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June 15, 2015

via email: sam@greenwoodconst.ca
CCTA File 114239

Sam Greenwood

Greenwood Aggregates
205467 County Road 109
Amaranth, ON L9W 0V1

**Re: Proposed Violet Hill Gravel Pit, Town of Mono
Traffic Review**

Dear Mr. Greenwood:

As requested, we have reviewed the proposed Violet Hill pit development plan from a transportation perspective, addressing the site access, site traffic volumes, and the potential impacts to the adjacent road system. Our findings are detailed below.

Proposed Pit Development

Site Location

The development site is located on the south side of Highway 89 between 3rd Line East and 4th Line East in the Town of Mono, Dufferin County. As illustrated in Figure 1, the site is bounded by each of the noted roads and is also bisected by 30 Sideroad. The site constitutes part lots 30, 31 and 32 of Concession 4

Site Plan

The proposal calls for a licensed gravel extraction operation. The area to be licensed is 149.4 hectares, to be extracted in a number of phases. The proposed annual extraction limit is 1,000,000 tonnes, although actual extraction is expected to be less (the 1,000,000 tonne limit is to allow for large construction projects in the immediate area).

Site Access

Direct access to Highway 89 is proposed to serve the site, to be located approximately 380 metres west of 4th Line East (measured centre to centre). The proposed access location is illustrated in Figure 2.

Typically, when a development site has frontage on upper and lower tier roads (the road system is tiered as follows: provincial highways - county roads - local roads), access is to be provided via the lower tier roads. As applicable to this application, Highway 89 is an upper tier road whereas 3rd Line East and 4th Line East are lower tier roads. While an access can be readily constructed to 4th Line East (in that the site has frontage on this road and the prevailing grades and existing conditions permit), the sight lines at the intersection of 4th Line East with Highway 89 are limited to/from the east due to the combined horizontal and vertical curves on the highway (as evident in Figure 3). Due to the later constraints, access via 4th Line East is not recommended.

While the site's west boundary is along 3rd Line East, there are significant grade changes within the site in this immediate area (grades within the site raise 20 to 25 metres higher than 3rd Line East). In addition, there are considerable woodlot areas (extension of the NEC Escarpment Natural Area Bush noted on the west side of 3rd Line East) and a number of surface drainage features and watercourses along the site's western boundary which are to be maintained (they are otherwise located outside of the designated extraction limits). Other lands west of 3rd Line East are noted as NEC Escarpment Rural Area Residential. Given these constraints, access via 3rd Line East has not been considered.

Site Generated Traffic

Estimates of the number of trips to be generated by the site have been based on the following:

- annual extraction limit of 1,000,000 tonnes;
- average truck capacity of 34 tonnes; and
- 250 operating days per year (consistent with year round operations).

The peak operating season is expected to be between the months of May and November, with 80% of the annual tonnage assumed to be extracted during this period. During this time, the pit is assumed to operate 13 hours per day (6:00 to 19:00). The off-peak season (December to April) will see the remaining 20% extracted (reflective of reduced market demands and construction activity during this period). During this period, reduce hours of operation area assumed (8 hours per day).

A summary of the truck trip estimates is provided in Table 1, including daily and hourly truck volumes. To further consider peak hour operations during the day, the average hourly volumes have been increased by a factor of 2 (ie. site activity will not be uniform over the course of the day as some hours will be busier than others). As per Table 1, during the peak season the site is expected to generate on average 12.5 loads per hour, which translates to 12.5 truck trips to the site and 12.5 truck trips from the site. In considering peak hour operations, 25 trucks to the site and 25 trucks from the site are estimated (assuming a peak hour factor of 2). During the off-peak season the volumes are expected to be approximately half. To maintain a conservative approach, the peak hour peak season trip estimates have been assumed in the subsequent assessment.

Table 1: Site Generated Traffic (loaded trucks)

Period	Tonnage	Operating Days	Tonnes/ Day	Loads/ Day	Loads/Hour average	Loads/Hour peak
Average (Jan – Dec)	1 000 000	250	4000	117	12	24
Peak Season ¹	800 000	145	5517	162	12.5	25
Off-Peak Season ²	200 000	105	1905	56	7	14

¹ peak season = May to November (during which it is assumed 80% of the annual tonnage will be extracted)

² off-peak season = December to April (during which it is assumed that 20% of annual tonnage will be extracted)

The pit will also generate automobile trips at the start and end of each day related to employee use. However, the volume of such will be minor and thus the associated impacts are considered negligible.

In consideration of the market areas, the following trip distribution is expected for aggregate material exported from the site:

- to the west via Highway 89: 25%; and
- to the east via Highway 89: 75%.

The resulting site generated traffic volumes assigned to the road network are illustrated in Figure 4. For purposes of this assessment, the noted peak hour volumes are considered for both the AM and PM peak hours.

Haul Routes

The destination of the aggregate material will dictate the haul route. Given the location of the site in proximity to Highway 89 and the proposed direct highway access, all truck traffic to/from the site will utilize Highway 89.

Highway 89 is a two-lane provincial highway, oriented east-west. The highway has a rural cross-section, including gravel shoulders and roadside ditches. Through the area the posted speed limit is 80 km/h, hence a design speed of 100 km/h (posted speed limit + 20 km/h) has been assumed. As previously note, there are a number of horizontal and vertical curves on the highway, reflective of the general topography of the area. As a provincial highway, this road is designated to accommodate significant traffic volumes and all vehicle types (including aggregate trucks). As such, it need not be designated as a haul route - this is inherent in the highway designation.

Photographs of Highway 89 in the vicinity of the proposed site access, which are representative of the highway through the area, are provided in Figure 5.

Traffic Operations Assessment

Existing Traffic Volumes

Traffic data through the study area was obtained from MTO and reflects the following:

- intersection turning movement count at Highway 89 and Highway 10 (October 31, 2013);
- intersection turning movement count at Highway 89 and Dufferin Road 18/Airport Road (October 31, 2012); and
- mid-block counts at a location 0.9 km west of Dufferin Road 18/Airport Road (April 23, 2012; August 8, 2012 and January 29, 2013).

The corresponding count summaries are attached in Appendix A. As the intersection turning movement counts pertain to the major intersections both west and east of the site, and the mid-block counts were completed within the immediate area, the data is considered directly relevant.

Following a review of the count data, the highest peak hour traffic volumes on Highway 89 were established (corresponding to the mid-block count completed August 8, 2012 which is considered representative of peak summer conditions) and employed in this study. As no data was available at the intersections of 3rd Line East and 4th Line East, the corresponding turning volumes were estimated in consideration of the level of area development and road system (both of which are somewhat limited and thus minimal volumes are anticipated). The resulting peak hour volumes are illustrated in Figure 6. As the count data was collected in 2012, it has been increased by 1% per year (as detailed below) to reflect current 2015 conditions. To reflect operations of the proposed pit, the associated site generated traffic volumes have also been included in the 2015 volumes.

Future Traffic Volumes

Traffic volumes expected for the 2020 and 2025 horizon years (representing 5 and 10 year planning horizons) for the study area have been estimated based on the 2012 traffic counts and historical growth on Highway 89 as per the *MTO Provincial Highways Traffic Volumes 1988-2010*¹ (which represents the most current published MTO data).

The MTO historical traffic data for the section of Highway 89 from the Mono-Adjala Townline to Highway 10 was reviewed for the period 2001 to 2010. During the 10-year period, the change in volumes ranged from an increase of 5% to a reduction of 18% year to year, with an average decrease of 2 to 3% per year. From 2001 to 2003 volumes increased, whereas from 2003 to 2010 volumes have decreased or remained the same.

¹ *Provincial Highways Traffic Volumes 1988-2007*, Ministry of Transportation of Ontario.

In considering future volumes, notwithstanding the recent decrease in traffic levels, an increase of 1% per year has been assumed to ensure a conservative approach. The resulting total volumes for 2020 and 2025 (including consideration for traffic to be generated by the Violet Hill Pit) are illustrated in Figure 7 and Figure 8 respectively. As previously noted, the site is expected to generate 25 truck trips to the site and 25 truck trips from the site during each peak hour.

Traffic Impacts

The traffic operations of the site access have been reviewed based on the projected traffic volumes and considering a simple access configuration (1 lane in and 1 lane out operating under stop control). The results of the analysis are summarized in Table 2 whereas detailed operational worksheets are provided in Appendix B. Average delays (seconds), levels of service and volume to capacity ratios are provided for the critical, stop controlled movement (exit from the pit). Level of service (LOS) A corresponds to the best operating condition with minimal delays whereas LOS F corresponds to poor operations resulting from high intersection delays. A volume to capacity ratio of 1.0 or greater indicates that the intersection is operating at or above capacity. As noted, excellent levels of service and minimal delays are expected – the additional traffic generated by the proposed pit will have minimal overall impacts to the operations of the road network.

Table 2: Site Access Operations

Intersection & Horizon Year	Control	AM Peak Hour			PM Peak Hour			
		delay	LOS	v/c	delay	LOS	v/c	
Site Access & Highway 89	2020	stop	11	B	0.04	11	B	0.04
Site Access & Highway 89	2025	stop	13	B	0.05	13	B	0.06

In considering the overall operations along Highway 89, the 2025 traffic projections yield peak hour peak directional volumes in the order of 400 to 500 vehicles (the maximum volumes per direction occur during the PM peak hour). For a provincial highway reflective of Highway 89, the assumed planning capacity is 900 to 1100 vehicles per hour per lane. As such, the future volumes will remain well below the theoretical planning capacity and hence the additional traffic to be generated by the pit can be readily accommodated.

Road System Improvements

Operational Improvements

As the operational assessment indicates that the site access intersection will provide acceptable levels of service and delay under the assumed intersection configuration (1 lane in and 1 lane out) and

control (stop control for outbound travel), no further improvements are required from an operational perspective.

Turn Lane Improvements

Notwithstanding the good operating conditions anticipated at the site access, the need for exclusive turn lanes on Highway 89 at the site access have been investigated based on MTO turn lane warrants and considering the following:

- 100 km/h design speed (assumed to be speed limit + 20 km/h);
- left and right turning volumes assuming operations at 1,000,000 tonnes per year; and
- approaching and opposing volumes on Highway 89.

At an unsignalized intersection, MTO criteria indicate that a right turn lane should be considered if right turn volumes exceed 60 vehicles per hour during the peak hour and are anticipated to create a hazard or reduce the capacity at the intersection. The eastbound right turn volumes on Highway 89 at the site access are projected to be in the order of 6 vehicles per hour (assuming an annual extraction limit of 1,000,000 tonnes) and thus well below the design criteria. With regard to the question of whether right turning site traffic would present a hazard at the site access, it is noted that the low volume of turning traffic (6 trucks per hour or 1 truck every 10 minutes) suggests that any operational effects on Highway 89 would be infrequent, and considering that trucks inbound to the site would be empty, the operational effects of their deceleration when turning are expected to be minor. It is further noted that the site access intersection is visible from a distance of approximately 280 metres, thus affording ample opportunity for vehicles following a truck which is slowing to complete a turn to make the necessary adjustments in their travel speeds. In this respect, an eastbound right turn lane on Highway 89 at the site access is not considered necessary. Notwithstanding, in consideration of the turning path of trucks and to minimize off-tracking and maintenance of the gravel shoulder upon approach to the site access, it is recommended that a 60 metre right turn taper be paved within the existing Highway 89 shoulder area which will serve as a partially paved shoulder (ie. the taper not be delineated as an exclusive right turn lane).

MTO left turn lane warrants have been reviewed based on the projected total traffic volumes and a design speed of 100 km/h (based on an 80 km/h speed limit). In considering the PM peak hour conditions (which reflect the more critical period) and a volume of 19 left turning trucks entering the site (which again assumes the site is operating at full capacity), a westbound left turn lane is warranted under each of the 2015, 2020 and 2025 horizon periods. While the turning volume is not significant (19 trucks per hour, which equates to approximately 1 left turn every 3 minutes), the through volumes are significant enough to warrant the turn lane. Based on MTO standards for a 100 km/h design speed, the left turn lane should consist of the following: 15 metre offset from the centre of the site access to the start of the left turn lane + 15 metre storage length + 70 metre parallel lane + 160 metre

taper length (total length of 260 metres to the east of the access). In addition, a run-out length of 190 metres would be required west of the access to transition back to 2 lanes.

Road Condition Improvements

As previously noted, Highway 89 is a provincial highway, the intent of which is to serve high volumes of traffic and all vehicle types. As such, it has been planned and constructed to accommodate the trips associated with the proposed development. Truck traffic is permitted on Highway 89 365 days per year - there are no load restrictions applied in the spring periods.

A visual inspection was conducted of Highway 89 as part of the site reconnaissance. The road is generally in good condition with no significant or major deficiencies that would affect the operations of the proposed pit.

Sight Line Assessment

Sight Distance Requirements

The Ministry of Transportation guidelines for a roadway with a design speed of 100 km/h dictate a minimum stopping sight distance of 185 metres and a turning sight distance of 375 metres.

Stopping distance refers to the minimum distance required for a vehicle travelling at the design speed to stop before reaching an object in the road. For example, should a vehicle slow or stop on Highway 89 to turn into the site, approaching vehicles (either eastbound or westbound) must have sufficient sight lines to ensure they are able to come to a complete stop without colliding with the vehicle. Turning sight distance, on the other hand, provides sufficient distance for a vehicle to enter a road and accelerate to the assumed operating speed before being overtaken by a vehicle approaching in the same direction at the design speed.

Available Sight Lines

The available sight lines at the proposed site access (between a truck at the site access and an approaching car) were established based on field reconnaissance and measures, the results of which are illustrated in Figure 9 (corresponding photographs are provided in Figure 5) and summarized below:

- 470 metres to/from the east; and
- 280 metres to/from the west.

Sight Line Assessment

For sight lines to/from the west and to/from the east, the minimum stopping sight distance requirements are satisfied. In this regard, should an approaching vehicle need to come to a complete

stop to avoid a collision with a gravel truck entering or exiting the site, they can do so safely and efficiently. While the turning sight distance is not satisfied to the west, this is not to suggest unsafe conditions. Rather, should a truck exit the site to proceed eastbound, vehicles approaching from behind may have to adjust their travel speed (ie. they may not be able to maintain an 80 km/h approach speed). In consideration of the above, no road improvements are required to address sight lines at the proposed site access.

As previously noted, while access via 4th Line is possible, thus utilizing the existing intersection, the sight lines to/from the east are limited to approximately 150 metres which is less than the minimum required stopping sight distance. In comparison, the proposed site access provides improved sight lines and thus provides a safer arrangement.

Summary

This review has addressed the transportation impacts associated with the proposed Violet Hill gravel pit, to be located on the south side of Highway 89 between 3rd Line East and 4th Line East. The key points and findings of the review are summarized below.

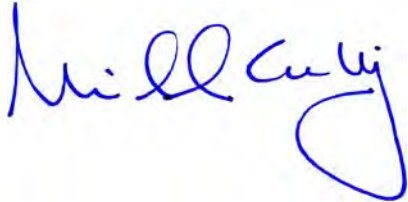
- The site is seeking an annual extraction licence limit of 1,000,000 tonnes, although actual extraction amounts are expected to be less.
- Assuming 1,000,000 tonnes extracted per year, the site is expected to generate approximately 117 loaded truck trips on average, per day (which translates to 117 truck trips to the site and 117 trips from the site).
- In considering that the peak operations are expected to be from May to November during which time 80% of the annual tonnage is assumed to be extracted, corresponding to the peak demands for materials, the daily truck trips will increase to 162 trucks (162 in and 162 out).
- Based on a 13 hour working day and assuming that peak hour volumes for site trips are 200% of the average hourly volumes, a peak hour volume of 25 trucks per hour (25 in and 25 out) is expected during the peak period of May to November.
- Aggregate material will be exported from the site via Highway 89. Approximately 25% of the material is destined to the west with the remaining 75% destined to the east.
- Under future total traffic conditions (for the years 2020 and 2025), the site access will provide excellent levels of service with minimal delays. Operations at the site access and along Highway 89 will remain under capacity.
- There are constraints along the 3rd Line East relating to grades, topography and natural features that preclude access via the 3rd Line East. Sight distances at the intersection of 4th Line East with Highway 89 do not satisfy the minimum MTO requirements for stopping sight distance and thus access via the 4th Line is not recommended. As such, direct access to Highway 89 is proposed.

- Sight distances on Highway 89 at the site access exceed the Ministry of Transportation guidelines for stopping sight distance for the assumed design speed of 100 kilometres per hour (185 metres). No improvements to address sight distance issues are recommended.
- The following improvements are recommended on Highway 89 at the site access to accommodate site traffic when operating at its extraction limit (1,000,000 tonnes per year):
 - a right turn taper (60 metres in length and to a width of 3.5 metres) should be provided for the eastbound right turn movement to reduce the long-term maintenance needs for this corner (in consideration of right turning trucks); and
 - a left turn lane (15 metre storage + 70 metre parallel lane + 160 metre taper) in addition to a run-out lane (160 metres) is warranted under the 2015, 2020 and 2025 horizons.
- The improvements given above are based on the site operating at its extraction limit of 1,000,000 tonnes per year and the resulting truck volumes that will be generated. Consideration should be given to a staged approach for the road improvements that reflects the actual amount of material to be extracted and shipped, recognizing that the actual amounts will likely be less, particularly during the opening few years. This will also allow the site to be in operation prior to the road improvements being required such that aggregate material from the site can be used in the construction.

Should you have any questions or comments on the above, please do not hesitate to contact us.

Yours truly,

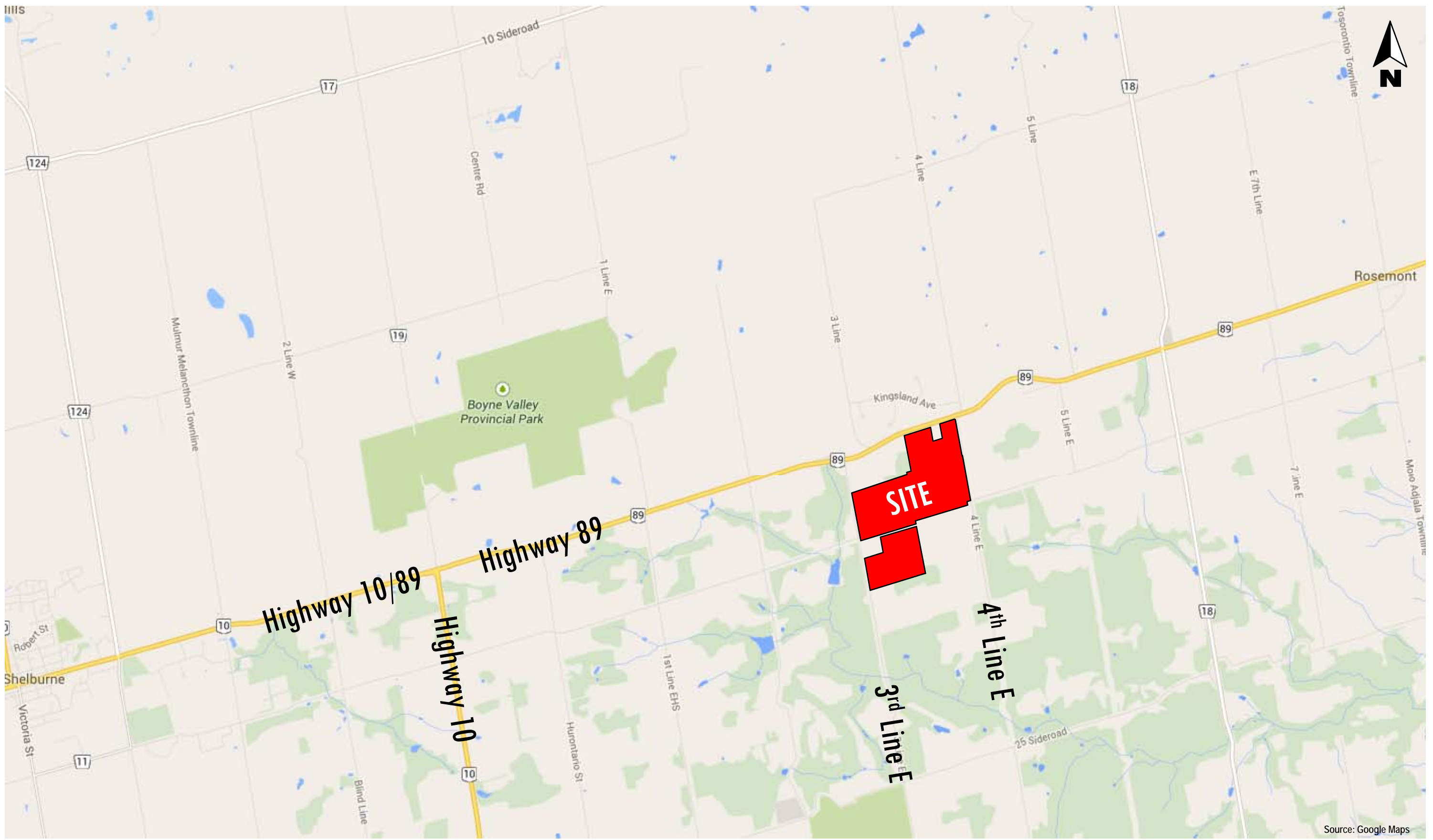
C.C. Tatham & Associates Ltd.



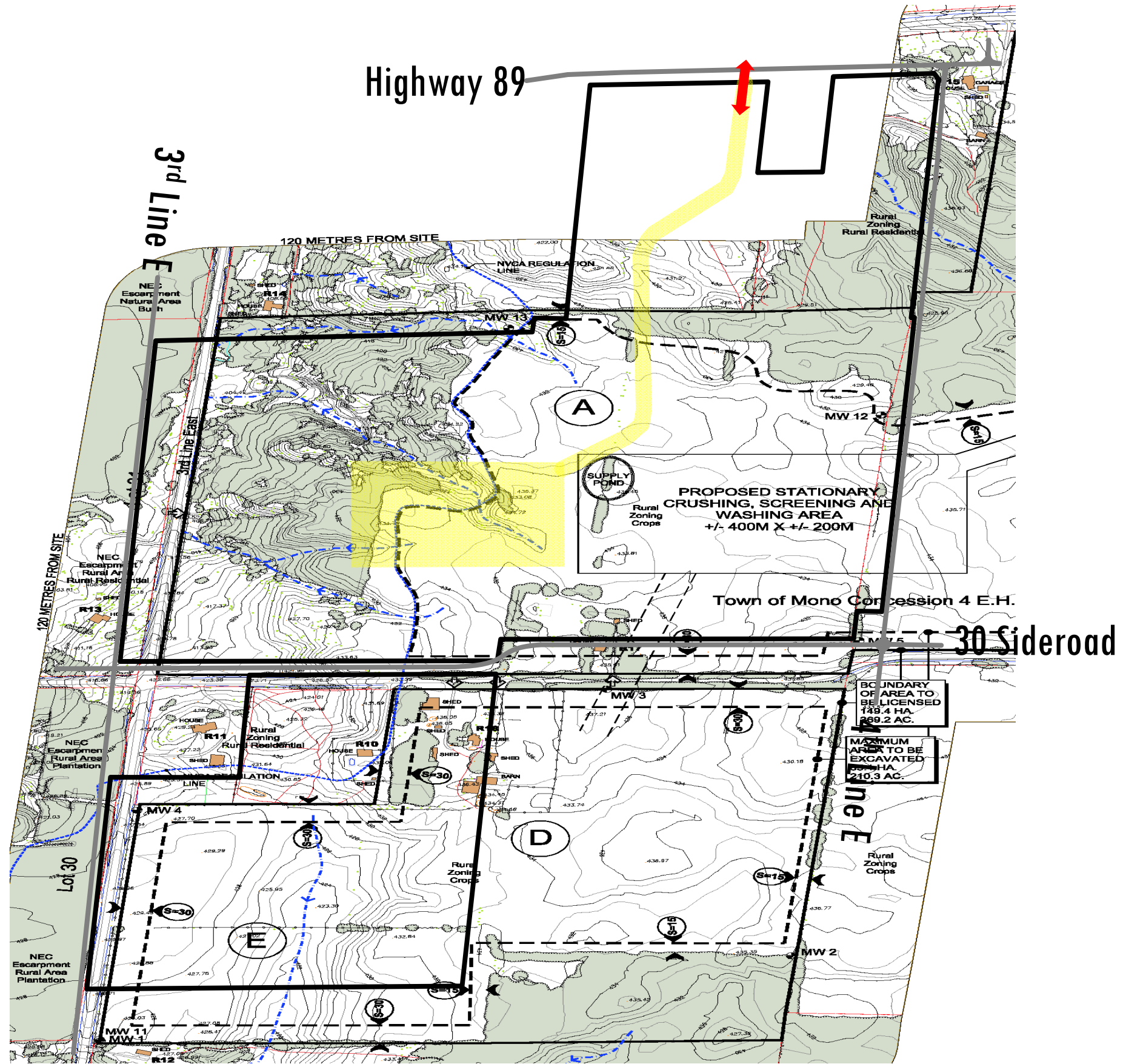
Michael Cullip, P.Eng
Director, Manager – Transportation & Municipal Engineering
MJC:mjc

copy: Craig Laing, C.D. Laing Aggregate Management Services (claingams5@gmail.com)

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Source: Google Maps



Legend

- | | | | |
|--|---------------------------------|--|--|
| | Boundary of Area to be Licensed | | Existing Tree Cover |
| | Area to be Excavated | | Existing Fences |
| | Elevation, 1M Contour | | Building/Structure Use and Receptor Number |
| | Elevation, Spot | | Monitoring Well MW1-MW13 Location and Number |
| | Parcel Fabric | | Existing Entrance/Exit |
| | Surface Drainage | | Cross Sections Location and Identifier |
| | Setbacks, Metres | | |

Violet Hill Pit Traffic Review

Site Concept & Access

Figure

2

Looking east along Highway 89 from the intersection at 4th Line East.

The sight lines to/from the east are limited to approximately 150 metres due to the combined horizontal and vertical curve on the highway.

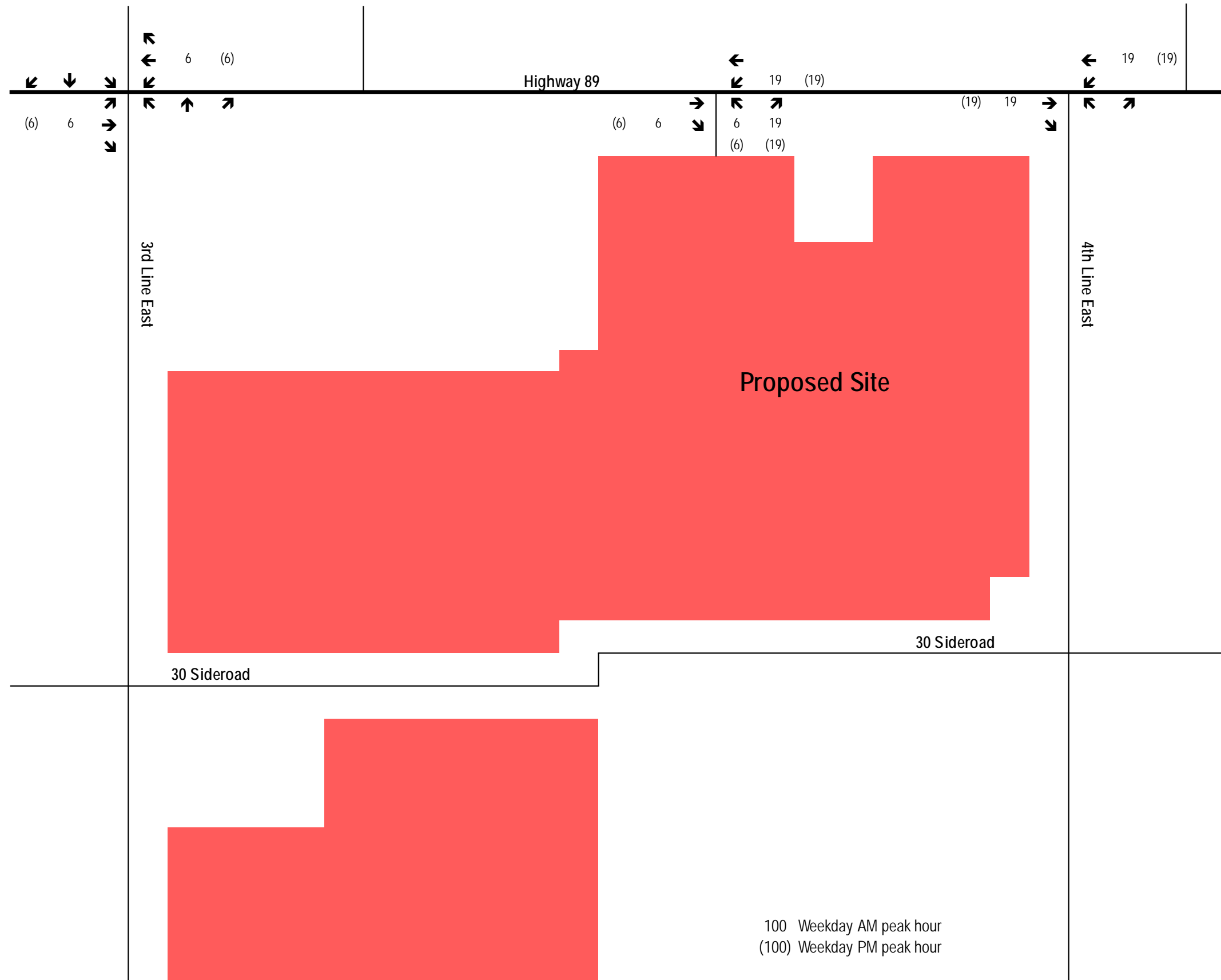
For a design speed of 100 km/h (20 km/h over the posted speed of 80 km/h for major roads), the minimum stopping sight distance requirement is 185 metres and the minimum turning sight distance is 375 metres. As such, the existing conditions do not satisfy the minimum standards and thus truck access via this intersection is not recommended.

Source: Google Maps



Area of combined horizontal and vertical curves on Highway 89 just east of 4th Line East

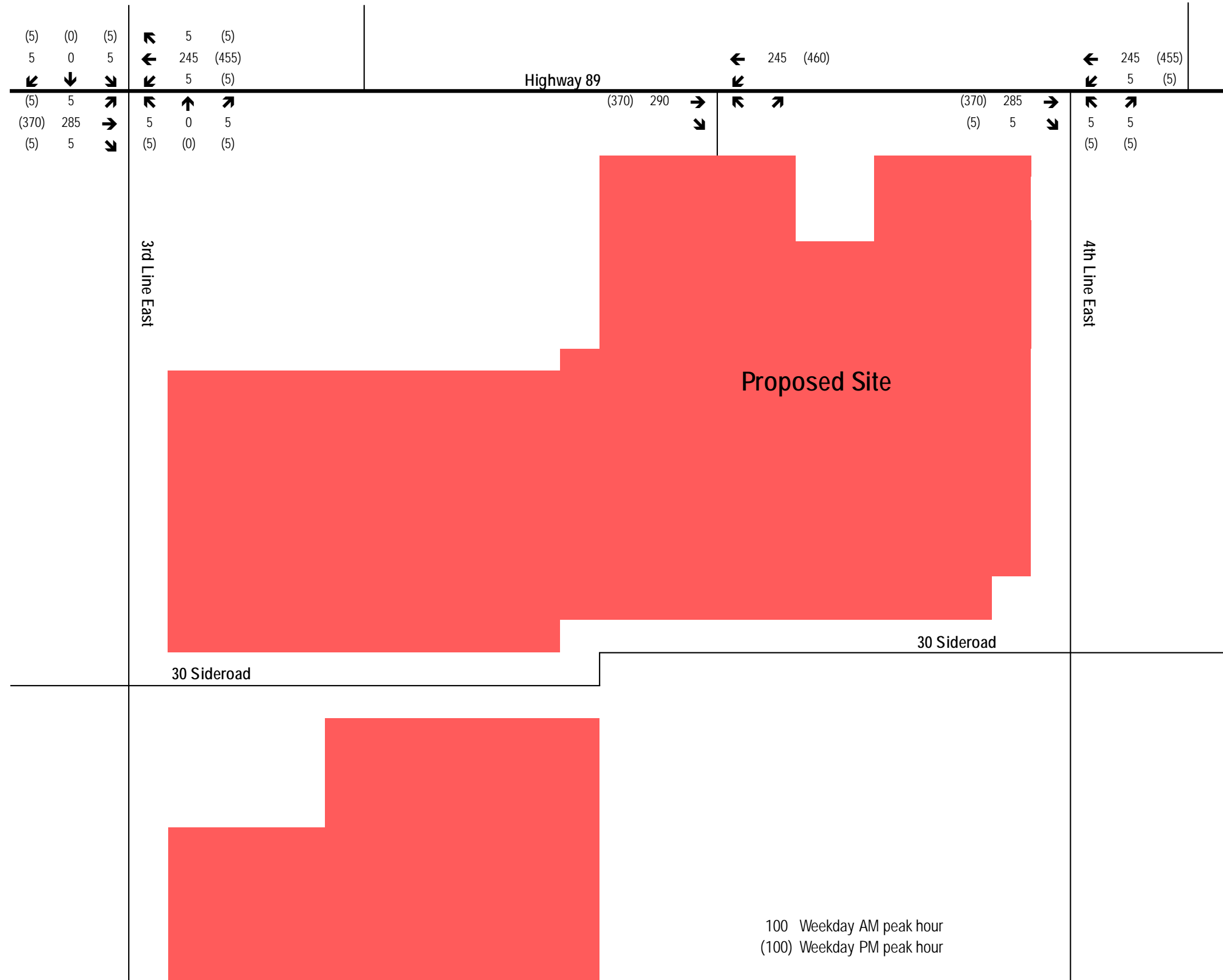
Source: Dufferin Maps

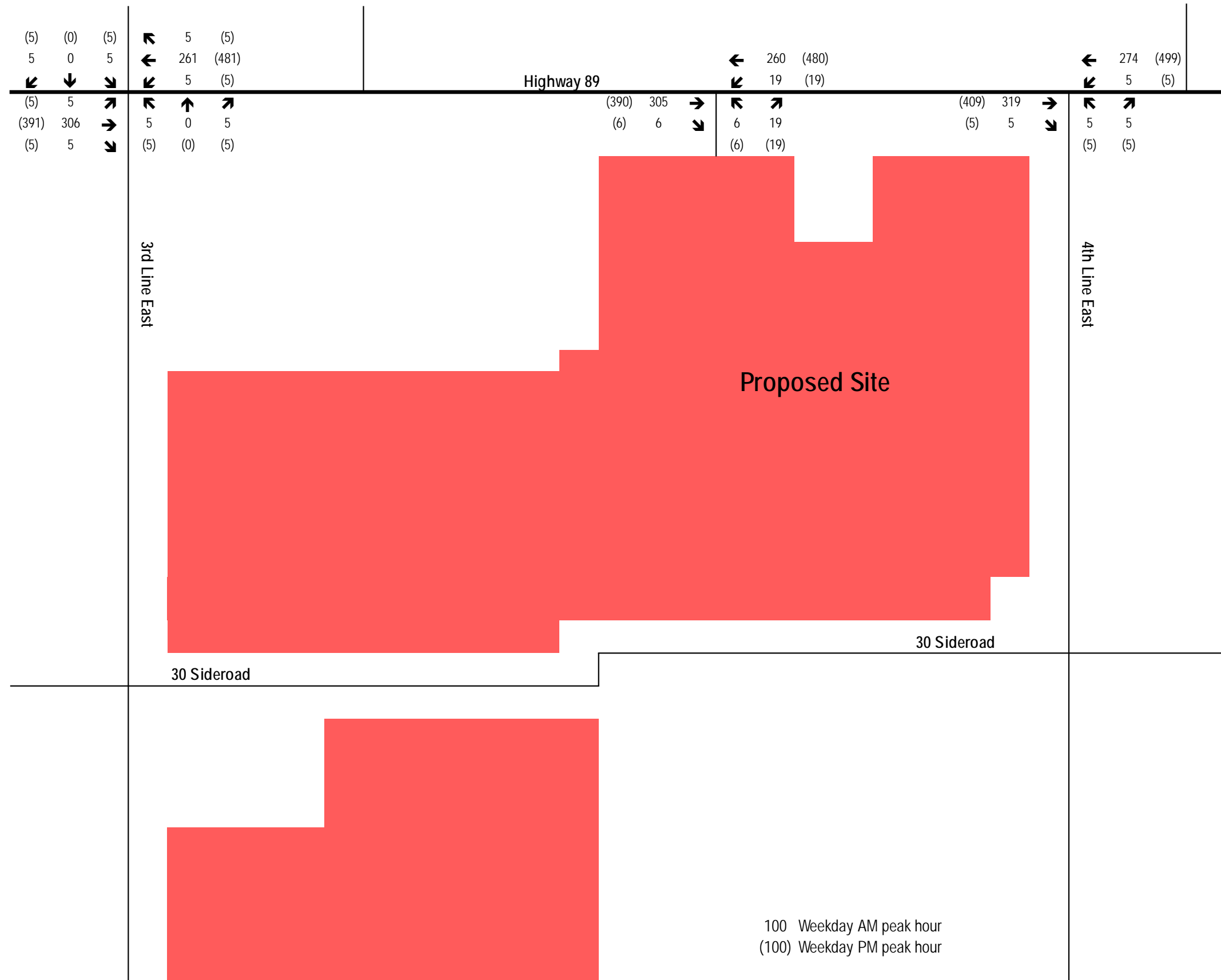


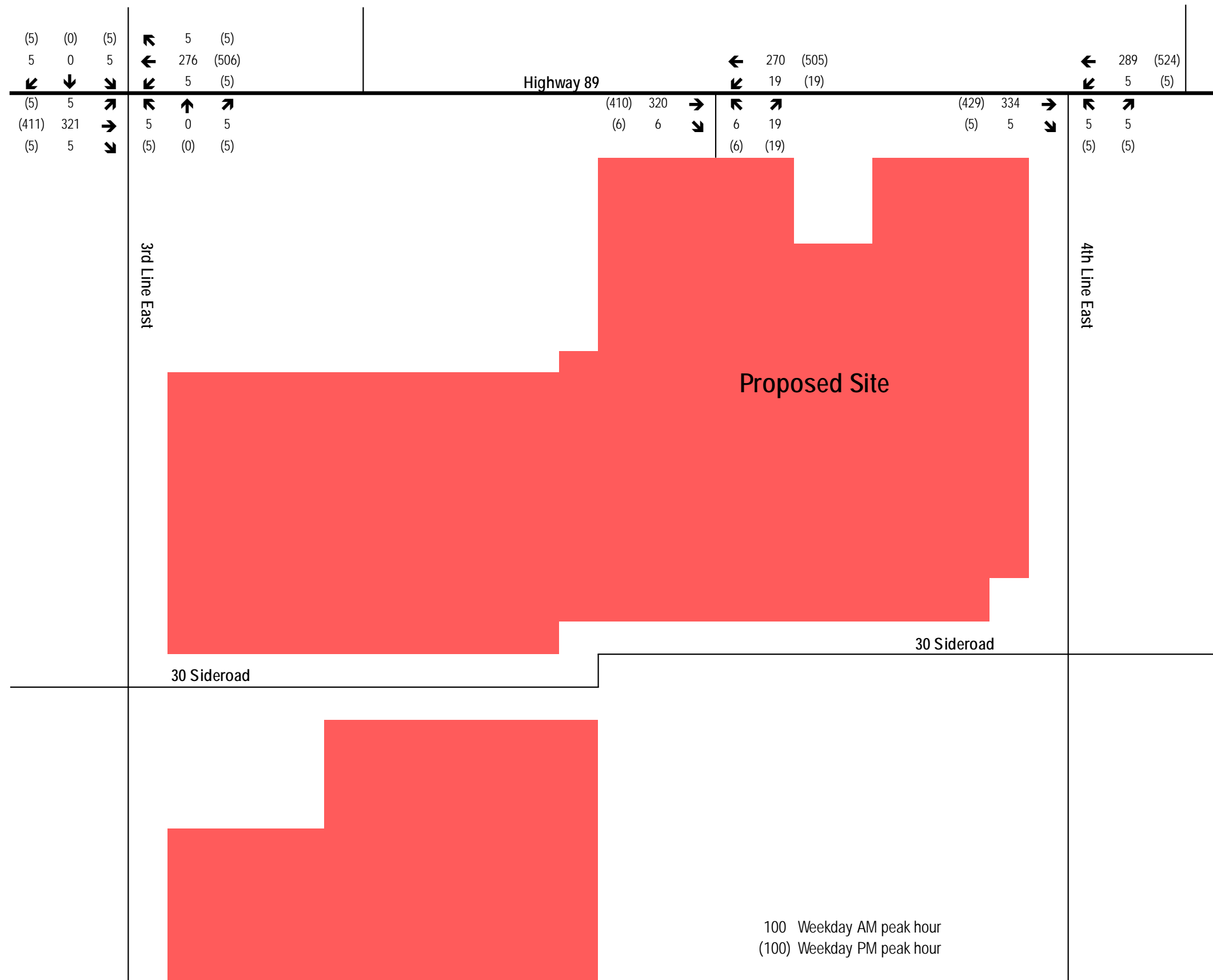
Looking east along Highway 89 from the proposed site access.



Looking west along Highway 89 from the proposed site access.

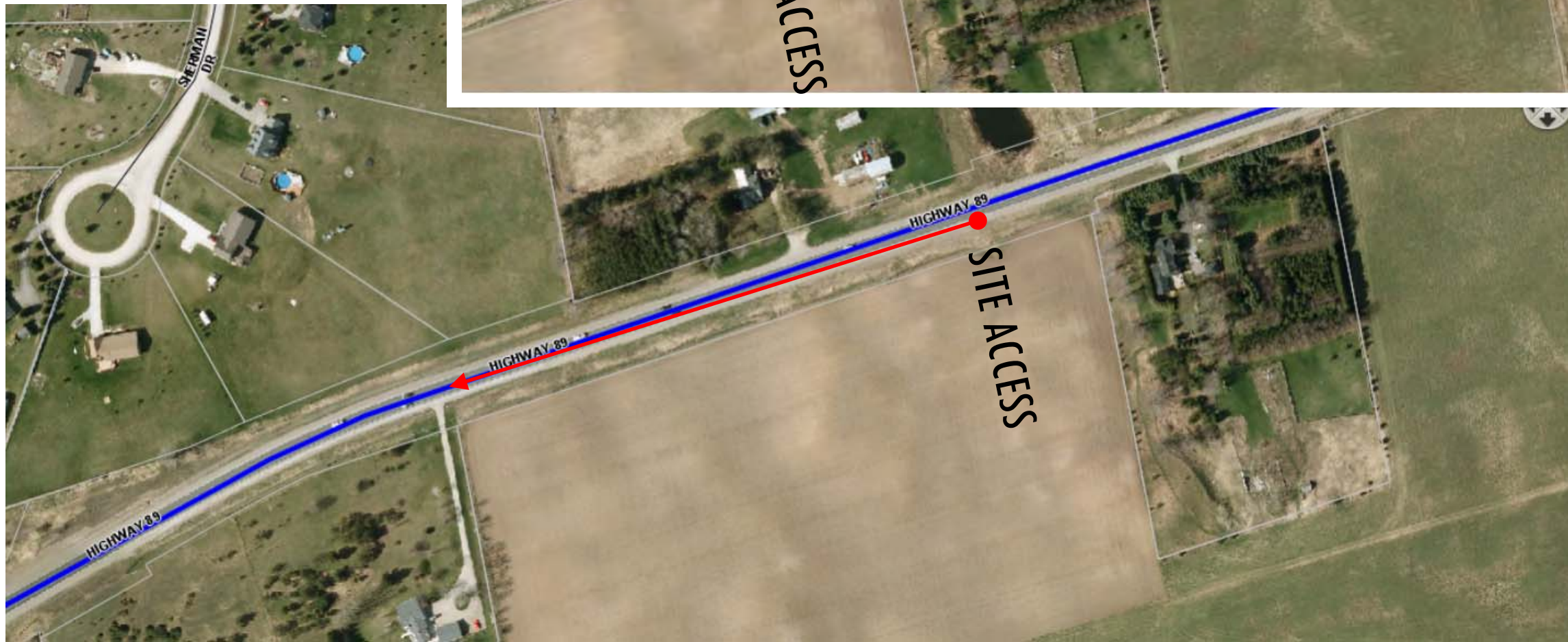






Looking east along Highway 89 from the proposed site access.

Sight distance = 470 metres
(limited by horizontal & vertical alignment)

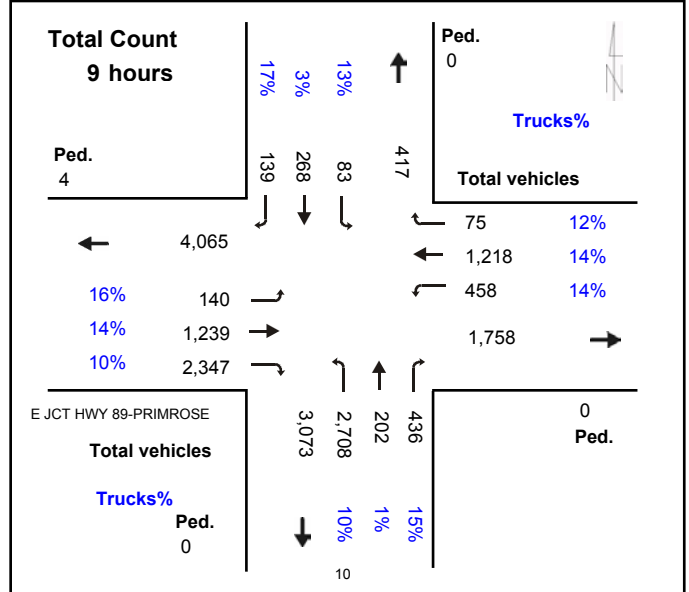
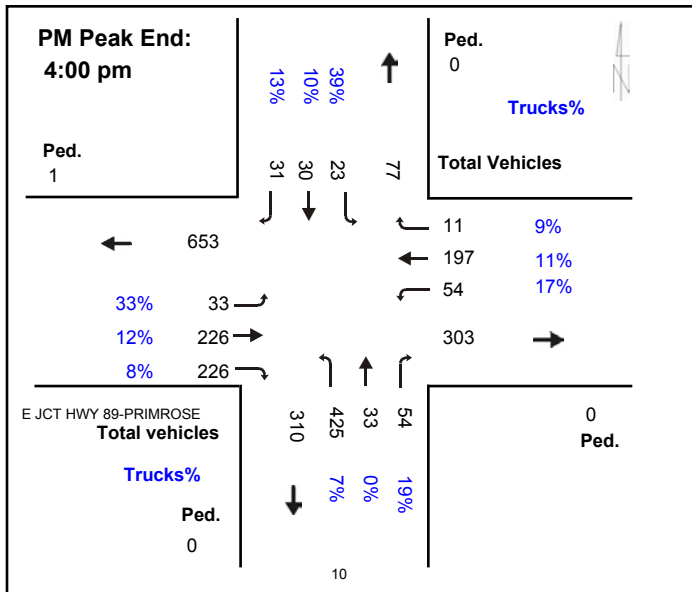
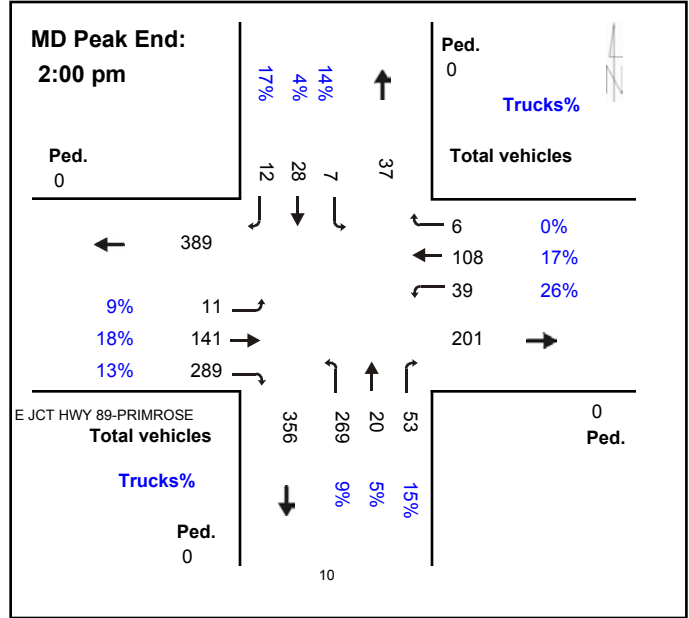
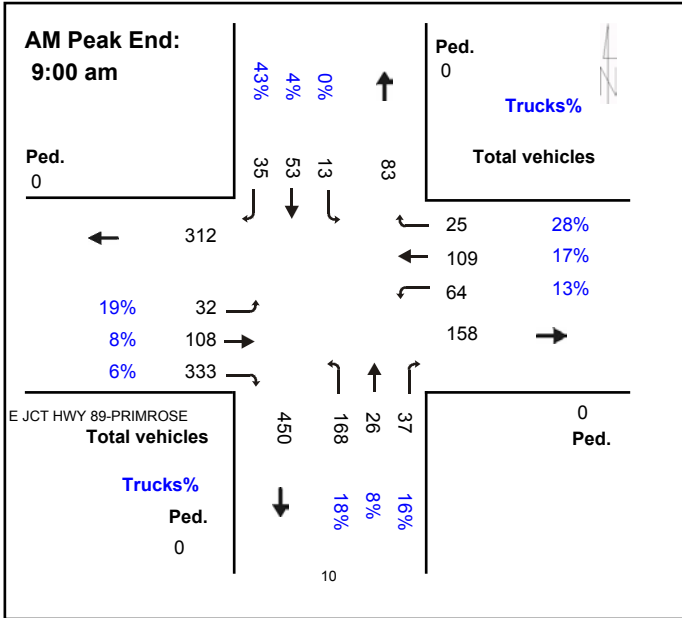


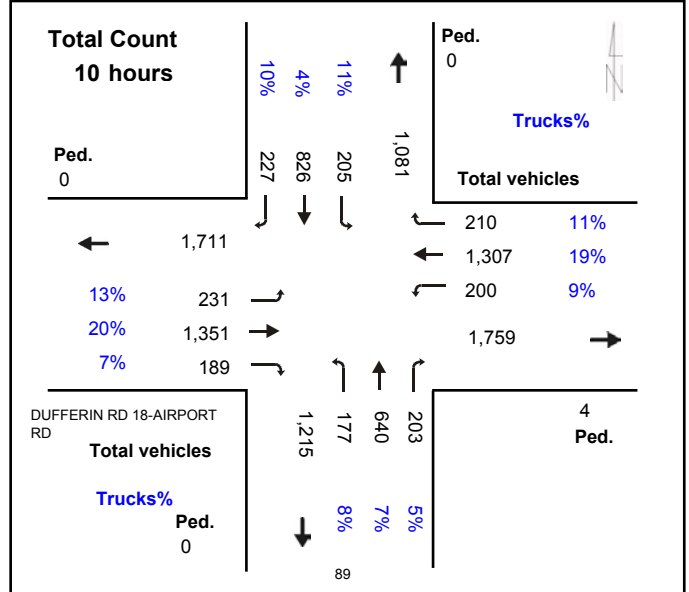
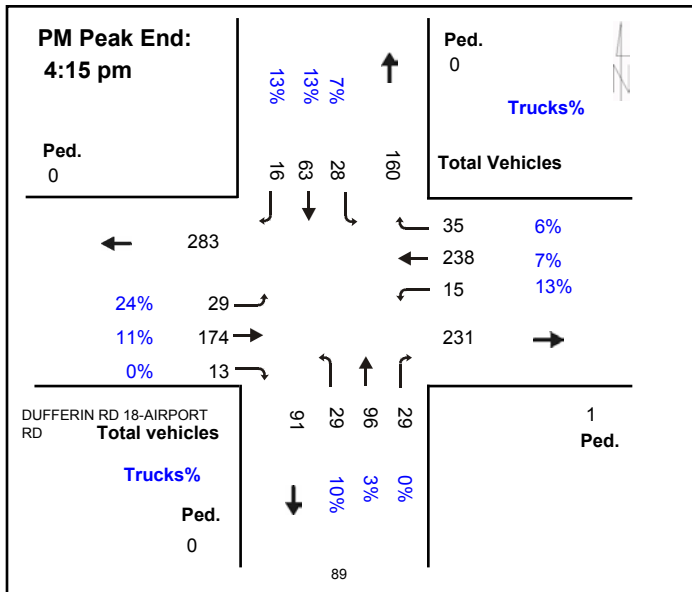
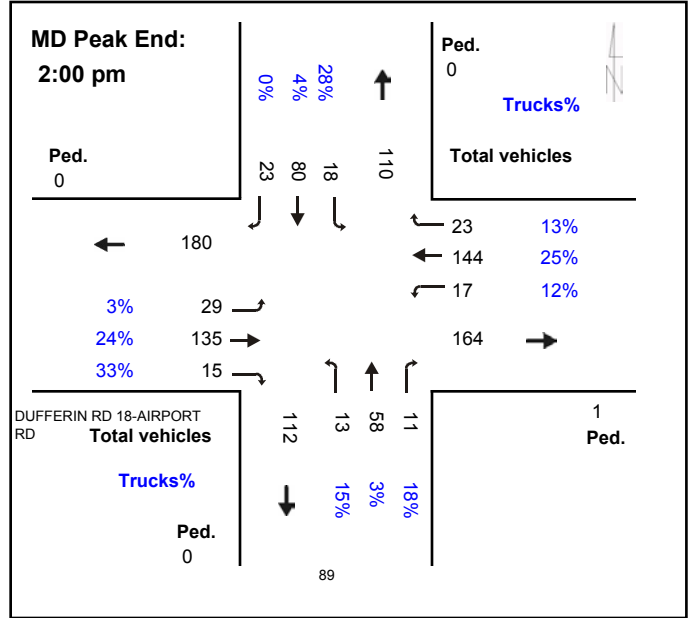
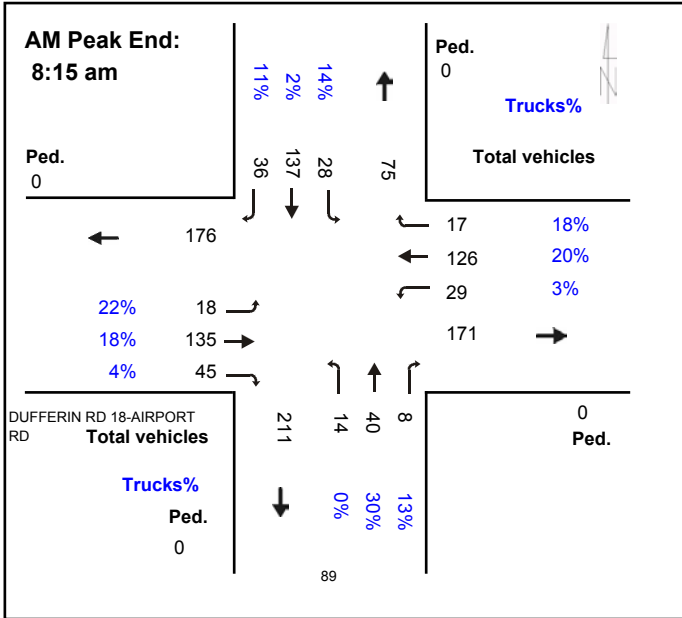
Source: Dufferin Maps

Looking west along Highway 89 from the proposed site access.

Sight distance = 280 metres
(limited by horizontal & vertical alignment)

**Appendix A:
Traffic Data**







Weekly Volume Summary

Mon, Apr 23, 2012

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: EB

Report Dates: Mar 22, 2012 to Mar 28, 2012

Hour Interval	Thu 12/03/22	Fri 23	Sat 24	Sun 25	Mon 26	Tue 27	Wed 28	Thu 29
0:00- 1:00		15	29	38	9	12	7	20
1:00- 2:00		13	15	14	4	12	21	12
2:00- 3:00		12	7	8	3	6	10	11
3:00- 4:00		17	9	5	8	11	11	12
4:00- 5:00		34	4	6	44	38	31	35
5:00- 6:00		184	41	18	191	185	177	178
6:00- 7:00		171	48	28	161	197	173	186
7:00- 8:00		191	76	27	233	205	213	235
8:00- 9:00		188	122	67	185	203	189	197
9:00-10:00		171	213	118	155	175	192	176
10:00-11:00		151	205	184	148	140	160	179
11:00-12:00		175	191	231	165	169	142	155
AM Total	0	1,322	960	744	1,306	1,353	1,326	1,396
12:00-13:00	140	173	250	221	147	148	150	
13:00-14:00	171	170	225	251	159	172	172	
14:00-15:00	192	284	227	205	209	202	191	
15:00-16:00	234	246	249	212	250	257	290	
16:00-17:00	218	237	175	206	184	179	218	
17:00-18:00	211	246	166	215	203	175	196	
18:00-19:00	159	243	131	145	135	131	143	
19:00-20:00	110	181	89	148	84	100	91	
20:00-21:00	78	88	90	105	54	71	78	
21:00-22:00	58	79	68	79	67	64	55	
22:00-23:00	54	57	64	55	39	51	58	
23:00-24:00	26	28	43	16	30	37	25	
PM Total	1,651	2,032	1,777	1,858	1,561	1,587	1,667	0
24 Hr. Total	1,651	3,354	2,737	2,602	2,867	2,940	2,993	1,396
Noon - Noon	2,973	2,992	2,521	3,164	2,914	2,913	3,063	



Weekly Volume Summary

Mon, Apr 23, 2012

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: WB

Report Dates: Mar 22, 2012 to Mar 28, 2012

Hour Interval	Thu 12/03/22	Fri 23	Sat 24	Sun 25	Mon 26	Tue 27	Wed 28	Thu 29
0:00- 1:00		25	116	30	11	28	31	25
1:00- 2:00		92	31	17	2	102	112	120
2:00- 3:00		39	10	14	7	30	34	32
3:00- 4:00		14	7	5	19	19	16	11
4:00- 5:00		15	10	3	21	20	13	19
5:00- 6:00		48	21	15	45	51	59	41
6:00- 7:00		83	44	21	92	98	91	99
7:00- 8:00		141	56	41	132	112	140	154
8:00- 9:00		169	115	57	172	177	164	151
9:00-10:00		164	156	101	130	117	140	133
10:00-11:00		152	164	138	149	136	129	159
11:00-12:00		173	186	194	125	135	154	138
AM Total	0	1,115	916	636	905	1,025	1,083	1,082
12:00-13:00	161	142	218	235	127	130	146	
13:00-14:00	166	187	176	219	148	138	151	
14:00-15:00	175	209	185	267	142	157	175	
15:00-16:00	296	371	300	265	264	253	278	
16:00-17:00	319	316	222	250	273	287	291	
17:00-18:00	281	297	204	193	216	262	255	
18:00-19:00	172	217	174	171	162	182	167	
19:00-20:00	140	167	113	116	100	102	109	
20:00-21:00	116	143	77	90	89	90	84	
21:00-22:00	89	89	77	83	83	75	71	
22:00-23:00	65	101	47	45	47	58	92	
23:00-24:00	45	48	47	28	52	52	53	
PM Total	2,025	2,287	1,840	1,962	1,703	1,786	1,872	0
24 Hr. Total	2,025	3,402	2,756	2,598	2,608	2,811	2,955	1,082
Noon - Noon	3,140	3,203	2,476	2,867	2,728	2,869	2,954	



Weekly Volume Summary

Mon, Apr 23, 2012

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: EB/WB

Report Dates: Mar 22, 2012 to Mar 28, 2012

Hour Interval	Thu 12/03/22	Fri 23	Sat 24	Sun 25	Mon 26	Tue 27	Wed 28	Thu 29
0:00- 1:00		40	145	68	20	40	38	45
1:00- 2:00		105	46	31	6	114	133	132
2:00- 3:00		51	17	22	10	36	44	43
3:00- 4:00		31	16	10	27	30	27	23
4:00- 5:00		49	14	9	65	58	44	54
5:00- 6:00		232	62	33	236	236	236	219
6:00- 7:00		254	92	49	253	295	264	285
7:00- 8:00		332	132	68	365	317	353	389
8:00- 9:00		357	237	124	357	380	353	348
9:00-10:00		335	369	219	285	292	332	309
10:00-11:00		303	369	322	297	276	289	338
11:00-12:00		348	377	425	290	304	296	293
AM Total	0	2,437	1,876	1,380	2,211	2,378	2,409	2,478
12:00-13:00	301	315	468	456	274	278	296	
13:00-14:00	337	357	401	470	307	310	323	
14:00-15:00	367	493	412	472	351	359	366	
15:00-16:00	530	617	549	477	514	510	568	
16:00-17:00	537	553	397	456	457	466	509	
17:00-18:00	492	543	370	408	419	437	451	
18:00-19:00	331	460	305	316	297	313	310	
19:00-20:00	250	348	202	264	184	202	200	
20:00-21:00	194	231	167	195	143	161	162	
21:00-22:00	147	168	145	162	150	139	126	
22:00-23:00	119	158	111	100	86	109	150	
23:00-24:00	71	76	90	44	82	89	78	
PM Total	3,676	4,319	3,617	3,820	3,264	3,373	3,539	0
24 Hr. Total	3,676	6,756	5,493	5,200	5,475	5,751	5,948	2,478
Noon - Noon	6,113	6,195	4,997	6,031	5,642	5,782	6,017	
	ADT 5,825	AWD 5,889	AADT	AAWD	SADT	SAWDT	WADT	DHV



Weekly Volume Summary

Wed, Aug 08, 2012

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: EB

Report Dates: Jul 9, 2012 to Jul 15, 2012

Hour Interval	Mon 12/07/09	Tue 10	Wed 11	Thu 12	Fri 13	Sat 14	Sun 15	Mon 16
0:00- 1:00		16	16	18	21	30	37	26
1:00- 2:00		12	14	19	18	13	34	7
2:00- 3:00		10	8	13	17	11	12	7
3:00- 4:00		10	10	13	15	8	1	13
4:00- 5:00		33	33	36	39	15	4	34
5:00- 6:00		223	212	218	195	46	26	204
6:00- 7:00		208	212	219	200	97	28	226
7:00- 8:00		221	214	222	197	126	61	223
8:00- 9:00		225	219	220	201	186	129	239
9:00-10:00		200	229	209	223	276	196	234
10:00-11:00		235	246	256	242	396	279	234
11:00-12:00		227	258	222	302	382	325	236
AM Total	0	1,620	1,671	1,665	1,670	1,586	1,132	1,683
12:00-13:00	223	227	215	246	309	395	360	
13:00-14:00	230	214	252	256	297	365	357	
14:00-15:00	235	246	247	269	406	342	329	
15:00-16:00	278	271	297	275	345	251	317	
16:00-17:00	230	242	268	233	353	233	297	
17:00-18:00	182	249	251	229	357	183	284	
18:00-19:00	194	198	206	231	372	183	240	
19:00-20:00	128	109	153	153	276	174	221	
20:00-21:00	92	98	103	118	178	167	222	
21:00-22:00	69	100	101	102	148	140	165	
22:00-23:00	85	88	71	77	80	111	111	
23:00-24:00	36	36	42	34	62	62	41	
PM Total	1,982	2,078	2,206	2,223	3,183	2,606	2,944	0
24 Hr. Total	1,982	3,698	3,877	3,888	4,853	4,192	4,076	1,683
Noon - Noon	3,602	3,749	3,871	3,893	4,769	3,738	4,627	



Weekly Volume Summary

Wed, Aug 08, 2012

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: WB

Report Dates: Jul 9, 2012 to Jul 15, 2012

Hour Interval	Mon 12/07/09	Tue 10	Wed 11	Thu 12	Fri 13	Sat 14	Sun 15	Mon 16
0:00- 1:00		26	34	48	33	111	40	18
1:00- 2:00		81	84	97	89	46	14	17
2:00- 3:00		20	25	28	21	11	9	11
3:00- 4:00		18	15	12	18	10	9	7
4:00- 5:00		24	26	26	23	14	6	28
5:00- 6:00		58	61	52	55	32	16	77
6:00- 7:00		125	98	114	107	39	32	126
7:00- 8:00		152	171	156	151	79	41	153
8:00- 9:00		172	209	203	166	174	85	171
9:00-10:00		219	208	185	192	235	139	175
10:00-11:00		195	192	221	209	270	220	228
11:00-12:00		205	200	228	261	277	268	227
AM Total	0	1,295	1,323	1,370	1,325	1,298	879	1,238
12:00-13:00	220	186	210	210	280	323	326	
13:00-14:00	213	229	226	225	330	333	367	
14:00-15:00	219	213	222	237	301	299	412	
15:00-16:00	334	332	333	347	440	280	416	
16:00-17:00	350	286	360	349	382	280	415	
17:00-18:00	281	282	305	320	383	210	400	
18:00-19:00	234	210	251	253	315	208	377	
19:00-20:00	148	175	172	191	251	194	332	
20:00-21:00	120	131	131	153	204	149	257	
21:00-22:00	106	109	133	109	153	154	192	
22:00-23:00	72	81	98	86	105	149	137	
23:00-24:00	49	56	50	42	69	65	56	
PM Total	2,346	2,290	2,491	2,522	3,213	2,644	3,687	0
24 Hr. Total	2,346	3,585	3,814	3,892	4,538	3,942	4,566	1,238
Noon - Noon	3,641	3,613	3,861	3,847	4,511	3,523	4,925	



Weekly Volume Summary

Wed, Aug 08, 2012

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

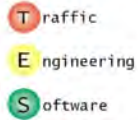
PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: EB/WB

Report Dates: Jul 9, 2012 to Jul 15, 2012

Hour Interval	Mon 12/07/09	Tue 10	Wed 11	Thu 12	Fri 13	Sat 14	Sun 15	Mon 16
0:00- 1:00		42	50	66	54	141	77	44
1:00- 2:00		93	98	116	107	59	48	24
2:00- 3:00		30	33	41	38	22	21	18
3:00- 4:00		28	25	25	33	18	10	20
4:00- 5:00		57	59	62	62	29	10	62
5:00- 6:00		281	273	270	250	78	42	281
6:00- 7:00		333	310	333	307	136	60	352
7:00- 8:00		373	385	378	348	205	102	376
8:00- 9:00		397	428	423	367	360	214	410
9:00-10:00		419	437	394	415	511	335	409
10:00-11:00		430	438	477	451	666	499	462
11:00-12:00		432	458	450	563	659	593	463
AM Total	0	2,915	2,994	3,035	2,995	2,884	2,011	2,921
12:00-13:00	443	413	425	456	589	718	686	
13:00-14:00	443	443	478	481	627	698	724	
14:00-15:00	454	459	469	506	707	641	741	
15:00-16:00	612	603	630	622	785	531	733	
16:00-17:00	580	528	628	582	735	513	712	
17:00-18:00	463	531	556	549	740	393	684	
18:00-19:00	428	408	457	484	687	391	617	
19:00-20:00	276	284	325	344	527	368	553	
20:00-21:00	212	229	234	271	382	316	479	
21:00-22:00	175	209	234	211	301	294	357	
22:00-23:00	157	169	169	163	185	260	248	
23:00-24:00	85	92	92	76	131	127	97	
PM Total	4,328	4,368	4,697	4,745	6,396	5,250	6,631	0
24 Hr. Total	4,328	7,283	7,691	7,780	9,391	8,134	8,642	2,921
Noon - Noon	7,243	7,362	7,732	7,740	9,280	7,261	9,552	
	ADT 8,024	AWD 7,519	AADT	AAWD	SADT	SAWDT	WADT	DHV



Weekly Volume Summary

Tue, Jan 29, 2013

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: EB

Report Dates: Sep 26, 2012 to Oct 2, 2012

Hour Interval	Wed 12/09/26	Thu 27	Fri 28	Sat 29	Sun 30	Mon 1	Tue 2	Wed 3
0:00- 1:00		13	5	22	26	11	15	16
1:00- 2:00		13	14	12	13	5	15	12
2:00- 3:00		7	10	10	19	9	12	11
3:00- 4:00		10	8	13	3	9	12	13
4:00- 5:00		36	35	12	6	34	32	37
5:00- 6:00		184	184	39	19	222	211	218
6:00- 7:00		205	191	76	40	236	215	208
7:00- 8:00		207	214	125	61	231	212	219
8:00- 9:00		218	207	200	104	187	191	193
9:00-10:00		198	237	221	151	198	184	219
10:00-11:00		202	245	248	215	167	185	210
11:00-12:00		203	263	278	283	213	176	189
AM Total	0	1,496	1,613	1,256	940	1,522	1,460	1,545
12:00-13:00	188	181	241	252	311	191	193	
13:00-14:00	192	214	269	309	268	209	212	
14:00-15:00	225	242	357	305	278	208	205	
15:00-16:00	266	315	318	256	299	257	254	
16:00-17:00	233	265	292	283	306	233	203	
17:00-18:00	219	230	331	218	247	191	209	
18:00-19:00	147	212	273	184	207	177	142	
19:00-20:00	97	156	216	121	194	114	116	
20:00-21:00	99	87	146	140	145	108	101	
21:00-22:00	63	83	98	78	68	54	58	
22:00-23:00	63	53	57	54	38	56	50	
23:00-24:00	35	33	44	35	14	29	31	
PM Total	1,827	2,071	2,642	2,235	2,375	1,827	1,774	0
24 Hr. Total	1,827	3,567	4,255	3,491	3,315	3,349	3,234	1,545
Noon - Noon	3,323	3,684	3,898	3,175	3,897	3,287	3,319	



Weekly Volume Summary

Tue, Jan 29, 2013

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

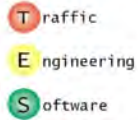
PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: WB

Report Dates: Sep 26, 2012 to Oct 2, 2012

Hour Interval	Wed 12/09/26	Thu 27	Fri 28	Sat 29	Sun 30	Mon 1	Tue 2	Wed 3
0:00- 1:00		29	33	144	18	15	34	26
1:00- 2:00		14	21	28	25	11	17	20
2:00- 3:00		130	122	17	12	5	92	93
3:00- 4:00		18	24	9	8	7	22	19
4:00- 5:00		18	25	15	10	24	17	22
5:00- 6:00		53	45	29	36	65	54	57
6:00- 7:00		117	114	48	60	114	101	119
7:00- 8:00		154	146	87	88	188	183	144
8:00- 9:00		172	192	160	90	191	188	173
9:00-10:00		167	207	242	111	143	159	153
10:00-11:00		177	191	282	193	162	171	174
11:00-12:00		182	230	288	257	171	163	174
AM Total	0	1,231	1,350	1,349	908	1,096	1,201	1,174
12:00-13:00	180	203	240	294	300	192	169	
13:00-14:00	178	174	282	273	299	179	178	
14:00-15:00	206	212	270	283	303	197	198	
15:00-16:00	308	312	398	296	328	321	304	
16:00-17:00	262	312	358	264	362	315	268	
17:00-18:00	279	308	348	242	307	248	286	
18:00-19:00	219	187	260	194	246	192	192	
19:00-20:00	149	148	203	155	191	136	102	
20:00-21:00	103	118	162	141	136	89	84	
21:00-22:00	80	91	98	101	99	59	74	
22:00-23:00	64	78	89	65	38	51	65	
23:00-24:00	53	52	56	41	16	43	37	
PM Total	2,081	2,195	2,764	2,349	2,625	2,022	1,957	0
24 Hr. Total	2,081	3,426	4,114	3,698	3,533	3,118	3,158	1,174
Noon - Noon	3,312	3,545	4,113	3,257	3,721	3,223	3,131	



Weekly Volume Summary

Tue, Jan 29, 2013

Location: HWY. 89 - 0.9KM WEST OF DUFFERIN RD 18 - AIRPORT RD

LHRS/Offset: 38640 / 0.0

Region: Southwest

Pattern Type: n/a

PCS#: n/a

Hwy. TVIS#: 89018

Count Direction: EB/WB

Report Dates: Sep 26, 2012 to Oct 2, 2012

Hour Interval	Wed 12/09/26	Thu 27	Fri 28	Sat 29	Sun 30	Mon 1	Tue 2	Wed 3
0:00- 1:00		42	38	166	44	26	49	42
1:00- 2:00		27	35	40	38	16	32	32
2:00- 3:00		137	132	27	31	14	104	104
3:00- 4:00		28	32	22	11	16	34	32
4:00- 5:00		54	60	27	16	58	49	59
5:00- 6:00		237	229	68	55	287	265	275
6:00- 7:00		322	305	124	100	350	316	327
7:00- 8:00		361	360	212	149	419	395	363
8:00- 9:00		390	399	360	194	378	379	366
9:00-10:00		365	444	463	262	341	343	372
10:00-11:00		379	436	530	408	329	356	384
11:00-12:00		385	493	566	540	384	339	363
AM Total	0	2,727	2,963	2,605	1,848	2,618	2,661	2,719
12:00-13:00	368	384	481	546	611	383	362	
13:00-14:00	370	388	551	582	567	388	390	
14:00-15:00	431	454	627	588	581	405	403	
15:00-16:00	574	627	716	552	627	578	558	
16:00-17:00	495	577	650	547	668	548	471	
17:00-18:00	498	538	679	460	554	439	495	
18:00-19:00	366	399	533	378	453	369	334	
19:00-20:00	246	304	419	276	385	250	218	
20:00-21:00	202	205	308	281	281	197	185	
21:00-22:00	143	174	196	179	167	113	132	
22:00-23:00	127	131	146	119	76	107	115	
23:00-24:00	88	85	100	76	30	72	68	
PM Total	3,908	4,266	5,406	4,584	5,000	3,849	3,731	0
24 Hr. Total	3,908	6,993	8,369	7,189	6,848	6,467	6,392	2,719
Noon - Noon	6,635	7,229	8,011	6,432	7,618	6,510	6,450	
	ADT 6,984	AWD 6,706	AADT	AAWD	SADT	SAWDT	WADT	DHV

**Appendix B:
Traffic Operations**

HCM Unsignalized Intersection Capacity Analysis
 1: Site Access & Hwy 89

Total Traffic 2020 AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	305	6	19	260	6	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	321	6	20	274	6	20
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			327			324
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			327			324
tC, single (s)			4.1			6.2
tC, 2 stage (s)						
tF (s)			2.2			3.3
p0 queue free %			98			97
cM capacity (veh/h)			1232			717

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	327	294	26
Volume Left	0	20	6
Volume Right	6	0	20
cSH	1700	1232	620
Volume to Capacity	0.19	0.02	0.04
Queue Length 95th (m)	0.0	0.4	1.0
Control Delay (s)	0.0	0.7	11.1
Lane LOS		A	B
Approach Delay (s)	0.0	0.7	11.1
Approach LOS			B

Intersection Summary			
Average Delay			0.8
Intersection Capacity Utilization	39.3%		ICU Level of Service
Analysis Period (min)	15		A

HCM Unsignalized Intersection Capacity Analysis

1: Site Access & Hwy 89

Total Traffic 2020 PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↶	↷
Volume (veh/h)	390	6	19	480	6	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	411	6	20	505	6	20
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			417	959		414
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			417	959		414
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			98	98		97
cM capacity (veh/h)			1142	280		639
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	417	525	26			
Volume Left	0	20	6			
Volume Right	6	0	20			
cSH	1700	1142	489			
Volume to Capacity	0.25	0.02	0.05			
Queue Length 95th (m)	0.0	0.4	1.3			
Control Delay (s)	0.0	0.5	12.8			
Lane LOS			A		B	
Approach Delay (s)	0.0	0.5	12.8			
Approach LOS			B			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			50.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 1: Site Access & Hwy 89

Total Traffic 2025 AM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	320	6	19	270	6	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	337	6	20	284	6	20
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			343			340
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			343			340
tC, single (s)			4.1			6.2
tC, 2 stage (s)						
tF (s)			2.2			3.3
p0 queue free %			98			97
cM capacity (veh/h)			1216			702

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	343	304	26
Volume Left	0	20	6
Volume Right	6	0	20
cSH	1700	1216	604
Volume to Capacity	0.20	0.02	0.04
Queue Length 95th (m)	0.0	0.4	1.0
Control Delay (s)	0.0	0.7	11.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.7	11.2
Approach LOS			B

Intersection Summary			
Average Delay			0.7
Intersection Capacity Utilization	39.8%		ICU Level of Service
Analysis Period (min)	15		A

HCM Unsignalized Intersection Capacity Analysis
 1: Site Access & Hwy 89

Total Traffic 2025 PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	↔	↔
Volume (veh/h)	410	6	19	505	6	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	432	6	20	532	6	20
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			438		1006	435
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			438		1006	435
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		98	97
cM capacity (veh/h)			1122		262	621

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	438	552	26
Volume Left	0	20	6
Volume Right	6	0	20
cSH	1700	1122	468
Volume to Capacity	0.26	0.02	0.06
Queue Length 95th (m)	0.0	0.4	1.4
Control Delay (s)	0.0	0.5	13.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	13.2
Approach LOS			B

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization		52.0%	ICU Level of Service A
Analysis Period (min)		15	