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MEMO

DATE December 15, 2021 **PROJECT NO.** 1909-5629
RE Long Sault Industrial Park
Traffic Memo – Avonmore Road at Grade Rail Crossing

TO R. Michel Pilon
Jennifer Murray

FROM Peter Apasnore, MASc., P.Eng., PTOE

Dear R. Michel & Jennifer,

C.F. Crozier & Associates Inc. (Crozier) was retained by Avenue 31 Capital Inc. to provide transportation engineering services in support of the development application for a proposed rail yard development located at Avonmore Road and CN Kingston Subdivision in Long Sault, Township of South Stormont in the County of Stormont, Dundas, Glengarry.

This memo reviews the traffic related impacts of future rail stop at the proposed rail yard site on the Avonmore Road and adjacent intersections. The review herein focuses on traffic impacts in future with the Phase A industrial development traffic in place. The scope of this memo is summarized below:

- Description of proposed development and background information
- Train Crossing Stoppage Time Calculation
- Traffic Operations Analysis in the ultimate 2035 Future Total horizon (Phase A only)

1.0 BACKGROUND

Per the site plan (dated July 14, 2021, attached in **Appendix A**), the development proposal includes a rail track yard, a single storey rail shop building (approximately 1200 m^2 Gross Floor Area) and a gravel parking lot. A full moves site access at County Road 15 (Avonmore Road) is proposed to serve Phase A.

The subject Phase A forms part of a proposed larger industrial subdivision located between Avonmore Road and Moulinette Road along the Canadian National (CN) rail track in Long Sault, Township of South Stormont, SDG. The site is bound by Highway 401 to the north, vegetated lands and Avonmore Road to the east, the CN rail corridor to the south, and Moulinette Road to the west.

The subject property covers an area of approximately 285 ha and is currently a vegetated undeveloped lot. The property is currently zoned as MH-h (Heavy Industrial, holding provision) under the Township of South Stormont Zoning By-law No. 2011-100. Refer to **Figure 1** for the site location.

A Traffic Impact Study (TIS) was previously prepared by Crozier (dated November 2021) to assess the traffic related impacts of the proposed Phase A rail yard development on the surrounding road network (herein referred to as the "Phase A TIS". Excerpts in **Appendix B**). This traffic memo was prepared per County request to address concerns related to potential traffic impacts at the Avonmore Road level crossing as a result of the implementation of the rail yard development, which is a stop point.

Through correspondence with the proponent, it is understood that train traffic along the CN Kingston Subdivision is expected to remain the same compared to present conditions. This train traffic is presently traversing the rail crossing at an average speed of 60 miles per hour (mph).

The proposed train yard is expected to receive up to one train stoppage service per day, at a maximum length of 8000 ft. This train is expected to traverse the crossing at an average speed of 25 mph.

2.0 BOUNDARY ROAD NETWORK

The study scope includes the railway crossing junction along with the nearby intersection of Avonmore Road (County Road 15) and County Road 36. The boundary road network is summarized in **Table 1** below.

Table 1: Boundary Road Network

Feature	Roadway	
	Avonmore Road	**County Road 36**
Direction	Two-way (North-South)	Two-way (East-West)
Classification	County Arterial	Arterial
Jurisdiction	SDG Counties	SDG Counties
Span	County Road 29 to County Road 2	County Road 18 to County Road 15
Speed Limit	80 km/h	80 km/h
Number of travel Lanes	2 lanes	2 lanes

3.0 TRAIN STOPPAGE TIME CALCULATION

In order to analyze the traffic operations in the study area, a stopping time calculation was performed to understand the amount of time the crossing will be closed to vehicles at the Avonmore Road level crossing as a result of a train servicing the proposed development.

As discussed in **Section 1.0**, information provided by the proponent has resulted in the following assumptions used for the analysis herein:

- A maximum train length of 8000 feet
- A total of up to one train per day servicing the proposed rail yard
- An average train speed of 25 mph for trains bound for the proposed rail yard

A 20 second minimum pre-emption time is typical for at grade train crossings; however, a buffer time is mostly added to account for equipment response and trains that may accelerate beyond the expected speed. Therefore, an allowance of 30 seconds was added to the time taken for the train to traverse the rail crossing to account for the time needed for the barrier gates to close and open as well as the time when the crossing lights first activate before the barrier gates close.

Therefore, crossing time was calculated using the equation outlined below:

$$T_{Crossing} = (L_{Train} \,/\, V_{Train}) + t_{allowance}$$

Where;
$T_{Crossing}$ *= Crossing Time*
L_{Train} *= Length of Train (m)*
V_{Train} *= Velocity of Train (m/s)*
$t_{allowance}$ *= 30 second time allowance*

Therefore, the maximum stopping time calculation for the future daily train to stop at the proposed rail yard development is:

$$T_{Crossing} = [2440m/(11m/s)] + 30s \; = 222s \; + 30s$$
$$T_{Crossing} = 252s \; \approx 4 \; min$$

And the maximum stopping time calculation for a train travelling at 60mph (current conditions) is:

$$T_{Crossing} = [2440m/(26m/s)] + 30s \; = 94s \; + 30s$$
$$T_{Crossing} = 124s \; \approx 2 \; min$$

Therefore, the maximum stopping time for vehicles at the Avonmore Road level crossing during a train stoppage at the proposed rail yard development is 252 seconds compared to normal crossing under the 65mph speed without a stoppage at the proposed site which is 124 seconds. Therefore, a maximum stopping time increment of 128 seconds is forecast for traffic along the Avonmore Road and is expected to occur up to once daily.

4.0 TRAFFIC OPERATIONS ANALYSIS

4.1 Traffic Queues and Adjacent Intersection Impacts

Although it is not expected that the daily train servicing the proposed rail yard will pass during the peak hour of the Avonmore Road traffic, this worst case scenario was nevertheless analyzed herein.

To estimate future traffic volumes within the study area, traffic data was collected by Spectrum Traffic Data Inc. on behalf of Crozier on Tuesday June 22, 2021, at the study intersection of Avonmore Road and County Road 36. The time of the traffic survey was from 6:00 a.m. to 10:00 a.m. and from 3:00 p.m. to 7:00 p.m. Peak hours were identified in each survey period. The peak hours of the turning movement counts occurred between 7:15 a.m. to 8:15 a.m. for the a.m. survey period and between 4:15 p.m. to 5:15 p.m. for the p.m. survey period. Traffic Data is included in **Appendix C**.

To remain consistent with the Phase A TIS, the traffic counts were grown to expected non-pandemic 2021 levels by a factor of 1.5 for the a.m. peak hour and 1.2 in the p.m. peak hour. These factors were determined based on a comparison of traffic counts undertaken in 2018 and 2021 at the Highway 401 ramp terminal intersections with Moulinette Road.

The analysis herein used a horizon year of 2035, consistent with the ultimate horizon of the Phase A TIS. To project traffic volumes to this horizon, the adjusted 2021 traffic volumes were grown by 2% per annum. Further, the site traffic shown in Figures 8 and 9 of the Phase A TIS (included in **Appendix B** herein) was added to the grown traffic volumes to result in 2035 future total traffic volumes at the intersection of Avonmore Road and County Road 36. The traffic volumes entering and exiting the south approach of this intersection were applied at the level crossing. The 2035 future total traffic volumes in the study area are shown in **Figure 2**.

The assessment of traffic operations in the study area is based on the method outlined in the "Highway Capacity Manual, 2000" using Synchro 11 modelling software. The study area was modelled using existing lane configurations and traffic controls. Traffic flow along Avonmore Road is free-flowing outside of the rail stoppage and given trains are occasional, an even larger time (than crossing stoppage time) can be afforded to the north/south movements on Avonmore Road after a rail crossing event. Therefore, the crossing was modelled in Synchro as pre-timed with a 252 second minimum green time for the train crossing while 300 seconds of green time was assumed for the free-flowing movements on Avonmore Road.

The results of the traffic operational analysis for the 2035 future total scenario are summarized in **Table 2** below. Detailed capacity analyses result sheets are included in **Appendix D**.

Table 2: 2035 Future Total Traffic Operations - Train Crossing

Intersection	Control	Peak Hour	Maximum Queue[1]
Avonmore Road Level Crossing	Traffic Signal Pre-emption (Gated barriers)	A.M.	61.2m (NB) 57.3m (SB)
		P.M.	131.4m (NB) 57.7m (SB)
Avonmore Road and County Road 36	Stop (minor street)	A.M.	45.1m (WB) 57.4m (SB)
		P.M.	50.7m (WB) 61.3m (SB)

Note 1: SimTraffic queuing results were derived from Sim-Traffic reports using 5-minute seeding, 20-minute simulation and an average of five simulations.

The key impact of the crossing stoppage is the resulting northbound and southbound queues. As presented in Table 2, the maximum northbound queue is 131.4 m and the southbound is 57.7 m. Given County Road 36 is located approximately 65m from the stop-line, the intersection of Avonmore Road & County Road 36 is not expected to be impacted per the Sim-traffic result. However, under practical operations, the southbound queues are expected to extend and block the County Road 36 momentarily during the train crossing event. This may further result in a momentary queue for westbound traffic at the County Road 36 intersection due to temporary impedance on westbound left turn movements.

Queuing at the south approach extends to a maximum of 131.4m in the critical p.m. peak hour. The separation between the stop-line at the grade-level crossing and the nearby intersection of Avonmore Road and County Road 36 / Jenkins Road is approximately 220m away, therefore, no blockage impacts to this intersection is forecast during a rail crossing event.

It is noted that the findings herein are conservative and based on the assumption that the four minute rail stoppage at the proposed rail yard occurs in the peak 15 minute period of the a.m. or p.m. peak periods. Queuing issues are expected to be much better under all other periods of a rail crossing events occur during each day of the week.

The Avonmore road and County Road 36 was modelled in Synchro to assess concurrent impacts during the train crossing event. As presented in Table 3, operations are expected to remain adequate and clear up after the gates at the crossing, at a LOS "B" or better during the peak hours.

Table 3: 2035 Future Total Traffic Operations

Intersection	Control	Peak Hour	Level of Service	Control Delay	v/c ratio
Avonmore Road and County Road 36	Stop (minor street)	A.M.	B	10.6s	0.12 (WB)
		P.M.	B	11.3s	0.15 (WB)

4.2 Emergency Vehicle

In the unlikely event that an emergency vehicle approaches the rail intersection during a train crossing event, the emergency vehicle is expected to be delayed a maximum of 252 seconds

assuming the emergency vehicle arrives exactly when the train pre-emption and or gates closing begins. It is expected that during the crossing event, the emergency vehicle will use the opposing free lanes to get to the front of any built up queue and will be the first to clear the rail crossing after the barrier gates reopen. Emergency vehicles elsewhere at the adjacent intersections not bound for the rail crossing location will not be impacted.

The aforementioned delay is only 128 seconds longer than the typical crossing at the location under existing conditions. Further, there is only a maximum of one train stoppage at the proposed rail yard site. Therefore, minor impacts to traffic and emergency vehicles is forecast.

5.0 CONCLUSION

This traffic memo has assessed the traffic impacts of the proposed Phase A rail yard development on the Avonmore Road traffic particularly at the grade-level rail crossing. The analysis herein resulted in the following key findings:

- Given the study assumptions, a maximum crossing time of 252 seconds or approximately 4 minutes is expected for the single daily train bound for the rail yard; an increment of 128 seconds from typical crossing (no yard stoppage) events.

- Should the unlikely event of a train stoppage at the rail yard occur in the a.m. or p.m. peak hour, there may be a temporary occasional queue for the westbound traffic at the County Road 36 intersection due to momentary impedance on westbound left turn movements caused by momentary blockage of the County Road 36 intersection.

- It is expected that, near the end of the train crossing, vehicles intending to make a southbound left or westbound movement at this intersection may be unable to do so momentarily due to the queuing situation. However, this impact is expected to be minor and no significant operational issues are forecasted at the intersection, with the intersection operating a LOS "B".

- No blockage impacts at the intersection of Avonmore Road and County Road 36 / Jenkins Road is forecast during a train crossing.

- The impacts of a train stoppage at the site on an emergency vehicle is expected to be similar to the existing conditions with some expected delay of up to 252 seconds to the vehicle.

We trust that this traffic review addresses any transportation concerns related to the Avonmore Road level crossing. Minor changes to the site plan will not materially affect the conclusions contained within this memo. Should you have any questions or wish to discuss further, please feel free to give us a call.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.

Peter Apasnore, MASc., P.Eng., PTOE
Project Engineer

/AH

Encl.

Figure 1 – Site Location
Figure 2 – 2035 Future Total Traffic Volumes

Appendix A – Site Plan
Appendix B – Long Sault Business Park – Phase A Traffic Impact Study Excerpts
Appendix C – Traffic Data
Appendix D – Detailed Capacity Analysis Reports

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FIGURES

Legend

= SUBJECT LANDS

Project

TRAFFIC MEMO
AVONMORE ROAD RAIL CROSSING

Drawing

SITE LOCATION

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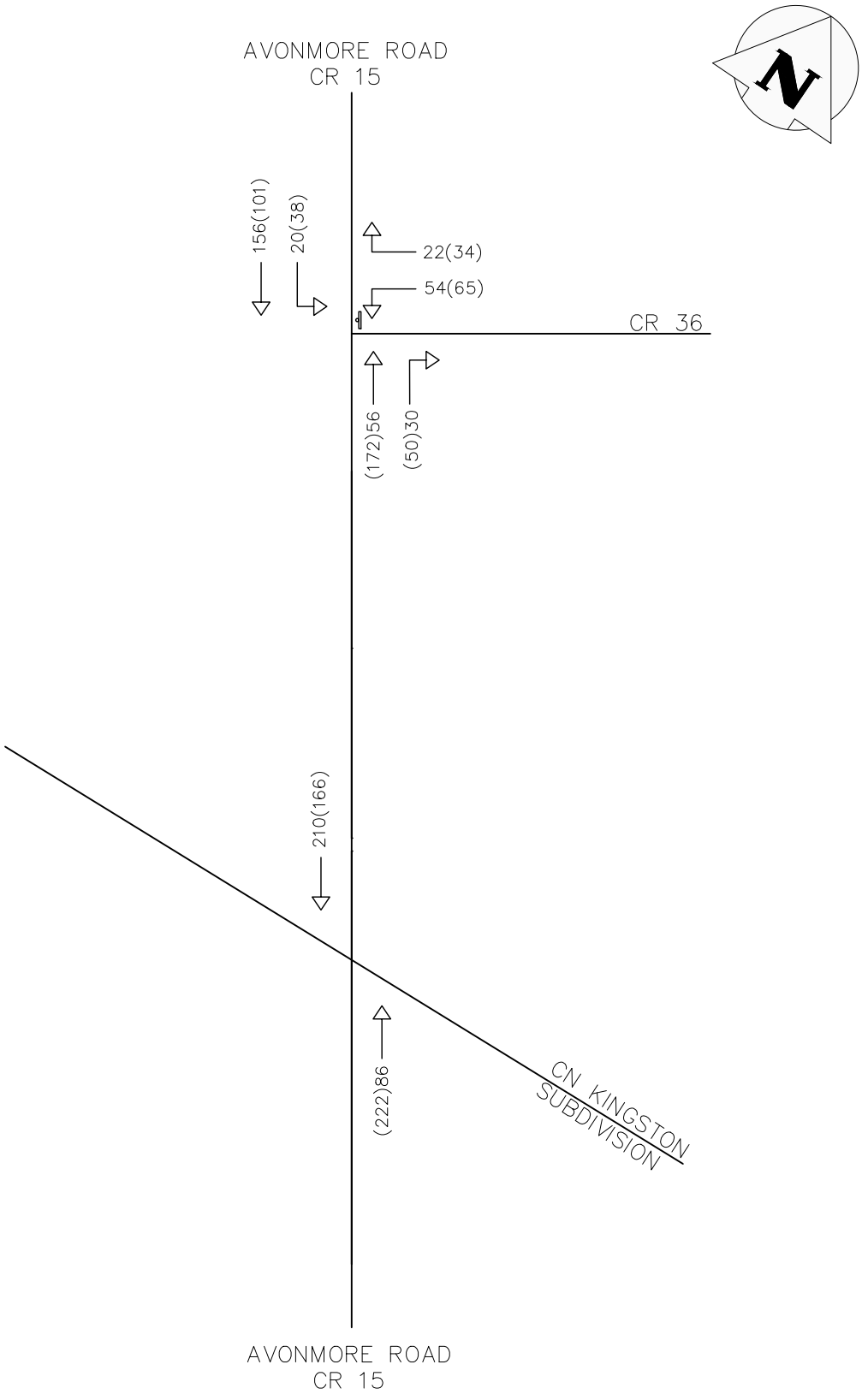
Drawn By	Design By	Project
R.L.	A.H.	1909-5629

Scale	Date	Check By	Drawing
N.T.S.	12/07/2021	A.H.	FIG 1



NOTE: THIS FIGURE IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED.

Legend

- SIGNAL CONTROL
- STOP CONTROL
- XX(YY) WEEKDAY A.M. (WEEKDAY P.M.) PEAK HOUR VOLUMES

Project

TRAFFIC MEMO
AVONMORE ROAD RAIL CROSSING

Drawing

2035 FUTURE TOTAL
TRAFFIC VOLUMES

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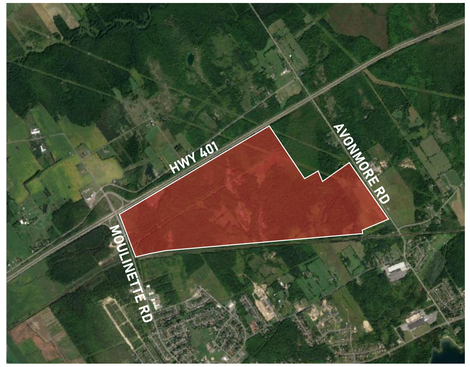
Drawn By	Design By	Project	Scale	Date	Check By	Drawing
R.L.	A.H.	1909-5629	N.T.S.	12/07/2021	A.H.	FIG 2

APPENDIX A

Site Plan

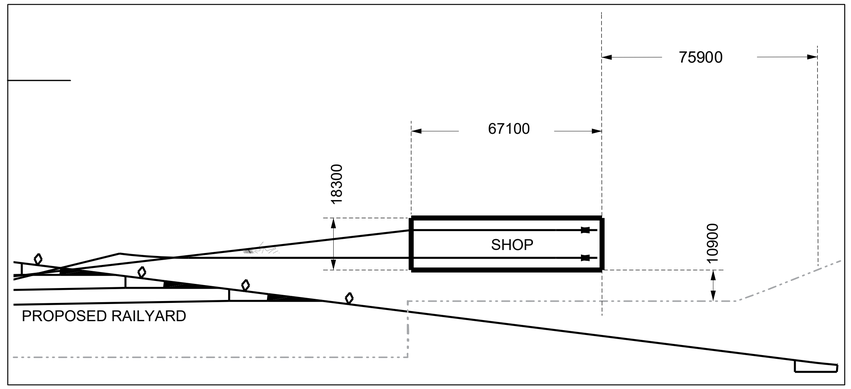
Development Standards		
i.) Development on private or partial services (municipal water or sanitary sewers):		
	Required	Provided
Lot Area (minimum)	1 ha (2.5 acres)	271.6 ha
Lot Frontage (minimum)	60 m (196.85 ft.)	822 m
Yard Requirements (minimum)		
Front	12 m (39.37 ft.)	378 m
Rear	12 m (39.37 ft.)	2656 m
Exterior Side	12 m (39.37 ft.)	1625 m
Interior Side	7.5 m (24.61 ft.)	10.9 m
Building Height (maximum)	15 m (49.21 ft.)	6 m
Accessory Building	6 m (19.69 ft.)	0
Lot Coverage (maximum)	20%	4%
(ii) Development on full services (municipal water and sanitary sewers)		
	Required	Provided
Lot Area (minimum)	1000 m2 (5005.22 sq.ft.)	271.6 ha
Lot Frontage (minimum)	20 m (49.21 ft.)	822 m
Yard Requirements (minimum)		
Front	7.5 m (24.61 ft.)	378 m
Rear	7.5 m (24.61 ft.)	2656 m
Exterior Side	7.5 m (24.61 ft.)	1625 m
Interior Side	3 m (9.84 ft.)	10.9 m
Building Height (maximum)	15 m (49.21 ft.)	6 m
Accessory Building	6 m (19.69 ft.)	0
Lot Coverage (maximum)	40%	4%



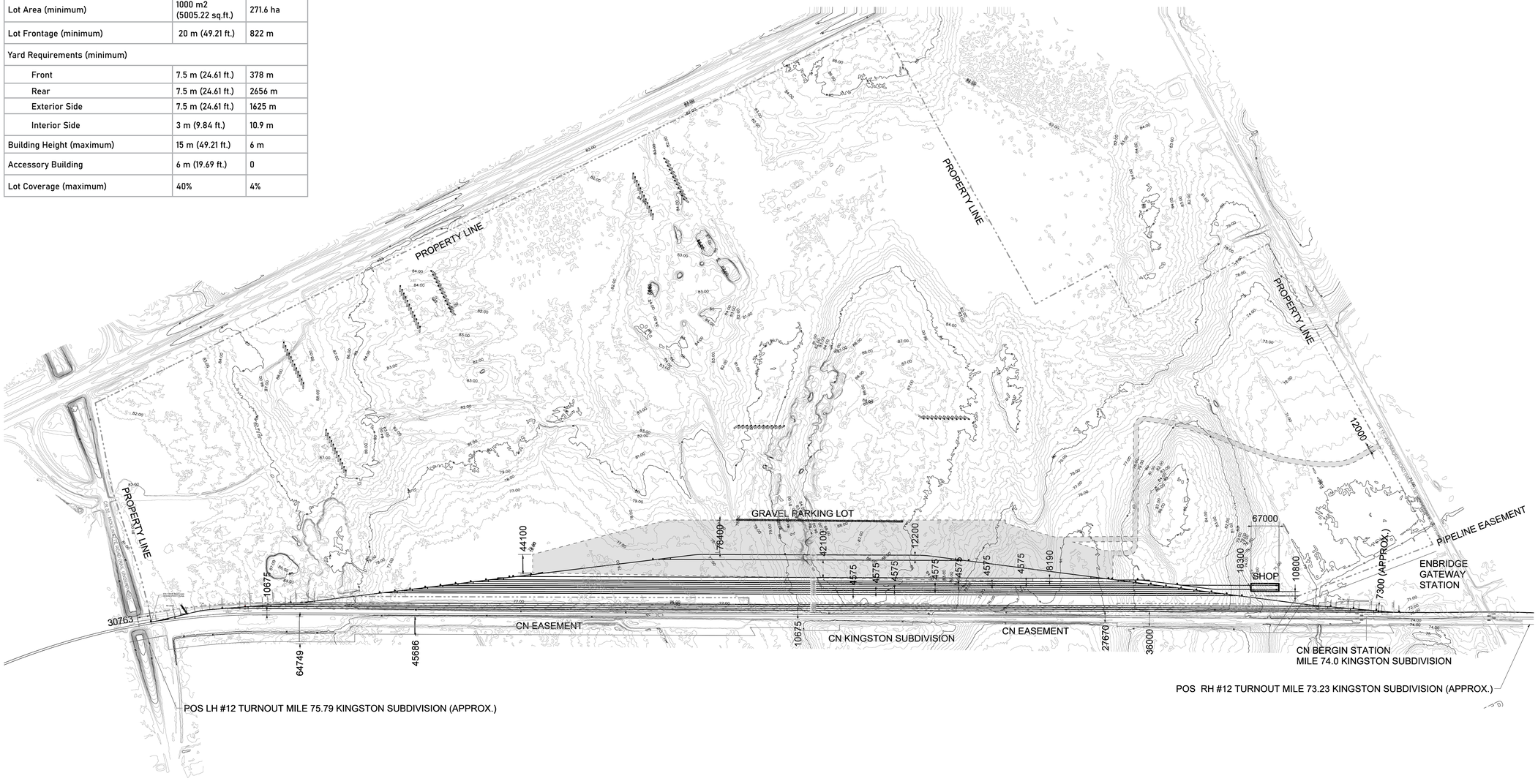
1 / A01 LOCATION PLAN SCALE N.T.S.

SITE PLAN LEGEND

ICON	DESCRIPTION
	12m Wide Roadway
	Proposed Buildings
	Proposed Rail Line



1 / A01 SHOP PLAN SCALE 1:500



1 / A01 SITE PLAN SCALE 1:5000

0 25 50 100 200 250 300 350 400 450 500 550

SHEET SIZE: ARCH D (24"x36")

NOTES:

Contractor shall check and verify all dimensions on site and report any discrepancies to the Architect before proceeding.

GENERAL SITE PLAN NOTES:

1. Exterior site lighting shall be directed onto the site

no.	revision	date
01	ISSUED FOR COORDINATION	2021/07/14

north / nord

Re:PUBLIC URBANISM

PHONE 514.503.2614
E MAIL hicks@republicurbanism.com

detail no. / sheet no. / 1 / A1 / détail no. / feuille no.

project / projet: LONG SAULT RAILYARDS SITE PLAN

LONG SAULT, ON

designed by / conçu par	JM	approved by / approuvé par	PH
drawn by / dessiné par	JM	project no. / no. du projet	
date	2021/07/14	scale	as noted

drawing / dessin: SITE PLAN

revision / révision

sheet no. / no. de la feuille: A01

APPENDIX B

Long Sault Business Park – Phase A Traffic Impact Study Excerpts

TRAFFIC IMPACT STUDY

LONG SAULT INDUSTRIAL PARK - PHASE A

TOWNSHIP OF SOUTH STORMONT
UNITED COUNTIES OF STORMONT, DUNDAS AND GLENGARY

PREPARED FOR:

AVENUE 31 CAPITAL INC.

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
211 YONGE STREET, SUITE 301
TORONTO, ON M5B 1M4

NOVEMBER 2021

CFCA FILE NO. 1909-5629

CROZIER
CONSULTING ENGINEERS

5.0 Future Background Conditions

5.1 Horizon Years

To evaluate future traffic operations at the study intersections, the full buildout (assumed in 2025), a five-year horizon (2030) and a ten-year horizon (2035) were analyzed. The study horizons are consistent with the MTO TIS Guidelines and were further confirmed through email correspondence with MTO and SDG County staff.

5.2 Future Boundary Road Network Improvements

The MTO has identified potential future interchange improvements to the existing interchange at Highway 401 and Moulinette Road. The improvements would involve the upgrade of the existing interchange from a Parclo A-2 to a Parclo A-4 (or a variation thereof) which includes the following:

- Free-flow on ramps from County Road 35 southbound to Highway 401 eastbound and westbound; and
- Free-flow on-ramp from Moulinette Road northbound to Highway 401 eastbound and westbound.

Further, the MTO has identified the potential for a future interchange at Highway 401 and Avonmore Road. The interchange would be a Parclo A-4, similar to the potential future interchange layout at Highway 401 and Moulinette Road.

At this time, the timing and configurations of the above noted future road network improvements is currently unknown. Additionally, as outlined in **Section 6.1**, the Trip Generation of the Phase A portion of the industrial development being analyzed herein is not expected to be significant, amounting to 32 and 29 vehicle trips in the a.m. and p.m. peak hours, respectively. Therefore, consideration of the MTO interchange improvements to the boundary road network was deemed outside the scope of this TIS. The requirement of these or other road improvements is dependent on the entire master subdivision buildout as well as potential future background developments in the area. However, at this time and for the purpose of the subject Phase A development, the noted MTO improvements are not required.

5.3 Future Traffic Volume Forecast

As advised by the SDG county staff, through correspondence (refer to **Appendix B**); the following annual growth rates (compounded annually) were applied to the adjusted 2021 existing traffic volumes outlined in **Figure 2**:

- For all movements along County Road 29 (both segments), a growth rate of 5% was applied
- For all other movements in the boundary road network, a growth rate of 2% was applied

The noted growth rates were deemed by staff to capture potential background developments and thus no additional background developments were incorporated into the future traffic projection.

Figures 3, 4 and 5 outline the 2025, 2030, and 2035 future background traffic volumes used for analysis.

5.4 Intersection Operations

The 2025, 2030 and 2035 future background traffic operational measures of effectiveness are outlined in **Tables 5, 6 and 7.** These operations are based on the future background traffic volumes illustrated in **Figures 3, 4 and 5** for the 2025, 2030 and 2035 background traffic scenarios, respectively. Level of Service definitions are included in **Appendix E**. Detailed capacity analyses result sheets are included in **Appendix F**.

intersection of County Road 2 and Avonmore Road. Two movements were identified as having exceeded the critical volume-to-capacity threshold: the eastbound through and right-turn movement in the a.m. peak hour (0.85), and the westbound left-turn and through movement in the p.m. peak hour (0.86). These through movements are associated with Cornwall commuter traffic, and are approaching capacity. Future optimization of the signal timing plan may be considered to ensure adequate capacity is provided.

The study intersections are forecast to operated similarly or better under the 2025 and 2030 horizons compared to the ultimate 2035 horizon. No traffic operation issues are forecast.

6.0 Site Generated Traffic

6.1 Trip Generation

To forecast the site trip generation, the analysis herein separately forecasted the vehicle and truck traffic associated with the proposed development to capture all vehicular traffic movements.

To forecast the vehicle trips generated by the proposed development, the ITE Trip Generation Manual, 11th Edition was used. Land Use Category (LUC) 030, "Intermodal Truck Terminal" is described as "a facility where goods are transferred between trucks, between trucks and railroads, or between trucks and ports". LUC 030 was used to estimate vehicle trips generated by the proposed development. "Peak hour of adjacent street traffic" was used to forecast trips generated by the development. Further, through correspondence with the proponent (Avenue 31 Capital Inc.), a maximum of 24 employees are expected to be employed at the site at Phase A full-buildout. This value was used as the independent variable for the proposed development vehicle trip generation forecast.

Furthermore, the truck trip generation forecast was established using information supplied by the proponent. It is expected that a maximum of 60 daily truck trips will be generated by the Phase A development. It is standard practice that 10% of the expected daily trips be considered to occur in the peak hours for a land use such as the rail yard/ industrial. For conservative analysis. As such, 10% of the expected total daily truck trips were assigned to each of the a.m. and p.m. peak hours.

The combined trip generation forecast is summarized in **Table 8** below.

Table 8: Site Generated Trips

Site	Trip Type	Peak Hour	Number of Trips		
			Inbound	Outbound	Total
Long Sault Rail Yard – Phase A	Vehicle Trips	A.M.	9	11	20
		P.M.	9	8	17
	Truck Trips	A.M.	6	6	12
		P.M.	6	6	12
	Total Trips	**A.M.**	**15**	**17**	**32**
		P.M.	**15**	**14**	**29**

The proposed development is forecast to generate a total of 32 and 29 two-way trips during the weekday a.m. and p.m. peak hours, respectively.

6.2 Trip Distribution and Assignment

The new site generated trips were distributed based on existing travel patterns and expected catchment areas for both vehicle (employee) traffic and heavy truck traffic. The trip distribution used to assign proposed development trips is summarized in **Table 9.**

Table 9: Trip Distribution

Boundary Road Network Entry/Exit Location	Direction	Vehicle Trip Distribution	Truck Trip Distribution	Destinations
Highway 401	West	15%	40%	Kingston, Toronto
Highway 401	East	15%	35%	Montreal, Quebec City
Avonmore Road (CR15)	North	20%	5%	Ottawa, Hawkesbury
County Road 36	West	10%	0%	Long Sault, Ingleside
Highway 2	East	40%	20%	Cornwall, Plattsburgh U.S.
Total	N/A	**100%**	**100%**	

The trip distribution within the boundary road network is illustrated in **Figure 6** and **Figure 7** for vehicle traffic and truck traffic, respectively. The resulting site trip assignments to the boundary road network is presented in **Figure 8** and **Figure 9** for vehicle traffic and truck traffic, respectively.

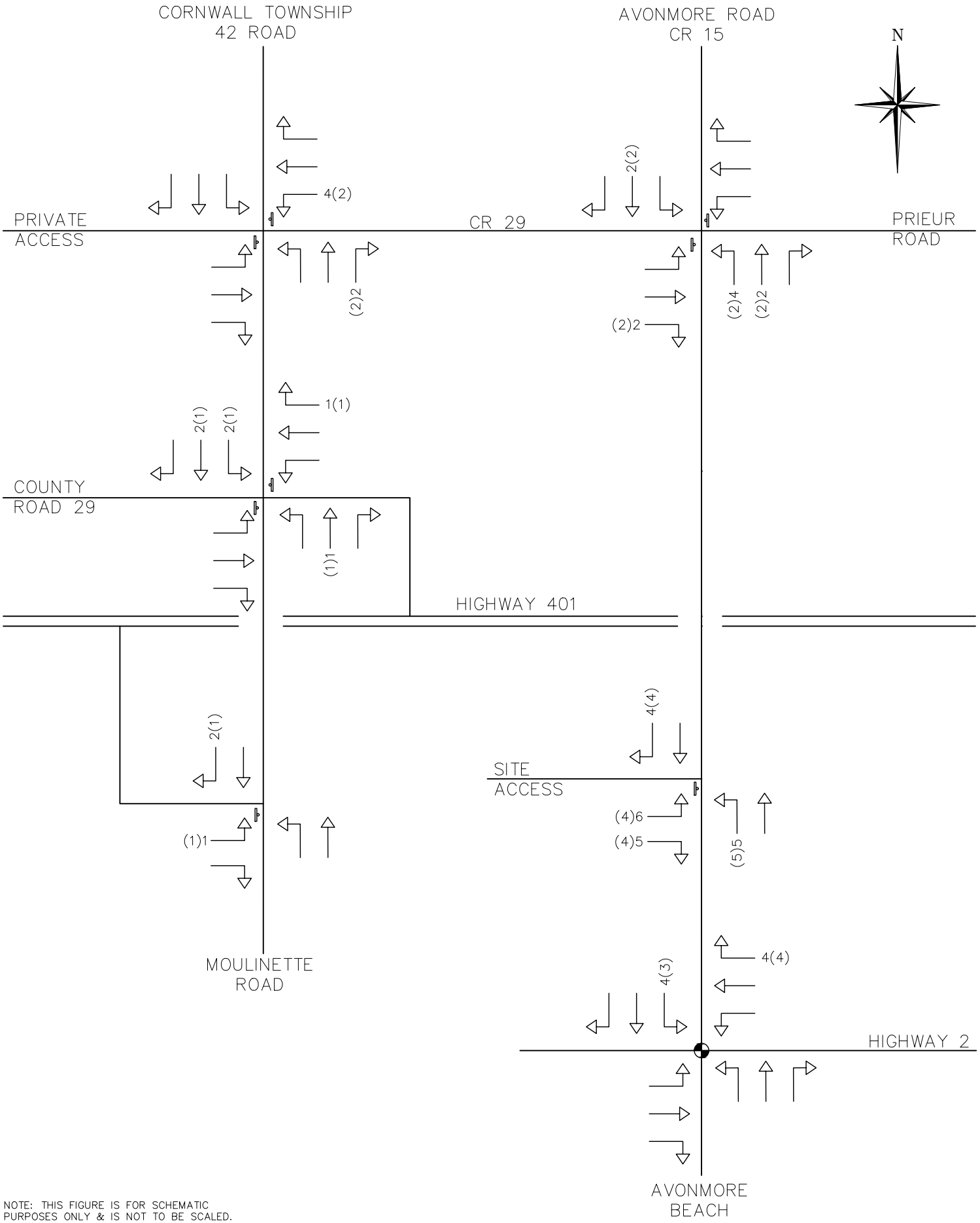
7.0 Future Total Conditions

7.1 Basis of Assessment

The traffic impacts arising from the proposed development were assessed on the basis of the site generated traffic illustrated in **Figures 8 and 9** superimposed on the future background traffic volumes in **Figures 3, 4, and 5.** The resulting future total traffic volumes for the weekday a.m. and p.m. peak hours are illustrated in **Figures 10, 11, and 12** for the 2025, 2030, and 2035 horizon years.

7.2 Intersection Operations

Tables 10, 11 and 12 outline the future total traffic conditions in the 2025, 2030 and 2035 scenarios, respectively. These operations are based on the 2025, 2030 and 2035 future total traffic volumes illustrated in **Figures 10, 11 and 12**, respectively. Level of Service definitions are provided in **Appendix E.** Detailed capacity analyses result sheets are included in **Appendix F.**



NOTE: THIS FIGURE IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED.

Legend

- SIGNAL CONTROL
- STOP CONTROL
- XX(YY) WEEKDAY A.M. (WEEKDAY P.M.) PEAK HOUR VOLUMES

Project: LONG SAULT PHASE A INDUSTRIAL PARK

Drawing: SITE TRIP ASSIGNMENT: VEHICLES

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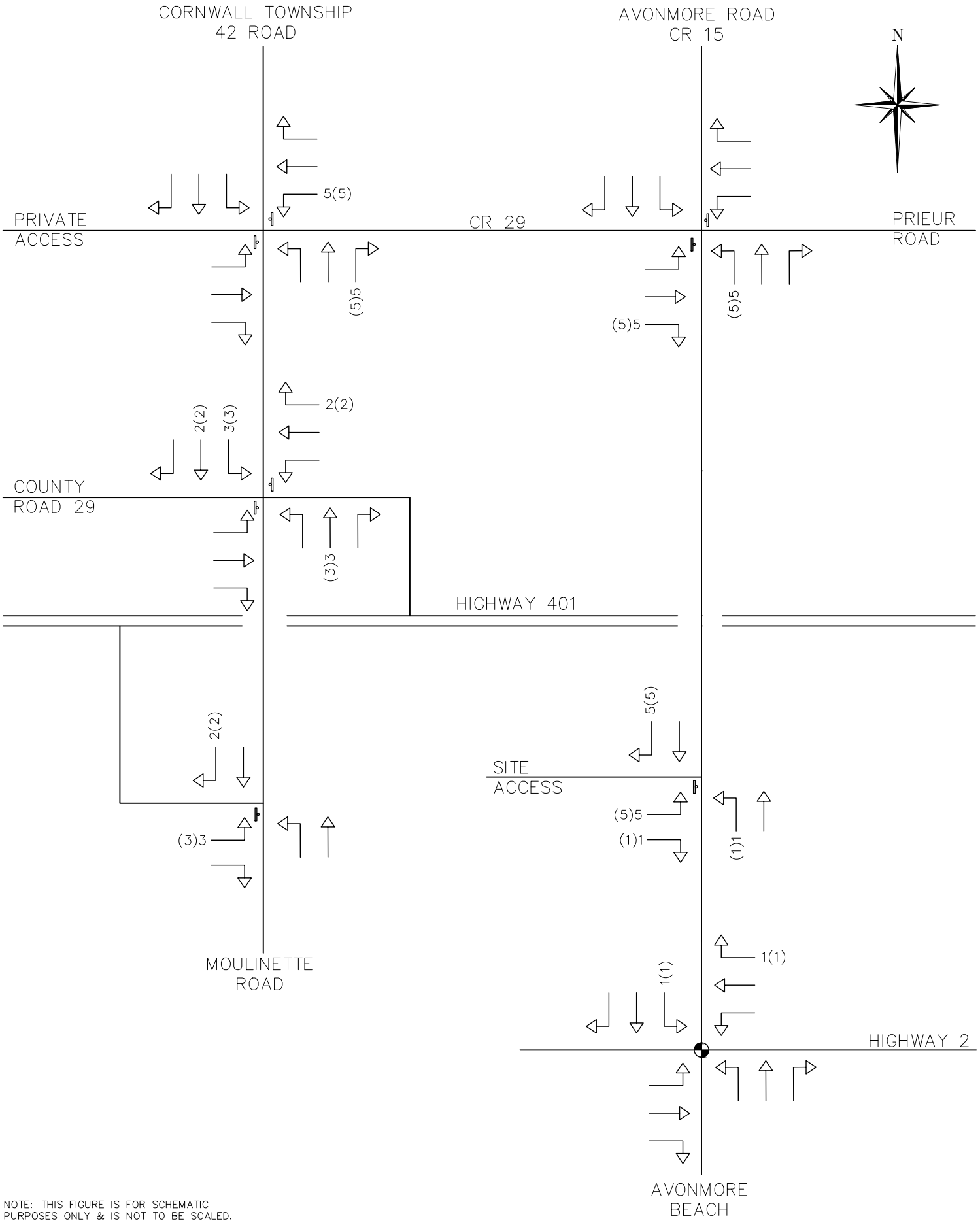
Drawn By	Design By	Project	Scale	Date	Check By	Drawing
R.L.	A.H.	1909-5629	N.T.S.	10/22/2021	A.H.	FIG 8



NOTE: THIS FIGURE IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED.

Legend

- SIGNAL CONTROL
- STOP CONTROL
- XX(YY) WEEKDAY A.M. (WEEKDAY P.M.) PEAK HOUR VOLUMES

Project: LONG SAULT PHASE A INDUSTRIAL PARK

Drawing: SITE TRIP ASSIGNMENT: TRUCKS

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Drawn By	Design By	Project	Scale	Date	Check By	Drawing
R.L.	A.H.	1909-5629	N.T.S.	10/22/2021	A.H.	FIG 9

APPENDIX C

Traffic Data

Crozier & Associates
SUITE 301 211 YONGE
STREET
TORONTO ONTARIO, M5B 1M4
CANADA

Turning Movement Count (5 . COUNTY RD 15 & COUNTY RD 36 N)

Start Time	N Approach COUNTY RD 15					E Approach COUNTY RD 36 N					S Approach COUNTY RD 15					Int. Total (15 min)	Int. Total (1 hr)
	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	UTurn S:S	Peds S:	Approach Total		
06:00:00	7	1	0	0	8	1	5	0	0	6	2	7	0	0	9	23	
06:15:00	7	1	0	0	8	3	5	0	0	8	3	5	0	0	8	24	
06:30:00	13	1	0	0	14	1	7	0	0	8	8	2	0	0	10	32	
06:45:00	18	2	0	0	20	2	7	0	0	9	0	6	0	0	6	35	114
07:00:00	12	1	0	0	13	2	8	0	0	10	2	7	0	0	9	32	123
07:15:00	16	4	0	0	20	3	10	0	0	13	5	8	0	0	13	46	145
07:30:00	21	3	0	0	24	6	7	0	0	13	3	7	0	0	10	47	160
07:45:00	20	3	0	0	23	1	3	0	0	4	2	3	0	0	5	32	157
08:00:00	19	0	0	0	19	1	7	0	0	8	5	7	0	0	12	39	164
08:15:00	17	6	0	0	23	3	4	0	0	7	3	7	0	0	10	40	158
08:30:00	12	2	0	0	14	0	4	0	0	4	3	7	0	0	10	28	139
08:45:00	18	2	0	0	20	0	4	0	0	4	4	15	0	0	19	43	150
09:00:00	11	1	0	0	12	0	7	0	0	7	3	10	0	0	13	32	143
09:15:00	15	3	0	0	18	3	3	0	0	6	7	10	0	1	17	41	144
09:30:00	9	3	0	0	12	0	6	0	1	6	4	6	0	0	10	28	144
09:45:00	15	3	0	0	18	2	8	0	0	10	5	13	0	0	18	46	147
BREAK																	
15:00:00	12	6	0	0	18	3	6	0	0	9	4	21	0	0	25	52	
15:15:00	10	4	0	0	14	5	4	1	0	10	6	12	0	0	18	42	
15:30:00	18	4	0	0	22	6	10	0	0	16	7	12	0	0	19	57	
15:45:00	20	4	0	0	24	4	7	0	0	11	8	19	0	0	27	62	213
16:00:00	14	4	0	0	18	2	13	0	0	15	2	28	1	0	31	64	225
16:15:00	17	6	0	0	23	9	10	0	0	19	7	19	0	0	26	68	251
16:30:00	19	9	0	0	28	3	6	0	0	9	10	25	0	0	35	72	266
16:45:00	14	6	0	0	20	4	16	0	0	20	8	26	0	0	34	74	278
17:00:00	11	3	0	0	14	6	9	0	0	15	7	35	0	0	42	71	285
17:15:00	10	9	0	0	19	4	6	0	0	10	3	14	0	0	17	46	263
17:30:00	11	2	0	0	13	3	6	0	0	9	3	11	0	0	14	36	227
17:45:00	14	1	0	0	15	5	10	0	0	15	2	9	0	0	11	41	194
18:00:00	11	7	0	0	18	3	2	1	0	6	4	15	0	0	19	43	166
18:15:00	11	1	0	0	12	5	4	0	0	9	2	9	0	0	11	32	152
18:30:00	13	5	0	0	18	3	10	0	0	13	4	12	0	0	16	47	163
18:45:00	7	1	0	0	8	2	4	0	0	6	3	6	0	0	9	23	145

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STREET
TORONTO ONTARIO, M5B 1M4
CANADA

Grand Total	442	108	0	0	550	95	218	2	1	315	139	393	1	1	533	**1398**	-
Approach%	80.4%	19.6%	0%		-	30.2%	69.2%	0.6%		-	26.1%	73.7%	0.2%		-	**-**	-
Totals %	31.6%	7.7%	0%		39.3%	6.8%	15.6%	0.1%		22.5%	9.9%	28.1%	0.1%		38.1%	**-**	-
Heavy	43	17	0		-	9	17	0		-	6	38	0		-	**-**	-
Heavy %	9.7%	15.7%	0%		-	9.5%	7.8%	0%		-	4.3%	9.7%	0%		-	**-**	-
Bicycles	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-
Bicycle %	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-

Crozier & Associates
SUITE 301 211 YONGE
STREET
TORONTO ONTARIO, M5B 1M4
CANADA

Peak Hour: 07:15 AM - 08:15 AM Weather: Overcast Clouds (13.63 °C)

Start Time	N Approach COUNTY RD 15					E Approach COUNTY RD 36 N					S Approach COUNTY RD 15					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
07:15:00	16	4	0	0	20	3	10	0	0	13	5	8	0	0	13	46
07:30:00	21	3	0	0	24	6	7	0	0	13	3	7	0	0	10	47
07:45:00	20	3	0	0	23	1	3	0	0	4	2	3	0	0	5	32
08:00:00	19	0	0	0	19	1	7	0	0	8	5	7	0	0	12	39
Grand Total	76	10	0	0	86	11	27	0	0	38	15	25	0	0	40	**164**
Approach%	88.4%	11.6%	0%		-	28.9%	71.1%	0%		-	37.5%	62.5%	0%		-	**-**
Totals %	46.3%	6.1%	0%		52.4%	6.7%	16.5%	0%		23.2%	9.1%	15.2%	0%		24.4%	**-**
PHF	0.9	0.63	0		0.9	0.46	0.68	0		0.73	0.75	0.78	0		0.77	**-**
Heavy	5	3	0		8	0	5	0		5	1	6	0		7	**-**
Heavy %	6.6%	30%	0%		9.3%	0%	18.5%	0%		13.2%	6.7%	24%	0%		17.5%	**-**
Lights	71	7	0		78	11	22	0		33	14	19	0		33	**-**
Lights %	93.4%	70%	0%		90.7%	100%	81.5%	0%		86.8%	93.3%	76%	0%		82.5%	**-**
Single-Unit Trucks	2	3	0		5	0	3	0		3	1	2	0		3	**-**
Single-Unit Trucks %	2.6%	30%	0%		5.8%	0%	11.1%	0%		7.9%	6.7%	8%	0%		7.5%	**-**
Buses	0	0	0		0	0	0	0		0	0	0	0		0	**-**
Buses %	0%	0%	0%		0%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Articulated Trucks	3	0	0		3	0	2	0		2	0	4	0		4	**-**
Articulated Trucks %	3.9%	0%	0%		3.5%	0%	7.4%	0%		5.3%	0%	16%	0%		10%	**-**
Bicycles on Road	0	0	0		0	0	0	0		0	0	0	0		0	**-**
Bicycles on Road %	0%	0%	0%		0%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	**-**
Pedestrians%	-	-	-	0%		-	-	-	0%		-	-	-	0%		**-**

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STREET
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CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (15.37 °C)

Start Time	N Approach COUNTY RD 15					E Approach COUNTY RD 36 N					S Approach COUNTY RD 15					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
16:15:00	17	6	0	0	23	9	10	0	0	19	7	19	0	0	26	68
16:30:00	19	9	0	0	28	3	6	0	0	9	10	25	0	0	35	72
16:45:00	14	6	0	0	20	4	16	0	0	20	8	26	0	0	34	74
17:00:00	11	3	0	0	14	6	9	0	0	15	7	35	0	0	42	71
Grand Total	61	24	0	0	85	22	41	0	0	63	32	105	0	0	137	**285**
Approach%	71.8%	28.2%	0%		-	34.9%	65.1%	0%		-	23.4%	76.6%	0%		-	**-**
Totals %	21.4%	8.4%	0%		29.8%	7.7%	14.4%	0%		22.1%	11.2%	36.8%	0%		48.1%	**-**
PHF	0.8	0.67	0		0.76	0.61	0.64	0		0.79	0.8	0.75	0		0.82	**-**
Heavy	5	5	0		10	6	0	0		6	2	8	0		10	**-**
Heavy %	8.2%	20.8%	0%		11.8%	27.3%	0%	0%		9.5%	6.3%	7.6%	0%		7.3%	**-**
Lights	56	19	0		75	16	37	0		53	30	97	0		127	**-**
Lights %	91.8%	79.2%	0%		88.2%	72.7%	90.2%	0%		84.1%	93.8%	92.4%	0%		92.7%	**-**
Single-Unit Trucks	5	4	0		9	5	0	0		5	1	7	0		8	**-**
Single-Unit Trucks %	8.2%	16.7%	0%		10.6%	22.7%	0%	0%		7.9%	3.1%	6.7%	0%		5.8%	**-**
Buses	0	0	0		0	0	0	0		0	0	0	0		0	**-**
Buses %	0%	0%	0%		0%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Articulated Trucks	0	1	0		1	1	0	0		1	1	1	0		2	**-**
Articulated Trucks %	0%	4.2%	0%		1.2%	4.5%	0%	0%		1.6%	3.1%	1%	0%		1.5%	**-**
Bicycles on Road	0	0	0		0	0	4	0		4	0	0	0		0	**-**
Bicycles on Road %	0%	0%	0%		0%	0%	9.8%	0%		6.3%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	**-**
Pedestrians%	-	-	-	0%		-	-	-	0%		-	-	-	0%		**-**

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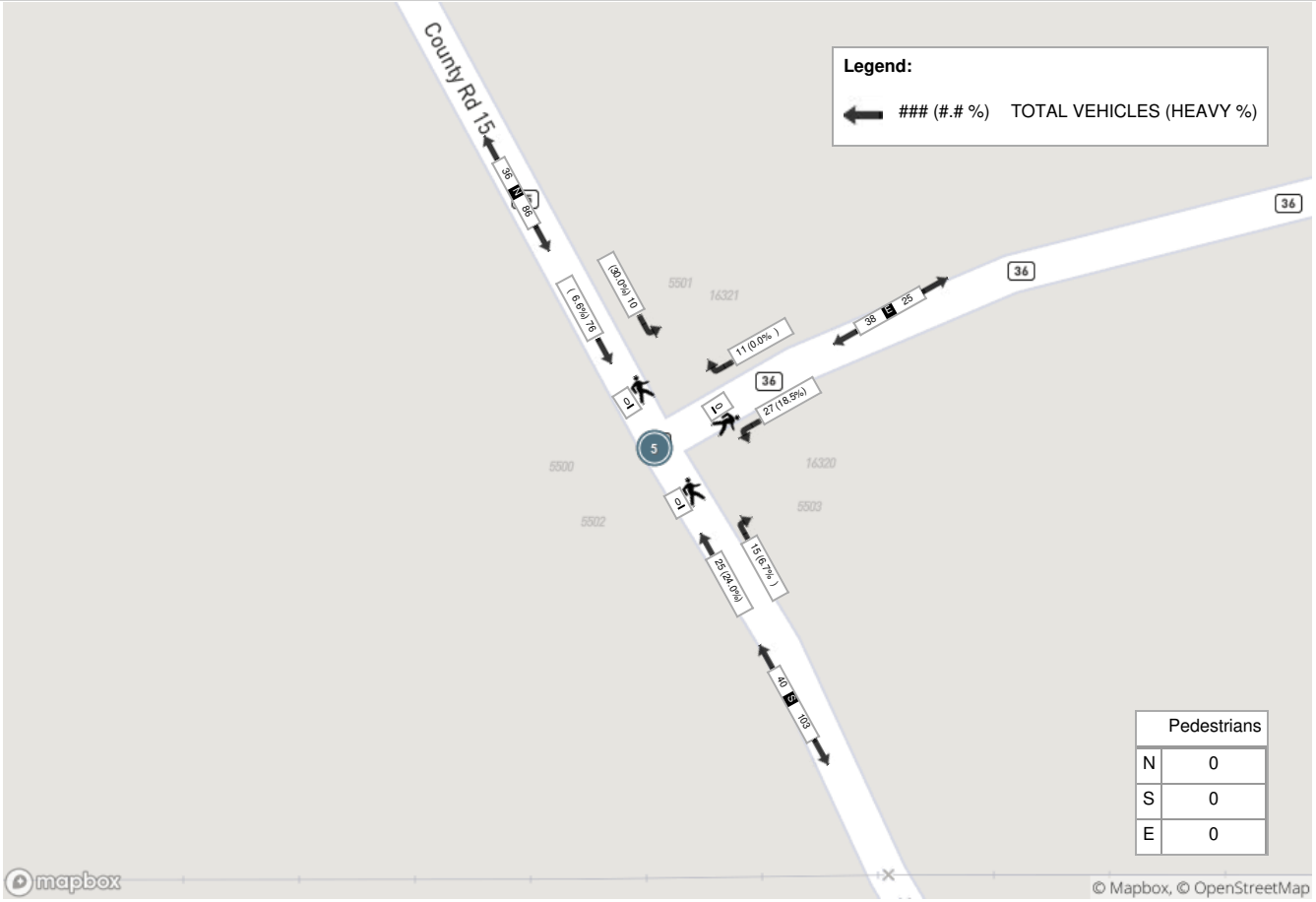
STREET
TORONTO ONTARIO, M5B 1M4
CANADA

Peak Hour: 07:15 AM - 08:15 AM Weather: Overcast Clouds (13.63 °C)



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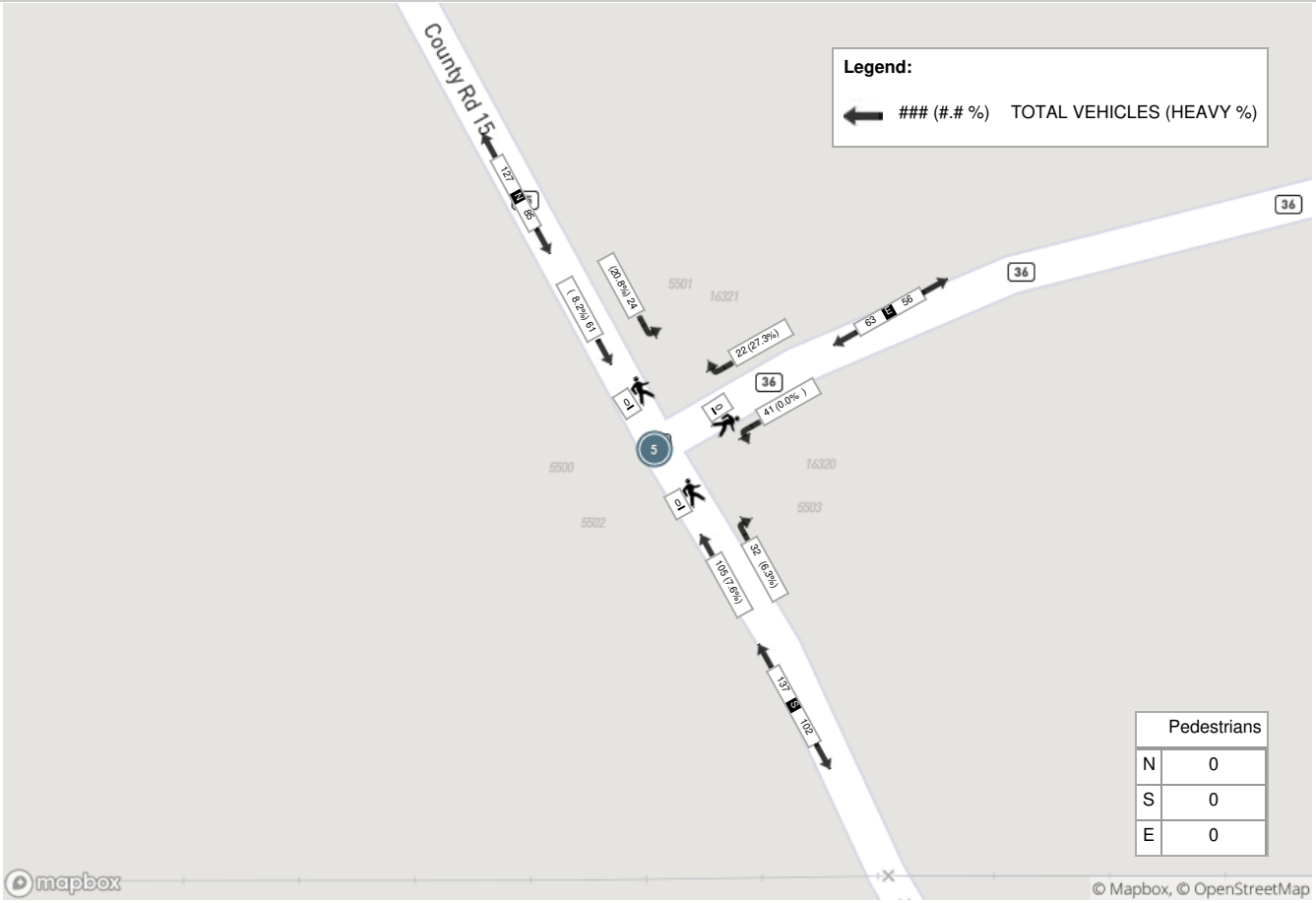
SUITE 301 211 YONGE
STREET
TORONTO ONTARIO, M5B 1M4
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (15.37 °C)



APPENDIX D

Detailed Capacity Analysis Reports

Intersection: 1: Avonmore Road

Movement	NB	SB
Directions Served	T	T
Maximum Queue (m)	61.2	57.3
Average Queue (m)	16.2	24.9
95th Queue (m)	56.7	66.5
Link Distance (m)	279.2	54.8
Upstream Blk Time (%)		21
Queuing Penalty (veh)		43
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Avonmore Road & County Road 36

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (m)	45.1	57.4
Average Queue (m)	17.8	15.8
95th Queue (m)	39.2	58.8
Link Distance (m)	222.4	223.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 43

Intersection: 1: Avonmore Road

Movement	NB	SB
Directions Served	T	T
Maximum Queue (m)	131.4	57.7
Average Queue (m)	50.5	24.3
95th Queue (m)	135.4	64.9
Link Distance (m)	279.2	54.8
Upstream Blk Time (%)		14
Queuing Penalty (veh)		23
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Avonmore Road & County Road 36

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (m)	50.7	61.3
Average Queue (m)	18.4	13.5
95th Queue (m)	48.2	53.1
Link Distance (m)	222.4	223.8
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 23

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	54	22	56	30	20	156
Future Volume (vph)	54	22	56	30	20	156
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.961		0.953			
Flt Protected	0.966					0.994
Satd. Flow (prot)	1572	0	1551	0	0	1743
Flt Permitted	0.966					0.994
Satd. Flow (perm)	1572	0	1551	0	0	1743
Link Speed (k/h)	80		80			80
Link Distance (m)	231.1		77.0			230.7
Travel Time (s)	10.4		3.5			10.4
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	19%	0%	24%	7%	30%	7%
Adj. Flow (vph)	61	25	63	34	22	175
Shared Lane Traffic (%)						
Lane Group Flow (vph)	86	0	97	0	0	197
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.0%		ICU Level of Service A	
Analysis Period (min) 15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	54	22	56	30	20	156
Future Volume (Veh/h)	54	22	56	30	20	156
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	61	25	63	34	22	175
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)			77			
pX, platoon unblocked	0.97	0.97			0.97	
vC, conflicting volume	299	80			97	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	263	37			54	
tC, single (s)	6.6	6.2			4.4	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.5	
p0 queue free %	91	98			98	
cM capacity (veh/h)	660	1010			1348	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	86	97	197
Volume Left	61	0	22
Volume Right	25	34	0
cSH	734	1700	1348
Volume to Capacity	0.12	0.06	0.02
Queue Length 95th (m)	3.0	0.0	0.4
Control Delay (s)	10.6	0.0	1.0
Lane LOS	B		A
Approach Delay (s)	10.6	0.0	1.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	27.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	65	34	172	50	38	101
Future Volume (vph)	65	34	172	50	38	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.954		0.970			
Flt Protected	0.968					0.986
Satd. Flow (prot)	1625	0	1733	0	0	1698
Flt Permitted	0.968					0.986
Satd. Flow (perm)	1625	0	1733	0	0	1698
Link Speed (k/h)	80		80			80
Link Distance (m)	231.1		77.0			230.7
Travel Time (s)	10.4		3.5			10.4
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	0%	27%	8%	6%	21%	8%
Adj. Flow (vph)	68	35	179	52	40	105
Shared Lane Traffic (%)						
Lane Group Flow (vph)	103	0	231	0	0	145
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.2%		ICU Level of Service A	
Analysis Period (min) 15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	65	34	172	50	38	101
Future Volume (Veh/h)	65	34	172	50	38	101
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	68	35	179	52	40	105
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)			77			
pX, platoon unblocked	0.93	0.93			0.93	
vC, conflicting volume	390	205			231	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	308	110			137	
tC, single (s)	6.4	6.5			4.3	
tC, 2 stage (s)						
tF (s)	3.5	3.5			2.4	
p0 queue free %	89	96			97	
cM capacity (veh/h)	620	820			1246	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	103	231	145
Volume Left	68	0	40
Volume Right	35	52	0
cSH	676	1700	1246
Volume to Capacity	0.15	0.14	0.03
Queue Length 95th (m)	4.1	0.0	0.8
Control Delay (s)	11.3	0.0	2.4
Lane LOS	B		A
Approach Delay (s)	11.3	0.0	2.4
Approach LOS	B		

Intersection Summary			
Average Delay		3.2	
Intersection Capacity Utilization		35.2%	ICU Level of Service A
Analysis Period (min)		15	