

FORECASTING REPORT

**THUNDER ROAD & BOUNDARY ROAD
PROPOSED INDUSTRIAL DEVELOPMENT
CITY OF OTTAWA**

**PREPARED FOR:
THUNDER ROAD DEVELOPMENTS (2019) INC.**

DRAFT

**PREPARED BY:
C.F. CROZIER & ASSOCIATES INC.
2800 HIGH POINT DRIVE, SUITE 100
MILTON, ON
L9T 6P4**

DECEMBER 2020

CFCA FILE NO. 1909-5772

The material in this report reflects best judgment in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. C.F. Crozier & Associates Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



TABLE OF CONTENTS

1.0	Introduction	1
1.1	Background	1
1.2	Subject Property	1
1.3	Development Proposal	1
2.0	Trip Generation Forecasts	2
2.1	Auto Trip Generation	2
2.2	Non-Auto Trip Generation	3
3.0	Mode Shares.....	4
3.1	Existing Mode Shares	4
3.2	Future Mode Share Targets	5
4.0	Trip Distribution and Assignment	6
4.1	Employee Trip Distribution	6
4.2	Heavy Truck Trip Distribution	7
4.3	Trip Assignment	8
5.0	Background Network Travel Demands	8
5.1	Background Transportation Network Plans.....	8
5.2	Background Growth	9
5.3	Background Development	9
6.0	Demand Rationalization.....	9
7.0	Summary of Forecasting	10

LIST OF TABLES

Table 1:	Auto Trip Generation
Table 2:	Non-Auto Trip Generation
Table 3:	Existing Mode Share
Table 4:	Future Mode Share Targets

LIST OF APPENDICES

Appendix A:	Conceptual Site Plan
Appendix B:	NCR Survey Data
Appendix C:	Trip Distribution Analysis
Appendix D:	Growth Rate Analysis
Appendix E:	CRRC TIS Excerpts

LIST OF FIGURES

Figure 1:	Site Location Plan
------------------	--------------------

1.0 Introduction

1.1 Background

Crozier & Associates Inc. (Crozier) was retained by Thunder Road Developments (2019) Inc. to prepare a Transportation Impact Assessment in support of the Official Plan Amendment (OPA), Zoning By-Law Amendment (ZBA) and Site Plan Approval (SPA) applications for the proposed industrial development located at Thunder Road and Boundary Road in the City of Ottawa.

Per the City of Ottawa's "Transportation Impact Assessment Guidelines (2017)", a Forecasting Report is required to be submitted to the City of Ottawa (the City) prior to commencing the Transportation Impact Assessment (TIA). This report is to fulfill that requirement.

The subject property is within the Ministry of Transportation of Ontario (MTO) Permit Controlled Area and thus will be subject to MTO review and approval, including conformance to the MTO's "Traffic Impact Study Guideline" (September 2014).

The Screening and Scoping Report prepared by Crozier was submitted to the City and MTO in November 2020 as part of the City's TIA process. The report was approved by the City and MTO. Thus, the methodology proposed in this report for the Forecasting Report is based on the approved scope of work per the Screening and Scoping Report.

1.2 Subject Property

The subject property covers an area of approximately 43.15 acres and is located in a rural area east of the urban core of Ottawa. The subject property is located south of Highway 417 and near the Amazon Facility east of Boundary Road that was constructed in 2019. Highway 417 functions as the transportation link between Ottawa and Quebec.

The subject property is designated as "General Rural Area" per the City's Official Plan which permits farms, rural housing, wood lots and forests, small industries, golf courses and existing clusters of residential subdivisions and severances and commercial development. It is noted that the east side of Boundary Road is identified as "Employment Area" per the City's Official Plan.

The subject property is currently zoned as "Rural Countryside Zone" (RU) per the City's Zoning By-Law 2008-250. The purpose of the RU zone is to "accommodate agricultural, forestry, country residential lots created by severance and other land uses characteristic of Ottawa's countryside, in areas designated as General Rural Area, Rural Natural Features and Greenbelt Rural in the Official Plan..."

The subject property is bound by Thunder Road to the north, treed areas to the south and west, and Boundary Road to the east. With the exception of two residences at Boundary Road and a residential dwelling on Thunder Road, the subject property is primarily vacant. **Figure 1** contains the Site Location Plan.

1.3 Development Proposal

Per the Conceptual Site Plan prepared by Ware Malcomb dated November 2, 2020 (see **Appendix A**), the development proposes the following:

- An industrial building (Industrial Building 1) with 600,611 sq. ft of Gross Floor Area (GFA), 426 auto parking spaces, 98 trailer parking spaces and two full-moves accesses to Thunder Road;
- An industrial building (Industrial Building 2) with 41,449 sq. ft of GFA, 57 auto parking spaces and a full-moves access to Thunder Road, and
- An industrial building (Industrial Building 3) with 31,988 sq. ft of GFA, 52 auto parking spaces and a full-moves access to Boundary Road opposite the south Amazon access.

The development is expected to be built-out and occupied within a five-year horizon (i.e. 2025).

2.0 Trip Generation Forecasts

Trip generation for the proposed development was forecasted using the latest published data from the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. The ITE Trip Generation Manual is a compendium of industry collected trip generation data across North America for a variety of land uses and is used industry wide as a source for trip generation forecasts.

2.1 Auto Trip Generation

The trip generation rates for Land Use Category (LUC) 150 "Warehousing" were applied to the proposed industrial buildings to forecast auto trips generated by the buildings. The trip generation rates per ITE are 0.17 trips per 1,000 sq. ft of GFA during the weekday a.m. peak hour and 0.19 trips per 1,000 sq. ft of GFA during the weekday p.m. peak hour.

The total trip generation for the proposed industrial buildings was categorized into passenger cars and heavy truck traffic. Per the ITE Trip Generation Handbook (3rd Edition), Table I.1, approximately 20% of site traffic generated by LUC 150 "Warehousing" on a weekday is heavy truck traffic. Site traffic generated by similar land use LUC 130 "Industrial Park" consists of between 1-31% of heavy truck traffic during the weekday peak hours with an average of 13%, and site traffic generated by similar land use LUC 152 "High-Cube Warehouse/Distribution Centre" consists of between 9-29% of heavy truck traffic during the weekday peak hours. Therefore, an estimate of 20% for heavy truck traffic is considered reasonable.

Table 1 outlines the auto trip generation for the proposed development.

Table 1: Auto Trip Generation

Building	GFA	Land use	Trips Generated – A.M. Peak			Trips Generated – P.M. Peak		
			In	Out	Total	In	Out	Total
Total Auto Trip Generation								
1	600,611 sq. ft	Industrial	79 (77%)	23 (23%)	102 (0.17)	31 (27%)	83 (73%)	114 (0.19)
2	41,449 sq. ft	Industrial	5 (77%)	2 (23%)	7 (0.17)	2 (27%)	6 (73%)	8 (0.19)
3	31,988 sq. ft	Industrial	4 (77%)	1 (23%)	5 (0.17)	2 (27%)	4 (73%)	6 (0.19)
DEVELOPMENT TOTAL:			88	26	114	35	93	128
Passenger Car Trip Generation (80%)								
1	600,611 sq. ft	Industrial	63	18	81	25	66	91
2	41,449 sq. ft	Industrial	4	2	6	2	5	7
3	31,988 sq. ft	Industrial	3	1	4	2	3	5
DEVELOPMENT TOTAL:			70	21	91	29	74	103
Heavy Truck Trip Generation (20%)								
1	600,611 sq. ft	Industrial	16	5	21	6	17	23
2	41,449 sq. ft	Industrial	1	0	1	0	1	1
3	31,988 sq. ft	Industrial	1	0	1	0	1	1
DEVELOPMENT TOTAL:			18	5	23	6	19	25

The full build-out of the proposed development is expected to generate approximately 91 and 103 total two-way passenger car trips during the weekday a.m. and p.m. peak hour, respectively, and approximately 23 and 25 total two-way heavy truck trips during the weekday a.m. and p.m. peak hour, respectively.

Given that the proposed development is solely industrial use, no trip synergy is expected between the buildings and no pass-by trips are expected to be generated by the development. Therefore, no internal trip synergy reductions or pass-by trip reductions were applied.

2.2 Non-Auto Trip Generation

The City's TIA Guidelines provide methodology for forecasting non-auto trips using the ITE Trip Generation Rates, as follows:

- Assume a 10% non-auto mode share for trips generated by the proposed development for low-density areas with low transit mode shares; and
- Assume an average vehicle occupancy of 1.15 for the purposes of translating auto trips to person trips.

The methodology outlined above equates to a factor of 1.28 to be applied to the ITE vehicle trip rates to forecast person trips. The resultant person trip generation rates are 0.22 trips per 1,000 sq. ft of GFA

during the weekday a.m. peak hour and 0.24 trips per 1,000 sq. ft of GFA during the weekday p.m. peak hour.

Table 2 outlines the non-auto trip generation for the proposed development.

Table 2: Non-Auto Trip Generation

Building	GFA	Land use	Trips Generated – A.M. Peak			Trips Generated – P.M. Peak		
			In	Out	Total	In	Out	Total
Total Person Trip Generation								
1	600,611 sq. ft	Industrial	102 (77%)	30 (23%)	132 (0.22)	39 (27%)	105 (73%)	144 (0.24)
2	41,449 sq. ft	Industrial	7 (77%)	2 (23%)	9 (0.22)	3 (27%)	7 (73%)	10 (0.24)
3	31,988 sq. ft	Industrial	5 (77%)	2 (23%)	7 (0.22)	2 (27%)	6 (73%)	8 (0.24)
DEVELOPMENT TOTAL:			114	34	148	44	118	162
Non-Auto Trip Generation (10%)								
1	600,611 sq. ft	Industrial	10	3	13	4	11	15
2	41,449 sq. ft	Industrial	1	0	1	0	1	1
3	31,988 sq. ft	Industrial	1	0	1	0	1	1
DEVELOPMENT TOTAL:			12	3	15	4	13	17

The full build-out of the proposed development is expected to generate approximately 148 and 162 total person trips during the weekday a.m. and p.m. peak hour, respectively, and approximately 15 and 17 total non-auto trips during the weekday a.m. and p.m. peak hour, respectively.

3.0 Mode Shares

3.1 Existing Mode Shares

The National Capital Region (NCR) Origin-Destination survey was reviewed to identify existing mode shares in the study area for transit, walking, cycling, auto passengers and auto trips for the Traffic Assessment Zone (TAZ) that contains the proposed development.

The subject property is located in the Rural Southeast TAZ. Thus, the latest census data (2011) was analyzed for the Rural Southeast TAZ. Specifically, the mode shares for trips entering and exiting the Rural Southeast TAZ during the weekday a.m. and p.m. peak periods (6:30 a.m. – 9:00 a.m., and 3:30 p.m. – 6:00 p.m.) were analyzed and are outlined in **Table 3**.

Appendix B contains the NCR survey data.

Table 3: Existing Mode Share

Travel Mode	Weekday A.M. Peak Period		Weekday P.M. Peak Period		Average	Assumed Existing for Study Area
	Inbound	Outbound	Inbound	Outbound		
Auto Driver	69%	68%	73%	64%	69%	77%
Auto Passenger	9%	14%	18%	30%	18%	20%
Transit	0%	6%	5%	3%	3%	3%
Cycling	0%	0%	0%	0%	0%	0%
Walking	2%	0%	0%	0%	0%	0%
Other ¹	20%	12%	4%	3%	10%	0%
Total	100%	100%	100%	100%	100%	100%

Note 1: Per the NCR survey methodology, "other" refers to trips made by school bus, paratransit, taxi, motorcycle/scooter, intercity/chartered bus, ferry, VIVA Rail or air.

As outlined above, the average auto mode share is approximately 87% and the average non-auto mode share is approximately 13%. It is noted that the mode share for "other" is significantly higher during the weekday a.m. peak hour compared to the weekday p.m. peak hour. This could be attributed to school bus activity during the morning school hours which overlap with the weekday a.m. commuter peak hours, whereas afternoon school hours don't typically overlap with weekday p.m. commuter peak hours.

It is further noted that the Rural Southeast TAZ consists of suburban areas such as Greely and Metcave which may act as the origin or destination points for walking and other trips such as school bus and taxi. The subject lands are located in a rural area with no nearby suburban areas that would act as origin or destination points for walking trips and other trips made by school bus, ferry, rail or air.

Therefore, the existing "other" mode share for the immediate study area would realistically be expected to be none or negligible at best. Thus, the mode share for auto driver and auto passenger would be expected to be higher than the average from the census data. The transit mode share assumption of 3% is also considered conservative as the nearest transit facility in the study area is the Route 222 (OC Transpo) bus stop at the GreyHawk Golf Club located 1.25 kilometres north of the subject property and there are no existing pedestrian facilities on Boundary Road in the area.

Based on these assumptions, the existing non-auto mode share in the study area is only 3% which is less than the City's standard base assumption of 10% for low-density areas. This means that the person and non-auto trip generation forecasts outlined in **Table 2** may be overstated.

3.2 Future Mode Share Targets

Future mode share targets have been established for the proposed development taking into account the context of the development proposal, the assumed horizon year of 2025 for build-out, planned future roadway capacity and alternative transportation infrastructure improvements in the study area, and non-auto trip generation opportunities of the proposed development.

Table 4 outlines the future mode share targets for the proposed development.

Table 4: Future Mode Share Targets

Travel Mode	Assumed Existing Mode Share for Study Area	Target Mode Share (2025)	Rationale
Auto Driver	77%	65% (-12%)	Potential to increase auto passenger and transit mode shares may result in reductions in single-occupant vehicle (SOV) trips
Auto Passenger	20%	25% (+5%)	Potential for development to promote carpooling (e.g. provide preferred carpool parking spaces) to reduce SOV trips
Transit	3%	10% (+7%)	Potential to extend existing Route 222 transit service from Boundary Road (north) to service subject property and increase transit as a viable mode of transportation
Cycling	0%	0%	Rural area with no nearby origin/destination points for cycling or walking trips, no planned cycling or walking infrastructure improvements in the study area, warehouse distribution nature of development typically not associated with cycling or walking trips
Walking	0%	0%	
Total	100%	100%	--

As outlined above, a heavy reliance on auto travel is still expected in the future given the warehouse distribution nature of the proposed development, the rural context of the study area with no nearby origin or destination points for walking or cycling trips, and the absence of planned alternative transportation infrastructure improvements in the study area.

However, there are potential opportunities for the proposed development to reduce single-occupant vehicle (SOV) trips by promoting carpooling (e.g. provide preferred carpool parking spaces) and co-ordinating with the City to extend the existing Route 222 transit service from Boundary Road (north) to service the subject property, thus increasing transit opportunities for employees of the proposed development. The latter opportunity would have to be confirmed by City staff as a consideration in the future.

Increasing the transit mode share to 10% in the future would line up with the City's standard base assumption of 10% non-auto trips for developments in low density areas. If a 10% transit mode share is achieved in the future, then the person and non-auto trip generation forecasts outlined in **Table 2** would be applicable.

4.0 Trip Distribution and Assignment

4.1 Employee Trip Distribution

The employee trips generated by the proposed development will be distributed to the road network based on origin and destination data from the NCR survey (2011) for the Rural Southeast and Rural East TAZ, given that the subject property is adjacent to the Rural East TAZ. The percentage of trips from origin points outside of the study area entering the study area during the weekday a.m. peak hour were analyzed, and the following trip distribution was derived:

- 35% to and from the south via Boundary Road
- 5% to and from the south/west via Mitch Owens Road
- 20% to and from the north via Boundary Road
- 25% to and from the west via Highway 417
- 15% to and from the east via Highway 417

Appendix B contains the NCR survey data and **Appendix C** contains the trip distribution analysis based on percentage of trips from various origin points.

It is noted that this trip distribution is similar to the trip distribution that was applied to the "Transportation Impact Study Addendum #1" prepared by NOVATECH for the Amazon Warehouse and Distribution Facility (YOW1) that was recently constructed in the study area. The study was prepared in April 2018 and is herein referred to as the NOVATECH study.

Employee trip distribution was derived in the NOVATECH study based on:

- origin and destination data provided by the proponent;
- origin and destination data from the NCR survey (2011) for the Rural Southeast and Rural East TAZ; and
- the population of surrounding communities per Statistics Canada.

The rationale listed above are accepted justification for trip distribution assumptions per the City's TIA Guidelines. Additionally, the 2011 NCR survey data used in the NOVATECH study still reflects the latest NCR survey data that is currently available.

The assumed trip distribution for employees in the NOVATECH study is as follows:

- 30% to and from the south via Boundary Road
- 5% to and from the south/west via Mitch Owens Road
- 20% to and from the north via Boundary Road
- 25% to and from the west via Highway 417
- 20% to and from the east via Highway 417

The study was approved by the City in 2018 and the proposed development will operate similarly to this warehouse and distribution facility. Therefore, given the similar land use and the similar trip distributions, the employee trip distribution in the NOVATECH study will be applied to this TIA for consistency.

4.2 Heavy Truck Trip Distribution

The heavy truck trips generated by the proposed development will be distributed to the road network based on expected catchment areas for heavy trucks. The City of Ottawa and surrounding areas, as well as the Gatineau areas of Quebec are considered to be the major truck origin and destination points to the west, and the Montreal and surrounding areas are considered to be the major truck origin and destination point to the east. Therefore, a reasonable truck distribution is as follows:

- 60% to and from the west via Highway 417
- 40% to and from the east via Highway 417

Heavy truck trip distribution was derived in the NOVATECH study based on logical routing assumptions (given Ottawa to the west and Quebec to the east via Highway 417), as follows:

- 65% to and from the west via Highway 417
- 35% to and from the east via Highway 417

Given the similar land use and the similar assumed trip distributions, the heavy truck trip distribution in the NOVATECH study will be applied to this TIA for consistency.

4.3 Trip Assignment

Employee and truck trips generated by the proposed development will be assigned to the road network based on the trip distribution outlined in Section 4.0. Trips are assumed to travel to and from their origin and destination points based on the most convenient route available and the route with the shortest travel time.

For Building 1, employees are expected to enter and exit the site via the easterly access to Thunder Road (located at the horizontal curve) and the proposed access to Boundary Road. Heavy trucks are expected to enter and exit the site via the westerly access to Thunder Road. The westerly access extends within the site as a drive aisle solely connecting to the truck loading area while employee parking connects solely to the drive aisle extending from the easterly access.

For Building 2, all employees and heavy trucks will enter and exit the site via the sole proposed access to Thunder Road.

For Building 3, employees are expected to enter and exit the site via the proposed access to Boundary Road. The proponent has stated that the intent for heavy truck circulation for Building 3 is to have trucks both enter and exit the site via the easterly access to Thunder Road (located at the horizontal curve) and access the Building 3 truck loading area via the drive aisle extending from the Thunder Road site access.

5.0 Background Network Travel Demands

5.1 Background Transportation Network Plans

No future roadway capacity improvements nor alternative transportation infrastructure plans have been identified on Thunder Road nor Boundary Road in the study area per the City's Transportation Master Plan (2013). Further, several roadway improvements have recently been implemented on Boundary Road to support the Amazon Facility build-out.

As mentioned in the Screening and Scoping Report, the City is currently updating their Transportation Master Plan which may include improvements to Thunder Road or Boundary Road. The City can confirm if any future improvements are planned in the study area. However, for the purposes of this study, no background roadway improvements are assumed to occur.

The NOVATECH study that was prepared for the Amazon Facility recommended that the City consider implementing traffic signal control and an auxiliary northbound left-turn lane at the intersection of Boundary Road and Mitch Owens Road. The study found that under 2017 existing conditions, traffic signals and an auxiliary left-turn lane were warranted at the intersection, and that under future total conditions, the forecasted operations at the intersection were poor and indicated the need for traffic

signal control. While this improvement has not been implemented as have the NOVATECH recommended improvements on Boundary Road at Highway 417 Eastbound Ramp Terminal and at Thunder Road / Amazon Way, this TIA will consider this recommendation. Therefore, the TIA will analyze the intersection of Boundary Road and Mitch Owens Road with and without the recommended improvements to compare operations and validate the NOVATECH recommendation.

5.2 Background Growth

Historical growth rates were derived from Annual Average Daily Traffic (AADT) and Summer Average Daily Traffic (SADT) trends on Highway 417 at the Boundary Road Interchange. The latest AADT and SADT data available are for 2016; thus, growth rates from 2012 to 2016 were analyzed. **Appendix D** contains the growth rate analysis.

A compounded growth rate of 0.19% compounded annually was determined from the AADT for Highway 417 between 2012 and 2016, and a compounded growth rate of 0.66% compounded annually was determined from the SADT for Highway 417 between 2012 and 2016. These low growth rates indicate low traffic growth in the study area.

The NOVATECH study applied a conservative growth rate of 2% compounded annually to existing traffic volumes to forecast future background traffic volumes. This growth rate is exclusive of background development generated traffic in the study area (discussed in Section 5.3). Additionally, the "Traffic Impact Study – Addendum 2" prepared by Taggart Group of Companies for the future Capital Region Resource Recovery Centre (CRRRC) in the study area also applied a growth rate of 2% compounded annually.

Therefore, given the calculated growth rates in the study area and the growth rate applied in background studies, the 2% growth rate compounded annually will be applied in this TIA for consistency.

5.3 Background Development

A review of the City's development applications map indicates a background development located on the properties at 5471-5613 Boundary Road and 5508-5800 Frontier Road. The development application is for Site Plan Control and is for a future waste management facility for the Capital Region Resource Recovery Centre (CRRRC). Thus, this development will be accounted for in the TIA.

Per Figure 3.1 from the "Traffic Impact Study – Addendum 2" prepared by Taggart Group of Companies for the CRRRC, the development is expected to add site traffic to the study intersections. The weekday peak hour volumes outlined in Figure 3.1 of the CRRRC were added to the boundary road network under 2025, 2030 and 2035 future background conditions. **Appendix E** contains excerpts from the CRRRC TIS.

6.0 Demand Rationalization

Preliminary capacity analysis was conducted for this forecasting report to determine if there are any locations or movements under future analysis scenarios where the forecasted demand exceeds capacity. Per the City's TIA guidelines, if the forecasted demand for a location or movement is expected to exceed capacity (i.e. volume-to-capacity ratio exceeding 1.00), then future travel demands must be rationalized to account for capacity limitations on the transportation network.

For the purposes of this analysis, the ultimate build-out scenario (2035 future total conditions) was analyzed. The analysis methodology follows the City's TIA guidelines for Synchro 9.2 inputs and modelling parameters and will be detailed in the TIA Analysis Report as part of the next step in the TIA process.

Preliminary modelling of 2035 future total conditions indicates that the only movement expected to operate with a volume-to-capacity ratio exceeding 1.00 is the eastbound left-turn movement at Boundary Road and Mitch Owens Road during the weekday p.m. peak hour, with a ratio of 1.01. These operations are attributed to the reduced available capacity for the eastbound left-turn movement given the stop-controlled approach and the heavy through volumes on Boundary Road, as evidenced by the high forecasted average delay of 85 seconds.

However, these results are consistent with the findings of the NOVATECH study and as discussed earlier, the NOVATECH study recommended that the City implement traffic signal control and an auxiliary northbound left-turn lane at the intersection to improve traffic operations. If traffic signals are implemented, then the intersection is expected to operate with an average delay less than 20 seconds and a maximum volume-to-capacity ratio less than 0.80, thus resulting in no movements on the road network under 2035 future total conditions expected to exceed capacity.

Therefore, the TIA will analyze the intersection of Boundary Road and Mitch Owens Road with and without the recommended improvements to rationalize the future forecasted demand at the intersection.

7.0 Summary of Forecasting

The full build-out of the proposed development is expected to generate:

- approximately 91 and 103 total two-way passenger car trips during the weekday a.m. and p.m. peak hour, respectively;
- approximately 23 and 25 total two-way heavy truck trips during the weekday a.m. and p.m. peak hour, respectively;
- approximately 148 and 162 total person trips during the weekday a.m. and p.m. peak hour, respectively; and
- approximately 15 and 17 total non-auto trips during the weekday a.m. and p.m. peak hour, respectively.

The average auto mode share in the planning zone containing the subject property is approximately 87% and the average non-auto mode share is approximately 13%. However, the average mode share of 10% for "other" modes of transportation such as school bus, paratransit, taxi, motorcycle/scooter, intercity/chartered bus, ferry, VIVA Rail or air is not considered realistic given the immediate study area with no nearby suburban areas that would act as origin or destination points for walking trips and other trips made by school bus, ferry, rail or air. Therefore, the assumed existing mode share for the study area is 97% auto and 3% non-auto (reflecting minimal transit services in the area).

A heavy reliance on auto travel is still expected in the future given the warehouse distribution nature of the proposed development and the auto reliant nature of the study area. However, there are potential opportunities for the proposed development to reduce single-occupant vehicle (SOV) trips by promoting carpooling (e.g. provide preferred carpool parking spaces) and co-ordinating with the City to extend the existing transit service from Boundary Road (north) to service the subject property, thus increasing transit opportunities for employees of the proposed development. The latter

opportunity would have to be confirmed by City staff as a consideration in the future. Thus, the target transit mode share is 10% compared to the existing 3% mode share for the study area.

Employee trips generated by the proposed development will be distributed to the road network based on origin-destination data and the population of surrounding communities per Statistics Canada. Heavy truck trips generated by the proposed development will be distributed to the road network based on expected catchment areas and logical routing assumptions for heavy trucks.

While no future roadway capacity improvements have been identified, the City can confirm if any future improvements are planned in the study area per the update of their Transportation Master Plan. The NOVATECH study that was prepared for the Amazon Facility recommended that the City consider implementing traffic signal control and an auxiliary northbound left-turn lane at the intersection of Boundary Road and Mitch Owens Road. While this improvement has not been implemented, this TIA will consider this recommendation and analyze the intersection of Boundary Road and Mitch Owens Road with and without the recommended improvements to compare operations and validate the NOVATECH recommendation.

For consistency with background studies in the area, a growth rate of 2% compounded annually will be applied in this TIA. The TIA will account for background traffic generated by the future Capital Region Resource Recovery Centre waste management facility south of the Amazon Facility.

Preliminary modelling of 2035 future total conditions indicates that the only movement expected to operate with a volume-to-capacity ratio exceeding 1.00 is the eastbound left-turn movement at Boundary Road and Mitch Owens Road during the weekday p.m. peak hour, with a ratio of 1.01. These operations are attributed to the reduced available capacity for the eastbound left-turn movement given the stop-controlled approach and the heavy through volumes on Boundary Road. If traffic signals are implemented, then the intersection is expected to operate with an average delay less than 20 seconds and a maximum volume-to-capacity ratio less than 0.80, thus resulting in no movements on the road network under 2035 future total conditions expected to exceed capacity.

Therefore, the TIA will analyze the intersection of Boundary Road and Mitch Owens Road with and without the recommended improvements to rationalize the future forecasted demand at the intersection.

Respectfully submitted by,

C.F. CROZIER & ASSOCIATES INC.

DRAFT

Alexander J.W. Fleming, MBA, P.Eng.
Associate

/DL

C.F. CROZIER & ASSOCIATES INC.

DRAFT

Darren J. Loro, C.E.T.
Transportation Technologist

J:\1900\1909-Avenue 31\5772-Thunder Rd\Reports\5772_Forecasting Report (December 2020).docx

APPENDIX A

Conceptual Site Plan

DRAFT

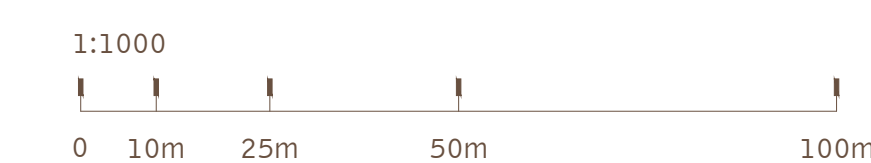
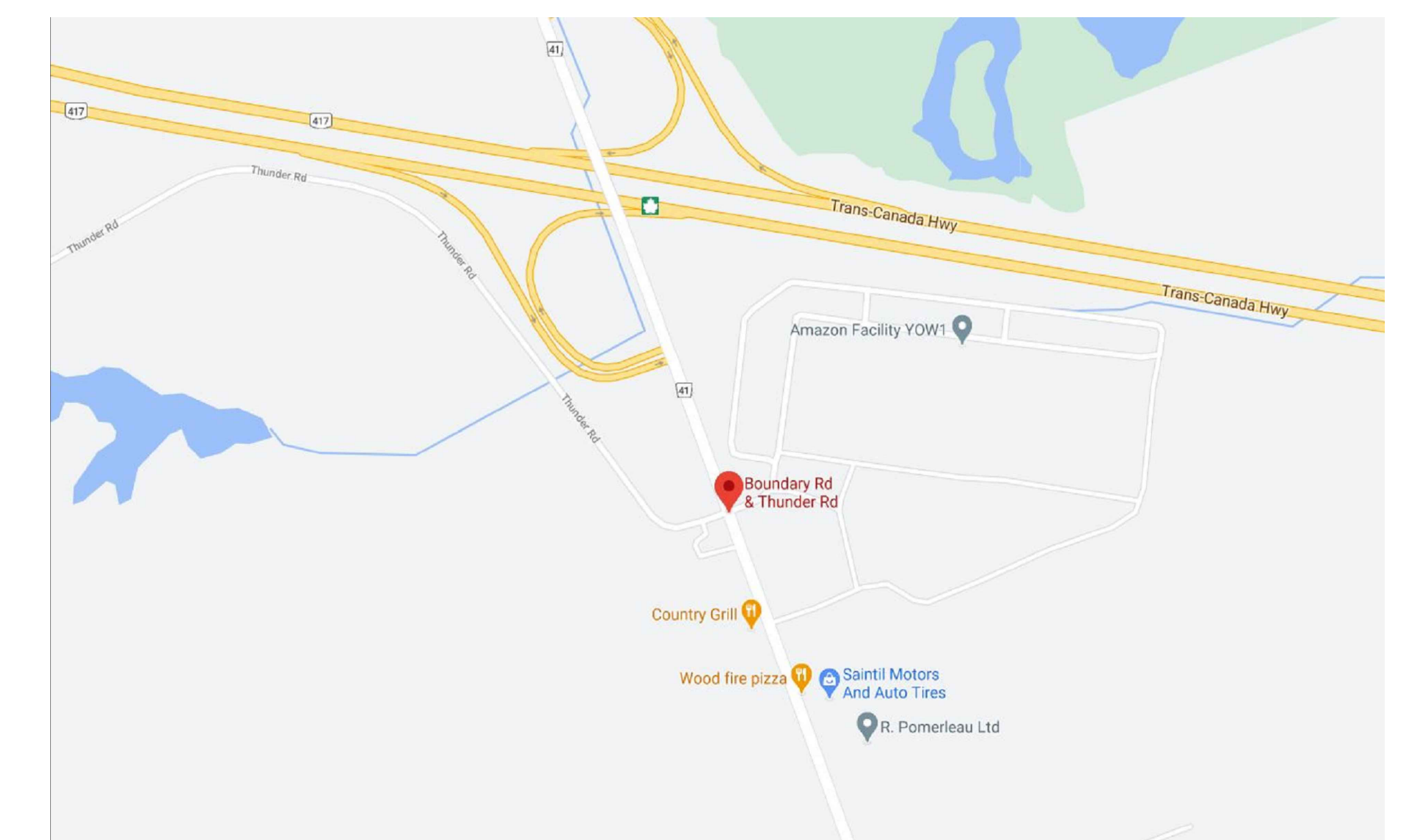


PROJECT DATA:

SITE 1 AREA:			
GROSS:		15.34 HA	153,400 m ²
DETECTION:	@ 3%	4,283 m ²	
NET:		3.42 HA	149,117 m ²
BUILDING 1 FOOTPRINT:			
BUILDING 3 FOOTPRINT:		55,799 m ²	
TOTAL:		2,972 m ²	
		58,771 m ²	
COVERAGE:			
GROSS:		38%	
NET:		39%	
BUILDING 1 PARKING PROVIDED:			
AUTO:		426 STALLS	
	<i>REQ. ACCESSIBLE</i>	9 STALLS	
TRAILER:		98 STALLS	
TRUCK DOCKS:			
▲ DOCK-HIGH DOORS		74	
● GRADE-LEVEL DOORS		4	
BUILDING 3 PARKING PROVIDED:			
AUTO:		52 STALLS	
	<i>REQ. ACCESSIBLE</i>	3 STALLS	
● GRADE-LEVEL DOORS		10	
SITE 2 AREA:			
GROSS:		2.41 HA	24,086 m ²
BUILDING FOOTPRINT:			
COVERAGE:		3,850 m ²	
GROSS:		16%	
PARKING PROVIDED:			
AUTO:		57 STALLS	
	<i>REQ. ACCESSIBLE</i>	@1.48/100 m ²	
		3 STALLS	
TRUCK DOCKS:			
▲ DOCK-HIGH DOORS		19	
● GRADE-LEVEL DOORS		2	

This conceptual design is based upon a preliminary review of entitlement requirements and on unverified and possibly incomplete site and/or building information, and is intended merely to assist in exploring how the project might be developed.

Boundary Source:
 GIS MAP & AERIAL IMAGE



scheme: 1

Conceptual Site Plan

Thunder Road Industrial
 Thunder Road & Boundary Road Ottawa, ON K4B 1P6

WARE MALCOMB

TOR20-0041-00
 11.02.2020

SHEET
1

APPENDIX B

NCR Survey Data

DRAFT

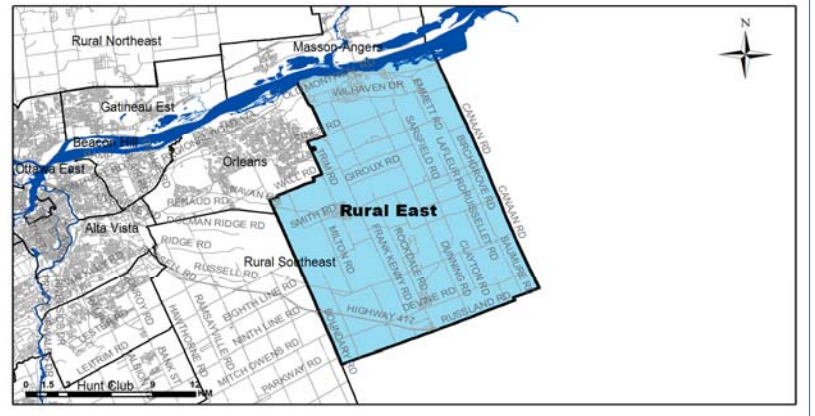
Demographic Characteristics

Population	11,420	Actively Travelled	9,090
Employed Population	5,480	Number of Vehicles	9,320
Households	4,090	Area (km ²)	287.5

Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	2,850	2,180	5,040
Part Time Employed	90	360	450
Student	1,280	1,320	2,600
Retiree	1,010	1,020	2,030
Unemployed	130	100	240
Homemaker	0	400	400
Other	50	90	150
Total:	5,410	5,480	10,900

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	500	490	990
Licensed Drivers	4,450	4,410	8,850
Telecommuters	0	80	80
Trips made by residents	13,710	14,700	28,410

Selected Indicators	
Daily Trips per Person (age 5+)	2.61
Vehicles per Person	0.82
Number of Persons per Household	2.79
Daily Trips per Household	6.95
Vehicles per Household	2.28
Workers per Household	1.34
Population Density (Pop/km ²)	40

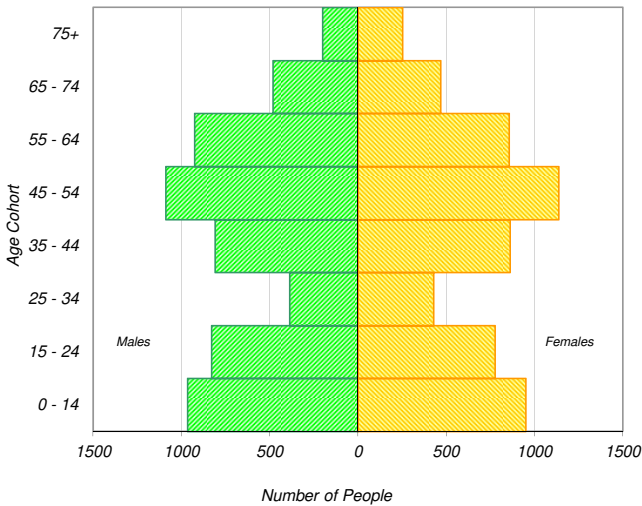


Household Size		
1 person	580	14%
2 persons	1,280	31%
3 persons	780	19%
4 persons	990	24%
5+ persons	460	11%
Total:	4,090	100%

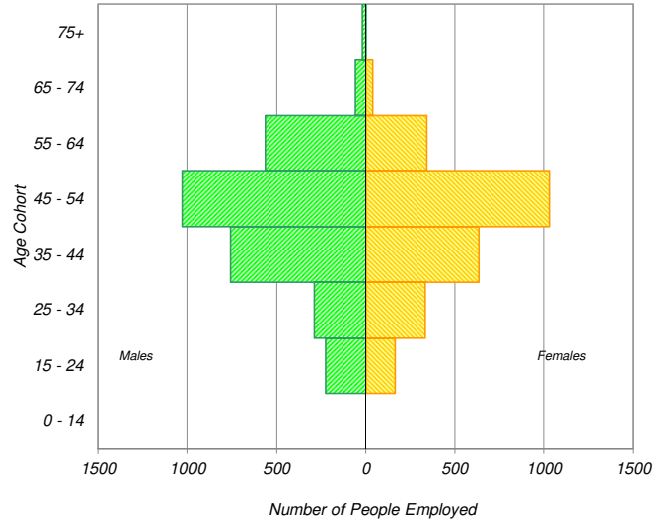
Households by Vehicle Availability		
0 vehicles	60	1%
1 vehicle	810	20%
2 vehicles	1,820	44%
3 vehicles	910	22%
4+ vehicles	490	12%
Total:	4,090	100%

Households by Dwelling Type		
Single-detached	3,270	80%
Semi-detached	270	7%
Townhouse	220	5%
Apartment/Condo	330	8%
Total:	4,090	100%

Population



Employed Population

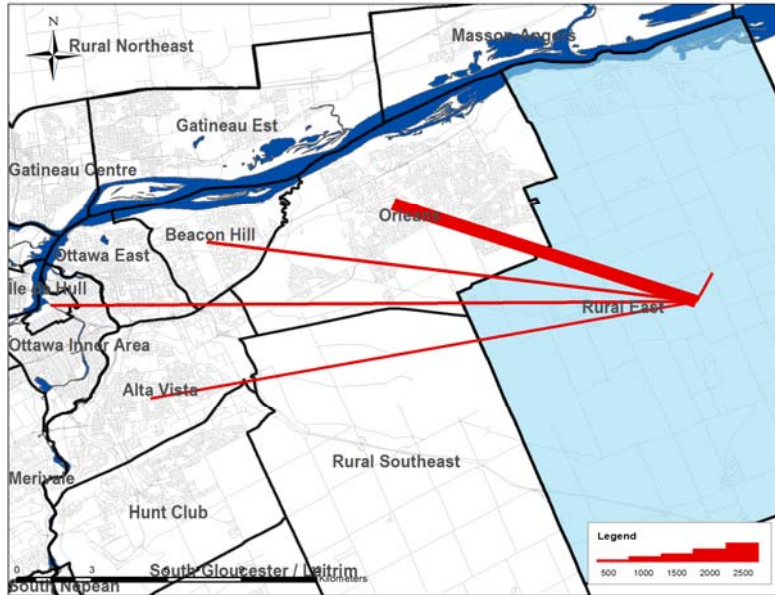


* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

Travel Patterns

Top Five Destinations of Trips from Rural East

AM Peak Period



Summary of Trips to and from Rural East

AM Peak Period (6:30 - 8:59)

Districts	Destinations of Trips From		Origins of Trips To	
	District	% Total	District	% Total
Ottawa Centre	450	8%	0	0%
Ottawa Inner Area	250	5%	70	3%
Ottawa East	160	3%	60	3%
Beacon Hill	350	7%	60	2%
Alta Vista	430	8%	110	4%
Hunt Club	140	3%	50	2%
Merivale	340	6%	10	0%
Ottawa West	60	1%	40	2%
Bayshore / Cedarview	50	1%	20	1%
Orléans	1,970	37%	1,000	38%
Rural East	820	15%	820	31%
Rural Southeast	30	1%	170	6%
South Gloucester / Leitrim	10	0%	0	0%
South Nepean	60	1%	20	1%
Rural Southwest	20	0%	0	0%
Kanata / Stittsville	30	1%	100	4%
Rural West	0	0%	0	0%
Île de Hull	70	1%	10	0%
Hull Périphérie	30	1%	10	0%
Plateau	0	0%	0	0%
Aylmer	0	0%	30	1%
Rural Northwest	0	0%	0	0%
Pointe Gatineau	0	0%	30	1%
Gatineau Est	0	0%	20	1%
Rural Northeast	40	1%	0	0%
Buckingham / Masson-Angers	0	0%	0	0%
Ontario Sub-Total:	5,170	97%	2,540	96%
Québec Sub-Total:	140	3%	100	4%
Total:	5,310	100%	2,640	100%

Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	3,600	27%	1,100	8%	710	19%
School	1,590	12%	790	6%	320	9%
Shopping	1,460	11%	300	2%	90	2%
Leisure	1,290	10%	1,160	9%	410	11%
Medical	480	4%	90	1%	0	0%
Pick-up / drive passenger	1,150	9%	580	4%	350	9%
Return Home	3,120	23%	8,900	67%	1,620	43%
Other	670	5%	460	3%	250	7%
Total:	13,360	100%	13,380	100%	3,750	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	2,280	51%	660	36%	270	33%
School	1,370	30%	740	41%	310	38%
Shopping	70	2%	0	0%	0	0%
Leisure	70	2%	100	5%	10	1%
Medical	120	3%	40	2%	0	0%
Pick-up / drive passenger	380	8%	50	3%	120	15%
Return Home	30	1%	130	7%	70	9%
Other	180	4%	100	5%	40	5%
Total:	4,500	100%	1,820	100%	820	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	60	3%	90	2%	60	9%
School	10	0%	0	0%	0	0%
Shopping	180	8%	20	0%	30	5%
Leisure	250	11%	340	8%	110	17%
Medical	120	5%	30	1%	0	0%
Pick-up / drive passenger	250	11%	150	4%	40	6%
Return Home	1,290	58%	3,510	85%	400	61%
Other	60	3%	10	0%	20	3%
Total:	2,220	100%	4,150	100%	660	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	30,490		12%
AM Peak Period	7,140	23%	11%
PM Peak Period	7,030	23%	9%

Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	8,560	64%	8,540	64%	2,210	59%
Auto Passenger	2,530	19%	2,660	20%	650	17%
Transit	1,210	9%	1,220	9%	20	1%
Bicycle	30	0%	30	0%	100	3%
Walk	20	0%	20	0%	440	12%
Other	1,000	7%	920	7%	330	9%
Total:	13,350	100%	13,390	100%	3,750	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	2,510	56%	830	46%	400	49%
Auto Passenger	750	17%	240	13%	170	21%
Transit	420	9%	550	30%	10	1%
Bicycle	0	0%	20	1%	10	1%
Walk	0	0%	20	1%	70	9%
Other	810	18%	150	8%	160	20%
Total:	4,490	100%	1,810	100%	820	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	1,280	58%	2,770	67%	360	55%
Auto Passenger	390	18%	730	18%	150	23%
Transit	420	19%	440	11%	10	2%
Bicycle	10	0%	10	0%	10	2%
Walk	20	1%	0	0%	60	9%
Other	100	5%	210	5%	70	11%
Total:	2,220	100%	4,160	100%	660	100%

Avg Vehicle Occupancy	From District		To District		Within District	
24 Hours	1.30		1.31		1.29	
AM Peak Period	1.30		1.29		1.43	
PM Peak Period	1.30		1.26		1.42	

Transit Modal Split	From District		To District		Within District	
24 Hours	10%		10%		1%	
AM Peak Period	11%		34%		2%	
PM Peak Period	20%		11%		2%	

Rural Southeast

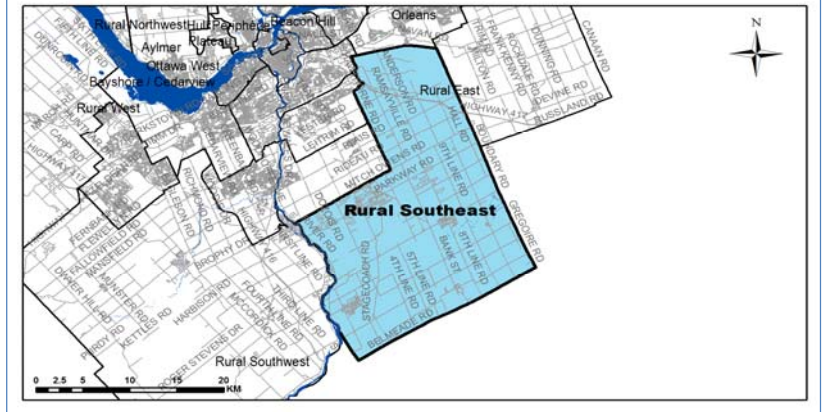
Demographic Characteristics

Population	26,840	Actively Travelled	21,350
Employed Population	13,620	Number of Vehicles	19,650
Households	9,320	Area (km ²)	508.6

Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	6,760	5,460	12,230
Part Time Employed	310	1,080	1,390
Student	3,300	2,860	6,160
Retiree	2,000	2,150	4,150
Unemployed	230	190	420
Homemaker	10	610	630
Other	200	290	490
Total:	12,820	12,640	25,460

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	590	700	1,290
Licensed Drivers	10,120	10,110	20,230
Telecommuters	10	80	100
Trips made by residents	32,130	35,050	67,170

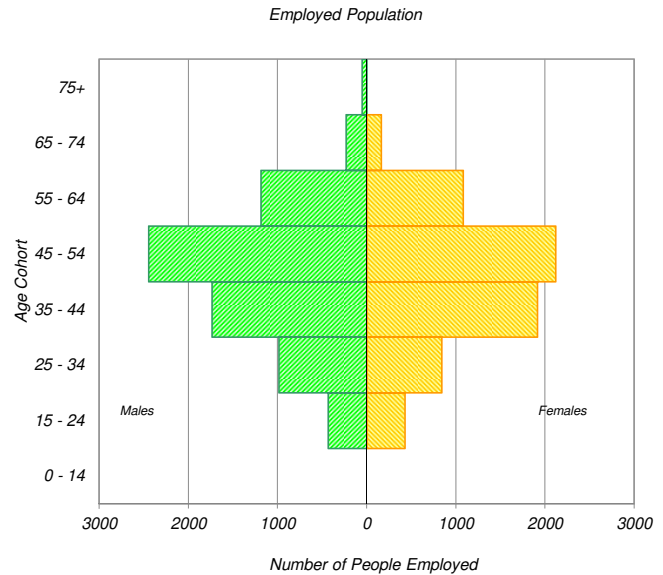
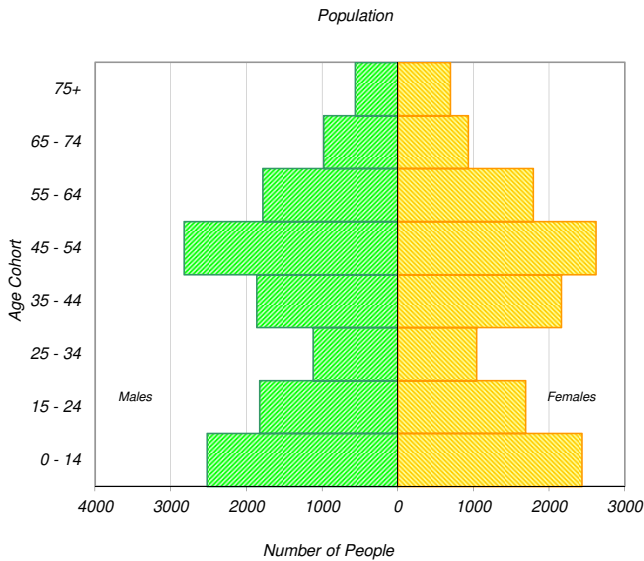
Selected Indicators	
Daily Trips per Person (age 5+)	2.64
Vehicles per Person	0.73
Number of Persons per Household	2.88
Daily Trips per Household	7.21
Vehicles per Household	2.11
Workers per Household	1.46
Population Density (Pop/km ²)	50



Household Size		
1 person	1,210	13%
2 persons	3,390	36%
3 persons	1,730	19%
4 persons	2,120	23%
5+ persons	880	9%
Total:	9,320	100%

Households by Vehicle Availability		
0 vehicles	200	2%
1 vehicle	1,760	19%
2 vehicles	5,180	56%
3 vehicles	1,470	16%
4+ vehicles	710	8%
Total:	9,320	100%

Households by Dwelling Type		
Single-detached	9,020	97%
Semi-detached	70	1%
Townhouse	140	2%
Apartment/Condo	90	1%
Total:	9,320	100%

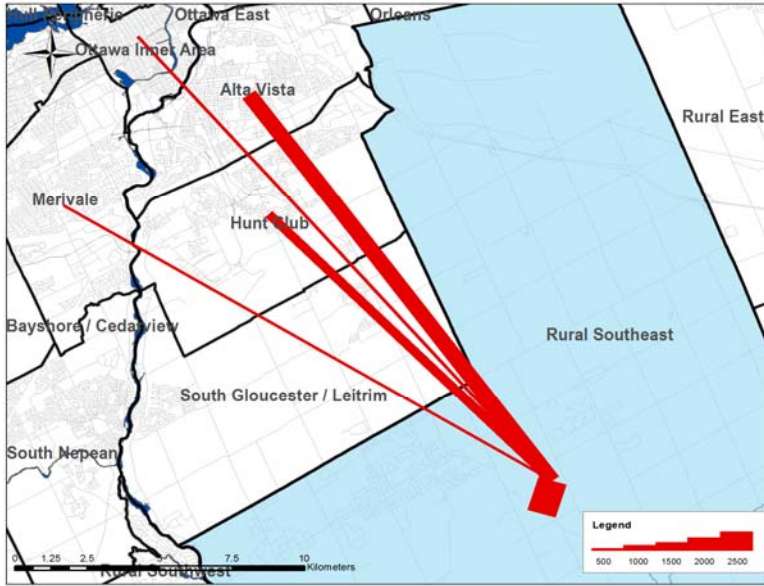


* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

Travel Patterns

Top Five Destinations of Trips from Rural Southeast

AM Peak Period



Summary of Trips to and from Rural Southeast

Districts	Destinations of Trips From		Origins of Trips To	
	District	% Total	District	% Total
Ottawa Centre	690	5%	20	0%
Ottawa Inner Area	830	6%	6	1%
Ottawa East	260	2%	40	1%
Beacon Hill	480	4%	10	0%
Alta Vista	1,550	12%	140	2%
Hunt Club	1,210	9%	190	3%
Merivale	960	7%	10	0%
Ottawa West	190	1%	50	1%
Bayshore / Cedarview	180	1%	40	1%
Orléans	290	2%	70	1%
Rural East	170	1%	30	0%
Rural Southeast	4,440	33%	4,440	73%
South Gloucester / Leitrim	570	4%	210	3%
South Nepean	580	4%	250	4%
Rural Southwest	520	4%	390	6%
Kanata / Stittsville	260	2%	50	1%
Rural West	0	0%	20	0%
Île de Hull	110	1%	0	0%
Hull Périphérie	0	0%	30	0%
Plateau	0	0%	0	0%
Aylmer	0	0%	0	0%
Rural Northwest	0	0%	0	0%
Pointe Gatineau	0	0%	0	0%
Gatineau Est	0	0%	0	0%
Rural Northeast	0	0%	70	1%
Buckingham / Masson-Angers	0	0%	0	0%
Ontario Sub-Total:	13,180	99%	6,020	98%
Québec Sub-Total:	110	1%	100	2%
Total:	13,290	100%	6,120	100%

Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	7,950	34%	1,470	6%	2,180	13%
School	2,360	10%	440	2%	2,570	16%
Shopping	2,600	11%	490	2%	620	4%
Leisure	2,230	9%	1,950	8%	1,270	8%
Medical	850	4%	300	1%	130	1%
Pick-up / drive passenger	2,180	9%	810	3%	1,170	7%
Return Home	3,780	16%	17,300	74%	7,300	45%
Other	1,580	7%	670	3%	1,110	7%
Total:	23,530	100%	23,430	100%	16,350	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	4,930	56%	710	42%	1,000	23%
School	1,870	21%	380	22%	2,280	51%
Shopping	270	3%	30	2%	30	1%
Leisure	140	2%	130	8%	130	3%
Medical	260	3%	20	1%	10	0%
Pick-up / drive passenger	800	9%	140	8%	380	9%
Return Home	160	2%	170	10%	230	5%
Other	440	5%	120	7%	370	8%
Total:	8,870	100%	1,700	100%	4,430	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	220	8%	60	1%	170	5%
School	50	2%	20	0%	0	0%
Shopping	450	16%	160	2%	110	3%
Leisure	530	19%	590	7%	240	7%
Medical	70	2%	70	1%	0	0%
Pick-up / drive passenger	390	14%	350	4%	210	6%
Return Home	830	29%	6,970	84%	2,670	75%
Other	320	11%	120	1%	150	4%
Total:	2,860	100%	8,340	100%	3,550	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	63,310		26%
AM Peak Period	15,000	24%	30%
PM Peak Period	14,750	23%	24%

Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	16,890	72%	16,830	72%	7,750	47%
Auto Passenger	4,160	18%	4,250	18%	2,670	16%
Transit	970	4%	960	4%	40	0%
Bicycle	50	0%	20	0%	0	0%
Walk	30	0%	40	0%	1,630	10%
Other	1,460	6%	1,320	6%	4,260	26%
Total:	23,560	100%	23,420	100%	16,350	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	5,960	67%	1,170	69%	1,550	35%
Auto Passenger	1,270	14%	150	9%	530	12%
Transit	530	6%	0	0%	20	0%
Bicycle	20	0%	0	0%	0	0%
Walk	0	0%	30	2%	400	9%
Other	1,070	12%	350	21%	1,940	44%
Total:	8,850	100%	1,700	100%	4,440	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	1,830	64%	6,110	73%	1,530	43%
Auto Passenger	860	30%	1,450	17%	640	18%
Transit	90	3%	430	5%	20	1%
Bicycle	0	0%	0	0%	0	0%
Walk	0	0%	0	0%	310	9%
Other	100	3%	340	4%	1,040	29%
Total:	2,880	100%	8,330	100%	3,540	100%

Avg Vehicle Occupancy	From District		To District		Within District	
24 Hours	1.25		1.25		1.34	
AM Peak Period	1.21		1.13		1.34	
PM Peak Period	1.47		1.24		1.42	

Transit Modal Split	From District		To District		Within District	
24 Hours	4%		4%		0%	
AM Peak Period	7%		0%		1%	
PM Peak Period	3%		5%		1%	

APPENDIX C

Trip Distribution Analysis

DRAFT

EMPLOYEE TRIP DISTRIBUTION ANALYSIS

District	Trips entering district (am)	% Total	Arriving From:	Route	Total %	Rounded %
Ottawa Inner Area	130	1%	Highway 417 (West)			
Ottawa East	110	1%	Highway 417 (West)	Highway 417 (West)	24%	25%
Beacon Hill	60	1%	Highway 417 (West)	Highway 417 (East)	17%	15%
Alta Vista	250	3%	Highway 417 (West)	Boundary Road (North)	18%	20%
Hunt Club	240	3%	Highway 417 (West)	Mitch Owens Road (West)	5%	5%
Ottawa West	90	1%	Highway 417 (West)	Boundary Road (South)	36%	35%
Bayshore / Cedarview	60	1%	Highway 417 (West)			
Orleans	1070	12%	Boundary Road (North)			
Rural East	820	9%	Highway 417 (East)			
Rural Southeast	4570	52%	<i>10% Highway 417 (West), 5% Highway 417 (East), 5% Boundary Road (North), 32% Boundary Road (South)</i>			
South Gloucester / Leitrim	210	2%	Mitch Owens Road (West)			
South Nepean	270	3%	Mitch Owens Road (West)			
Rural Southwest	390	4%	Boundary Road (South)			
Kanata / Stittsville	150	2%	Highway 417 (West)			
Ile de Hull	10	0%	Highway 417 (West)			
Hull Periphère	10	0%	Highway 417 (West)			
Alymer	30	0%	Highway 417 (West)			
Pointe Gatineau	30	0%	Highway 417 (West)			
Gatineau Est	20	0%	Highway 417 (West)			
Rural Northeast	70	1%	Boundary Road (North)			
Quebec	200	2%	Highway 417 (East)			
	8790	100%				

APPENDIX D

Growth Rate Analysis

DRAFT

Highway 417 and Boundary Road Interchange*MTO Data*

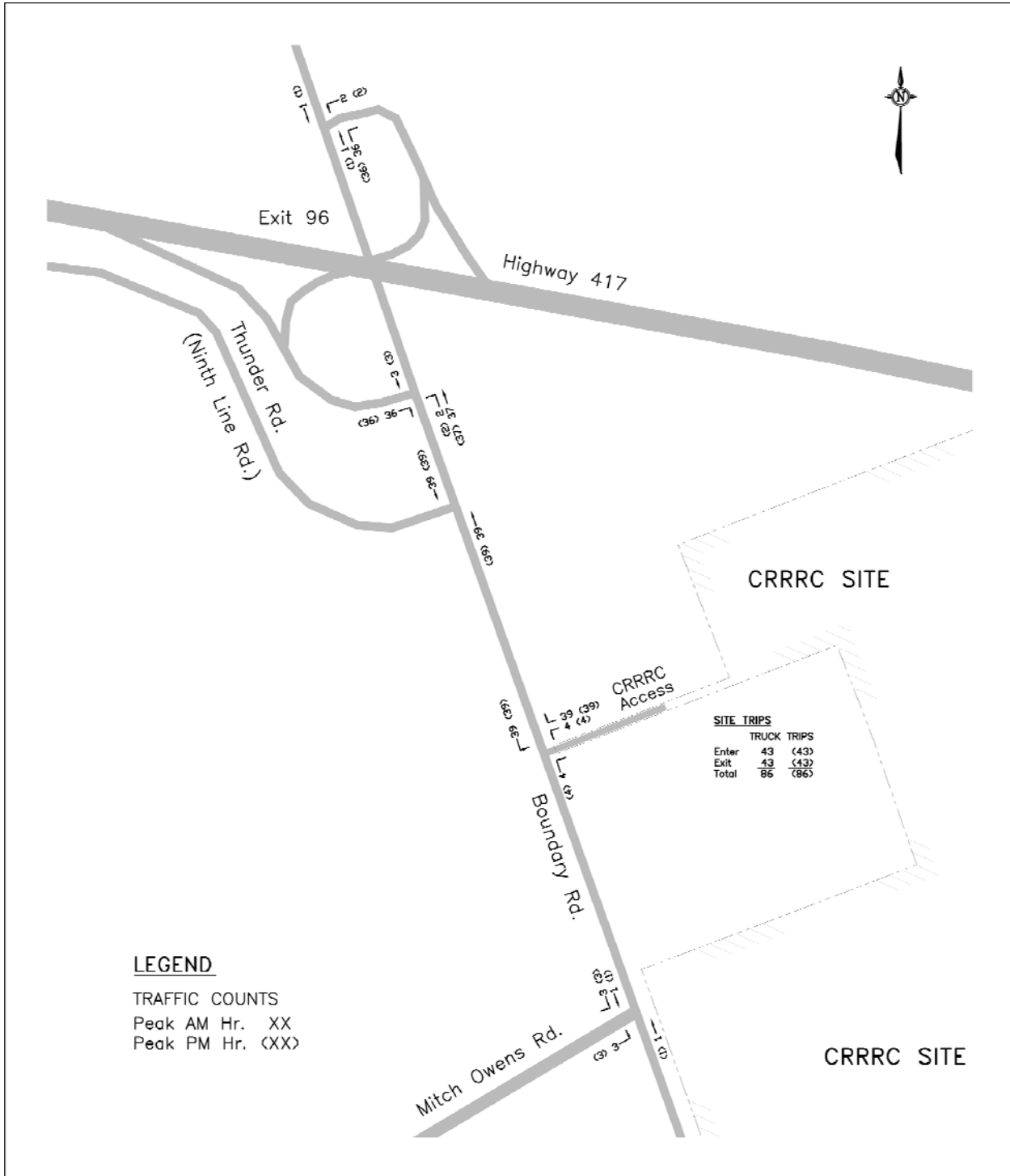
Year	AADT	Year-to-Year Increase	Average Increase
2012	44200	-6.56%	0.19%
2013	41300	2.66%	
2014	42400	2.36%	
2015	43400	2.30%	
2016	44400		

Year	SADT	Year-to-Year Increase	Average Increase
2012	65,000	-4.62%	0.66%
2013	62,000	2.42%	
2014	63,500	2.52%	
2015	65,100	2.30%	
2016	66,600		

APPENDIX E

CRRRC TIS Excerpts

DRAFT



NOT TO SCALE

Figure 3.1: Weekday Peak AM and PM Hour Site Generated Trips

4.0 FUTURE TRAFFIC VOLUMES

This Addendum has assumed an annual compounded growth rate of 2 percent as discussed in the TIS. The growth rate was applied to all lane movements shown in the traffic counts presented in Figure 2.1 for the weekday peak AM and PM hour. Figure 4.1 shows the expected 2022 background traffic, which would represent traffic five years beyond build out from growth outside the immediate area.

The East Gateway Properties truck transfer terminal is proposed to be located on the east side of Boundary Road north of the CRRRC Site. The truck transfer terminal will have an access that will form the east access to the intersection of Boundary Road and Thunder Road. It is understood that the terminal facility expects build out by the year 2026. For the expected background traffic at the year 2027, which represents ten years beyond opening of the CRRRC Site, this Addendum has increased the existing traffic (Figure 2.1) at a 2 percent compounded rate to the year 2027, and added the expected traffic from the truck transfer terminal. The volume and distribution of trips from the proposed terminal were determined from the Transportation Impact Study report dated October 2014 for 5341 Boundary Road Transport prepared by Dillon Consulting Limited (Dillon). The Dillon TIS examined both a “Low Building Coverage” and a “High Building Coverage” scenario. As discussed at the meeting of April 22, 2015, this Addendum has utilized the traffic associated with the average of both scenarios and added the expected terminal trips to the 2027 background traffic, which is shown in Figure 4.2.

The expected total traffic volumes at the year 2022, which are shown in Figure 4.3, were determined by the addition of the expected background traffic of Figure 4.1 and the expected Site generated trips of Figure 3.1. For the expected 2027 total traffic shown in Figure 4.4, the 2027 background traffic (Figure 4.2) was added to the Site generated trips (Figure 3.1).

4.1 Traffic Analysis

The following are the results of the intersection analysis at the year 2022 (5 years beyond CRRRC Site opening), and at the year 2027 (10 years beyond opening), including the East Gateway Properties truck transfer terminal trips.

Boundary Road and CRRRC Site Access

A left turn lane warrant analysis was conducted at the Site access using the procedure documented in the MTO publication, *Geometric Design Standards for Ontario Highways*. The analysis utilized the expected 2027 traffic and a design speed of 90 km/h. (80 km./h. posted speed) at the access. The warrant analysis, which is presented in the Appendix as Exhibit 5, determined that a southbound left turn lane with 25 m for passenger car storage was required during the both the peak AM and PM hour. Utilizing a passenger car equivalent for heavy vehicles of 2.0 as documented in the MTO publication, the required length of the southbound left turn lane at the CRRRC truck access would therefore be 50 m. The following is the recommended lane configuration:

FIGURES

DRAFT



THUNDER ROAD & BOUNDARY ROAD
CITY OF OTTAWA



**CROZIER
& ASSOCIATES**
Consulting Engineers

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905 875-0026 T
905 875-4915 F
WWW.CFCROZIER.CA

SITE LOCATION PLAN

Drawn	T.D.S.	Design	D.L.	Project No.	1909-5772	
Check	T.D.S.	Check	D.L.	Scale	N.T.S	Dwg. FIG. 01