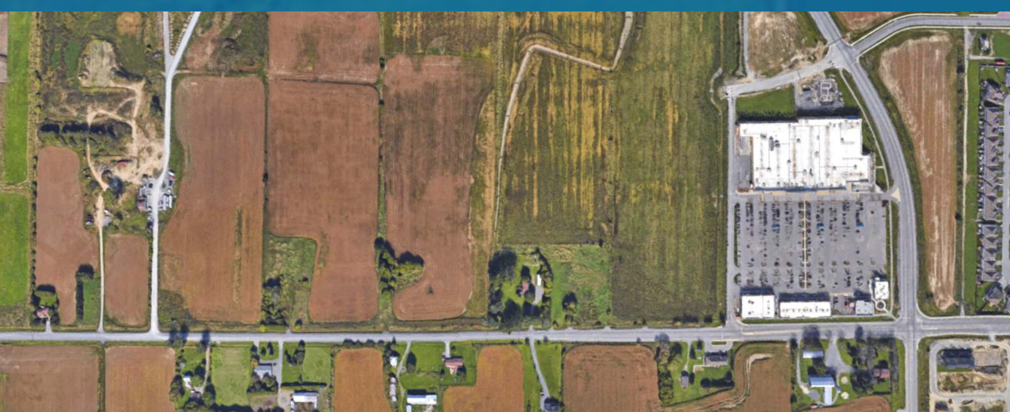
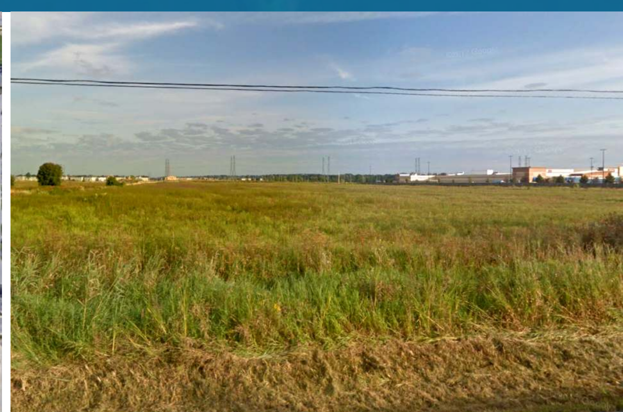
August 2019

Transportation Impact Assessment

Blackstone South Condo Development





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Blackstone South Condo Development

TIA Report

prepared for:
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August 27, 2019

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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 this 27 day of August, 2019.
(City)

Name: Matthew Mantle
(Please Print)

Professional Title: Transportation Engineer

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

Office Contact Information (Please Print)
Address: 1223 Michael Street
City / Postal Code: Ottawa K1J 7T2
Telephone / Extension: 613 – 691 - 1528
E-Mail Address: matthew.mantle@parsons.com

Stamp

TIA Report

1. SCREENING FORM

The screening form was prepared for the subject development and included as part of the subsequent report. The screening form confirmed the need for a Transportation Impact Assessment (TIA) based on the Trip Generation trigger (216 proposed units total).

The screening form and correspondences are provided in Appendix A.

2. DESCRIPTION OF PROPOSED DEVELOPMENT

2.1.1. PROPOSED DEVELOPMENT

This study has been prepared as part of the Blackstone South Development (Appendix B) located at the municipal address, 5505 Fernbank Road. The subject property will be constructed over two phases. is proposed to consist in total of 216 units composed of three-storey dwellings, 302 vehicle parking spaces (259 residential and 43 visitor parking spaces), an expected 109 bicycle parking and. However, due to the anticipated rapid build-out of the site, the analysis will be performed as a single-phase development and is expected to be fully built-out by 2020. The development will have three full-movement accesses to the surrounding road network, namely a single access connecting at the west of the site (to the future Rouncey Road Extension) and the other two accesses will connect to the north (off a proposed east-west local roadway running along the northern front of the proposed site). There is no proposed access to Fernbank Road. The subject property is currently zoned R4Z [2513] as per Zoning By-Law No. 2008-250, Part 6 - Section 161. Figure 1 shows the site location and the nearby road network. Figure 2 shows the proposed site plan.

Figure 1: Local Context

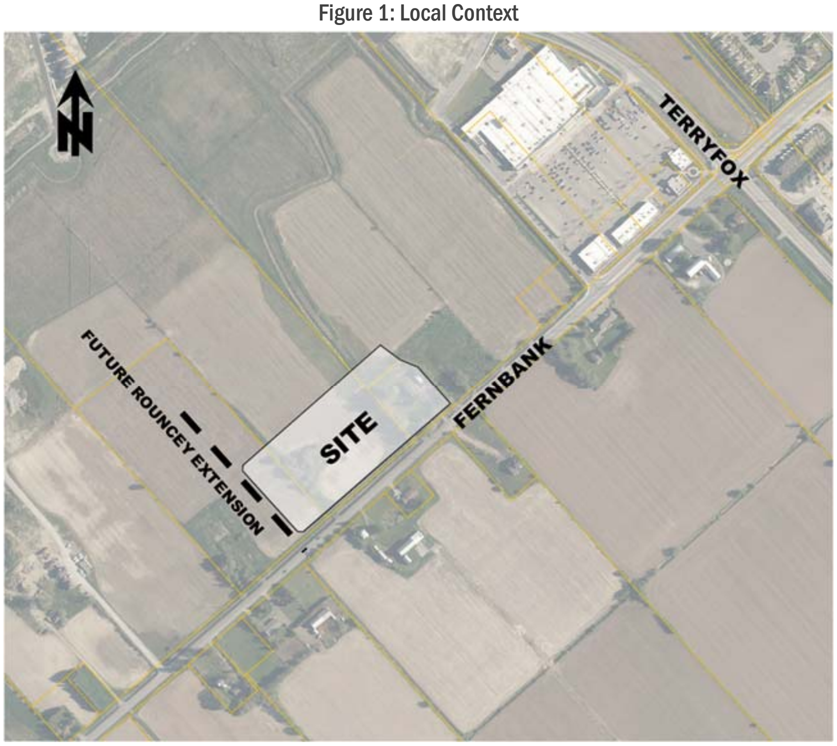
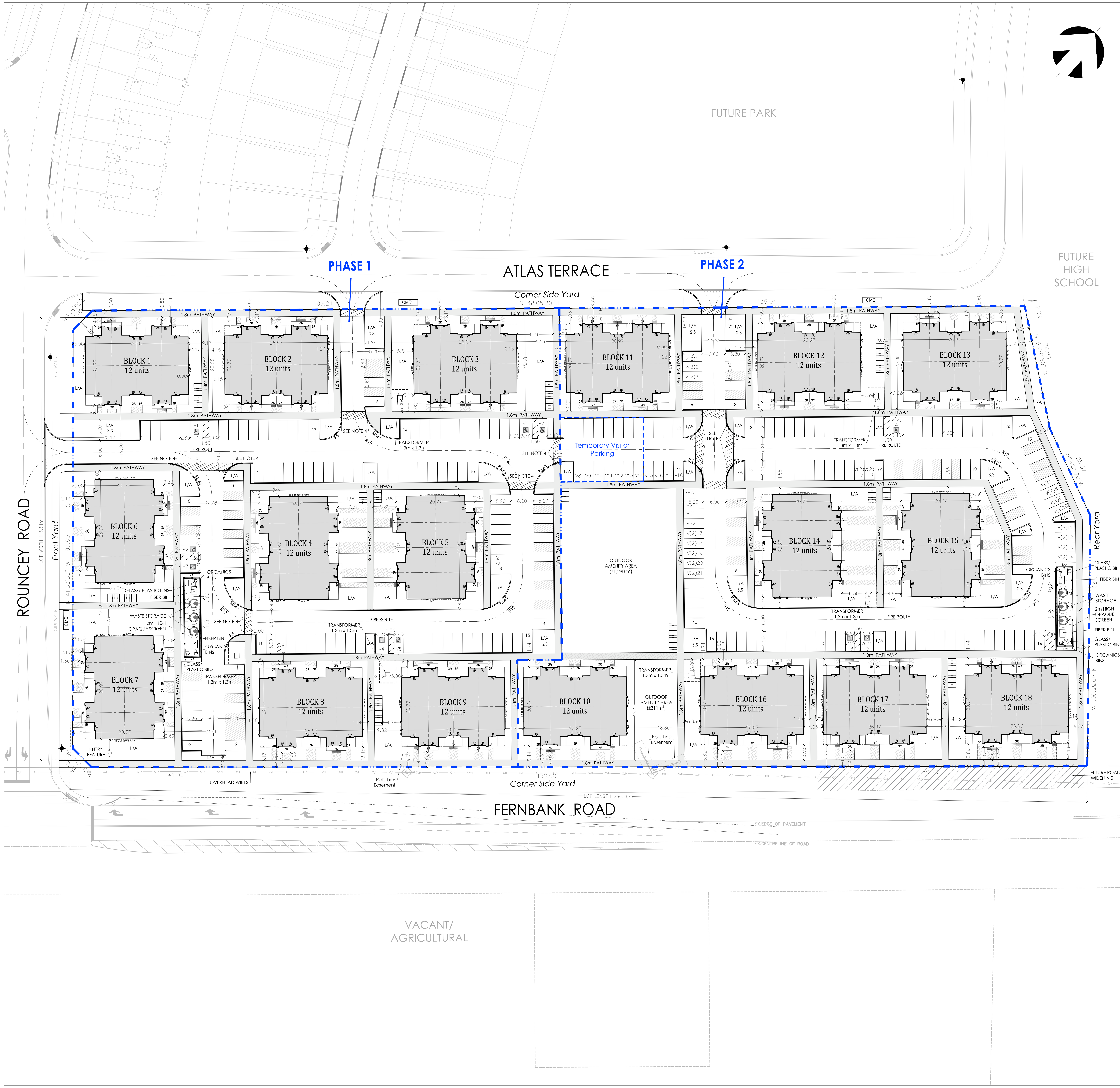


Figure 2: Site Plan



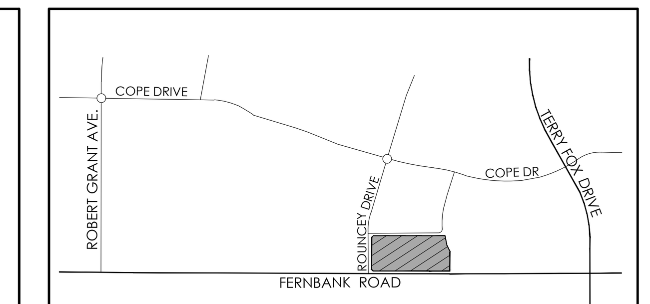
SITE STATISTICS AND DEVELOPMENT DATA

PHASE 1	
SITE AREA	14,970.72 m^2 (1.50 ha)
PAVED AREA	4,439.43 m^2 (30%)
LANDSCAPED AREA	5,381.31m^2 (36%)
TOTAL BUILDING COVERAGE	5,149.98 m^2 (34%)
TOTAL GROSS FLOOR AREA	12,617.64 m^2
TOTAL UNITS	108
DENSITY (UPH)	72 UPH
ZONE CATEGORY	R4Z (2513)
PARKING:	142
RESIDENT PARKING	135 (Note: 5 parking spaces for Block 10)
VISITOR PARKING	7 (Note: 15 spaces to be located in Phase 2)
PHASE 2	
SITE AREA	16,424.52 m^2 (1.64 ha)
PAVED AREA	4,433.15 m^2 (27%)
LANDSCAPED AREA	6,841.39 m^2 (42%)
TOTAL BUILDING COVERAGE	5,149.98 m^2 (31%)
TOTAL GROSS FLOOR AREA	12,617.64 m^2
TOTAL UNITS	108
DENSITY (UPH)	66 UPH
ZONE CATEGORY	R4Z (2513)
PARKING:	160
RESIDENT PARKING	124 (Note: 5 parking spaces to be located in Phase 1)
VISITOR PARKING	36 (Note: 15 spaces for Phase 1 visitor parking)
COMBINED TOTAL	
SITE AREA	31,395 m^2 (3.14 ha)
TOTAL UNITS	216
DENSITY (UPH)	69

SECTION	ZONE PROVISION - PLANNED UNIT DEVELOPMENT	REQUIRED	PROPOSED
162A (Table)	MIN. LOT AREA (m^2)	1,400m^2	31,395m^2
162A (Table)	MIN. LOT WIDTH (m)	18.0m	115.6m
162A (Table)	MAX. BUILDING HEIGHT (m)	15.0m	12.0m
162A (Table)	MIN. FRONT YARD SETBACK (m)	3.0m	3.0m
162A (Table)	MIN. CORNER SIDE YARD SETBACK (m)	3.0m	4.0m
2018-266	MIN. REAR YARD SETBACK (m)	4.0m	4.9m
101 (Table)	RESIDENT PARKING	259 (@1.2/unit)	259 (@1.2/unit)*
102 (Table)	VISITOR PARKING	43 (@0.2/unit)	43 (@0.2/unit)
111A (Table)	BICYCLE PARKING	108 (@0.5/unit)	109 (@0.5/unit)
131 (Table)(1)	MIN. WIDTH OF PRIVATE WAY (m)	6.0m	6m
131 (Table)(2)	MIN. SETBACK OF ANY WALL OF A RES. BUILDING TO PRIVATE WAY (m)	1.8m	2.4m
131 (Table)(4)	MIN. SEPARATION DISTANCE BETWEEN BUILDINGS WITHIN A PLANNED UNIT DEVELOPMENT (m)	1.2m	4.6m

*Section 106 (3a)- Up to 40% of the required parking spaces may be reduced in width for small cars only. Proposed 40 spaces for small car parking.

SECTION	ADDITIONAL PROVISIONS	REQUIRED	PROPOSED
65	PERMITTED PROJECTIONS INTO REQUIRED YARDS:		
65 (5)	FIRE ESCAPES, OPEN STAIRWAYS, STOOP (m)	>0.6m to lot line	1.6m
65 (6)	COVERED OR UNCOVERED BALCONY, PORCH, DECK	>1m to lot line	2.1m
		2.0m (Max)	1.4m
106 (1)(a)	MIN. PERPENDICULAR PARKING SPACE SIZE (m)	2.6m x 5.2m	2.6m x 5.2m
106 (2)	BARRIER FREE PARKING		
	TYPE A PARKING SPACE SIZE (m)	3.4m wide	3.4m wide
	TYPE B PARKING SPACE SIZE (m)	2.4m wide	2.4m wide
106 (3)(a)	REDUCED PARKING SPACE SIZE (m)	2.4m x 4.6m	2.4m x 5.2m
109 (3)(b)	MAX. WALKWAY WIDTH PERMITTED IN YARD (m)	1.8m	1.8m
110 (1)	MIN. % OF PARKING LOT LANDSCAPED	15%	>15%
110 (Table)	LANDSCAPE AREA SURROUNDING PARKING LOT:		
	ABUTTING A STREET (m)	3.0m	4.3m
	NOT ABUTTING A STREET (m)	3.0m	3.3m
110 (3)	REFUSE COLLECTION AREAS:		
110 (3)(b)	MIN. WASTE COLLECTION SETBACK TO LOT LINE (m)	3.0m	4.0m
110 (3)(c)	OPAQUE SCREEN MIN. HEIGHT (m)	2.0m	2.0m
137 (Table)	AMENITY AREA:		
	TOTAL MIN. AMENITY AREA (6m^2 per unit)	1,296m^2	±4,200m^2
	MIN. COMMUNAL AMENITY AREA	648m^2	±1,609m^2



KEY MAP N.T.S.

Subject Lands

SCALE 1:500 0 5 10 15 20 25 30

LEGEND

- STACKED DWELLING
- WALKWAY TO ENTRY
- PATHWAY
- CROSSWALK
- CURB (0.2m)
- DEPRESSED CURB
- PORCH
- PROJECTION (STAIRS)
- S.S SNOW STORAGE AREA
- L/A LANDSCAPED AREA
- BLOCK BOUNDARY
- PHASE LINE
- SMALL CAR PARKING STALLS
- NO PARKING
- BIKE RACKS
- FIRE HYDRANT
- ENTRANCE
- TRANSFORMER
- CANADA POST MAIL BOX
- V VISITOR PARKING PHASE 1
- V(2) VISITOR PARKING PHASE 2
- R RISERS

DATE [D.M.Y]	REVISION	BY
24/07/19	General revision	SP
19/07/19	General revision	SP
09/05/19	Issue for submission	SP

GENERAL NOTES

1. DO NOT SCALE DRAWINGS FOR PRINT.
2. THIS DRAWING IS THE EXCLUSIVE PROPERTY OF KORSIAK URBAN PLANNING AND MATTAMY HOMES. COPYRIGHT RESERVED.
3. WALKWAYS AND CURBS TO BE TIED INTO PUBLIC ROW WHERE APPLICABLE.
4. REFERENCES CITY OF OTTAWA T.W.S.I. DETAIL SC7.3
5. SURVEY BOUNDARY BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. 14 CONCOURSE GATE, SUITE 500. NEPEAN, ONTARIO. K2E 7S6. TEL: (613) 727-0850 FAX: (613) 727-1079

PROJECT TEAM

SITE PLAN DESIGN: KORSIAK Urban Planning
LANDSCAPE ARCHITECTURE: NAK design strategies
MECHANICAL/ ELECTRICAL: LRL
PLANNING: FOTENN Planning + Design
TRANSPORTATION: PARSONS
ARCHITECTURE: Q4A
NOISE: GRADIENTWIND
ENVIRONMENTAL: KILGOUR
CIVIL ENGINEER: Stantec
GEOTECHNICAL & STRUCTURAL: patersongroup

mattamyHOMES

50 Hines Road, Suite 100, Ottawa, ON Canada K2K 2M5

Blackstone South Condo Block

5441AND 5505 FERNBANK ROAD
BLOCK 366
PART OF LOTS 29 AND 30
CONCESSION 10
GEOGRAPHIC TOWNSHIP OF GOULBOURN
CITY OF OTTAWA
REGISTERED PLAN 4M-XXXX

TITLE: SITE PLAN

DATE: July 25, 2019	DRAWN BY: SP CHECKED BY: CR	DRAWING NO.
FILE NO.: PC2018-0249		
JOB NO.: Mattamy - Blackstone		

PC2018-0249

2.1.2. EXISTING CONDITIONS

AREA ROAD NETWORK

Fernbank Road is a City of Ottawa roadway that is an east-west arterial road currently running between Dwyer Hill Road from the west through to Eagleson Road in the east. Fernbank Road has a two-lane undivided rural cross section with gravel shoulders. The posted speed limit is 80km/h along the frontage of 5505 Fernbank Road, and it is assumed that this speed limit will be reduced to 60 km/h by the completion of the subject development.

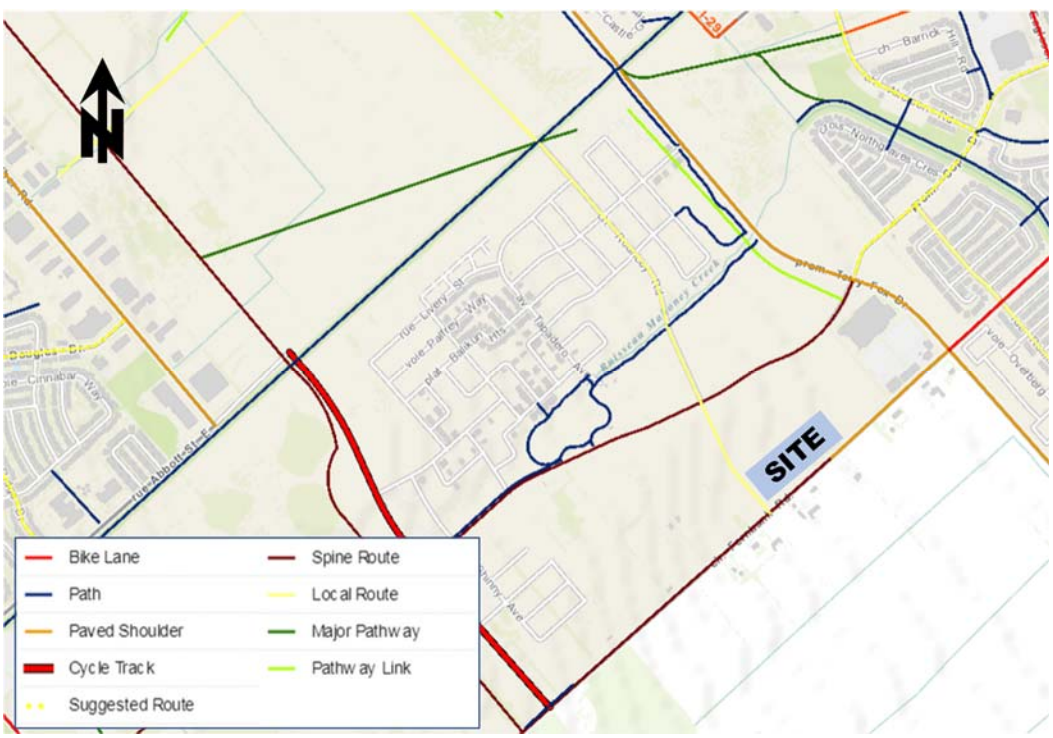
Rouncey Road is a future north-south two-lane collector road that is not currently continuous, however, will be extended as part of the proposed development. This road currently has a cul-de-sac at both its existing northern and southern most ends. The roadway is planned to connect just north of Abbott Street East extending south through the planned Cope Drive extension and terminating at Fernbank Road. The posted speed limit is assumed to be 50km/h along the future roadway. It is noted that a temporary connection labeled Rouncey Road on Google Maps exists. This connection is approximately 250m west of the future Rouncey Road connection. Ultimately, it is understood that the Road will be a City of Ottawa roadway.

PEDESTRIAN/CYCLING NETWORK

There are currently no pedestrian facilities provided along Fernbank Road west of Terry Fox Drive. There are currently no planned pedestrian facilities identified on the Ottawa Pedestrian Plan (2013) within the vicinity of the site.

The City of Ottawa's 2013 Cycling Plan identifies Fernbank Road as a 'Spine' Route and the future extension of Rouncey Road as a 'Local' Route. Currently, no separated cycle facilities along Fernbank Road. Figure 3 illustrates the surrounding cycling network.

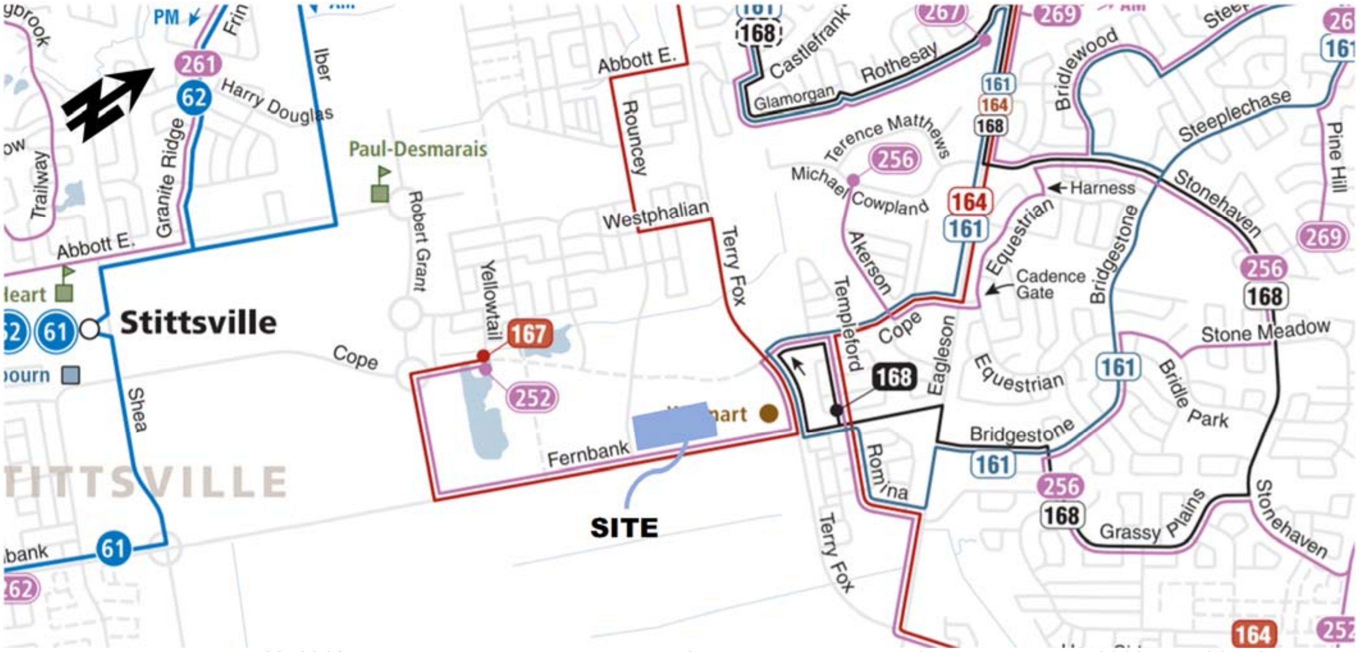
Figure 3: Cycling Network



TRANSIT NETWORK

OC Transpo service currently has services running along Fernbank Road; However, no stop locations are located within the study area. The existing routes servicing the area are #167 and #252. Figure 4 illustrates the current system map.

Figure 4: Area Transit Network

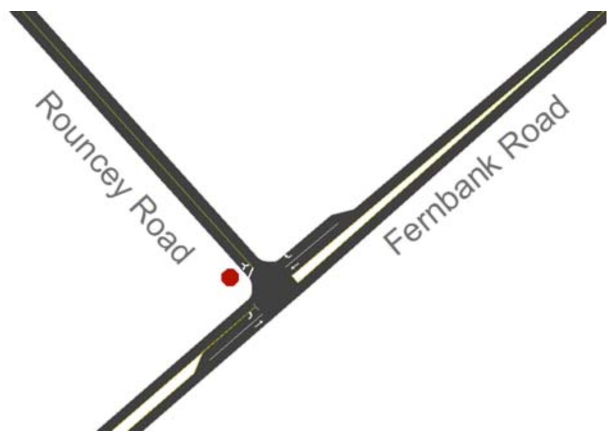


Retrieved on Aug. 13, 2018, http://www.octranspo.com/images/files/maps/system_map/System_Map_June_2018_REV_01.pdf

EXISTING STUDY AREA INTERSECTIONS

Fernbank/Rouncey (future intersection)

As determined in the 5505 Fernbank, Blackstone South TIA previously submitted to the City (Appendix B). The future Fernbank/Rouncey intersection will be an unsignalized 'T' intersection. The Rouncey Road north leg will consist of a single travel lane in either direction with stop control at the intersection. Fernbank Road east leg will consist of a right-turn lane and a through lane heading westbound and a single lane heading eastbound. The west leg of Fernbank Road will consist of an auxiliary left-turn lane and a through lane heading eastbound and a single lane heading westbound.



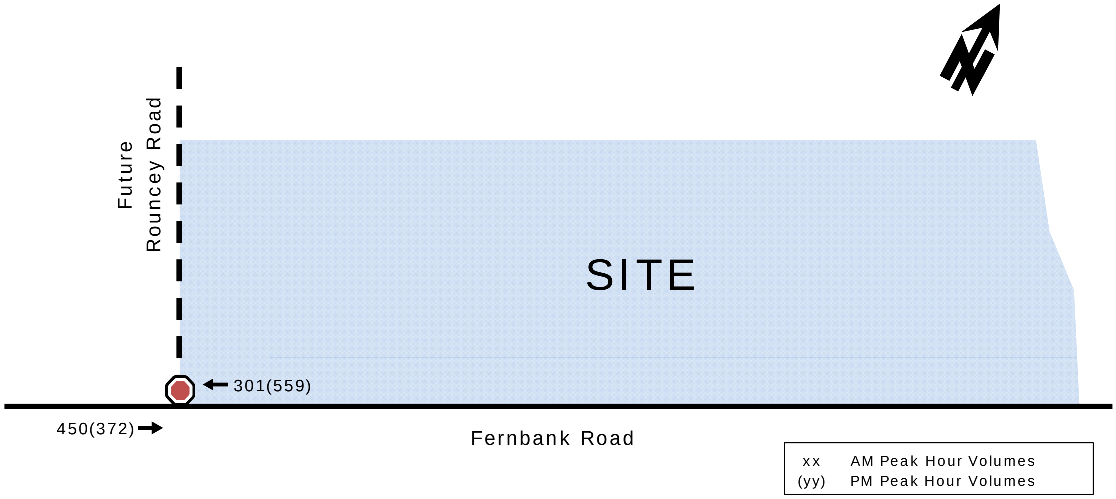
EXISTING DRIVEWAYS TO ADJACENT DEVELOPMENT

Fernbank Road is the only boundary roadway that currently exists near the site, although there are no proposed site connections to it. Rouncey Road to the west of the site is not yet constructed but is planned to include several residential driveways along the west side of the roadway. Atlas Terrace to the north of the site is not yet constructed but is planned to be a local road with no driveways proposed along the frontage of the proposed development.

EXISTING INTERSECTION VOLUMES

To establish the baseline of the projected roadway operations at the future Rouncey Road/Fernbank Road intersection an operational analysis of the existing traffic conditions at the adjacent intersection of Fernbank Road/Robert Grant Avenue has been undertaken. No recent counts were available from the City of Ottawa. Turning movement counts were undertaken on Tuesday February 21, 2017, the count is used to provide the existing two-way traffic volumes currently passing though the future Rouncey Road location and is shown in Figure 5. Appendix C contains the detailed traffic data sheets.

Figure 5: Existing Peak Hour Traffic Volumes



EXISTING AREA TRAFFIC MANAGEMENT MEASURES

Proposed roadways are not yet constructed and have no existing area traffic measures.

EXISTING ROAD SAFETY CONDITIONS

Collision data was requested from the City of Ottawa for mid-block Fernbank Road and no data was available prior to this study for the area at and near the future Rouncey Road at Fernbank Road intersection.

2.1.3. PLANNED CONDITIONS

PLANNED STUDY AREA TRANSPORTATION NETWORK CHANGES

Fernbank Road is identified as a transit priority corridor with isolated measures (City of Ottawa Transportation Master Plan (TMP) 2013, Ultimate Network) and widening has been proposed in the Network Concept Map 10 (TMP). In addition, three Park-and-Rides are identified along Robert Grant Avenue from Fernbank Road to Abbott Street E in the 2031 Affordable Network and Network Concept plans.

OTHER AREA DEVELOPMENTS

With respect to other area development, the following development applications have been submitted to the City of Ottawa in the vicinity of the proposed site:

5505 Fernbank Road

Mattamy Homes is proposing the construction of a residential subdivision comprised of 214 single-family detached homes and 239 townhomes, and 156 condo units located at the above address, directly west of the subject development. The Transportation Impact Assessment (TIS) (prepared by Parsons) projected approximately 264 veh/h and 327 veh/h during the morning and afternoon peak hours, respectively.

5505 Fernbank Road-Phases 4-8

Mattamy Homes and Cardel Homes is proposing construction residential subdivision composed of 2 schools, 423 detached single-family homes, 376 condominium/townhomes, and 156 condominiums. The Transportation Impact Study (TIS) was prepared by Parsons and has projected two-way traffic of 1,349 veh/h in the AM peak period and 876 veh/h during the PM peak period. Since this study (condominium block) was included as part of the 5505 Fernbank Road Phase 4-8 TIS, the trip generation from the previous TIS will be used in this study as background traffic on the future roadways (i.e. Future Rouncey Road and Future Cope Road.)

100 Gelderland Private, 115 Westphalian Avenue, 5431 Fernbank Road
A residential development comprised of 42 townhouse dwellings is being proposed at the above address, directly east of the subject development. A traffic study has not been prepared to date.

1180 Terry Fox Drive, 5343 Fernbank Road, 5357 Fernbank Road
A Jiffy Lube development consisting of three service bays (223 sq. m) is being proposed at the above address, 200m northeast of the subject development. A traffic study has not been prepared to date.

1039 Terry Fox Drive,
A subdivision comprised of 255 townhouses, 100,000 sq. ft of commercial and 600,000 sq. ft of employment/office is proposed at the above address, approximately 1,000m northeast of the subject development. The Community Transportation Study (prepared by Novatech) projected approximately 1,017 veh/h and 1,157 veh/h during the AM and PM peak hours, respectively.

5331 Fernbank Road
A development located on the northeast corner of Terry Fox Drive at Fernbank Road, comprised of eight commercial shopping buildings with total combined retail gross-floor-area of 89,700 sq. ft. and 371 vehicle parking spaces. The anticipated full buildout is fall 2020 with projected two-way generated vehicle trips of 169 veh/h, 299 veh/h, and 376 veh/h during the AM, PM, and Saturday peak hours, respectively.

5897 Fernbank Road
A development located on the northwest corner of the intersection of Fernbank Road at Shae Road, comprised of approximately four retail buildings with a total combined Ground Floor Area of 59,200 sq. ft. and 196 vehicle parking spaces. The anticipated full buildout is 2024 with projected two-way generated vehicle trips of 58 veh/h and 226 veh/h during the AM and PM peak hours, respectively.

5969 Fernbank Road
A development located on the northwest corner of Shea at Fernbank Road, comprised of 357 units, consisting of 238 townhomes and 119 single family homes, and the estimated date of occupancy is 2020. The projected two-way generated vehicle trips are 239 veh/h and 311 veh/h during the AM and PM peaks respectively.

5970 Fernbank Road
A development located southwest of the intersection of Shea Road and Fernbank Road with frontage on both Shea Road and Fernbank Road. The 32-hectare development consists of 730 of medium to low density residential housing. The anticipated full buildout is 2018 with projected two-way generated vehicle trips of 429 veh/h and 538 veh/h during the AM and PM peak hours, respectively.

6015, 6021, 6041 Fernbank Rd
A property that is currently going through a Zoning By-Law Amendment and Plan of Subdivision approval process. The subject lands are located on the north side of Fernbank Road between Robert Grant Avenue and Tim Sheehan Place. The lands are primarily vacant with one detached dwelling occupying the property at 5621 Fernbank Road. Lands to the north are occupied by detached dwellings that were part of Phase 3 of the Fernbank Crossing Subdivision. Lands to the east are occupied by townhouses under construction, while lands to the west of Robert Grant Avenue are currently vacant. Lands south of Fernbank Road are outside the urban boundary and are rural in nature.

5786 Fernbank
In 2011, the IBI Group submitted a Transportation Letter to the City of Ottawa for the development known as Claridge Homes – Fernbank Subdivision, taking place west of Robert Grant Ave. It is currently understood that the development has been put on hold since then.

Bridlewood Trails (480 Brigitta Street/866, 898 Eagleson Road and 1335, 1365 Terry Fox Drive)
Phase 3 of Bridlewood Trails; a residential subdivision with 409 units is proposed by Claridge Homes. The development will consist of 255 traditional townhouse units, 120 back-to-back townhouse units and 34 semi-detached units, which will be accessed via Romina Street and Overberg Way

20 Cope Drive
Farmhouse Investments Inc. retained the IBI Group to provide transportation engineering consulting services for a proposed expansion at of the site located at 20 Cope Dr. The purpose of the expansion is to ensure that the site is accessible to trucks at the access along Cope Dr and within the loading bay area. No new traffic volumes are anticipated to result from this expansion.

2.2. STUDY AREA AND TIME PERIODS

2.2.1. STUDY AREA

TRANSIT

It is anticipated that transit will be provided within the Blackstone South Community. See Section 2.1.2 - Transit Network, for existing bus routes.

NETWORK CONCEPT

Exempted. See Table 1.

INTERSECTION DESIGN

The study area is to include the future intersection of Fernbank Road at Rouncey Road, the Future boundary roads of Fernbank Road along the proposed developments western property line and the proposed local road running along the north property line.

2.2.2. TIME PERIODS

Given the land use, the weekday morning and afternoon peak hours are considered the critical time periods for operational analysis for this residential development.

2.2.3. HORIZON YEARS

For the purposes of the operational analysis it is assumed that the subject development will be completed by 2020. As such, the following horizons are recommended for analysis:

- Full Buildout – 2020
- Full Buildout + 5 Year Horizon – 2025

2.3. EXEMPTIONS REVIEW

Based on the foregoing analysis and review of the existing conditions in Step 2, the Scoping Report, it is recommended that the TIA exclude the following modules and elements summarized in Table 1.

Table 1: Exemptions Review Summary

Module	Element	Exemption Consideration
4.2 Parking	4.2.2 Spillover Parking-	The subject development is proposing to provide 259 parking spaces for residents, 43 visitor parking spaces and 109 bike parking spaces. The parking is expected to meet the City's residential parking requirements for the zone (259 resident parking spaces, 43 visitors and 109 bike parking spaces). As such, parking is not expected to spill out of the site.
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Development relies on local street for access. The peak hour traffic generated by the development will be approximately 135 vehicles or less, this works out to be an average of less than 2 cars a minute during the peak period. The total vehicle trips generated by this development are not expected to adversely affect with the overall operations of the local roadway; therefore, NTM measures are not anticipated to be required.
4.8 Network Concept	-	The proposed development is not expected to generate more than 200 person-trips during peak hour in excess of the equivalent volume permitted by established zoning

3. FORECASTING

3.1. DEVELOPMENT GENERATED TRAVEL DEMAND

3.1.1. TRIP GENERATION AND MODE SHARES

The Condominium Block development consists of 216 stacked dwellings. Appropriate trip generation rates for the Condominium Block were obtained from the 2009 TRANS Trip Generation Residential Trip Rates -Study report, which are summarized in Table 2.

Table 2: ITE Trip Generation Rates

Land Use	Data Source	Trip Rates	
		AM Peak	PM Peak
High-Rise Condominiums	TRANS	T = 0.46(du);	T = 0.46du);
Notes: T = Average Vehicle Trip Ends du = Dwelling unit			

The vehicle trip generation for the proposed development is summarized in Table 3.

Table 3: Condominium Block Vehicle Trip Generation

Land Use	Area	AM Peak (Vehicles/h)			PM Peak (Vehicles/h)		
		In	Out	Total	In	Out	Total
High-Rise Condominiums	216 units	27	72	99	57	42	99

The vehicle trips shown in Table 3 for the proposed site were converted to total person trips using the auto modal share values in Table 3.6 of the TRANS report. Total person-trip generation values were then reduced to non-auto modal shares using these same values. Table 4 summarizes modal shares for the proposed development.

Table 4: Mode Shares for the Condominium Block Development

Travel Mode	Mode Share	AM Peak (Person Trips/h)			Mode Share	PM Peak (Person Trips/h)		
		In (28%)	Out (72%)	Total		In (58%)	Out (42%)	Total
Auto Driver	44%	27	72	99	44%	57	42	99
Auto Passenger	9%	5	15	20	14%	19	13	32
Transit	34%	22	55	77	33%	43	31	74
Non-motorized	13%	9	20	29	9%	12	8	20
Total Person Trips	100%	63	162	225	100%	131	94	225
Total 'New' Auto Trips		27	72	99		57	42	99

As shown in Table 4, the resulting number of potential 'new' two-way vehicle trips for the proposed Condominium block development using the TRANS report, is approximately 99 veh/h during both the weekday morning and afternoon peak hours.

However, since this development is located within an area where the modal shares provided in the TRANS report may not be representative of what is anticipated, the 2011 OD Survey modal shares (see Table 5) have been applied to the total person trips from Table 4 above and summarized in Table 6 below.

The modes shares have been estimated using the 2011 OD Survey Data for the Kanata/Stittsville traffic zone. As this is on the edge of the rural zone, the mode share is not anticipated to change greatly until the development matures and additional transit services are provided. Thus, the existing mode shares have been carried forward as the Mode Share Targets for the purposes of this analysis. The 2011 OD Survey estimated Modal Shares are summarized in Table 5 below.

Table 5: 2011 OD-Survey Modal Share Targets for the Development

Travel Mode	Mode Share Target
Auto Driver	60%
Auto Passenger	15%
Transit	15%
Non-motorized	10%

Table 6: 2011 OD-Survey Modal Share Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
		In (28%)	Out (72%)	Total	In (58%)	Out (42%)	Total
Auto Driver	60%	38	97	135	72	56	135
Auto Passenger	15%	10	23	33	9	15	34
Transit	15%	10	24	34	20	14	34
Non-motorized	10%	7	16	23	14	9	23
Total Person Trips	100%	65	160	225	115	94	226
Total 'New' Auto Trips		38	97	135	72	56	135

As shown in Table 6, the resulting number of potential 'new' two-way vehicle trips for the proposed Condominium block development using the 2011 OD - Survey, is approximately 135 veh/h during both the weekday morning and afternoon peak hours. These generated traffic trips will be used in the analysis for the future horizons.

3.1.2. TRIP DISTRIBUTION

Based on the 2011 NCR Household Origin-Destination Survey and the location of adjacent arterial roadways and neighbourhoods, the distribution of site-generated traffic volumes was estimated as follows:

- 40% to/from the north;
- 10% to/from the south;
- 40% to/from the east; and
- 10% to/from the west.

3.1.3. TRIP ASSIGNMENT

The site is proposed to provide access through three driveways, these will include: Proposed full-movement driveway connection off Rouncey Road located approximately 115m north of Fernbank Road and two full-movement driveway connections to a future east-west local road, located along the northern frontage of the proposed Condominium Block. These driveways are located approximately 80 m and 175 m to the east of Rouncey Road.

Figure 6 illustrates the percent assignment of 'new' site-generated vehicle trips and Figure 7 illustrates 'new' site-generated vehicle trips.

Figure 6: Percent Site-Generated Traffic Assignment

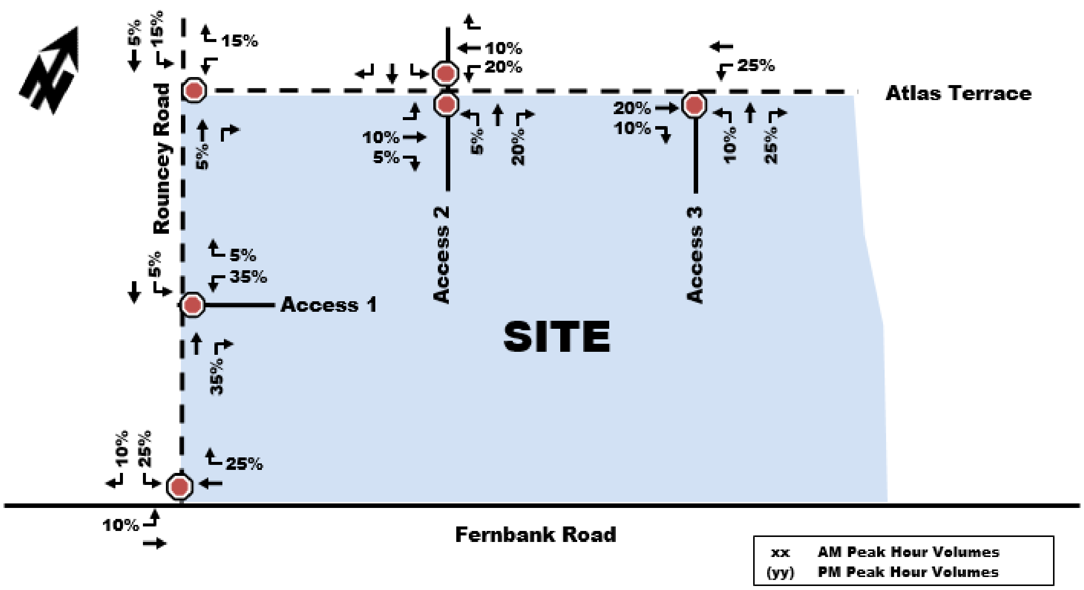
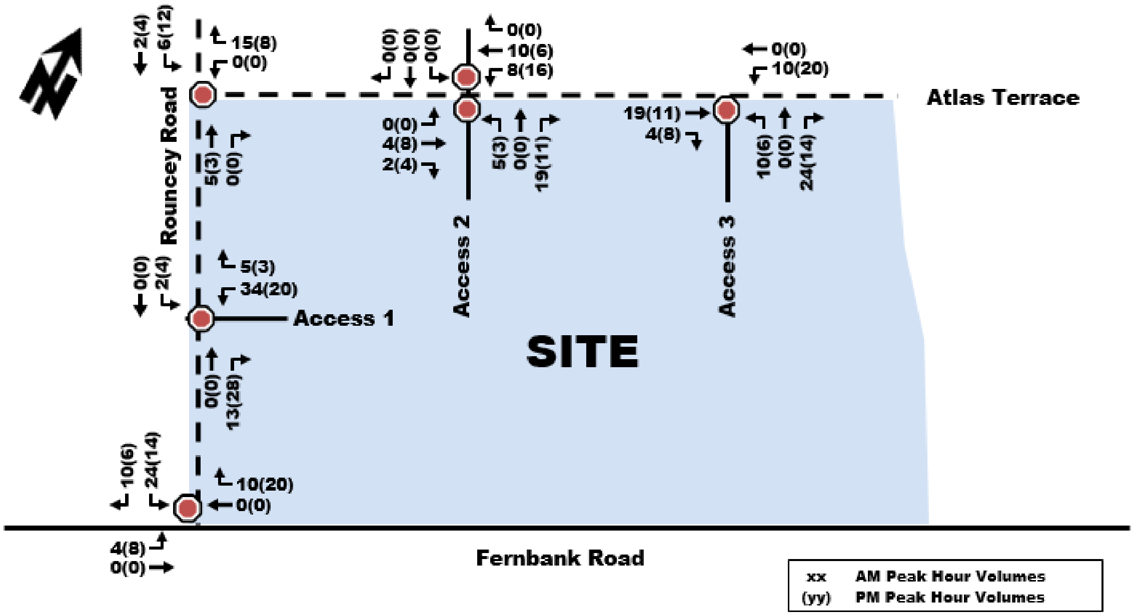


Figure 7: Condominium Block Site-Generated Traffic



3.2. BACKGROUND NETWORK TRAVEL DEMANDS

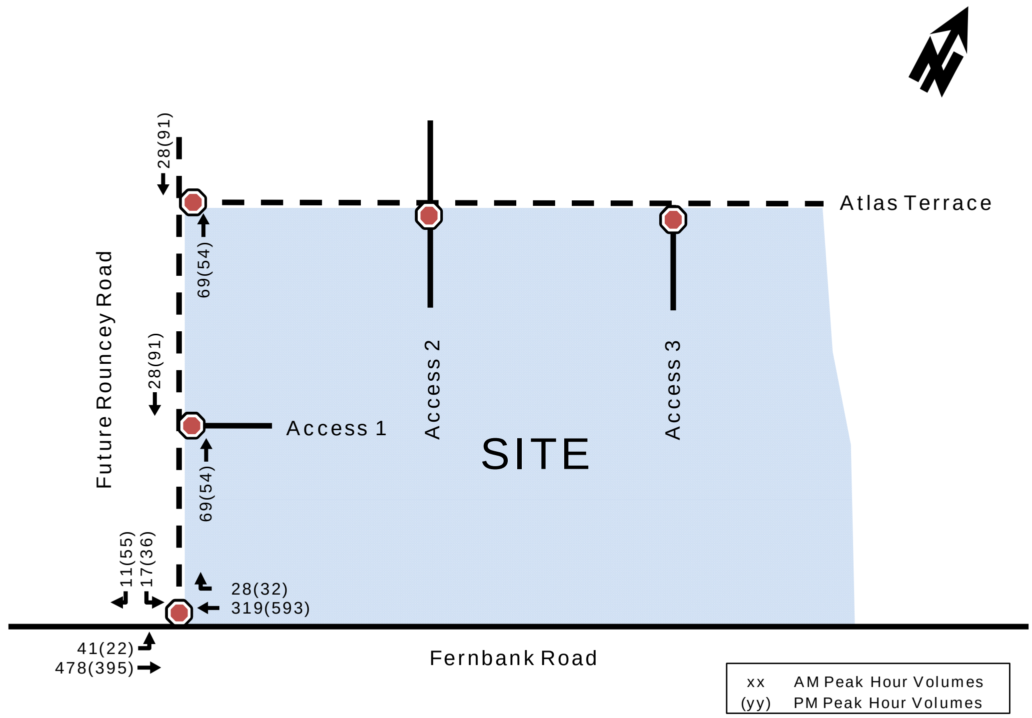
3.2.1. TRANSPORTATION NETWORK PLANS

Fernbank Road is identified as a transit priority corridor with isolated measures (City of Ottawa Transportation Master Plan (TMP) 2013, Ultimate Network) and widening has been proposed in the Network Concept Map 10 (TMP). In addition, three Park-and-Rides are identified along Robert Grant Avenue from Fernbank Road to Abbott Street E in the 2031 Affordable Network and Network Concept plans.

3.2.2. BACKGROUND GROWTH

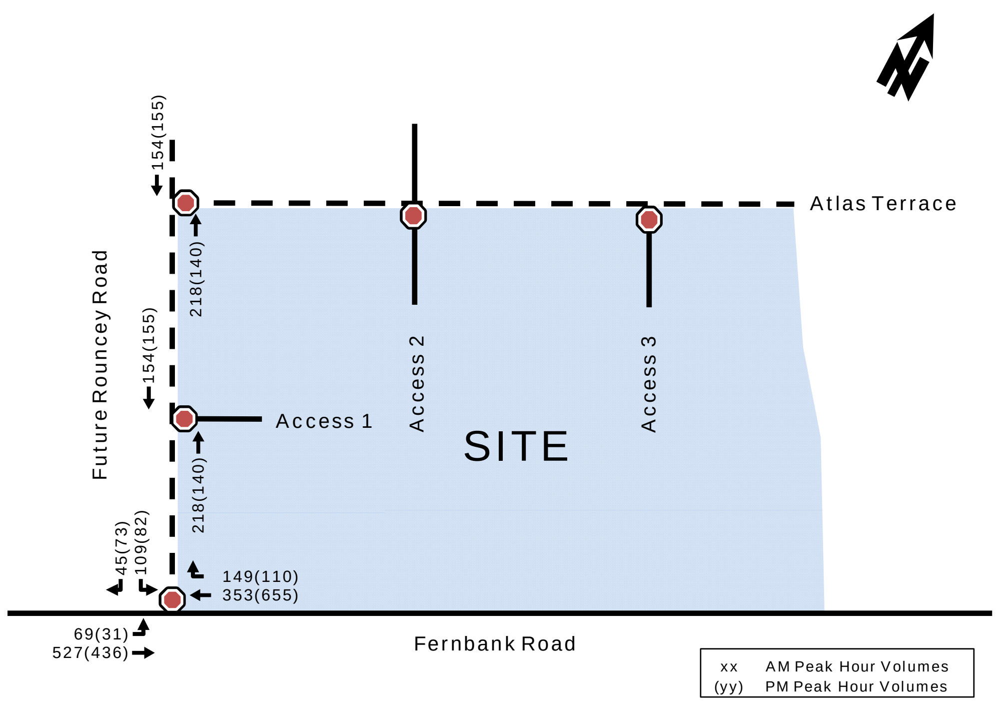
To account for background growth along Fernbank Road several background developments have been considered. All the developments considered are expected to reach full build-out prior to the 2025 horizon. To account for background growth beyond the study area, a 2% background growth rate per annum (compounded) has been applied to the existing Fernbank Road counts. Figure 8 and Figure 9 illustrates the future background traffic volumes with the applied growth for the 2020 and 2025 horizons.

Figure 8: Future Background 2020



As displayed in Figure 8 above, the future Rouncey Road projected trips have been introduced to account for the traffic generated by the Dawson development located to the northeast of the Blackstone Condo Block and have been applied to the roadway for the anticipated full build-out period 2020. See Appendix B.

Figure 9: Future Background 2025

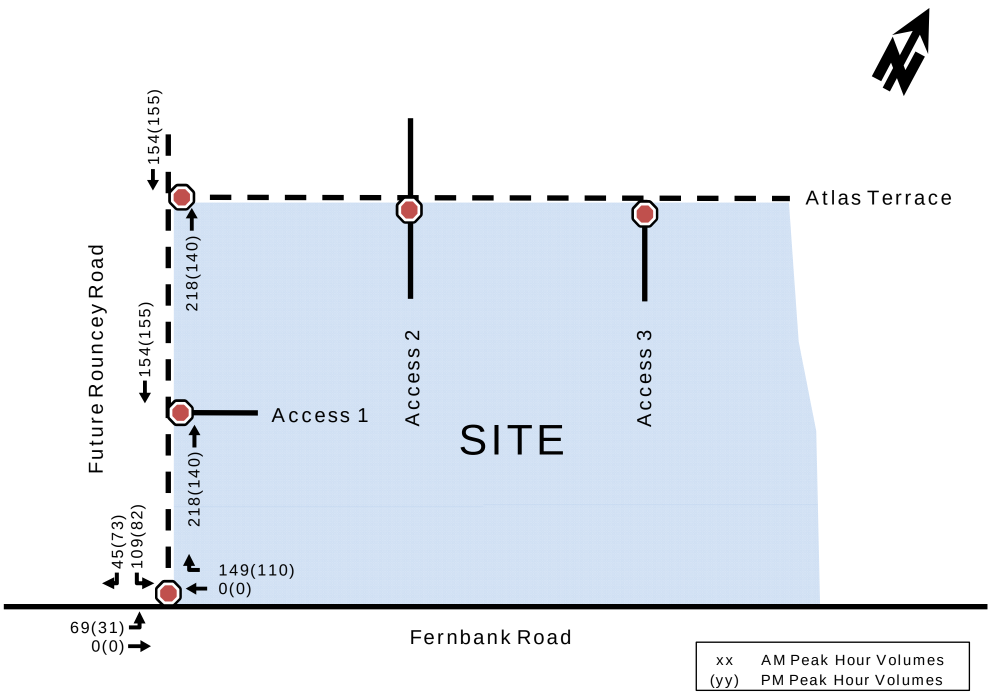


As displayed in Figure 9 above, the Fernbank Road future background traffic growth has been applied at 2% per annum and the future Rouncey Road projected trip rates have been taken from the surrounding developments as shown in Figure 10, for the anticipated 2025 horizon year. See Appendix B.

3.2.3. OTHER DEVELOPMENTS

Since the Blackstone development phases 4-8 (Appendix B) is anticipated to be built out by 2025, the traffic generated from this and the adjacent developments will be applied as traffic growth for Rouncey Road for the 2025 horizon. The total traffic volumes generated of these surrounding developments are illustrated in Figure 10 below.

Figure 10: 2025 Anticipated Other Area Traffic Volumes



3.3. DEMAND RATIONALIZATION

Based on the projected background traffic volumes at the proposed intersections no capacity issues are anticipated as these intersections will be designed to accommodate projected volumes. This issue will be further explored in a more detailed review of the total projected traffic volumes and network intersection design in the ensuing Strategy Report.

4. ANALYSIS

4.1. DEVELOPMENT DESIGN

4.1.1. DESIGN FOR SUSTAINABLE MODES

The total number of parking spaces provided for vehicles by the Blackstone South Condo Development is 304 surface parking spaces, which meets the minimum By-Law requirement for residential and visitor vehicular parking. The parking spaces are all stationed along the circumference of the condo blocks.

Bicycle parking is provided throughout the development area in 11 blocks of 5 to 10 spaces each. As such, the total number of bicycle spaces available is 109. This meets the required By-Law minimum of 0.5 bicycle spaces per unit (108 spaces per 216 units).

Sidewalks are provided on both sides of the future Rouncey Road and are connected to Fernbank Road. Sidewalks are also provided on the north side only of Atlas Terrace. Within the condominium development, 1.8 m pathways are provided to give pedestrians access to the condominiums and the courtyard in the centre of the site.

With regards to transit, OC Transpo Bus Routes #167 and #252 currently provide services in the vicinity of the site, by travelling on Terry Fox Dr, Fernbank Rd (no stops currently available) and Robert Grant Ave. Bus Route #167 (Terry Fox<>Blackstone) is a "Local" route that operates on weekdays only at a rate of every-30-minutes in the morning peak period (Terry Fox destined), every-30-minutes in the afternoon peak period (Blackstone destined) and once per hour during other time periods of either destination. Bus Route #252 (Mackenzie King<>Fernbank) is a "Connexion" route that operates during weekday rush hours only at a rate of every-10-to-15-minutes during the morning peak period (Mackenzie King destinations available only) and every-15-to-20-minutes during the afternoon peak period (Fernbank destinations available only).

4.1.2. CIRCULATION AND ACCESS

The proposed development includes two 6.7m two-way driveway connections to the Future Road and one 6.7m two-way driveway connection to Rouncey Road. All driveways lead to 6.7m aisles that connect to surface parking spaces. Turning templates performed by others are depicted in the Site Plan. No issues are anticipated regarding access of municipal services vehicles and garbage collection trucks.

4.1.3. NEW STREET NETWORKS

This development is proposed to be constructed along several planned roadways as it is part of the Blackstone South development. The future boundary roads will be Rouncey Road and Atlas Terrace.

Rouncey Road is proposed to be a north-south collector roadway which will connect to Fernbank Road at the southwest corner of the proposed site. The roadway is proposed to be approximately 10.5 m wide with one travel lane in each direction and on-street parking. Note that on-street parking will not be provided along the frontage of the proposed development.

Atlas Terrace is proposed to be a local road that runs east-west along the northern boundary of the proposed property approximately 7.5 m wide with one travel lane in each direction.

4.2. PARKING

4.2.1. PARKING SUPPLY

Refer to section 10.1.1 for a description of the parking supply available to accommodate autos and bicycles.

4.3. BOUNDARY STREET DESIGN

The boundary street segments for the development are Fernbank Road, the future Rouncey Road and the future Atlas Terrace.

Fernbank Road's future geometry along the frontage of the site's property consists of the following features:

- No existing or planned sidewalks;
- 1 vehicle travel lane in each direction;
- More than 3,000 vehicles per day on the roadway;
- Assumed future operating speed greater than 60 km/h;
- No dedicated transit or cycling facilities;
- 3.7 m wide lanes; and
- No on-street parking.

Rouncey Road's future geometry along the frontage of the site's property consists of the following features:

- 2.0 m wide sidewalks on both sides of the roadway;
- Approximately 2.0 m Boulevard widths on both sides of the roadway;
- 1 vehicle travel lanes in each direction;
- More than 3,000 vehicles per day on the roadway;
- Assumed operating speed of 30 to 50 km/h;
- Planned "Local Route" cycling facility;
- No dedicated transit facilities;
- 3.7 m wide lanes; and
- No on-street parking along the frontage of the site.

Atlas Terrace's future geometry along the frontage of the site's property consists of the following features:

- 1.8 m wide sidewalks on the north side of the roadway and no sidewalk on the south side;
- Approximately 0.5 m wide boulevard on the north side of the roadway and no boulevard on the south side;
- 1 vehicle travel lanes in each direction;
- Less than 3,000 vehicles per day on the roadway;
- Assumed operating speed of 30 to 50 km/h;
- No planned cycling facility;
- No dedicated transit facilities;
- 3.7 m wide lanes; and
- No on-street parking.

Table 11 below provides the results of Multi-Modal Level of Service (MMLOS) analysis for road segments of boundary roads surrounding the site, as well as the target (or minimum desirable) levels of service as set by the City of Ottawa's Official Plan. The site location, as well as the surrounding boundary roads, fall under a "General Urban Area" designation. Furthermore, the road classifications for Fernbank Road, Rouncey Road and Atlas Terrace are Arterial, Collector and unclassified, respectively, within the City of Ottawa's Official Plan.

Table 7: MMLOS – Projected 2025 Road Segments

Road Segment	Level of Service							
	Pedestrian (PLoS)		Bicycle (BLoS)		Transit (TLoS)		Truck (TkLoS)	
	PLoS	Target	BLoS	Target	TLoS	Target	TkLoS	Target
Rouncey Road	B	C	B	B	D	No Target	B	Not a truck route/no target
Fernbank Road	F	C	D	C	D	No Target	B	E
Atlas Terrace	B	C	B	D	D	No Target	B	Not a truck route/no target

Letters that are highlighted in red indicate a failure to meet the minimum desirable level of service. All results in the table meet the target level of service, with the exception of Fernbank Road's pedestrian level of service (PLoS) and bicycle level of service. These are not met due to the lack of pedestrian and cycling facilities along Fernbank Road.

With regards to transit, there are no transit priority plans at any of the boundary streets and as such, there are no TLoS targets. Rouncey Road and Atlas Terrace both do not form part of Ottawa's truck route, and as such, have no truck level of service (TkLoS) target.

The MMLOS analysis sheet is provided in Appendix D

4.4. ACCESS INTERSECTION DESIGN

4.4.1. LOCATION AND DESIGN OF ACCESS

There is a total of three private roadway connections that are proposed to provide access to the development. Two of the connections are planned to be constructed along the north side of the development off of future Atlas Terrace. The final connection is proposed to connect to Rouncey Road approximately 85m north of Fernbank Road.

Atlas Terrace will function as a local road, while Rouncey Road will function as a collector roadway. Accesses #1 and #3 form 3-legged T-intersections as they intersect Rouncey Road and Atlas Terrace, respectively. Access #2 forms a four-legged intersection with the north leg leading to a future roadway with surrounding future residential developments (and their private driveways). Also, Atlas Terrace intersects Rouncey Road to form a 3-legged T-intersection.

Furthermore, there are no signalized intersections on the frontages of the proposed development, with the nearest signalized intersection being the Smart Centres (Walmart) access on Fernbank Road, approximately 500 m east of the future Rouncey Road.

4.4.2. INTERSECTION CONTROL AND DESIGN

Based on the projected volumes, the three site accesses, Atlas Terrace/Future Rouncey Road intersection and Fernbank Road/Future Rouncey Road intersection require STOP controls only. The STOP control signs would be implemented for minor street approaches at all intersections, while major street approaches can remain free-flow.

There are no existing or future planned signalized intersection on the frontages of the proposed development, as such no MMLoS analysis can be provided for the surrounding intersections, since MMLoS intersection analysis is for signalized intersections only.

4.5. TRANSPORTATION DEMAND MANAGEMENT

Refer to Appendix E for the TDM Checklist. Some of the TDM measures that the proponent is providing/considering are as follows:

- Sidewalks provided om the both sides of Rouncey Road and on the north side of Atlas Terrace;
- 1.8m pathways within the development providing access to sidewalks;
- Marked cross-walks provided at designated areas on-site crossing internal laneways; and,
- On-site bicycle parking provided according to the City's By-Law requirements.

4.6. NEIGHBOURHOOD TRAFFIC MANAGEMENT

Exempt as per Section 2.3.

Development relies on local street for access. The peak hour traffic generated by the development will be approximately 135 vehicles, this works out to be an average of less than 2 cars a minute during the peak periods. The total vehicle trips generated by this development are not expected to adversely affect with the overall operations of the local roadway; therefore, NTM measures are not anticipated to be required.

4.7. TRANSIT

As shown in Table 6 of section 3.1.1, the proposed condominium development is projected to generate approximately 34 two-way transit riders during peak hours. OC Transpo has indicated that transit service will be provided on Cope Drive and Rouncey Road. Bus stop locations have been identified and included in the CUP for the Blackstone South subdivision project. The Blackstone South Condo development has been considered in this transit planning effort.

4.8. REVIEW OF NETWORK CONCEPT

Exempt as per Section 2.3.

The proposed development is not expected to generate more than 200 person-trips during peak hour in excess of the equivalent volume permitted by established zoning.

4.9. INTERSECTION DESIGN

4.9.1. EXISTING CONDITIONS

Existing conditions analysis were not carried out in Synchro because the study area in its entirety consists of future roads (Rouncey Road, Atlas Terrace and the three site accesses) that are not existent today.

4.9.2. FUTURE BACKGROUND 2020 CONDITIONS

Using the Future Background 2020 traffic volumes illustrated in Figure 8 above, and Table 8 below provides the analysis results for the intersection of Fernbank/Rouncey. The SYNCHRO model output for Future Background 2020 conditions is provided in Appendix F.

Table 8: Future Background 2020 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Rouncey Road (U)	C(D)	20.0(25.7)	SBL(SBL)	0.8(1.6)	-	-
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane. (S) Signalized Intersection. (U) Unsignalized Intersection.						

The southbound left-turn movement at the intersection of Fernbank/Rouncey is projected to operate at a LoS 'D' or better during morning and afternoon peak hour periods.

4.9.3. FUTURE BACKGROUND 2025 CONDITIONS

Using the Future Background 2025 traffic volumes illustrated in Figure 9 above and, Table 9 below provides the analysis results for the intersection of Fernbank/Rouncey. The SYNCHRO model output for Future Background 2025 conditions is provided in Appendix G.

Table 9: Future Background 2025 Performance at Study Area Intersections

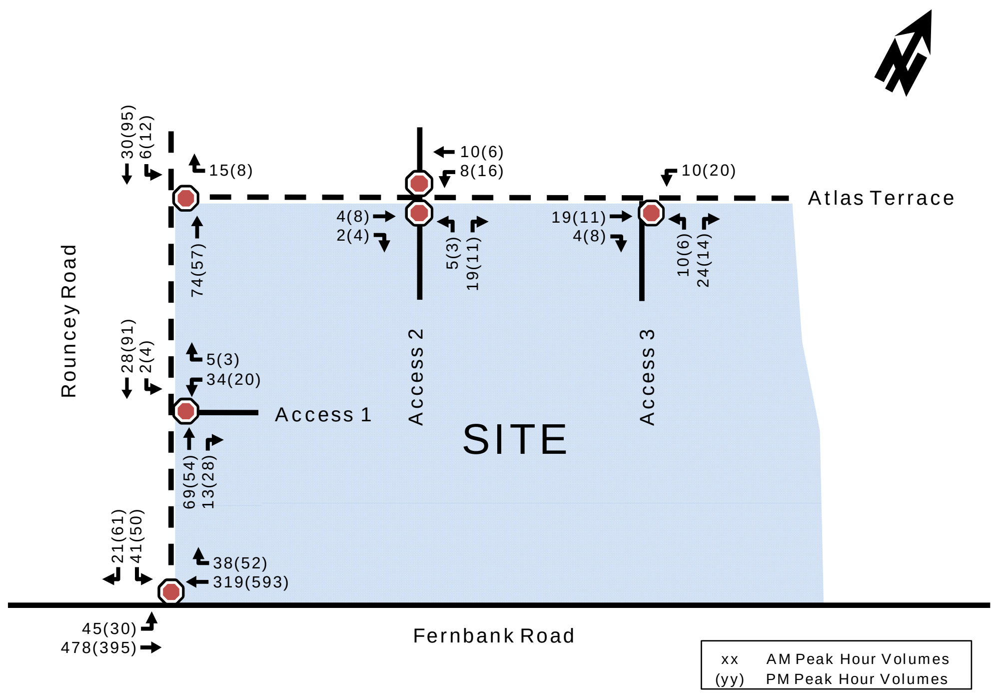
Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Rouncey Road (U)	E(E)	36.0(37.9)	SBL(SBL)	4.0(3.2)	-	-
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane. (S) Signalized Intersection. (U) Unsignalized Intersection.						

The southbound left-turn movement at the intersection of Fernbank/Rouncey is projected to operate at an acceptable LoS 'E' or better during morning and afternoon peak hour periods.

4.9.4. TOTAL PROJECTED 2020 CONDITIONS – FULL BUILD-OUT

The total projected 2020 traffic volumes were derived by superimposing the site-generated traffic volumes (Figure 7) onto projected 2020 background traffic volumes (Figure 8). The resulting total projected traffic volumes are illustrated in Figure 11.

Figure 11: Total Projected 2020 Traffic Volumes



The following Table 10 provides a summary of the total projected operations at the study area intersection based on the SYNCHRO (V10) traffic analysis software. The SYNCHRO model output of total projected conditions is provided within Appendix H.

Table 10: Total Projected 2020 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Rouncey Road (U)	C(D)	20.0(25.7)	SBL(SBL)	1.5(2.0)	-	-
Rouncey Road/Access #1 (U)	A(A)	9.2(9.5)	WB(WB)	2.5(1.2)	-	-
Rouncey Road/Atlas Terrace (U)	A(A)	8.7(8.6)	WB(WB)	1.4(0.9)	-	-
Atlas Terrace/Access #2 (U)	A(A)	8.5(8.5)	NB(NB)	5.4(4.9)	-	-
Atlas Terrace/Access #3 (U)	A(A)	8.6(8.6)	NB(NB)	5.5(5.4)	-	-

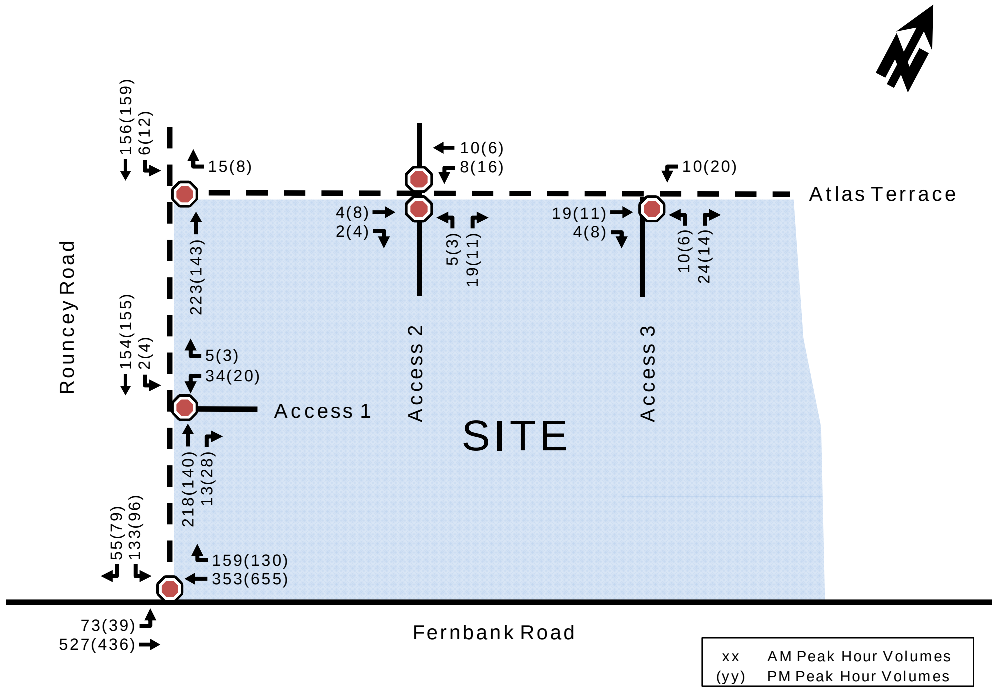
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.
(S) Signalized Intersection.
(U) Unsignalized Intersection.

Similar to Future Background 2020 conditions, the critical movement at the unsignalized intersection of Fernbank/Rouncey is projected to operate at a LoS 'D', or better, for the morning and afternoon peak hour periods of Total Projected 2020 conditions. All other unsignalized intersections within the study area operate at a LoS 'A' in both morning and afternoon peak hour periods.

4.9.5. TOTAL PROJECTED 2025 CONDITIONS – SITE BUILD-OUT + 5 YEARS

The total projected 2025 traffic volumes were derived by superimposing the site-generated traffic volumes (Figure 7) onto projected 2025 background traffic volumes (Figure 9). The resulting total projected 2025 traffic volumes are illustrated in Figure 12.

Figure 12: Total Projected 2025 Traffic Volumes



The following Table 11 provides a summary of the total projected operations at the study area intersection based on the SYNCHRO (V10) traffic analysis software. The SYNCHRO model outputs of total projected 2025 conditions is provided within Appendix I.

Table 11: Total Projected 2025 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Rouncey Road (U)	E(E)	45.0(45.3)	SBL(SBL)	5.6(4.1)	-	-
Rouncey Road/Access #1 (U)	B(B)	11.2(10.5)	WB(WB)	1.1(0.8)	-	-
Rouncey Road/Atlas Terrace (U)	A(A)	9.6(9.1)	WB(WB)	0.5(0.5)	-	-
Atlas Terrace/Access #2 (U)	A(A)	8.5(8.5)	NB(NB)	5.4(4.9)	-	-
Atlas Terrace/Access #3 (U)	A(A)	8.5(8.6)	NB(NB)	5.4(5.4)	-	-

Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.
(S) Signalized Intersection.
(U) Unsignalized Intersection.

During the Future Background 2025 conditions, the southbound movement at the unsignalized intersection of Fernbank/Rouncey is projected to operate at an acceptable LoS 'E' for both morning and afternoon peak hour periods. The remaining unsignalized intersections within the study area are projected to operate at a LoS 'B' or better during the morning and afternoon peak hour periods.

5. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Based on the results summarized herein the following transportation related conclusions are offered:

- The proposed development is located within an undeveloped field and is included as part of the Blackstone South Development subdivision;
- Based on local area developments and the historic traffic data, a 2% per annum growth rate was applied to the study area roadways and intersections;
- Since this is and the surrounding properties are all undeveloped few pedestrian facilities currently exist; However, the proposed development will include sidewalks both within the Site and connect to the surrounding developments;
- The future study area intersections are projected to operate with a LoS 'D' or better in the future 2020 horizon year;
- The future study area intersections are projected to operate with an LoS 'B' or better with exception of Fernbank/Renaud intersection, which is anticipated to operate with a LoS 'E' in the future 2025 horizon year for both morning and afternoon peak hour periods;
- The MMLoS analysis along the boundary roads of Fernbank Road, Atlas Terrace and Rouncey Road are expected to meet the MMLoS targets for each roadway with exception of the pedestrian LoS 'F' along Fernbank Road. This is due to the lack of pedestrian facilities provided given the rural condition along Fernbank Road.
- The net increase in vehicle demand generated by the proposed development is approximately 135 veh/h during the morning and afternoon peak hours; and,
- Parking facilities for vehicles and bicycles are expected to meet the City's By-Law requirements.

Based on the foregoing, the proposed development fits well into the context of the surrounding area, and its location and design services to promote use of walking, cycling, and transit modes, thus supporting City of Ottawa policies, goals and objectives with respect to redevelopment, intensification and modal share. As such, the proposed condominium development of 5505 Fernbank Road, Blackstone Condo Development is recommended from a transportation perspective.

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Appendix A

SCREENING FORM AND CITY RESPONSE

1. INTRODUCTION

The following transportation-related comments were received by the City of Ottawa (April 29, 2019) in response to the Step 3 Blackstone Condo Development submission dated April 15, 2019. Responses to these city comments are provided herein.

2. CITY COMMENTS

2.1. TRANSPORTATION ENGINEERING COMMENTS

Comment 1: The calculated vehicle trips and person-trips from Tables 3 and 4 are still not accurate. Please use the vehicle trip rate from Table 6.3 of the Trans Trip Generation Study.
Response 1: Vehicle trip generation has been updated.

Comment 2: As per our previous comment, the modal shares should be based on the most recent TRANS O-D Survey for the applicable district (Kanata-Stittsville), not on the Trip Generation manual. Remove the reference of Table 3.6 of the Trans Trip Generation Study.
Response 2: This has been done. please see section 3.1.1, tables 5 and 6.

Comment 3: Please include the following developments:
- 5786 Fernbank
- Bridlewood Trails (480 Brigitta Street)
- 20 Cope Drive

Response 3: Report updated to include.

1. INTRODUCTION

The following transportation-related comments were received by the City of Ottawa (July 4, 2019) in response to the Step 4 Blackstone Condo Development submission dated May 3, 2019. Responses to these city comments are provided herein.

2. CITY COMMENTS

2.1. TRANSPORTATION ENGINEERING COMMENTS

Comment 1: Bicycle Level Of Service (BLOS) for future Rouncey Road should be evaluated in order to implement the appropriate type of bicycle facility. Rouncey Road is a major collector road and cycle tracks along Rouncey Road should be considered.

Response 1: Sidewalks are already built on both streets. Please note some of the transportation comments are subdivision-related, not SPC-related. Additionally, the BLoS for the future Rouncey Road has been completed and is outlined in Table 10. Rouncey Road is classified as a collector in a General Urban Area and the target BLoS 'B' is already met with the current design.

Comment 2: Include implementation details, where applicable, in the TDM-supportive Development Design and Infrastructure Checklist.

Response 2: Noted. Report updated.

Comment 3: Describe which of the bike parking locations will be sheltered.

Response 3: No sheltered bike parking will be provided. Report updated.

Comment 4: Sections 4.1.3 and 4.3 have conflicting accounts of the presence of on-street parking along Rouncey Road. Please clarify.

Response 4: Sections 4.1.3 and 4.3 updated. There will be on-street parking provided along Rouncey Road however it won't be provided along the site's frontage.

Comment 5: Re-calculate the Pedestrian Level Of Service (PLOS) on Rouncey Road and the Bicycle Level Of Service (BLOS) on Fernbank Road. There are no proposed sidewalks or bike lanes on Fernbank Road.

Response 5: As there is no on-street parking provided along the site's frontage on Rouncey Road, the PLoS remains the same. The BLoS for Fernbank Road has been updated within Table 7.

Comment 6: While the fire route is depicted, no turning movements are shown on the site plan.

Response 6: See attached plan displaying Fire Truck (HSU) movements throughout site.

Comment 7: Finalize the incomplete sentence in section 4.4.1.

Response 7: The sentence has been finalized.

Comment 8: Section 4.6 and 2.3 describe differing amounts of local traffic along the same road.

Response 8: *Section 2.3 updated to describe correct amount of anticipated traffic on the subject roadway.*

Comment 9: The site plan shows 108 total units instead of 216.

Response 9: *The site plan has been updated to reflect the statistics of both phases of development which consist of 108 units each (totaling 216 units).*

Comment 10: Include a copy of all warrant analyses in the appendices.

Response 10: *No warrants completed for this TIA, as this Site and surrounding roadways were included as part of the Blackstone South Development (Plan of Subdivision).*

2.2. TRAFFIC SIGNAL OPERATIONS

Comment 1: No comments.

Response 1: *Noted.*

2.3. TRAFFIC SIGNAL DESIGN

Comment 1: No comments.

Response 1: *Noted.*

2.4. TRANSIT SERVICES

Comment 1: It is anticipated that transit service will be provided on Cope Drive and Rouncey Road. Bus stop locations have been identified and included in the CUP for the Blackstone South subdivision project. The Blackstone South Condo development has been considered in this transit planning effort. Include this information in the TIA report. No other comments on behalf of OC Transpo.

Response 1: *The following comment has been included in Section 4.7 Transit:*
OC Transpo has indicated that transit service will be provided on Cope Drive and Rouncey Road. Bus stop locations have been identified and included in the CUP for the Blackstone South subdivision project. The Blackstone South Condo development has been considered in this transit planning effort.

Appendix B

BLACKSTONE SOUTH PHASES 4-8 TIS

May 2017

5505 Fernbank Road
Blackstone Phases 4-8

Transportation Impact Study

PARSONS

5505 Fernbank Road
Blackstone
Phases 4 – 8

Transportation Impact Study

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May 18, 2017

476217-01000

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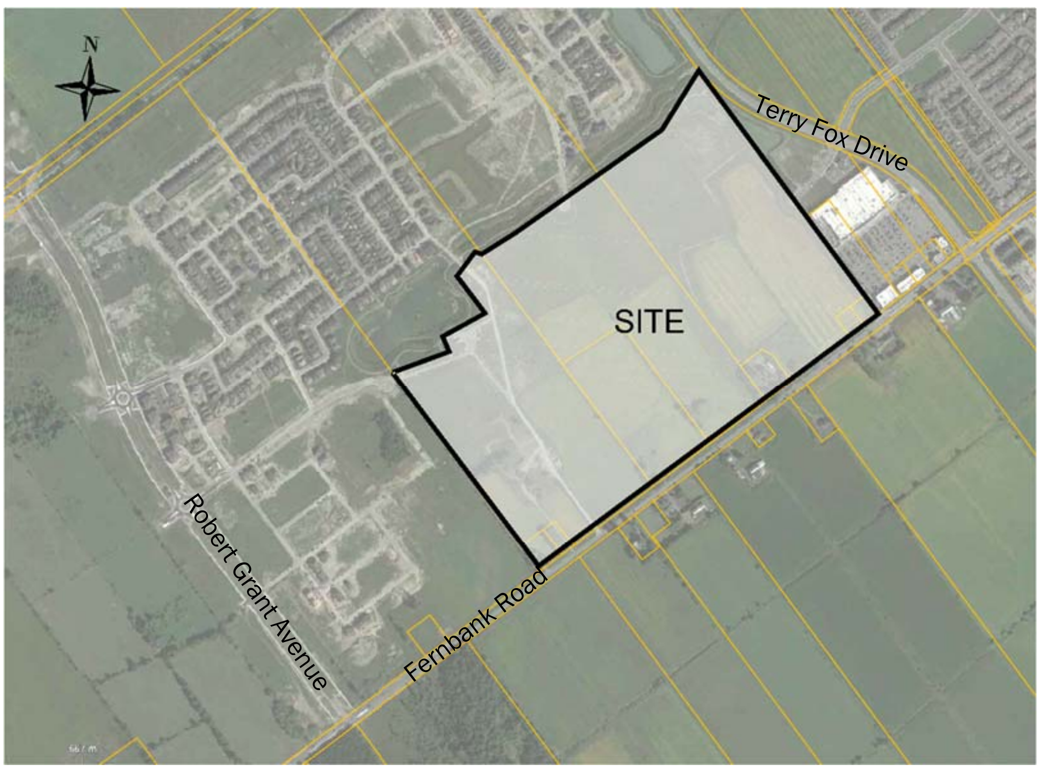
Blackstone Transportation Impact Study

1. INTRODUCTION

This study has been prepared to support a Draft Plan of Subdivision application for Mattamy Homes' and Cardel Homes' proposed developments at 5505 Fernbank Road, referred to as the Blackstone South Development. The proposed development includes single detached and townhome style houses. The site will be constructed in several phases, but is anticipated to be built out quickly and multiple phases will be constructed concurrently. The subject site connects at several points to the adjacent developments as well as the adjacent road network.

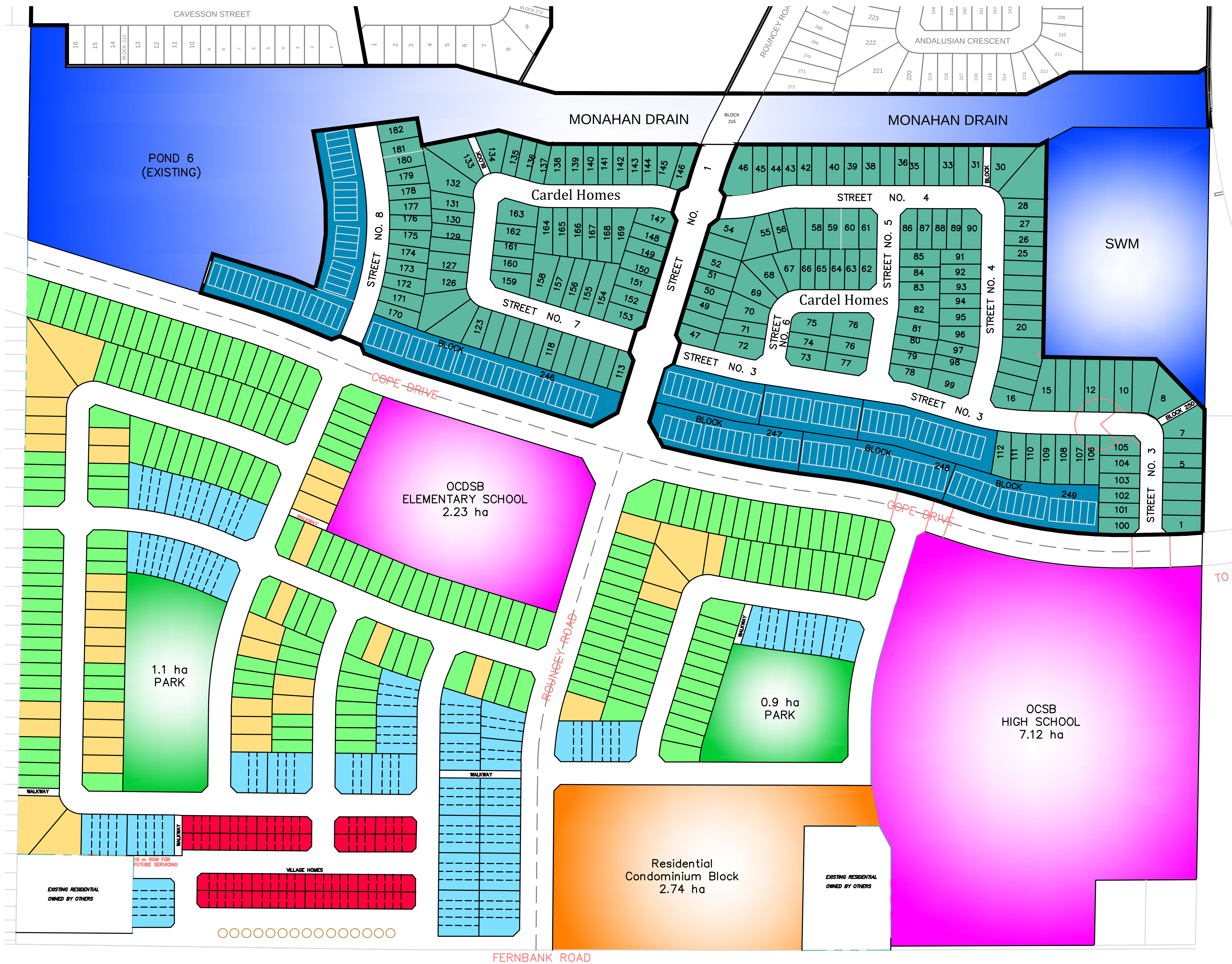
Figure 1 shows the site location and the nearby road network. Figure 2 shows the proposed site plan.

Figure 1: Local Site Context



Consistent with the City of Ottawa's 2006 Transportation Impact Assessment Guidelines (TIA Guidelines), a Transportation Impact Study (TIS) is required to support the subject development application. The following horizons will be considered in the demand forecasting and operational analysis, 2017 (Existing Conditions), 2025 (Full Build-out, assumed), and 2030 (Full build-out plus 5 years).

Prior to commencement of this study a pre-consultation / scoping e-mail was sent to City Staff for discussion / approval. E-mail correspondence with City Staff has been included as Appendix A.



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Blackstone South

April 5, 2017

Lot Count (Mattamy)

21' Village Townhome	92
21' Widelot Townhome	127
32' Single Detached	201
46' Single Detached	40
Residential Block	156
	616

Lot Count (Cardel)

Singles	182
Towns	157
	339

1.1. CONTEXT

The development is part of the Fernbank Community, located within the West Urban Community of the City of Ottawa. The Fernbank Community was the subject of a Community Design Plan (CDP) in 2006. The CDP outlines the planning context and planning principles that influence the design and construction of the Fernbank Community. Through this planning process the outline of the road network was established.

A Transportation Brief has been completed for 570 Hazeldean Road, Mattamy's development to the north of the subject development. This TB, completed in 2013, outlined the traffic generated by the proposed development. The previous study assumes that the development would be fully built-out in 2021. It is assumed that this build-out horizon has remained unchanged.

A Transportation Impact Analysis is underway for the Abbott-Fernbank Holdings to the east of the subject development, referred to as Abbott Fernbank Phase 4. This TIA, to be completed in 2017, will outline the traffic generated by the proposed development. This study assumes that development would be fully built-out in 2021. This information has been provided by the author of the Abbott - Fernbank study in advance of the submission.

Appendix B contains excerpts of the Dawson Transportation Brief and Abbott Fernbank Phase 4, detailing the site generated trips.

As no other development applications were indicated by the City Staff to be pending at the time of this study, it is assumed that other developments would be fully built out beyond the full build out horizon of 5505 Fernbank Road.

2. EXISTING CONDITIONS

2.1. STUDY AREA ROAD NETWORK

The Study Area road network is summarized below:

Fernbank Road is an east-west arterial road that runs between Dwyer Hill Road and Eagleson Road. Fernbank Road has a two-lane undivided rural cross section with gravel shoulders. The posted speed limit is 80km/h along the frontage of 5505 Fernbank Road, it is assumed that this speed limit would be reduced to 60 km/h by the completion of the subject development. It is identified as a transit priority corridor with isolated measures (City of Ottawa Transportation Master Plan (TMP) 2013, Ultimate Network) and widening has been proposed in the Network Concept Map 10 (TMP). The widening is not included in the affordable network and was therefore not considered in this study.

Robert Grant Avenue is a north-south arterial road that runs through the Fernbank Community. This road is currently only constructed from Fernbank Road to Abbot Street East, but will ultimately connect to the Palladium Drive Highway 417 interchange.

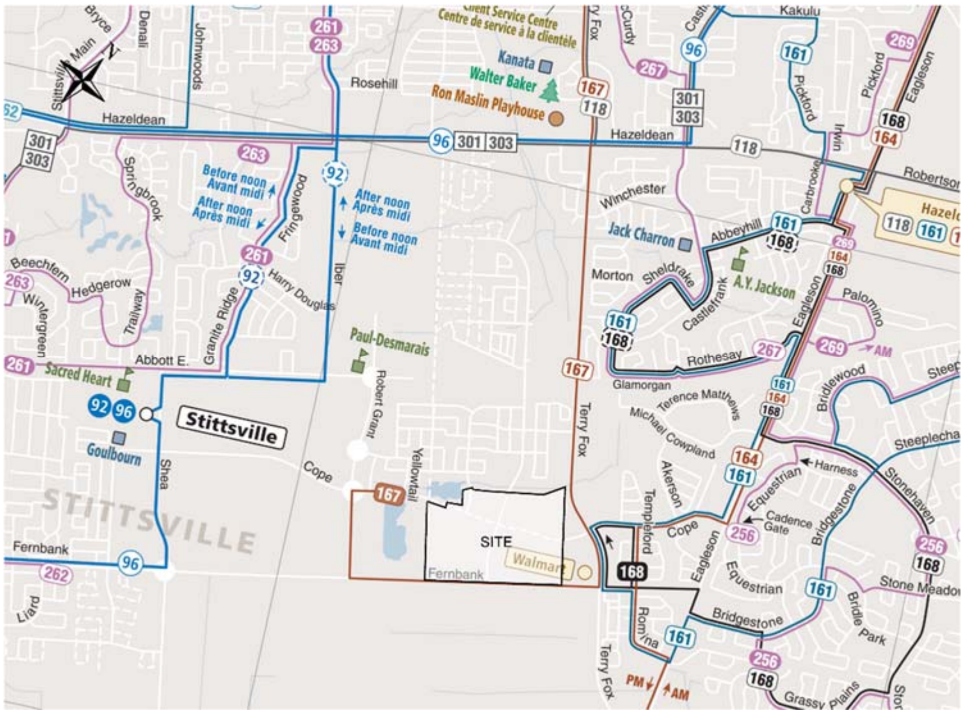
Cope Drive is an east-west collector road that is not currently continuous, but will be connected as part of the proposed development. This road connects to Eagleson Road east of the subject development and Robert Grant Avenue west of the subject development.

Rouncey Road is a north-south collector road that is not currently continuous, but would be connected as part of the proposed development. This road connects the northern part of the Fernbank Community to both Cope Drive and Fernbank Road.

2.2. TRANSIT NETWORK

OC Transpo Route 96 and 262 run along Fernbank Road, Route 96 and 92 run along Shea Road. Bus Route 167 currently serves the Blackstone community with a transit stop at Rouncey Road / Westphalian Avenue. The closest transit stop on Fernbank Road is located at Laird Street and on Shea Road, the Goulbourn Complex is the last stop. Figure 3 shows the transit routes through the Study Area.

Figure 3: Existing Transit Network



Accessed January 9, 2017

2.3. PEDESTRIAN & CYCLING NETWORK

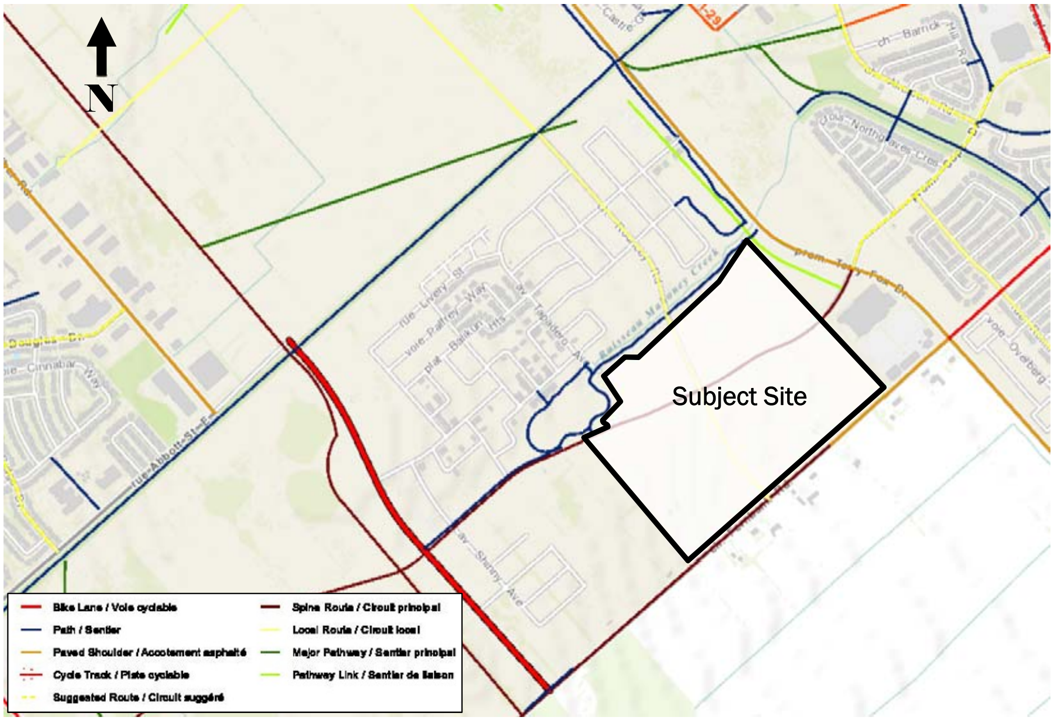
Sidewalks are provided within the immediate study area. The existing sidewalks connect Robert Grant Avenue to Abbott Street East and the residential area west of the site.

Cycle Tracks are provided on both sides of Robert Grant Avenue, which connects at the south to paved shoulders on Fernbank Road and the Trans-Canada Trail to the north.

A major pathway connection terminates at the roundabout at the intersection of Fernbank Road and Robert Grant Avenue which originates at the Trans Canada Trail. The Ottawa Pedestrian Plan (2013) does not identify any extension to this pathway.

The City of Ottawa's 2013 Cycling Plan identifies Fernbank Road as a Spine or Citywide-cycling route. Figure 4 illustrates the study area, and surrounding area, cycling network.

Figure 4: Cycling Network



A cross-section for Cope Road has been previously defined as part of the Abbot-Fernbank Lands and this cross-section will be carried through the subject development. The cross-section includes a multi-use pathway along the north side and a sidewalk is included along the south side. The typical cross-section has been included in Appendix C.

2.4. COLLISION REPORTS

Collision data was requested from the City of Ottawa for the intersections of Cope Drive at Robert Grant Avenue and Fernbank Road at Robert Grant Avenue for the most recent 3 years prior to the commencement of this study. However, no data was available for this intersection, and therefore it is inferred that no reportable collisions have occurred within the 3 years prior to this study.

2.5. EXISTING TRAFFIC OPERATIONS

To establish the baseline intersection operations an operational analysis of the existing traffic conditions has been undertaken for the study area intersection. No recent counts were available from the City of Ottawa. New turning movement counts were undertaken on Thursday February 16, 2017 and Tuesday February 21, 2017, these are summarized on Figure 5. Appendix D contains the detailed traffic data sheets.

To assess the peak hour traffic conditions at the existing roundabout a level of service analysis has been completed using the traffic analysis software Sidra. The key parameters used in the analysis include:

- Existing lane arrangements
- A value of 2% Heavy Vehicle volume was used
- Default values for all other inputs (as defined by Sidra)

To assess the peak hour traffic conditions at the signalized and unsignalized intersections a level of service analysis has been completed using Trafficware Synchro 9.1, which implements the methods of the 2000 Highway Capacity Manual. The key parameters used in the analysis include:

- A saturation flow rate of 1800 (as per the City of Ottawa TIA Guidelines)
- Default values for all other inputs (as defined by Synchro 9.1)

The results of the operational analysis are summarized in Table 1. The Sidra and Synchro analysis outputs are provided in Appendix E.

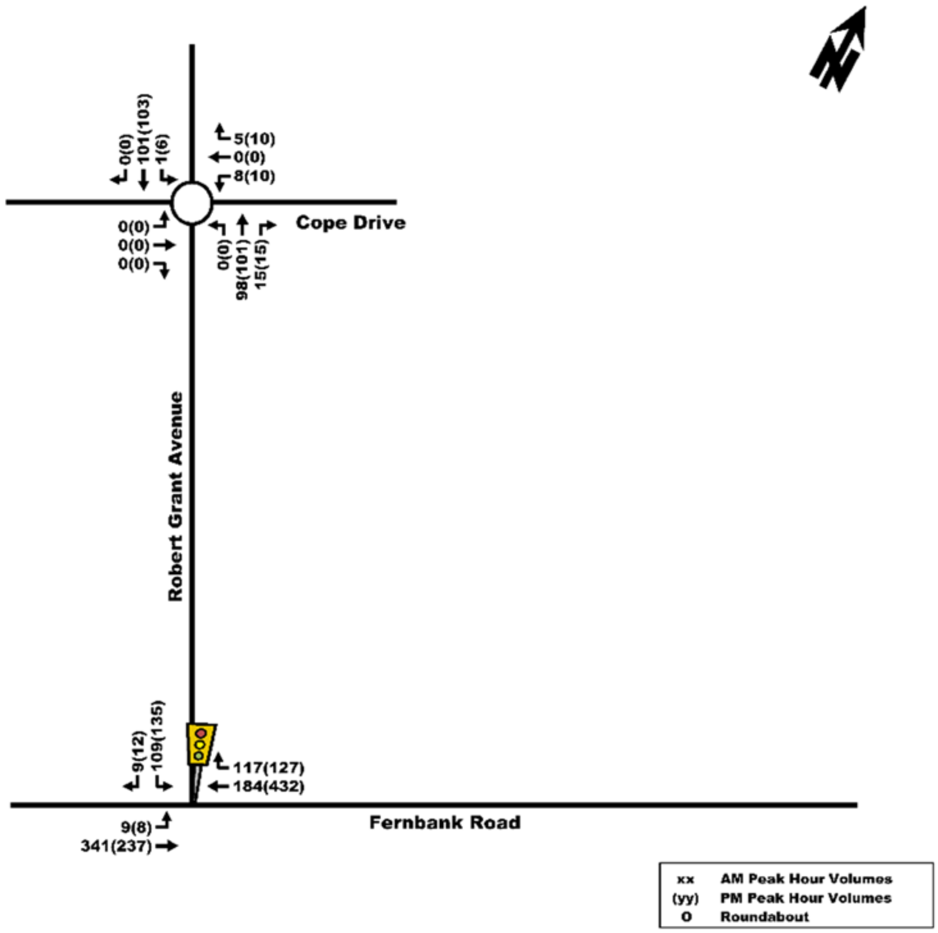
Table 1: Intersection Operational Analysis
2017 Existing Conditions

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Robert Grant Avenue [1]	A(A)	0.37(0.45)	EBT(WBT)	9.4(10.7)	A(A)	0.35(0.42)
Robert Grant Avenue/Cope Drive[3]	A(A)	5.2(4.3)	SB(SB)	5.0(4.3)	-	-

Note:
1- Signalized Intersection
2- Unsignalized Intersection
3- Roundabout Intersection

The existing roundabout at Robert Grant Avenue and Cope Drive as well as the signalized intersection of Fernbank at Robert Grant Avenue were shown to operate with good overall levels of service and no critical movements. As a result, no mitigation measures are recommended.

Figure 5: Existing Peak Hour Traffic Volumes



3. DEMAND FORECASTING

3.1. BACKGROUND TRAFFIC GROWTH

To account for background growth along Fernbank Road and Robert Grant Avenue several background developments have been considered. All the developments considered are expected to reach full build-out prior to the 2025 horizon. To account for background growth beyond the study area, a 2% background growth rate per annum (compounded) has been applied. The background development traffic volumes were combined with the existing traffic volumes and the percent background growth to estimate the future background traffic for 2025 and 2030. Figure 6 shows the future background traffic volumes for the 2025 horizon. Figure 7 shows the future background traffic volumes for the 2030 horizon.

3.2. SITE TRIP GENERATION

The number of vehicle trips has been estimated, based on the proposed land uses, to project the impact of the proposed development on the surrounding road network. Table 2 documents the proposed land uses, the ITE Land Use Codes, and the independent variables that are being proposed for the Blackstone South Development.

Table 2: Proposed Land Uses

Land Use	Data Source	Independent Variable
Single-Family Detached Housing	ITE 210	423 Units
Residential Condominium / Townhouse	ITE 230	376 Units
Residential Condominium Block	ITE 220	156 Units
High School	ITE 530	1,916 Students
Elementary School	ITE 520	650 Students

The ITE Land Use Codes and independent variables described above were used to develop the baseline automobile trip generation. The baseline automobile trip generation is multiplied by 1.30 to estimate the number of peak hour person trips that could be generated by the proposed development. The 2011 NCR Household Origin – Destination Survey was reviewed to determine the mode share characteristics of the subject area, specifically, the Kanata – Stittsville Area. Table 3 documents the mode share based on the O-D survey.

Table 3: South Nepean Existing Mode Share

Travel Mode	Mode Share
Auto Driver	60%
Auto Passenger	15%
Transit	10%
Non-motorized	15%
Total Person Trips	100%

Table 4 summarizes the vehicle trip generation for the full build-out of the proposed development based on the foregoing assumptions. A full trip generation table is included in Appendix F.

Table 4: Site Trip Generation (Full Build-Out)

	AM Peak Hour			PM Peak Hour		
	Inbound	Outbound	Total	Inbound	Outbound	Total
Net new Vehicle Trips	666	683	1,349	514	362	876

3.3. VEHICLE TRAFFIC DISTRIBUTION AND ASSIGNMENT

The vehicle traffic distribution and assignment was developed using the 2011 NCR Household Origin – Destination Survey. The resultant distribution is outlined in Table 5.

Table 5: Traffic Distribution

To/From	Distribution
North	40%
South	10%
East	40%
West	10%
Total	100%

Using these distributions and the access configuration, new site-generated trips were assigned to the study area intersections. Figure 8 shows the full build-out site generated traffic volumes.

3.4. PROJECTED TRAFFIC VOLUMES

The background traffic volumes were combined with the site traffic to determine the weekday AM and PM peak hour total traffic forecasts. The future total traffic volumes for the 2025, and 2030 horizon years are shown in Figure 9, and Figure 10 respectively.

Figure 6: Future Background Traffic (2025)

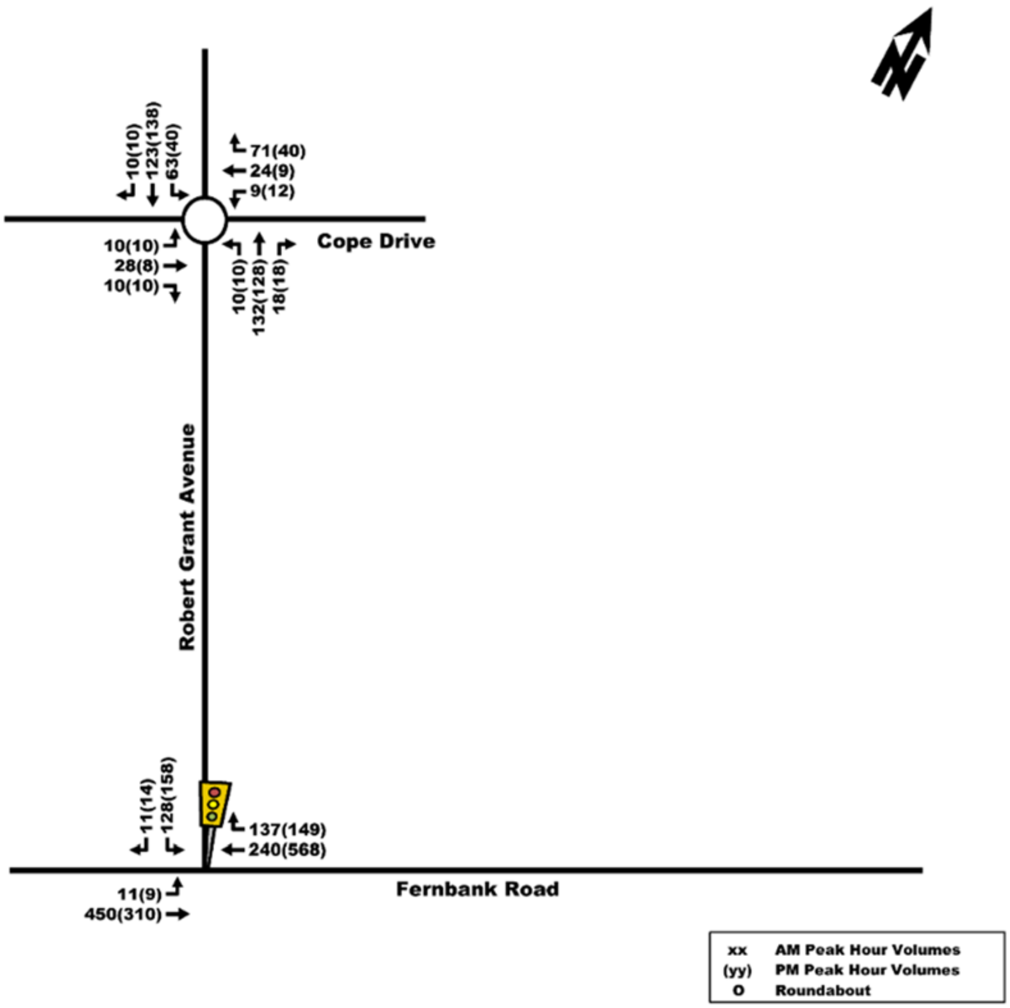


Figure 7: Future Background Traffic (2030)

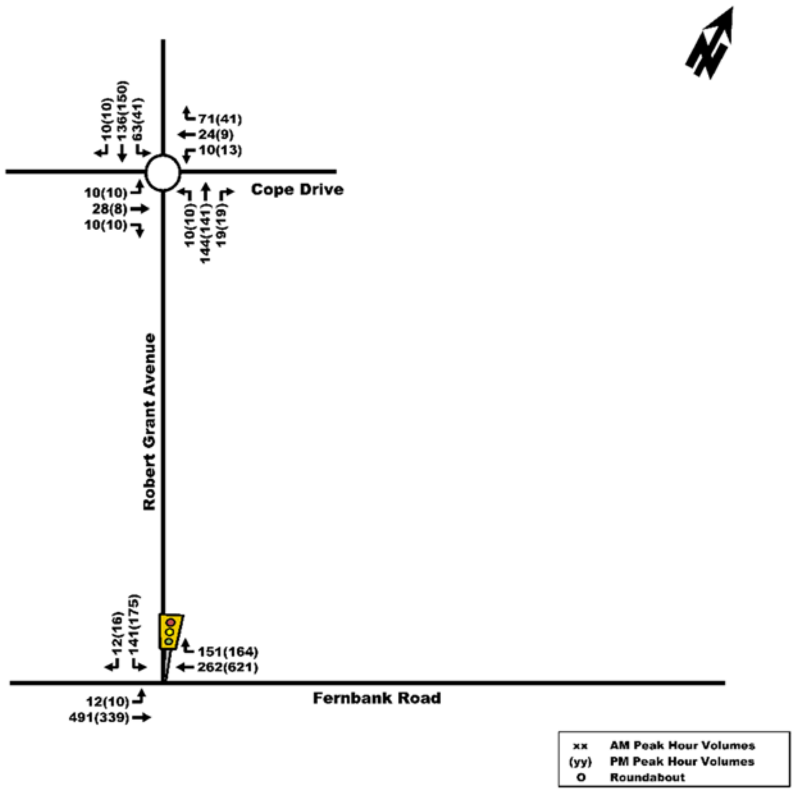


Figure 8: Site Generated Traffic Volumes (Full Build-Out)

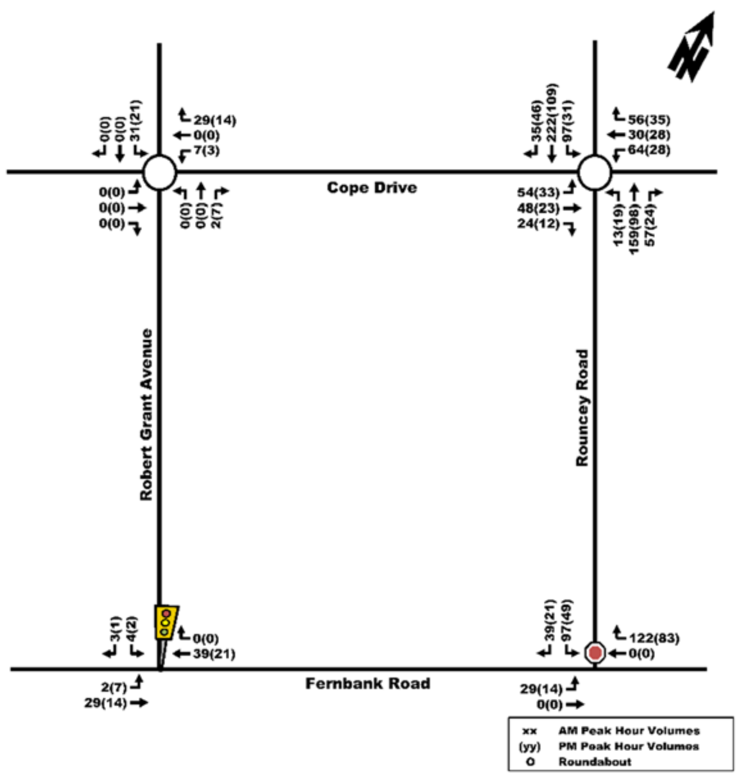


Figure 9: Future Total Traffic (2025)

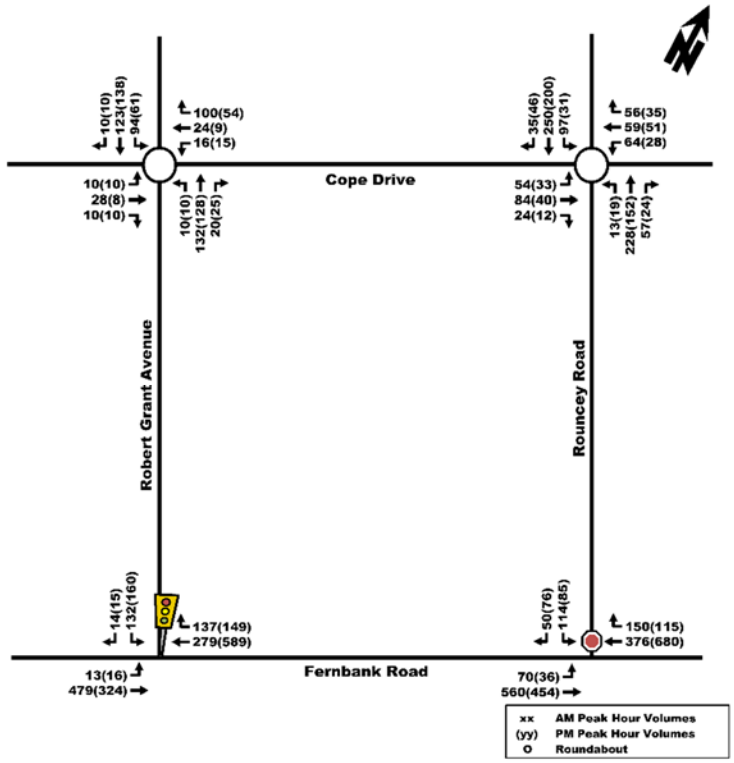
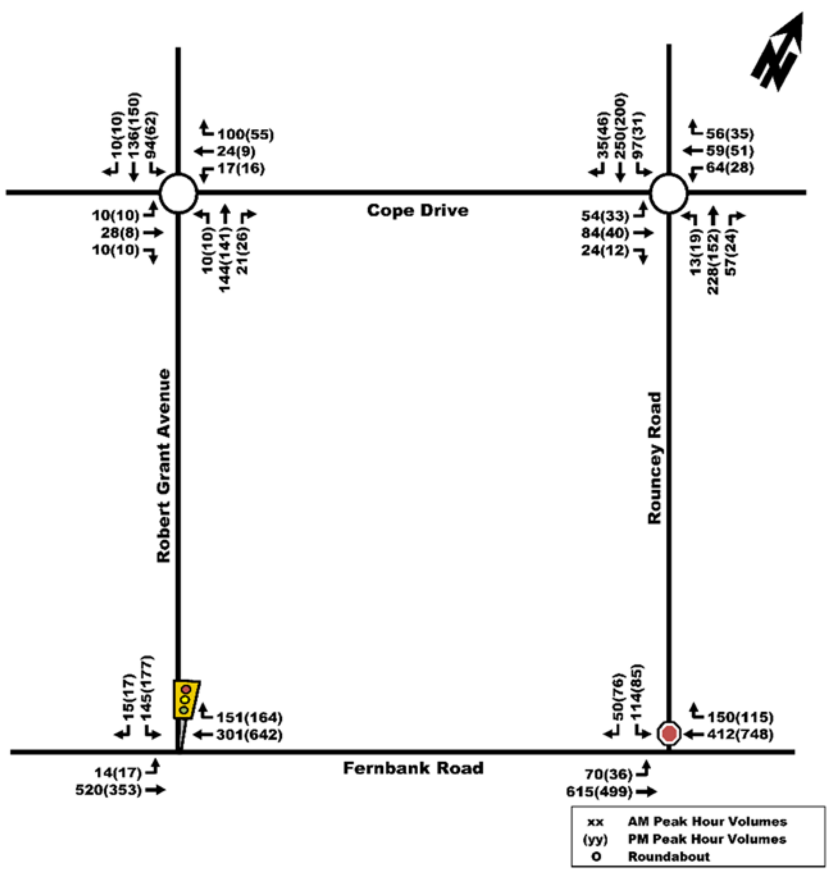


Figure 10: Future Total Traffic (2030)



4. FUTURE TRAFFIC OPERATIONS

4.1. 2025 FUTURE BACKGROUND CONDITIONS

A level of service analysis of the future background AM and PM peak hour operating conditions was undertaken using the same parameters as in the analysis of existing conditions. Table 6 summarizes the operational analysis for the projected 2025 future background conditions. Sidra analysis outputs are included in Appendix G.

Table 6: Intersection Operational Analysis
2025 Future Background Conditions

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Robert Grant Avenue [1]	A(A)	0.43(0.60)	EBT(WBT)	9.9(12.1)	A(A)	0.40(0.56)
Robert Grant Avenue/Cope Drive[3]	A(A)	5.3(5.2)	NB(NB)	5.2(5.0)	-	-
Note: *1- Signalized Intersection* *2- Unsignalized Intersection* *3- Roundabout Intersection*						

The roundabout intersection of Robert Grant Avenue and Cope Drive, with the addition of the background developments, is projected to operate well, with Level of Service A (LOS A) during the AM and PM peak periods. The signalized intersection at Fernbank Road and Robert Grant Avenue is projected to operate at LOS B for the AM and PM peak periods.

4.2. 2025 TOTAL FUTURE CONDITIONS

A level of service analysis of the future AM and PM peak hour operating conditions, including the subject development, was undertaken using the same parameters as in the analysis of existing conditions, with the addition of the intersections of Rouncey Road at Cope Drive and Rouncey Road at Fernbank Road.

Table 7 summarizes the operational analysis for the projected 2025 total future conditions. Sidra and Synchro analysis outputs are included in Appendix H.

Table 7: Intersection Operational Analysis
2025 Future Traffic Conditions

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Robert Grant Avenue [1]	A(B)	0.50(0.65)	EBT(WBT)	10.3(12.8)	A(A)	0.47(0.60)
Rouncey Road/Fernbank Road [2]	E(E)	41.6(47.0)	SB(SB)	5.6(5.5)	-	-
Robert Grant Avenue/Cope Drive [3]	A(A)	5.7(5.4)	NB(NB)	5.5(5.2)	-	-
Rouncey Road /Cope Drive [3]	A(A)	8.9(6.8)	NB(NB)	8.5(6.1)	-	-
Note: *1- Signalized Intersection* *2- Unsignalized Intersection* *3- Roundabout Intersection*						

The new unsignalized intersection at Fernbank Road and Rouncey Road will operate at LOS E during the AM and PM peak hour. The poor operation is due to the high through volumes along Fernbank Road. It should be noted that the through volumes on the east – west legs of the intersection operate with LOS A. A signal warrant was examined using OTM Book 12 methodology for a future intersection with future volumes. Using this methodology, a traffic control signal is not warranted at this location for the 2025 Total Future Conditions. The roundabout at Robert Grant Avenue and the newly added roundabout at Rouncey Road and Cope Drive is projected to operate at LOS A for both AM and PM peak periods. The signalized intersection at Fernbank Road and Robert Grant Avenue is projected to operate at LOS B in the AM and LOS C in the PM peak hour.

A left turn lane warrant was examined at Rouncey Road and Fernbank Road for the eastbound direction along Fernbank Road, and was found to be warranted. For the westbound direction along Fernbank a right turn lane was added to improve the conditions at the intersection of Fernbank Road and Rouncey Road as the right turn volumes were greater than 60 veh/h for both AM and PM peak periods. Appendix I documents the left turn lane warrant.

4.3. 2030 FUTURE BACKGROUND CONDITIONS

A level of service analysis of the 2030 future background AM and PM peak hour operating conditions was undertaken using the same parameters as in the analysis of 2025 future background conditions. Table 8 summarizes the operational analysis for the projected 2030 future background conditions. Sidra and Synchro analysis outputs are included in Appendix J.

Table 8: Intersection Operational Analysis
2030 Future Background Conditions

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Robert Grant Avenue [1]	B(B)	0.61(0.68)	EBT(WBT)	11.6(13.4)	A(B)	0.56(0.64)
Robert Grant Avenue/Cope Drive [3]	A(A)	5.5(5.3)	NB(NB)	5.3(5.1)	-	-
Note: *1- Signalized Intersection* *2- Unsignalized Intersection* *3- Roundabout Intersection*						

The roundabout at Robert Grant Avenue and Cope Drive is shown to operate well with LOS A and short delays in both the AM and PM peak hours. The signalized intersection at Fernbank Road and Robert Grant Avenue is shown to operate at LOS B for AM and PM peak periods.

4.4. 2030 TOTAL FUTURE CONDITIONS

A level of service analysis of the 2030 total future AM and PM peak hour operating conditions was undertaken using the same parameters as in the analysis of 2025 total future conditions. Table 9 summarizes the operational analysis for the projected 2030 total future conditions. Sidra and Synchro analysis outputs are included in Appendix K.

Table 9: Intersection Operational Analysis
2030 Future Traffic Conditions

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Fernbank Road/Robert Grant Avenue [1]	B(B)	0.63(0.69)	EBT(WBT)	11.9(13.7)	A(B)	0.58(0.64)
Rouncey Road/Fernbank Road [2]	F(F)	55.4(67.4)	SB(SB)	6.9(7.2)	-	-
Robert Grant Avenue/Cope Drive [3]	A(A)	5.9(5.5)	NB(NB)	5.7(5.3)	-	-
Rouncey Road/Cope Drive [3]	A(A)	8.9(6.8)	NB(NB)	8.5(6.1)	-	-

Note:
1- Signalized Intersection
2- Unsignalized Intersection
3- Roundabout Intersection

With the addition of traffic from the full build-out of the proposed site, the roundabout at Robert Grant Avenue and Cope Drive will continue to operate at LOS A during both peak hours. The signalized intersection at Robert Grant Avenue and Fernbank Road will operate at LOS C with the addition of the site traffic.

Similar to 2025 total future conditions the unsignalized intersection of Rouncey Road and Fernbank Road will operate with poor LOS, and high delays. This is caused by the high volume of east/west traffic on Fernbank Road causing delays to the minor, southbound approach of the intersection. The east/west legs of the intersection are projected to operate with LOS A. Additionally, a signal warrant was examined using OTM Book 12 methodology for a future intersection with future volumes. Using the methodology, a traffic control signal is not warranted at this location for the 2030 Total Future Conditions.

5. TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) strategies have the potential to be an integral part of a planned development. For this site, the proximity of dedicated on-road cycling facilities will contribute to maximizing the bicycle mode split. As well, several other TDM measures could be considered to reduce vehicle use, including:

- Improving the quality and safety of pedestrian facilities, such as enhanced sidewalks/lighting
- Ride-sharing programs (e.g. community forum where residents can register/arrange carpooling or on-site parking can be reserved for VRTUCAR cars)
- Provide a transit information to encourage residents to utilize transit
- Develop a program to encourage both residents to have transit passes

TDM strategies are important in encouraging active modes of transportation to/from the site, further lessening the reliance on the private automobile.

6. CONCLUSIONS

The conclusions of the Transportation Impact Study are as follows:

a) The existing study area intersections have been shown to operate with a good overall LOS (LOS A) and minimal delays. No mitigation measures were required to address existing deficiencies.

b) It is projected that the site will generate 1,349 and 876 net new auto trips in the AM and PM peak hours respectively (per Table 4: Site Trip Generation).

c) The analysis of 2025 and 2030 future background conditions (without site generated traffic) indicated that the roundabout intersection would operate with good LOS (LOS B or better) and minimal delays. No mitigation measures were required to address deficiencies as a result of the addition of background growth.

d) The analysis of 2025 and 2030 total future traffic forecasts (including site-generated traffic) showed that the roundabout at Robert Grant Avenue and Cope Drive would continue to operate with few delays and good LOS (LOS A), with the inclusion of the site-generated traffic. The signalized intersection at Robert Grant Avenue will continue to operate well, with some delays, and LOS B or better.

e) The internal intersection of Cope Drive at Rouncey Road is planned to be a roundabout. This intersection was analyzed as a single lane roundabout and was found to operate with good LOS (LOS A) with the proposed intersection configuration, and projected traffic volumes.

f) The new access intersection of Rouncey Road at Fernbank Road was analyzed as an unsignalized intersection with a stop control on the minor (southbound) leg. Left and right auxiliary turning lanes have been examined at this location. An eastbound right turn lane and a westbound left turn lane were found to be warranted. The access intersection was analyzed using the foregoing configuration. It was projected that the minor leg would operate with LOS F; however, this leg was shown to operate within theoretical capacity (i.e. v/c<1.0). A signal warrant was undertaken using the OTM Book 12 methodology. It was found that a traffic control signal was not warranted for either 2025 or 2030 total future conditions.

Upon approval of the traffic analysis contained herein, the following tasks will be undertaken:

- Functional design of the Cope Drive at Rouncey Road Roundabout
- Roadway Modification Approval for the intersection of Rouncey Road at Fernbank Road

It is anticipated that the study area intersections, with the noted mitigations measures, will operate acceptably. It is therefore recommended that, from a transportation perspective, the subject development be approved.

Prepared By

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Reviewed By

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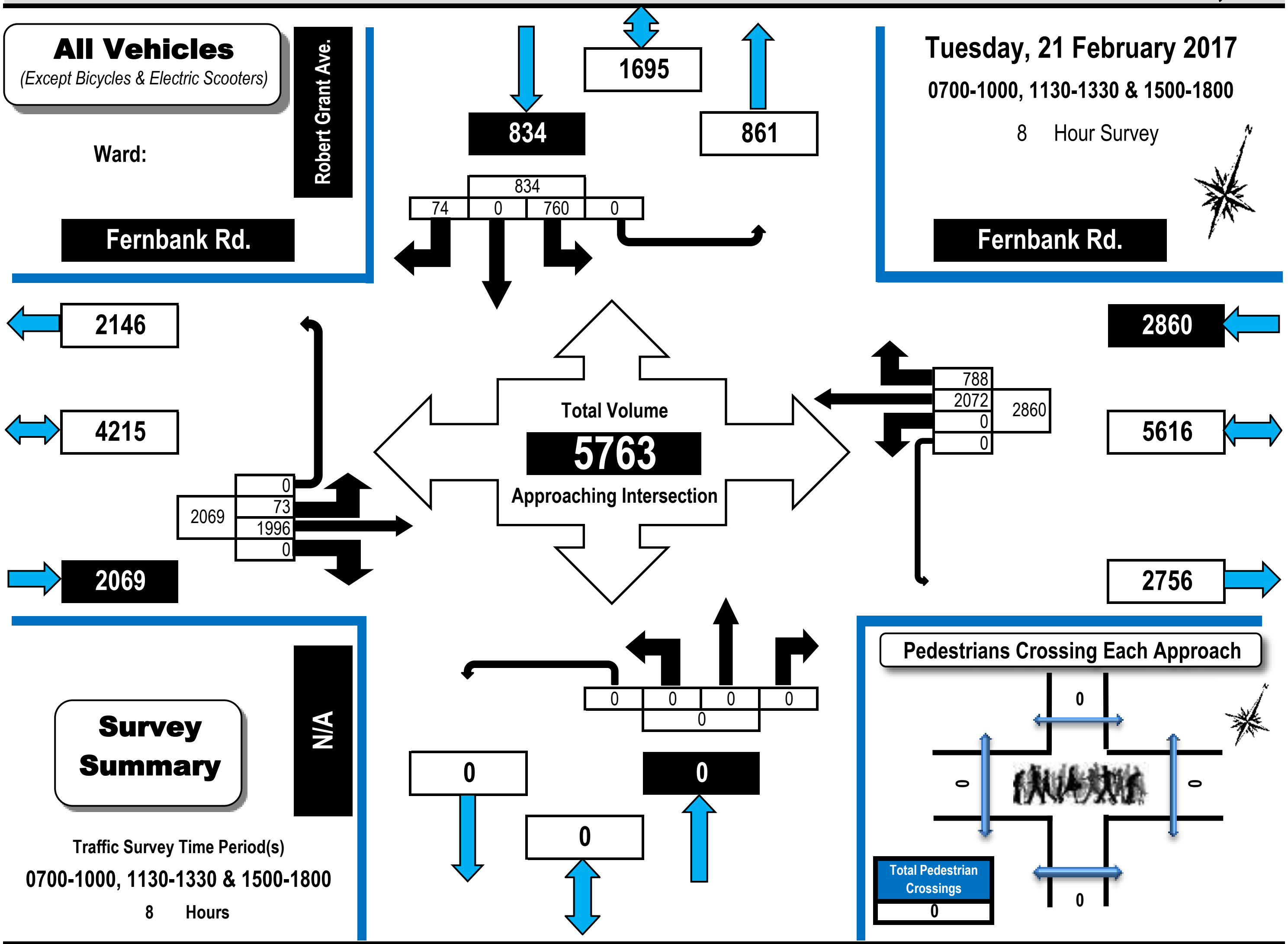
Appendix C

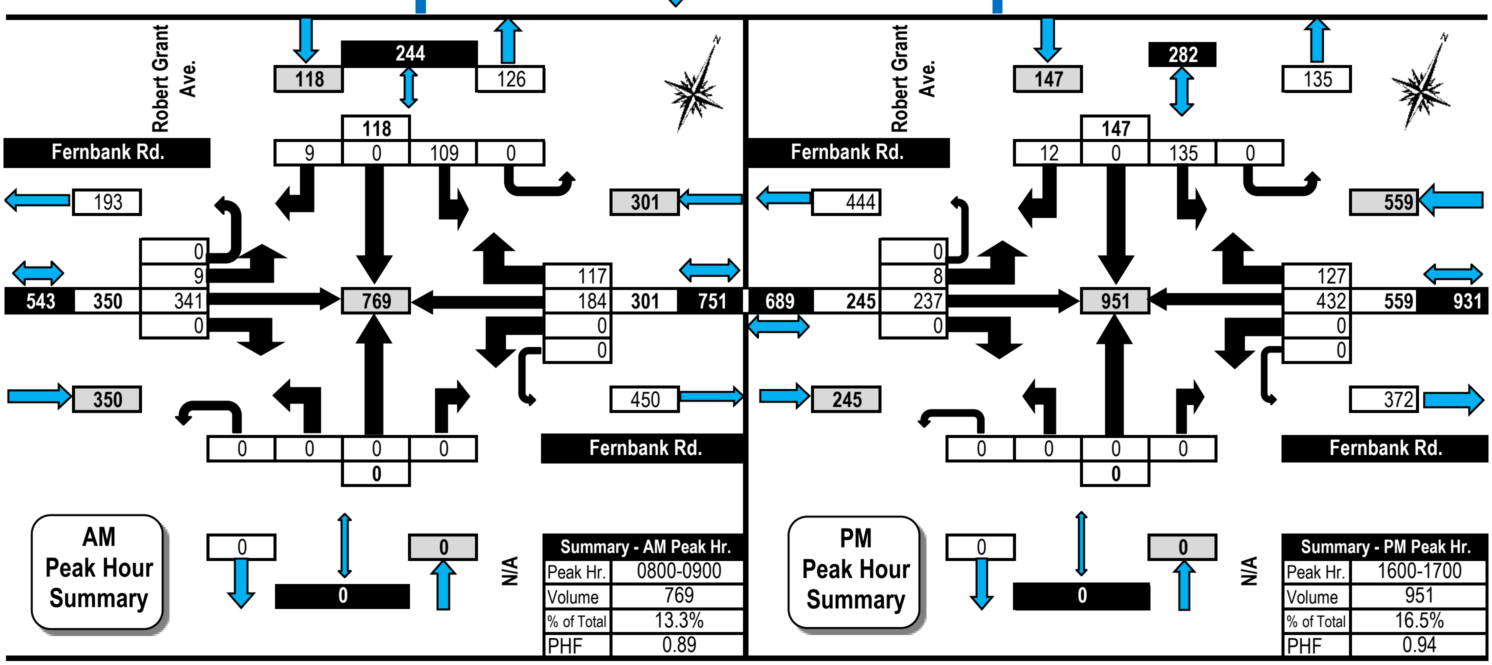
TRAFFIC COUNT

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams

Automobiles, Taxis, Light Trucks, Vans, SUV's, Motorcycles, Heavy Trucks, Buses, and School Buses

Fernbank Road & Robert Grant Avenue — Stittsville, ON





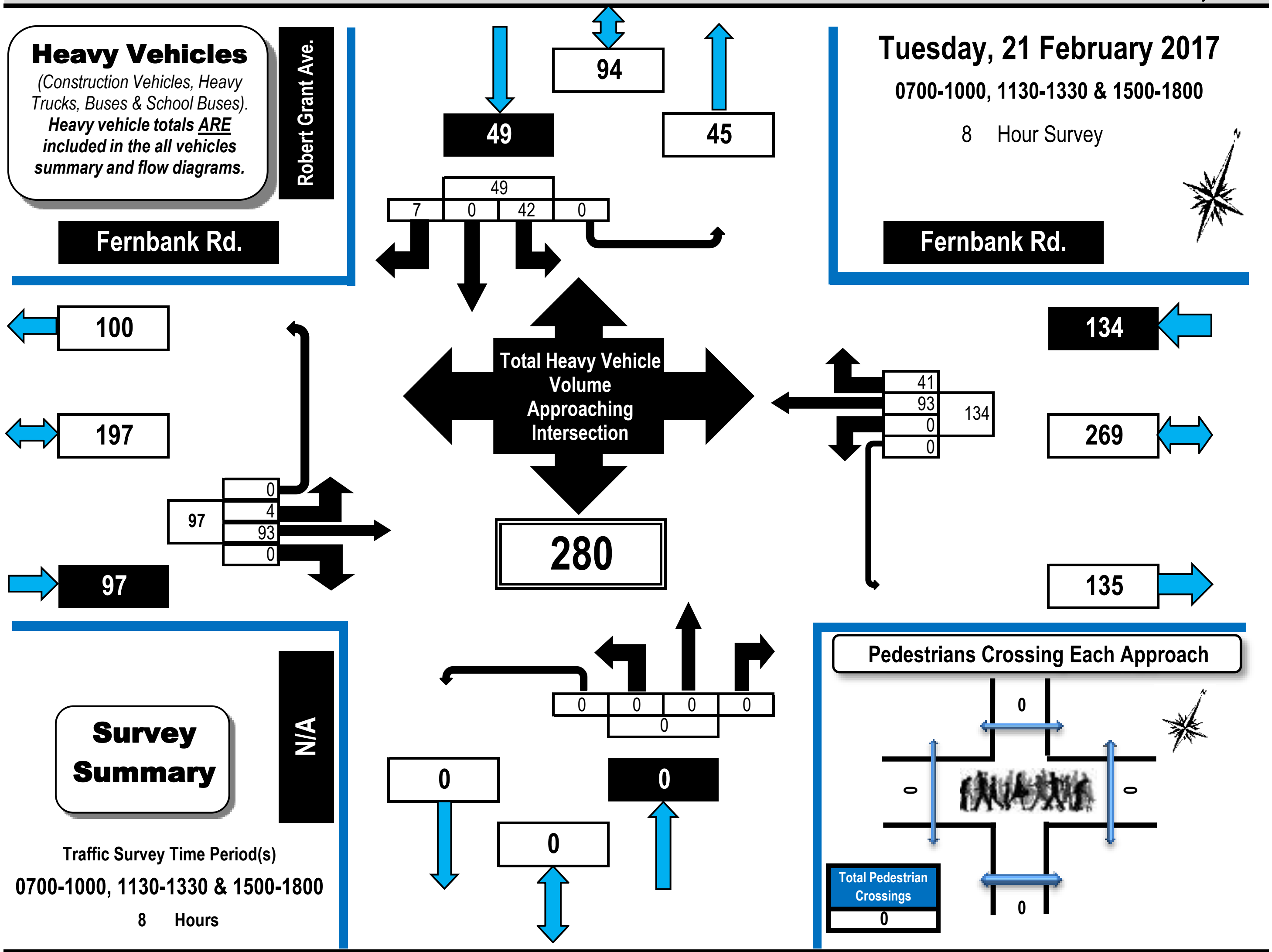
Summary - AM Peak Hr.	
Peak Hr.	0800-0900
Volume	769
% of Total	13.3%
PHF	0.89

Summary - PM Peak Hr.	
Peak Hr.	1600-1700
Volume	951
% of Total	16.5%
PHF	0.94

Turning Movement Count
Heavy Vehicle Summary
Flow Diagram

Heavy Trucks, Buses, and School Buses

Fernbank Road & Robert Grant Avenue — Stittsville, ON



Fernbank Road & Robert Grant Avenue — Stittsville, ON

Survey Date: Tuesday, 21 February 2017 **Start Time:** 0700
Weather: Partly Cloudy/Overcast **Survey Duration:** 8 Hrs. **Survey Hours:** 0700-1000, 1130-1330 & 1500-1800

	Fernbank Rd.					Fernbank Rd.					N/A					Robert Grant Ave.					
	Eastbound					Westbound					Northbound					Southbound					
Time Period	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	LT	ST	RT	UT	S. Tot	G.Tot.
0700-0800	1	2	0	0	3	0	5	4	0	9	0	0	0	0	0	10	0	0	0	10	22
0800-0900	1	5	0	0	6	0	6	8	0	14	0	0	0	0	0	3	0	2	0	5	25
0900-1000	0	11	0	0	11	0	6	6	0	12	0	0	0	0	0	9	0	1	0	10	33
1130-1230	0	15	0	0	15	0	17	2	0	19	0	0	0	0	0	4	0	1	0	5	39
1230-1330	0	18	0	0	18	0	16	5	0	21	0	0	0	0	0	2	0	0	0	2	41
1500-1600	1	15	0	0	16	0	20	8	0	28	0	0	0	0	0	9	0	2	0	11	55
1600-1700	1	15	0	0	16	0	12	6	0	18	0	0	0	0	0	3	0	1	0	4	38
1700-1800	0	12	0	0	12	0	11	2	0	13	0	0	0	0	0	2	0	0	0	2	27
Totals	4	93	0	0	97	0	93	41	0	134	0	0	0	0	0	42	0	7	0	49	280

Turning Movement Count

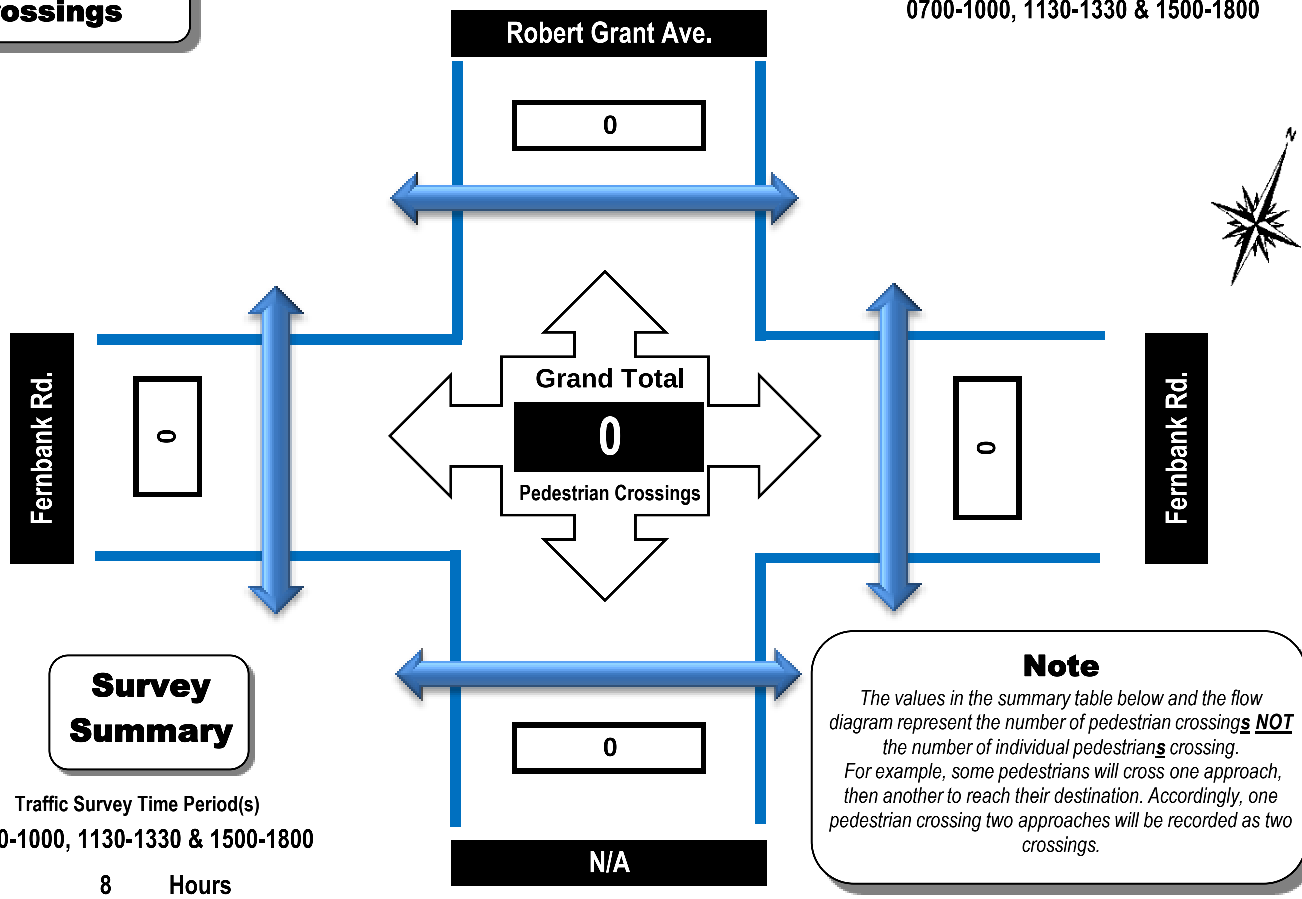
Pedestrian Crossings Summary and Flow Diagram

Fernbank Road & Robert Grant Avenue — Stittsville, ON

Pedestrian Crossings

Tuesday, 21 February 2017

0700-1000, 1130-1330 & 1500-1800



Survey Summary

Traffic Survey Time Period(s)

0700-1000, 1130-1330 & 1500-1800

8 Hours

Note

The values in the summary table below and the flow diagram represent the number of pedestrian crossings NOT the number of individual pedestrians crossing. For example, some pedestrians will cross one approach, then another to reach their destination. Accordingly, one pedestrian crossing two approaches will be recorded as two crossings.

Fernbank Road & Robert Grant Avenue — Stittsville, ON

Survey Date: Tuesday, 21 February 2017 **Start Time:** 0700

Weather: Partly Cloudy/Overcast **Survey Duration:** 8 Hrs. **Survey Hours:** 0700-1000, 1130-1330 & 1500-1800

Time Period	West Side Crossing Fernbank Rd.	East Side Crossing Fernbank Rd.	Street Total	South Side Crossing N/A	North Side Crossing Robert Grant Ave.	Street Total	Grand Total
0700-0800	0	0	0	0	0	0	0
0800-0900	0	0	0	0	0	0	0
0900-1000	0	0	0	0	0	0	0
1130-1230	0				0	0	0
1230-1330	0				0	0	0
1500-1600	0	0	0	0	0	0	0
1600-1700	0	0	0	0	0	0	0
1700-1800	0	0	0	0	0	0	0
Totals	0	0	0	0	0	0	0

No Pedestrians Observed

Turning Movement Count

Summary Report Including AM/PM Peak Hours, PHF, AADT and Expansion Factors

Automobiles, Taxis, Light Trucks, Vans, SUV's, Motorcycles, Heavy Trucks, Buses, and School Buses

Fernbank Road & Robert Grant Avenue — Stittsville, ON

Survey Date: Tuesday, 21 February 2017 **Start Time:** 0700 **AADT Factor:** 1.0

Weather: Partly Cloudy/Overcast **Survey Duration:** 8 Hrs. **Survey Hours:** 0700-1000, 1130-1330 & 1500-1800

	Fernbank Rd. Eastbound					Fernbank Rd. Westbound						N/A Northbound					Robert Grant Ave. Southbound						
Time Period	LT	ST	RT	UT	E/B Tot	LT	ST	RT	UT	W/B Tot	Street Total	LT	ST	RT	UT	N/B Tot	LT	ST	RT	UT	S/B Tot	Street Total	Grand Total
0700-0800	16	366	0	0	**382**	0	133	106	0	**239**	**621**	0	0	0	0	**0**	85	0	8	0	**93**	**93**	**714**
0800-0900	9	341	0	0	**350**	0	184	117	0	**301**	**651**	0	0	0	0	**0**	109	0	9	0	**118**	**118**	**769**
0900-1000	8	283	0	0	**291**	0	153	71	0	**224**	**515**	0	0	0	0	**0**	73	0	10	0	**83**	**83**	**598**
1130-1230	4	192	0	0	**196**	0	184	63	0	**247**	**443**	0	0	0	0	**0**	73	0	9	0	**82**	**82**	**525**
1230-1330	13	191	0	0	**204**	0	197	67	0	**264**	**468**	0	0	0	0	**0**	54	0	8	0	**62**	**62**	**530**
1500-1600	11	187	0	0	**198**	0	388	119	0	**507**	**705**	0	0	0	0	**0**	109	0	16	0	**125**	**125**	**830**
1600-1700	8	237	0	0	**245**	0	432	127	0	**559**	**804**	0	0	0	0	**0**	135	0	12	0	**147**	**147**	**951**
1700-1800	4	199	0	0	**203**	0	401	118	0	**519**	**722**	0	0	0	0	**0**	122	0	2	0	**124**	**124**	**846**
Totals	**73**	**1996**	**0**	**0**	**2069**	**0**	**2072**	**788**	**0**	**2860**	**4929**	**0**	**0**	**0**	**0**	**0**	**760**	**0**	**74**	**0**	**834**	**834**	**5763**

Equivalent 12 & 24-hour Vehicle Volumes Including the Annual Average Daily Traffic (AADT) Factor Applicable to the Day and Month of the Turning Movement Count

➡ **Expansion factors are applied exclusively to standard weekday 8-hour turning movement counts** ⬅

Equivalent 12-hour vehicle volumes. These volumes are calculated by multiplying the 8-hour totals by the 8 ➡12 expansion factor of 1.39

Average daily 12-hour vehicle volumes. These volumes are calculated by multiplying the equivalent 12-hour totals by the AADT factor of: 1.0

24-Hour AADT. These volumes are calculated by multiplying the average daily 12-hour vehicle volumes by the 12 ➡24 expansion factor of 1.31

Equ. 12 Hr	101	2774	0	0	**2876**	0	2880	1095	0	**3975**	**6851**	0	0	0	0	**0**	1056	0	103	0	**1159**	**1159**	**8011**
AADT 12-hr	101	2774	0	0	**2876**	0	2880	1095	0	**3975**	**6851**	0	0	0	0	**0**	1056	0	103	0	**1159**	**1159**	**8011**
AADT 24 Hr	133	3635	0	0	**3767**	0	3773	1435	0	**5208**	**8975**	0	0	0	0	**0**	1384	0	135	0	**1519**	**1519**	**10494**

AM Peak Hour Factor ➡ 0.89

AM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
0800-0900	9	341	0	0	**350**	0	184	117	0	**301**	**651**	0	0	0	0	**0**	109	0	9	0	**118**	**118**	**769**

PM Peak Hour Factor ➡ 0.94

PM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
1600-1700	8	237	0	0	**245**	0	432	127	0	**559**	**804**	0	0	0	0	**0**	135	0	12	0	**147**	**147**	**951**

Comments

Many of the heavy vehicles travelling eastbound and westbound on Fernbank Road are dump trucks involved in snow removal activity.

Notes:

1. Includes all vehicle types except bicycles and electric scooters.
2. Expansion factors are not applied to turning movement counts if they are less than 8-hours in duration.
3. When expansion and AADT factors are applied, the results will differ slightly due to rounding.

Disclaimer:

Appendix D

MMLOS

Multi-Modal Level of Service - Segments Form

Consultant	Parsons	Project	476836
Scenario	Future Projected 2025	Date	Aug. 27, 2019
Comments			

SEGMENTS		Street A	Rouncey Road 1	Fernbank Road 2	Atlas Terrace 3	Section 4	Section 5	Section 6	Section 7	Section 8	Section 9
Pedestrian	Sidewalk Width Boulevard Width	F	≥ 2 m 0.5 - 2 m	no sidewalk n/a	1.8 m < 0.5 m						
	Avg Daily Curb Lane Traffic Volume		≤ 3000	> 3000	≤ 3000						
	Operating Speed On-Street Parking		> 30 to 50 km/h no	> 60 km/h no	> 30 to 50 km/h no						
	Exposure to Traffic PLoS		A	F	B	-	-	-	-	-	-
	Effective Sidewalk Width		1.5 m	1.2 m	1.5 m						
	Pedestrian Volume		250 ped/hr	250 ped/hr	250 ped/hr						
	Crowding PLoS		B	B	B	-	-	-	-	-	-
	Level of Service		**B**	**F**	**B**	-	-	-	-	-	-
Bicycle	Type of Cycling Facility	D	Mixed Traffic	Mixed Traffic	Mixed Traffic						
	Number of Travel Lanes		≤ 2 (no centreline)	≤ 2 (no centreline)	≤ 2 (no centreline)						
	Operating Speed		>40 to <50 km/h	≥ 50 to 60 km/h	>40 to <50 km/h						
	# of Lanes & Operating Speed LoS		B	D	B	-	-	-	-	-	-
	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						
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes	≤ 3 lanes	≤ 3 lanes						
	Sidestreet Operating Speed		≤ 40 km/h	≤ 40 km/h	≤ 40 km/h						
	Unsignalized Crossing - Lowest LoS		A	A	A	-	-	-	-	-	-
	Level of Service		**B**	**D**	**B**	-	-	-	-	-	-
Transit	Facility Type	D	Mixed Traffic	Mixed Traffic	Mixed Traffic						
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8	Vt/Vp ≥ 0.8	Vt/Vp ≥ 0.8						
	Level of Service		**D**	**D**	**D**	-	-	-	-	-	-
Truck	Truck Lane Width	B	> 3.7 m	> 3.7 m	> 3.7 m						
	Travel Lanes per Direction		1	1	1						
	Level of Service		**B**	**B**	**B**	-	-	-	-	-	-

Appendix E

TDM CHECKLIST

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)*	☑ Bicycle parking is to be provided in well lighted/visible areas no shelters provided.
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

FUTURE BACKGROUND 2020 SYNCHRO ANALYSIS OUTPUT

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	41	478	319	28	17	11
Future Vol, veh/h	41	478	319	28	17	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	503	336	29	18	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	365	0	-	0	925	336
Stage 1	-	-	-	-	336	-
Stage 2	-	-	-	-	589	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1194	-	-	-	299	706
Stage 1	-	-	-	-	724	-
Stage 2	-	-	-	-	554	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1194	-	-	-	288	706
Mov Cap-2 Maneuver	-	-	-	-	288	-
Stage 1	-	-	-	-	698	-
Stage 2	-	-	-	-	554	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	15.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1194	-	-	-	288	706
HCM Lane V/C Ratio	0.036	-	-	-	0.062	0.016
HCM Control Delay (s)	8.1	-	-	-	18.3	10.2
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	0.1

Appendix G

FUTURE BACKGROUND 2025 SYNCHRO ANALYSIS OUTPUT

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	22	395	593	32	36	55
Future Vol, veh/h	22	395	593	32	36	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	416	624	34	38	58

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	658	0	-	0	1086	624
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	462	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	930	-	-	-	239	485
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	634	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	930	-	-	-	233	485
Mov Cap-2 Maneuver	-	-	-	-	233	-
Stage 1	-	-	-	-	521	-
Stage 2	-	-	-	-	634	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	17.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	930	-	-	-	233	485
HCM Lane V/C Ratio	0.025	-	-	-	0.163	0.119
HCM Control Delay (s)	9	-	-	-	23.4	13.4
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.6	0.4

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	69	527	353	149	109	45
Future Vol, veh/h	69	527	353	149	109	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	555	372	157	115	47

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	529	0	-	0	1073	372
Stage 1	-	-	-	-	372	-
Stage 2	-	-	-	-	701	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1038	-	-	-	244	674
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	492	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1038	-	-	-	227	674
Mov Cap-2 Maneuver	-	-	-	-	227	-
Stage 1	-	-	-	-	648	-
Stage 2	-	-	-	-	492	-

Approach	EB	WB	SB
HCM Control Delay, s	1	0	28.6
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1038	-	-	-	227	674
HCM Lane V/C Ratio	0.07	-	-	-	0.505	0.07
HCM Control Delay (s)	8.7	-	-	-	36	10.7
HCM Lane LOS	A	-	-	-	E	B
HCM 95th %tile Q(veh)	0.2	-	-	-	2.6	0.2

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	31	436	655	110	82	73
Future Vol, veh/h	31	436	655	110	82	73
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	459	689	116	86	77

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	805	0	-	0	1214	689
Stage 1	-	-	-	-	689	-
Stage 2	-	-	-	-	525	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	819	-	-	-	201	446
Stage 1	-	-	-	-	498	-
Stage 2	-	-	-	-	593	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	819	-	-	-	193	446
Mov Cap-2 Maneuver	-	-	-	-	193	-
Stage 1	-	-	-	-	478	-
Stage 2	-	-	-	-	593	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	27
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	819	-	-	-	193	446
HCM Lane V/C Ratio	0.04	-	-	-	0.447	0.172
HCM Control Delay (s)	9.6	-	-	-	37.9	14.7
HCM Lane LOS	A	-	-	-	E	B
HCM 95th %tile Q(veh)	0.1	-	-	-	2.1	0.6

Appendix H

TOTAL PROJECTED 2020 SYNCHRO ANALYSIS OUTPUT

Intersection						
Int Delay, s/veh	1.4					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	15	74	0	6	30
Future Vol, veh/h	0	15	74	0	6	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	16	78	0	6	32

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	122	78	0	0	78	0
Stage 1	78	-	-	-	-	-
Stage 2	44	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	873	983	-	-	1520	-
Stage 1	945	-	-	-	-	-
Stage 2	978	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	870	983	-	-	1520	-
Mov Cap-2 Maneuver	870	-	-	-	-	-
Stage 1	941	-	-	-	-	-
Stage 2	978	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.7	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	983	1520	-
HCM Lane V/C Ratio	-	-	0.016	0.004	-
HCM Control Delay (s)	-	-	8.7	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	45	478	319	38	41	21
Future Vol, veh/h	45	478	319	38	41	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	47	503	336	40	43	22

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	376	0	-	0	933	336
Stage 1	-	-	-	-	336	-
Stage 2	-	-	-	-	597	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1182	-	-	-	295	706
Stage 1	-	-	-	-	724	-
Stage 2	-	-	-	-	550	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1182	-	-	-	283	706
Mov Cap-2 Maneuver	-	-	-	-	283	-
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	550	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	16.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1182	-	-	-	283	706
HCM Lane V/C Ratio	0.04	-	-	-	0.153	0.031
HCM Control Delay (s)	8.2	-	-	-	20	10.3
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.5	0.1

Intersection	
Int Delay, s/veh	2.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	34	5	69	13	2	28
Future Vol, veh/h	34	5	69	13	2	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	36	5	73	14	2	29

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	113	80	0	0	87	0
Stage 1	80	-	-	-	-	-
Stage 2	33	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	884	980	-	-	1509	-
Stage 1	943	-	-	-	-	-
Stage 2	989	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	883	980	-	-	1509	-
Mov Cap-2 Maneuver	883	-	-	-	-	-
Stage 1	942	-	-	-	-	-
Stage 2	989	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	894	1509	-
HCM Lane V/C Ratio	-	-	0.046	0.001	-
HCM Control Delay (s)	-	-	9.2	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	4	2	8	10	0	5	0	19	0	0	0
Future Vol, veh/h	0	4	2	8	10	0	5	0	19	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	4	2	8	11	0	5	0	20	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	11	0	0	6	0	0	32	32	5	42	33	11
Stage 1	-	-	-	-	-	-	5	5	-	27	27	-
Stage 2	-	-	-	-	-	-	27	27	-	15	6	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1608	-	-	1615	-	-	976	861	1078	961	860	1070
Stage 1	-	-	-	-	-	-	1017	892	-	990	873	-
Stage 2	-	-	-	-	-	-	990	873	-	1005	891	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1608	-	-	1615	-	-	972	857	1078	940	856	1070
Mov Cap-2 Maneuver	-	-	-	-	-	-	972	857	-	940	856	-
Stage 1	-	-	-	-	-	-	1017	892	-	990	869	-
Stage 2	-	-	-	-	-	-	985	869	-	986	891	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	3.2	8.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1054	1608	-	-	1615	-	-	-
HCM Lane V/C Ratio	0.024	-	-	-	0.005	-	-	-
HCM Control Delay (s)	8.5	0	-	-	7.2	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

Intersection						
Int Delay, s/veh	5.5					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	19	4	10	0	10	24
Future Vol, veh/h	19	4	10	0	10	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	20	4	11	0	11	25

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	24	0	44	22
Stage 1	-	-	-	-	22	-
Stage 2	-	-	-	-	22	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1591	-	967	1055
Stage 1	-	-	-	-	1001	-
Stage 2	-	-	-	-	1001	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1591	-	960	1055
Mov Cap-2 Maneuver	-	-	-	-	960	-
Stage 1	-	-	-	-	994	-
Stage 2	-	-	-	-	1001	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.3	8.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1025	-	-	1591	-
HCM Lane V/C Ratio	0.035	-	-	0.007	-
HCM Control Delay (s)	8.6	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	8	57	0	12	95
Future Vol, veh/h	0	8	57	0	12	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	8	60	0	13	100

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	186	60	0	0	60	0
Stage 1	60	-	-	-	-	-
Stage 2	126	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	803	1005	-	-	1544	-
Stage 1	963	-	-	-	-	-
Stage 2	900	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	796	1005	-	-	1544	-
Mov Cap-2 Maneuver	796	-	-	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	900	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.6	0	0.8
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1005	1544	-
HCM Lane V/C Ratio	-	-	0.008	0.008	-
HCM Control Delay (s)	-	-	8.6	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	30	395	593	52	50	61
Future Vol, veh/h	30	395	593	52	50	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	32	416	624	55	53	64

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	679	0	-	0	1104	624
Stage 1	-	-	-	-	624	-
Stage 2	-	-	-	-	480	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	913	-	-	-	234	485
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	622	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	913	-	-	-	226	485
Mov Cap-2 Maneuver	-	-	-	-	226	-
Stage 1	-	-	-	-	515	-
Stage 2	-	-	-	-	622	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	19.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	913	-	-	-	226	485
HCM Lane V/C Ratio	0.035	-	-	-	0.233	0.132
HCM Control Delay (s)	9.1	-	-	-	25.7	13.6
HCM Lane LOS	A	-	-	-	D	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.9	0.5

Intersection						
Int Delay, s/veh	1.2					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	3	54	28	4	91
Future Vol, veh/h	20	3	54	28	4	91
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	3	57	29	4	96

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	176	72	0	0	86	0
Stage 1	72	-	-	-	-	-
Stage 2	104	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	814	990	-	-	1510	-
Stage 1	951	-	-	-	-	-
Stage 2	920	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	812	990	-	-	1510	-
Mov Cap-2 Maneuver	812	-	-	-	-	-
Stage 1	948	-	-	-	-	-
Stage 2	920	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	832	1510	-
HCM Lane V/C Ratio	-	-	0.029	0.003	-
HCM Control Delay (s)	-	-	9.5	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	8	4	16	6	0	3	0	11	0	0	0
Future Vol, veh/h	0	8	4	16	6	0	3	0	11	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	8	4	17	6	0	3	0	12	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	6	0	0	12	0	0	50	50	10	56	52	6
Stage 1	-	-	-	-	-	-	10	10	-	40	40	-
Stage 2	-	-	-	-	-	-	40	40	-	16	12	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1615	-	-	1607	-	-	950	841	1071	941	839	1077
Stage 1	-	-	-	-	-	-	1011	887	-	975	862	-
Stage 2	-	-	-	-	-	-	975	862	-	1004	886	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1615	-	-	1607	-	-	942	832	1071	923	830	1077
Mov Cap-2 Maneuver	-	-	-	-	-	-	942	832	-	923	830	-
Stage 1	-	-	-	-	-	-	1011	887	-	975	853	-
Stage 2	-	-	-	-	-	-	964	853	-	993	886	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.3	8.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1040	1615	-	-	1607	-	-	-
HCM Lane V/C Ratio	0.014	-	-	-	0.01	-	-	-
HCM Control Delay (s)	8.5	0	-	-	7.3	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	5.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	11	8	20	0	6	14
Future Vol, veh/h	11	8	20	0	6	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	8	21	0	6	15

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	20	0	58	16
Stage 1	-	-	-	-	16	-
Stage 2	-	-	-	-	42	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1596	-	949	1063
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	980	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1596	-	937	1063
Mov Cap-2 Maneuver	-	-	-	-	937	-
Stage 1	-	-	-	-	994	-
Stage 2	-	-	-	-	980	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.3	8.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1022	-	-	1596	-
HCM Lane V/C Ratio	0.021	-	-	0.013	-
HCM Control Delay (s)	8.6	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Appendix I

TOTAL PROJECTED 2025 SYNCHRO ANALYSIS OUTPUT

Intersection						
Int Delay, s/veh	0.5					
Movement	**WBL**	**WBR**	**NBT**	**NBR**	**SBL**	**SBT**
Lane Configurations						
Traffic Vol, veh/h	0	15	223	0	6	156
Future Vol, veh/h	0	15	223	0	6	156
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	16	235	0	6	164
Major/Minor	**Minor1**		**Major1**		**Major2**	
Conflicting Flow All	411	235	0	0	235	0
Stage 1	235	-	-	-	-	-
Stage 2	176	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	597	804	-	-	1332	-
Stage 1	804	-	-	-	-	-
Stage 2	855	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	594	804	-	-	1332	-
Mov Cap-2 Maneuver	594	-	-	-	-	-
Stage 1	800	-	-	-	-	-
Stage 2	855	-	-	-	-	-
Approach	**WB**		**NB**		**SB**	
HCM Control Delay, s	9.6		0		0.3	
HCM LOS	A					

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	804	1332	-
HCM Lane V/C Ratio	-	-	0.02	0.005	-
HCM Control Delay (s)	-	-	9.6	7.7	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	73	527	353	159	133	55
Future Vol, veh/h	73	527	353	159	133	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	77	555	372	167	140	58

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	539	0	-	0	1081	372
Stage 1	-	-	-	-	372	-
Stage 2	-	-	-	-	709	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1029	-	-	-	241	674
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	488	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1029	-	-	-	223	674
Mov Cap-2 Maneuver	-	-	-	-	223	-
Stage 1	-	-	-	-	645	-
Stage 2	-	-	-	-	488	-

Approach	EB	WB	SB
HCM Control Delay, s	1.1	0	35
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1029	-	-	-	223	674
HCM Lane V/C Ratio	0.075	-	-	-	0.628	0.086
HCM Control Delay (s)	8.8	-	-	-	45	10.8
HCM Lane LOS	A	-	-	-	E	B
HCM 95th %tile Q(veh)	0.2	-	-	-	3.7	0.3

Intersection						
Int Delay, s/veh	1.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	34	5	218	13	2	154
Future Vol, veh/h	34	5	218	13	2	154
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	36	5	229	14	2	162

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	402	236	0	0	243	0
Stage 1	236	-	-	-	-	-
Stage 2	166	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	604	803	-	-	1323	-
Stage 1	803	-	-	-	-	-
Stage 2	863	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	603	803	-	-	1323	-
Mov Cap-2 Maneuver	603	-	-	-	-	-
Stage 1	801	-	-	-	-	-
Stage 2	863	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	623	1323	-
HCM Lane V/C Ratio	-	-	0.066	0.002	-
HCM Control Delay (s)	-	-	11.2	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	4	2	8	10	0	5	0	19	0	0	0
Future Vol, veh/h	0	4	2	8	10	0	5	0	19	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	4	2	8	11	0	5	0	20	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	11	0	0	6	0	0	32	32	5	42	33	11
Stage 1	-	-	-	-	-	-	5	5	-	27	27	-
Stage 2	-	-	-	-	-	-	27	27	-	15	6	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1608	-	-	1615	-	-	976	861	1078	961	860	1070
Stage 1	-	-	-	-	-	-	1017	892	-	990	873	-
Stage 2	-	-	-	-	-	-	990	873	-	1005	891	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1608	-	-	1615	-	-	972	857	1078	940	856	1070
Mov Cap-2 Maneuver	-	-	-	-	-	-	972	857	-	940	856	-
Stage 1	-	-	-	-	-	-	1017	892	-	990	869	-
Stage 2	-	-	-	-	-	-	985	869	-	986	891	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	3.2	8.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1054	1608	-	-	1615	-	-	-
HCM Lane V/C Ratio	0.024	-	-	-	0.005	-	-	-
HCM Control Delay (s)	8.5	0	-	-	7.2	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	5.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	19	4	10	0	10	24
Future Vol, veh/h	19	4	10	0	10	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	20	4	11	0	11	25

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	24	0	44	22
Stage 1	-	-	-	-	22	-
Stage 2	-	-	-	-	22	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1591	-	967	1055
Stage 1	-	-	-	-	1001	-
Stage 2	-	-	-	-	1001	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1591	-	960	1055
Mov Cap-2 Maneuver	-	-	-	-	960	-
Stage 1	-	-	-	-	994	-
Stage 2	-	-	-	-	1001	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.3	8.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1025	-	-	1591	-
HCM Lane V/C Ratio	0.035	-	-	0.007	-
HCM Control Delay (s)	8.6	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	8	143	0	12	159
Future Vol, veh/h	0	8	143	0	12	159
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	8	151	0	13	167

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	344	151	0	0	151	0
Stage 1	151	-	-	-	-	-
Stage 2	193	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	652	895	-	-	1430	-
Stage 1	877	-	-	-	-	-
Stage 2	840	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	645	895	-	-	1430	-
Mov Cap-2 Maneuver	645	-	-	-	-	-
Stage 1	868	-	-	-	-	-
Stage 2	840	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.1	0	0.5
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	895	1430	-
HCM Lane V/C Ratio	-	-	0.009	0.009	-
HCM Control Delay (s)	-	-	9.1	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	436	655	130	96	79
Future Vol, veh/h	39	436	655	130	96	79
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	400	-	-	800	300	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	41	459	689	137	101	83

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	826	0	-	0	1230	689
Stage 1	-	-	-	-	689	-
Stage 2	-	-	-	-	541	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	805	-	-	-	196	446
Stage 1	-	-	-	-	498	-
Stage 2	-	-	-	-	583	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	805	-	-	-	186	446
Mov Cap-2 Maneuver	-	-	-	-	186	-
Stage 1	-	-	-	-	473	-
Stage 2	-	-	-	-	583	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	31.6
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	805	-	-	-	186	446
HCM Lane V/C Ratio	0.051	-	-	-	0.543	0.186
HCM Control Delay (s)	9.7	-	-	-	45.3	14.9
HCM Lane LOS	A	-	-	-	E	B
HCM 95th %tile Q(veh)	0.2	-	-	-	2.8	0.7

Intersection						
Int Delay, s/veh	0.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	3	140	28	4	155
Future Vol, veh/h	20	3	140	28	4	155
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	3	147	29	4	163

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	333	162	0	0	176	0
Stage 1	162	-	-	-	-	-
Stage 2	171	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	662	883	-	-	1400	-
Stage 1	867	-	-	-	-	-
Stage 2	859	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	660	883	-	-	1400	-
Mov Cap-2 Maneuver	660	-	-	-	-	-
Stage 1	864	-	-	-	-	-
Stage 2	859	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.5	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	682	1400	-
HCM Lane V/C Ratio	-	-	0.035	0.003	-
HCM Control Delay (s)	-	-	10.5	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	8	4	16	6	0	3	0	11	0	0	0
Future Vol, veh/h	0	8	4	16	6	0	3	0	11	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	8	4	17	6	0	3	0	12	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	6	0	0	12	0	0	50	50	10	56	52	6
Stage 1	-	-	-	-	-	-	10	10	-	40	40	-
Stage 2	-	-	-	-	-	-	40	40	-	16	12	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1615	-	-	1607	-	-	950	841	1071	941	839	1077
Stage 1	-	-	-	-	-	-	1011	887	-	975	862	-
Stage 2	-	-	-	-	-	-	975	862	-	1004	886	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1615	-	-	1607	-	-	942	832	1071	923	830	1077
Mov Cap-2 Maneuver	-	-	-	-	-	-	942	832	-	923	830	-
Stage 1	-	-	-	-	-	-	1011	887	-	975	853	-
Stage 2	-	-	-	-	-	-	964	853	-	993	886	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.3	8.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	1040	1615	-	-	1607	-	-	-
HCM Lane V/C Ratio	0.014	-	-	-	0.01	-	-	-
HCM Control Delay (s)	8.5	0	-	-	7.3	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection						
Int Delay, s/veh	5.4					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	11	8	20	0	6	14
Future Vol, veh/h	11	8	20	0	6	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	12	8	21	0	6	15

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	20	0	58	16
Stage 1	-	-	-	-	16	-
Stage 2	-	-	-	-	42	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1596	-	949	1063
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	980	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1596	-	937	1063
Mov Cap-2 Maneuver	-	-	-	-	937	-
Stage 1	-	-	-	-	994	-
Stage 2	-	-	-	-	980	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.3	8.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1022	-	-	1596	-
HCM Lane V/C Ratio	0.021	-	-	0.013	-
HCM Control Delay (s)	8.6	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-