JLR No.: 31079-000

August 30, 2021

Transportation Impact Assessment

360 Bobolink Ridge

J.L.Richards
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TIA Plan Reports

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

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

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

CERTIFICATION

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

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

City Of Ottawa
Infrastructure Services and Community Sustainability
Planning and Growth Management
110 Laurier Avenue West, 4th fl.
Ottawa, ON K1P 1J1
Tel. : 613-580-2424
Fax: 613-560-6006

Ville d'Ottawa
Services d 'infrastructure et Viabilité des collectivités
Urbanisme et Gestion de la croissance
110, avenue Laurier Ouest
Ottawa (Ontario) K1P 1J1
Tél. : 613-580-2424
Télécopieur: 613-560-6006

Dated at Ottawa (City) this 30 day of August, 2021.

Name: Gordon Scobie
(Please Print)

Professional Title: Civil Engineer

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

Office Contact Information (Please Print)	
Address:	864 Lady Ellen Place
City / Postal Code:	Ottawa, ON K1Z 5M2
Telephone / Extension:	613 728-3571
E-Mail Address:	gscobie@jlrichards.ca

Stamp

City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	**360 Bobolink Ridge**
Description of Location	8.75 acre vacant lot to be developed for residential use (refer to attached plan)
Land Use Classification	Residential – Medium Density
Development Size (units)	Approx. 373 dwelling units
Development Size (m^2)	n/a
Number of Accesses and Locations	One driveway connection to Bobolink Ridge and one driveway connection to Livery Street
Phase of Development	Single phase
Buildout Year	2024

If available, please attach a sketch of the development or site plan to this form.

2. Trip Generation Trigger

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size
Single-family homes	40 units
Townhomes or apartments	90 units ✓
Office	3,500 m^2
Industrial	5,000 m^2
Fast-food restaurant or coffee shop	100 m^2
Destination retail	1,000 m^2
Gas station or convenience market	75 m^2

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, the Trip Generation Trigger is satisfied.

3. Location Triggers

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

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).*

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

4. Safety Triggers

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

If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?	✓	
Does the development satisfy the Location Trigger?	✓	
Does the development satisfy the Safety Trigger?	✓	

If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

Table of Contents

Introduction **1**

1.0 Screening **1**

2.0 Scoping **1**
2.1 Existing and Planned Conditions 1
Description of Proposed Development 1
Existing Conditions 4
Area Road Network 4
Study Area Intersections 4
Existing Driveways to Adjacent Development 5
Pedestrian/Cycling Network 7
Transit Network 10
Area Traffic Management 12
Peak Hour Travel Demands 12
Existing Road Safety Conditions 15
Planned Conditions 15
Study Area Transportation Network Changes 15
Other Area Development 16
2.2 Study Area and Time Periods 17
Study Area 17
Time Periods 17
Horizon Years 17
2.3 Exemptions Review 18

3.0 Forecasting **19**
3.1 Development-Generated Travel Demand 19
Trip Generation 19
Travel Mode Shares 20
Trip Distribution 21
Trip Assignment 21
3.2 Background Network Travel Demands 21
Transportation Network Plans 21
Other Area Development 22
Background Growth 22
3.3 Demand Rationalization 23
Existing and Background Conditions 23
Adjustments to Background Network Demand 26
Total Projected Conditions 26
Adjustments to Site-Generated Demand 30

4.0 Analysis **31**
4.1 Development Design 31
Design for Sustainable Modes 31
Circulation and Access 31
New Street Networks 32
4.2 Parking 32
Parking Supply 32
Vehicular Parking 32

Bike Parking 32
Spillover Parking....32
4.3 Boundary Street Design 33
Mobility....33
Segment MMLOS Summary....33
Pedestrian LOS 34
Bike LOS 34
Transit LOS 34
Truck LOS 34
Road Safety....35
Neighbourhood Traffic Management (NTM)....35
4.4 Access Intersection Design 36
Location and Design of Access....36
Intersection Control 37
Intersection Design....37
4.5 Transportation Demand Management 37
4.6 Neighbourhood Traffic Management 37
4.7 Transit 37
Route Capacity....38
Transit Priority 38
4.8 Review of Network Concept 38
4.9 Intersection Design....38
Intersection Control 38
Intersection Design....38

5.0 Findings and Recommendations 38

List of Figures

Figure 1: Local Context 2
Figure 2: Proposed Site Plan 3
Figure 3: Adjacent Driveways 6
Figure 4: Existing Pedestrian Network 8
Figure 5: Existing Cycling Network 9
Figure 6: Transit Routes Within Study Area (Source: OC Transpo System Map) 11
Figure 7: Transit Stops Within Study Area 11
Figure 8: Existing Vehicular Volumes AM(PM) 13
Figure 9: Existing Volumes AM(PM) - Non-motorists 14
Figure 10: Collison Frequency 15
Figure 11: Upcoming Construction and Infrastructure Projects 16
Figure 12: 'New' Projected Site-Generated Traffic 21
Figure 13: Background Traffic Volumes (2024) 22
Figure 14: Background Traffic Volumes (2029) 23
Figure 15: Total Projected Traffic Volumes (2024) 27
Figure 16: Total Projected Traffic Volumes (2029) 29
Figure 17: Road Classification 33

List of Tables

Table 1: OC Transpo Stop Information 10
Table 2: OC Transpo Route Information 10
Table 3: Area Development 16
Table 4: Module Exemption Review 18
Table 5: TRANS Peak Hour Trip Generation Rates 19
Table 6: Modified Peak Period Person Trips 19
Table 7: Projected Modal Site Generated Trips 20
Table 8: Study Area Intersection Operations – Existing Conditions 24
Table 9: Study Area Intersection Operations – 2024 Background Conditions 25
Table 10: Study Area Intersection Operations – 2029 Background Conditions 26
Table 11: Study Area Intersection Operations – Total Projected Conditions (2024) 28
Table 12: Study Area Intersection Operations – Total Projected Conditions (2029) 30
Table 13: Vehicular Parking Supply 32
Table 14: Segment MMLOS – Existing LOS(Target LOS) 34
Table 15: Historical Collision Data Summary by Intersection 35

List of Appendices

Appendix A – Existing Traffic Counts
Appendix B – Collision Data
Appendix C – Existing and Background Conditions Output Data (2024, 2029)
Appendix D – Total Projected Conditions Output Data (2024, 2029)
Appendix E – Transportation Demand Management (TDM) Strategies
Appendix F – Segment MMLOS
Appendix G – Collision Analysis
Appendix H – TDM Checklist
Appendix I – Transit Route Maps
Appendix J – Transit Ridership Data

Introduction

With respect to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines, a total of five separate submissions are required for City review/approval. Each submission is a component/section of a formal TIA, which includes:

- *Step 1 – Screening*
- *Step 2 – Scoping*
- *Step 3 – Forecasting*
- *Step 4 – Analysis*
- *Step 5 – TIA Submission* (i.e. Findings and Recommendations)

This report has been structured with these above noted *Steps 1-5* as numbered sections accordingly, as outlined in the City's TIA Guidelines.

1.0 Screening

In regards to *Step 1 – Screening*, this is a form that contains a list of triggers to determine if the proposed size, type and location of a proposed development will require a formal TIA, as part of the City's development application approval process (e.g. not all new developments require a TIA).

With respect to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines, the proposed development (described below in Section 2.1) triggered the trip generation, location and the safety criteria outlined in the City's TIA *Step – 1 Screening* form. Given these triggers were met, a formal TIA (i.e. completed steps 1-5) must accompany the subject development application.

2.0 Scoping

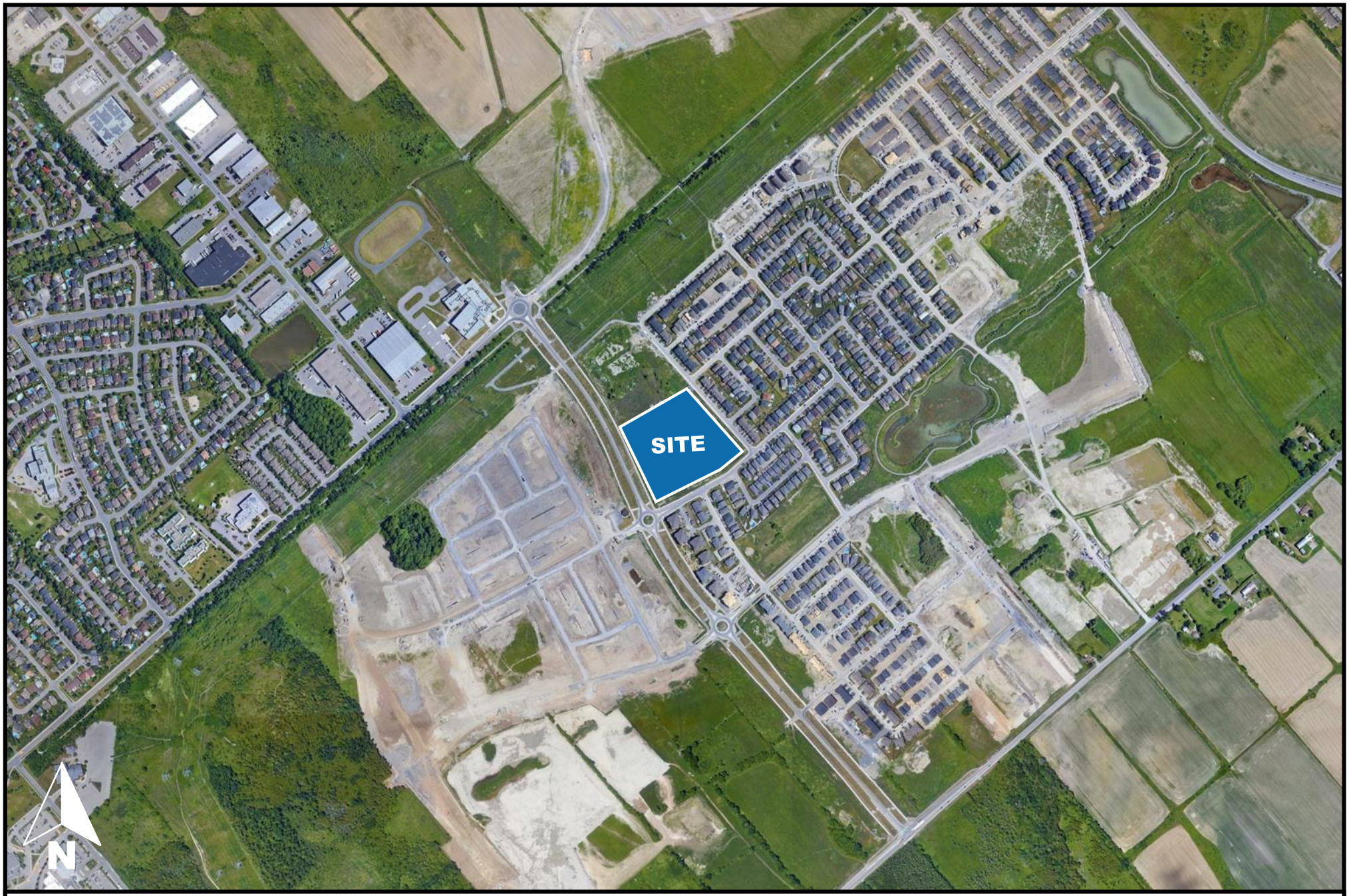
2.1 Existing and Planned Conditions

Description of Proposed Development

Based on the information provided, it is our understanding the proponent is seeking City approval for the development of approximately 8.76 acres of vacant land municipally known as 360 Bobolink Ridge, Ottawa, which is within the community known as Stittsville. The subject site is located within the northeast quadrant of the Bobolink/Robert Grant Avenue intersection. The latest Site Plan illustrates that the proposed development will include 4 medium density apartment buildings, accumulating to approximately 360 dwelling units. The subject development will be constructed in a single phase, with an estimated build-out year of 2024.

The latest Site Plan shows that the proposed development will include a total of three vehicle driveway connections to/from the site. One site access will be located on Bobolink Ridge approximately 110 m east of the Bobolink/Robert Grant intersection; one will be on Livery Street, approximately 85 m north of the Bobolink/Livery intersection; and the third is a potential (and to be confirmed) driveway connection to Robert Grant Avenue, approximately 100 m north of the Bobolink/Robert Grant intersection. Pedestrians will have direct access to existing sidewalks along Bobolink Ridge, Robert Grant Avenue and Livery Street, which supports active mobility between on-site facilities and the developed surrounding pedestrian network.

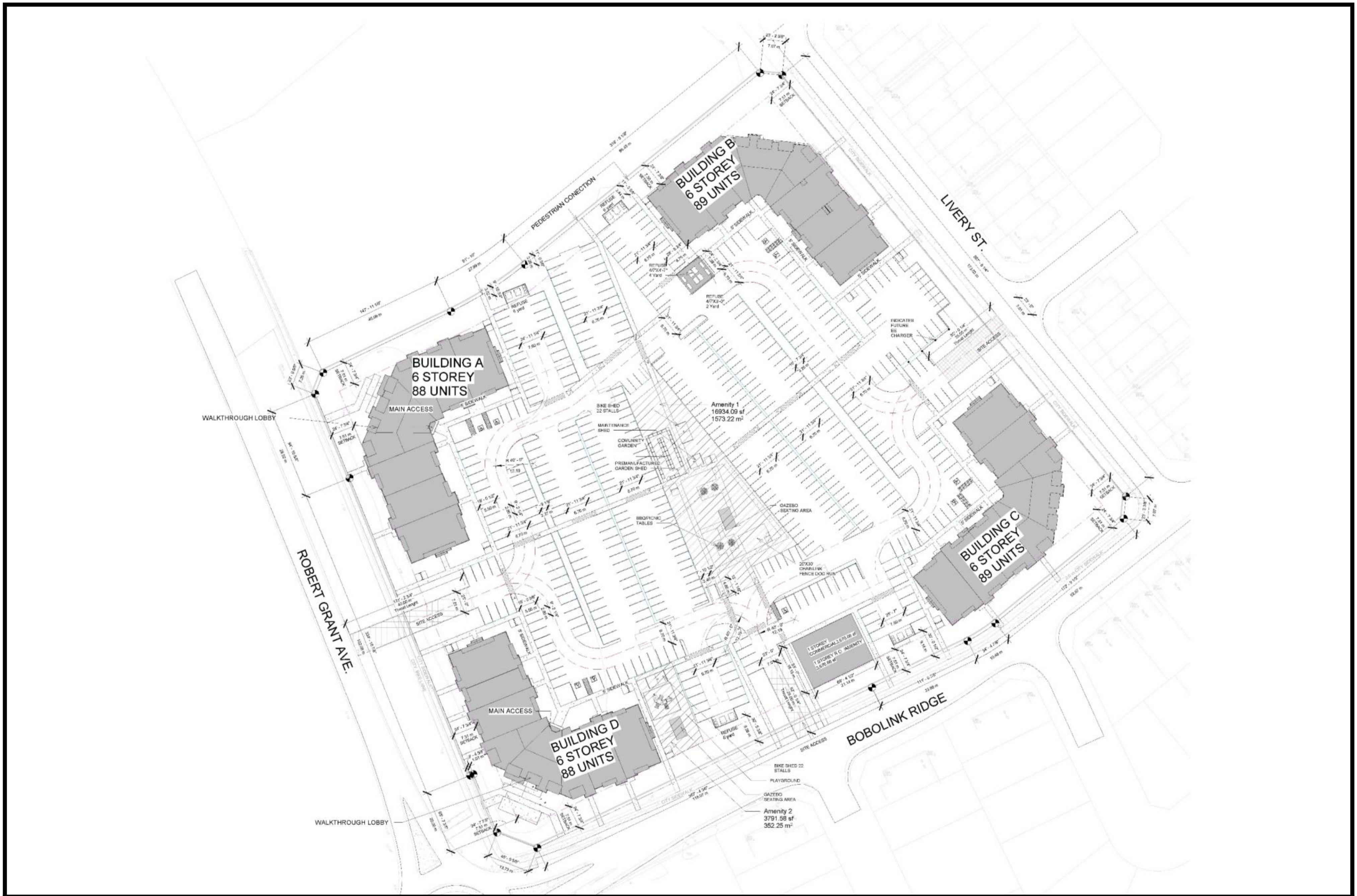
The local context surrounding the subject development site is depicted in the following **Figure 1**, and the proposed Site Plan is depicted in the subsequent **Figure 2**.



J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

Figure 1: Local Context



J.L. Richards
ENGINEERS · ARCHITECTS · PLANNERS

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

Figure 2: Proposed Site Plan

Existing Conditions

Area Road Network

Bobolink Ridge is a two-lane local roadway (i.e. one travel lane per direction) along the subject site's frontage. It extends between Angel Heights in the west and Asturcon Street in the east. Within the vicinity of the subject site, the posted speed limit is 40 km/h and parking regulations are unposted and therefore, parking is permitted for a maximum of 3 hrs along both sides of the roadway where possible, with respect to City By-Law.

Robert Grant Avenue is a two-lane arterial roadway (i.e. one travel lane per direction), it extends between Abbott Street in the north and Fernbank Road in the south. Within the vicinity of the subject development site, the posted speed limit is 60 km/h and on-street parking regulations are unposted.

Shinny Avenue is a two-lane local roadway (i.e. one travel lane per direction), which extends from Bobolink Ridge in the north and Defence Street in the southeast. Within the vicinity of the subject site, the posted speed limit is 40 km/h and on-street parking regulations are unposted.

Livery Street is a two-lane local road (i.e. one travel lane per direction), which extends between Bobolink Ridge in the south and Tapadero Avenue in the northeast. Within the vicinity of the subject site, the posted speed limit is 40 km/h and on-street parking is prohibited on the east side of the road, and on the west side of the road, on-street parking regulations are unposted.

Study Area Intersections

Bobolink/Robert Grant

The Bobolink/Robert Grant intersection is a YEILD controlled four-legged single lane roundabout. All approaches to the roundabout consist of a single lane that accommodates all possible movements.

Bobolink/Shinny
The Bobolink/Shinny intersection is an unsignalized, three-legged intersection with STOP control on the minor approach only (Shinny Avenue). All approaches consist of a single lane that accommodates all possible movements.

All movements are permitted at this location.

Bobolink/Livery
The Bobolink/Livery intersection is an unsignalized, three-legged intersection with STOP control on the minor approach only (Livery Street). All approaches consist of a single lane that accommodates all possible movements.

All movements are permitted at this location.

Existing Driveways to Adjacent Development

As depicted in the following **Figure 3**, there are approximately 140 driveway connections within a 200 m boundary of the proposed site driveway connections. All driveways adjacent to the subject development provide access/egress for private low-rise residential land uses, such as single-family homes and townhomes/low-rise apartments.

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

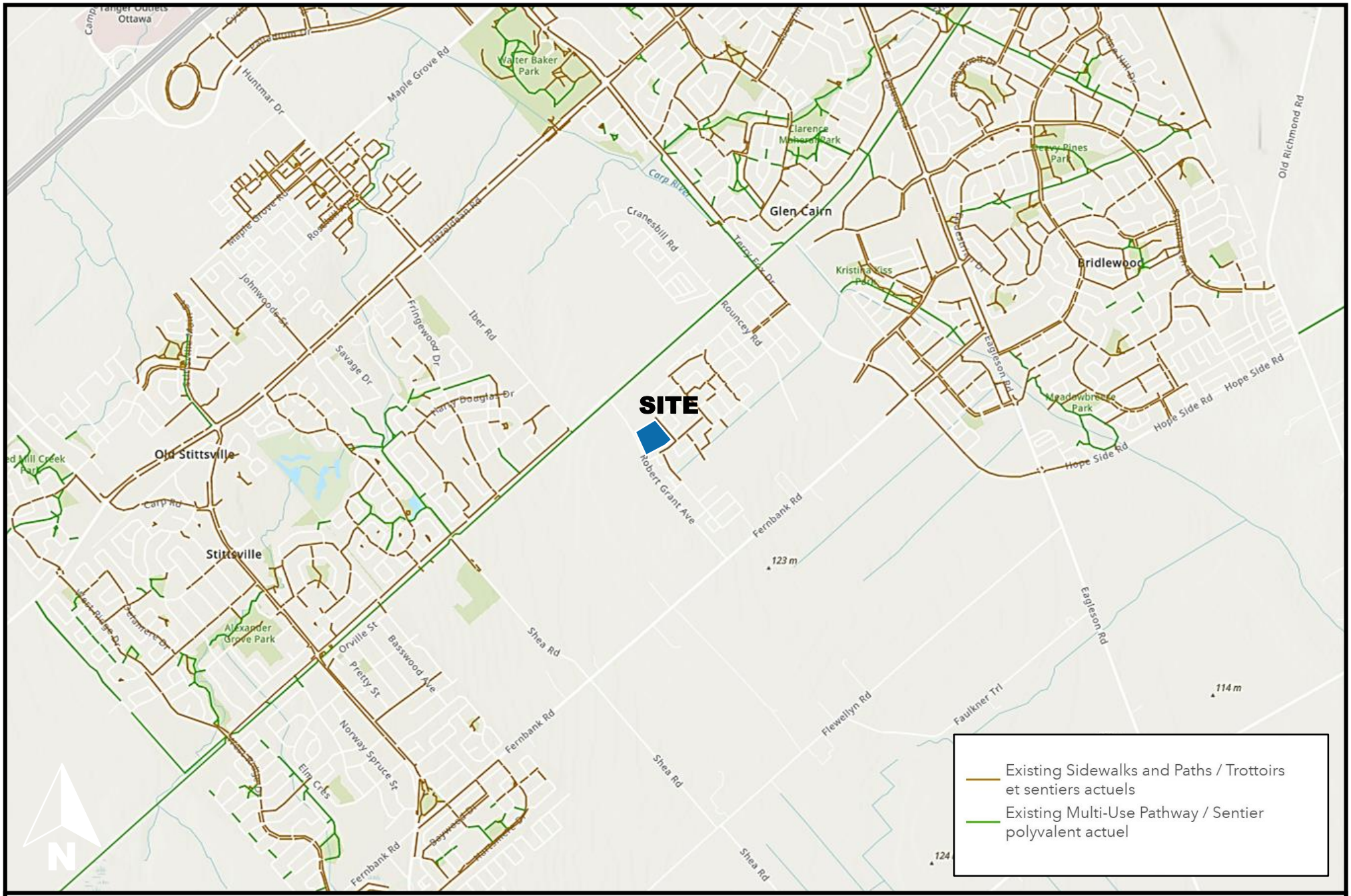
Figure 3: Adjacent Driveways

Pedestrian/Cycling Network

The pedestrian network within the vicinity of the subject site is fairly well developed. Along Bobolink Ridge, sidewalks are provided along the north side of the roadway, and along the subject site's frontage, a sidewalk is also provided on the south side of the Bobolink Ridge from Robert Grant Avenue to Shinny Avenue. A sidewalk is also provided on the west side of Livery Street, along the subject site's frontage only. Along Robert Grant Avenue, sidewalks are provided on both sides of the roadway.

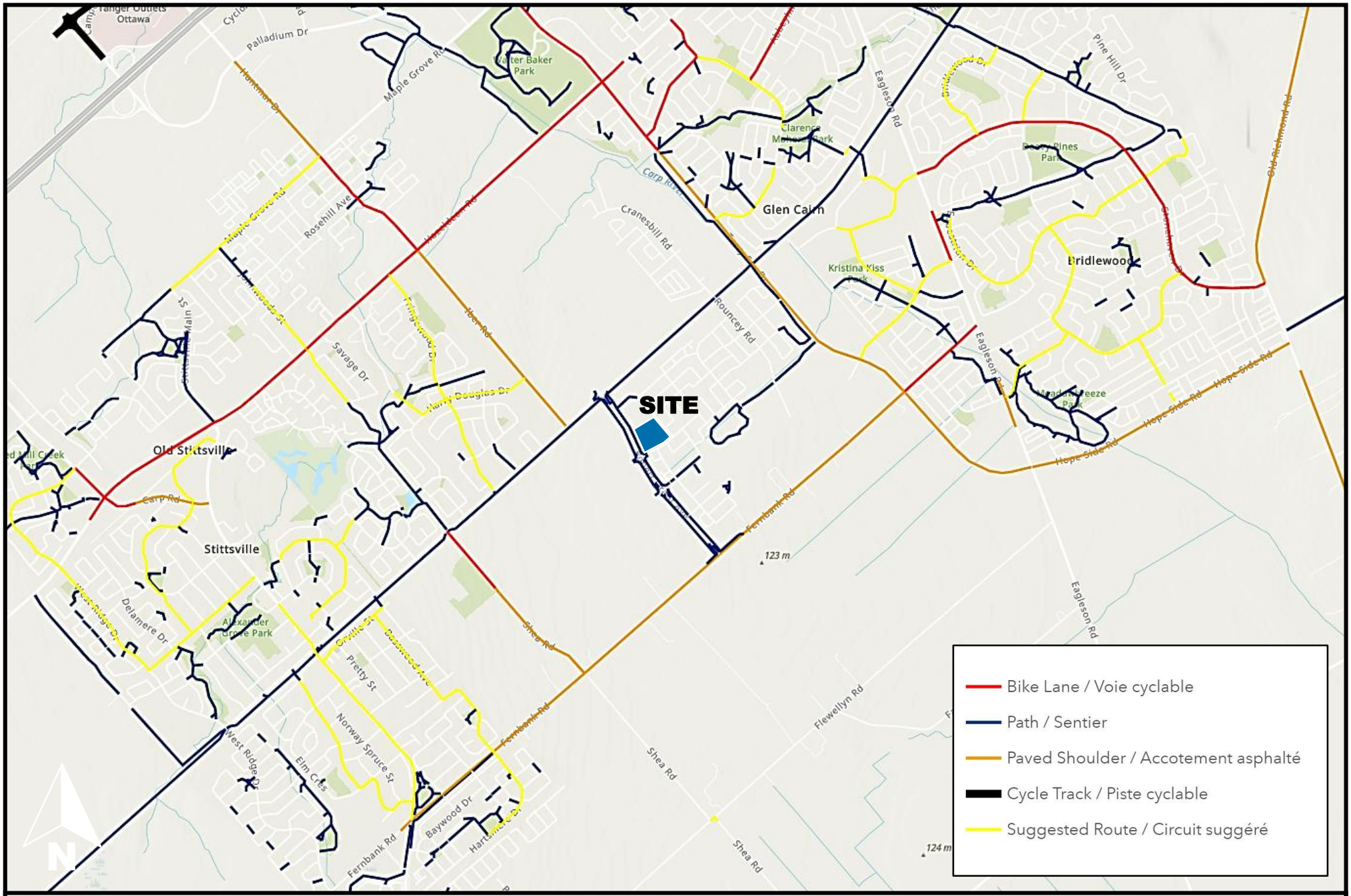
With respect to cyclists, current cycling facilities are also fairly well established. Within the study area, a paved pathway is provided along both sides of Robert Grant Avenue, which connects to the Trans Canada Trail in the north and Fernbank Road in the south, where paved shoulders are provided.

Detailed maps of the existing study area pedestrian/cycling network, and how it connects to the greater network is depicted in the following **Figure 4** and **Figure 5**, as sourced from the City's online Open data tool. It should be noted that the sidewalks on Robert Grant Avenue have not been updated on the City's online Open data sources, but have been described above.



J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

Figure 4: Pedestrian Network



J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

Figure 5: Cycling Network

Transit Network

OC Transpo currently provides five bus stops within walking distance to/from the subject development site, which are serviced by three separate bus routes.

The following **Table 1** summarizes existing bus stops, their associated routes and direction of travel, and the following **Table 2** provides additional route information.

Table 1: OC Transpo Stop Information

Stop #	Location	Route Identifier	Direction
1626	Abbott/Iber	62	Westbound
1646	Iber/Abbott	62	Eastbound
5050	Robert Grant/Haliburton	167, 252	Northbound, Inbound
5051	Robert Grant/Haliburton	167, 252	Southbound, Outbound
8493	Cope/Yellowtail	167, 252	Southbound, Northbound, Outbound, Inbound

Table 2: OC Transpo Route Information

Route	Origin/Destination	Service Type	Frequency
62	Tunney's Pasture ↔ Stittsville & Terry Fox	Rapid	30 mins 7-day all-day service
167	Terry Fox ↔ Blackstone	Local	30 mins Mon-Fri selected time periods
252	Tunney's Pasture ↔ Fernbank	Connexion	15 mins Mon-Fri peak periods only

The following **Figure 6** depicts OC Transpo routes and **Figure 7** depicts transit stop locations within the vicinity of the subject development site.

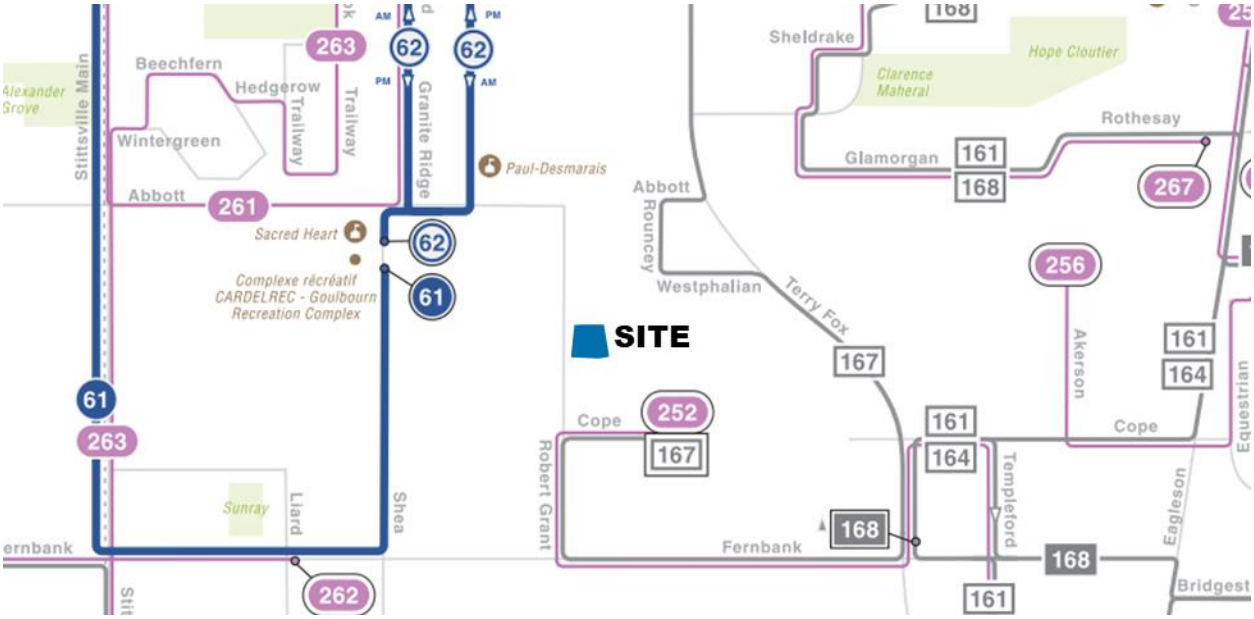


Figure 6: Transit Routes Within Study Area (Source: OC Transpo System Map)

Figure 7: Transit Stops Within Study Area

Based on the foregoing, the subject development site is relatively well serviced by transit. With respect to the City's current Transportation Master Plan (TMP), Robert Grant Avenue is also a

planned transit priority corridor, which will further enhance area transit service. The timing of this future corridor is described further in the subsequent *Study Area Transportation Network Changes* section of this report.

Area Traffic Management

There are currently no traffic calming measures within the vicinity of the subject site. However, Robert Grant Avenue consists of a series of roundabouts, which are considered to be an effective tool to mitigate vehicle speeds.

Peak Hour Travel Demands

For the purpose of this assessment and based on discussions with the City staff, the following study area intersections have been identified for intersection capacity analysis:

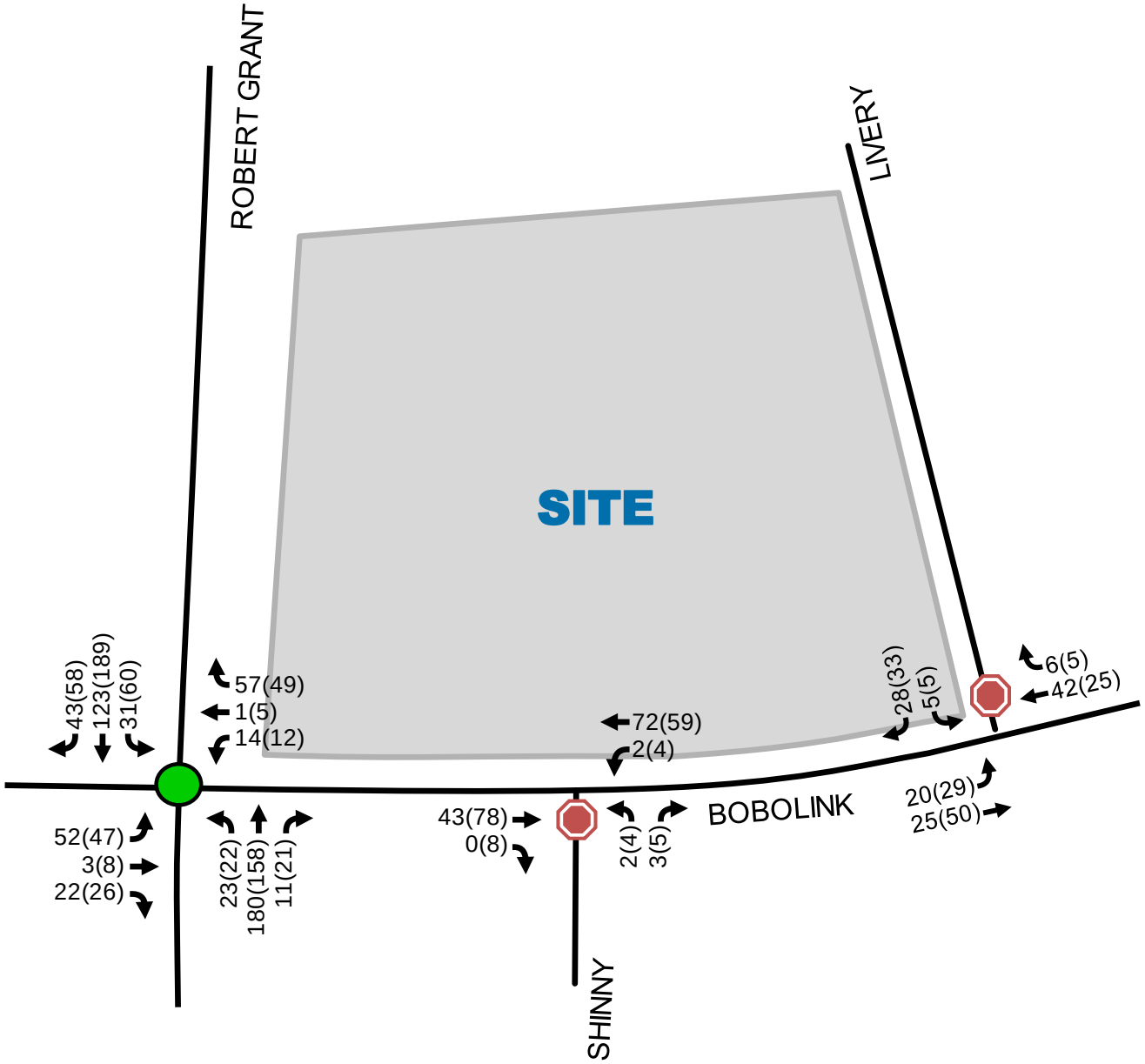
- Bobolink/Robert Grant
- Bobolink/Shinny
- Bobolink/Livery

The following **Figure 8** depicts the observed weekday morning and afternoon peak hour vehicular movements at study area intersections, and **Figure 9** depicts pedestrian and cyclist movements over the same peak hours. Detailed traffic volume data collected on March 31, 2021, is provided as **Appendix A**.

It should be noted that at the time of data collection and with respect to Ontario's colour-coded COVID-19 response framework, Ottawa was under a "Red-Restrict" zone during field observations. While the province still encourages working from home as much as possible, the Red-Restrict zone is less restrictive than the "Grey-Lockdown" zone/stay-at-home orders. Therefore, it should be understood that field observations on March 31, 2021 do not represent a sample of typical conditions; however, the conditions observed on this day are as close to typical as possible, given the ongoing impacts on travel behaviour related to the COVID-19 pandemic.

Comparing recently collected traffic volume data to historical data collected in January 2019, there has been an approximate 38% growth in traffic volumes at the Robert Grant/Bobolink roundabout, despite the ongoing impacts related to the COVID-19 pandemic. This growth can be attributed to new housing in the area and construction related vehicle activity. At the Bobolink/Livery intersection, a traffic volume data comparison to November 2019 data reveals an approximate 25% decline in volumes, which is more inline with projected impacts related to the COVID-19 pandemic.

Despite the inconsistencies in available data, the volume data depicted in the following **Figure 8** and **Figure 9** will be sufficient for analysis purposes.

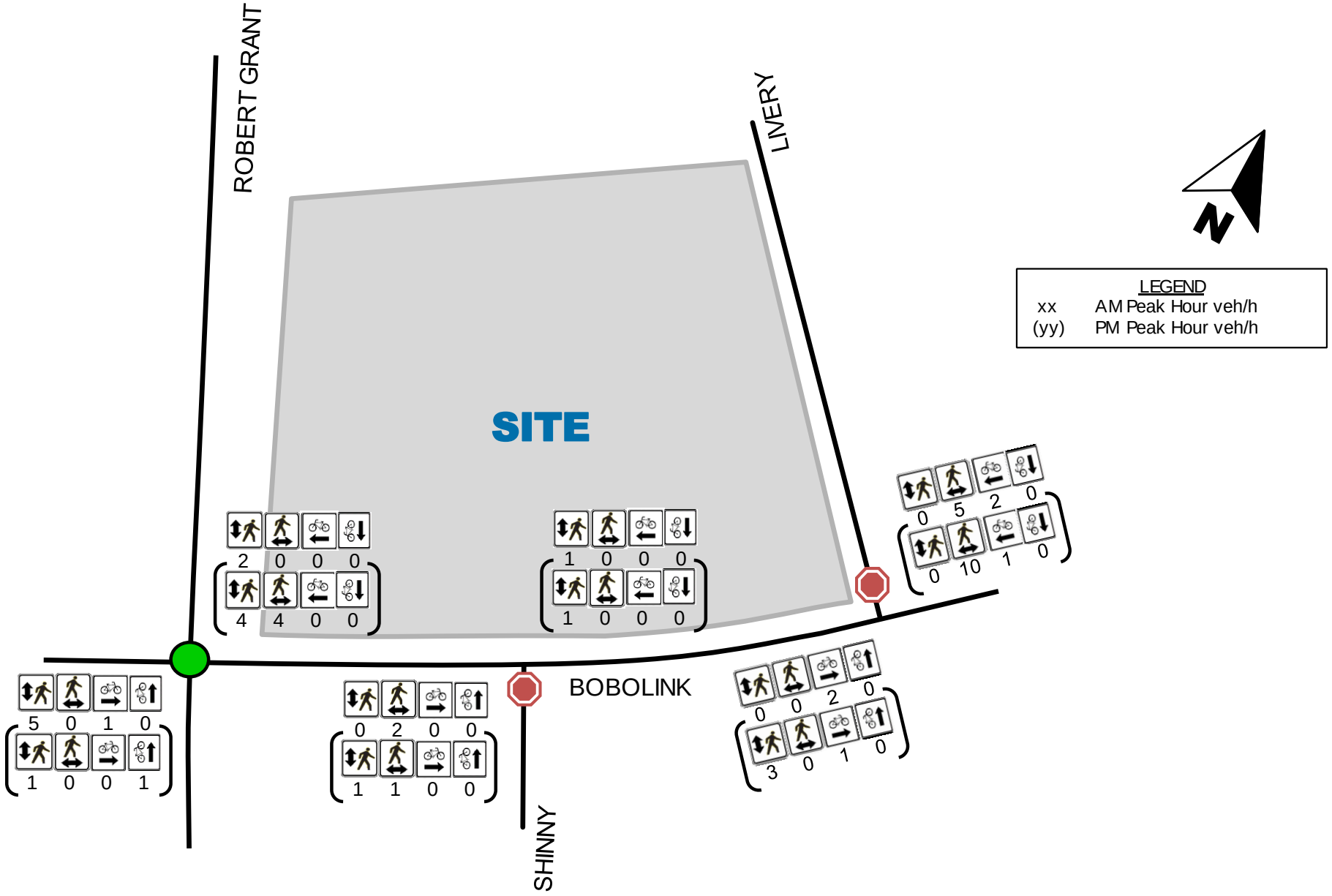


LEGEND

xx	AM Peak Hour veh/h
(yy)	PM Peak Hour veh/h

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

Figure 8: Existing Vehicular Volumes AM(PM)



J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

Figure 9: Existing Volumes AM(PM) – Non-motorists

Existing Road Safety Conditions

The most recent collision history for the past five (5) years was obtained from the City (i.e. available collision data for the years of 2015 – 2019, inclusive). The collision data includes all collisions at intersections and roadway segments that occurred on boundary streets adjacent to/surrounding the subject development site.

Based on the most recent available historical collision data, the five-year total number of recorded collisions that occurred on boundary streets is 3. All the collisions that occurred on boundary streets resulted in property damage only and were angle type collisions.

The following **Figure 10** is a map that depicts the locations and year of collisions the occurred on boundary streets and within the vicinity of the subject development site. The source collision data is provided in **Appendix B**, and a more detail collision analysis is included in the subsequent *Step 4 – Analysis* section of this report.

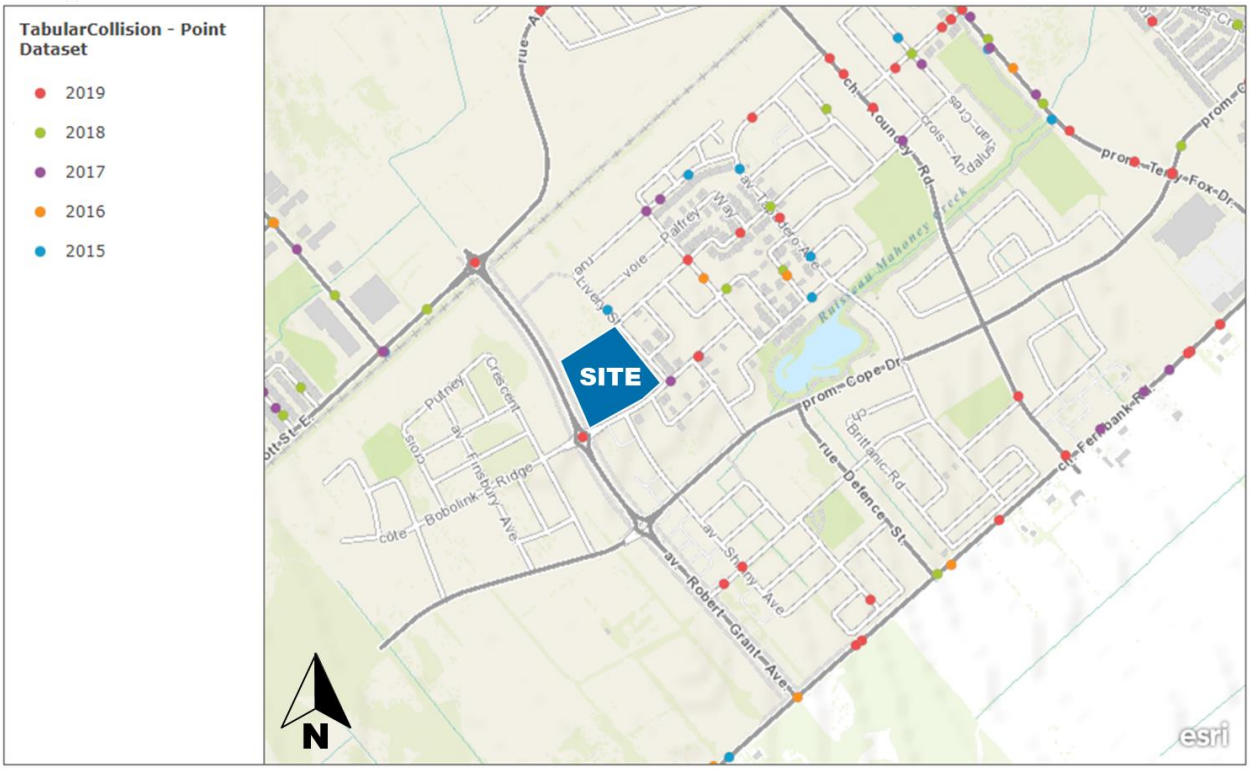


Figure 10: Collison Frequency

Planned Conditions

Study Area Transportation Network Changes

Transit Projects

According to the City of Ottawa Transportation Master Plan (TMP), transit signal priority and queue jump lanes are planned for selected intersections along Robert Grant Avenue between Fernbank Road and Palladium Drive. This network change is referred to as the "Stittsville North-South Arterial" as part of the City's planned 2031 *Affordable Network*.

Road Projects

Referencing the City's Construction and Infrastructure Projects website, new road construction projects are anticipated to happen along Robert Grant Avenue within 4 to 7 years. Additionally, it should also be noted:

- Abbott Street is scheduled for resurfacing within the next 1-2 years; and
- Sewer works is scheduled for this year along Iber Road.

The following **Figure 12** depicts the approximate location of these infrastructure projects relative to the subject site.

Figure 11: Upcoming Construction and Infrastructure Projects

The single dot on **Figure 11**, located in the east quadrant of the map, indicates the construction of a new park, which is planned to occur this year.

Outlined in the TMP, the extension of Robert Grant Avenue, north of Abbott Street, is scheduled to take place as a Phase 2 project between 2020 and 2025, according to the City's planned 2031 *Affordable Network*.

Other Area Development

Planned developments within the vicinity of the subject development were identified using the City's online Development Application Tool. The following **Table 3** below summarizes the registered developments within the vicinity of the subject site.

Table 3: Area Development

Location	Anticipated Build-Out Year	Size	Land Use
1000 Robert Grant Avenue	2023	3 low to mid rise apartments	Residential

It should be noted that the projected impact of the above mentioned development has accounted for in the subsequent *Step 3 – Forecasting* section of this report.

2.2 Study Area and Time Periods

Study Area

As discussed with and confirmed by City staff, the following study area intersections were selected for the purpose of this assessment:

- Bobolink/Robert Grant
- Bobolink/Shinny
- Bobolink/Livery

Time Periods

Given the surrounding road network typically experiences the heaviest volumes during the weekday morning and afternoon peak hours, this assessment considered weekday morning and afternoon peak hours for analysis purposes only.

Horizon Years

For the purpose of this assessment, the following development timeline was assumed:

- **2024** – Estimated full build-out of the subject development
- **2029** – 5-years beyond full build-out (required with respect to the City's TIA Guidelines)

2.3 Exemptions Review

Given the size and nature of the proposed subject development site, **Table 4** outlines which elements identified in the 2017 Transportation Impact Assessment Guidelines that can be exempt from this analysis.

Table 4: Module Exemption Review

Module	Element	Exemption Criteria	Exemption Status
Design Review			
4.1 Development Design	4.1.2 Circulation and Access	Required for Site Plans	***Not Exempt***
	4.1.3 New Street Network	Required for Plans of Subdivisions	Exempt
4.2 Parking	4.2.1 Parking Supply	Required for Site Plans	***Not Exempt***
	4.2.2 Spillover Parking	Required for Site Plans where parking supply will be 15% below unconstrained demand	Exempt
Network Impact			
4.5 Transportation Demand Management	All Elements	Not required for Site Plans expected to have fewer than 60 employees and/or students on location at any given time	Exempt
4.6 Neighborhood Traffic Management	4.6.1 Adjacent Neighborhoods	Required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Exempt
4.8 Network Concept	All Elements	Required when development is projected to generate more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by established zoning	Exempt

3.0 Forecasting

3.1 Development-Generated Travel Demand

Trip Generation

As previously described, the latest Site Plan illustrates that the proposed development will consist of 4 medium density apartment buildings, accumulating to approximately 368 dwelling units. The proposed development will be constructed in a single phase, with an anticipated buildout year of 2024.

Consistent with the City's TIA guidelines, projected site-generated traffic was estimated using appropriate trip generation rates from the latest TRANS Trip Generation Manual Summary Report, dated October 21, 2020. Based on location and type of development envisioned, the following **Table 5** summarizes appropriate trip generation rates for estimating projected site-generated traffic.

Table 5: TRANS Peak Hour Trip Generation Rates

Land Use	ITE Land Use Code	AM Peak Hour	PM Peak Hour
Multifamily Housing (Mid-Rise)	ITE 221 TRANS Study Table 3 & 4 Person Trips	T_A = 0.80(U) x 0.50	T_A = 0.90 (U) x 0.44
Notes: *T_A = Average Person Trips* *U = Per Unit*			

Based on the foregoing, the projected weekday morning and afternoon peak hour person trip generation for the proposed development is summarized in **Table 6**.

Table 6: Modified Peak Period Person Trips

Land Use	Area (Units)	AM Peak Hour (Person Trips/h)			PM Peak Hour (Person Trips/h)		
		In	Out	Total	In	Out	Total
Multifamily Housing (Mid-Rise)	368	45	102	147	84	62	146

As summarized in **Table 6**, the proposed development is projected to generate an approximate two-way total of 147 and 146 person trips/h during weekday morning and afternoon peak hours, respectively. Directional splits (i.e. inbound vs outbound trips) were also obtained from the TRANS Trip Generation Manual Summary Report.

To determine the number of person trips arriving/departing by travel mode, total projected person trips were subdivided by percent mode shares. With respect to the TRANS Trip Generation Manual Summary Report, mode shares have been developed for select land uses, specific to City of Ottawa districts (e.g. Kanata-Stittsville, Orleans, Hunt Club, Ottawa Centre, etc.). Using mode share values from the TRANS Trip Generation Manual Summary Report as a baseline, other key factors were also taken into consideration, including; proximity and quality of transit, pedestrian

and cycling facilities, purpose of trips, etc. The following **Table 7** summarizes appropriate mode share values that were used for analysis purposes.

Travel Mode Shares

With respect to the TRANS Summary Report, the proposed development is located in the Kanata-Stittsville district and the AM/PM peak period modal splits within this district, reveal person trips are generally compromised of 52-56% auto drivers, 15-19% auto passengers, 15-21% transit and 10-13% non-motorized modes of travel.

Based on TRANS mode share values and other key factors that can affect mode choice, the projected site-generated person trips were subdivided into separate travel modes and summarized in **Table 7** below.

Table 7: Projected Modal Site Generated Trips

Travel Mode	Mode Share	AM Peak Hour (Person Trips/h)			PM Peak Hour (Person Trips/h)		
		In	Out	Total	In	Out	Total
Auto Driver	50%	23	51	74	42	31	73
Auto Passenger	20%	9	21	30	17	13	30
Transit	25%	11	25	36	21	15	36
Non-motorized	5%	2	5	7	4	3	7
Total Person Trips	100%	45	102	147	84	62	146
Total 'New' Vehicle Trips		**23**	**51**	**74**	**42**	**31**	**73**

As shown in **Table 7**, the proposed development is projected to generate approximate two-way vehicle volumes of 74 veh/h and 73 veh/h during weekday morning and afternoon peak hours, respectively.

With regard to active modes, the proposed development is projected to generate approximate two-way person trips of 7 trips/h, during both weekday morning and afternoon peak hours, respectively.

With regard to transit trips during both weekday morning and afternoon peak hours, the proposed development is projected to generate approximately two-way person trips of 36 trips/h, respectively.

Trip Distribution

The projected distribution of site-generated traffic was derived based on existing travel patterns, the site's connections to/from the surrounding road network, our local area knowledge (e.g. the location and proximity of other area shopping, communities, recreational opportunities, etc.). For analysis purposes and to be consistent with other area studies, the following approximate distribution of projected site-generated traffic was assumed:

70%	to/from the north via Robert Grant Avenue;
5%	to/from the east via Livery Street;
+ 25%	to/from the south via Robert Grant Avenue.
100%	

Trip Assignment

Based on the above assumed distribution, projected site-generated traffic was assigned to the study area network and is depicted in the following **Figure 12**.

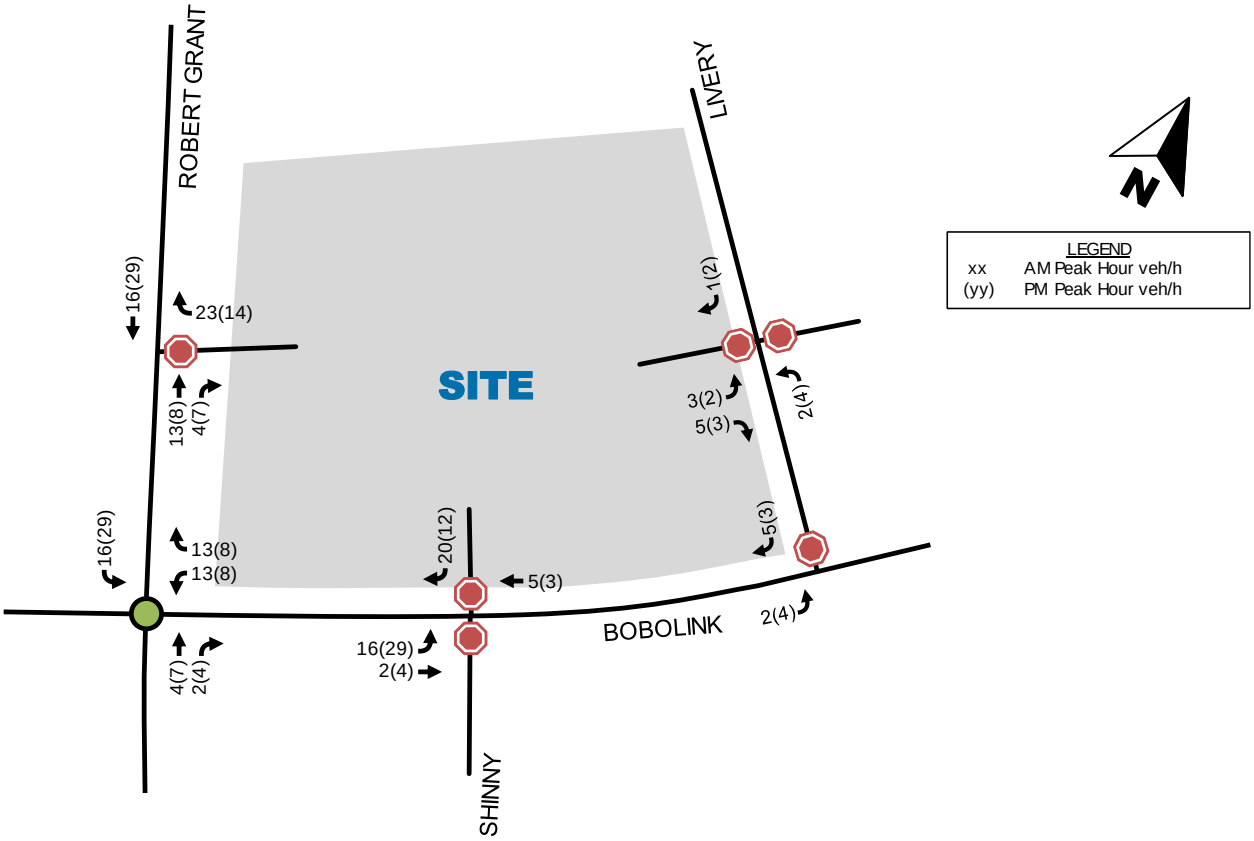


Figure 12: 'New' Projected Site-Generated Traffic

3.2 Background Network Travel Demands

Transportation Network Plans

According to Ottawa's current Transportation Master Plan (TMP), Phase 2 of the Robert Grant Avenue extension project is expected to start between 2020 and 2025. In addition to the extension of Robert Grant transit signal priority and queue jump lanes are planned for selected intersections along Robert Grant Avenue between Fernbank Road and Palladium Drive. This network change

is referred to as the "Stittsville North-South Arterial," which is part of the City's planned 2031 *Affordable Network*.

Other Area Development

Using the City's Development Application Tool, the only proposed development that was identified as having potential impacts on the study area network is located at 1000 Robert Grant Avenue, which is directly adjacent to the subject development site. The site-generated traffic from this identified area development was explicitly accounted for in the subsequent analysis using projected volumes obtained from a TIA report prepared by Parsons.

Background Growth

Upon review of the TIA study prepared for the previously mentioned area development published in June 2020, a 2% annum background traffic growth rate was assumed. Therefore, to be consistent with previously complete studies within proximity of the subject development, a 2% per annum background traffic growth rate was assumed along Robert Grant Avenue.

Based on a 2% per annum background traffic growth rate and explicitly accounting for projected site-generated from area development, the following **Figure 13** and **Figure 14** depict total projected 'background' traffic volumes for the 2024 and 2029 horizon years, respectively, in the absence of the subject development.

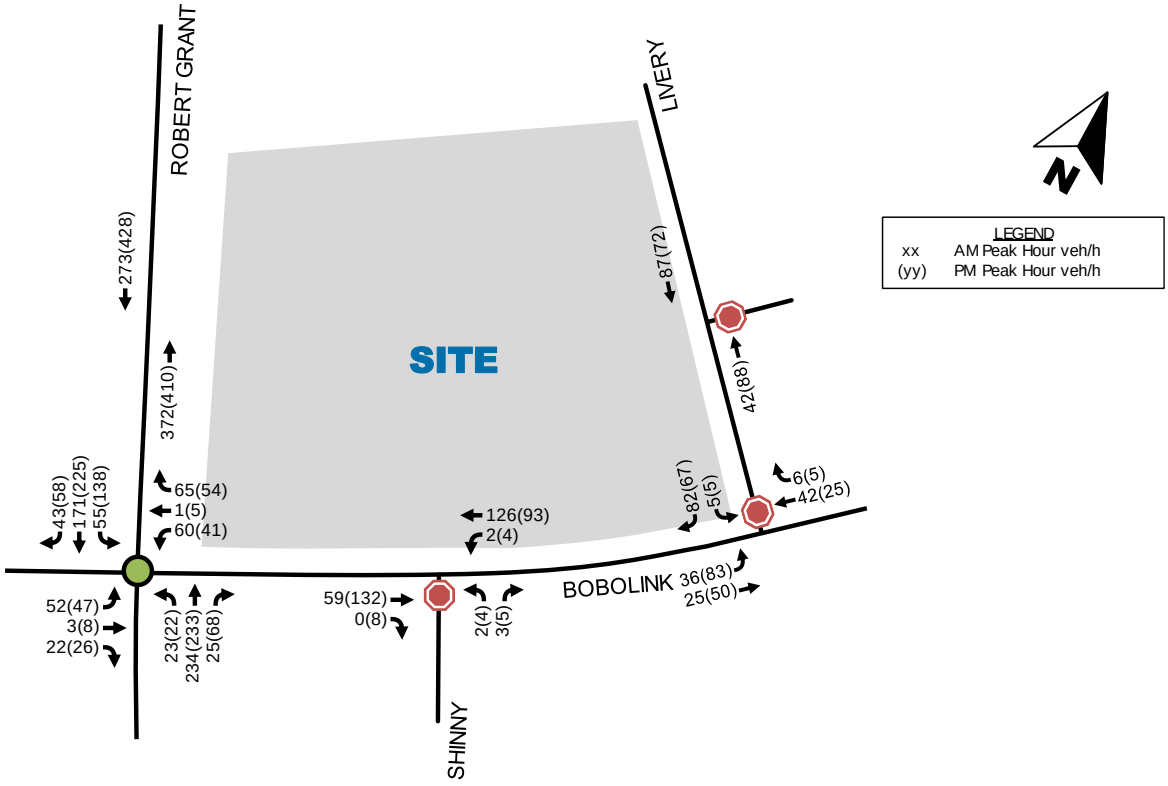


Figure 13: Background Traffic Volumes (2024)

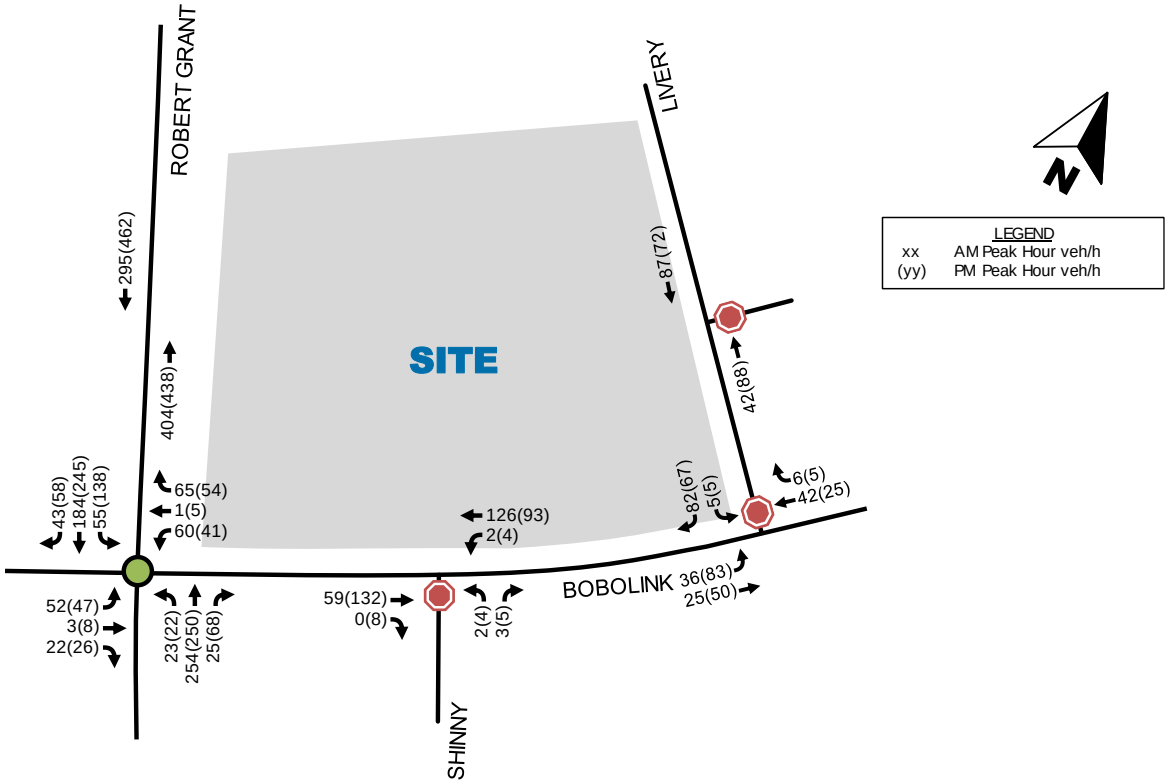


Figure 14: Background Traffic Volumes (2029)

3.3 Demand Rationalization

The following section summarizes the vehicular intersection capacity analysis of existing, future background and future total volume scenarios.

Using the intersection capacity analysis software Synchro (v10), study area intersections were assessed in terms of vehicle delay (seconds), 95th percentile queues (meters), a volume-to-capacity ratio (V/C ratio) and a corresponding Auto Level of Service (LOS or Auto-LOS). It should be noted that the overall performance of an unsignalized and roundabout intersection is an Auto-LOS output from Synchro, which is based on an Intersection Capacity Utilization (ICU) method, and each movement is assigned a LOS based on delay.

Existing and Background Conditions

The following **Table 8**, **Table 9** and **Table 10** summarize existing and projected background conditions at study area intersections, in the absence of the proposed development. The objective of this analysis is to determine if network improvements are, or will be required to support background traffic, or if projected future demand should be adjusted (e.g. once an auto network becomes saturated, a modal shift can be expected). Detailed Synchro output data for existing and future background conditions are provided in **Appendix C**.

Table 8: Study Area Intersection Operations – Existing Conditions

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
Shinny/Bobolink - Unsignalized									
EB	1 T/R	0.03	0.0	A	0	0.06	0.0	A	0
WB	1 L/T	0.00	0.2	A	0	0.00	0.4	A	0
NB	1 L/R	0.01	8.8	A	0	0.01	9.0	A	0
Overall		**0.16**	**0.4**	**A**	-	**0.17**	**0.7**	**A**	-
Bobolink/Livery - Unsignalized									
EB	1 L/T	0.01	3.3	A	0	0.02	2.8	A	1
WB	1 T/R	0.03	0.0	A	0	0.02	0.0	A	0
SB	1 L/R	0.04	8.8	A	1	0.04	8.8	A	1
Overall		**0.19**	**3.5**	**A**	-	**0.22**	**3.8**	**A**	-
Robert Grant/Bobolink - Roundabout									
EB	1 L/T/R	0.09	4.8	A	0	0.11	5.5	A	0
WB	1 L/T/R	0.01	5.2	A	0	0.09	5.0	A	0
NB	1 L/T/R	0.24	5.9	A	7	0.23	5.9	A	7
SB	1 L/T/R	0.21	5.3	A	7	0.32	6.6	A	7
Overall		**0.38**	**5.4**	**A**	-	**0.47**	**6.1**	**A**	-

As shown in **Table 8**, study area intersections are currently operating well with an overall Auto-LOS 'A' during weekday morning and afternoon peak hours. With regard to 'critical' movements, they are also operating with an Auto-LOS of 'A' during both peak hours, this is indicative of significant spare network capacity.

In terms of 95th percentile queues, vehicle queues are not anticipated to block adjacent driveways or intersections.

The following **Table 9** summarizes intersection operations for the 2024 horizon year with the addition of background traffic volumes only. This future background scenario assumes no intersection or network improvements.

Table 9: Study Area Intersection Operations – 2024 Background Conditions

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
Shinny/Bobolink - Unsignalized									
EB	1 T/R	0.04	0.0	A	0	0.09	0.0	A	0
WB	1 L/T	0.00	0.1	A	0	0.00	0.3	A	0
NB	1 L/R	0.01	9.1	A	0	0.01	9.5	A	0
Overall		**0.19**	**0.3**	**A**	-	**0.19**	**0.5**	**A**	-
Bobolink/Livery - Unsignalized									
EB	1 L/T	0.03	4.4	A	1	0.06	4.8	A	2
WB	1 T/R	0.03	0.0	A	0	0.02	0.0	A	0
SB	1 L/R	0.10	9.0	A	3	0.08	9.0	A	2
Overall		**0.23**	**5.4**	**A**	-	**0.27**	**5.5**	**A**	-
Robert Grant/Bobolink - Roundabout									
EB	1 L/T/R	0.11	5.5	A	0	0.13	6.6	A	0
WB	1 L/T/R	0.18	6.5	A	7	0.14	6.0	A	0
NB	1 L/T/R	0.32	7.0	A	7	0.40	8.8	A	14
SB	1 L/T/R	0.30	6.6	A	7	0.46	8.7	A	14
Overall		**0.48**	**6.6**	**A**	-	**0.60**	**8.2**	**A**	-

As shown in **Table 9**, study area intersections are projected to continue operating well and with significant overall spare capacity (i.e. operating with an overall Auto-LOS 'A' during weekday morning and afternoon peak hours). With regard to 'critical' movements, they are projected to operate with an Auto-LOS of 'A' during both peak hours, this is indicative of significant spare network capacity.

In terms of 95th percentile queues, vehicle queues are not anticipated to block adjacent driveways or intersections.

The following **Table 10** summarizes intersection operations for the 2029 horizon year with the addition of background traffic volumes only. This future background scenario assumes no intersection improvements or network improvements.

Table 10: Study Area Intersection Operations – 2029 Background Conditions

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
Shinny/Bobolink - Unsignalized									
EB	1 T/R	0.04	0.0	A	0	0.09	0.0	A	0
WB	1 L/T	0.00	0.1	A	0	0.00	0.3	A	0
NB	1 L/R	0.01	9.1	A	0	0.01	9.5	A	0
Overall		**0.19**	**0.3**	**A**	-	**0.19**	**0.5**	**A**	-
Bobolink/Livery - Unsignalized									
EB	1 L/T	0.03	4.4	A	1	0.06	4.8	A	2
WB	1 T/R	0.03	0.0	A	0	0.02	0.0	A	0
SB	1 L/R	0.10	9.0	A	3	0.08	9.0	A	2
Overall		**0.23**	**5.4**	**A**	-	**0.27**	**5.5**	**A**	-
Robert Grant/Bobolink - Roundabout									
EB	1 L/T/R	0.11	5.6	A	0	0.13	6.7	A	0
WB	1 L/T/R	0.18	6.7	A	7	0.15	6.2	A	7
NB	1 L/T/R	0.35	7.3	A	14	0.43	9.1	A	14
SB	1 L/T/R	0.31	6.7	A	7	0.48	9.0	A	21
Overall		**0.50**	**6.8**	**A**	-	**0.62**	**8.6**	**A**	-

As shown in **Table 10**, study area intersections are projected to continue operating well and with significant overall spare capacity (i.e. operating with an overall Auto-LOS 'A' during weekday morning and afternoon peak hours). With regard to 'critical' movements, they are projected to operate with an Auto-LOS of 'A' during both peak hours, this is indicative of significant spare network capacity.

In terms of 95th percentile queues, vehicle queues are again, not anticipated to block adjacent driveways or intersections. Based on the foregoing, projected increases in future background traffic will not warrant any network modifications.

Adjustments to Background Network Demand

Given study area intersections are projected to operate with significant overall spare capacity for future background conditions, it is not considered necessary to adjust projected background demands at this time.

Total Projected Conditions

The following **Figure 15** depicts 'total' projected volumes for the horizon year of 2024, which were derived by superimposing site-generated traffic volumes onto projected background traffic volumes (e.g. summing together volumes depicted in **Figure 12** and **Figure 13**, resulting in **Figure 15**).

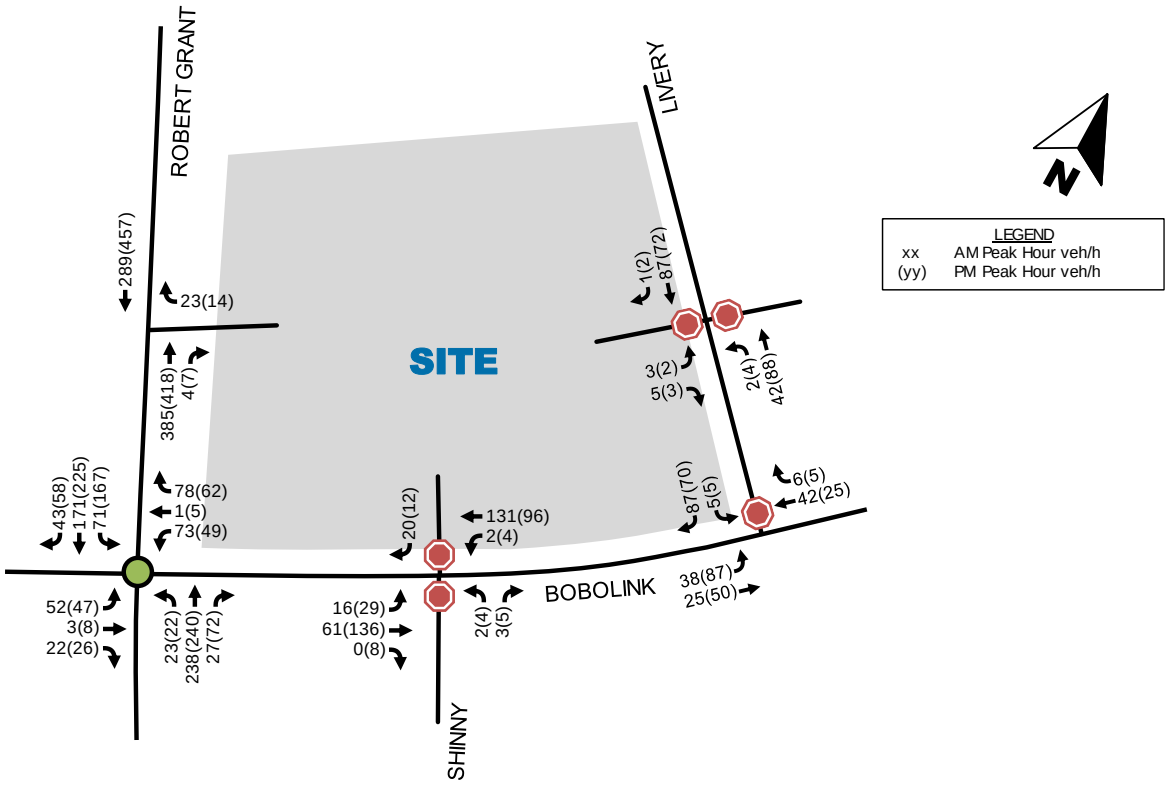


Figure 15: Total Projected Traffic Volumes (2024)

Similar to existing and future background conditions, total projected conditions were assessed using the intersection capacity analysis software Synchro (v10). Metrics such as Auto-LOS, V/C ratio, 95th percentile queue (metres) and vehicular delay (seconds) were analyzed. Assuming no intersection improvements, the following **Table 11** summarizes the intersection operational analysis of the study area intersections for the total projected 2024 horizon year.

Detailed Synchro output data for future total projected conditions is provided in **Appendix D**.

Table 11: Study Area Intersection Operations – Total Projected Conditions (2024)

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
Shinny/Site Driveway/Bobolink - Unsignalized									
EB	1 L/T/R	0.01	1.7	A	0	0.02	1.4	A	1
WB	1 L/T/R	0.00	0.1	A	0	0.00	0.3	A	0
NB	1 L/T/R	0.01	9.4	A	0	0.01	10.0	A	0
SB	1 L/T/R	0.02	9.1	A	1	0.01	8.9	A	0
Overall		**0.24**	**1.6**	**A**	-	**0.28**	**1.6**	**A**	-
Bobolink/Livery - Unsignalized									
EB	1 L/T	0.03	4.5	A	1	0.06	4.9	A	2
WB	1 T/R	0.03	0.0	A	0	0.02	0.0	A	0
SBL	1 L/R	0.10	9.0	A	3	0.09	9.0	A	2
Overall		**0.23**	**5.5**	**A**	-	**0.27**	**5.6**	**A**	-
Robert Grant/Bobolink - Roundabout									
EB	1 L/T/R	0.11	5.7	A	0	0.13	6.9	A	0
WB	1 L/T/R	0.22	7.0	A	7	0.16	6.3	A	7
NB	1 L/T/R	0.33	7.3	A	7	0.43	9.5	A	14
SB	1 L/T/R	0.32	6.9	A	7	0.49	9.4	A	21
Overall		**0.57**	**7.0**	**A**	-	**0.69**	**8.8**	**A**	-
Livery/Site Driveway/Ginseng - Unsignalized									
EB	1 L/T/R	0.01	9.0	A	0	0.01	9.1	A	0
WB	1 L/T/R	0.00	0.0	A	0	0.00	0.0	A	0
NB	1 L/T/R	0.00	0.3	A	0	0.00	0.3	A	0
SB	1 L/T/R	0.00	0.0	A	0	0.00	0.0	A	0
Overall		**0.15**	**0.6**	**A**	-	**0.18**	**0.4**	**A**	-
Robert Grant/Site Driveway - Unsignalized									
WBR	1 R	0.04	11.0	A	1	0.03	11.2	A	1
NB	1 T/R	0.25	0.0	A	0	0.28	0.0	A	0
SBT	1 T	0.19	0.0	A	0	0.30	0.0	A	0
Overall		**0.32**	**0.4**	**A**	-	**0.34**	**0.2**	**A**	-

As shown in **Table 11**, assuming no intersection or network improvements, study area intersections are projected to continue operating well and with significant overall spare capacity (i.e. operating with an overall Auto-LOS 'A' during weekday morning and afternoon peak hours).

With regard to 'critical' movements, they are projected to continue to operate with an Auto-LOS of 'A' during both peak hours, and in terms of 95th percentile queues, vehicle queues are not anticipated to block adjacent driveways or intersections with additional traffic generated by the subject development.

Five years beyond full site build-out, the following **Figure 16** depicts the future 'total' volumes for the horizon year of 2029, which were derived by superimposing site-generated traffic volumes onto projected background traffic volumes (e.g. summing volumes together from **Figure 12** and **Figure 14**, resulting in **Figure 16**).

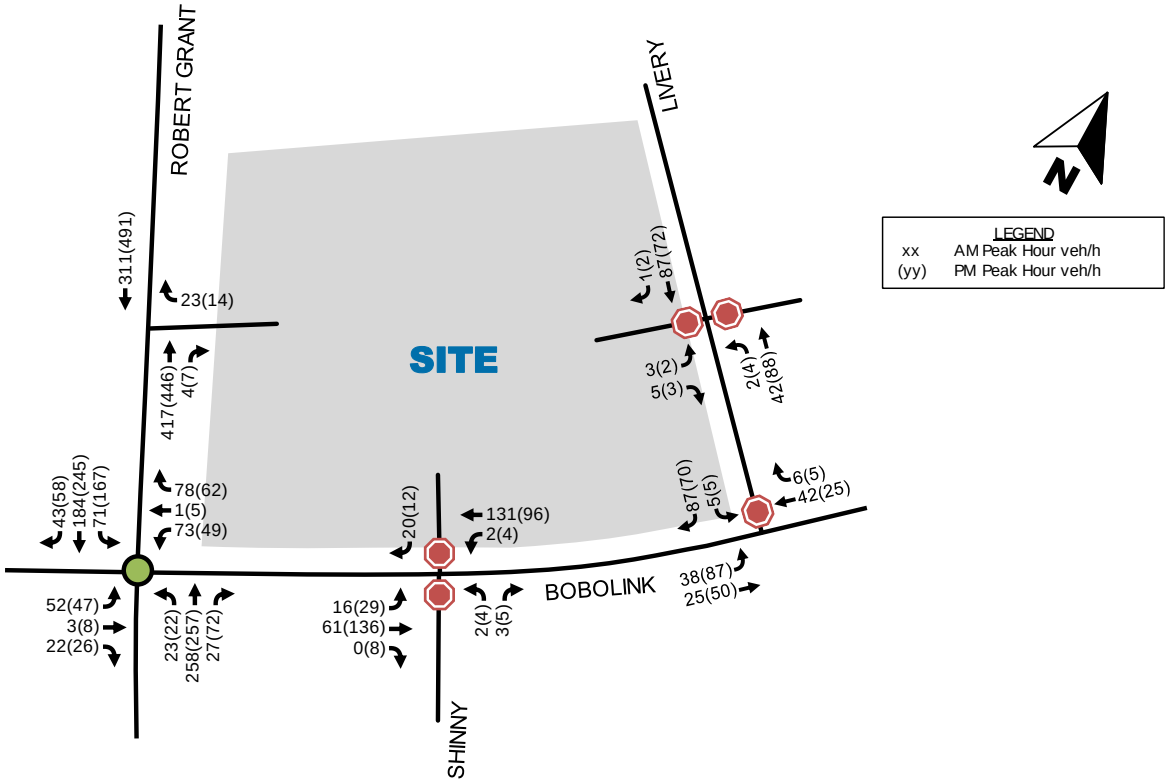


Figure 16: Total Projected Traffic Volumes (2029)

The following **Table 12** summarizes the intersection operational analysis of the study area intersections for the total projected 2029 horizon year, using the intersection capacity analysis software Synchro (v10) and metrics such as Auto-LOS, V/C ratio, 95th percentile queue (metres) and vehicular delay (seconds).

Detailed Synchro output data for future total projected conditions is provided in **Appendix D**.

Table 12: Study Area Intersection Operations – Total Projected Conditions (2029)

Dir	Lanes	AM Peak Hour				PM Peak Hour			
		v/c	Delay (s)	LOS	Queue (m)	v/c	Delay (s)	LOS	Queue (m)
Shinny/Site Driveway/Bobolink - Unsignalized									
EB	1 L/T/R	0.01	1.7	A	0	0.02	1.4	A	1
WB	1 L/T/R	0.00	0.1	A	0	0.00	0.3	A	0
NB	1 L/T/R	0.01	9.4	A	0	0.01	10.0	A	0
SB	1 L/T/R	0.02	9.1	A	1	0.01	8.9	A	0
Overall		**0.24**	**1.6**	**A**	-	**0.28**	**1.6**	**A**	-
Bobolink/Livery - Unsignalized									
EB	1 L/T	0.03	4.5	A	1	0.06	4.9	A	2
WB	1 T/R	0.03	0.0	A	0	0.02	0.0	A	0
SB	1 L/R	0.10	9.0	A	3	0.09	9.0	A	2
Overall		**0.23**	**5.5**	**A**	-	**0.27**	**5.6**	**A**	-
Robert Grant/Bobolink - Roundabout									
EB	1 L/T/R	0.11	5.8	A	0	0.14	7.1	A	0
WB	1 L/T/R	0.22	7.3	A	7	0.17	6.5	A	7
SB	1 L/T/R	0.36	7.6	A	14	0.45	9.9	A	14
NB	1 L/T/R	0.33	7.1	A	7	0.51	9.8	A	21
Overall		**0.59**	**7.2**	**A**	-	**0.72**	**9.2**	**A**	-
Livery/Site Driveway/Ginseng - Unsignalized									
EB	1 L/T/R	0.01	9.0	A	0	0.01	9.1	A	0
WB	1 L/T/R	0.00	0.0	A	0	0.00	0.0	A	0
NB	1 L/T/R	0.00	0.3	A	0	0.00	0.3	A	0
SB	1 L/T/R	0.00	0.0	A	0	0.00	0.0	A	0
Overall		**0.15**	**0.15**	**0.6**	**A**	-	**0.18**	**0.4**	**A**
Robert Grant/Site Driveway - Unsignalized									
WBR	1 R	0.04	11.3	A	1	0.03	11.5	A	1
NB	1 T/R	0.27	0.0	A	0	0.30	0.0	A	0
SBT	1 T	0.20	0.0	A	0	0.32	0.0	A	0
Overall		**0.33**	**0.4**	**A**	-	**0.35**	**0.2**	**A**	-

As shown in **Table 12**, assuming no intersection improvements, study area intersections are projected to continue operating well and with significant overall spare capacity (i.e. operating with an overall Auto-LOS 'A' during weekday morning and afternoon peak hours).

With regard to 'critical' movements, they are projected to continue to operate with an Auto-LOS of 'A' during both peak hours, and in terms of 95th percentile queues, vehicle queues are not anticipated to block adjacent driveways or intersections with additional background traffic and traffic generated by the subject development.

Based on the foregoing, the existing study are network has sufficient spare intersection capacity to support future background traffic and projected site-generated traffic.

Adjustments to Site-Generated Demand

With respect to projected site-generated traffic for the subject development lands and other area developments, adjusting modal splits away from projected auto trips further is difficult to justify, given study area intersections are projected to operate with significant spare capacity. It should

also be noted that certain individuals will ultimately be required to drive for one reason or another (e.g. distance between origin/destination is too great, travel is a requirement for employment, physical disabilities limit travel options to personal vehicle etc.), despite the convenience/availability of alternative travel modes.

4.0 Analysis

With respect to the City of Ottawa TIA Guidelines, this module reviews the proposed transportation network elements within the development study area to ensure that they provide effective access for all users, while creating an environment that encourages walking, cycling, and transit use and prioritizes safety.

4.1 Development Design

Design for Sustainable Modes

Pedestrian Facilities: Sidewalks are currently provided along both sides of Robert Grant Avenue and along Bobolink Ridge from Robert Grant Avenue to Shinny Avenue. East of Shinny Avenue, sidewalks are provided along the north side of Bobolink Ridge only. Along the west side of Livery Street, sidewalks are also provided. Throughout the proposed development, sidewalks will be provided, connecting pedestrians to the surrounding pedestrian network.

Sidewalks must be continuous and depressed through all three unsignalized accesses. There is also a missing section of sidewalk on Bobolink Ridge that should be replaced with concrete. Additionally, given the existing sidewalk and MUP are significantly set back from the Robert Grant Avenue, there should be no obstacles that could impede sightlines between drivers and pedestrians or cyclists. Increasing visibility of this conflict zone through signage and green thermoplastic pavement markings is recommended.

Cycle Facilities: As mentioned in the *Step 2 – Scoping* section, the surrounding cycling network is fairly well established. A paved pathway is provided along both sides of Robert Grant Avenue, which connects to the Trans Canada Trail in the north and Fernbank Road in the south, where paved shoulders are provided. On-site bicycle parking will be provided in well-lit areas that are in close proximity to the building's main entrances, satisfying Zoning By-Law requirements.

Transit Facilities: As mentioned in the *Step 2 – Scoping* section, there are five transit stops located within the vicinity of the subject development site. It should be noted that the only transit stop located within the OC Transpo service design guidelines of 400 m walking distance to/from the site, is located at Cope/Yellowtail Walk. The other four transit stops previously listed in **Table 1** are located approximately 700 m to/from the subject development site.

With respect to the City's TIA Guidelines, a Transportation Demand Management (TDM) – *Supportive Development Design and Infrastructure* checklist has been completed. A copy of the TDM checklist is provided in **Appendix E**. All required TDM-supportive design and infrastructure measures in the TDM checklist were met.

Circulation and Access

As depicted in **Figure 2**, the current access/egress design for the subject development indicates that 6.7 m wide drive aisles will be provided throughout the proposed parking lot, which satisfies the City's Zoning By-Law provisions for *"Aisles and Driveways".* In addition, this also complies with Building Code requirements for emergency vehicle access, which require a clear 6 m wide

fire route. Based on the proposed locations of garbage receptacles, an AutoTurn truck turning analysis should be conducted to ensure sufficient turning radii will be provided.

New Street Networks

With respect to the City's TIA guidelines and as previously summarized in **Table 4**, this element is exempt.

4.2 Parking

With respect to the City's TIA guidelines, this module reviews the development's planned parking supply to ensure there is a balance between operational needs, the encouragement of sustainable travel modes, and the desire to minimize neighbourhood impacts.

Parking Supply

Vehicular Parking

The proposed development is located in Area C (Suburban), identified in Schedule 1A of the City's Zoning By-law, and the following **Table 13** summarizes the minimum parking space requirements for mid-rise apartments, in accordance with the City's Zoning By-law, Section 101, Table 101.

Table 13: Vehicular Parking Supply

Required Parking	Zoning Requirement	Dwelling Units/GFA	Minimum Parking Requirement
Parking	1.2 per dwelling unit	354 DU	425
Visitor Parking	0.2 per dwelling unit	354 DU	71
Office Parking	2.3 per 100 m^2 of gross floor area	171 m^2	4
Business Parking	3.4 per 100 m^2 of gross floor area	342 m^2	12
		Total Required	**512**
		Provided (As shown on Site Plan)	513

As summarized in **Table 13**, the amount of provided auto parking satisfies the City's Zoning By-law provisions for "*Parking, Queuing and Loading Provisions*". Additionally, by not over-supplying parking, the proposed development encourages residents to consider alternative travel modes for their daily commute, by limiting the majority of the proposed dwellings to a single car.

Bike Parking

The subject site is proposed to have 180 bicycle parking spaces, which satisfies the requirements with respect to the City's Zoning By-law, Section 111 "*Bicycle Parking Space Rates and Provisions*". As previously mentioned, on-site bicycle parking will be provided in well-lit areas, close to the building's main entrances. The proposed parking and the proximity to dedicated cycling facilities will encourage residents to consider cycling as a viable travel mode for their daily commute.

Spillover Parking

With respect to the City's TIA Guidelines and given the proponent will not be seeking a reduction in the minimum supply of parking for the subject development, this module is exempt.

4.3 Boundary Street Design

With respect to the City's TIA Guidelines, this module determines design elements of boundary streets required to accommodate the proposed development, consistent with the City's complete streets philosophy and its urban design objectives for the development area. The identified boundary streets for the subject site are Bobolink Ridge, Robert Grant Avenue and Livery Street, which are all owned and maintained by the City of Ottawa.

Mobility

A Multi-Modal Level of Service (MMLOS) analysis was conducted for the subject site's boundary streets, which is a measure of risk, comfort and stress for active modes and a measure of impedance, delay and reliability for trucks/buses. With respect to the City of Ottawa's MMLOS guidelines, target MMLOS values were obtained from Exhibit 22 of the MMLOS guidelines and are identified in brackets in the following **Table 14**. The detailed MMLOS assessment is included as **Appendix F**.

Segment MMLOS Summary

The following **Figure 17** depicts the road classifications from the City's GeoOttawa website. It should be noted that there are no designated truck routes within the study area network.

Figure 17: Road Classification

The following **Table 14** is a MMLOS analysis summary of existing conditions for all modes (i.e. Pedestrian, Cycling, Transit and Trucks) along the road segments described above. Any LOS results highlighted in red indicate that the target MMLOS was not met for that segment.

It should be noted that a MMLOS segment analysis focuses on local transit provided along boundary streets only.

Table 14: Segment MMLOS – Existing LOS(Target LOS)

No.	Road Name	Segment Between	PLOS	BLOS	TLOS	TkLOS
1	Robert Grant Avenue	Site Driveway - Bobolink	C(C)	A(C)	D(D)	B(E)
2	Bobolink Ridge	Robert Grant - Site Driveway	B(C)	A(D)	n/a(D)	No Target
3	Bobolink Ridge EB	Site Driveway - Livery	n/a(C)	A(D)	n/a(D)	No Target
	Bobolink Ridge WB		B(C)	A(D)		
4	Livery Street NB	Bobolink - Site Driveway	n/a(C)	A(D)	n/a(D)	No Target
	Livery Street SB		B(C)	A(D)		

Notes: *'n/a' denotes insufficient input data*

Based on the results summarized in **Table 14**, the following should be noted/considered:

Pedestrian LOS

- The sections of Bobolink Ridge and Livery Street that do not meet the PLOS targets is due to lack of provided sidewalks.
- It should be noted that due to the high volume of traffic on Robert Grant Avenue, the PLOS target for that road segment only meets the minimum LOS target, despite all design guidelines being met and a large buffer between the sidewalk and active travel lanes.

Bike LOS

- All road segments exceed BLOS targets.

Transit LOS

- The sections of Bobolink Ridge and Livery Street that do not meet the TLOS targets is due to the lack of transit services operating on these segments. It is recommended that consideration is given to providing new bus stops at the Robert Grant/Bobolink intersection.
- It should be noted that the only way to improve the TLOS, is to implement dedicated transit lanes. As outlined in the City's *"2031 Affordable Network Plan",* Robert Grant Avenue is planned to be extended north past Abbott Street and transit priority measures are planned to be implemented from Fernbank Road to Palladium Drive. The implementation of these measures will provide improved transit service/reliability; however, the TLOS will be unchanged until a dedicated facility is provided.

Truck LOS

- Boundary street segments meet TkLOS targets.

Given the planned network improvements will not improve the study area MMLOS, a future segment MMLOS analysis will result in the same LOS results summarized in **Table 14**. Therefore, no additional analysis is required.

Road Safety

For the purpose of a road safety review, collision records for boundary streets were examined to determine if locations exhibit any collision trends that might be mitigated by engineering intervention. If there is a collision trend that is outside the norm of what is expected, then the potential exists to reduce the collision experience by addressing the over-represented collision trend. Whenever changes are being made to the road environment, it is an opportunity to examine whether a safety intervention could result in meaningful safety benefits. Where there are identifiable safety trends, it is worthwhile to mitigate those, such that the added traffic from a new development does not increase the risk of new collisions.

Based on a review of the most recent five (5) years of historical collision data (collected from January 1st, 2015 to December 31st, 2019), the following **Table 15** summarizes the number and rate (i.e. collisions per million entering vehicles) of collisions within the vicinity of the subject development site, at study area intersections. It should be noted that no collisions were reported along road segments adjacent to the subject development site.

Table 15: Historical Collision Data Summary by Intersection

Intersection	Total Collisions (5-year Total)	Rate (C/MEV)	Classification		
			Property Damage	Non-fatal Injury	Fatal Injury
Robert Grant/Bobolink	2	0.38	2	0	0
Bobolink/Shinny	0	0.00	0	0	0
Bobolink/Livery	1	0.84	1	0	0
Total	3	-	3	0	0

Notes: *C/MEV = Collisions per Million Entering Vehicles*

As shown in **Table 15**, the rate of collisions within the study area are considered to be infrequent and relatively minor (e.g. no fatal or non-fatal injuries have been reported).

A more detailed collision analysis is included as **Appendix G** and source collision data is included as **Appendix B**.

Neighbourhood Traffic Management (NTM)

This section reviews the development location to determine if the proposed will exacerbate existing operational concerns on boundary streets.

The subject development site will have one connection to/from Bobolink Ridge and one connection to/from Livery Street, which are both classified as local roadways. Current and projected traffic volumes on Livery Street are proposed to continue to remain under the vehicle threshold for a local street classification (i.e. 120 veh/h during peak hours). However, Bobolink Ridge is projected to operate over the vehicle threshold for a local street classification with approximate peak hour volumes of 130 veh/h.

Given Bobolink Ridge collects traffic from local streets and feeds Robert Grant Avenue, which is an arterial roadway, Bobolink Ridge technically operates more as a collector roadway than a local roadway, by definition. If Bobolink Ridge is regarded as a collector roadway, the projected peak

hour volumes are well within the volume threshold of 300 veh/h during peak hours for a collector roadway classification, with respect to the City's TIA Guidelines. Without this reclassification of Bobolink Ridge, changes to the proposed development's access scheme will have notable implications. For example, forcing more site-generated traffic to use the proposed Robert Grant Avenue driveway connection will result in additional conflicting turning volumes at this location (in close proximity to the Robert Grant/Bobolink roundabout). Forcing this would also likely require a raised median on Bobolink Ridge from Robert Grant Avenue to approximately 30 m east of Shinny Avenue (to restrict movements to/from driveway connections), or full closure of the proposed driveway connections to local streets may be necessary to limit traffic volumes on Bobolink Ridge.

Based on the foregoing, it is our opinion that the benefits of having alternative driveway connections should outweigh the benefits of restricting Bobolink Ridge to 120 veh/h during peak hours (e.g. ease for heavy vehicle circulation, emergency access, vehicle capacity, etc.). As such, NTM strategies and/or an alternative access scheme are not recommended for the subject development site.

4.4 Access Intersection Design

With respect to the City's TIA Guidelines, this module determines design elements of the points of access to/from the subject development site, consistent with the City's Complete Streets philosophy, MMLOS guidelines, and its urban design objectives for the development area.

Location and Design of Access

There are three site driveway connections to/from the subject development being proposed. One driveway connection will be located on Bobolink Ridge approximately 110 m east of the Bobolink/Robert Grant intersection; one will be on Livery Street, approximately 85 m north of the Bobolink/Livery intersection; and the third driveway connection will be located on Robert Grant Avenue, approximately 100 m north of the Bobolink/Robert Grant intersection. With respect to the City's Private Approach By-Law No. 2003-447, the new proposed driveway connections will satisfy By-Law requirements.

All three site driveways are proposed to be approximately 7 m in width, which satisfies the City's Zoning By-law provisions for "*Aisles and Driveways*". As depicted in **Figure 2**, proposed driveway connections to Bobolink Ridge and Livery Street will be full movement, and the one driveway connection to Robert Grant Avenue will be restricted to right-in/right-out only, due to safety/operational concerns, given its proximity to the Bobolink/Robert Grant intersection. It should be noted that following the widening of Robert Grant Avenue, direct access/egress to Robert Grant Avenue could be permanently closed, if operations prove to be problematic.

A clear throat length is the area provided as part of a driveway, to store vehicles that are queued to enter the network or site and is provided to avoid spillover of queued vehicles onto the connecting roadway. With respect to TAC's 2017 *Geometric Design Guide for Canadian Roads*, the minimum clear throat lengths for driveways are based on the proposed land use, development size and abutting road classification (collector or arterial). As depicted in **Figure 17**, Bobolink Ridge and Livery Street are both classified as a local streets and Robert Grant Avenue is classified as an arterial roadway. Therefore, based on Table 8.9.3 found in the TAC Geometric Design Guide, a clear throat length of 25 m is recommended for both site driveways to Bobolink Ridge and Livery Street, and a 40 m clear throat length is recommended for the site driveway connection to Robert Grant Avenue. Based on the foregoing, the proposed throat lengths will satisfy the TAC Design Guide.

Intersection Control

The new site driveway connections are proposed to be YEILD or STOP controlled on the minor approach only, which will be sufficient from an operational perspective. It should also be noted that the proposed site driveways to Bobolink and Livery will form the fourth leg of these existing three-legged STOP controlled 'T' intersections, which will result in 2-way STOP control.

Intersection Design

Given there are no existing or proposed signalized intersections within the vicinity of the subject development site, additional MMLOS analysis is not required.

4.5 Transportation Demand Management

With respect to the City's TIA Guidelines, a review of Transportation Demand Management (TDM) strategies is a requirement for the subject development. Determining which TDM strategies maybe appropriate for implementation, a formal TDM checklist is provided by the City for review by the proponent.

Following a review of the City's TDM checklist and based on available information, a completed TDM checklist is attached as **Appendix H**, which identified the following strategies for implementation:

- Designate an on-site TDM coordinator;
- Conduct periodic surveys;
- Provide transit schedules in all lobbies and site office;
- Implement bikeshare and/or carshare stations based on tenant demand;
- Only a single parking stall will be included in the monthly rent;
- Include transit information in welcome packages for new tenants; and
- Offer personalized trip planning to new residents provided by the TDM coordinator.

Implementing the above strategies will help increase the likelihood, and frequency of people choosing sustainable travel modes that are not only better for the environment, but also benefit physical and mental health.

4.6 Neighbourhood Traffic Management

With respect to the City's TIA Guidelines, this module reviews significant access routes to/from the development and identifies any required neighbourhood traffic management (NTM) measures to mitigate impacts on collector and local roads.

As mentioned previously in the *4.3 – Boundary Street Design* section of this report, the proposed development is projected to generate relatively low site-generated traffic volumes, and therefore, additional NTM measures are not recommended.

4.7 Transit

Transit stops that serve the development site were previously mentioned in the *Step 2 – Scoping* section, which included stop information, routes and location (summarized in **Table 1**). Additionally, transit route information, including frequency and service type, were previously summarized in **Table 2**. It should be noted that the only transit stop located within the OC Transpo service design guidelines (i.e. within 400 m walking distance to/from the site) is located at the Cope/Yellowtail Walk intersection. It should be noted that there are four other transit stops located in relatively close proximity to the subject site, which are located at the Iber/Abbott Street and

Robert Grant/Haliburton Heights intersections, approximately 700 m walking distance to/from the subject development site. Detailed transit maps are included in **Appendix I**.

Route Capacity

Current transit ridership data for the bus stops listed in **Table 1** was provided by the City and is included as **Appendix J**. Based on the projected modal split of site-generated traffic, it was estimated that 25% of the trips generated by the site will be accommodated by transit, which equates to approximately 36 additional transit person trips for each peak hour.

With respect to local transit, the study area is serviced by 40 ft buses on approximate 15-30 min headways, which have a person capacity of approximately 50 passengers per bus. According to passenger on/off data provided by the City, there are approximately 1 to 25 passengers per bus that arrive/depart at the bus stops within the vicinity of the subject development site during peak hours.

Assuming projected site-generated transit trips to/from the subject development will be spread between the handful of local bus stops within the vicinity of the site (e.g. beyond 400 m walking distance), it is projected that future transit users can be easily accommodated by the existing area transit service.

Transit Priority

Given the relatively low volume of projected site-generated traffic, transit travel times should not be impacted. However, as mentioned previously, transit signal priority and queue jump lanes are planned for selected intersections along Robert Grant Avenue between Fernbank Road and Palladium Drive.

4.8 Review of Network Concept

With respect to the City's TIA Guidelines, this module is exempt.

4.9 Intersection Design

With respect to the City's TIA Guidelines, this module determines the design elements of the study area intersections required to accommodate the proposed development, consistent with the City's Complete Streets philosophy and MMLOS practices.

Intersection Control

All site driveways are currently proposed to be STOP or YEILD control on the minor approach. Based on the intersection capacity analysis in the *Step 3 – Forecasting* section, and consistent with the City's policies, goals and objectives, additional signal or intersection control will not be warranted.

Intersection Design

Based on the intersection capacity analysis in the *Step 3 – Forecasting* section, and consistent with the City's policies, goals and objectives, additional intersection or road widenings will not be warranted.

5.0 Findings and Recommendations

As with any infill development, the introduction of a new land use will have impacts on the surrounding transportation network. J.L. Richards and Associates Limited has completed a review of these impacts and summarized the findings within this transportation assessment, which

follows the format of a Transportation Impact Assessment (TIA) Study, as requested by the City of Ottawa. At this stage, and with respect to the City's TIA Guidelines, the following findings and conclusions are offered:

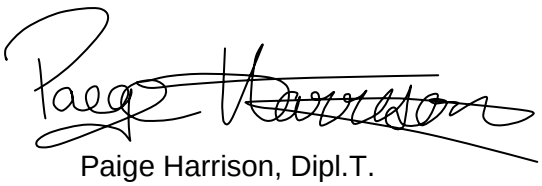
- Study area intersections are currently operating with spare capacity and are projected to continue operating with spare capacity with additional traffic generated by the proposed development. There are also no prevailing safety concerns, based on historical collision data.
- Given the local context, the private auto is projected to be the primary mode choice for travel with an approximate mode share of 50% for the proposed development.
- The proposed development is projected to generate 'new' two-way vehicle volumes of 74 veh/h and 73 veh/h during weekday morning and afternoon peak hours, respectively.
- With regard to active modes, the proposed development is projected to generate approximate two-way person trips of 7 trips/h for both weekday morning and afternoon peak hours.
- With regard to transit trips during weekday morning and afternoon peak hours, the proposed development is projected to generate approximately two-way person trips of 36 trips/h for each peak hour.
- The proposed parking supply for the subject development site meets the minimum By-Law requirements.
- Bobolink Ridge is projected to exceed the vehicle threshold of a local road during peak hours with 131 veh/h. However, NTM strategies and/or an alternative access scheme are not recommended.
- Existing MMLOS targets for transit are not met for the majority of study area road segments due to lack of transit service provided. It is recommended that consideration is given to providing new bus stops at the Robert Grant/Bobolink intersection.
- The overall layout of the site is laid out effectively and should operate acceptably. However, an AutoTurn truck turning analysis should be conducted to ensure sufficient turning radii will be provided for larger vehicles (e.g. fire and garbage trucks, etc.).
- Sidewalks must be continuous and depressed through all three unsignalized accesses. There is also a missing section of sidewalk on Bobolink Ridge that should be replaced with concrete.
- There should be no obstacles that could impede sightlines between drivers and pedestrians or cyclists at the driveway connection to Robert Grant Avenue. Increasing visibility of this conflict zone through signage and green thermoplastic pavement markings is recommended.
- Based on projected volumes and intersection capacity analysis, additional intersection control or road widenings will not be warranted. However, the driveway connection to Robert Grant Avenue could be permanently closed, if operations prove to be problematic.

The proposed development fits well into the context of the surrounding area and it is projected to have minimal impact on the surrounding transportation network.

Based on the foregoing, the proposed development located at 360 Bobolink Ridge is recommended from a transportation perspective, as the design and location of the proposed development serves the City of Ottawa's policies, goals and objectives.

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:



Paige Harrison, Dipl.T.
Civil Designer, Transportation

Reviewed by:

Gordon Scobie, P.Eng.
Civil Engineer, Transportation

Appendix A

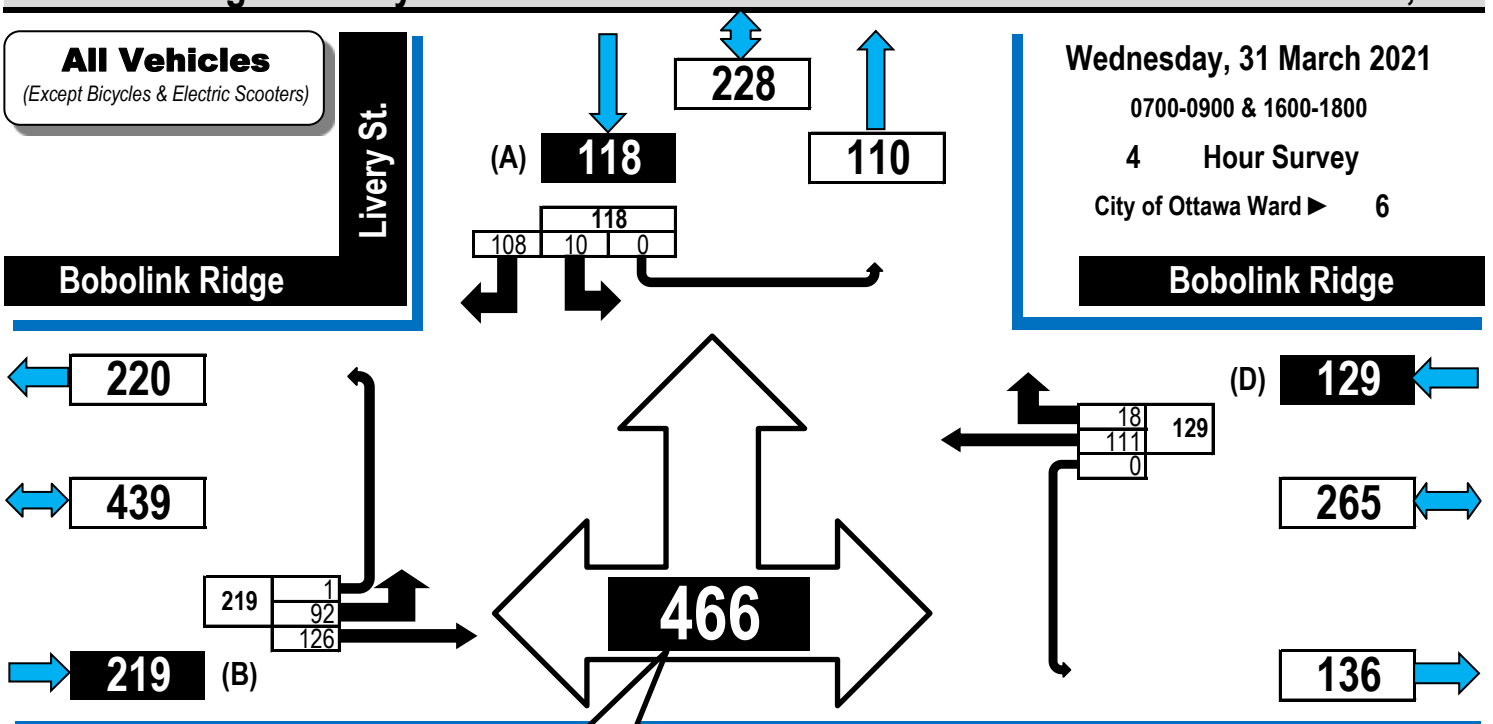
Existing Traffic Counts

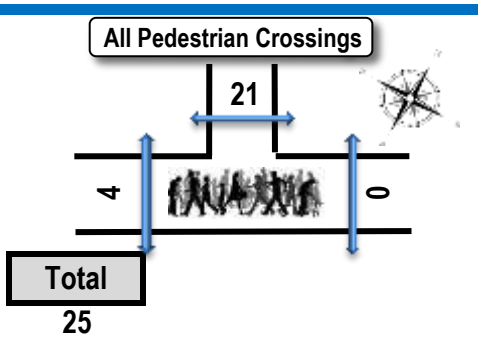
Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

Bobolink Ridge & Livery Street — Stittsville, ON

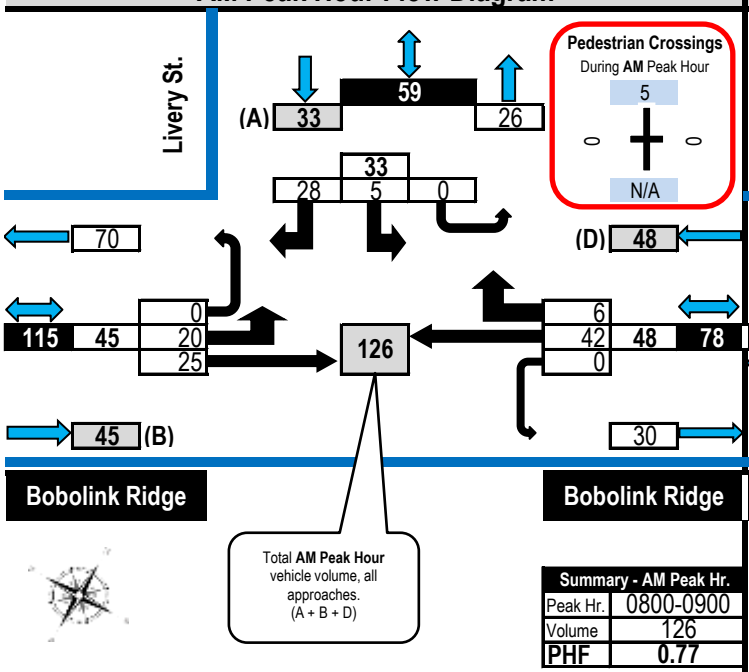
All Vehicles
(Except Bicycles & Electric Scooters)

Wednesday, 31 March 2021
0700-0900 & 1600-1800
4 Hour Survey
City of Ottawa Ward ▶ 6



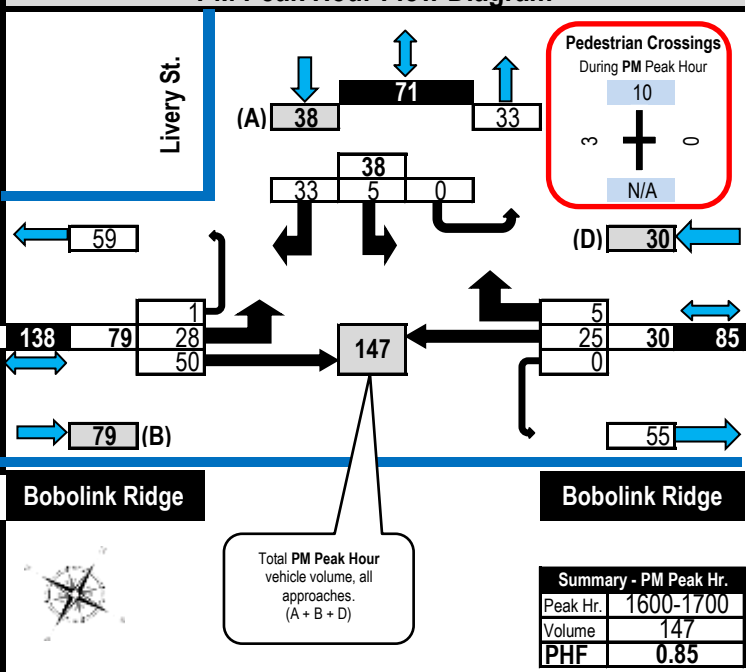


AM Peak Hour Flow Diagram



Summary - AM Peak Hr.	
Peak Hr.	0800-0900
Volume	126
PHF	0.77

PM Peak Hour Flow Diagram



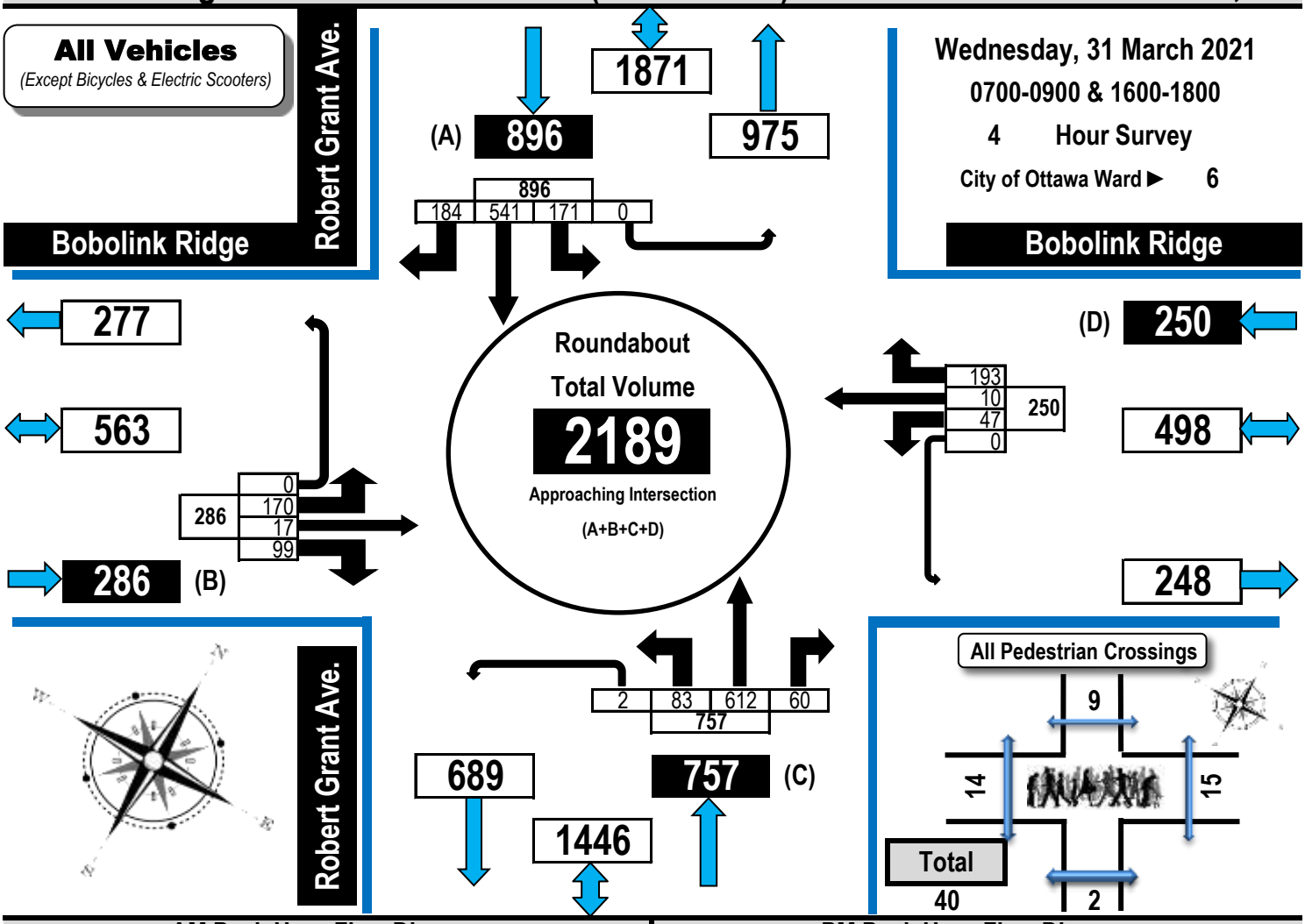
Summary - PM Peak Hr.	
Peak Hr.	1600-1700
Volume	147
PHF	0.85

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

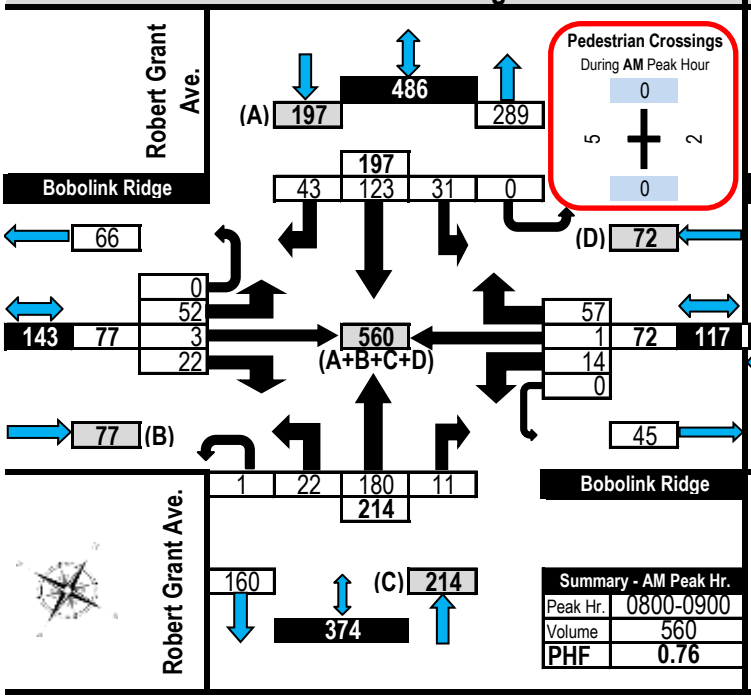
Bobolink Ridge & Robert Grant Avenue (Roundabout) — Stittsville, ON

All Vehicles *(Except Bicycles & Electric Scooters)*

Wednesday, 31 March 2021
0700-0900 & 1600-1800
4 Hour Survey
City of Ottawa Ward ▶ 6



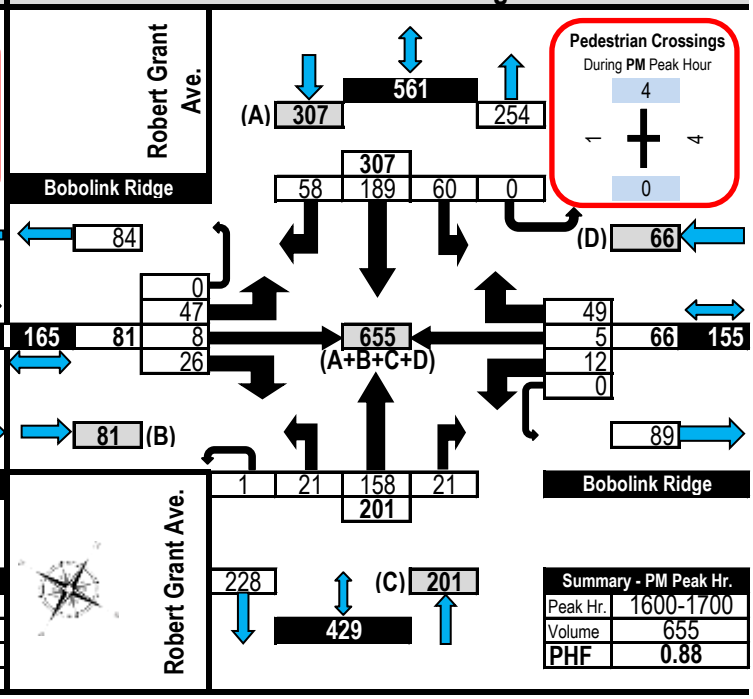
AM Peak Hour Flow Diagram



Summary - AM Peak Hr.

Peak Hr.	0800-0900
Volume	560
PHF	0.76

PM Peak Hour Flow Diagram



Summary - PM Peak Hr.

Peak Hr.	1600-1700
Volume	655
PHF	0.88

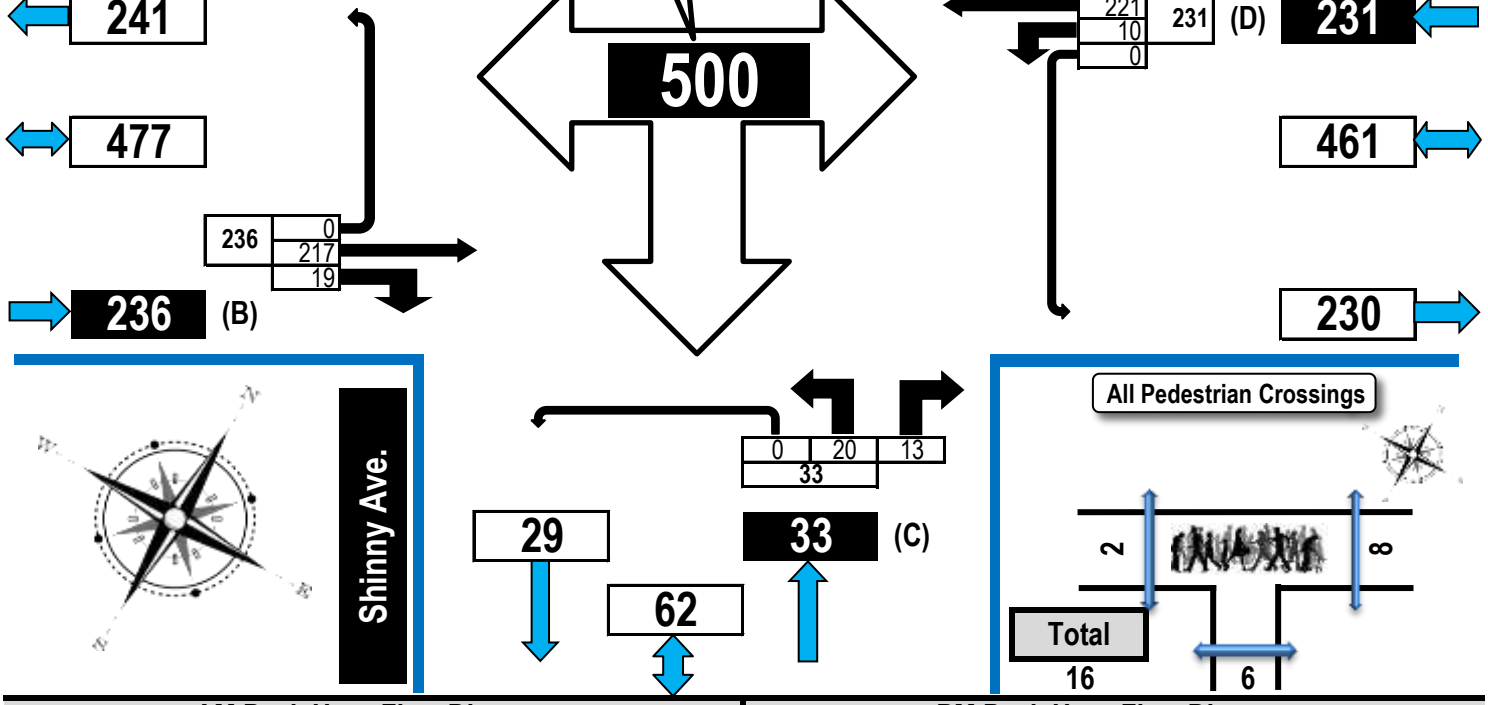
Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

Bobolink Ridge & Shinny Avenue — Stittsville, ON

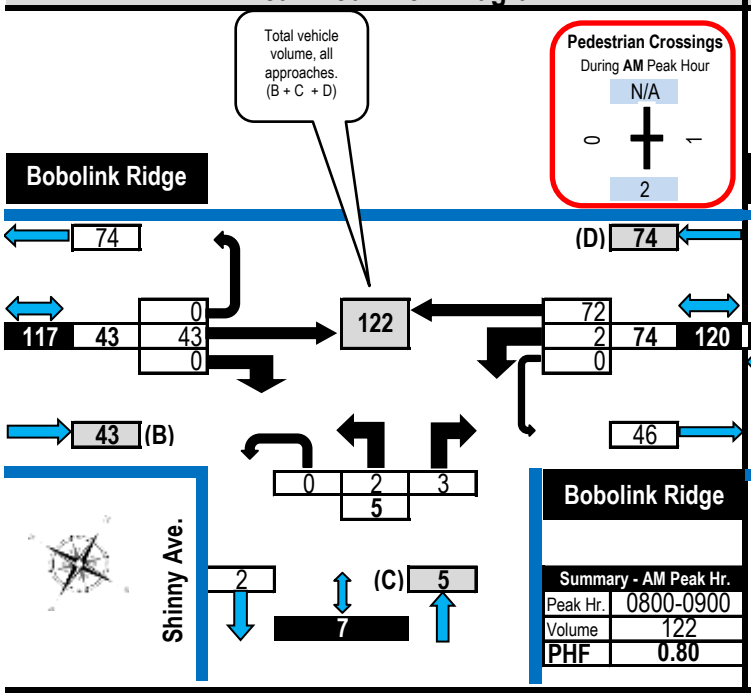
All Vehicles
(Except Bicycles & Electric Scooters)

Total vehicle volume, all approaches. (B + C + D)

Wednesday, 31 March 2021
0700-0900 & 1600-1800
4 Hour Survey
City of Ottawa Ward ▶ 6

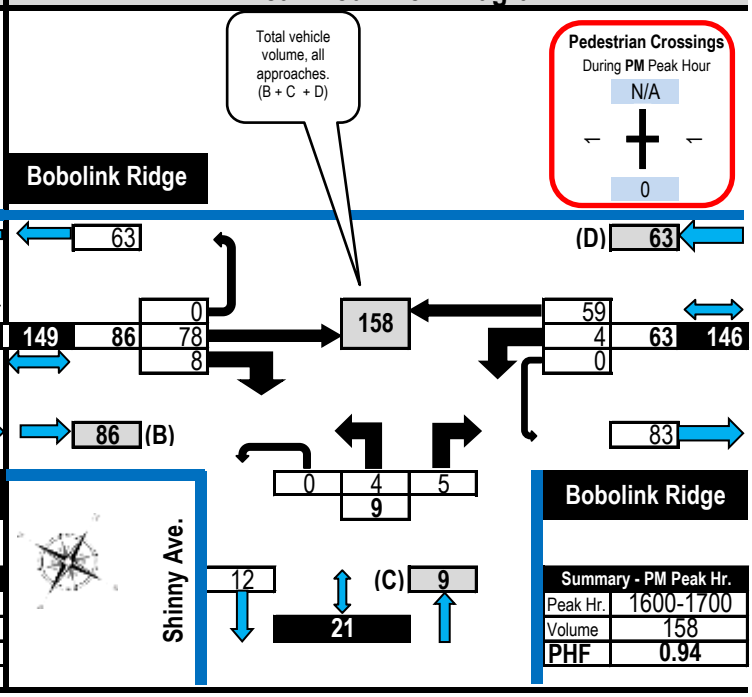


AM Peak Hour Flow Diagram



Summary - AM Peak Hr.	
Peak Hr.	0800-0900
Volume	122
PHF	0.80

PM Peak Hour Flow Diagram



Summary - PM Peak Hr.	
Peak Hr.	1600-1700
Volume	158
PHF	0.94

Appendix B

Collision Data

OBJECTID	DATE	ANOM_ID	YEAR	TIME	LOCATION	GEO_ID	ACCIDENT_LO	CLASS_OF_AC	IMPACT_TYPE	ENVIRONMEN	LIGHT	ROAD_SURFA	TRAFFIC_CON	TRAFFIC_CONTROL_CONDITION
61273	10/5/2017 4:00	2036	2017	12/31/1899 5:4(	BOBOLINK RDG @ ROBERT GRANT AVE		03 - At intersec	03 - P.D. only	02 - Angle	01 - Clear	01 - Daylight	01 - Dry	11 - Roundabout	
77765	4/10/2019	19-4336	2019	06:50:00+00	BOBOLINK RDG @ ROBERT GRANT AVE	14790	03 - At intersec	03 - P.D. only	02 - Angle	01 - Clear	01 - Daylight	02 - Wet	11 - Roundabou	01 - Functioning
61272	9/11/2017 4:00	2035	2017	12/31/1899 12::	BOBOLINK RDG @ LIVERY ST		03 - At intersec	03 - P.D. only	02 - Angle	01 - Clear	01 - Daylight	01 - Dry	02 - Stop sign	

Appendix C

Existing and Background Conditions Output Data (2024, 2029)

Intersection	
Intersection Delay, s/veh	5.4
Intersection LOS	A

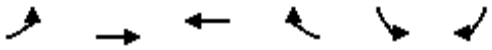
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	85	80	238	219
Demand Flow Rate, veh/h	86	81	243	224
Vehicles Circulating, veh/h	191	290	97	44
Vehicles Exiting, veh/h	77	50	180	327
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	3	1	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	4.8	5.2	5.9	5.3
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	86	81	243	224
Cap Entry Lane, veh/h	933	845	1025	1081
Entry HV Adj Factor	0.988	0.987	0.979	0.979
Flow Entry, veh/h	85	80	238	219
Cap Entry, veh/h	922	835	1004	1058
V/C Ratio	0.092	0.096	0.237	0.207
Control Delay, s/veh	4.8	5.2	5.9	5.3
LOS	A	A	A	A
95th %tile Queue, veh	0	0	1	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	43	0	2	72	2	3
Future Volume (Veh/h)	43	0	2	72	2	3
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	48	0	2	80	2	3
Pedestrians				1	1	
Lane Width (m)				3.6	3.6	
Walking Speed (m/s)				1.0	1.0	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			49		133	50
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			49		133	50
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1556		859	1016

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	48	82	5
Volume Left	0	2	2
Volume Right	0	0	3
cSH	1700	1556	947
Volume to Capacity	0.03	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.2	8.8
Lane LOS		A	A
Approach Delay (s)	0.0	0.2	8.8
Approach LOS			A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	16.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	20	25	42	6	5	28
Future Volume (Veh/h)	20	25	42	6	5	28
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	28	47	7	6	31
Pedestrians					3	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	57				126	54
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	57				126	54
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	97
cM capacity (veh/h)	1543				854	1011

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	50	54	37
Volume Left	22	0	6
Volume Right	0	7	31
cSH	1543	1700	982
Volume to Capacity	0.01	0.03	0.04
Queue Length 95th (m)	0.3	0.0	0.9
Control Delay (s)	3.3	0.0	8.8
Lane LOS	A		A
Approach Delay (s)	3.3	0.0	8.8
Approach LOS			A

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	19.2%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	6.1
Intersection LOS	A

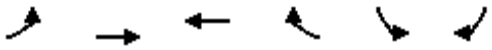
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	90	73	223	341
Demand Flow Rate, veh/h	92	74	227	347
Vehicles Circulating, veh/h	295	257	130	43
Vehicles Exiting, veh/h	95	100	257	288
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	1	2	0	2
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.5	5.0	5.9	6.6
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	92	74	227	347
Cap Entry Lane, veh/h	841	874	992	1082
Entry HV Adj Factor	0.976	0.985	0.984	0.982
Flow Entry, veh/h	90	73	223	341
Cap Entry, veh/h	821	860	977	1063
V/C Ratio	0.109	0.085	0.229	0.321
Control Delay, s/veh	5.5	5.0	5.9	6.6
LOS	A	A	A	A
95th %tile Queue, veh	0	0	1	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	78	8	4	59	4	5
Future Volume (Veh/h)	78	8	4	59	4	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	87	9	4	66	4	6
Pedestrians	1			1	1	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			97		168	94
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			97		168	94
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	99
cM capacity (veh/h)			1495		819	962

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	96	70	10
Volume Left	0	4	4
Volume Right	9	0	6
cSH	1700	1495	899
Volume to Capacity	0.06	0.00	0.01
Queue Length 95th (m)	0.0	0.1	0.3
Control Delay (s)	0.0	0.4	9.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.4	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	17.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	29	50	25	5	5	33
Future Volume (Veh/h)	29	50	25	5	5	33
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	32	56	28	6	6	37
Pedestrians		3			5	
Lane Width (m)		3.6			3.6	
Walking Speed (m/s)		1.0			1.0	
Percent Blockage		0			1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	39				156	39
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				156	39
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				99	96
cM capacity (veh/h)	1563				814	1024

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	88	34	43
Volume Left	32	0	6
Volume Right	0	6	37
cSH	1563	1700	989
Volume to Capacity	0.02	0.02	0.04
Queue Length 95th (m)	0.5	0.0	1.1
Control Delay (s)	2.8	0.0	8.8
Lane LOS	A		A
Approach Delay (s)	2.8	0.0	8.8
Approach LOS			A

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	22.1%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	6.6
Intersection LOS	A

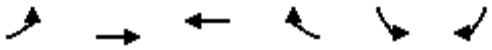
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	85	140	314	299
Demand Flow Rate, veh/h	86	142	321	305
Vehicles Circulating, veh/h	324	351	124	96
Vehicles Exiting, veh/h	77	94	286	397
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	3	1	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.5	6.5	7.0	6.6
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	86	142	321	305
Cap Entry Lane, veh/h	817	795	998	1027
Entry HV Adj Factor	0.988	0.986	0.978	0.981
Flow Entry, veh/h	85	140	314	299
Cap Entry, veh/h	807	784	976	1007
V/C Ratio	0.105	0.179	0.322	0.297
Control Delay, s/veh	5.5	6.5	7.0	6.6
LOS	A	A	A	A
95th %tile Queue, veh	0	1	1	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	59	0	2	126	2	3
Future Volume (Veh/h)	59	0	2	126	2	3
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	66	0	2	140	2	3
Pedestrians				1	1	
Lane Width (m)				3.6	3.6	
Walking Speed (m/s)				1.0	1.0	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			67		211	68
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			67		211	68
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1533		776	993

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	66	142	5
Volume Left	0	2	2
Volume Right	0	0	3
cSH	1700	1533	893
Volume to Capacity	0.04	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.1	9.1
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.1
Approach LOS			A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	36	25	42	6	5	82
Future Volume (Veh/h)	36	25	42	6	5	82
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	40	28	47	7	6	91
Pedestrians					3	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	57				162	54
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	57				162	54
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				99	91
cM capacity (veh/h)	1543				805	1011

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	68	54	97
Volume Left	40	0	6
Volume Right	0	7	91
cSH	1543	1700	995
Volume to Capacity	0.03	0.03	0.10
Queue Length 95th (m)	0.6	0.0	2.6
Control Delay (s)	4.4	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.4	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	22.5%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	8.2
Intersection LOS	A

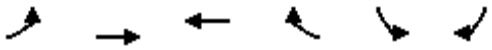
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	90	112	359	467
Demand Flow Rate, veh/h	92	114	366	476
Vehicles Circulating, veh/h	458	341	218	77
Vehicles Exiting, veh/h	95	243	332	378
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	1	2	0	2
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.6	6.0	8.8	8.7
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	92	114	366	476
Cap Entry Lane, veh/h	715	803	909	1046
Entry HV Adj Factor	0.976	0.981	0.980	0.981
Flow Entry, veh/h	90	112	359	467
Cap Entry, veh/h	698	788	891	1026
V/C Ratio	0.129	0.142	0.403	0.455
Control Delay, s/veh	6.6	6.0	8.8	8.7
LOS	A	A	A	A
95th %tile Queue, veh	0	0	2	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	132	8	4	93	4	5
Future Volume (Veh/h)	132	8	4	93	4	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	147	9	4	103	4	6
Pedestrians	1			1	1	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			157		264	154
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			157		264	154
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	99
cM capacity (veh/h)			1421		721	891

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	156	107	10
Volume Left	0	4	4
Volume Right	9	0	6
cSH	1700	1421	814
Volume to Capacity	0.09	0.00	0.01
Queue Length 95th (m)	0.0	0.1	0.3
Control Delay (s)	0.0	0.3	9.5
Lane LOS		A	A
Approach Delay (s)	0.0	0.3	9.5
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	18.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	50	25	5	5	67
Future Volume (Veh/h)	83	50	25	5	5	67
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	92	56	28	6	6	74
Pedestrians		3			5	
Lane Width (m)		3.6			3.6	
Walking Speed (m/s)		1.0			1.0	
Percent Blockage		0			1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	39				276	39
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				276	39
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				99	93
cM capacity (veh/h)	1563				668	1024

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	34	80
Volume Left	92	0	6
Volume Right	0	6	74
cSH	1563	1700	985
Volume to Capacity	0.06	0.02	0.08
Queue Length 95th (m)	1.5	0.0	2.1
Control Delay (s)	4.8	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.8	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	6.8
Intersection LOS	A

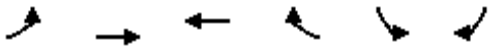
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	85	140	336	313
Demand Flow Rate, veh/h	86	142	344	319
Vehicles Circulating, veh/h	338	374	124	96
Vehicles Exiting, veh/h	77	94	300	420
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	3	1	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.6	6.7	7.3	6.7
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	86	142	344	319
Cap Entry Lane, veh/h	806	777	998	1027
Entry HV Adj Factor	0.988	0.986	0.978	0.981
Flow Entry, veh/h	85	140	336	313
Cap Entry, veh/h	796	766	976	1007
V/C Ratio	0.107	0.183	0.345	0.311
Control Delay, s/veh	5.6	6.7	7.3	6.7
LOS	A	A	A	A
95th %tile Queue, veh	0	1	2	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	59	0	2	126	2	3
Future Volume (Veh/h)	59	0	2	126	2	3
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	66	0	2	140	2	3
Pedestrians				1	1	
Lane Width (m)				3.6	3.6	
Walking Speed (m/s)				1.0	1.0	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			67		211	68
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			67		211	68
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1533		776	993

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	66	142	5
Volume Left	0	2	2
Volume Right	0	0	3
cSH	1700	1533	893
Volume to Capacity	0.04	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.1	9.1
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.1
Approach LOS			A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	36	25	42	6	5	82
Future Volume (Veh/h)	36	25	42	6	5	82
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	40	28	47	7	6	91
Pedestrians					3	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	57				162	54
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	57				162	54
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				99	91
cM capacity (veh/h)	1543				805	1011

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	68	54	97
Volume Left	40	0	6
Volume Right	0	7	91
cSH	1543	1700	995
Volume to Capacity	0.03	0.03	0.10
Queue Length 95th (m)	0.6	0.0	2.6
Control Delay (s)	4.4	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.4	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	22.5%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

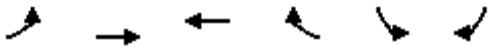
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	90	112	378	489
Demand Flow Rate, veh/h	92	114	386	498
Vehicles Circulating, veh/h	480	361	218	77
Vehicles Exiting, veh/h	95	243	354	398
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	1	2	0	2
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.7	6.2	9.1	9.0
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	92	114	386	498
Cap Entry Lane, veh/h	699	788	909	1046
Entry HV Adj Factor	0.976	0.981	0.980	0.981
Flow Entry, veh/h	90	112	378	489
Cap Entry, veh/h	683	773	891	1026
V/C Ratio	0.132	0.145	0.425	0.476
Control Delay, s/veh	6.7	6.2	9.1	9.0
LOS	A	A	A	A
95th %tile Queue, veh	0	1	2	3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	132	8	4	93	4	5
Future Volume (Veh/h)	132	8	4	93	4	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	147	9	4	103	4	6
Pedestrians	1			1	1	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			157		264	154
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			157		264	154
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	99
cM capacity (veh/h)			1421		721	891

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	156	107	10
Volume Left	0	4	4
Volume Right	9	0	6
cSH	1700	1421	814
Volume to Capacity	0.09	0.00	0.01
Queue Length 95th (m)	0.0	0.1	0.3
Control Delay (s)	0.0	0.3	9.5
Lane LOS		A	A
Approach Delay (s)	0.0	0.3	9.5
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	18.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	50	25	5	5	67
Future Volume (Veh/h)	83	50	25	5	5	67
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	92	56	28	6	6	74
Pedestrians		3			5	
Lane Width (m)		3.6			3.6	
Walking Speed (m/s)		1.0			1.0	
Percent Blockage		0			1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	39				276	39
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				276	39
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				99	93
cM capacity (veh/h)	1563				668	1024

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	34	80
Volume Left	92	0	6
Volume Right	0	6	74
cSH	1563	1700	985
Volume to Capacity	0.06	0.02	0.08
Queue Length 95th (m)	1.5	0.0	2.1
Control Delay (s)	4.8	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.8	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		

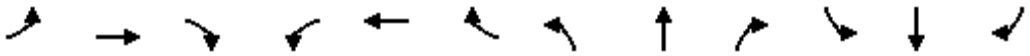
Appendix D

Total Projected Conditions
Output Data (2024, 2029)

Intersection	
Intersection Delay, s/veh	7.0
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	85	169	320	317
Demand Flow Rate, veh/h	86	173	327	324
Vehicles Circulating, veh/h	358	355	143	111
Vehicles Exiting, veh/h	77	115	301	417
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	3	1	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.7	7.0	7.3	6.9
Approach LOS	A	A	A	A

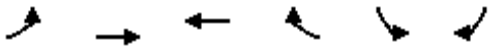
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	86	173	327	324
Cap Entry Lane, veh/h	790	792	979	1011
Entry HV Adj Factor	0.988	0.977	0.978	0.979
Flow Entry, veh/h	85	169	320	317
Cap Entry, veh/h	780	774	958	990
V/C Ratio	0.109	0.218	0.334	0.320
Control Delay, s/veh	5.7	7.0	7.3	6.9
LOS	A	A	A	A
95th %tile Queue, veh	0	1	1	1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	61	0	2	131	0	2	0	3	0	0	20
Future Volume (Veh/h)	16	61	0	2	131	0	2	0	3	0	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	18	68	0	2	146	0	2	0	3	0	0	22
Pedestrians					1			1				
Lane Width (m)					3.6			3.6				
Walking Speed (m/s)					1.0			1.0				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	146			69			277	255	70	258	255	146
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	146			69			277	255	70	258	255	146
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	100	100	98
cM capacity (veh/h)	1436			1530			651	639	991	684	639	901

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	86	148	5	22
Volume Left	18	2	2	0
Volume Right	0	0	3	22
cSH	1436	1530	820	901
Volume to Capacity	0.01	0.00	0.01	0.02
Queue Length 95th (m)	0.3	0.0	0.1	0.6
Control Delay (s)	1.7	0.1	9.4	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	1.7	0.1	9.4	9.1
Approach LOS			A	A

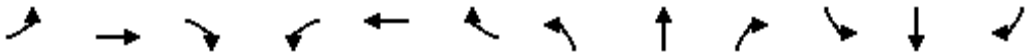
Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	24.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	38	25	42	6	5	87
Future Volume (Veh/h)	38	25	42	6	5	87
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	42	28	47	7	6	97
Pedestrians					3	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	57				166	54
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	57				166	54
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				99	90
cM capacity (veh/h)	1543				800	1011

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	70	54	103
Volume Left	42	0	6
Volume Right	0	7	97
cSH	1543	1700	995
Volume to Capacity	0.03	0.03	0.10
Queue Length 95th (m)	0.7	0.0	2.8
Control Delay (s)	4.5	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.5	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	0	5	0	0	0	2	42	0	0	87	1
Future Volume (Veh/h)	3	0	5	0	0	0	2	42	0	0	87	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	6	0	0	0	2	47	0	0	97	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	148	148	98	154	149	47	98			47		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	148	148	98	154	149	47	98			47		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	100	100	100	100			100		
cM capacity (veh/h)	819	742	959	806	742	1022	1495			1560		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	9	0	49	98
Volume Left	3	0	2	0
Volume Right	6	0	0	1
cSH	907	1700	1495	1560
Volume to Capacity	0.01	0.00	0.00	0.00
Queue Length 95th (m)	0.2	0.0	0.0	0.0
Control Delay (s)	9.0	0.0	0.3	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.0	0.0	0.3	0.0
Approach LOS	A	A		

Intersection Summary				
Average Delay	0.6			
Intersection Capacity Utilization	14.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	23	385	4	0	289
Future Volume (Veh/h)	0	23	385	4	0	289
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	26	428	4	0	321
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	751	430			432	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	751	430			432	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			100	
cM capacity (veh/h)	378	625			1128	

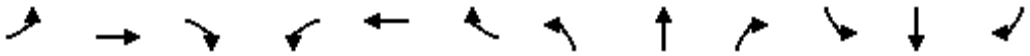
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	26	432	321
Volume Left	0	0	0
Volume Right	26	4	0
cSH	625	1700	1700
Volume to Capacity	0.04	0.25	0.19
Queue Length 95th (m)	1.0	0.0	0.0
Control Delay (s)	11.0	0.0	0.0
Lane LOS	B		
Approach Delay (s)	11.0	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	8.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	90	129	371	500
Demand Flow Rate, veh/h	92	131	378	510
Vehicles Circulating, veh/h	500	349	252	85
Vehicles Exiting, veh/h	95	281	340	395
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	1	2	0	2
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.9	6.3	9.5	9.4
Approach LOS	A	A	A	A

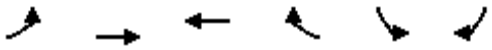
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	92	131	378	510
Cap Entry Lane, veh/h	685	797	878	1038
Entry HV Adj Factor	0.976	0.984	0.981	0.980
Flow Entry, veh/h	90	129	371	500
Cap Entry, veh/h	669	784	861	1017
V/C Ratio	0.134	0.164	0.430	0.492
Control Delay, s/veh	6.9	6.3	9.5	9.4
LOS	A	A	A	A
95th %tile Queue, veh	0	1	2	3



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	136	8	4	96	0	4	0	5	0	0	12
Future Volume (Veh/h)	29	136	8	4	96	0	4	0	5	0	0	12
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	32	151	9	4	107	0	4	0	6	0	0	13
Pedestrians					1			1				
Lane Width (m)					3.6			3.6				
Walking Speed (m/s)					1.0			1.0				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	107			161			348	336	158	342	340	107
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	107			161			348	336	158	342	340	107
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			99	100	99	100	100	99
cM capacity (veh/h)	1484			1417			586	570	886	596	567	947

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	192	111	10	13
Volume Left	32	4	4	0
Volume Right	9	0	6	13
cSH	1484	1417	735	947
Volume to Capacity	0.02	0.00	0.01	0.01
Queue Length 95th (m)	0.5	0.1	0.3	0.3
Control Delay (s)	1.4	0.3	10.0	8.9
Lane LOS	A	A	A	A
Approach Delay (s)	1.4	0.3	10.0	8.9
Approach LOS			A	A

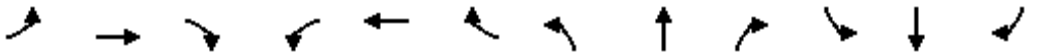
Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	27.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	87	50	25	5	5	70
Future Volume (Veh/h)	87	50	25	5	5	70
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	97	56	28	6	6	78
Pedestrians		3			5	
Lane Width (m)		3.6			3.6	
Walking Speed (m/s)		1.0			1.0	
Percent Blockage		0			1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	39				286	39
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				286	39
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				99	92
cM capacity (veh/h)	1563				657	1024

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	153	34	84
Volume Left	97	0	6
Volume Right	0	6	78
cSH	1563	1700	985
Volume to Capacity	0.06	0.02	0.09
Queue Length 95th (m)	1.6	0.0	2.2
Control Delay (s)	4.9	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.9	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	27.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	3	0	0	0	4	88	0	0	72	2
Future Volume (Veh/h)	2	0	3	0	0	0	4	88	0	0	72	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	0	3	0	0	0	4	98	0	0	80	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	187	187	81	190	188	98	82			98		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	187	187	81	190	188	98	82			98		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	772	706	979	766	705	958	1515			1495		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	0	102	82
Volume Left	2	0	4	0
Volume Right	3	0	0	2
cSH	884	1700	1515	1495
Volume to Capacity	0.01	0.00	0.00	0.00
Queue Length 95th (m)	0.1	0.0	0.1	0.0
Control Delay (s)	9.1	0.0	0.3	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.1	0.0	0.3	0.0
Approach LOS	A	A		

Intersection Summary				
Average Delay	0.4			
Intersection Capacity Utilization	18.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	14	418	7	0	457
Future Volume (Veh/h)	0	14	418	7	0	457
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	16	464	8	0	508
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	976	468			472	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	976	468			472	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			100	
cM capacity (veh/h)	279	595			1090	

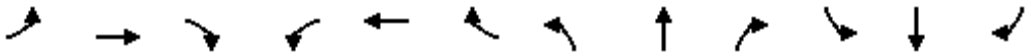
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	472	508
Volume Left	0	0	0
Volume Right	16	8	0
cSH	595	1700	1700
Volume to Capacity	0.03	0.28	0.30
Queue Length 95th (m)	0.7	0.0	0.0
Control Delay (s)	11.2	0.0	0.0
Lane LOS	B		
Approach Delay (s)	11.2	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	85	169	343	331
Demand Flow Rate, veh/h	86	173	351	338
Vehicles Circulating, veh/h	372	379	143	111
Vehicles Exiting, veh/h	77	115	315	441
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	3	1	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.8	7.3	7.6	7.1
Approach LOS	A	A	A	A

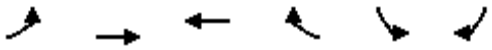
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	86	173	351	338
Cap Entry Lane, veh/h	779	773	979	1011
Entry HV Adj Factor	0.988	0.977	0.978	0.979
Flow Entry, veh/h	85	169	343	331
Cap Entry, veh/h	769	755	958	990
V/C Ratio	0.110	0.224	0.358	0.334
Control Delay, s/veh	5.8	7.3	7.6	7.1
LOS	A	A	A	A
95th %tile Queue, veh	0	1	2	1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	61	0	2	131	0	2	0	3	0	0	20
Future Volume (Veh/h)	16	61	0	2	131	0	2	0	3	0	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	18	68	0	2	146	0	2	0	3	0	0	22
Pedestrians					1			1				
Lane Width (m)					3.6			3.6				
Walking Speed (m/s)					1.0			1.0				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	146			69			277	255	70	258	255	146
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	146			69			277	255	70	258	255	146
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	100	100	98
cM capacity (veh/h)	1436			1530			651	639	991	684	639	901

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	86	148	5	22
Volume Left	18	2	2	0
Volume Right	0	0	3	22
cSH	1436	1530	820	901
Volume to Capacity	0.01	0.00	0.01	0.02
Queue Length 95th (m)	0.3	0.0	0.1	0.6
Control Delay (s)	1.7	0.1	9.4	9.1
Lane LOS	A	A	A	A
Approach Delay (s)	1.7	0.1	9.4	9.1
Approach LOS			A	A

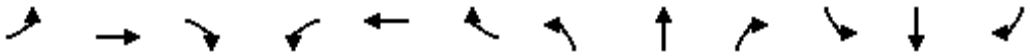
Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	24.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	38	25	42	6	5	87
Future Volume (Veh/h)	38	25	42	6	5	87
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	42	28	47	7	6	97
Pedestrians					3	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	57				166	54
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	57				166	54
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				99	90
cM capacity (veh/h)	1543				800	1011

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	70	54	103
Volume Left	42	0	6
Volume Right	0	7	97
cSH	1543	1700	995
Volume to Capacity	0.03	0.03	0.10
Queue Length 95th (m)	0.7	0.0	2.8
Control Delay (s)	4.5	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.5	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	0	5	0	0	0	2	42	0	0	87	1
Future Volume (Veh/h)	3	0	5	0	0	0	2	42	0	0	87	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	0	6	0	0	0	2	47	0	0	97	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	148	148	98	154	149	47	98			47		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	148	148	98	154	149	47	98			47		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	100	100	100	100			100		
cM capacity (veh/h)	819	742	959	806	742	1022	1495			1560		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	9	0	49	98
Volume Left	3	0	2	0
Volume Right	6	0	0	1
cSH	907	1700	1495	1560
Volume to Capacity	0.01	0.00	0.00	0.00
Queue Length 95th (m)	0.2	0.0	0.0	0.0
Control Delay (s)	9.0	0.0	0.3	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.0	0.0	0.3	0.0
Approach LOS	A	A		

Intersection Summary				
Average Delay	0.6			
Intersection Capacity Utilization	14.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	23	417	4	0	311
Future Volume (Veh/h)	0	23	417	4	0	311
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	26	463	4	0	346
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	811	465			467	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	811	465			467	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	96			100	
cM capacity (veh/h)	349	597			1094	

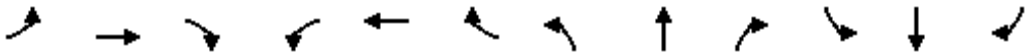
Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	26	467	346
Volume Left	0	0	0
Volume Right	26	4	0
cSH	597	1700	1700
Volume to Capacity	0.04	0.27	0.20
Queue Length 95th (m)	1.1	0.0	0.0
Control Delay (s)	11.3	0.0	0.0
Lane LOS	B		
Approach Delay (s)	11.3	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	33.4%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	9.2
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	90	129	390	522
Demand Flow Rate, veh/h	92	131	398	532
Vehicles Circulating, veh/h	522	369	252	85
Vehicles Exiting, veh/h	95	281	362	415
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	1	2	0	2
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.1	6.5	9.9	9.8
Approach LOS	A	A	A	A

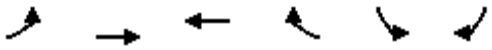
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	92	131	398	532
Cap Entry Lane, veh/h	670	781	878	1038
Entry HV Adj Factor	0.976	0.984	0.981	0.980
Flow Entry, veh/h	90	129	390	522
Cap Entry, veh/h	654	768	861	1017
V/C Ratio	0.137	0.168	0.453	0.513
Control Delay, s/veh	7.1	6.5	9.9	9.8
LOS	A	A	A	A
95th %tile Queue, veh	0	1	2	3



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	136	8	4	96	0	4	0	5	0	0	12
Future Volume (Veh/h)	29	136	8	4	96	0	4	0	5	0	0	12
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	32	151	9	4	107	0	4	0	6	0	0	13
Pedestrians					1			1				
Lane Width (m)					3.6			3.6				
Walking Speed (m/s)					1.0			1.0				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	107			161			348	336	158	342	340	107
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	107			161			348	336	158	342	340	107
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			99	100	99	100	100	99
cM capacity (veh/h)	1484			1417			586	570	886	596	567	947

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	192	111	10	13
Volume Left	32	4	4	0
Volume Right	9	0	6	13
cSH	1484	1417	735	947
Volume to Capacity	0.02	0.00	0.01	0.01
Queue Length 95th (m)	0.5	0.1	0.3	0.3
Control Delay (s)	1.4	0.3	10.0	8.9
Lane LOS	A	A	A	A
Approach Delay (s)	1.4	0.3	10.0	8.9
Approach LOS			A	A

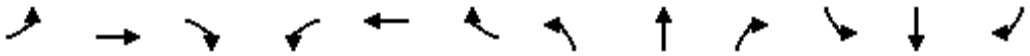
Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	27.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	87	50	25	5	5	70
Future Volume (Veh/h)	87	50	25	5	5	70
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	97	56	28	6	6	78
Pedestrians		3			5	
Lane Width (m)		3.6			3.6	
Walking Speed (m/s)		1.0			1.0	
Percent Blockage		0			1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	39				286	39
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				286	39
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				99	92
cM capacity (veh/h)	1563				657	1024

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	153	34	84
Volume Left	97	0	6
Volume Right	0	6	78
cSH	1563	1700	985
Volume to Capacity	0.06	0.02	0.09
Queue Length 95th (m)	1.6	0.0	2.2
Control Delay (s)	4.9	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	4.9	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	27.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	3	0	0	0	4	88	0	0	72	2
Future Volume (Veh/h)	2	0	3	0	0	0	4	88	0	0	72	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	0	3	0	0	0	4	98	0	0	80	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	187	187	81	190	188	98	82			98		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	187	187	81	190	188	98	82			98		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	772	706	979	766	705	958	1515			1495		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	0	102	82
Volume Left	2	0	4	0
Volume Right	3	0	0	2
cSH	884	1700	1515	1495
Volume to Capacity	0.01	0.00	0.00	0.00
Queue Length 95th (m)	0.1	0.0	0.1	0.0
Control Delay (s)	9.1	0.0	0.3	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.1	0.0	0.3	0.0
Approach LOS	A	A		

Intersection Summary				
Average Delay	0.4			
Intersection Capacity Utilization	18.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	14	446	7	0	491
Future Volume (Veh/h)	0	14	446	7	0	491
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	16	496	8	0	546
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1046	500			504	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1046	500			504	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			100	
cM capacity (veh/h)	253	571			1061	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	504	546
Volume Left	0	0	0
Volume Right	16	8	0
cSH	571	1700	1700
Volume to Capacity	0.03	0.30	0.32
Queue Length 95th (m)	0.7	0.0	0.0
Control Delay (s)	11.5	0.0	0.0
Lane LOS	B		
Approach Delay (s)	11.5	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix E

Transportation Demand Management (TDM) Strategies

Introduction

The City of Ottawa's *Transportation Impact Assessment (TIA) Guidelines* (specifically Module 4.1—Development Design) requires proponents of qualifying developments to use the City's **TDM-Supportive Development Design and Infrastructure Checklist** to assess the opportunity to implement design elements that are supportive of sustainable modes. The goal of this assessment is to ensure that the development provides safe and efficient access for all users, while creating an environment that encourages walking, cycling and transit use.

The remaining sections of this document are:

- Using the Checklist
- Glossary
- TDM-Supportive Development Design and Infrastructure Checklist: Non-Residential Developments
- TDM-Supportive Development Design and Infrastructure Checklist: Residential Developments

Readers are encouraged to contact the City of Ottawa's TDM Officer for any guidance and assistance they require to complete this checklist.

Using the Checklist

This **TDM-Supportive Development Design and Infrastructure Checklist** document includes two actual checklists, one for non-residential developments (office, institutional, retail or industrial) and one for residential developments (multi-family or condominium only; subdivisions are exempt). Readers may download the applicable checklist in electronic format and complete it electronically, or print it out and complete it by hand. As an alternative, they may create a freestanding document that lists the design and infrastructure measures being proposed and provides additional detail on them.

Each measure in the checklist is numbered for easy reference. Each measure is also flagged as:

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

Glossary

This glossary defines and describes the following measures that are identified in the **TDM-Supportive Development Design and Infrastructure Checklist**:

Walking & cycling: Routes
- Building location & access points
- Facilities for walking & cycling
- Amenities for walking & cycling

Walking & cycling: End-of-trip facilities
- Bicycle parking
- Secure bicycle parking
- Shower & change facilities
- Bicycle repair station

Transit
- Walking routes to transit
- Customer amenities

Ridesharing
- Pick-up & drop-off facilities
- Carpool parking

Carsharing & bikesharing
- Carshare parking spaces
- Bikeshare station location

Parking
- Number of parking spaces
- Separate long-term & short-term parking areas

Other
- On-site amenities to minimize off-site trips

In addition to specific references made in this glossary, readers should consult the City of Ottawa's design and planning guidelines for a variety of different land uses and contexts, available on the City's website at www.ottawa.ca. Readers may also find the following resources to be helpful:

- *Promoting Sustainable Transportation through Site Design*, Institute of Transportation Engineers, 2004 (www.cite7.org/wpdm-package/iterp-promoting-sustainable-transportation)
- *Bicycle End-of-Trip Facilities: A Guide for Canadian Municipalities and Employers*, Transport Canada, 2010 (www.fcm.ca/Documents/tools/GMF/Transport_Canada/BikeEndofTrip_EN.pdf)

▶ *Walking & cycling: Routes*

Building location & access points. Correctly positioning buildings and their entrances can help make walking convenient, comfortable and safe. Minimizing travel distances and maximizing visibility are key.

Facilities for walking & cycling. The Official Plan gives clear direction on the provision and design of walking and cycling facilities for both access and circulation. On larger, busier sites (e.g. multi-building campuses) the inclusion of sidewalks, pathways, marked crossings, stop signs and traffic calming features can create a safer and more supportive environment for active transportation.

Amenities for walking & cycling. Lighting, landscaping, benches and wayfinding can make walking and cycling safer and more secure, comfortable and accessible.

▶ *Walking & cycling: End-of-trip facilities*

Bicycle parking. The Official Plan and Zoning By-law both address the need for adequate bicycle parking at developments. Weather protection and theft prevention are major concerns for commuters who spend hundreds or thousands of dollars on a quality bicycle. Bicycle racks should have a design that enables secure locking while preventing damage to wheels. They should be located within sight of busy areas such as main building entrances or staffed parking kiosks.

Secure bicycle parking. Ottawa's Zoning By-law requires a secure area for bicycles at office or residential developments having more than 50 bicycle parking spaces. Lockable outdoor bike cages or indoor storage rooms that limit access to registered users are ideal.

Shower & change facilities. Longer-distance cyclists, joggers and even pedestrians can need a place to shower and change at work; the lack of such facilities is a major barrier to active commuting. Lockers and drying racks provide a place to store gear away from workspaces, and showers and grooming stations allow commuters to make themselves presentable for the office.

Bicycle repair station. Cycling commuters can experience maintenance issues that make the homeward trip difficult or impossible. A small supply of tools (e.g. air pump, Allen keys, wrenches) and supplies (e.g. inner tube patches, chain lubricant) in the workplace can help.

▶ *Transit*

Customer amenities. Larger developments that feature an on-site transit stop can make transit use more attractive by providing shelters, lighting and benches. Even better, they could integrate the passenger waiting area into a building entrance.

▶ *Ridesharing*

Pick-up & drop-off facilities. Having a safe place to load or unload passengers (for carpools as well as taxis and ride-hailing services) without obstructing pedestrians, cyclists or other vehicles can help make carpooling work.

Carpool parking. At destinations with large parking lots (or lots that regularly fill to capacity), signed priority carpool parking spaces can be an effective ridesharing incentive. Priority spaces are frequently abused by non-carpoolers, so a system to provide registered users with vehicle identification tags is recommended.

▶ *Carsharing & bikesharing*

Carshare parking spaces. For developments where carsharing could be an attractive option for employees, visitors or residents, ensuring an attractive location for future carshare parking spaces can avoid challenges associated with future retrofits.

Bikeshare station location. For developments where bikesharing could be an attractive option for employees, visitor or residents, ensuring an attractive location for a future bikeshare station can avoid challenges associated with future retrofits.

▶ *Parking*

Number of parking spaces. Parking capacity is an important variable in development design, as it can either support or subvert the mode share targets set during the transportation impact analysis (TIA). While the Zoning By-law establishes any minimum and/or maximum requirements for parking capacity, it also allows a reduction in any minimum to reflect the existence of on-site shower, change and locker rooms provided for cyclists.

Separate long-term & short-term parking areas. Because access to unused parking spaces can be a powerful incentive to drive, developments can better manage their parking supply and travel behaviours by separating long-term from short-term parking through the use of landscaping, gated controls or signs. Doing so makes it difficult for long-term parkers (e.g. commuters) to park in short-term areas (e.g. for visitors) as long as enforcement occurs; it also protects long-term parking capacity for its intended users.

▶ *Other*

On-site amenities to minimize off-site trips. Developments that offer facilities to limit employees' need for a car during their commute (e.g. to drop off children at daycare) or during their workday (e.g. to hit the gym) can free employees to make the commuting decision that otherwise works best for them.

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

Legend

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

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

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

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

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

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

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

Legend

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

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

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

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

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

Appendix F

Segment MMLOS

SEGMENTS		LOS	Robert Grant	Bobolink	Bobolink EB	Bobolink WB	Livery NB	Livery SB
			Site Drwy/Bobo	Robert/Site Drwy	Site Drwy/Livery	Site Drwy/Livery	Bobo/Site Drwy	Bobo/Site Drwy
Pedestrian	Sidewalk Width Boulevard Width	C	≥ 2 m > 2 m	≥ 2 m < 0.5	no sidewalk n/a	≥ 2 m < 0.5	no sidewalk n/a	≥ 2 m < 0.5
	Avg Daily Curb Lane Traffic Volume		> 3000	≤ 3000	≤ 3000	≤ 3000	≤ 3000	≤ 3000
	Operating Speed On-Street Parking		> 50 to 60 km/h no	> 30 to 50 km/h yes	> 30 to 50 km/h yes	> 30 to 50 km/h yes	> 30 to 50 km/h yes	> 30 to 50 km/h yes
	Exposure to Traffic PLoS		**C**	**B**	**F**	**B**	**F**	**B**
	Effective Sidewalk Width		2.0 m	2.0 m		2.0 m		2.0 m
	Pedestrian Volume		250 ped/hr	250 ped/hr		250 ped/hr		250 ped/hr
	Crowding PLoS		**B**	**B**	**-**	**B**	**-**	**B**
	Level of Service		**C**	**B**	**-**	**B**	**-**	**B**
Bicycle	Type of Cycling Facility	A	Physically Separated	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Number of Travel Lanes			≤ 2 (no centreline)	≤ 2 (no centreline)	≤ 2 (no centreline)	≤ 2 (no centreline)	≤ 2 (no centreline)
	Operating Speed			≤ 40 km/h	≤ 40 km/h	≤ 40 km/h	≤ 40 km/h	≤ 40 km/h
	# of Lanes & Operating Speed LoS		**-**	**A**	**A**	**A**	**A**	**A**
	Bike Lane (+ Parking Lane) Width							
	Bike Lane Width LoS		**-**	**-**	**-**	**-**	**-**	**-**
	Bike Lane Blockages							
	Blockage LoS		**-**	**-**	**-**	**-**	**-**	**-**
	Median Refuge Width (no median = < 1.8 m)			< 1.8 m refuge	< 1.8 m refuge	< 1.8 m refuge	< 1.8 m refuge	< 1.8 m refuge
	No. of Lanes at Unsignalized Crossing			≤ 3 lanes	≤ 3 lanes	≤ 3 lanes	≤ 3 lanes	≤ 3 lanes
	Sidestreet Operating Speed			≤ 40 km/h	≤ 40 km/h	≤ 40 km/h	≤ 40 km/h	≤ 40 km/h
	Unsignalized Crossing - Lowest LoS		**A**	**A**	**A**	**A**	**A**	**A**
	Level of Service		**A**	**A**	**A**	**A**	**A**	**A**
Transit	Facility Type	D	Mixed Traffic					
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8					
	Level of Service		**D**	**-**	**-**	**-**	**-**	**-**
Truck	Truck Lane Width	B	> 3.7 m	> 3.7 m	> 3.7 m	> 3.7 m	> 3.7 m	> 3.7 m
	Travel Lanes per Direction		1	1	1	1	1	1
	Level of Service		**B**	**B**	**B**	**B**	**B**	**B**

Appendix G

Collision Analysis

Total Area

Classification of Accident	01 - Approaching	02 - Angle	03 - Rear end	04 - Sideswipe	05 - Turning movement	06 - SMV unattended vehicle	07 - SMV other	99 - Other	Total	
03 - P.D. only	0	3	0	0	0	0	0	0	3	100%
02 - Non-fatal injury	0	0	0	0	0	0	0	0	0	0%
01 - Fatal injury	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	100%
	#2 or 0%	#1 or 100%	#2 or 0%	#2 or 0%	#2 or 0%	#2 or 0%	#2 or 0%	#2 or 0%		

BOBOLINK RDG @ ROBERT GRANT AVE

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2017-2019	2	4,860	1095	**0.38**

Classification of Accident	01 - Approaching	02 - Angle	03 - Rear end	04 - Sideswipe	05 - Turning movement	06 - SMV unattended vehicle	07 - SMV other	99 - Other	Total	
03 - P.D. only	0	2	0	0	0	0	0	0	2	100%
02 - Non-fatal injury	0	0	0	0	0	0	0	0	0	0%
01 - Fatal injury	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	100%
	0%	100%	0%	0%	0%	0%	0%	0%		

BOBOLINK RDG @ LIVERY ST

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2017-2019	1	1,088	1095	**0.84**

Classification of Accident	01 - Approaching	02 - Angle	03 - Rear end	04 - Sideswipe	05 - Turning movement	06 - SMV unattended vehicle	07 - SMV other	99 - Other	Total	
03 - P.D. only	0	1	0	0	0	0	0	0	1	100%
02 - Non-fatal injury	0	0	0	0	0	0	0	0	0	0%
01 - Fatal injury	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	100%
	0%	100%	0%	0%	0%	0%	0%	0%		

Appendix H

TDM Checklist

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

Legend

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

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

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

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

			TDM measures: *Residential developments*	Check if proposed & add descriptions
		3.	**TRANSIT**	
		3.1	**Transit information**	
BASIC		3.1.1	Display relevant transit schedules and route maps at entrances *(multi-family, condominium)*	☑ Transit schedules will be provided in lobbies and site office
BETTER		3.1.2	Provide real-time arrival information display at entrances *(multi-family, condominium)*	☐
		3.2	**Transit fare incentives**	
BASIC	★	3.2.1	Offer PRESTO cards preloaded with one monthly transit pass on residence purchase/move-in, to encourage residents to use transit	☐
BETTER		3.2.2	Offer at least one year of free monthly transit passes on residence purchase/move-in	☐
		3.3	**Enhanced public transit service**	
BETTER	★	3.3.1	Contract with OC Transpo to provide early transit services until regular services are warranted by occupancy levels *(subdivision)*	☐ not applicable
		3.4	**Private transit service**	
BETTER		3.4.1	Provide shuttle service for seniors homes or lifestyle communities (e.g. scheduled mall or supermarket runs)	☐
		4.	**CARSHARING & BIKESHARING**	
		4.1	**Bikeshare stations & memberships**	
BETTER		4.1.1	Contract with provider to install on-site bikeshare station (*multi-family)*	☑ May be implemented based on tenant demand
BETTER		4.1.2	Provide residents with bikeshare memberships, either free or subsidized *(multi-family)*	☑ May be implemented based on tenant demand
		4.2	**Carshare vehicles & memberships**	
BETTER		4.2.1	Contract with provider to install on-site carshare vehicles and promote their use by residents	☑ May be implemented based on tenant demand
BETTER		4.2.2	Provide residents with carshare memberships, either free or subsidized	☐
		5.	**PARKING**	
		5.1	**Priced parking**	
BASIC	★	5.1.1	Unbundle parking cost from purchase price *(condominium)*	☐ not applicable
BASIC	★	5.1.2	Unbundle parking cost from monthly rent *(multi-family)*	☑ One parking stall can be included in monthly rent

			TDM measures: *Residential developments*	Check if proposed & add descriptions
		6.	**TDM MARKETING & COMMUNICATIONS**	
		6.1	**Multimodal travel information**	
BASIC	★	6.1.1	Provide a multimodal travel option information package to new residents	☑ Welcome package for new tenants will contain transit information, options, and schedules. Information also provided' at site office.
		6.2	**Personalized trip planning**	
BETTER	★	6.2.1	Offer personalized trip planning to new residents	☑ Provided by TDM coordinator

Appendix I

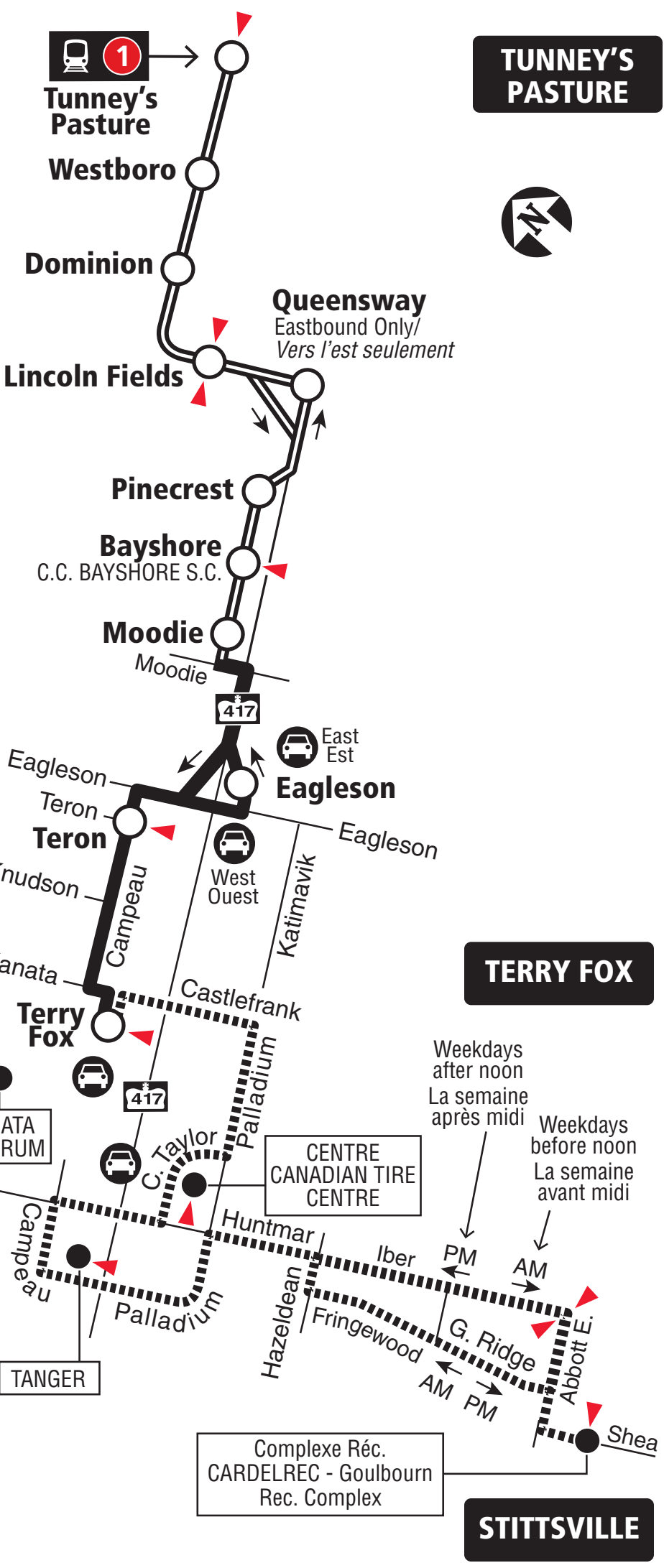
Transit Route Maps

62 Rapide

TERRY FOX STITTSVILLE
TUNNEY'S PASTURE

7 days a week / 7 jours par semaine

All day service
Service toute la journée



Transitway & Station

Monday to Friday only (limited evening service)
Lundi au vendredi seulement (service de soirée limité)

Park & Ride / Parc-o-bus

Timepoint / Heures de passage

2019.07

1

Starting July 14, 2019
À partir du 14 juillet 2019

Lost and Found / Objets perdus..... **613-563-4011**
Security / Sécurité **613-741-2478**

OC Transpo

INFO 613-741-4390
octranspo.com

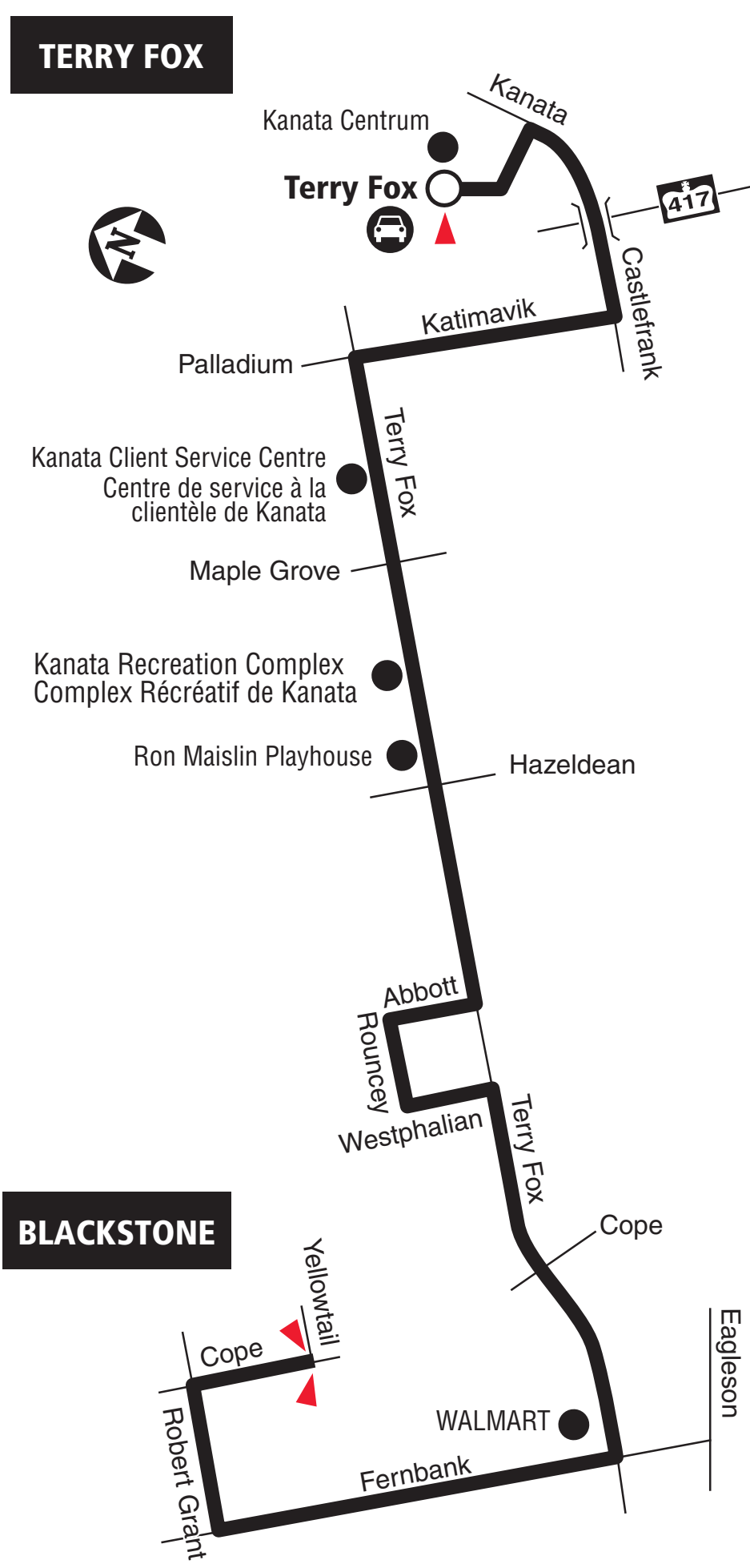
167

TERRY FOX
BLACKSTONE

Local

Monday to Friday/ Lundi au vendredi

Selected time periods
Périodes selectionnées



Transitway Station / Station du Transitway

Park & Ride / Parc-o-bus

Timepoint / Heures de passage

2019.06

Schedule / Horaire.....613-560-1000
Text / Texto 560560

plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres

Customer Service
Service à la clientèle **613-741-4390**

Lost and Found / Objets perdus..... **613-563-4011**

Security / Sécurité **613-741-2478**

Effective December 24, 2017
En vigueur 24 décembre 2017

OC Transpo

INFO 613-741-4390
octranspo.com

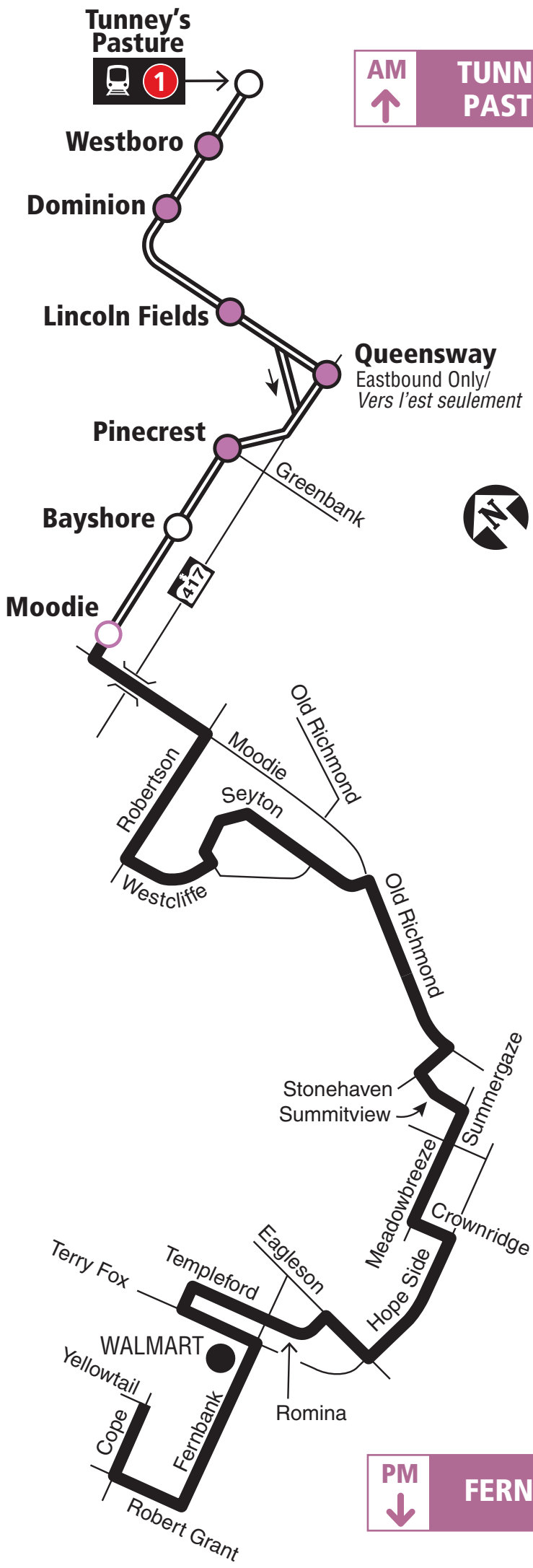
252 Connexion

FERNBANK
TUNNEY'S PASTURE

Monday to Friday / Lundi au vendredi

Peak periods only

Périodes de pointe seulement



Transitway & Station

Limited stops: Off only in AM / No stop in PM
Arrêts limités : Débarquement en AM seul. / Aucun arrêt en PM

AM: Off only - PM: Full Service
AM: Débarquement seul. - PM: Service complet

2019.07

1

Future route after O-Train Line 1 is open
Trajet du circuit après l'ouverture de la Ligne 1 de l'O-Train

Lost and Found / Objets perdus..... **613-563-4011**

Security / Sécurité **613-741-2478**

OC Transpo

INFO 613-741-4390
octranspo.com

Appendix J

Transit Ridership Data

Winter 2020 (5 Jan 2020 - 7 Mar 2020)

Stop No.	Location	Route	Direction	AM (6:00-9:00)			PM (15:00-18:00)			24-HR		
				Boardings	*Alightings*	*Avg Load at Departure*	*Boardings*	*Alightings*	*Avg Load at Departure*	*Boardings*	*Alightings*	*Avg Load at Departure*
8493	Cope / Yellowtail	167	SB	-	-	-	0	7	0	0	16	0
		167	NB	4	0	1	2	0	1	10	0	1
		252	OB	-	-	-	0	13	0	0	25	0
		252	IB	15	0	1	-	-	-	16	0	1
1626	Abbott / Iber	62	WB	0	8	1	-	-	-	1	16	1
1646	Iber / Abbott	62	EB	-	-	-	7	1	3	11	2	2
5050	Robert Grant W / Haliburton Heights	167	NB	0	2	1	0	0	1	1	0	1
		252	IB	9	0	3	-	-	-	0	0	1
5051	Robert Grant E / Haliburton Heights	167	SB	-	-	-	0	2	1	0	2	1
		252	OB	-	-	-	2	8	2	0	2	2

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www.jlrichards.ca

Ottawa

864 Lady Ellen Place
Ottawa ON Canada
K1Z 5M2
Tel: 613 728-3571

ottawa@jlrichards.ca

Kingston

203-863 Princess Street
Kingston ON Canada
K7L 5N4
Tel: 613 544-1424

kingston@jlrichards.ca

Sudbury

314 Countryside Drive
Sudbury ON Canada
P3E 6G2
Tel: 705 522-8174

sudbury@jlrichards.ca

Timmins

834 Mountjoy Street S
Timmins ON Canada
P4N 7C5
Tel: 705 360-1899

timmins@jlrichards.ca

North Bay

501-555 Oak Street E
North Bay ON Canada
P1B 8L3
Tel: 705 495-7597

northbay@jlrichards.ca

Hawkesbury

326 Bertha Street
Hawkesbury ON Canada
K6A 2A8
Tel: 613 632-0287

hawkesbury@jlrichards.ca

Guelph

107-450 Speedvale Ave. West
Guelph ON Canada
N1H 7Y6
Tel: 519 763-0713

guelph@jlrichards.ca

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