via Route 144. Route 99 provides access to the Leitrim Park-and-Ride lot and the City-wide rapid transit network via Leitrim Road and Albion Road to the west of the subject lands.

Once a week on Sunday mornings, Route 144 continues south along Bank Street past the Findlay Creek subdivision to the Ottawa-Carleton Hindu Temple, which is located on the east side of Bank Street, across from the proposed Remer Street 6 access intersection. Route 204 is a rural shopper's bus, which serves Metcalfe and Greely. Service is only offered on Thursdays, with one morning peak hour trip heading north towards South Keys and one afternoon peak hour trip heading south towards Greely /Metcalfe.

Existing transit route characteristics have been provided in **Table 2** and in **Exhibit 6** below. Transit service maps have been provided in **Appendix A**.

TABLE 2 – Existing Transit Service

ROUTE	DESCRIPTION	SERVICE PERIOD	PEAK HOUR FREQUENCY
99	Greenboro to Riverview/ Manotick	Weekdays: 6am-Midnight	15 to 30-minute
144	Leitrim to South Keys	Weekdays: 6:30am-12:30am	30-minute
204	Greely/Metcalfe to South Keys/Billings Bridge	Thursdays: 9:45am NB & 2:45pm SB (Free Service)	One Trip Every Thursday Per Direction

EXHIBIT 6 – Existing Transit Service (OC Transpo)



3.4 Collision Analysis

The City of Ottawa Transportation Impact Assessment Guidelines (October 2006) requires additional safety analysis when there have been either 33 or more total collisions reported at a particular location, or at least 6 collisions for any one movement, over a three year period. **Table 3** provides a summary of the total collisions recorded at various locations within the study area between the period January 1, 2013 and December 31, 2015. A copy of raw collision records have been provided in **Appendix B**.

TABLE 3 – Summary of Reported Collision Records within the Study Area

LOCATION	# OF REPORTED COLLISIONS
Bank Street and Leirim Road	19
Bank Street and Rotary Way	1
Bank Street and White Alder Ave/ Analdea Drive	14
Bank Street and Findlay Creek Drive	18
Bank Street and Findlay Creek Centre	3
Bank Street between Leirim Road and White Alder Ave/ Analdea Drive	3
Bank Street between White Alder Ave/ Analdea Drive and Findlay Creek	1
Bank Street between Findlay Creek Drive and Blais Road	3

Based on the above, the following locations meet the City's minimum warrant for further analysis with respect to total collisions reported during the three-year period:

Bank Street & Leirim Road:

- 9 collisions involving northbound vehicles
 - 2 were rear-end collisions
 - 3 occurred during dusk/dark conditions
 - 4 occurred during rain events
 - 6 occurred during AM/PM peak periods
- 8 collisions involving southbound vehicles
 - 6 were rear-end collisions
 - 3 occurred during dusk/dark conditions
 - 2 occurred during rain events
 - 4 occurred during AM/PM peak periods

Bank Street & White Alder Avenue/ Analdea Drive

- 9 collisions involving Southbound vehicles
 - 7 were rear-end collisions
 - 1 occurred during dusk/dark conditions
 - 5 occurred during rain/snow events
 - 4 occurred during AM/PM peak periods

Bank Street – Leitrim Road to White Alder Avenue/ Analdea Drive

- 15 collisions involving Southbound vehicles
 - 9 were rear-end collisions
 - 2 occurred during dusk/dark conditions
 - 2 occurred during rain events
 - 7 occurred during AM/PM peak periods

A review of the reported collisions at these locations has found that there is no significant pattern among the similar collision types listed above. However, onsite evaluations showed that Bank Street is congested during the peak periods, which is expected to contribute to the higher number of recorded collisions.

It is expected that the planned Bank Street widening and corresponding intersection modifications outlined in the Bank Street EA will reduce the number of reported collisions by increasing the capacity of Bank Street, which will improve operational performance along the corridor.

4 Future Transportation Network

4.1 Future Road Network

The City of Ottawa 2013 Transportation Master Plan (TMP) has established a Road Network Concept Plan for Ottawa which includes future road infrastructure projects that will be required to support the City's growth projections and travel behaviour targets by 2031.

The TMP has also identified an Affordable Road Network which is made up of a subset of the projects in the Network Concept Plan that can be realistically constructed by 2031, given restrictions to the availability of funds that are expected during this period. **Table 4** provides a summary of relevant projects in the vicinity of the study area, including the expected time frame for construction from the TMP.

The release of the Bank Street EA triggered an update to the staging of recommended modifications in the TMP. These changes have been reflected in **Table 4**.

TABLE 4 – Future Road Network Projects

ROAD/ PHASING	PROJECT DETAILS
Phase 2: 2020–2025	
Bank Street	Widen Bank Street from 2 to 4 lanes from Leitrim Road to Findlay Creek Drive including widening Leitrim Road to 4-lanes through the intersection.
Phase 3: 2026–2031	
Bank Street	Widen Bank Street from Findlay Creek Drive to south of Blais Road/ the Urban Boundary from 2 to 4 lanes.
Earl Armstrong Road	Widen from two to four lanes between Limebank Road and Bowesville Road.
Beyond 2031	
Bank Street	Widen Bank Street from south of the Urban Boundary to Rideau Road from 2 to 4 lanes, including a two-way left turn lane within the rural area. Widen Bank Street to 6 lanes through the Leitrim Road intersection.
Albion Road	Widen from two to four lanes between Leitrim Road and Lester Road
Earl Armstrong Road	New two-lane road between Bowesville Road and Hawthorne Road
Leitrim Road	Widen from two to four lanes between River Road and Limebank Road
	New four-lane re-aligned road between Limebank Road and Albion Road

The 2014 Development Charge Bylaw identified funds would be available in 2020–2021 for the widening of Bank Street between Leitrim Road and south of Findlay Creek Drive. However, the City has since indicated that based on their latest budgetary forecast, these funds will not be available until 2025. Therefore, it was assumed in this study that the City would not construct the Phase 2 modifications prior to 2025.

4.1.1 Bank Street EA Recommended Modifications

The Bank Street EA identifies both an 'interim' and an 'ultimate' roadway configuration. Relevant excerpts from the Bank Street EA have been provided in **Appendix C**. The key points from the recommended plan are as follows:

- Widening Bank Street to four lanes through the study area (2 through lanes in each direction)
- Realign and widen Leitrim Road to four lanes through the Bank Street intersection
- Pedestrian accommodation in the form of sidewalks, cyclist accommodation in the form of a cycle track within the urban area, multi-use pathways within the Greenbelt and paved shoulder separated from the travel lane by a rumble strip within the rural area
- Intersection improvements involving:
 - Interim Bank Street and Leitrim Road: Additional lanes and realignment of Leitrim Road including two through lanes in each direction on Leitrim Road, double left turn lanes eastbound and westbound and channelized right turn lanes in all directions

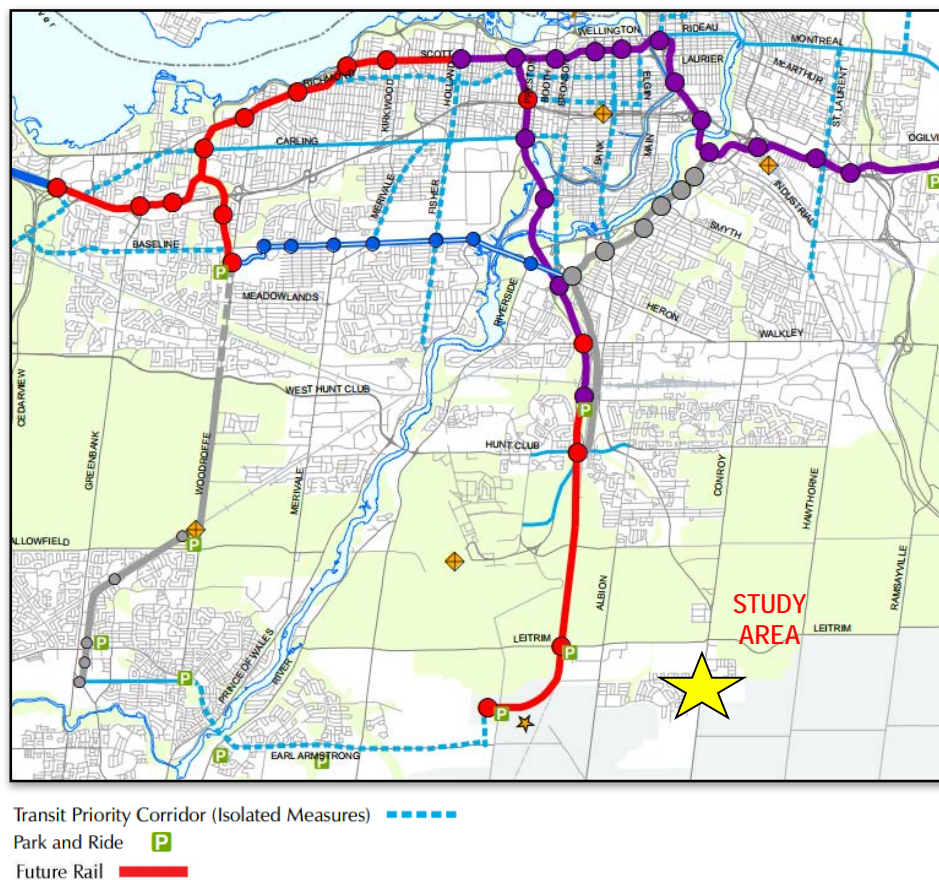
Ultimate Bank Street and Leitrim Road: Widening to six lanes (3 through lanes in each direction) through the intersection of Bank Street and Leitrim Road. In the northbound direction the third lane will be added north of Rotary Way and will continue to Conroy Road where it will become a right turn lane to Conroy Road northbound. In the southbound direction, the third lane will be added immediately south of Orville Kemp Street and will end before the Rotary Way intersection.

- New approaches to Rotary Way, Findlay Creek Drive, Findlay Creek Centre and Blais Road intersections to service local development. All intersections north of Blais Road will be signalized.
- Traffic signals or roundabout at Blais Road and Remer Street 6 intersections. Protect 2-lane roundabout right-of-way requirements in the vicinity of the Hindu Temple roundabouts implemented.
- Raised median within urban area to south of Remer Street 6 and at Rideau Road intersection. Two-way left turn lane between Remer Street 6 and Rideau Road intersection

4.2 Future Transit Facilities and Services

Stage 2 of the rapid transit implementation plan in the 2013 TMP will involve the extension of the O-Train from its current terminus at Greenboro to Bowesville Road, as shown in **Exhibit 7**. The expansion of this service will include five new stations: Gladstone, Walkley, South Keys, Leitrim and Bowesville. The station nearest to the proposed development, Leitrim Station, will see an expansion of the existing Park and Ride lot to accommodate the demand generated by the rail service. The current target for completion of the Stage 2 rail expansion is 2023.

EXHIBIT 7 – Rapid Transit and Transit Priority 2031 Affordable Network (TMP, November 2013)

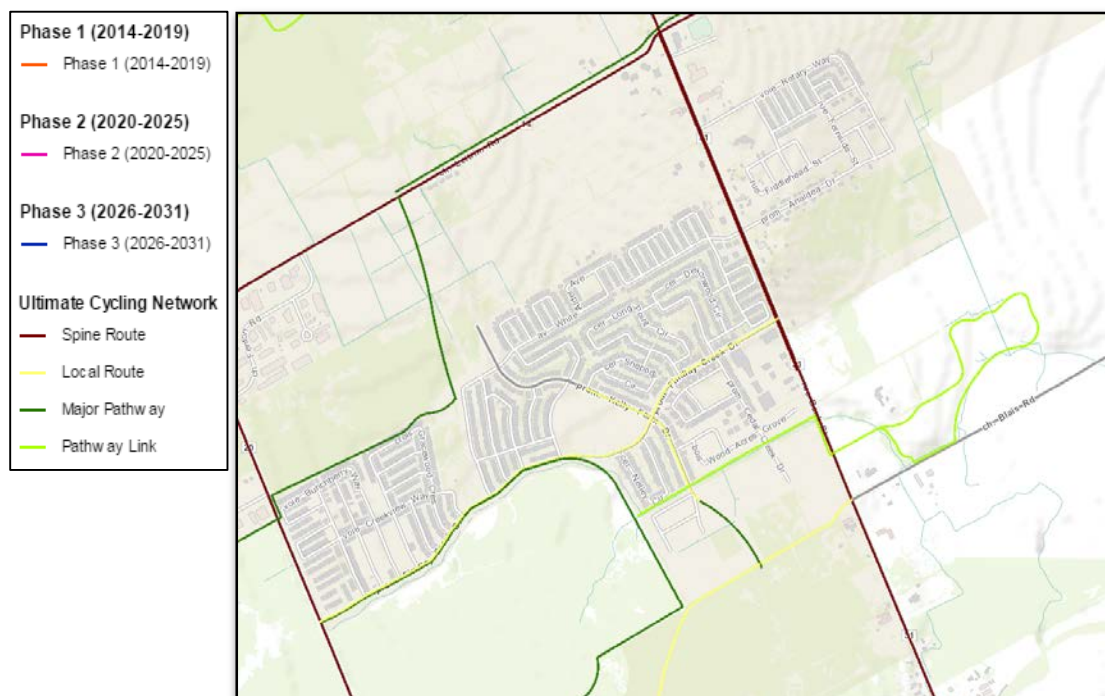


4.3 Future Cycling and Pedestrian Facilities

The Ottawa Cycling Plan (OCP), released in November 2013, classifies Bank Street as a Spine cycling route, while Findlay Creek Drive is classified as a Local route. **Exhibit 8** indicates the proposed cycling network concept for the area surrounding the proposed development.

The City's policy is to provide new cycling facilities or to upgrade existing facilities as part of any major road widening or road rehabilitation projects. As such, the ongoing Bank Street Widening EA Study will incorporate new facilities for cyclists in the revised recommended plan for the corridor. Similarly, any interim road modifications identified as requirements to mitigate the impact of the proposed development will incorporate cycling facilities in the design.

EXHIBIT 8 – Cycling Network Concept (Ottawa Cycling Plan, November 2013)



The Ottawa Cycling Plan (OCP), released in October 2013, classifies Bank Street, Albion Road and Leitrim Road as Spine Cycling Routes, while Street 14 and Findlay Creek Drive are classified as Local Cycling Routes. Note, the route alignments shown in the Cycling Network Concept may have been updated since 2013 based on the latest draft plan submissions.

5 Traffic Volume Generation

5.1 Approach and Methodology

Future traffic volumes in each horizon year were estimated using a projected traffic growth rate combined with the proposed Leitrim Community development traffic layered on top. Four (4) future horizons were established based on the recommended staging plan in the Bank Street EA Study. The horizons were based on the phasing plan set in the 2013 Transportation Master Plan (TMP).

- Year 2019 – End of Phase 1
- Year 2022 – Midpoint of Phase 2
- Year 2025 – End of Phase 2
- Year 2031 – End of Phase 3

The following Leitrim Community developments were accounted for separately in this analysis:

- Barrett Lands Subdivision
- Barrett Lands Extension Subdivision
- Findlay Creek Stage 2 Phase 4C
- The Transport Canada Lands
- Remer Lands
- OPA 76 Area 8A - Idone Lands
- OPA 76 Areas 9a and 9b Lands
- The remaining units in approved subdivisions: Findlay Creek, Sundance and Lemay

No other developments were considered in this analysis. All other potential developments in the surrounding area were expected to be accounted for in the background traffic growth rate. The Leitrim Community developments were expected to build out at a rate of 300 units per year starting in 2017 until the 2031 horizon year. Local trip generation rates would be applied to both residential and commercial uses.

5.2 Existing Traffic Volumes

The morning and afternoon peak hour turning movement counts at existing study area intersections were either provided by the City of Ottawa or manually collected by IBI Group.

- Bank and Leitrim (October 15, 2015)
- Bank and Rotary Way (June 5, 2015)
- Bank and White Alder / Analdea (June 5, 2015)
- Findlay Creek Drive and Bank Street (City of Ottawa, Friday June 5, 2015)
- Findlay Creek Shopping Centre Access and Bank Street (City of Ottawa, Wednesday, May 27, 2015)
- Blais Road and Bank Street (IBI Group, Wednesday January 27, 2016)

Existing (2016) peak hour traffic were derived from these counts by factoring all through movements along Bank Street by a 1.0% linear background growth rate. The rationale for the 1% background traffic growth rate has been provided in Section 5.3.

5.2.1 Redistribution of Findlay Creek Drive Traffic

Kelly Farm Drive is an existing north-south collector road located within Findlay Creek Village. Upon the development of the Barrett Lands subdivision immediately to the north, Kelly Farm Drive will be extended from its current terminus at White Alder Avenue to Leitrim Road. It is anticipated that this extension will trigger a redistribution of existing traffic from the Findlay Creek Village development to the new Kelly Farm Drive extension. It was estimated that approximately 20% of the existing traffic that currently travels to/from Albion Road and Bank Street, via the Findlay Creek Drive and White Alder Avenue intersections, would redirect to the Kelly Farm Drive Extension. The redistributed

traffic would then access Bank Street via the Bank Street and Leitrim Road intersection, and Albion Road via the Leitrim Road and Albion Road intersection.

The resulting existing (2016) peak hour traffic volumes accounting for a 1% background growth rate and the Kelly Farm Drive extension, are shown in **Exhibit 9**. Raw traffic count sheets and existing signal timing plans have been provided **Appendix D**.

5.3 Background Traffic Growth Rate

A 1.0% background traffic growth rate was applied to existing traffic counts along Bank Street to estimate future peak hour traffic volumes. This rate represents background traffic growth along Bank Street originating outside the Leitrim Community, such as the existing communities of Metcalfe and Greely to the south. The growth rate was based on the Bank Street EA model projections at the Leitrim Screenline. The 2031 model forecasts anticipated a 1.5% annual growth rate on Bank Street north of Leitrim Road, which included developments from the Leitrim Community.

The approach of this study was to add future Leitrim Community developments separately, which would reduce the overall growth rate along Bank Street. A 1.0% background traffic growth rate was considered reasonable. The rate was only applied to through movements on Bank Street, since side street traffic in the Leitrim Community would be accounted for separately.

5.4 Leitrim Community Traffic Generation

The peak hour traffic volumes from residential and commercial developments in the Leitrim Community were estimated using local trip generation rates that were developed from traffic counts completed in the existing Findlay Creek Community. The Findlay Creek Community was an ideal candidate to develop local rates since the community is surrounded by undeveloped lands and currently has only three accesses to the adjacent road network. Local

A separate traffic count was completed for the Findlay Creek Commercial Centre, which provided the local commercial trip generation rate. The residential and commercial trip generation rate raw data have been provided in **Appendix E**.

5.4.1 Residential Trip Generation Rate

All trips generated by residential areas in the Leitrim Community were estimated using a blended trip generation rate that was derived from local traffic counts. The existing Findlay Creek subdivision contains approximately 2,600 units split between single family, semi-detached, townhome and apartment units. It was assumed that this housing blend would be similar throughout the Leitrim Community; meaning the residential trip rate would be applied to the total number of units per development, regardless of housing type. The residential trip generation traffic count was completed on Friday December 9, 2016 at the following access points:

- Bank Street and Findlay Creek Drive
- Albion Road and Findlay Creek Drive
- Bank Street and White Alder Avenue

The traffic counts were recorded during the weekday morning and afternoon peak 3-hour periods. From these 3-hour periods, the morning and afternoon peak hours were established. To verify the accuracy of the local count, the results at the Bank Street and Findlay Creek Drive and the Bank Street and White Alder Avenue intersections were compared with 2015 City traffic counts at these intersections. The comparison showed that the 2016 traffic counts were higher than the 2015 City counts. Therefore, the local traffic counts were considered acceptable for developing a trip rate.

A 5% adjustment was made to the local counts to account for potential cut-through and non-residential traffic that may have inflated the counts. The final inbound and outbound peak hour traffic volumes were divided by the total number of existing units to determine the following average residential trip generation rate in the morning and afternoon peak hours:

- AM – 0.55 vehicles per unit
- PM – 0.60 vehicles per unit

EXHIBIT 9 – Existing (2016) Traffic

5.4.2 Commercial Trip Generation Rate

All trips generated by commercial blocks in the Leitrim Community were also estimated using a blended trip generation rate. The Findlay Creek Centre was the chosen local mixed-use commercial site. It is comprised of approximately 150,000 square feet of gross floor area (GFA) spread among two main buildings located to the rear of the site and smaller buildings along the Bank Street and Findlay Creek Drive frontages. Land uses consist of retail and specialty retail stores (e.g. supermarket, automotive store, and pharmacy) together with service outlets (e.g. banks, medical offices, day care and restaurants). It is anticipated that the proposed mixed-use blocks in other developments, e.g. Remer Lands and the OPA Lands, will include a similar mix of uses.

The commercial trip generation count was completed on Tuesday January 21, 2014 at the only three access driveways to the development. The traffic counts were recorded during the weekday morning and afternoon peak periods, from which a peak hour was derived.

Based on the peak hour volumes recorded, average commercial trip generation rates derived for the morning and afternoon peak hours were as follows:

- AM – 3.07 veh/h/1,000 sq.ft. GFA
- PM – 5.83 veh/h/1,000 sq.ft. GFA

The floor-area-ratio (FAR) of the Findlay Creek Centre was approximately 23%, which represents the amount of commercial floor area there is compared to the total site area. For this analysis, it was assumed this ratio would apply to all future commercial blocks in the Leitrim Community.

5.4.3 Unadjusted Trip Generation Results

The historical build out rates in the Leitrim Community ranged between 200 and 250 units per year. For this study, future build out was assumed to occur at a rate of 300 units per year between 2017 and 2031. **Table 5** outlines the expected buildout timings for each Leitrim Community development; all developments were expected to reach full buildout by 2031.

TABLE 5 – Leitrim Community Buildout Assumptions

DEVELOPMENT	LAND USE	SIZE (DU or '000 sf)			
		2019	2022	2025	2031
Remaining Findlay Creek	Residential	152			
Remaining Lemay and Sundance	Residential	158			
Transport Canada	Residential	0	140	231	
Findlay Creek Stage 2 Phase 4C	Residential	185	240		
Remer and Idone	Residential	93	417	645	1,155
	Commercial	158.733	260.351		
Barrett Lands	Residential	0	169	445	797
Barrett Lands Extension	Residential	116	150		
OPA 76 Area 9a and 9b	Residential	196	374	360	1,319
	Commercial	166.303			
TOTAL DWELLING UNITS		900	1,800	2,700	4,202

The local residential and commercial trip generation rates were applied to the buildout assumptions in **Table 5** to determine the unadjusted peak hour trip generation for each development. The results for residential and commercial uses have been shown in **Tables 6 and 7** respectively.

TABLE 6 – Unadjusted Residential Trip Generation Results

DEVELOPMENT	BUILDOUT YEAR	SIZE (DU)	PERIOD	GENERATED TRAFFIC (VPH)		
				IN	OUT	TOTAL
Remaining Existing Findlay Creek	2019	152	AM	21	63	84
			PM	58	33	91
Remaining Existing Lemay	2019	158	AM	22	65	87
			PM	60	35	95
Transport Canada Lands	2022	140	AM	19	58	77
			PM	53	31	84
	2025	231	AM	32	95	127
			PM	88	51	139
Findlay Creek Stage 2 Phase 4C	2019	185	AM	26	76	102
			PM	71	41	111
	2022	240	AM	33	99	132
			PM	91	53	144
Remer and Idone	2019	93	AM	13	38	51
			PM	35	20	56
	2022	417	AM	58	172	230
			PM	159	91	250
	2025	645	AM	89	267	356
			PM	246	141	387
	2031	1,155	AM	159	477	637
			PM	440	253	693
Barrett Lands Extension	2019	116	AM	16	48	64
			PM	44	25	70
	2022	150	AM	21	62	83
			PM	57	33	90
Barrett Lands	2022	169	AM	16	77	93
			PM	68	33	101
	2025	445	AM	61	184	245
			PM	170	97	267
	2031	797	AM	110	329	439
			PM	304	175	478
OPA 76 Areas 9a and 9b	2019	196	AM	27	81	108
			PM	75	43	118
	2022	374	AM	52	155	206
			PM	143	82	224
	2025	680	AM	94	281	375
			PM	259	149	408
	2031	1,319	AM	182	545	727
			PM	503	289	792
TOTAL	2019	900	AM	125	371	496
			PM	343	197	541
	2022	1800	AM	242	751	992
			PM	689	391	1,079
	2025	2700	AM	373	1,116	1,489
			PM	1,029	592	1,621
	2031	4202	AM	580	1,735	2,316
			PM	1,601	922	2,522

Notes:

vph = vehicles per hour; DU = Dwelling Units
Formula Rate and Splits for Residential Land Use:
AM T= 0.55(X) IN: 25%; OUT: 75%
PM T= 0.60(X) IN: 64%; OUT: 36%

TABLE 7 – Unadjusted Commercial Trip Generation Results

DEVELOPMENT	BUILDOUT YEAR	SIZE ('000 SF)	PERIOD	GENERATED TRAFFIC (VPH)		
				IN	OUT	TOTAL
Remer and Idone	2019	158.733	AM	283	205	487
			PM	444	481	925
	2022	260.351	AM	464	336	799
			PM	729	789	1,518
OPA 76 Areas 9a and 9b	2022	166.303	AM	296	214	511
			PM	465	504	970
Passby Trips (80%)						
Remer and Idone	2019	-	AM	195	195	390
			PM	370	370	740
	2022	-	AM	320	320	639
			PM	607	607	1,214
OPA 76 Areas 9a and 9b	2022	-	AM	204	204	408
			PM	388	388	776
Primary Trips (20%)						
Remer and Idone	2019	-	AM	57	41	97
			PM	89	96	185
	2022	-	AM	93	67	160
			PM	146	158	304
OPA 76 Areas 9a and 9b	2022	-	AM	59	43	102
			PM	93	101	194

Notes:

vph = vehicles per hour; SF = square feet

Formula Rate and Splits for Commercial Retail Land Use:

AM T= 3.07(X) IN: 58%; OUT: 42%

PM T= 5.83(X) IN: 48%; OUT: 52%

The commercial trips were separated into new trips and pass-by trips by the application of a pass-by proportion. Pass-by trips are trips made as an intermediate stop on the way from an origin to a primary destination (e.g. retail, service, fast-food restaurant). They are assumed to enter the site and then resume travel in the same direction. Therefore, pass-by trips are not new trips, but existing trips that have made a temporary detour.

The ITE manual indicates that pass-by proportions of approximately 80% are typical for highway commercial uses/ high-turnover uses. The Leitrim Community is located near the Urban Boundary and surrounded by primarily undeveloped lands. The commercial uses in this area are quite isolated. Bank Street is a heavily utilized commuter route, and any commercial uses along Bank Street are expected to generate a high proportion of pass-by trips during these peaks, rather than new trips. Therefore, a pass-by proportion of 80% was considered reasonable for all commercial areas in the Leitrim Community.

5.4.4 Adjusted Trip Generation Results

The trip generation results in **Tables 6 and 7** were subsequently adjusted to account for future increases in transit mode share (TMS). The City noted the observed transit mode share from the Riverside South/ Leitrim area to all other areas in the City to be approximately 10% in 2016 during the morning peak hour. The TMP projected this target transit mode share to reach 16% by 2031. To be conservative, it was assumed that the transit mode share would not start to increase until 2022 and that the transit mode share would remain at 10% in 2019. The rate of transit mode share growth was assumed to be linear and would be applied to both morning and afternoon peak hour traffic results up to the 2031 horizon.

No reductions for mixed-use/ synergistic effects were applied since these factors would be accounted for in the local rates. The adjusted trip generation results for residential and commercial uses have been summarized in **Tables 8 and 9** respectively.

The proposed Leitrim Community developments are expected to generate the following number of new trips:

- 2019
 - Residential: 500 morning peak hour trips; 550 afternoon peak hour trips
 - Commercial: 100 morning peak hour trips; 190 afternoon peak hour trips
- 2022
 - Residential: 1,000 morning peak hour trips; 1,050 afternoon peak hour trips
 - Commercial: 260 morning peak hour trips; 500 afternoon peak hour trips
- 2025
 - Residential: 1,450 morning peak hour trips; 1,550 afternoon peak hour trips
 - Commercial: 255 morning peak hour trips; 480 afternoon peak hour trips
- 2031
 - Residential: 2,200 morning peak hour trips; 2,400 afternoon peak hour trips
 - Commercial: 250 morning peak hour trips; 450 afternoon peak hour trips

TABLE 8 – Residential Trip Generation Results with TMS Adjustments

DEVELOPMENT	BUILDOUT YEAR	GENERATED TRAFFIC (VPH)					
		AM			PM		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Remaining Findlay Creek	2019	21	63	84	58	33	91
	2022	21	62	83	57	33	90
	2026	20	61	81	56	32	88
	2031	20	59	79	54	31	86
Remaining Lemay and Sundance	2019	22	65	87	60	35	95
	2022	21	64	86	59	34	93
	2026	21	63	84	58	34	92
	2031	20	61	82	57	33	89
Transport Canada Lands	2019	-	-	-	-	-	-
	2022	19	57	76	53	30	83
	2026	31	93	124	85	49	134
	2031	30	90	120	83	48	130
Findlay Creek Stage 2 Phase 4C	2019	26	76	102	71	41	111
	2022	33	98	130	90	52	142
	2026	32	96	128	89	51	140
	2031	31	93	124	86	49	135
Remer and Idone	2019	13	38	51	35	20	56
	2022	57	170	226	157	90	247
	2026	86	259	345	239	137	376
	2031	150	449	599	414	238	652
Barrett Lands Extension	2019	16	48	64	44	25	70
	2022	20	61	81	56	32	89
	2026	20	60	80	55	32	87
	2031	19	58	78	54	31	85
Barrett Lands	2019	-	-	-	-	-	-
	2022	16	76	92	67	33	100
	2026	60	178	238	165	95	259
	2031	103	310	413	286	164	450
OPA 76 Areas 9a and 9b	2019	27	81	108	75	43	118
	2022	51	152	203	140	81	221
	2026	91	273	364	251	144	396
	2031	171	513	684	473	272	744

TABLE 9 – Commercial Primary Trip Generation Results with TMS Adjustments

DEVELOPMENT	BUILDOUT YEAR	PERIOD	GENERATED TRAFFIC (VPH)		
			IN	OUT	TOTAL
Remer and Idone	2019	AM	57	41	97
		PM	89	96	185
	2022	AM	91	66	157
		PM	144	155	299
	2026	AM	90	65	155
		PM	141	153	294
	2031	AM	87	63	150
		PM	137	148	285
OPA 76 Areas 9a and 9b	2022	AM	58	42	101
		PM	92	99	191
	2026	AM	57	42	99
		PM	90	98	188
	2031	AM	56	40	96
		PM	87	95	182

Notes:

vph = vehicles per hour; SF = square feet

5.5 Trip Distribution and Assignment

Traffic generated by proposed residential and commercial areas, outlined in **Tables 8 and 9**, were distributed to the adjacent road network according to the proportions outlined in **Table 10**.

TABLE 10 – Residential Trip Distribution

DEVELOPMENT	DISTRIBUTION OF TRAFFIC BY ROADWAY IN/ OUT OF STUDY AREA			
	BANK STREET ¹	LEITRIM ROAD ²	FINDLAY CREEK DRIVE ³	OUTSIDE STUDY AREA ⁴
Remaining Findlay Creek; Transport Canada Lands; and Findlay Creek Stage 2 Phase 4C	65%	-	10%	25%
Remaining Lemay and Sundance	100%	-	-	-
Remer and Idone	75%	-	-	25%
Barrett Lands Extension; and Barrett Lands	20%	30%	-	50%
OPA 76 Areas 9a and 9b	90%	-	10%	-

Notes:

1 - Directional distribution on Bank Street for all developments = 95% North; 5% South

2 - Accounts for all traffic entering/ exiting via Leitrim Road, but crosses/ uses Bank Street

3 - Accounts for all traffic entering/ exiting via Findlay Creek Drive to the west, but crosses/ uses Bank Street

4 - Accounts for all traffic entering/ exiting that does not cross/ use Bank Street.

The specific turning movement distributions at study area intersections were based on existing traffic patterns. The pass-by distributions for the commercial areas were distributed as follows:

TABLE 11 – Pass-by Trip Distribution

DEVELOPMENT	ACCESS INTERSECTION	NORTHBOUND	SOUTHBOUND
Remer and Idone	Street 14/ Blais Road	10%	-
	Street 6	15%	-
OPA 76 Areas 9a and 9b	Street 1/ Findlay Creek Drive	-	25%
	Street 2/ Findlay Creek Centre	-	40%

Notes:

Pass-by distributions do not add up to 100% due to right-in right-outs; pass-by trips at RIRO intersections do not affect intersection turning movements

The resulting estimated site generated traffic volumes for the Leitrim Community in each future horizon have been provided in **Exhibits 10 to 13**. The estimated Leitrim Community peak hour traffic volumes were combined with the estimated background peak hour traffic volumes to determine the total peak hour traffic volumes in each future horizon, as shown in **Exhibits 14 to 17**.

EXHIBIT 10 – Leitrim Community (2019) Traffic

EXHIBIT 11 – Leitrim Community (2022) Traffic

EXHIBIT 12 – Leitrim Community (2025) Traffic

EXHIBIT 13 – Leitrim Community (2031) Traffic

EXHIBIT 14 – Future (2019) Total Traffic

EXHIBIT 15 – Future (2022) Total Traffic

EXHIBIT 16 – Future (2025) Total Traffic

EXHIBIT 17 – Future (2031) Total Traffic

6 Intersection Operational Review

The operations at all study area intersections were evaluated in the morning and afternoon peak hour traffic conditions at the following horizons:

- Existing Traffic (2016)
- Future (2019) Total Traffic
- Future (2022) Total Traffic
- Future (2026) Total Traffic
- Future (2031) Total Traffic

The following intersections were included in this analysis:

- Bank Street and Leitrim Road
- Bank Street and Rotary Way/ Barrett Lands Street 1
- Bank Street and White Alder Avenue/ Analdea Avenue
- Bank Street and Findlay Creek Drive/ OPA Street 1
- Bank Street and Findlay Creek Shopping Centre Access/ OPA Street 2
- Bank Street and Blais Road/ Remer Street 14
- Bank Street and Remer Street 6

The intersection capacity analysis of signalized and unsignalized intersections was completed using Synchro v9 software. The analysis for roundabouts was completed using SIDRA v6.1 software.

6.1 Base Road Network

The future network configuration for existing intersections in each horizon year was based on the previous horizon requirements or any future network modifications noted in the Bank Street EA. The 4-lane widening of Bank Street between Leitrim Road and the Earl Armstrong Road Extension, as noted in Section 4.1, was accounted for in the following analysis. The construction of the 4-lane widening is expected by 2025, based on City budgetary forecasts. Therefore, base road network in the 2025 horizon year assumed the 4-lane widening.

The future 4-lane intersection designs at the study area intersections were based on the Bank Street EA Interim and Ultimate Plans (designs provided in **Appendix C**). The base road network configuration assumed in each horizon has been summarized below:

Existing (2016)

- Existing configuration as per **Exhibit 3**

Future (2019)

- New development approaches constructed at existing intersections:
 - Eastbound approach at Bank Street and Rotary Way to service Barrett Lands – Street 1
 - Westbound approach at Bank Street and Findlay Creek Drive to service OPA Lands – Street 1
 - Westbound approach at Bank Street and Findlay Creek Centre to service OPA Lands – Street 2
 - Eastbound approach at Bank Street and Blais Road to service Remer Lands and Findlay Creek Stage 2 Phase 4C Lands – Street 14
 - Eastbound approach at Bank Street, approximately 400m south of Blais Road – Street 6
- It was assumed that all new approaches would have left-turn lanes and through-right-turn lanes.
- Inbound left-turn lanes, southbound right-turn lanes and shared through-right-turn lanes were assumed on Bank Street to all proposed accesses, as per the Bank Street EA.

Future (2022)

- No Changes from 2019

Future (2025)

- Widen Bank Street from 2 to 4-lanes between Leitrim Road and Findlay Creek Drive
- Proposed intersection design at Bank Street and Leitrim Road:
 - Double eastbound and westbound left-turn lanes
 - Northbound and southbound left-turn lane
 - Northbound and southbound right-turn lanes
 - Channelized right-turn lanes on all approaches
- Proposed intersection design at Bank Street and Rotary Way/ Barrett Street 1:
 - Add eastbound and northbound left-turn lanes
 - Southbound channelized right-turn
 - Convert westbound right-turn lane to through-right-turn lane
- Proposed intersection design at Bank Street and Findlay Creek Drive/ OPA Street 1:
 - Add westbound and southbound left-turn lanes
 - Westbound right-turn lane
 - Convert eastbound right-turn lane to through-right-turn lane

Future (2031)

- Extend Bank Street widening from Findlay Creek Drive to Remer Street 6
- Additional intersection modifications at Bank Street and Leitrim Road:
 - Westbound right-turn lane
 - Eastbound right-turn lane
- Proposed intersection design at Bank Street and Findlay Creek Centre/ OPA Street 2:
 - OPA Street 2 was not included in the EA; the configuration was assumed to be the same as OPA Street 1
 - Add westbound and southbound left-turn lanes
- Convert eastbound right-turn lane to through-right-turn lane Proposed intersection design at Bank Street and Blais Road/ Remer Street 14:
 - Traffic Control Signals or a 2-Lane Roundabout
 - If Signals
 - Left-turn lane on all approaches
 - Southbound right-turn lane
 - Eastbound left-turn lane
- Proposed intersection design at Bank Street and Remer Street 6:
 - Traffic Control Signals or a 2-Lane Roundabout
 - If Signals
 - Northbound and eastbound left-turn lane
 - Southbound right-turn lane

Further discussion on the geometric requirements for auxiliary turn lanes and storage lengths at proposed access intersections has been provided in Section 7.3.

6.2 Intersection Analysis Criteria

6.2.1 Signalized Intersections

In qualitative terms, the Level-of-Service (LOS) defines operational conditions within a traffic stream and their perception by motorists. A LOS definition generally describes these conditions in terms of such factors as delay, speed and travel time, freedom to manoeuvre, traffic interruptions, safety, comfort and convenience. LOS can also be related to the ratio of the volume to capacity (v/c) which is simply the relationship of the traffic volume (either measured or forecast) to the

capability of the intersection or road section to accommodate a given traffic volume. This capability varies depending on the factors described above. LOS are given letter designations from A to F. LOS "A" represents the best operating conditions and LOS "E" represents the level at which the intersection or an approach to the intersection is carrying the maximum traffic volume that can, practicably, be accommodated. LOS F indicates that the intersection is operating beyond its theoretical capacity.

The City of Ottawa has developed criteria as part of the Transportation Impact Assessment Guidelines, which directly relate the volume to capacity (v/c) ratio of a signalized intersection to a LOS designation. These criteria are as follows:

TABLE 12 – LOS Criteria for Signalized Intersections

LOS	VOLUME TO CAPACITY RATIO (v/c)
A	0 to 0.60
B	0.61 to 0.70
C	0.71 to 0.80
D	0.81 to 0.90
E	0.91 to 1.00
F	> 1.00

The intersection capacity analysis technique provides an indication of the LOS for each movement at the intersection under consideration and for the intersection as a whole. The overall v/c ratio for an intersection is defined as the sum of equivalent volumes for all critical movements at the intersection divided by the sum of capacities for all critical movements.

6.2.2 Unsignalized Intersections

The capacity of an unsignalized intersection can also be expressed in terms of the LOS it provides. For an un-signalized intersection, the Level of Service is defined in terms of the average movement delays at the intersection. This is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this includes the time required for a vehicle to travel from the last-in-queue position to the first-in-queue position. The average delay for any particular minor movement at the un-signalized intersection is a function of the capacity of the approach and the degree of saturation.

The Highway Capacity Manual 2010 (HCM), prepared by the Transportation Research Board, includes the following Levels of Service criteria for un-signalized intersections, related to average movement delays at the intersection, as indicated in **Table 13**.

TABLE 13 – LOS Criteria for Unsignalized Intersections

LOS	DELAY (seconds)
A	<10
B	>10 and <15
C	>15 and <25
D	>25 and <35
E	>35 and <50
F	>50

The unsignalized intersection capacity analysis technique included in the HCM and used in the current study provides an indication of the Level of Service for each movement of the intersection under consideration. By this technique, the performance of the unsignalized intersection can be compared under varying traffic conditions, using the Level of Service concept in a qualitative sense. One unsignalized intersection can be compared with another unsignalized intersection using this concept. Level of Service 'E' represents the capacity of the movement under consideration and generally, in large urban areas, Level of Service 'D' is considered to represent an acceptable operating condition (Level of Service 'E' is considered an acceptable operating condition for planning purposes for intersections located

within Ottawa's Urban Core— the downtown and its vicinity). Level of Service 'F' indicates that the movement is operating beyond its design capacity.

6.2.3 Roundabouts

Roundabout options were considered at two locations as possible options besides traffic signals (specified in the Bank Street EA): Bank Street and Remer Street 14, and Bank Street and Remer Street 6. A detailed roundabout capacity analysis was completed using SIDRA analysis software. SIDRA is an industry accepted program that uses a similar delay-based methodology as the HCM 2010. Any movement with a v/c ratio greater than 1.0 triggers an LOS F for that movement. If the v/c ratio for any movement is equal to or less than 1.0, the delay criteria for unsignalized intersections, shown in **Table 13**, should be followed.

6.2.1 Traffic Signal Warrant

Traffic control signal warrants were completed for all unsignalized stop or yield controlled intersections. The warrant was based on the established methodology outlined in the Ontario Traffic Manual, Book 12, Ministry of Transportation Ontario (MTO), 2012.

Future traffic conditions were estimated using an Average Hourly Volume (AHV) for each intersection approach using the following equation and applied to the warrant procedure:

$$\text{Average Hourly Volume} = \frac{(\text{AM Peak Hour Volume} + \text{PM Peak Hour Volume})}{4}$$

The results of the traffic signal warrant analysis showed that the Bank Street and Blais Road is expected to trigger the warrant by the 2019 horizon year. The Bank Street and Street 6 intersection did not trigger the warrant in the future 2025 horizon.

Details of the traffic signal warrants analyses described above are included in **Appendix F**

6.3 Analysis Methodology

Using the established intersection capacity analysis criteria described above, the existing and future conditions were analyzed during the weekday peak hour traffic volumes derived in the previous sections of this report.

The worst/ critical observed LOS movement at each study area intersection was recorded; if the LOS was E or lower, it was compared to the intersection LOS. If the intersection LOS was also indicated to be below City standards, potential roadway modifications or measures were considered and the intersection was re-evaluated.

Any recommended modifications would be carried forward to the following horizon. The only exception to this would be for City planned intersection modifications, such as in the Bank Street EA, whereby the base intersection configuration would follow the recommended City design.

6.4 Intersection Capacity Analysis Results

The following section presents the results of the intersection capacity analysis and roundabout capacity analysis. All tables summarize study area intersection LOS results during the morning and afternoon peak hour periods. The Synchro and SIDRA analysis output files have been provided in **Appendix G**.

6.4.1 Existing (2016) Traffic

The existing (2016) intersection capacity analysis was based on morning and afternoon peak hour traffic volumes shown in **Exhibit 8**. A summary of the results has been provided in **Table 14**.

TABLE 14 – Intersection Capacity Analysis: Existing (2016) Traffic

INTERSECTION	INTERSECTION CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Bank Street and Leitrim Road	Traffic Signals	AM	1.58	1.07	F	F
		PM	1.03	0.86	F	D
Bank Street and Rotary Way	Traffic Signals	AM	0.64	-	B	-
		PM	0.94	0.94	E	E
Bank Street and Analdea Drive / White Alder Ave	Traffic Signals	AM	0.80	-	C	-
		PM	0.77	-	C	-
Bank Street and Findlay Creek Drive	Traffic Signals	AM	0.82	-	D	-
		PM	0.72	-	C	-
Bank Street and Findlay Creek Centre	Traffic Signals	AM	0.35	-	A	-
		PM	0.59	-	A	-
Bank Street and Blais Road	WB Stop	AM	0.05	-	C	-
		PM	0.22	-	E	-

6.4.2 Future (2019) Total Traffic

The future (2019) intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes shown in **Exhibit 9**. A summary of the results has been provided in **Table 15**.

TABLE 15 – Intersection Capacity Analysis: Future (2019) Total Traffic

INTERSECTION	INTERSECTION CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Bank Street and Leitrim Road ¹	Traffic Signals	AM	0.86	-	D	-
		PM	0.84	-	D	-
Bank Street and Rotary Way/ Barrett Street	Traffic Signals	AM	0.80	-	C	-
		PM	1.05	1.05	F	F
Bank Street and Analdea Drive / White Alder Ave	Traffic Signals	AM	0.90	-	D	-
		PM	0.88	-	D	-
Bank Street and Findlay Creek Drive/ OPA Street 1	Traffic Signals	AM	0.88	-	D	-
		PM	0.80	-	C	-
Bank Street and Findlay Creek Centre/ OPA Street 2	Traffic Signals	AM	0.48	-	A	-
		PM	0.62	-	A	-
Bank Street and Blais Road/ Remer Street 14	EB-WB Stop	AM	1.08	-	F	-
		PM	2.07	-	F	-
	Traffic Signals	AM	0.71	-	C	-
		PM	0.74	-	C	-
	Single Lane Roundabout	AM	0.83	-	B	A
		PM	0.89	-	B	A
Bank Street and Remer Street 6	EB Stop	AM	0.28	-	D	-
		PM	0.82	-	F	-
	Traffic Signals	AM	0.51	-	A	-
		PM	0.66	-	A	-
	Single Lane Roundabout	AM	0.73	-	A	A
		PM	0.87	-	B	A

Notes: EB, WB = eastbound, westbound

New intersection approaches for proposed developments Barrett Lands Extension, OPA and Remer Lands were based on Bank Street Interim Plan assumptions. Proposed lane configurations outlined in Section 5.1. All new side street approaches were assumed to have an auxiliary left-turn lane and a through-right-turn lane.

Summary of Modifications:

- 1 - Bank Street and Leitrim Road reconstructed to Interim Plan design in the Bank Street EA
- 2 - Add a southbound slip lane

6.4.3 Future (2022) Total Traffic

The future (2022) intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes shown in **Exhibit 10**. All recommended modifications from the previous horizon have been carried forward to this horizon. A summary of the results has been provided in **Table 16**.

TABLE 16 – Intersection Capacity Analysis: Future (2022) Total Traffic

INTERSECTION	INTERSECTION CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Bank Street and Leitrim Road	Traffic Signals ¹	AM	0.90	-	D	-
		PM	0.90	-	D	-
Bank Street and Rotary Way/ Barrett Street 1 ¹	Traffic Signals	AM	1.07	1.07	F	F
		PM	1.32	1.32	F	F
Bank Street and Analdea Drive / White Alder Ave	Traffic Signals	AM	1.06	1.06	F	F
		PM	1.10	1.10	F	F
Bank Street and Findlay Creek Drive/ OPA Street 1	Traffic Signals	AM	0.95	0.92	E	E
		PM	0.84	-	D	-
Bank Street and Findlay Creek Centre/ OPA Street 2	Traffic Signals	AM	0.68	-	B	-
		PM	0.89	-	D	-
Bank Street and Blais Road/ Remer Street 14	Traffic Signals ²	AM	0.86	-	D	-
		PM	0.89	-	D	-
	Single Lane Roundabout	AM	0.93	-	C	B
		PM	1.04	-	C	F
Bank Street and Remer Street 6	Traffic Signals	AM	0.63	-	B	-
		PM	0.79	-	C	-
	Single Lane Roundabout ³	AM	0.81	-	A	A
		PM	0.91	-	A	B

Notes:

Summary of Modifications:

- 1 - Add eastbound and westbound right-turn lanes
- 2 - Add a southbound right-turn lane.
- 3 - Add a southbound slip lane

6.4.4 Future (2025) Total Traffic

The future (2025) intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes shown in **Exhibit 11**. All recommended modifications from the previous horizon have been carried forward to this horizon. A summary of the results has been provided in **Table 17**.

TABLE 17 – Intersection Capacity Analysis: Future (2025) Total Traffic

INTERSECTION	INTERSECTION CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Bank Street and Leitrim Road	Traffic Signals	AM	1.02	1.01	F	F
		PM	0.99	0.99	E	E
Bank Street and Rotary Way/ Barrett Street	Traffic Signals	AM	0.70	-	B	-
		PM	0.79	-	C	-
Bank Street and Analdea Drive / White Alder Ave	Traffic Signals	AM	0.79	-	C	-
		PM	0.65	-	B	-
Bank Street and Findlay Creek Drive/ OPA Street 1	Traffic Signals	AM	0.89	-	D	-
		PM	0.83	-	D	-
Bank Street and Findlay Creek Centre/ OPA Street 2	Traffic Signals	AM	0.77	-	C	-
		PM	0.90	-	D	-
Bank Street and Blais Road/ Remer Street 14	Traffic Signals	AM	0.90	-	D	-
		PM	0.95	0.95	E	E
	Single Lane Roundabout	AM	1.14	-	F	F
		PM	1.09	-	D	F
Bank Street and Remer Street 6	Traffic Signals	AM	0.63	-	B	-
		PM	0.85	-	D	-
	Single Lane Roundabout	AM	0.98	-	F	E
		PM	0.90	-	B	A

Notes:

It was assumed that Bank Street would be widened from 2 to 4 lanes from Leitrim Road to Findlay Creek Drive, as per Bank Street EA (2014). The intersection configurations were based on the Bank Street EA Interim Plan. Traffic signals south of Leitrim Road were coordinated and optimized.

6.4.5 Future (2031) Total Traffic

The future (2031) intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes shown in **Exhibit 12**. All recommended modifications from the previous horizon have been carried forward to this horizon. A summary of the results has been provided in **Table 18**.

TABLE 18 – Intersection Capacity Analysis: Future (2031) Total Traffic

INTERSECTION	INTERSECTION CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Bank Street and Leitrim Road	Traffic Signals	AM	1.42	1.42	F	F
		PM	1.39	1.39	F	F
Bank Street and Rotary Way/ Barrett Street	Traffic Signals	AM	0.89	-	D	-
		PM	0.89	-	D	-
Bank Street and Analdea Drive / White Alder Ave	Traffic Signals	AM	0.85	-	D	-
		PM	0.76	-	C	-
Bank and Findlay Creek Drive/ OPA Street 1	Traffic Signals	AM	0.90	-	D	-
		PM	0.82	-	D	-
Bank Street and Findlay Creek Centre/ OPA Street 2	Traffic Signals	AM	0.63	-	B	-
		PM	0.90	-	D	-
Bank Street and Blais Road/ Remer Street 14	Traffic Signals ¹	AM	0.83	-	D	-
		PM	0.87	-	D	-
	2-Lane Roundabout	AM	0.61	-	A	A
		PM	0.73	-	B	A
Bank and Remer Street 6	Traffic Signals ²	AM	0.75	-	C	-
		PM	0.83	-	D	-
	2-Lane Roundabout	AM	0.45	-	A	A
		PM	0.58	-	B	A

Notes:

It was assumed that Bank Street would be widened from 2 to 4 lanes from Leitrim Road to Blais Road, as per Bank Street EA (2014). The intersection configurations were based on the Bank Street EA Ultimate Plan (with the exception of Bank Street remaining a 4-lane roadway through Leitrim Road). Traffic signals south of Leitrim Road were coordinated and optimized.

Summary of Modifications:

- 1 - EA assumed 2-lane roundabout. Signal configuration assumed minimum left-turn requirement on all approaches. Through-right turn lane on north, east and westbound approaches. Minimum southbound right-turn lane required.
- 2 - EA assumed 2-lane roundabout. Signal configuration assumed minimum left-turn requirement and through-right turn lane on all approaches.

6.5 Summary of Intersection Capacity Analysis Results

6.5.1 Existing (2016) Results

The Bank Street and Leitrim Road intersection is presently operating above its theoretical capacity, due to heavy north and southbound commuter traffic in the morning and afternoon peak periods respectively. In addition, moderate-to-high left-turn traffic volumes from the side streets also contribute to intersection congestion. Increasing capacity through roadway modifications was shown to be the only effective means of improving levels-of-service.

The Bank Street and Rotary Way intersection does not operate within City standards in the afternoon peak hour, but is within theoretical capacity of the intersection (i.e. between 0.91 and 1.00). The intersection operates well in the morning peak period.

All remaining existing intersections are currently operating within City standards in both morning and afternoon peak periods.

6.5.2 Future (2019) Results

By 2019, new access approaches will be constructed at Rotary Way, Findlay Creek Drive, Findlay Creek Centre, Blais Road and Street 6. The recommended lane configurations at these locations will be confirmed during detailed design for each individual development.

Given the level of traffic and the geometric challenges that exist at the Bank Street and Leitrim Road intersection, interim measures were not considered feasible. It was recommended that the intersection be constructed as per the Bank Street EA Interim Design by the future 2019 horizon – ahead of the year 2025 schedule. With the proposed modifications, the operating condition of the Bank and Leitrim intersection improves to within City standards at 2019.

The Bank and Rotary Way intersection continues to operate within City standards during the morning peak hour but slightly above its theoretical capacity in the afternoon peak period. Although the Bank Street widening will resolve congestion in the afternoon peak, it may not be necessary at 2019. A 5% reduction in southbound traffic in the afternoon peak hour improves the level-of-service to within theoretical limits; a 10% reduction brings the level-of-service close to City standards. It is recommended that the intersection be monitored post-construction of the Bank Street and Leitrim intersection to determine future capacity requirements.

Both the Bank Street and Street 6, and Bank Street and Blais Road intersections did not operate within City standards as unsignalized intersections. Additional capacity in the form of traffic control signals or a roundabout would be required. Both modifications meet City operating standards under 2019 traffic conditions, traffic control signals are the preferred choice since they resulted in better operations and levels of service.

All remaining study area intersections operate within City standards in both morning and afternoon peak periods.

6.5.3 Future (2022) Results

The results of the analysis indicate that the modified Bank and Leitrim intersection will continue to operate within City standards under 2022 traffic conditions.

By 2022, both the Bank Street and Rotary Way, and Bank Street and White Alder intersections were projected to operate beyond capacity during the peak periods. The Bank Street and Findlay Creek Drive intersection will continue to operate within its theoretical capacity, but does not meet City standards under these conditions. At this point, the first section of the Bank Street widening, between Leitrim Road and Findlay Creek Drive, should be constructed. With the widening in place, all three intersections are expected to operate at an acceptable level of service.

The Bank Street and Street 14 intersection was shown to operate below City standards as a single lane roundabout. It is recommended that a traffic signal be proposed at this intersection to extend the lifespan of interim modifications.

All remaining study area intersections operate within City standards in both morning and afternoon peak periods with only minor modifications.

6.5.4 Future (2025) Results

The upgraded Bank and Leitrim intersection is expected to operate near its theoretical capacity by 2025, which is similar to levels experienced at the intersection today.

The Bank Street and Blais Road intersection will operate above City standards in the afternoon peak hour indicating that this section of Bank Street is beginning to approach its capacity as a two-lane road by this year and that widening to four lanes should be investigated.

The Bank Street and Remer Street 14, and Bank Street and Remer Street 6 intersections were both shown to operate below City standards as a single lane roundabout. It is recommended that traffic signals be proposed at these intersections to extend the lifespan of interim modifications.

All remaining intersections within the study area were projected to operate within City standards in both morning and afternoon peak periods at the 2025 horizon year.

6.5.5 Future (2031) Results

At 2031, the Bank and Leitrim intersection operates above its theoretical capacity in both morning and afternoon peak periods with four lanes on Bank Street. The ultimate plan from the Bank Street EA Study recommends six lanes on Bank Street from Conroy Road to just south of Leitrim Road to be implemented at some time beyond the 2031 horizon

year of the TMP. However, with this ultimate intersection configuration in place, levels-of-service still exceed theoretical capacity, but are comparable to the existing condition at the intersection.

The remaining intersections within the study area will continue to operate at acceptable levels of service under 2031 traffic conditions assuming the Bank Street widening from 2 to 4-lanes has been extended to Street 6 with traffic control signals at each intersection.

7 Geometric Review

The following section reviews all geometric requirements for the study area intersections. All relevant excerpts from referenced technical standards have been provided in **Appendix H**.

7.1 Sight Distance

Horizontal or vertical curves in a road may obstruct the line of sight of a vehicles turning from a side street, which increases the risk of a collision. As a result, Bank Street corridor was assessed for appropriate sight distances at each access.

No significant horizontal or vertical curves exist on Bank Street that would obstruct the view of a driver exiting the site. Proper care should be taken to ensure no obstructions be placed in the line-of-sight in the vicinity of the proposed access points.

7.2 Corner Clearances

The proposed developments includes minor accesses to and from arterial roadways in relative close proximity of major intersections. Corner clearances up and downstream of these major intersections need to be protected. According to the Geometric Design Guide for Canadian Road, published by the Transportation Association of Canada (TAC), for a signalized intersection, the minimum corner clearance along an arterial road is 70m, and the minimum corner clearance along a collector road is 55m (without a median on the collector road).

At the time of this study, The future access locations to the commercial blocks are expected to follow these guidelines, and will be assessed during the site plan application.

7.3 Auxiliary Lane Analysis

Auxiliary turning lane lengths for all study area intersections were based primarily on the operational results in Section 6.4. All study area intersection are expected to be signalized or have a roundabout by the future (2031) traffic horizon. Therefore, unsignalized auxiliary lane requirements were not evaluated.

7.3.1 Auxiliary Left-Turn Lane Requirements

A review of auxiliary left-turn lane storage requirements was completed at all signalized intersections within the study area under future (2031) total traffic conditions. The review compared the recommended storage lengths outlined in the Bank Street EA with the projected 95th percentile queue lengths from Synchro operational results, and the City of Ottawa queue length calculation based on the following equation:

$$\text{Storage Length, } S = \frac{NL}{C} \times 1.5$$

Where:

N = number of vehicles per hour

L = Length occupied by a vehicle in the queue = 7 m

C = number of traffic signal cycles per hour (3600 seconds per hour/cycle length)

For double left-turn lanes, the storage length is multiplied by 0.55, to account for uneven lane priority to determine the back of queue. The equation above is included in the TAC Design Guide. It includes an additional 50% above the storage length required for the average number of vehicle arrivals per cycle in the heaviest peak hour, which ensures a conservative length.

The results of the auxiliary left-turn lane analysis are summarized below in **Table 19**.

TABLE 19 – Recommended Auxiliary Left-Turn Storage Lengths at Signalized Intersections

INTERSECTION	APPROACH	95 TH %ILE QUEUE LENGTH (M)	CITY QUEUE LENGTH (M)	RECOMMENDED STORAGE LENGTH (M)
Bank Street and Leitrim Road	NB	20	25	40 ¹
	SB	#45	45	45
	EB (D)	#75	65	75
	WB (D)	#100	90	100
Bank Street and Rotary Way/ Barrett Street 1	NB	5	5	40 ¹
	SB	50	85	85
	EB	25	25	25
	WB	15	10	15
Bank Street and Analdea Drive / White Alder Ave	NB	5	5	40 ¹
	SB	5	5	40 ¹
	EB1	#75	75	75
	WB	5	5	5
Bank and Findlay Creek Drive/ OPA Street 1	NB	5	10	40 ¹
	SB	#45	60	60
	EB	#105	110	110
	WB	35	30	35
Bank Street and Findlay Creek Centre/ OPA Street 2	NB	35	65	65
	SB	50	100	100
	EB	10	5	10
	WB	#60	55	60
Bank Street and Blais Road/ Remer Street 14	NB	#10	25	40 ¹
	SB	10	10	40 ¹
	EB	90	130	130
	WB	10	5	10
Bank and Remer Street 6	NB	#50	40	50
	EB	#75	75	75

Notes:

Recommended storage lengths do not include deceleration lane and taper lengths.

(D) - Double Left-Turn Lane

- Synchro extrapolated queue length at congested intersections. From Synchro 9 User Guide "In practice, 95th percentile queue shown will rarely be exceeded and the queues shown with the # footnote are acceptable for the design of storage bays."

1 - Minimum storage lane requirement on arterial roadways.

Summary of Findings:

The recommended Bank Street EA designs were shown to provide sufficient left-turn storage capacity to accommodate future (2031) peak hour traffic volumes. The recommended left-turn storage lengths in **Table 19** above should be reviewed at detailed design for each individual development.

7.3.2 Auxiliary Right-Turn Lane Requirements

The MTO guidelines recommend that right-turn lanes be provided at signalized intersections if the right-turning volume is greater than 60 vehicles per hour and/or represents at least 10% of the approach volume on the main street. However, in this case, the operational analysis requirements from Section 6.4 was used to determine auxiliary right-turn lane requirements and storage lengths. In most cases, the operational results coincided with the MTO recommendation.

Auxiliary right-turn lanes and the corresponding storage lengths from the Synchro analysis have been summarized in **Table 20**. The right-turn storage lengths of all study area intersections should be reviewed and confirmed during detailed design.

TABLE 20 – Recommended Auxiliary Right-Turn Storage Lengths at Signalized Intersections

INTERSECTION	APPROACH	95 TH %ILE QUEUE LENGTH (M)	RECOMMENDED STORAGE LENGTH (M)
Bank Street and Leitrim Road	NB	15	15
	SB	55	55
	EB	0	0 ¹
	WB	20	20
Bank Street and Rotary Way/ Barrett Street 1	SB	5	5
	WB	55	55
Bank Street and Analdea Drive / White Alder Ave	SB	0	0 ¹
Bank and Findlay Creek Drive/ OPA Street 1	SB	10	10
	WB	30	30
Bank Street and Findlay Creek Centre/ OPA Street 2	SB	0	0 ¹
Bank Street and Blais Road/ Remer Street 14	SB	15	15
Bank and Remer Street 6	SB	0	0 ¹

Notes:

Recommended storage lengths do not account for deceleration lane and taper lane lengths.

1 - No storage required, only deceleration lane and taper lane if applicable.

8 Cost Estimate

The following cost estimates have been prepared for two staging options of the Bank Street EA proposed widening. The cost estimates are summarized in the tables below and include construction, engineering (design, contract administration, and construction inspection), utilities and overall contingency costs.

Table 21 summarizes the capital cost estimates from the Bank Street EA Study for the widening of Bank Street to the recommended EA Study design.

TABLE 21 – Bank Street Widening Cost Estimate – EA Study

BANK STREET WIDENING LIMITS	TMP PHASE	COST
South of Leitrim Road to South of Findlay Creek Drive (includes modified Leitrim intersection)	2 (2020 – 2025)	\$20,000,000
South of Findlay Creek Drive to Urban Boundary	3 (2026 – 2031)	\$7,000,000
Urban Boundary to Rideau Road	Post-2031	\$30,000,000

The total cost to widen Bank Street from Leitrim Road to south of Findlay Creek Drive is \$20M. This cost includes the upgrade to the Leitrim Road intersection including the realigned west approach. The cost to widen Bank Street from south of Leitrim Road to the Urban Boundary is \$7M.

8.1 Section 1 – Leitrim Road to South of Findlay Creek Drive

The results of the intersection capacity analysis indicate that upgrading the Bank Street and Leitrim Road intersection to the recommended design of the Bank Street EA Study will improve traffic operations at the intersection in the short term (2019). However, the existing capacity issues along the two-lane section of Bank Street south of Leitrim Road will continue to worsen as traffic increases with each year.

Table 22 presents a summary of the cost to modify the intersections along Bank Street in the interim period before Bank Street is widened to four lanes. With the exception of the intersection at Leitrim Road, which would be modified as per the EA Study design, the other intersection modifications are considered temporary and would therefore include non-recoverable or 'throw-away' costs. The amount of funds available for reimbursement through the current Development Charges (DC) Bylaw is noted for each project.

TABLE 22 – Interim Modifications Cost Estimate from Leitrim Road to Findlay Creek Drive

PROPOSED MODIFICATION	DEVELOPER	CAPITAL COST	DC BYLAW FUNDING	'THROW-AWAY' COST
Bank Street and Leitrim Road Intersection – EA Design	Cost-Shared	\$6,130,000	\$6,130,000	\$0
Bank Street and Rotary Way Intersection Modifications	Tartan	\$830,000	\$50,000	\$780,000
Bank Street and Findlay Creek Drive/ OPA Street 1 Intersection Modifications	Claridge / Urbandale	\$1,060,000	\$50,000	\$1,010,000
TOTALS		\$8,020,000	\$6,230,000	\$1,790,000

The estimated capital cost for the upgraded Leitrim Road intersection alone is approximately \$6.13M. This cost would be fully reimbursable through the DC Bylaw at the current 2025 timing indicated by the City. For the scenario in which the widening of Bank Street is delayed until 2022, there will be a need to upgrade the Rotary Way and Findlay Creek

Drive intersections in the interim period to allow for the addition of a fourth leg at each intersection. The estimated cost of these interim modifications is \$1.80M, of which only \$100,000 is currently available through the DC Bylaw fund.

8.2 Section 2 – South of Findlay Creek Drive to the Urban Boundary

The results of the intersection capacity analysis indicate that widening of Bank Street south of Findlay Creek Drive will not be required until sometime between 2025 and 2031. In the interim period, there will be a need to upgrade the existing intersections at the Findlay Creek Commercial Centre Access and at Blais Road to allow for the introduction of a fourth leg at each intersection. A new intersection at the proposed Street 6 location will also be required.

The interim costs associated with these intersections are summarized in **Table 23** below.

TABLE 23 – Interim Modifications Cost Estimate South of Findlay Creek Drive to Urban Boundary

PROPOSED MODIFICATION	DEVELOPER	CAPITAL COST	DC BYLAW FUNDING	'THROW-AWAY' COST
Bank Street and Findlay Creek Centre/ OPA Street 2	Claridge / Urbandale	\$795,000	\$0	\$795,000
Bank Street and Blais Road/ Remer Street 14	Regional / Tartan	\$1,310,000 ¹	\$950,000	\$360,000
Bank Street and Remer Street 6	Regional	\$1,265,000 ¹	\$950,000	\$315,000
TOTALS		\$3,370,000¹	\$1,900,000¹	\$1,470,000¹

Notes:

1. Traffic Signals

The estimated capital cost to upgrade the Findlay Creek Commercial Access / OPA 9b Street 2 intersection is \$795,000. There are currently no funds earmarked in the DC bylaw for this intersection.

The estimated capital cost to upgrade the Blais Road intersection with traffic signal control is approximately \$1.3M. The estimated cost of the proposed intersection at Remer Street 6 is approximately \$1.26M. There is \$950,000 identified in the DC Bylaw for each intersection. The remainder of the cost could be non-recoverable.

9 Conclusions and Recommendations

The Leitrim Community Master Transportation Study was commissioned on behalf of the Leitrim Community Owners Group, which includes Tartan Land Consultants, The Regional Group, Claridge Homes and Urbandale Corporation.

The overall conclusion of this study is that the Leitrim Community Development can be accommodated by the adjacent road network with the appropriate modifications in place. The Leitrim Community Owners Group shall be responsible for constructing the Bank Street and Leitrim Road intersection based on the interim design plan in the Bank Street EA, as well as all proposed access intersections and internal transportation facilities as dictated by each individual draft plan. These modifications are expected to provide temporary relief along the Bank Street corridor until the City planned widening (from Leitrim Road to Findlay Creek Drive) can be completed by 2025.

It is expected that the Leitrim Community Owners Group will be fully reimbursed by the City of Ottawa for the cost of the Bank Street and Leitrim Road intersection in accordance with the City of Ottawa Development Charges By-Law.

The key findings and recommendations from the MTS are as follows:

Leitrim Development Lands Characteristics

- The Leitrim Community Development Lands are comprised of the following developments:
 - Barrett Lands Development (3100 Leitrim Road);
 - Barrett Extension Lands Development (4660 Bank Street);
 - Findlay Creek Stage 2 Phase 4C development (4798 Bank Street);
 - OPA 76 Areas 9a and 9b development (4791, 4789 and 4771 Bank Street);
 - Idone Lands (4840 Bank Street); and
 - Remer Lands (4800 Bank Street)
- The proposed rights-of-way for internal roads within the Leitrim Community will be as follows:
 - Local Roads – 14.0m, 16.5m or 18.0m
 - Internal Collector Roads – 20.0m
 - Cedar Creek Drive
 - Sora Way
 - Major Collector Roads – 24m or 26m
 - Kelly Farm Drive
 - Barrett Street 1 (Barrett Farm Drive)
 - OPA Street 1
 - OPA Street 2
 - Remer Street 14
 - Remer Street 6
- Proposed collector roads within the development lands can support transit, which will be necessary to ensure all residents are within 400m of daily service.
- Existing transit service can be extended along Bank Street, Findlay Creek Drive and Kelly Farm Drive to serve all proposed developments on the west side of Bank Street. A new service route can be added for proposed developments on the east side of Bank Street via the OPA Street 1 access and OPA Street 12 that circulates to Rotary Way. The details of the implementation of transit service to the area will be developed with OC Transpo staff during the approvals process for each proposed development.
- Internal collector roadways and some local roadways will have sidewalks to provide connections to local parks and pathways. No dedicated cycling facilities have been proposed within the development lands.

- TDM and non-auto mode provisions will be reinforced. Appropriate connections, both internal and to the regional network, have been provided to accommodate active transportation.
- Full buildout of the Leitrim Community Development, as defined in this study, was assumed by 2031.

Existing Conditions Analysis

- The study area included the following existing intersections:
 - Bank Street and Leitrim Road
 - Bank Street and Rotary Way
 - Bank Street and White Alder Avenue/ Analdea Avenue
 - Bank Street and Findlay Creek Drive
 - Bank Street and Findlay Creek Shopping Centre Access
 - Bank Street and Blais Road
- A review of the reported collisions show the majority of collisions occurring at three intersections in the entire corridor (Leitrim Road, White Alder Avenue and Findlay Creek Drive). It is expected that the planned Bank Street widening and corresponding intersection modifications outlined in the Bank Street EA will reduce the number of reported collisions by increasing the capacity of Bank Street, which will improve operational performance along the corridor.
- There are three existing transit service routes operating within the study area: 99, 144 and 204. The 99 and 144 provide daily service while the 204 operates weekly.
- There are small pockets of pedestrian and cycling facilities along Bank Street. It is expected these gaps will be filled as development progresses within the study area.
- All existing study area intersections with the exception of Bank Street and Leitrim Road, and Bank Street and Rotary Way intersections were shown to operate within City standards in 2016. These results coincided with field observations showing significant traffic queues during the morning and afternoon peak periods at the Bank Street and Leitrim Road intersection.

Future Background Traffic

- Future traffic volumes were estimated using an annual traffic growth rate combined with the proposed Leitrim Community developments layered on top for each horizon year.
- A 1.0% background traffic growth rate was applied to existing traffic counts along Bank Street to represent regional traffic growth from outside the Leitrim Community (e.g. Greely and Metcalfe). The rate was derived from the Bank Street EA. Side street traffic was accounted for separately in the Leitrim Community development traffic generation.
- Future background traffic volumes were adjusted to account for the impact of the Kelly Farm Drive extension. It is expected that the extension will trigger a redistribution of a portion of the existing traffic volumes from the Findlay Creek Village development to the new Kelly Farm extension, bypassing Bank Street. A 20% redirection of existing traffic was assumed.
- Four future analysis horizons were established based on the phases established in the City of Ottawa TMP: 2019, 2022, 2025 and 2031. The 2022 horizon was added to further refine the analysis to determine more precisely trigger points for required roadway modifications.

Leitrim Community Trip Generation

- Local trip generation rates for commercial and residential land uses were developed by IBI using traffic counts completed in the existing Findlay Creek Community.
- The local rates were adjusted for expected growth in transit mode share between 2016 and 2031.

- The proposed Leitrim Community developments are expected to generate the following peak hour trips at each future horizon:
 - 2019 - Residential: 500 morning peak hour trips; 550 afternoon peak hour trips
Commercial: 100 morning peak hour trips; 190 afternoon peak hour trips
 - 2022 - Residential: 1,000 morning peak hour trips; 1,050 afternoon peak hour trips
Commercial: 260 morning peak hour trips; 500 afternoon peak hour trips
 - 2025- Residential: 1,450 morning peak hour trips; 1,550 afternoon peak hour trips
Commercial: 255 morning peak hour trips; 480 afternoon peak hour trips
 - 2031 - Residential: 2,200 morning peak hour trips; 2,400 afternoon peak hour trips
Commercial: 250 morning peak hour trips; 450 afternoon peak hour trips

Bank Street Widening

- The City of Ottawa completed the Bank Street EA in 2014. City staff confirmed the first phase, widening Bank Street from 2 to 4 lanes from Leitrim Road to Findlay Creek Drive, is scheduled to be completed by 2025.
- The second phase, widening of Bank Street from 2 to 4 lanes from Findlay Creek Drive to the Urban Boundary, was anticipated between 2026 and 2031 in the Bank Street EA. City staff has yet confirm the timing for the second phase.
- The recommended modifications in the Bank Street EA include full pedestrian and cycling facilities, including sidewalks, exclusive bike lanes and crossing facilities.

Future Traffic Analysis

- In the Future (2019) horizon year:
 - By 2019, new access approaches will be constructed at Rotary Way, Findlay Creek Drive, Findlay Creek Centre and Blais Road. The recommended lane configurations at these locations will be confirmed during detailed design for each individual development.
 - It is recommended that the Bank Street and Leitrim Road intersection be constructed as per the Bank Street EA Interim Design by the future 2019 horizon – ahead of the year 2025 schedule. With the proposed modifications, the Bank Street and Leitrim Road intersection is expected to operate within City standards in 2019.
 - The Bank Street and Rotary Way intersection continues to operate within City standards during the morning peak hour but slightly above its theoretical capacity in the afternoon peak period. It is recommended that the intersection be monitored post-construction of the Bank Street and Leitrim intersection interim design to confirm future capacity requirements.
 - Both the Bank Street and Street 6, and Bank Street and Blais Road intersections did not operate within City standards as unsignalized intersections. Additional capacity in the form of traffic control signals or a roundabout would be required. Both modifications meet City operating standards under 2019 traffic condition, but traffic control signals were shown to provide more capacity and better levels of service, which makes it the preferred modification.
 - All remaining study area intersections operate within City standards in both morning and afternoon peak periods.
- In the Future (2022) horizon year:
 - The Bank Street and Leitrim Road intersection was shown to operate within City standards under 2022 traffic conditions with the recommended Bank Street EA interim design.
 - By 2022, both the Bank Street and Rotary Way, and Bank Street and White Alder intersections were projected to operate beyond capacity during the peak periods. The Bank Street and Findlay

Creek Drive intersection will continue to operate within its theoretical capacity, but does not meet City standards under these conditions. At this point, the first section of the Bank Street widening, between Leitrim Road and Findlay Creek Drive, should be constructed. With the widening in place, both intersections are expected to operate at an acceptable level of service.

- The Bank Street and Street 14 intersection was shown to operate below City standards as a single lane roundabout. It is recommended that a traffic signal be proposed at this intersection to provide a longer lifespan for interim modifications.
- All remaining study area intersections operate within City standards in both morning and afternoon peak periods with only minor modifications.
- In the Future (2025) horizon year:
 - The upgraded Bank and Leitrim intersection is expected to operate near its theoretical capacity by 2025, which is similar to levels experienced at the intersection in 2016.
 - The Bank Street and Blais Road, and Bank Street and Street 6 intersection were shown to operate above City standards in the afternoon peak hour, indicating that this section of Bank Street is beginning to approach its capacity as a two-lane road by this horizon year and that widening to four lanes should be investigated.
 - All remaining intersections within the study area were projected to operate within City standards in both morning and afternoon peak periods at the 2025 horizon year.
- In the Future (2031) horizon year:
 - The Bank and Leitrim intersection operates above its theoretical capacity in both morning and afternoon peak periods with four lanes on Bank Street. The ultimate plan from the Bank Street EA Study recommends six lanes on Bank Street from Conroy Road to just south of Leitrim Road, which would make levels-of-service similar to existing conditions.
 - The remaining intersections within the study area are expected to operate at acceptable levels of service under 2031 traffic conditions assuming the Bank Street widening from 2 to 4-lanes has been extended to Street 6, with traffic signals at each intersection.

Geometric Analysis Results

- Geometric evaluations revealed no sight distance or corner clearance issues. Proper care should be taken to ensure no obstructions are placed in the line-of-sight in the vicinity of the proposed access points. The future access locations to the commercial blocks are expected to follow these guidelines, and will be assessed during the site plan application when more details are available.
- All auxiliary lane and storage length requirements at signalized intersections were summarized in Section 7.3 of this study. New access intersections should be constructed as per City standards with required turning lanes.
- The Bank Street EA did not recommend any northbound right-turn lanes except at the Bank Street and Leitrim Road intersection. The operational results confirmed these designs were sufficient. No further modifications were necessary.
- All geometric recommendations should be reviewed and confirmed during detailed design for each individual development.

SUMMARY OF RECOMMENDATIONS

The following table outlines the staging of modifications for each intersection by horizon year up to 2031. The responsibility for modifications at each intersection will be as follows:

Interim Design Modifications (2019-2025)

- Bank Street and Leitrim Road Interim Design – Leitrim Community Owners Group
- Bank Street and Rotary Way – Tartan Land Consultants
- Bank Street and Findlay Creek Drive – Urbandale Corporation and Claridge Homes
- Bank Street and Findlay Creek Centre – Urbandale Corporation and Claridge Homes
- Bank Street and Blais Road – The Regional Group and Tartan Land Consultants
- Bank Street and Street 6 – The Regional Group

Ultimate Design Modifications (2025-2031)

- Bank Street widening from 2 to 4 lanes from south of Leitrim Road to Street 6 – City of Ottawa

TABLE 24 – Summary of Recommended Actions/ Modifications

HORIZON	RECOMMENDED ACTIONS/ MODIFICATIONS
Existing (2016)	Begin design of Bank Street and Leitrim Road Interim Intersection Design for implementation by 2019.
Total Traffic Future (2019)	<p>Optimize and coordinate all traffic signal timings.</p> <p>Bank Street & Leitrim Road</p> <ul style="list-style-type: none"> • Summary of Bank Street EA Interim Plan intersection configuration: <ul style="list-style-type: none"> ○ Widening Bank Street and Leitrim Road from 2 to 4 lanes through the intersection ○ Double eastbound and westbound left-turn lanes ○ Single northbound and southbound left-turn lanes ○ Northbound and southbound right-turn lanes ○ Channelized right-turns at each approach ○ Recommended storage lengths defined in Section 7.3 <p>Bank Street & Rotary Way:</p> <ul style="list-style-type: none"> • New Access intersection to Barrett Lands Street 1 (Barrett Farm Drive) by Tartan: <ul style="list-style-type: none"> ○ Northbound and eastbound left-turn lane ○ Southbound right-turn lane with channelization ○ Recommended storage lengths defined in Section 7.3 <p>Bank Street & Findlay Creek Drive:</p> <ul style="list-style-type: none"> • New Access intersection to OPA Lands Street 1 by Urbandale and Claridge: <ul style="list-style-type: none"> ○ Southbound and westbound left-turn lane ○ Recommended storage lengths defined in Section 7.3 <p>Bank Street & Findlay Creek Centre:</p> <ul style="list-style-type: none"> • New Access intersection to OPA Lands Street 2 by Urbandale and Claridge: <ul style="list-style-type: none"> ○ Southbound and westbound left-turn lane ○ Recommended storage lengths defined in Section 7.3 <p>Bank Street & Blais Road:</p> <ul style="list-style-type: none"> • New Access intersection to Remer/ Findlay Creek Street 14 by Regional and Tartan: • Single Lane Roundabout or Traffic Control Signals • If Signals <ul style="list-style-type: none"> ○ Left-turn lane on all approaches ○ Southbound right-turn lane ○ Eastbound left-turn lane ○ Recommended storage lengths defined in Section 7.3 <p>Bank Street & Remer Street 6:</p> <ul style="list-style-type: none"> • New Access intersection to Remer/ Idone Lands Street 6 by Regional: • Single Lane Roundabout or Traffic Control Signals • If Signals <ul style="list-style-type: none"> ○ Northbound and eastbound left-turn lane ○ Southbound right-turn lane ○ Recommended storage lengths defined in Section 7.3
Total Traffic Future (2022)	<p>Bank Street & Rotary Way; Bank Street & White Alder Avenue/ Analdea Drive</p> <ul style="list-style-type: none"> • Both intersections operate below City standards with interim modifications • Bank Street widening to Findlay Creek should begin implementation to ensure completion by 2025

HORIZON	RECOMMENDED ACTIONS/ MODIFICATIONS
	Bank Street & Blais Road <ul style="list-style-type: none"> Single Lane Roundabout operates below City standards. Recommend signals at this intersection to extend lifespan of interim modifications
Total Traffic Future (2025)	<p>Bank Street EA modifications implemented down to Findlay Creek Drive. Optimize and coordinate all signal timing plans.</p> Bank Street & Leitrim Road <ul style="list-style-type: none"> Add eastbound and westbound right-turn lanes as per Bank Street EA Ultimate Plan Bank Street & Blais Road; Bank Street & Remer Street 6 <ul style="list-style-type: none"> Single Lane Roundabout operates below City standards. Recommend signals at this intersection to extend lifespan of interim modifications
Total Traffic Future (2031)	<p>Bank Street EA modifications implemented down to Urban Boundary. Optimize and coordinate all signal timing plans. Investigate potential widening of Bank Street from 4 to 6 lanes, as per the Bank Street EA Ultimate Plan.</p>

The recommended design of Bank Street in the future (2031) horizon year based on the results of the Leitrim Community MTS has been provided in **Exhibit 18**.

EXHIBIT 18 – Recommended Lane Configurations and Intersection Control

10 Professional Authorization

Prepared By:

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