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Ramara Quarry

TRANSPORTATION IMPACT STUDY

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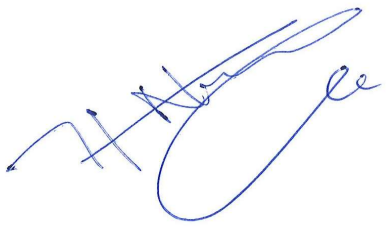	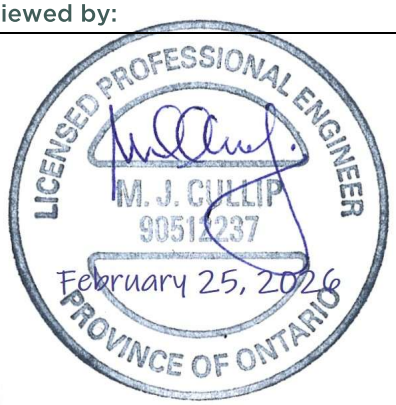
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Issue	Date	Description
1	February 25, 2026	Final Report

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1 Introduction

Tatham Engineering Limited was retained by Brand X Materials and Supply Inc. to conduct a Transportation Impact Study in support of the proposed quarry development to be located at 6059 Pearl Carrick Road, Township of Ramara, County of Simcoe. The location of the development site is illustrated in Figure 1.

1.1 REPORT OBJECTIVE

The objective of the report is to present the findings of the transportation impact study and address the requirements of the Township with respect to the potential transportation impacts of the development on the area road network. In particular, the following will be discussed:

- the operations of the road system through the study area prior to the proposed development;
- the growth in the traffic volumes not otherwise attributed to the development (ie. from overall growth in the area and/or other developments);
- the number of new trips the proposed development is likely to generate;
- the operations of the study area road system upon completion of the development; and
- the resulting impacts and need for mitigating measures (if required) to ensure acceptable overall road operations.

1.2 REPORT STRUCTURE

The report is structured as follows:

- Chapter 1: introduction and study purpose;
- Chapter 2: existing conditions, detailing the road system and corresponding traffic operations;
- Chapter 3: future conditions, prior to the completion of the proposed development (referred to as future background conditions), the expected growth in traffic levels and developments; and the resulting operating conditions;
- Chapter 4: proposed development and associated details including land use, access, and traffic volumes;
- Chapter 5: future conditions, with completion of the proposed development (referred to as future total conditions); and
- Chapter 6: summary of the report and key findings.

2 Existing Conditions

This chapter will detail the current road network, traffic volumes and traffic operations under existing conditions.

2.1 ROAD NETWORK

The road network to be addressed by this study consists of the following roads and intersections:

Roads

- Concession Road B-C
- County Road 169
- County Road 45 (Monck Road)
- Pearl Carrick Road

Intersection

- Concession Road B-C / County Road 169
- County Road 169 / County Road 45 (Monck Road)

2.1.1 Roads

Aerial mapping and imagery of the road system is provided in Figure 2, with additional details provided below:

Concession Road B-C

Concession Road B-C is classified as a local road as per the *Official Plan*[1] for the Township of Ramara and has a 2-lane rural cross section (1-lane in each direction). The roadway is paved with gravel shoulders from its intersection with County Road 169 for approximately 4.5 kilometres to the east, after which it transitions to an unpaved surface. The posted speed limit along Concession Road B–C is 60 km/h.

County Road 169

County Road 169 falls under the jurisdiction of the County of Simcoe and is classified as a primary arterial in the *Official Plan*[2] for the County of Simcoe. The road has a 2-lane cross section (1-lane in each direction), is oriented in the north-south direction and has a rural cross section with paved shoulders in the proximity of the intersection with Concession Road B-C but transitions to gravel shoulders in both the north and south directions. The posted speed of the road is 80 km/h.

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[1] *Official Plan,* Township of Ramara, Consolidated: January 2016
[2] *Official Plan,* County of Simcoe, Consolidated: February 2023

County Road 45 (Monck Road)

County Road 45, known locally as Monck Road, also falls under the jurisdiction of the County of Simcoe and is classified as a secondary arterial. It has a 2-lane rural cross section (1-lane in each direction) with gravel shoulders on each side. The road is oriented in the east-west direction and has a posted speed of 60 km/h.

Pearl Carrick Road

Pearl Carrick Road is classified as a local road and is oriented in the north-south direction. It has a 2-lane cross section with gravel surface, shoulders, and open ditches for drainage. Access to the proposed development will be provided from Pearl Carrick Road.

2.1.2 Intersections

The key intersections within the study area are illustrated in Figure 3.

County Road 169 & Concession Road B-C

The intersection between Concession Road B-C and County Road 169 is a 3-leg intersection operating under stop control on the minor leg (Concession Road B-C). The south approach has a through and right turn lane (45 metre taper and 15 metre parallel length, as measured from aerial photographs based on the pavement markings). The north approach has a left turn lane (165 metre taper and 80 metre parallel/storage length) and an exclusive through lane. The east approach has a shared left-right turn lane.

County Road 169 & County Road 45 (Monck Road)

The intersection between County Road 169 and County Road 45 (Monck Road) a 4-leg intersection operating under signal control. The north and south approaches have exclusive through, right and left turn lanes. The west and east approach each have shared through-right turn lanes and separate left turn lanes. The turn lanes at the intersection have the following configurations:

- north approach left turn: 145 metre taper and 60 metre parallel + storage length
- north approach right turn: 50 metre taper
- south approach left turn: 160 metre taper and 65 metre parallel + storage length
- south approach right turn: 50 metre taper and 20 metre storage
- east approach left turn: 140 metre taper and 65 metre parallel + storage length
- west approach: 75 metre taper and 75 metre parallel + storage length

2.2 TRAFFIC VOLUMES

2.2.1 Traffic Counts

To determine existing traffic volumes on the road network, traffic counts were conducted at the following intersections:

- County Road 169 and Concession Road B-C; and
- County Road 169 and County Road 45 (Monck Road).

The traffic counts were conducted on Thursday, August 22, 2024 between 7:00 to 10:00 and 16:00 to 19:00 hrs., and are presented in Figure 4, with detailed worksheets provided in Appendix A. Given the time of year, the traffic volumes are considered reflective of the peak summer volumes, and also reflective of typical aggregate operations within the study area.

2.2.2 2025 Traffic Volumes

To reflect 2025 traffic volumes, the 2024 traffic counts on Count Road 45 and County Road 169 were increased by 3.0%; no increase was applied to Concession Road B-C volumes given its local status serving limited development. Additional information pertaining to traffic growth rates is provided in Section 3.2.1. The resulting traffic volumes are illustrated in Figure 5.

2.3 TRAFFIC OPERATIONS

To provide a baseline from which the future traffic operations can be assessed, the existing traffic operations were reviewed.

2.3.1 Intersection Operations

As the capacity, and hence operations, of a road system is effectively governed by its intersections, the review focused on the noted intersection, based on:

- the 2025 traffic volumes;
- the existing intersection configuration and control; and
- procedures outlined in the *Highway Capacity Manual 6th Edition*[3] (using Synchro v.11 software).

For unsignalized intersections, the analysis considers:

- the average delay (measured in seconds);

[3] *Highway Capacity Manual, 6th Edition*. Transportation Research Board. Washington DC. October 2016.

- level of service (LOS); and
- volume to capacity (v/c) for critical movements (ie. those operating under stop control).

With respect to the noted metrics:

- level of service 'A' corresponds to the best operating condition with minimal delays whereas level of service 'F' corresponds to poor operations resulting from high intersection delays (additional details regarding Level of Service definitions are provided in Appendix B; and
- a v/c ratio of less than 1.0 indicates the intersection movement/approach is operating at less than capacity while v/c of 1.0 indicates capacity has been reached.

The results of the analysis of the intersection within the study area are presented in Table 1, with detailed worksheets provided in Appendix C.

Table 1: Intersection Operations - 2025

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	v/c	Delay	LOS	v/c
County Road 169 & Concession Road B-C	WB LR	stop	13	B	0.06	13	B	0.07
	SB L	free	10	A	0.01	9	A	-
County Road 169 & County Road 45 (Monck Road)	EB L	signal	6	A	0.12	13	B	0.15
	EB TR	signal	6	A	0.15	15	B	0.51
	WB L	signal	6	A	0.00	12	B	0.01
	WB TR	signal	6	A	0.17	14	B	0.39
	NB L	signal	7	A	0.03	4	A	0.05
	NB T	signal	9	A	0.47	5	A	0.23
	NB R	signal	7	A	0.00	4	A	0.01
	SB L	signal	8	A	0.03	4	A	0.05
	SB T	signal	8	A	0.27	5	A	0.23
	SB R	signal	7	A	0.02	4	A	0.02
	overall		8	A	0.30	9	A	0.31

L – left T – thru R – right LT – left-thru TR – thru-right LTR – left-thru-right LR – left-right

As indicated, both of the subject intersections provide excellent levels of service (LOS A or B) with volumes well below the available intersection capacities (as evident by v/c ratios well below 1.0).

2.3.2 Road Operations

In considering the overall traffic volumes and the respective capacities, the following have been assumed:

- capacity of 900 vehicles per hour per lane (vphpl) on the County roads; and
- capacity of 400 vphpl on the local roads (Concession Road B-C).

As per the traffic volumes presented in Figure 5, the peak hour peak directional volumes are in the order of:

- 30 vehicles on Concession Road B-C;
- 135 to 230 on County Road 45 (Monck Road); and
- 260 to 270 on County Road 169.

The existing volumes are well below the respective road capacities, and hence there is considerable reserve capacity to accommodate future increases.

2.4 ROAD NETWORK IMPROVEMENT

Given the operations of the key intersections and road sections, no road network improvements are deemed necessary under existing conditions.

3 Future Background Condition

This chapter will describe the road network and background traffic volumes expected for the years 2028, 2033 and 2037. The 2028 horizon has been adopted to reflect full build-out of the subject development (ie. operations of the Ramara Quarry at full capacity), whereas the 2033 and 2037 horizons will address long term impacts (5 and 10 years beyond build-out).

3.1 ROAD NETWORK

The *Official Plan for the Township of Ramara* and *County of Simcoe's Transportation Master Plan* were reviewed to identify any planned road network improvements within the study area and associated timeframes. Based on this review, no improvements are scheduled within the horizon years, and the existing road network will remain unchanged throughout the analysis period.

3.2 TRAFFIC VOLUMES

Background traffic volumes for the years 2028, 2033 and 2038 have been determined based on the existing traffic volumes, projected traffic growth and consideration for other development specific traffic volumes as detailed in the following sections.

3.2.1 Background Growth

Population

As per census data, the population of the Township of Ramara has increased from 9,844 in 2016 to 10,377 in 2021, which translates to a growth rate of 1.1% per annum.

Traffic Volumes

The County of Simcoe monitors traffic volumes along its road by means of an Annual Traffic Count Program. The Annual Average Daily Traffic (AADT) data was reviewed to determine traffic growth on the respective sections of County Road 45 (Monck Road) and County Road 169 within the study area. The associated volumes and resulting annual growth rates are summarized in Table 2.

Assumed Growth

In consideration of the historical population and traffic volumes growth rates, a future growth rate of 3.0% has been assumed for both County Road 169 and County Road 45 (Monck Road). While a slightly greater growth was realized on County Road 45 (Monck Road) between County Road 46 and County Road 169, the most current volumes are comparable to the other County Road 45 (Monck Road) road sections and thus a similar growth is expected. An assessment of

Concession Road B-C historical volumes was not undertaken given the absence of traffic data; given the limited reach of the road, limited development and limited existing traffic volumes, a 0% growth rate has been assumed.

Table 2: Simcoe County AADT Volumes

ROAD SECTION	AADT VOLUMES			ANNUAL GROWTH		
	2017	2020	2023	2017 to 2020	2020 to 2023	2017 to 2023
County Road 45 Cty Rd 46 to 169	2,600	2,800	3,500	2.5%	7.7%	5.1%
County Road 45 Cty Rd 169 to 44	3,200	3,300	3,500	1.0%	2.0%	1.5%
County Road 169 Hwy 12 to Cty Rd 45	3,700	3,800	4,200	0.9%	3.4%	2.1%
County Road 169 Cty Rd 45 to 44	3,900	4,200	4,600	2.5%	3.1%	2.8%

3.2.2 Background Developments

Existing Aggregate Operations

Several existing aggregate operations (quarries and pits) are located in the vicinity of the proposed development (as illustrated in Figure 6) and currently utilize Concession Road B–C for both site access and haulage. While the truck volumes from these quarries have been captured in the existing traffic counts, the quarries may not all be active and/or operating at their licensed extraction capacities. For the purpose of this analysis and to ensure a conservative assessment of future traffic conditions, background truck traffic volumes will be included based on the full licensed extraction rates for each operation, which were obtained from the *Ministry of Natural Resources, Ontario (MNR)*[4]. A minimum of 5 peak hour truck trips per direction has been assumed for each quarry, even for operations with relatively low extraction rates, to ensure a conservative evaluation of cumulative traffic impacts.

The resulting traffic volumes for full-capacity quarry operations for each background quarry are illustrated in Appendix D with a summary provided in Table 3.

[4] *Pits and Quarries Online, Ministry of Natural Resources*

Table 3: Peak Hour Truck Volumes - Background Developments

AGGREGATE SITE	EXTRACTION LICENCE	PEAK HOUR TRUCK VOLUMES
Kingfisher	20,000	5
NRK Quarry	100,000	5
Orillia Quarry	500,000	10
Rama Limestone	500,000	10
Ramara Landscaping	500,000	10
Bot Aggregates	1,500,000	30
Total		**70**

Future Aggregate Operations

An application for an extension to the existing NRK Quarry has been submitted to the MNR and Township of Ramara. The proposed annual shipping limit for this expansion is 1,000,000 tonnes. Consequently, the extraction licence for the quarry has been increased to 1,100,000. The expected trip generation during peak hours from the expanded operations is summarized in Table 4.

Table 4: Peak Hour Truck Volumes – NRK Quarry

QUARRY	EXTRACTION LICENCE	PEAK HOUR TRUCK VOLUME
NRK Quarry	1,100,000	22

Existing + Future Aggregate Operations

The resulting traffic volumes due to background quarry operations are illustrated in Figure 7. The assignment of the truck volumes through the study area beyond Concession Road B-C reflects existing travel demands and patterns observed in the 2024 traffic counts, providing a realistic representation of routing behavior and directional flow for truck movement in the study area.

In considering the existing truck traffic volumes as captured in the traffic counts, a marked increase has been considered, reflective of peak operations (ie. at full capacity). A summary of the respective volumes is provided in Table 5. It is important to note that this assessment applies a conservative approach, as the estimated volumes are based on the maximum licensed

extraction rates and assume full operational days with typical average truck payloads (40 tonnes), while surrounding operations are not necessarily operating at full capacity.

Table 5: Comparison - Existing & Projected Traffic Volumes

PARAMETER	WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
	In	Out	Total	In	Out	Total
Traffic counts (2024)	28	20	48	8	13	21
Projected Volumes at Full Capacity	87	87	174	87	87	174

3.2.3 Background Traffic Volumes

The background traffic volumes for each horizon year are presented in Figure 8 through Figure 10, comprised of the following:

- the existing volumes increased 3% per annum of County Roads and 0% per annum on Concession Road B-C;
- truck traffic volumes to reflect peak operations of the existing aggregate sites; and
- additional truck traffic volumes to reflect peak operations of any new aggregate sites.

3.3 TRAFFIC OPERATIONS

3.3.1 Intersection Operations

The key intersections were again analyzed for each horizon year given the projected background volumes and maintaining the existing intersection configuration and control. Results and discussion for each are provided in the following sections; analysis worksheets are provided in Appendix E.

2028 Horizon

The results of the operational assessment for the 2028 background conditions are summarized in Table 6.

At the intersection of County Road 169 and Concession Road B-C, the movements operate with LOS C for westbound traffic and LOS A for southbound movements, with low v/c ratios under 0.27, indicating minimal delays.

At the County Road 169 and County Road 45 (Monck Road) signalized intersection, all individual movements operate at LOS A or B during both peak periods, with an overall intersection LOS of

A. The v/c ratios for all movements remain well below critical thresholds, with the highest being 0.54 for the eastbound through-right movement in the PM peak.

Table 6: Intersection Operation – 2028 Background

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	v/c	Delay	LOS	v/c
County Road 169 & Concession Road B-C	WB LR	stop	16	C	0.22	17	C	0.26
	SB L	free	10	A	0.03	9	A	0.03
County Road 169 & County Road 45 (Monck Road)	EB L	signal	6	A	0.20	13	B	0.25
	EB TR	signal	6	A	0.16	15	B	0.54
	WB L	signal	6	A	0.00	12	B	0.01
	WB TR	signal	6	A	0.19	14	B	0.42
	NB L	signal	8	A	0.03	5	A	0.06
	NB T	signal	10	A	0.54	6	A	0.30
	NB R	signal	8	A	0.00	4	A	0.01
	SB L	signal	8	A	0.04	5	A	0.08
	SB T	signal	9	A	0.35	6	A	0.29
	SB R	signal	8	A	0.05	5	A	0.04
	overall	signal	8	A	0.34	9	A	0.37

L – left T – thru R – right LT – left-thru TR – thru-right LTR – left-thru-right LR – left-right

2033 Horizon

The results of the operational assessment for the 2033 background conditions are summarized in Table 7.

The assessment indicates that the study intersections will continue to operate efficiently with minimal delays and spare capacity across all movements. At the County Road 169 and Concession Road B-C intersection, westbound movements operate at LOS C with slight increases in delay and v/c ratios compared to 2028 but remain within acceptable limits (v/c = 0.30). Southbound movements continue to operate at LOS A with negligible delays.

At the County Road 169 and County Road 45 (Monck Road) signalized intersection, all movements maintain LOS A or B during both AM and PM peak hours. The highest v/c ratio observed is 0.59 for the eastbound through-right movement in the PM peak, approaching but still below critical thresholds, indicating a moderate increase in demand. Overall, the intersection performs at LOS A with low average delays and a total v/c ratio of 0.38 in the AM and 0.42 in the PM, suggesting the intersection has sufficient capacity to accommodate background growth through 2033.

Table 7: Intersection Operation - 2033 Background

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	v/c	Delay	LOS	v/c
County Road 169 & Concession Road B-C	WB LR	stop	17	C	0.24	19	C	0.30
	SB L	free	10	A	0.03	9	A	0.03
County Road 169 & County Road 45 (Monck Road)	EB L	signal	8	A	0.26	13	B	0.26
	EB TR	signal	8	A	0.22	16	B	0.59
	WB L	signal	7	A	0.00	12	B	0.01
	WB TR	signal	8	A	0.26	13	B	0.47
	NB L	signal	6	A	0.03	5	A	0.07
	NB T	signal	8	A	0.49	6	A	0.35
	NB R	signal	6	A	0.00	5	A	0.01
	SB L	signal	6	A	0.04	5	A	0.10
	SB T	signal	7	A	0.31	6	A	0.34
	SB R	signal	7	A	0.05	5	A	0.05
	overall	signal	8	A	0.38	10	A	0.42

L – left T – thru R – right LT – left-thru TR – thru-right LTR – left-thru-right LR – left-right

2038 Horizon

The results of the operational assessment for the 2038 background conditions are summarized in Table 8.

The analysis shows a modest increase in traffic volumes at both study intersections, with operations continuing to remain well within acceptable limits. At the County Road 169 and Concession Road B-C intersection, westbound movements experience slightly higher delays compared to previous years but still operate at LOS C, with a v/c ratio of 0.28 in the AM and 0.35 in the PM. Southbound left turn movements continue to operate efficiently at LOS A, with no change in performance indicators.

Table 8: Intersection Operation - 2038 Background

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	v/c	Delay	LOS	v/c
County Road 169 & Concession Road B-C	WB LR	stop	19	C	0.27	22	C	0.34
	SB L	free	10	B	0.03	10	A	0.03
County Road 169 & County Road 45 (Monck Road)	EB L	signal	9	A	0.30	11	B	0.24
	EB TR	signal	8	A	0.27	13	B	0.55
	WB L	signal	7	A	0.01	10	A	0.01
	WB TR	signal	9	A	0.32	12	B	0.43
	NB L	signal	6	A	0.03	6	A	0.10
	NB T	signal	8	A	0.53	9	A	0.45
	NB R	signal	6	A	0.01	6	A	0.01
	SB L	signal	6	A	0.04	7	A	0.14
	SB T	signal	7	A	0.33	9	A	0.44
	SB R	signal	6	A	0.05	6	A	0.06
	overall	signal	8	A	0.43	10	A	0.49

L – left T – thru R – right LT – left-thru TR – thru-right LTR – left-thru-right LR – left-right

At the County Road 169 and County Road 45 (Monck Road) signalized intersection, all movements continue to operate at LOS A or B, and no movement approaching capacity. The eastbound through-right movement continues to represent the highest demand with a v/c ratio of 0.55 in the PM peak, reflecting a steady but manageable growth trend. The overall intersection performance remains strong with LOS A during both peaks and v/c ratios of 0.43 in the AM and

0.49 in the PM, indicating that the intersection can continue to accommodate forecasted background traffic growth without significant congestion or delay.

3.3.2 Road Operations

In considering the 2038 peak hour peak directional volumes, the following are noted:

- Concession Road B-C will operate at approximately 25% of the available capacity (peak hour peak directional volumes of 90 to 105 vehicles versus a capacity of 400 vehicles per hour per lane (vphpl));
- County Road 45 (Monck Road) will operate at less than 40% of the available capacity (peak hour volumes of 220 to 350 versus 900 vphpl); and
- County Road 169 will operate at less than 50% of the available capacity (peak hour volumes of 415 to 450 versus 900 vphpl).

3.4 ROAD NETWORK IMPROVEMENTS

Based on the results of the traffic analysis under background traffic scenarios, no road network improvements are required. All study area intersections and roads are projected to continue operating within acceptable capacity thresholds, with levels of service ranging from A to C and volume-to-capacity v/c ratios remaining well below critical limits. This confirms that the existing road network, including County Road 169, County Road 45 (Monck Road), and Concession Road B-C, has sufficient capacity to accommodate background growth without the need for additional infrastructure upgrades.

4 Proposed Development

This chapter will provide additional details regarding the proposed development, including its location, projected site-generated traffic volumes, and the assignment of said volumes to the adjacent road network.

4.1 LOCATION

The proposed aggregate development is located at 6059 Pearl Carrick Road in the Township of Ramara, as illustrated in Figure 1. Existing private roads run along the north (Donald Carrick Lane) and west (Pearl Carrick Road) boundaries of the property.

4.2 LAND USE & PHASING

The proposed development involves the establishment of a mineral aggregate extraction operation (quarry). The site will be developed within the limits of the designated extraction footprint (as illustrated in Figure 11), in accordance with the aggregate licence application currently in preparation (500,000 tonne licence capacity). The land use is consistent with the surrounding rural and resource-based context and aligns with the region's broader planning objectives for mineral resource utilization. The operation will be carried out in compliance with relevant municipal policies, provincial regulations and aggregate industry standards.

Notwithstanding the licence limit, it is expected that actual extraction will be somewhat less, as dictated by demand. However, while this is recognized, this review considers the potential impacts associated with an increase in traffic levels assuming 500,000 tonnes per year (ie. operating at full site capacity), thereby considering a worse case scenario and maintaining a conservative approach.

4.3 ACCESS

4.3.1 Location & Configuration

Site access for the proposed quarry is planned to be located on Pearl Carrick Road (as indicated in Figure 11), with truck traffic connecting to the broader road network via Concession Road B–C.

The access will be designed in accordance with Transportation Association of Canada (TAC) guidelines to ensure safe and efficient movement of heavy vehicles entering and exiting the site. Detailed access design elements, including geometry and turning radii, will be addressed through the site plan approval process.

To support the anticipated operational requirements of the proposed Ramara Quarry, the section of Pearl Carrick Road from the site access to Concession B-C will require upgrading prior to the commencement of quarry operations. Hence, the following recommendation shall be included on the Aggregate Resources Act site plan for the proposed Ramara Quarry to ensure that the haul route is constructed to a suitable standard for quarry operations prior to the commencement of shipping.

"Prior to shipping, the licensee shall enter into an agreement with the Township of Ramara to upgrade Pearl Carrick Road from Concession B–C to the proposed quarry access."

4.3.2 Sight Lines

A sight line assessment was conducted to establish the available sight lines at the proposed site access location. The assessment has considered both minimum stopping and intersection sight distance, as defined below and dictated per Transportation Association of Canada (TAC) guidelines:

- the minimum stopping sight distance provides sufficient distance for an approaching motorist to observe a stationary hazard in the road and bring their vehicle to a complete stop prior to the hazard; and
- the intersection sight distance allows a vehicle to enter a main road from a side street (or site access) and attain the appropriate operating speed without significantly impacting the operating speed of an approaching vehicle.

The minimum stopping and intersection sight distance requirements for a design speed of 70 km/h (assumed to reflect the posted speed of 60 km/h on Concession B-C) are summarized in Table 9. Adjustments have been made to the intersection sight-distance requirements to account for a single unit truck and combination truck (eg. tractor trailer) exiting the site (as per TAC guidelines). While it is acknowledged that trucks need longer stopping sight distances for a given speed than passenger cars, the truck driver eye height is typically greater and thus separate stopping sight distances for cars and trucks are not generally used (as per TAC guidelines).

Table 9: Sight Line Requirements

DESIGN SPEED	STOPPING SIGHT DISTANCE	INTERSECTION SIGHT DISTANCE	
		Left Turn	Right Turn
70 km/h	105 m	150 m - Car 185 m - Single Unit Truck 225 m - Tractor Trailer	130 m – Car 170 m – Single Unit Truck 205 m – Tractor Trailer

The sight distances observed during the field visit are summarized in Table 10, and illustrated in Figure 12.

Table 10: Available Sight Lines

LOCATION	DESIGN SPEED	INTERSECTION SIGHT DISTANCE	
		Left Turn	Right Turn
Site Access	70 km/h	> 250 m	> 250 m

Based on the field measurements, the available sight lines at the proposed site access exceed 250 metres in both directions. These values exceed the minimum intersection sight distance requirements and stopping sight distances outlined by TAC manual. As such, the available sight distances are more than sufficient to support safe ingress and egress of heavy vehicles at the site, confirming that sight line conditions meet and exceed applicable design standards.

4.4 TRAFFIC

4.4.1 Trip Generation

Truck trip estimates are derived from the anticipated volume of material to be hauled, with consideration given to the total quantity of extracted aggregate and the average truck payload. To assess traffic operations, the forecasted truck trips have been determined based on the following:

- Extraction rate: The maximum extraction limit under the aggregate licence is 500,000 tonnes per year, representing the highest possible annual material output.
- Quarry operations: While the site will operate year-round, most of the extraction is expected to occur during the peak season (which is assumed May to November) when building and road construction demands are greatest. For analysis purposes, this peak season is assumed to span approximately 140 operating days during which 80% of the annual limit will be extracted. During the peak season, the quarry is assumed to operate 12 hours per day (7:00 to 19:00, with shipping/loading permitted to start at 6:00), whereas during the off-peak period, reduced hours of operation are assumed (8 hours per day). While Saturday operations may occur, such is not considered to be typical and thus has not been considered.
- Vehicle size: The assumed average truck payload is 40 tonnes per load, reflecting a mix of transport trucks, tri-axle trucks and tri-axle trucks with pup trailers, which are commonly used across similar operations and has been indicated by the client.

A summary of the resulting truck volumes is provided in Table 11, including daily and hourly truck volumes. To further consider peak hour operations, during a typical day, the average hourly volumes have been increased by a factor of 1.5 (ie. site activity will not be uniform over the course of the day as some hours are busier than others).

Table 11: Site Generated Traffic

OPERATING LEVEL	UNITS	PEAK PERIOD	OFF-PEAK PERIOD
Period		May to November	December to April
Percent Shipped		80%	20%
Total Shipped	tonnes	400,000	100,000
Average Shipped per Day	tonnes	2,857	1,000
Average Loads per Day	loads/day	71	25
Average Loads per Hour	loads/hour	6	3
Peak Hour Factor		1.5	1.5
Peak Loads per Hour	loads/hour	9	5
Peak Trucks per Hour	trucks/hour	18	10

During the peak season (May to November), the quarry is assumed to operate at 80% of its annual extraction rate, equating to 400,000 tonnes per year. This results in an average of 2,857 tonnes extracted per day, generating approximately 71 truck trips per day. With an assumed 12-hour workday, this translates to 6 truck loads per hour, and 9 truck loads per peak hour (accounting for a 1.5 peak hour factor). As each load constitutes 2 truck trips (1 trip to the site and 1 trip from the site), the average hour and peak hour truck volumes are projected to be 12 and 18 respectively during the peak season.

During the off-peak season (December to April), representing 20% of annual extraction (100,000 tonnes/year), daily extraction averages 1,000 tonnes, requiring 25 truck trips per day. With shorter 8-hour days, this yields 3 truck loads per hour or 5 per peak hour, amounting to 6 and 10 peak hour truck trips respectively..

It is reiterated that the above assumes an annual extraction of 500,000 tonnes, corresponding to the site's proposed licence. Actual extraction levels are typically less than the permitted annual tonnage amount and thus the site generated truck volumes will be less.

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

4.4.2 Trip Distribution & Assignment

Based on correspondence with the client, the trip distribution of truck traffic generated by the proposed quarry operations will primarily be oriented south along County Road 169, with an estimated 80% of the total volume serving markets in Orillia, Barrie, Bradford and Midland. The remaining 20% of truck traffic is expected to head north toward Huntsville and Parry Sound, although volumes in that direction are anticipated to remain relatively low - no more than 50,000 tonnes annually.

At the intersection of County Road 169 and County Road 45 (Monck Road), all truck traffic from the site is expected to turn west onto County Road 45 (Monck Road). This routing allows vehicles to access County Road 44 and ultimately connect to Highway 12 in a direct and efficient manner for reaching key market destinations such as Orillia, Barrie, Bradford and Midland. As such, the westbound movement on County Road 45 (Monck Road) will carry the bulk of site-related traffic flow at this location.

The resulting site generated traffic volumes and the assignment of such to the study area road system are presented in Figure 13 for both the AM and PM peak hours. It is assumed that the peak hour operations of the proposed quarry will correspond to both the AM and PM peak hours of the road system to consider the worse case for both periods (in all likelihood, the PM peak hour volumes will be less given the "end of day" operating characteristics of related aggregate activities).

5 Future Total Conditions

This chapter will address the resulting impacts of the proposed development on the adjacent road system. The following areas are to be addressed:

- road capacity and access operations; and
- potential improvements to the study area road network, if necessary.

5.1 TRAFFIC VOLUMES

To assess the impacts of the increased traffic volumes resulting from the proposed development, the site generated traffic was combined with the 2028, 2033 and 2038 background traffic volumes. The total traffic volumes are illustrated in Figure 14 to Figure 16.

5.2 TRAFFIC OPERATIONS

5.2.1 Intersection Operations

The intersections within the study area were again investigated considering the total traffic volumes for each horizon year. Detailed worksheets of the analysis of each horizon year provided in Appendix F with discussions below.

2028 Horizon

The results of the operational assessment for the 2028 total conditions are summarized in Table 12.

Under the 2028 total traffic conditions, which combine background traffic growth with site-generated trips from the proposed quarry, all intersections within the study area are expected to operate at satisfactory levels of service. County Road 169 and Concession Road B-C maintains a LOS of C for westbound movements, with volume-to-capacity (v/c) ratios remaining low (0.25 in the AM and 0.29 in the PM). Similarly, the signalized intersection at County Road 169 and County Road 45 (Monck Road) continues to function effectively with overall intersection LOS of A in the AM peak and PM peaks, and v/c ratios well below capacity thresholds. These results indicate that the addition of site traffic has a minimal impact on overall network performance in 2028, confirming the adequacy of the existing road infrastructure.

Table 12: Intersection Operation – 2028 Total

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	v/c	Delay	LOS	v/c
County Road 169 & Concession Road B-C	WB LR	stop	16	C	0.25	18	C	0.29
	SB L	free	10	A	0.03	9	A	0.03
County Road 169 & County Road 45 (Monck Road)	EB L	signal	6	A	0.22	14	B	0.28
	EB TR	signal	6	A	0.16	15	B	0.54
	WB L	signal	6	A	0.00	12	B	0.01
	WB TR	signal	6	A	0.19	14	B	0.42
	NB L	signal	8	A	0.03	5	A	0.06
	NB T	signal	10	A	0.54	6	A	0.30
	NB R	signal	8	A	0.00	4	A	0.01
	SB L	signal	8	A	0.04	5	A	0.08
	SB T	signal	9	A	0.35	6	A	0.29
	SB R	signal	8	A	0.05	5	A	0.05
	overall	signal	8	A	0.35	9	A	0.37

L – left T – thru R – right LT – left-thru TR – thru-right LTR – left-thru-right LR – left-right

2033 Horizon

The results of the assessment for the 2033 total traffic conditions are summarized in Table 13.

The intersections within the study area are expected to continue operating efficiently with minimal delays. At County Road 169 and Concession Road B-C, the westbound movements maintain LOS C, with v/c ratios remaining low. The County Road 169 and County Road 45 (Monck Road) intersection also continues to operate at excellent levels of service (LOS A and B across all movements), with the overall intersection LOS remaining A in both peak periods. The addition of site-generated trips from the quarry does not compromise intersection capacity or performance, indicating the road network remains adequate to support projected traffic volumes in 2033.

Table 13: Intersection Operation - 2033 Total

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	v/c	Delay	LOS	v/c
County Road 169 & Concession Road B-C	WB LR	stop	18	C	0.27	20	C	0.33
	SB L	free	10	A	0.03	9	A	0.03
County Road 169 & County Road 45 (Monck Road)	EB L	signal	8	A	0.29	13	B	0.29
	EB TR	signal	8	A	0.22	16	B	0.59
	WB L	signal	7	A	0.00	12	B	0.01
	WB TR	signal	8	A	0.26	14	B	0.47
	NB L	signal	7	A	0.03	5	B	0.07
	NB T	signal	8	A	0.49	7	A	0.35
	NB R	signal	6	A	0.00	5	A	0.01
	SB L	signal	7	A	0.04	5	A	0.10
	SB T	signal	8	A	0.31	7	A	0.34
	SB R	Signal	7	A	0.06	5	A	0.05
	overall	signal	8	A	0.39	10	A	0.42

L – left T – thru R – right LT – left-thru TR – thru-right LTR – left-thru-right LR – left-right

2038 Horizon

The results of the assessment for the 2038 total traffic conditions are summarized in Table 14.

The intersections within the study area are projected to continue operating with sufficient capacity and minimal delays. At County Road 169 and Concession Road B-C, all movements maintain acceptable levels of service - LOS C for westbound left-right movement, with volume-to-capacity ratios remaining well below critical thresholds. Similarly, at the signalized intersection of County Road 169 and County Road 45 (Monck Road), all individual movements operate at LOS A or B, with the overall intersection maintaining LOS A in both AM and PM peak periods. The projected traffic volumes, inclusive of background growth and site-generated trips, do not result

in any operational concerns or capacity issues. This indicates that the road network will continue to accommodate traffic efficiently through the 2038 horizon.

Table 14: Intersection Operation - 2038 Total

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	v/c	Delay	LOS	v/c
County Road 169 & Concession Road B-C	WB LR	stop	20	C	0.30	23	C	0.38
	SB L	free	11	B	0.04	10	A	0.03
County Road 169 & County Road 45 (Monck Road)	EB L	signal	9	A	0.33	11	B	0.26
	EB TR	signal	8	A	0.27	13	B	0.55
	WB L	signal	7	A	0.01	10	A	0.01
	WB TR	signal	9	A	0.31	12	B	0.43
	NB L	signal	6	A	0.03	6	A	0.10
	NB T	signal	8	A	0.53	9	A	0.45
	NB R	signal	6	A	0.01	6	A	0.01
	SB L	signal	6	A	0.04	7	A	0.14
	SB T	signal	7	A	0.34	9	A	0.44
	SB R	signal	6	A	0.06	6	A	0.07
	overall	signal	8	A	0.44	10	A	0.49

L – left T – thru R – right LT – left-thru TR – thru-right LTR – left-thru-right LR – left-right

5.2.2 Road Operations

The additional site generated traffic volumes will result in 9 additional truck trips per direction during the peak hours on Concession Road B-C, and less than 9 on the County roads. Given the excess reserve capacity provided under the future background conditions, these additional volumes can be readily accommodated without concern.

5.3 ROAD NETWORK IMPROVEMENTS

Based on the operational analysis under total traffic conditions for the 2028, 2033 and 2038 horizons, no road network improvements are required. Both of the subject intersections operate at acceptable levels of service (LOS A to C), and volume-to-capacity (v/c) ratios remain well below critical thresholds throughout both AM and PM peak periods. The results indicate that the existing road infrastructure has sufficient capacity to accommodate growth in traffic due to subject development (considering full capacity operations).

Therefore, no upgrades or modifications to the surrounding road network are recommended as part of this study.

6 Summary

Proposed Development

This review has addressed the transportation impacts associated with the proposed mineral aggregate site to be located at 6059 Pearl Carrick Road in the Township of Ramara, County of Simcoe. Site access is planned via Pearl Carrick Road, connecting to the broader road network through Concession Road B–C.

Upon completion, the quarry is expected to generate 18 truck trips (inbound and outbound combined) during its peak hour of operations; for assessment purposes, the quarry peak hours have been assumed to correspond to each of the AM and PM peak hours of the area road system (eg. the commuter peak hours).

Transportation Impacts

The operations of the intersection of County Road 169 with Concession Road B-C and County Road 169 with County Road 45 (Monck Road) were reviewed under existing, background and future conditions. The results of the operational analysis indicate that the intersections have sufficient capacity to accommodate the additional demand, with the intersection of County Road 169 and County Road 45 (Monck Road) performing at overall LOS A. Similarly, the respective roads were reviewed, and the projected future traffic volumes will remain well below the road capacity levels, indicating that such can be readily accommodated.

Thus, no improvements are required to accommodate the subject development.

Site Access Sight Line Assessment

The site access sight line assessment confirms that minimum sight distance requirements for a design speed of 70 km/h are satisfied at the access point, addressing the most critical safety consideration.

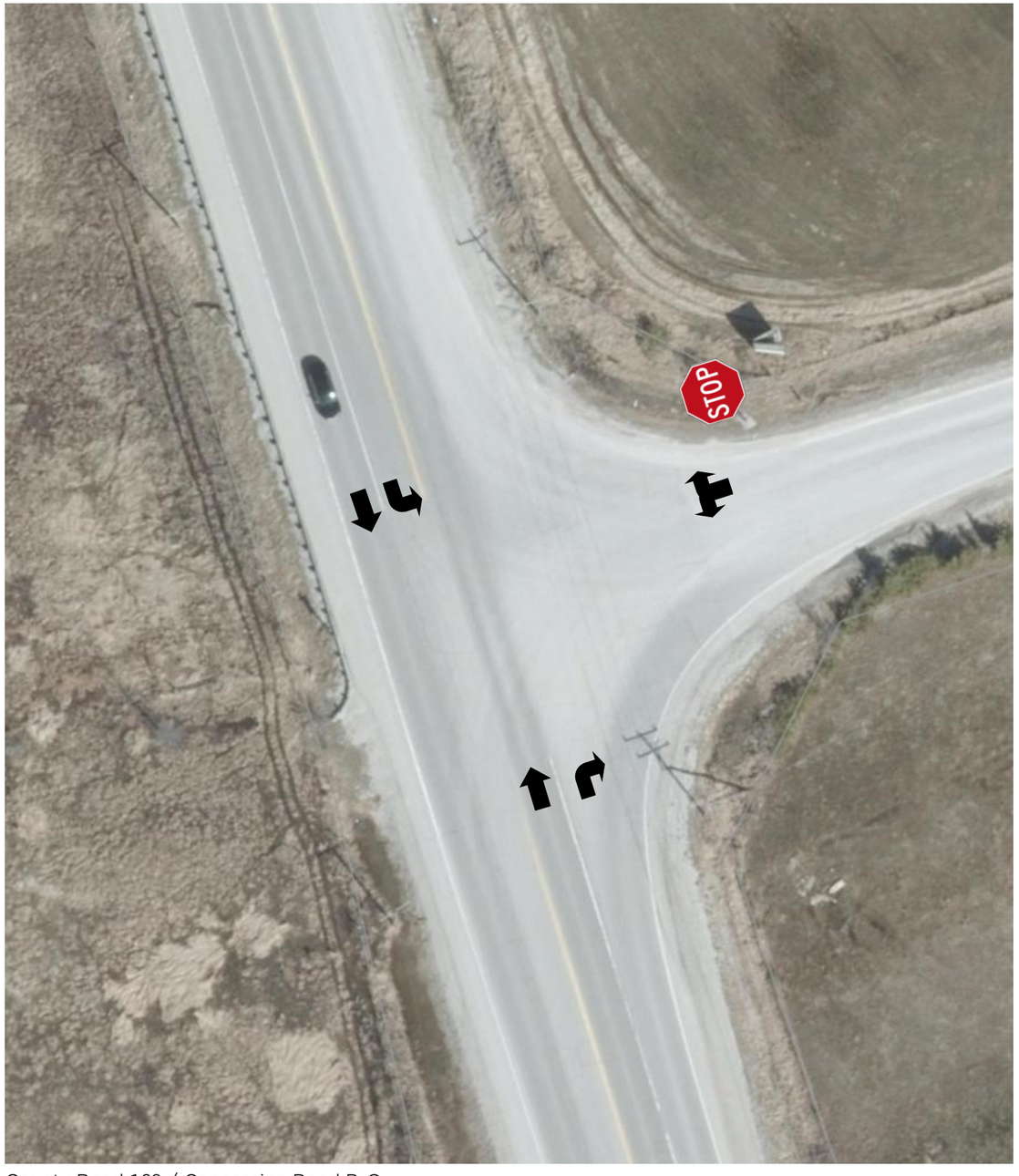
Source: Simcoe Maps

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 1: Site Location

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 2: Road Network

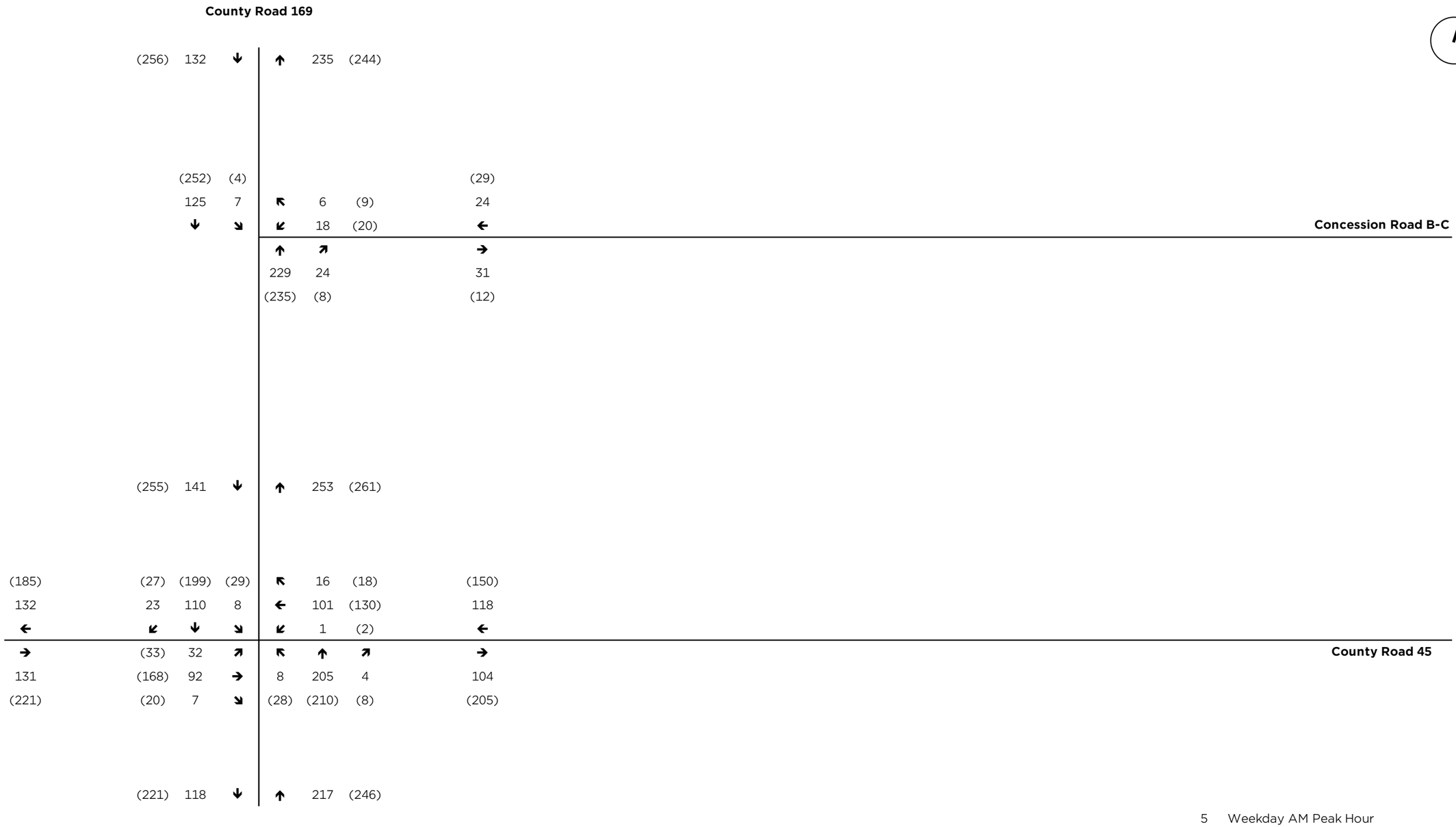


County Road 169 / Concession Road B-C

County Road 169 / County Road 45

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 3: Study Area Intersections

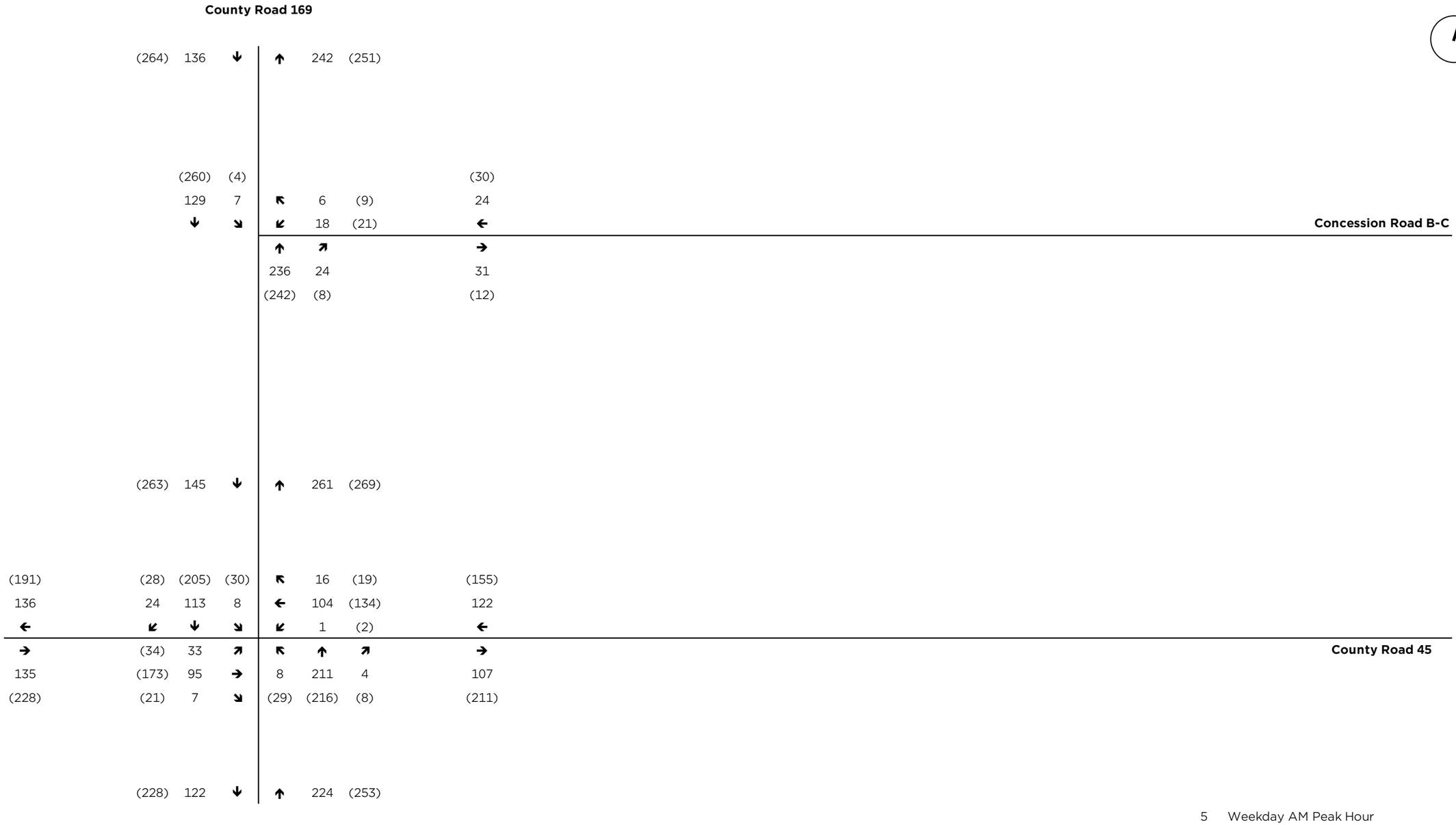


5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 4: Traffic Counts - 2024

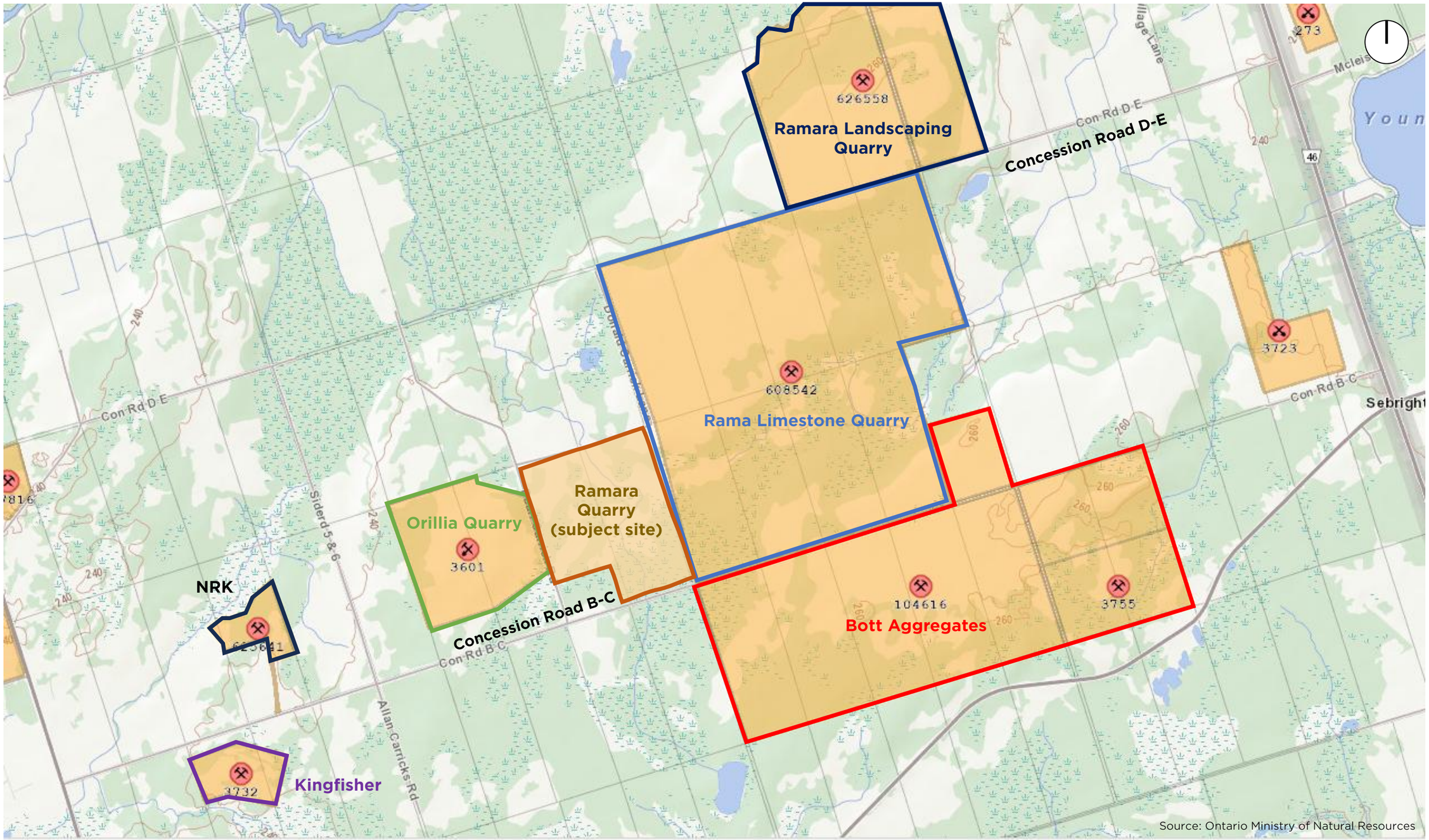


5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

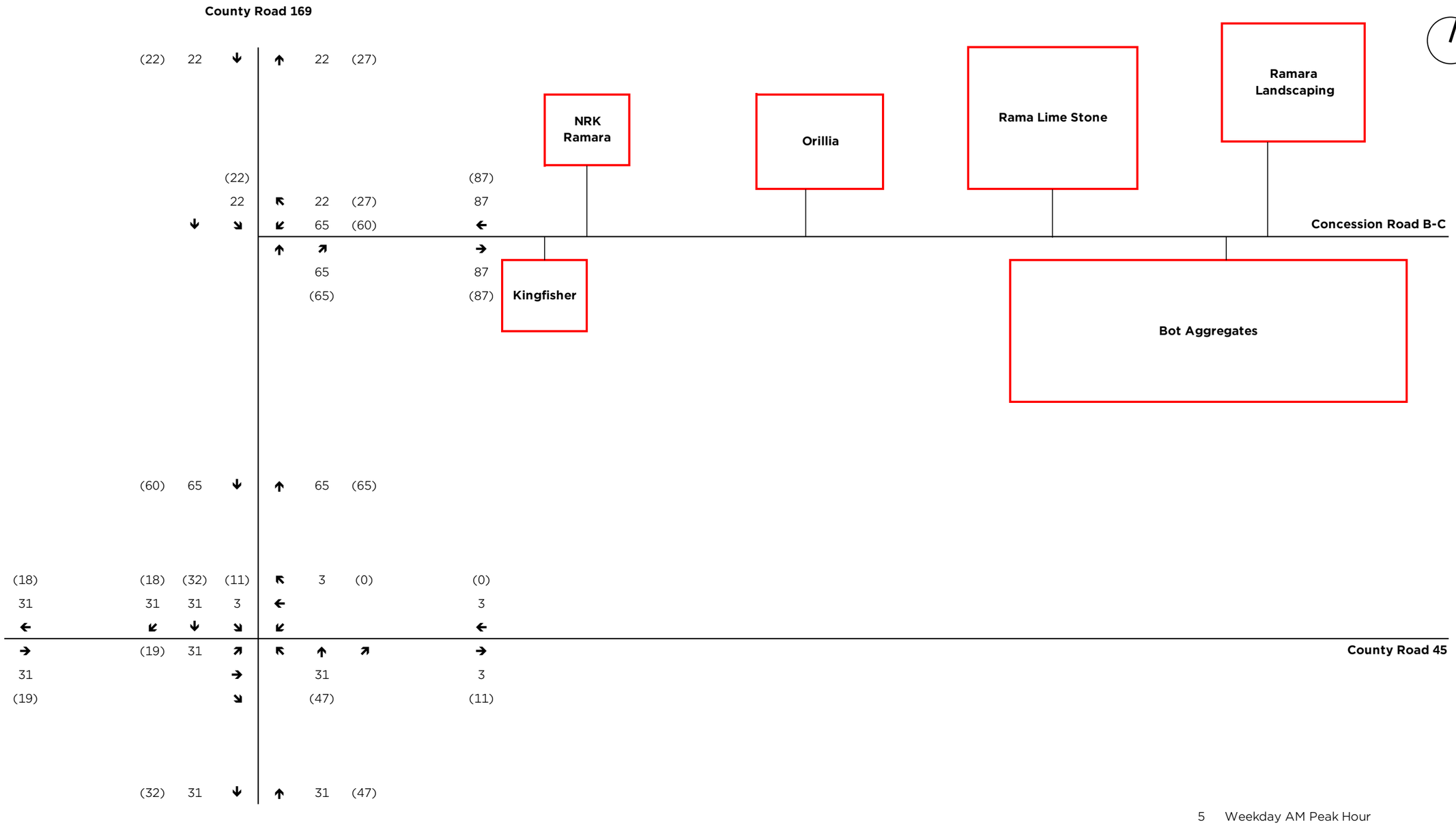
RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 5: Traffic Volumes - 2025



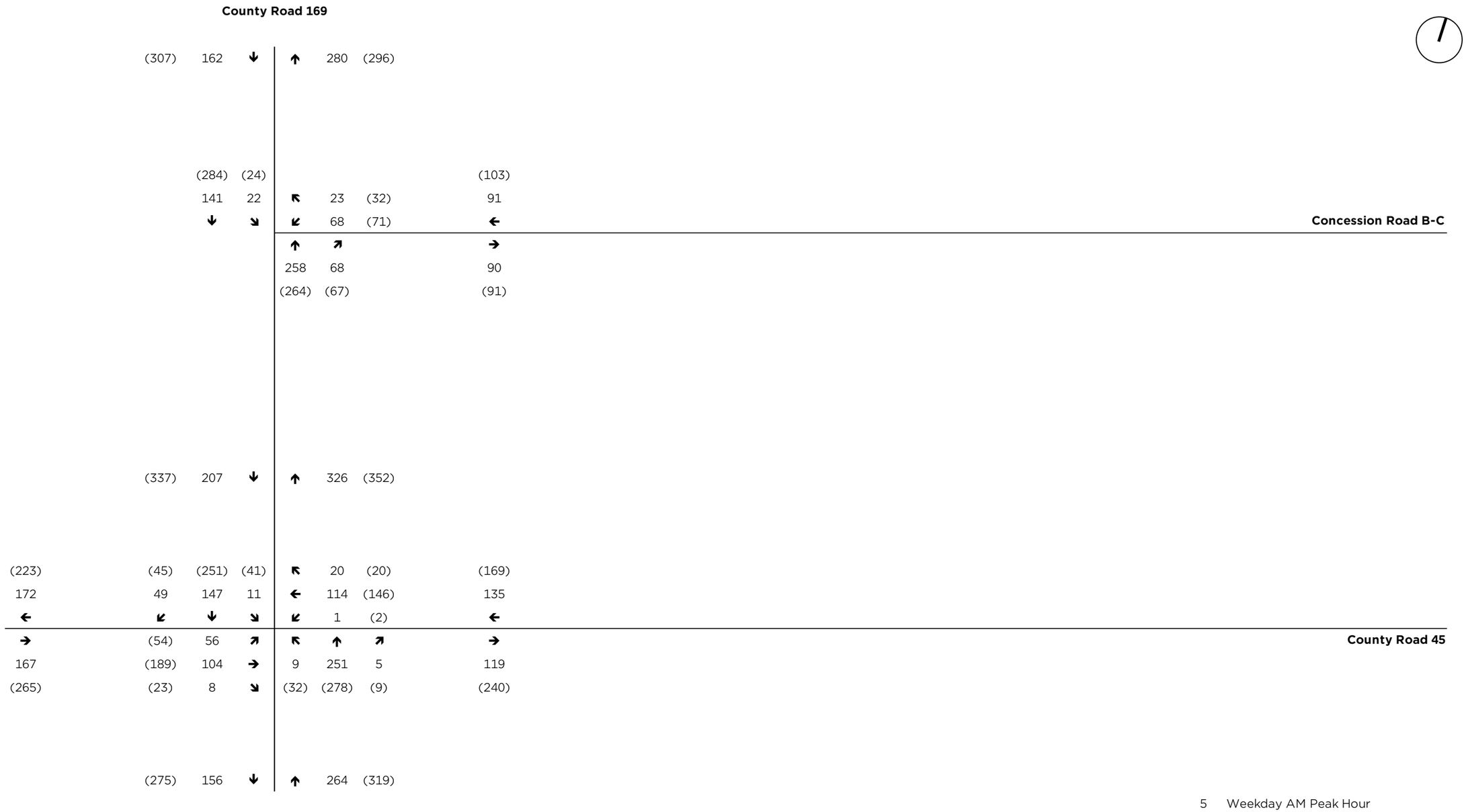
RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 6: Background Developments – Aggregate Sites



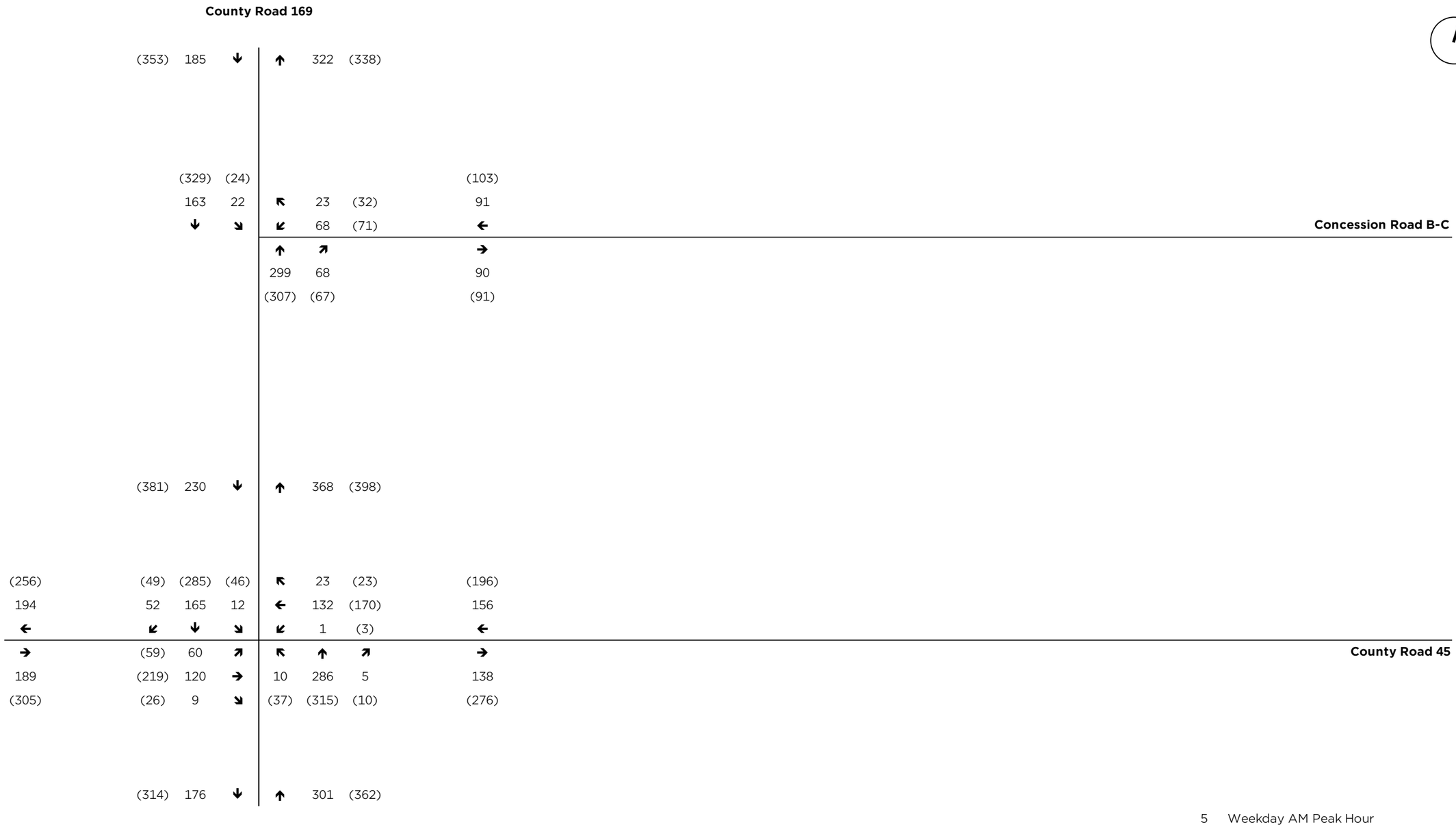
RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 7: Traffic Volumes – Background Developments



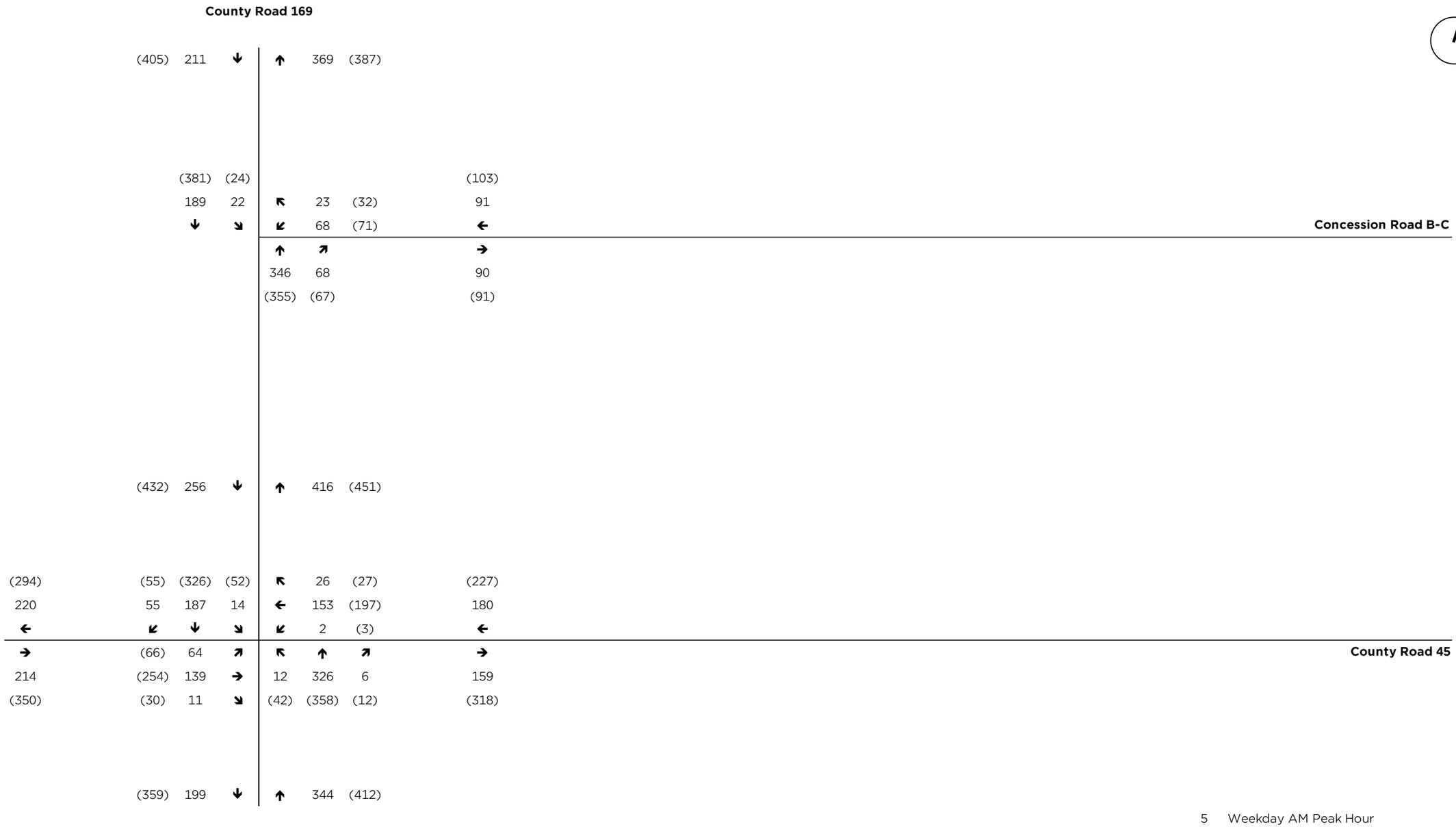
RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 8: Traffic Volumes – 2028 Background



RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 9: Traffic Volumes – 2033 Background

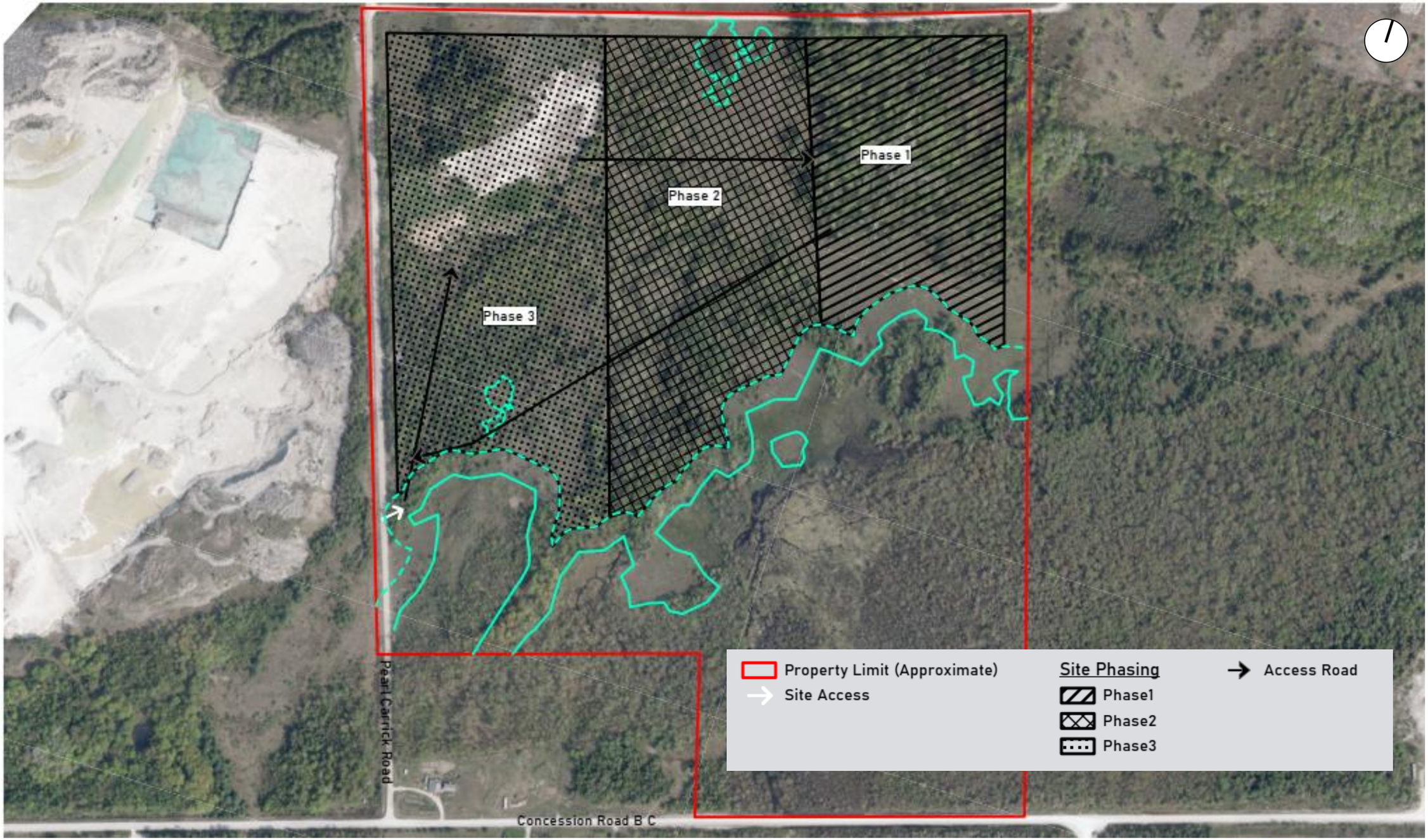


5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 10: Traffic Volumes – 2038 Background



RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 11: Concept Phasing Plan

Looking south on Pearl Carrick Road from the proposed site access

Looking north on Pearl Carrick Road from the proposed site access

Sight Lines to/from the south

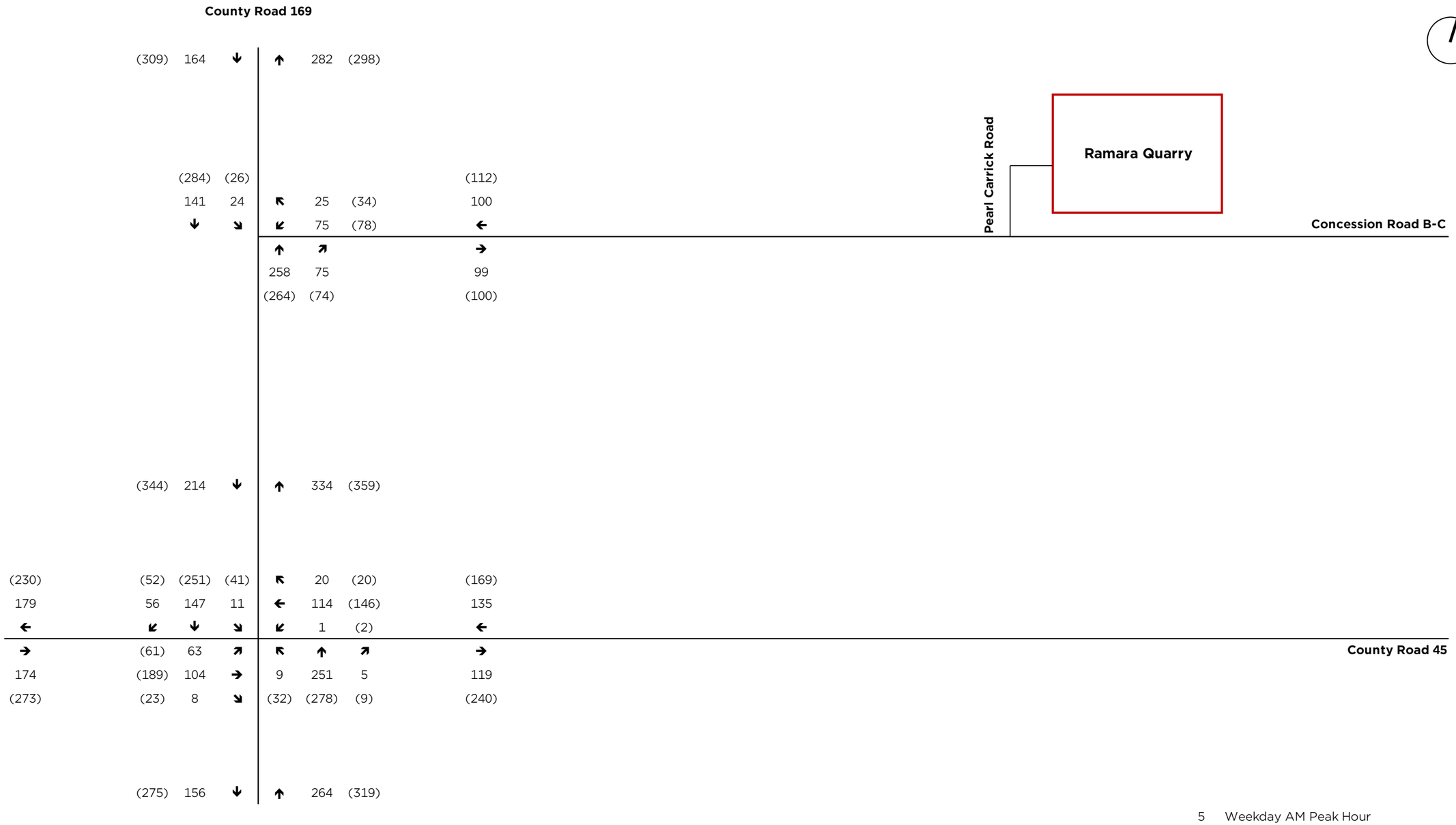
Sight Lines to/from the north

5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

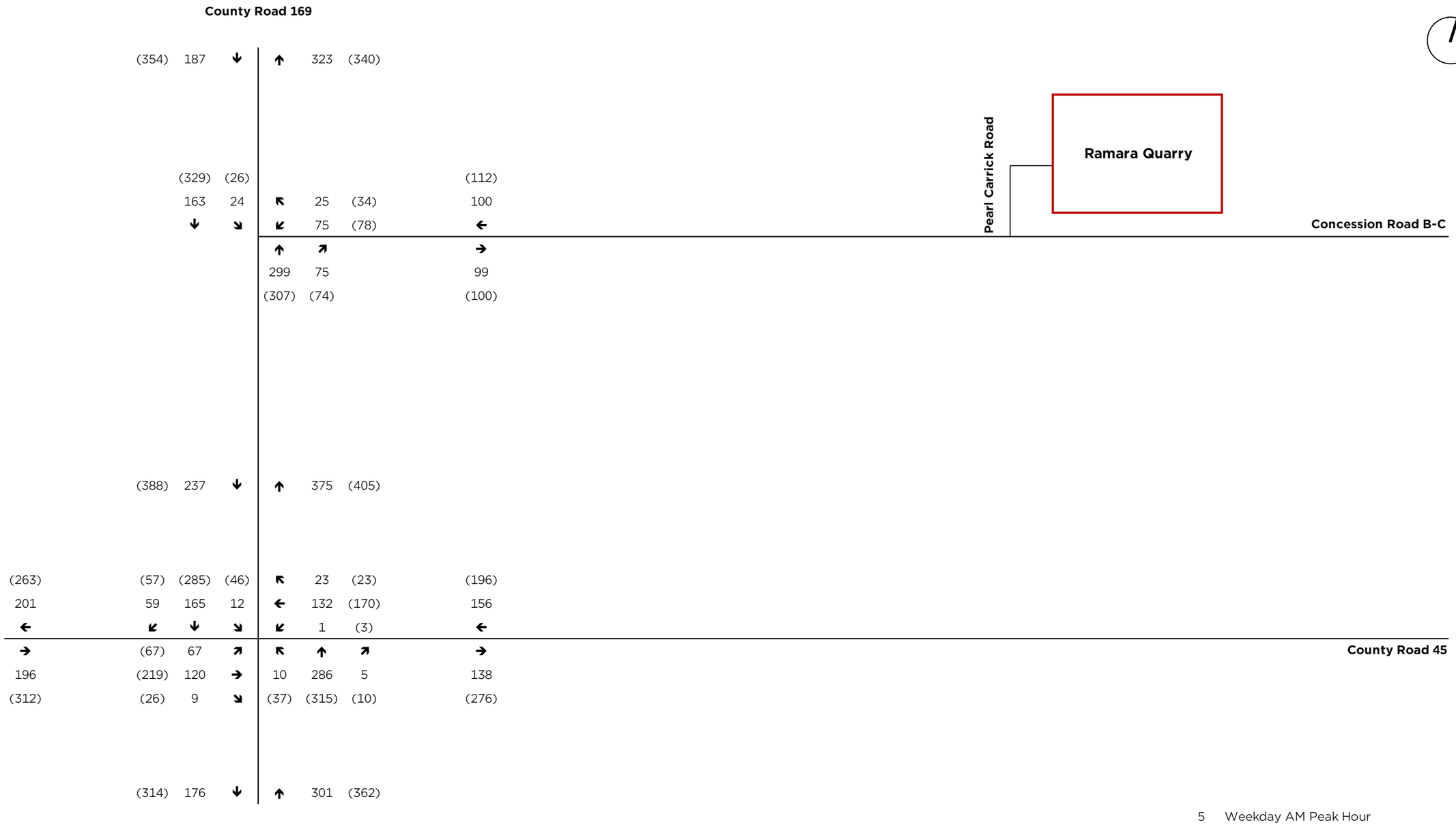
RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 13: Site Traffic



RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 14: Traffic Volumes – 2028 Total



RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 15: Traffic Volumes – 2032 Total

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure 16: Traffic Volumes – 2038 Total

Appendix A:
Traffic Counts

Accu-Traffic Inc.

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 10:00:00

One Hour Peak
From: 9:00:00
To: 10:00:00

Municipality: Ramara
Site #: 2415400001
Intersection: County Rd 169 & Concession B-C
TFR File #: 1
Count date: 22-Aug-24

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Non-Signalized Intersection ****

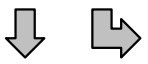
Major Road: County Rd 169 runs N/S

North Leg Total: 367
North Entering: 132
North Peds: 0
Peds Cross: ⋈

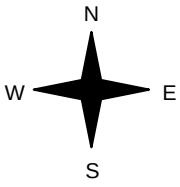
Buses	0	0	0
Trucks	11	7	18
Cars	114	0	114
Totals	125	7	

Buses	0
Trucks	25
Cars	210
Totals	235

East Leg Total: 55
East Entering: 24
East Peds: 0
Peds Cross: ⋈



	Cars	Trucks	Buses	Totals
	1	5	0	6
	2	15	1	18
	3	20	1	



	Cars	Trucks	Buses	Totals
	3	28	0	31

Cars	116	Cars	209	3	212
Trucks	26	Trucks	20	21	41
Buses	1	Buses	0	0	0
Totals	143	Totals	229	24	

Peds Cross: ⋈
South Peds: 0
South Entering: 253
South Leg Total: 396

Comments

Accu-Traffic Inc.

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 19:00:00

One Hour Peak
From: 16:00:00
To: 17:00:00

Municipality: Ramara
Site #: 2415400001
Intersection: County Rd 169 & Concession B-C
TFR File #: 1
Count date: 22-Aug-24

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Non-Signalized Intersection ****

Major Road: County Rd 169 runs N/S

North Leg Total: 500
North Entering: 256
North Peds: 0
Peds Cross: ⋈

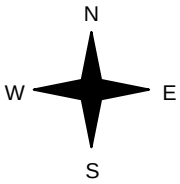
Buses	0	0	0
Trucks	26	2	28
Cars	226	2	228
Totals	252	4	

Buses	0
Trucks	12
Cars	232
Totals	244

East Leg Total: 41
East Entering: 29
East Peds: 0
Peds Cross: ⋈

County Rd 169

Cars	Trucks	Buses	Totals
5	4	0	9
11	9	0	20
16	13	0	



Concession B-C Rd

Cars	Trucks	Buses	Totals
4	8	0	12

County Rd 169

Cars	237
Trucks	35
Buses	0
Totals	272

Cars	227	2	229
Trucks	8	6	14
Buses	0	0	0
Totals	235	8	

Peds Cross: ⋈
South Peds: 0
South Entering: 243
South Leg Total: 515

Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Total Count Diagram

Municipality: Ramara
Site #: 2415400001
Intersection: County Rd 169 & Concession B-C
TFR File #: 1
Count date: 22-Aug-24

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Non-Signalized Intersection ****

Major Road: County Rd 169 runs N/S

North Leg Total: 2331
North Entering: 1031
North Peds: 0
Peds Cross: ⋈

Buses	1	0	1
Trucks	86	26	112
Cars	912	6	918
Totals	999	32	

Buses	0
Trucks	106
Cars	1194
Totals	1300

East Leg Total: 238
East Entering: 131
East Peds: 0
Peds Cross: ⋈

County Rd 169

Cars	Trucks	Buses	Totals
22	28	0	50
32	48	1	81
54	76	1	

N
W E
S

Concession B-C Rd

Cars	Trucks	Buses	Totals
29	78	0	107

County Rd 169

Cars	944		
Trucks	134		
Buses	2		
Totals	1080		

Cars	1172	23	1195
Trucks	78	52	130
Buses	0	0	0
Totals	1250	75	

Peds Cross: ⋈
South Peds: 0
South Entering: 1325
South Leg Total: 2405

Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Traffic Count Summary

Intersection: County Rd 169 & Concession B-C | **Count Date:** 22-Aug-24 | **Municipality:** Ramara

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*8*	*93*	*0*	*101*	*0*
9:00:00	*9*	*110*	*0*	*119*	*0*
10:00:00	*7*	*125*	*0*	*132*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*4*	*252*	*0*	*256*	*0*
18:00:00	*2*	*222*	*0*	*224*	*0*
19:00:00	*2*	*197*	*0*	*199*	*0*
Totals:	32	999	0	1031	0

North/South Total Approaches: 2356

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*0*	*142*	*17*	*159*	*0*
9:00:00	*0*	*163*	*11*	*174*	*0*
10:00:00	*0*	*229*	*24*	*253*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*0*	*235*	*8*	*243*	*0*
18:00:00	*0*	*262*	*9*	*271*	*0*
19:00:00	*0*	*219*	*6*	*225*	*0*
S Totals:	0	1250	75	1325	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*16*	*0*	*13*	*29*	*0*
9:00:00	*13*	*0*	*11*	*24*	*0*
10:00:00	*18*	*0*	*6*	*24*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*20*	*0*	*9*	*29*	*0*
18:00:00	*12*	*0*	*6*	*18*	*0*
19:00:00	*2*	*0*	*5*	*7*	*0*
Totals:	81	0	50	131	0

East/West Total Approaches: 131

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*0*	*0*	*0*	*0*	*0*
9:00:00	*0*	*0*	*0*	*0*	*0*
10:00:00	*0*	*0*	*0*	*0*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*0*	*0*	*0*	*0*	*0*
18:00:00	*0*	*0*	*0*	*0*	*0*
19:00:00	*0*	*0*	*0*	*0*	*0*
W Totals:	0	0	0	0	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	*7:00*	*8:00*	*9:00*	*10:00*	*16:00*	*17:00*	*18:00*	*19:00*
Crossing Values:	*0*	*16*	*13*	*18*	*0*	*20*	*12*	*2*

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Count Date: 22-Aug-24 Site #: 2415400001

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Buses - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	18	18	0	0	2	2	2	2	0	0	0	0	0	0	0	0	0	0
7:30:00	0	0	35	17	0	0	3	1	7	5	0	0	0	0	0	0	0	0	0	0
7:45:00	1	1	58	23	0	0	5	2	11	4	0	0	0	0	0	0	0	0	0	0
8:00:00	1	0	78	20	0	0	7	2	15	4	0	0	0	0	0	0	0	0	0	0
8:15:00	1	0	102	24	0	0	8	1	20	5	0	0	0	0	0	0	0	0	0	0
8:30:00	3	2	128	26	0	0	10	2	22	2	0	0	0	0	0	0	0	0	0	0
8:45:00	3	0	155	27	0	0	14	4	25	3	0	0	0	0	0	0	0	0	0	0
9:00:00	3	0	174	19	0	0	14	0	29	4	0	0	0	0	0	0	0	0	0	0
9:15:00	3	0	197	23	0	0	14	0	30	1	0	0	0	0	0	0	0	0	0	0
9:30:00	3	0	234	37	0	0	18	4	35	5	0	0	0	0	0	0	0	0	0	0
9:45:00	3	0	257	23	0	0	19	1	37	2	0	0	0	0	0	0	0	0	0	0
10:00:00	3	0	288	31	0	0	21	2	40	3	0	0	0	0	0	0	0	0	0	0
10:15:00	3	0	288	0	0	0	21	0	40	0	0	0	0	0	0	0	0	0	0	0
16:00:00	3	0	288	0	0	0	21	0	40	0	0	0	0	0	0	0	0	0	0	0
16:15:00	5	2	349	61	0	0	21	0	53	13	0	0	0	0	0	0	0	0	0	0
16:30:00	5	0	413	64	0	0	23	2	59	6	0	0	0	0	0	0	0	0	0	0
16:45:00	5	0	464	51	0	0	23	0	61	2	0	0	0	0	0	0	0	0	0	0
17:00:00	5	0	514	50	0	0	23	0	66	5	0	0	0	0	0	0	0	0	0	0
17:15:00	5	0	585	71	0	0	23	0	68	2	0	0	0	0	0	0	0	0	0	0
17:30:00	5	0	643	58	0	0	23	0	71	3	0	0	0	0	0	0	0	0	0	0
17:45:00	6	1	695	52	0	0	24	1	72	1	0	0	0	0	0	0	0	0	0	0
18:00:00	6	0	728	33	0	0	24	0	74	2	0	0	0	0	0	0	0	0	0	0
18:15:00	6	0	766	38	0	0	24	0	79	5	0	0	0	0	0	0	0	0	0	0
18:30:00	6	0	815	49	0	0	25	1	81	2	0	0	0	0	0	0	0	0	0	0
18:45:00	6	0	860	45	0	0	26	1	85	4	0	0	0	0	0	0	0	0	0	0
19:00:00	6	0	912	52	0	0	26	0	86	1	0	0	0	0	1	1	0	0	0	0
19:15:00	6	0	912	0	0	0	26	0	86	0	0	0	0	0	1	0	0	0	0	0
19:15:15	6	0	912	0	0	0	26	0	86	0	0	0	0	0	1	0	0	0	0	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Count Date: 22-Aug-24 Site #: 2415400001

Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Buses - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	1	1	0	0	1	1	4	4	0	0	5	5	0	0	0	0	0	0	0	0
7:30:00	1	0	0	0	1	0	6	2	0	0	5	0	0	0	0	0	0	0	0	0
7:45:00	3	2	0	0	3	2	9	3	0	0	9	4	0	0	0	0	0	0	0	0
8:00:00	3	0	0	0	4	1	13	4	0	0	9	0	0	0	0	0	0	0	0	0
8:15:00	6	3	0	0	4	0	20	7	0	0	12	3	0	0	0	0	0	0	0	0
8:30:00	6	0	0	0	6	2	21	1	0	0	15	3	0	0	0	0	0	0	0	0
8:45:00	6	0	0	0	6	0	23	2	0	0	17	2	0	0	0	0	0	0	0	0
9:00:00	6	0	0	0	7	1	23	0	0	0	17	0	0	0	0	0	0	0	0	0
9:15:00	6	0	0	0	7	0	25	2	0	0	20	3	0	0	0	0	0	0	0	0
9:30:00	7	1	0	0	8	1	29	4	0	0	21	1	0	0	0	0	0	0	0	0
9:45:00	8	1	0	0	8	0	33	4	0	0	22	1	1	1	0	0	0	0	0	0
10:00:00	8	0	0	0	8	0	38	5	0	0	22	0	1	0	0	0	0	0	0	0
10:15:00	8	0	0	0	8	0	38	0	0	0	22	0	1	0	0	0	0	0	0	0
16:00:00	8	0	0	0	8	0	38	0	0	0	22	0	1	0	0	0	0	0	0	0
16:15:00	11	3	0	0	12	4	40	2	0	0	24	2	1	0	0	0	0	0	0	0
16:30:00	16	5	0	0	13	1	43	3	0	0	25	1	1	0	0	0	0	0	0	0
16:45:00	17	1	0	0	13	0	44	1	0	0	25	0	1	0	0	0	0	0	0	0
17:00:00	19	2	0	0	13	0	47	3	0	0	26	1	1	0	0	0	0	0	0	0
17:15:00	23	4	0	0	16	3	48	1	0	0	26	0	1	0	0	0	0	0	0	0
17:30:00	28	5	0	0	17	1	48	0	0	0	26	0	1	0	0	0	0	0	0	0
17:45:00	29	1	0	0	19	2	48	0	0	0	26	0	1	0	0	0	0	0	0	0
18:00:00	30	1	0	0	19	0	48	0	0	0	26	0	1	0	0	0	0	0	0	0
18:15:00	30	0	0	0	19	0	48	0	0	0	26	0	1	0	0	0	0	0	0	0
18:30:00	32	2	0	0	20	1	48	0	0	0	26	0	1	0	0	0	0	0	0	0
18:45:00	32	0	0	0	21	1	48	0	0	0	28	2	1	0	0	0	0	0	0	0
19:00:00	32	0	0	0	22	1	48	0	0	0	28	0	1	0	0	0	0	0	0	0
19:15:00	32	0	0	0	22	0	48	0	0	0	28	0	1	0	0	0	0	0	0	0
19:15:15	32	0	0	0	22	0	48	0	0	0	28	0	1	0	0	0	0	0	0	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Count Date: 22-Aug-24 Site #: 2415400001

Interval Time	Passenger Cars - South Approach						Trucks - South Approach						Buses - South Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		South Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	27	27	0	0	0	0	6	6	3	3	0	0	0	0	0	0	0	0
7:30:00	0	0	64	37	1	1	0	0	11	5	7	4	0	0	0	0	0	0	0	0
7:45:00	0	0	101	37	1	0	0	0	15	4	9	2	0	0	0	0	0	0	0	0
8:00:00	0	0	123	22	1	0	0	0	19	4	16	7	0	0	0	0	0	0	0	0
8:15:00	0	0	158	35	2	1	0	0	23	4	17	1	0	0	0	0	0	0	0	0
8:30:00	0	0	190	32	3	1	0	0	25	2	20	3	0	0	0	0	0	0	0	0
8:45:00	0	0	231	41	3	0	0	0	33	8	21	1	0	0	0	0	0	0	0	0
9:00:00	0	0	270	39	3	0	0	0	35	2	25	4	0	0	0	0	0	0	0	0
9:15:00	0	0	307	37	4	1	0	0	40	5	29	4	0	0	0	0	0	0	0	0
9:30:00	0	0	356	49	6	2	0	0	45	5	33	4	0	0	0	0	0	0	0	0
9:45:00	0	0	408	52	6	0	0	0	49	4	42	9	0	0	0	0	0	0	0	0
10:00:00	0	0	479	71	6	0	0	0	55	6	46	4	0	0	0	0	0	0	0	0
10:15:00	0	0	479	0	6	0	0	0	55	0	46	0	0	0	0	0	0	0	0	0
16:00:00	0	0	479	0	6	0	0	0	55	0	46	0	0	0	0	0	0	0	0	0
16:15:00	0	0	553	74	6	0	0	0	57	2	49	3	0	0	0	0	0	0	0	0
16:30:00	0	0	602	49	8	2	0	0	57	0	50	1	0	0	0	0	0	0	0	0
16:45:00	0	0	657	55	8	0	0	0	58	1	52	2	0	0	0	0	0	0	0	0
17:00:00	0	0	706	49	8	0	0	0	63	5	52	0	0	0	0	0	0	0	0	0
17:15:00	0	0	771	65	13	5	0	0	66	3	52	0	0	0	0	0	0	0	0	0
17:30:00	0	0	838	67	14	1	0	0	68	2	52	0	0	0	0	0	0	0	0	0
17:45:00	0	0	898	60	16	2	0	0	69	1	52	0	0	0	0	0	0	0	0	0
18:00:00	0	0	959	61	17	1	0	0	72	3	52	0	0	0	0	0	0	0	0	0
18:15:00	0	0	1018	59	18	1	0	0	73	1	52	0	0	0	0	0	0	0	0	0
18:30:00	0	0	1074	56	19	1	0	0	74	1	52	0	0	0	0	0	0	0	0	0
18:45:00	0	0	1127	53	22	3	0	0	77	3	52	0	0	0	0	0	0	0	0	0
19:00:00	0	0	1172	45	23	1	0	0	78	1	52	0	0	0	0	0	0	0	0	0
19:15:00	0	0	1172	0	23	0	0	0	78	0	52	0	0	0	0	0	0	0	0	0
19:15:15	0	0	1172	0	23	0	0	0	78	0	52	0	0	0	0	0	0	0	0	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Count Date: 22-Aug-24 Site #: 2415400001

Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Buses - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 10:00:00

One Hour Peak
From: 9:00:00
To: 10:00:00

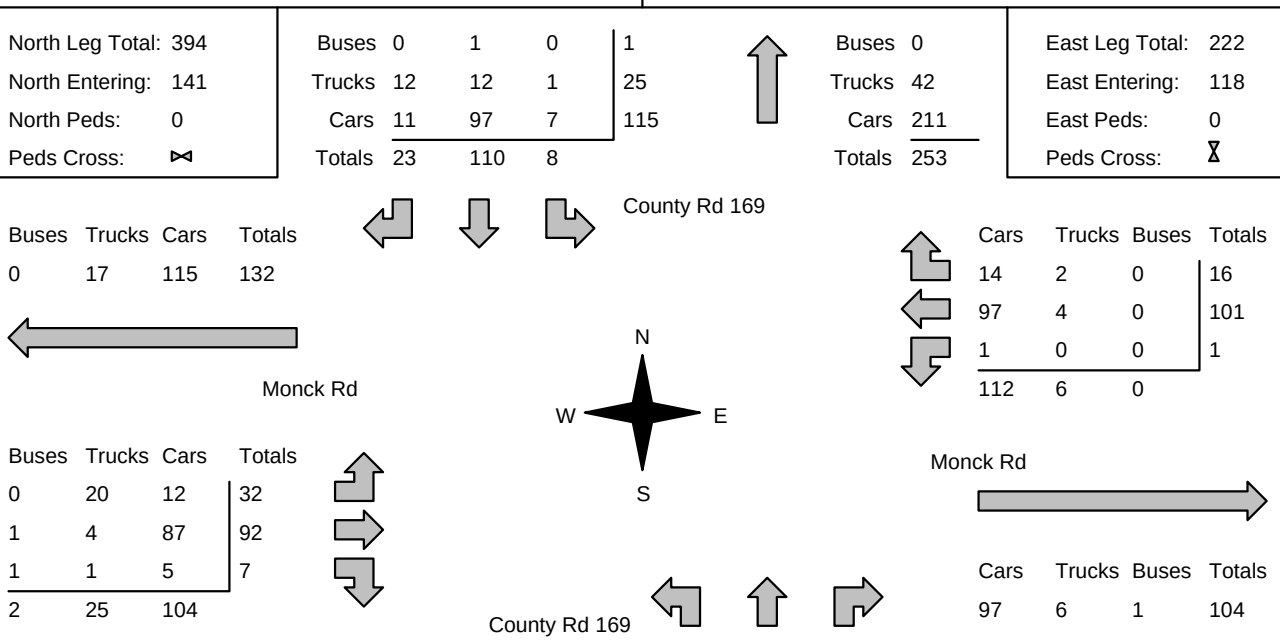
Municipality: Ramara
Site #: 2415400002
Intersection: County Rd 169 & Monck Rd
TFR File #: 1
Count date: 22-Aug-24

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Signalized Intersection ****

Major Road: County Rd 169 runs N/S



Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 19:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

Municipality: Ramara
Site #: 2415400002
Intersection: County Rd 169 & Monck Rd
TFR File #: 1
Count date: 22-Aug-24

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Signalized Intersection ****

Major Road: County Rd 169 runs N/S

North Leg Total: 516
North Entering: 255
North Peds: 0
Peds Cross: ⋈

Buses	0	0	0	0
Trucks	5	9	3	17
Cars	22	190	26	238
Totals	27	199	29	

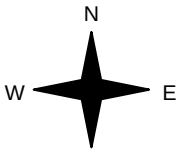
Buses	0
Trucks	14
Cars	247
Totals	261

East Leg Total: 355
East Entering: 150
East Peds: 0
Peds Cross: ⧗

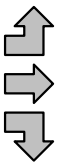
Buses	Trucks	Cars	Totals
0	10	175	185

Monck Rd

Cars	Trucks	Buses	Totals
18	0	0	18
125	5	0	130
2	0	0	2
145	5	0	



Buses	Trucks	Cars	Totals
0	4	29	33
0	4	164	168
0	0	20	20
0	8	213	



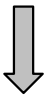
Monck Rd

Cars	Trucks	Buses	Totals
198	7	0	205

County Rd 169

Peds Cross: ⧗
West Peds: 0
West Entering: 221
West Leg Total: 406

Cars	212			
Trucks	9			
Buses	0			
Totals	221			



Cars	28	200	8	236
Trucks	0	10	0	10
Buses	0	0	0	0
Totals	28	210	8	

Peds Cross: ⋈
South Peds: 1
South Entering: 246
South Leg Total: 467

Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Total Count Diagram

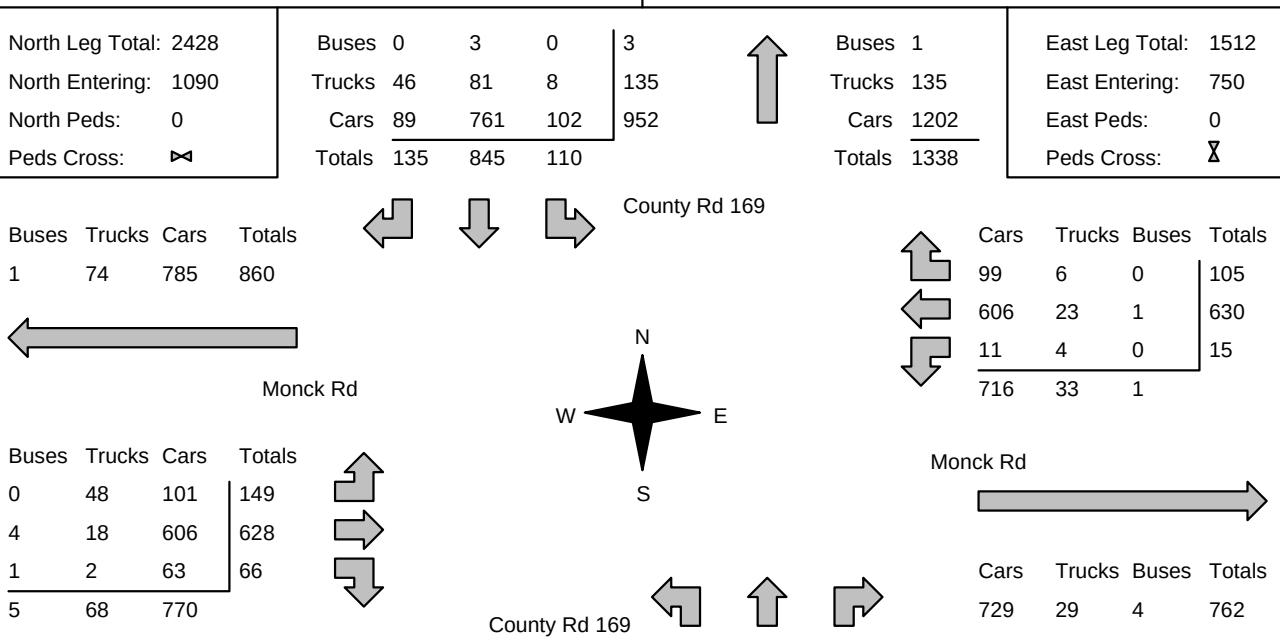
Municipality: Ramara
Site #: 2415400002
Intersection: County Rd 169 & Monck Rd
TFR File #: 1
Count date: 22-Aug-24

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Signalized Intersection ****

Major Road: County Rd 169 runs N/S



Comments

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Traffic Count Summary

Intersection: County Rd 169 & Monck Rd | **Count Date:** 22-Aug-24 | **Municipality:** Ramara

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*13*	*80*	*21*	*114*	*0*
9:00:00	*11*	*85*	*29*	*125*	*0*
10:00:00	*8*	*110*	*23*	*141*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*29*	*212*	*33*	*274*	*0*
18:00:00	*25*	*183*	*20*	*228*	*0*
19:00:00	*24*	*175*	*9*	*208*	*0*
Totals:	110	845	135	1090	0

North/South Total Approaches: 2293

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*20*	*128*	*3*	*151*	*0*
9:00:00	*16*	*142*	*2*	*160*	*0*
10:00:00	*8*	*205*	*4*	*217*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*20*	*193*	*6*	*219*	*0*
18:00:00	*19*	*224*	*5*	*248*	*1*
19:00:00	*12*	*192*	*4*	*208*	*0*
S Totals:	95	1084	24	1203	1

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*2*	*76*	*14*	*92*	*0*
9:00:00	*2*	*76*	*20*	*98*	*0*
10:00:00	*1*	*101*	*16*	*118*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*3*	*135*	*21*	*159*	*0*
18:00:00	*3*	*114*	*16*	*133*	*0*
19:00:00	*4*	*128*	*18*	*150*	*0*
Totals:	15	630	105	750	0

East/West Total Approaches: 1592

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Buses				Total Peds
	Left	Thru	Right	Grand Total	
7:00:00	*0*	*0*	*0*	*0*	*0*
8:00:00	*21*	*31*	*10*	*62*	*0*
9:00:00	*14*	*70*	*8*	*92*	*0*
10:00:00	*32*	*92*	*7*	*131*	*0*
16:00:00	*0*	*0*	*0*	*0*	*0*
17:00:00	*29*	*165*	*19*	*213*	*0*
18:00:00	*28*	*158*	*10*	*196*	*0*
19:00:00	*25*	*112*	*11*	*148*	*0*
W Totals:	149	628	65	842	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	*7:00*	*8:00*	*9:00*	*10:00*	*16:00*	*17:00*	*18:00*	*19:00*
Crossing Values:	*0*	*99*	*92*	*134*	*0*	*197*	*190*	*157*

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Count Date: 22-Aug-24 Site #: 2415400002

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Buses - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	3	3	16	16	1	1	0	0	2	2	5	5	0	0	0	0	0	0	0	0
7:30:00	5	2	31	15	1	0	0	0	5	3	8	3	0	0	0	0	0	0	0	0
7:45:00	8	3	49	18	6	5	0	0	10	5	11	3	0	0	0	0	0	0	0	0
8:00:00	12	4	65	16	8	2	1	1	15	5	13	2	0	0	0	0	0	0	0	0
8:15:00	12	0	82	17	14	6	1	0	19	4	19	6	0	0	0	0	0	0	0	0
8:30:00	15	3	103	21	20	6	2	1	22	3	19	0	0	0	0	0	0	0	0	0
8:45:00	19	4	122	19	24	4	3	1	25	3	20	1	0	0	0	0	0	0	0	0
9:00:00	21	2	137	15	29	5	3	0	28	3	21	1	0	0	0	0	0	0	0	0
9:15:00	22	1	157	20	29	0	3	0	30	2	22	1	0	0	0	0	0	0	0	0
9:30:00	26	4	185	28	37	8	3	0	36	6	25	3	0	0	0	0	0	0	0	0
9:45:00	28	2	208	23	37	0	3	0	37	1	30	5	0	0	1	1	0	0	0	0
10:00:00	28	0	234	26	40	3	4	1	40	3	33	3	0	0	1	0	0	0	0	0
10:15:00	28	0	234	0	40	0	4	0	40	0	33	0	0	0	1	0	0	0	0	0
16:00:00	28	0	234	0	40	0	4	0	40	0	33	0	0	0	1	0	0	0	0	0
16:15:00	37	9	282	48	45	5	4	0	51	11	36	3	0	0	2	1	0	0	0	0
16:30:00	43	6	339	57	51	6	4	0	57	6	41	5	0	0	2	0	0	0	0	0
16:45:00	49	6	384	45	56	5	5	1	59	2	41	0	0	0	2	0	0	0	0	0
17:00:00	55	6	424	40	60	4	6	1	61	2	46	5	0	0	2	0	0	0	0	0
17:15:00	64	9	483	59	66	6	7	1	63	2	46	0	0	0	2	0	0	0	0	0
17:30:00	69	5	529	46	73	7	7	0	66	3	46	0	0	0	2	0	0	0	0	0
17:45:00	76	7	577	48	78	5	7	0	67	1	46	0	0	0	2	0	0	0	0	0
18:00:00	79	3	599	22	80	2	7	0	69	2	46	0	0	0	2	0	0	0	0	0
18:15:00	84	5	642	43	80	0	7	0	74	5	46	0	0	0	2	0	0	0	0	0
18:30:00	89	5	682	40	82	2	8	1	76	2	46	0	0	0	2	0	0	0	0	0
18:45:00	95	6	717	35	86	4	8	0	78	2	46	0	0	0	2	0	0	0	0	0
19:00:00	102	7	761	44	89	3	8	0	81	3	46	0	0	0	3	1	0	0	0	0
19:15:00	102	0	761	0	89	0	8	0	81	0	46	0	0	0	3	0	0	0	0	0
19:15:15	102	0	761	0	89	0	8	0	81	0	46	0	0	0	3	0	0	0	0	0

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Count Date: 22-Aug-24 Site #: 2415400002

Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Buses - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	17	17	3	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0
7:30:00	1	1	35	18	9	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7:45:00	2	1	53	18	11	2	0	0	2	1	0	0	0	0	0	0	0	0	0	0
8:00:00	2	0	73	20	12	1	0	0	3	1	2	2	0	0	0	0	0	0	0	0
8:15:00	2	0	88	15	16	4	0	0	3	0	2	0	0	0	1	1	0	0	0	0
8:30:00	2	0	101	13	22	6	0	0	4	1	2	0	0	0	1	0	0	0	0	0
8:45:00	2	0	129	28	26	4	2	2	5	1	2	0	0	0	1	0	0	0	0	0
9:00:00	2	0	145	16	32	6	2	0	6	1	2	0	0	0	1	0	0	0	0	0
9:15:00	2	0	169	24	36	4	2	0	6	0	3	1	0	0	1	0	0	0	0	0
9:30:00	2	0	189	20	41	5	2	0	7	1	3	0	0	0	1	0	0	0	0	0
9:45:00	2	0	218	29	44	3	2	0	9	2	4	1	0	0	1	0	0	0	0	0
10:00:00	3	1	242	24	46	2	2	0	10	1	4	0	0	0	1	0	0	0	0	0
10:15:00	3	0	242	0	46	0	2	0	10	0	4	0	0	0	1	0	0	0	0	0
16:00:00	3	0	242	0	46	0	2	0	10	0	4	0	0	0	1	0	0	0	0	0
16:15:00	3	0	279	37	51	5	3	1	10	0	4	0	0	0	1	0	0	0	0	0
16:30:00	4	1	309	30	59	8	3	0	13	3	4	0	0	0	1	0	0	0	0	0
16:45:00	4	0	337	28	65	6	3	0	14	1	4	0	0	0	1	0	0	0	0	0
17:00:00	5	1	371	34	67	2	3	0	16	2	4	0	0	0	1	0	0	0	0	0
17:15:00	5	0	399	28	71	4	3	0	16	0	4	0	0	0	1	0	0	0	0	0
17:30:00	6	1	434	35	77	6	3	0	18	2	4	0	0	0	1	0	0	0	0	0
17:45:00	7	1	459	25	81	4	3	0	19	1	4	0	0	0	1	0	0	0	0	0
18:00:00	8	1	481	22	82	1	3	0	20	1	5	1	0	0	1	0	0	0	0	0
18:15:00	9	1	506	25	85	3	3	0	20	0	5	0	0	0	1	0	0	0	0	0
18:30:00	10	1	538	32	89	4	4	1	21	1	5	0	0	0	1	0	0	0	0	0
18:45:00	11	1	558	20	94	5	4	0	22	1	6	1	0	0	1	0	0	0	0	0
19:00:00	11	0	606	48	99	5	4	0	23	1	6	0	0	0	1	0	0	0	0	0
19:15:00	11	0	606	0	99	0	4	0	23	0	6	0	0	0	1	0	0	0	0	0
19:15:15	11	0	606	0	99	0	4	0	23	0	6	0	0	0	1	0	0	0	0	0

Accu-Traffic Inc.
Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Count Date: 22-Aug-24 Site #: 2415400002

Interval Time	Passenger Cars - South Approach						Trucks - South Approach						Buses - South Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		South Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	4	4	25	25	0	0	3	3	8	8	0	0	0	0	0	0	0	0	0	0
7:30:00	9	5	56	31	0	0	3	0	12	4	0	0	0	0	0	0	0	0	0	0
7:45:00	13	4	91	35	3	3	3	0	16	4	0	0	0	0	0	0	0	0	0	0
8:00:00	17	4	106	15	3	0	3	0	22	6	0	0	0	0	0	0	0	0	0	0
8:15:00	25	8	137	31	4	1	3	0	25	3	0	0	0	0	0	0	0	0	0	0
8:30:00	27	2	163	26	4	0	3	0	28	3	1	1	0	0	0	0	0	0	0	0
8:45:00	29	2	198	35	4	0	3	0	38	10	1	0	0	0	0	0	0	0	0	0
9:00:00	33	4	227	29	4	0	3	0	43	5	1	0	0	0	0	0	0	0	0	0
9:15:00	35	2	262	35	5	1	3	0	52	9	1	0	0	0	0	0	0	0	0	0
9:30:00	37	2	301	39	5	0	3	0	55	3	2	1	0	0	0	0	0	0	0	0
9:45:00	40	3	353	52	7	2	4	1	58	3	2	0	0	0	0	0	0	0	0	0
10:00:00	40	0	412	59	7	0	4	0	63	5	2	0	0	0	0	0	0	0	0	0
10:15:00	40	0	412	0	7	0	4	0	63	0	2	0	0	0	0	0	0	0	0	0
16:00:00	40	0	412	0	7	0	4	0	63	0	2	0	0	0	0	0	0	0	0	0
16:15:00	43	3	473	61	8	1	5	1	63	0	2	0	0	0	0	0	0	0	0	0
16:30:00	45	2	510	37	9	1	5	0	63	0	3	1	0	0	0	0	0	0	0	0
16:45:00	49	4	562	52	11	2	5	0	63	0	3	0	0	0	0	0	0	0	0	0
17:00:00	59	10	601	39	12	1	5	0	67	4	3	0	0	0	0	0	0	0	0	0
17:15:00	65	6	653	52	14	2	5	0	71	4	3	0	0	0	0	0	0	0	0	0
17:30:00	73	8	710	57	17	3	5	0	73	2	3	0	0	0	0	0	0	0	1	1
17:45:00	76	3	765	55	17	0	5	0	75	2	3	0	0	0	0	0	0	0	1	0
18:00:00	78	2	817	52	17	0	5	0	75	0	3	0	0	0	0	0	0	0	1	0
18:15:00	84	6	871	54	18	1	5	0	76	1	3	0	0	0	0	0	0	0	1	0
18:30:00	85	1	925	54	19	1	5	0	78	2	3	0	0	0	0	0	0	0	1	0
18:45:00	87	2	968	43	19	0	5	0	80	2	3	0	0	0	0	0	0	0	1	0
19:00:00	90	3	1002	34	21	2	5	0	81	1	3	0	0	0	1	1	0	0	1	0
19:15:00	90	0	1002	0	21	0	5	0	81	0	3	0	0	0	1	0	0	0	1	0
19:15:15	90	0	1002	0	21	0	5	0	81	0	3	0	0	0	1	0	0	0	1	0

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Traffic Monitoring & Data Analysis

Accu-Traffic Inc.

Count Date: 22-Aug-24 Site #: 2415400002

Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Buses - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	2	2	6	6	1	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	4	2	11	5	2	1	6	3	0	0	0	0	0	0	0	0	0	0	0	0
7:45:00	7	3	22	11	9	7	9	3	0	0	0	0	0	0	0	0	0	0	0	0
8:00:00	7	0	30	8	10	1	14	5	0	0	0	0	0	0	1	1	0	0	0	0
8:15:00	8	1	48	18	12	2	15	1	1	1	0	0	0	0	1	0	0	0	0	0
8:30:00	12	4	59	11	15	3	16	1	2	1	0	0	0	0	1	0	0	0	0	0
8:45:00	15	3	75	16	17	2	16	0	3	1	0	0	0	0	2	1	0	0	0	0
9:00:00	16	1	93	18	18	1	19	3	6	3	0	0	0	0	2	0	0	0	0	0
9:15:00	19	3	120	27	19	1	22	3	8	2	1	1	0	0	2	0	0	0	0	0
9:30:00	22	3	136	16	21	2	25	3	8	0	1	0	0	0	2	0	0	0	0	0
9:45:00	25	3	156	20	22	1	37	12	9	1	1	0	0	0	2	0	1	1	0	0
10:00:00	28	3	180	24	23	1	39	2	10	1	1	0	0	0	3	1	1	0	0	0
10:15:00	28	0	180	0	23	0	39	0	10	0	1	0	0	0	3	0	1	0	0	0
16:00:00	28	0	180	0	23	0	39	0	10	0	1	0	0	0	3	0	1	0	0	0
16:15:00	34	6	224	44	26	3	43	4	11	1	1	0	0	0	4	1	1	0	0	0
16:30:00	40	6	261	37	28	2	44	1	11	0	1	0	0	0	4	0	1	0	0	0
16:45:00	45	5	300	39	36	8	47	3	13	2	1	0	0	0	4	0	1	0	0	0
17:00:00	48	3	341	41	42	6	48	1	13	0	1	0	0	0	4	0	1	0	0	0
17:15:00	62	14	379	38	47	5	48	0	13	0	1	0	0	0	4	0	1	0	0	0
17:30:00	69	7	425	46	48	1	48	0	15	2	1	0	0	0	4	0	1	0	0	0
17:45:00	72	3	454	29	48	0	48	0	15	0	1	0	0	0	4	0	1	0	0	0
18:00:00	76	4	497	43	51	3	48	0	15	0	2	1	0	0	4	0	1	0	0	0
18:15:00	83	7	519	22	55	4	48	0	17	2	2	0	0	0	4	0	1	0	0	0
18:30:00	83	0	547	28	56	1	48	0	17	0	2	0	0	0	4	0	1	0	0	0
18:45:00	94	11	582	35	60	4	48	0	18	1	2	0	0	0	4	0	1	0	0	0
19:00:00	101	7	606	24	62	2	48	0	18	0	2	0	0	0	4	0	1	0	0	0
19:15:00	101	0	606	0	63	1	48	0	18	0	2	0	0	0	4	0	1	0	0	0
19:15:15	101	0	606	0	63	0	48	0	18	0	2	0	0	0	4	0	1	0	0	0

Appendix B:
LOS Definitions

TATHAM ENGINEERING

Level of Service – Unsignalized Intersections

Level of Service (LOS) for unsignalized intersections is defined in terms of control delay for each critical lane. Control delay includes initial deceleration, queue move-up time, stopped delay and final acceleration delay, and is a function of the service rate or capacity of the approach and degree of saturation.

The following table describes in detail the characteristics of each level of service, with A being the best and F being the worst.

LOS	EXPECTED DELAY TO STREET TRAFFIC	DELAY (sec/veh)
A	Little or no delays	$0 < d \leq 10$
B	Short traffic delays	$10 < d \leq 15$
C	Average traffic delays	$15 < d \leq 25$
D	Long traffic delays	$25 < d \leq 35$
E	Very long traffic delays	$35 < d \leq 50$
F	Extreme delays with queuing which may cause congestion affecting other traffic movements in the intersection	$50 < d$

source: 2010 Highway Capacity Manual

TATHAM ENGINEERING

Level of Service – Signalized Intersections

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is made up of a number of factors that relate to control, geometrics, traffic and incidents. Only the portion of total delay attributed to the control facility is quantified. This control delay includes initial deceleration, queue move-up time, stopped delay and final acceleration delay.

The following table describes in detail the characteristics of each level of service, with A being the best and F being the worst.

LOS	EXPECTED DELAY TO STREET TRAFFIC	DELAY (sec/veh)
A	This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all at this LOS. Short cycle lengths may also contribute to low delay.	$0 < d \leq 10$
B	This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop at this level than at LOS A, causing longer average delays.	$10 < d \leq 20$
C	These higher delays may result from fair progression, longer cycle length, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, though many still pass through the intersection without stopping.	$20 < d \leq 35$
D	At this level, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavourable progression, long cycle lengths, or high volume to capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures become noticeable.	$35 < d \leq 55$
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.	$55 < d \leq 80$
F	At this level, oversaturation occurs when arrival flow rates exceed the design capacity of the intersection. It may also occur at high v/c ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors to such high delay levels. LOS F is considered to be unacceptable to most drivers.	$80 < d$

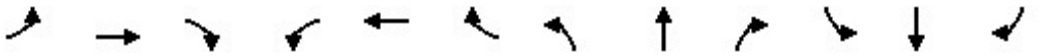
source: 2010 Highway Capacity Manual

Appendix C:
Existing Conditions

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	18	6	236	24	7	129
Future Volume (Veh/h)	18	6	236	24	7	129
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	7	257	26	8	140
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	413	257			283	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	413	257			283	
tC, single (s)	7.2	7.0			5.1	
tC, 2 stage (s)						
tF (s)	4.2	4.0			3.1	
p0 queue free %	96	99			99	
cM capacity (veh/h)	463	620			876	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	27	257	26	8	140
Volume Left	20	0	0	8	0
Volume Right	7	0	26	0	0
cSH	495	1700	1700	876	1700
Volume to Capacity	0.05	0.15	0.02	0.01	0.08
Queue Length 95th (m)	1.3	0.0	0.0	0.2	0.0
Control Delay (s)	12.7	0.0	0.0	9.1	0.0
Lane LOS	B			A	
Approach Delay (s)	12.7	0.0		0.5	
Approach LOS	B				

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		



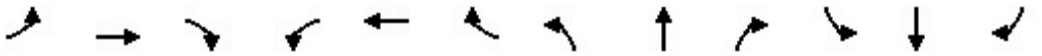
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	95	7	1	104	16	8	211	4	8	113	24
Future Volume (vph)	33	95	7	1	104	16	8	211	4	8	113	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1120	1815		913	1791		1615	1746	1306	1615	1624	1021
Flt Permitted	0.67	1.00		0.69	1.00		0.67	1.00	1.00	0.62	1.00	1.00
Satd. Flow (perm)	794	1815		658	1791		1143	1746	1306	1047	1624	1021
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	103	8	1	113	17	9	229	4	9	123	26
RTOR Reduction (vph)	0	5	0	0	10	0	0	0	3	0	2	17
Lane Group Flow (vph)	36	106	0	1	120	0	9	229	1	9	124	6
Heavy Vehicles (%)	63%	4%	14%	100%	4%	13%	13%	10%	25%	13%	11%	52%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	10.3	10.3		10.3	10.3		7.5	7.5	7.5	7.5	7.5	7.5
Effective Green, g (s)	10.3	10.3		10.3	10.3		7.5	7.5	7.5	7.5	7.5	7.5
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.28	0.28	0.28	0.28	0.28	0.28
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	305	697		252	688		319	488	365	293	454	285
v/s Ratio Prot		0.06			c0.07			c0.13			0.08	
v/s Ratio Perm	0.05			0.00			0.01		0.00	0.01		0.01
v/c Ratio	0.12	0.15		0.00	0.17		0.03	0.47	0.00	0.03	0.27	0.02
Uniform Delay, d1	5.3	5.4		5.1	5.4		7.0	8.0	7.0	7.0	7.5	7.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1		0.0	0.1		0.0	0.7	0.0	0.0	0.3	0.0
Delay (s)	5.5	5.5		5.1	5.6		7.0	8.7	7.0	7.1	7.9	7.0
Level of Service	A	A		A	A		A	A	A	A	A	A
Approach Delay (s)		5.5			5.6			8.6			7.7	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	26.8	Sum of lost time (s)	9.0
Intersection Capacity Utilization	27.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	21	9	242	8	4	260
Future Volume (Veh/h)	21	9	242	8	4	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	23	10	263	9	4	283
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	554	263			272	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	554	263			272	
tC, single (s)	6.8	6.6			4.6	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.7	
p0 queue free %	95	99			100	
cM capacity (veh/h)	426	684			1059	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	33	263	9	4	283
Volume Left	23	0	0	4	0
Volume Right	10	0	9	0	0
cSH	481	1700	1700	1059	1700
Volume to Capacity	0.07	0.15	0.01	0.00	0.17
Queue Length 95th (m)	1.7	0.0	0.0	0.1	0.0
Control Delay (s)	13.0	0.0	0.0	8.4	0.0
Lane LOS	B			A	
Approach Delay (s)	13.0	0.0		0.1	
Approach LOS	B				

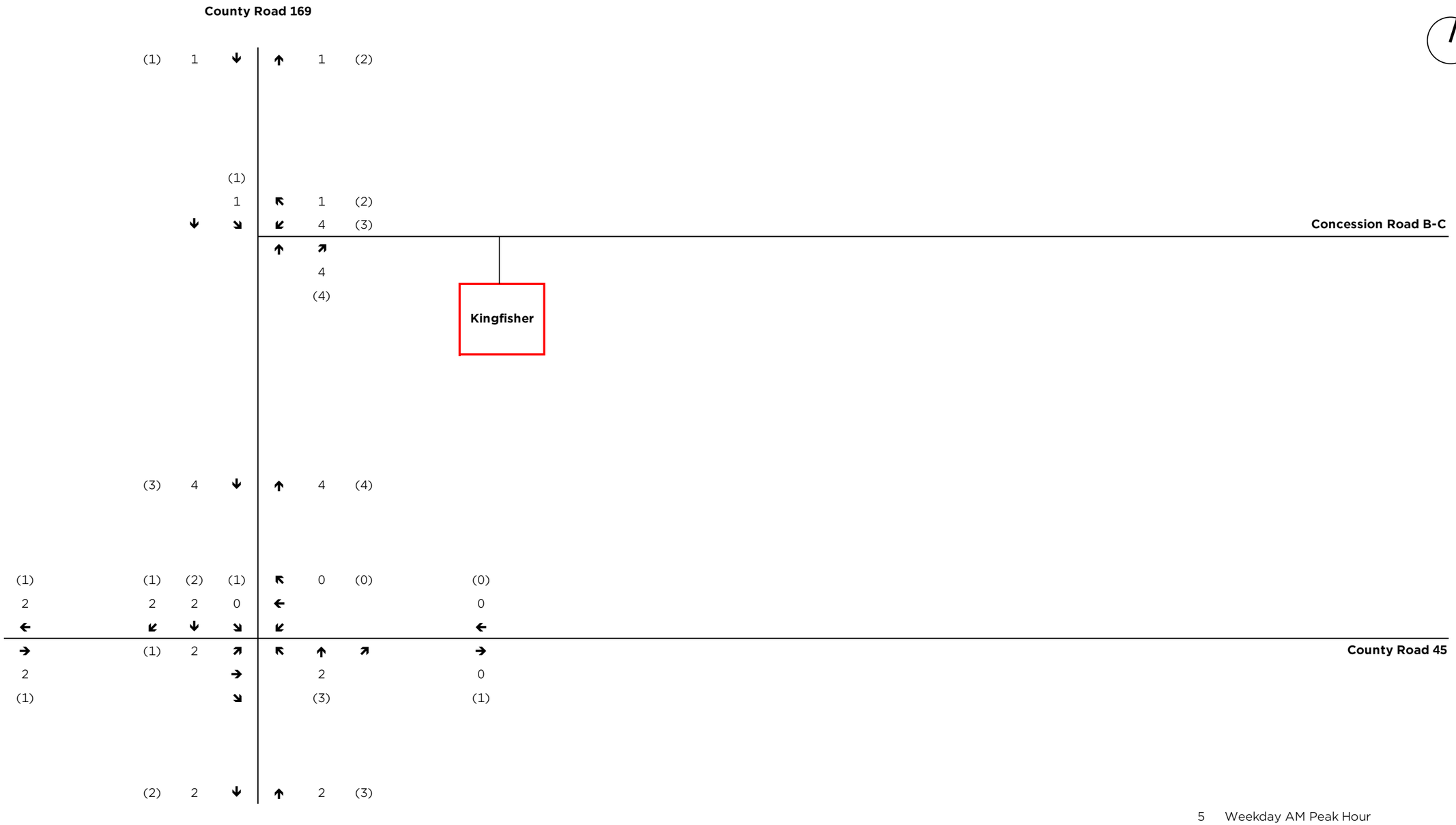
Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	23.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	173	21	2	134	19	29	216	8	30	205	28
Future Volume (vph)	33	173	21	2	134	19	29	216	8	30	205	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1630	1857		1825	1821		1825	1830	1633	1659	1732	1304
Flt Permitted	0.65	1.00		0.63	1.00		0.61	1.00	1.00	0.61	1.00	1.00
Satd. Flow (perm)	1117	1857		1202	1821		1173	1830	1633	1069	1732	1304
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	188	23	2	146	21	32	235	9	33	223	30
RTOR Reduction (vph)	0	13	0	0	15	0	0	0	4	0	1	12
Lane Group Flow (vph)	36	198	0	2	152	0	32	235	5	33	225	15
Heavy Vehicles (%)	12%	2%	0%	0%	4%	0%	0%	5%	0%	10%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	7.9	7.9		7.9	7.9		21.0	21.0	21.0	21.0	21.0	21.0
Effective Green, g (s)	7.9	7.9		7.9	7.9		21.0	21.0	21.0	21.0	21.0	21.0
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.55	0.55	0.55	0.55	0.55	0.55
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	232	387		250	379		649	1013	904	592	959	722
v/s Ratio Prot		c0.11			0.08			0.13			c0.13	
v/s Ratio Perm	0.03			0.00			0.03		0.00	0.03		0.01
v/c Ratio	0.16	0.51		0.01	0.40		0.05	0.23	0.01	0.06	0.23	0.02
Uniform Delay, d1	12.3	13.3		11.9	13.0		3.9	4.3	3.8	3.9	4.3	3.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	1.1		0.0	0.7		0.1	0.5	0.0	0.2	0.6	0.1
Delay (s)	12.6	14.4		11.9	13.7		4.0	4.9	3.8	4.1	4.9	3.9
Level of Service	B	B		B	B		A	A	A	A	A	A
Approach Delay (s)		14.2			13.6			4.7			4.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	37.9	Sum of lost time (s)	9.0
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Appendix D:
Background Developments

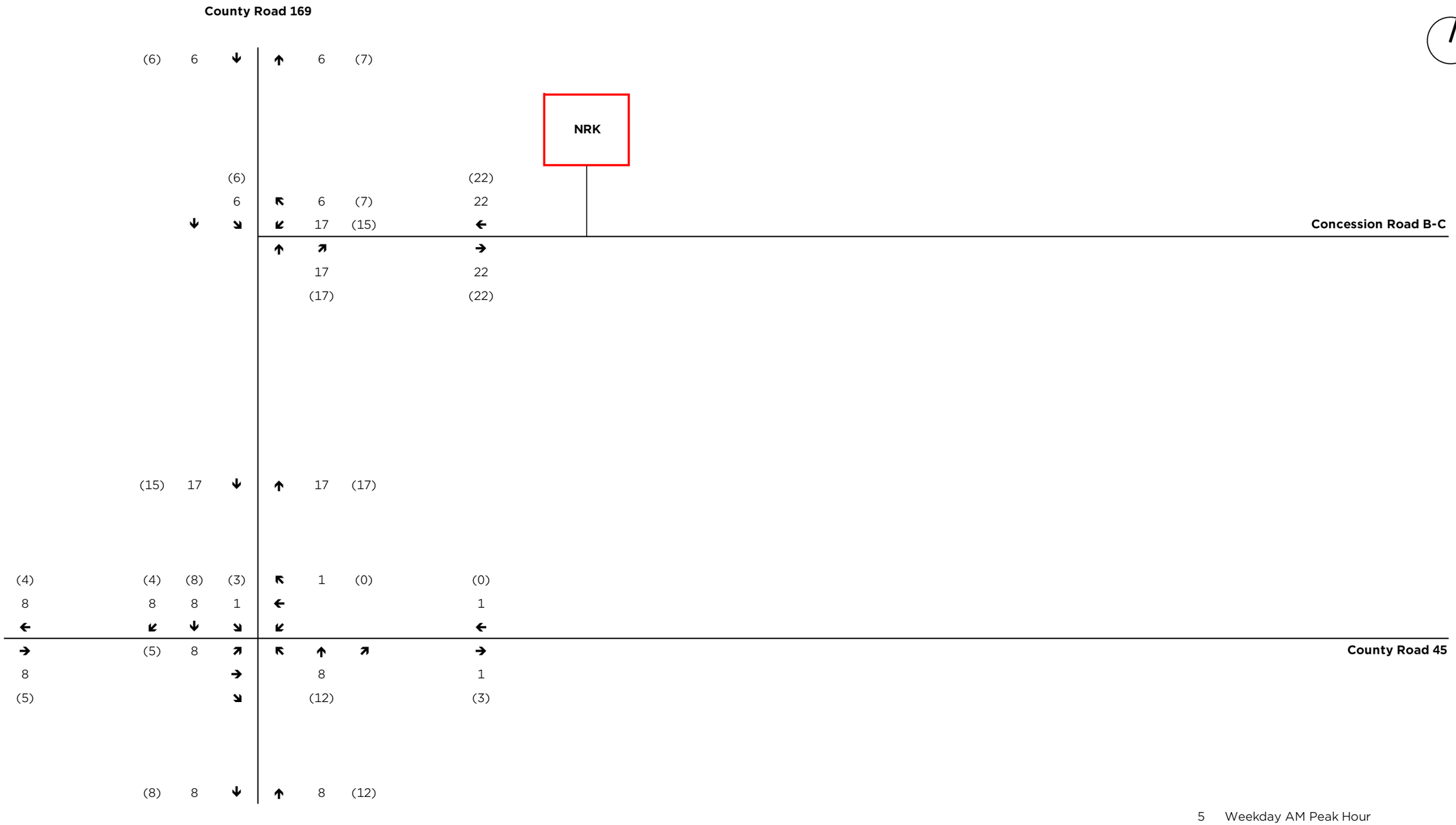


5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure : Background Development – Kingfisher Traffic Volumes

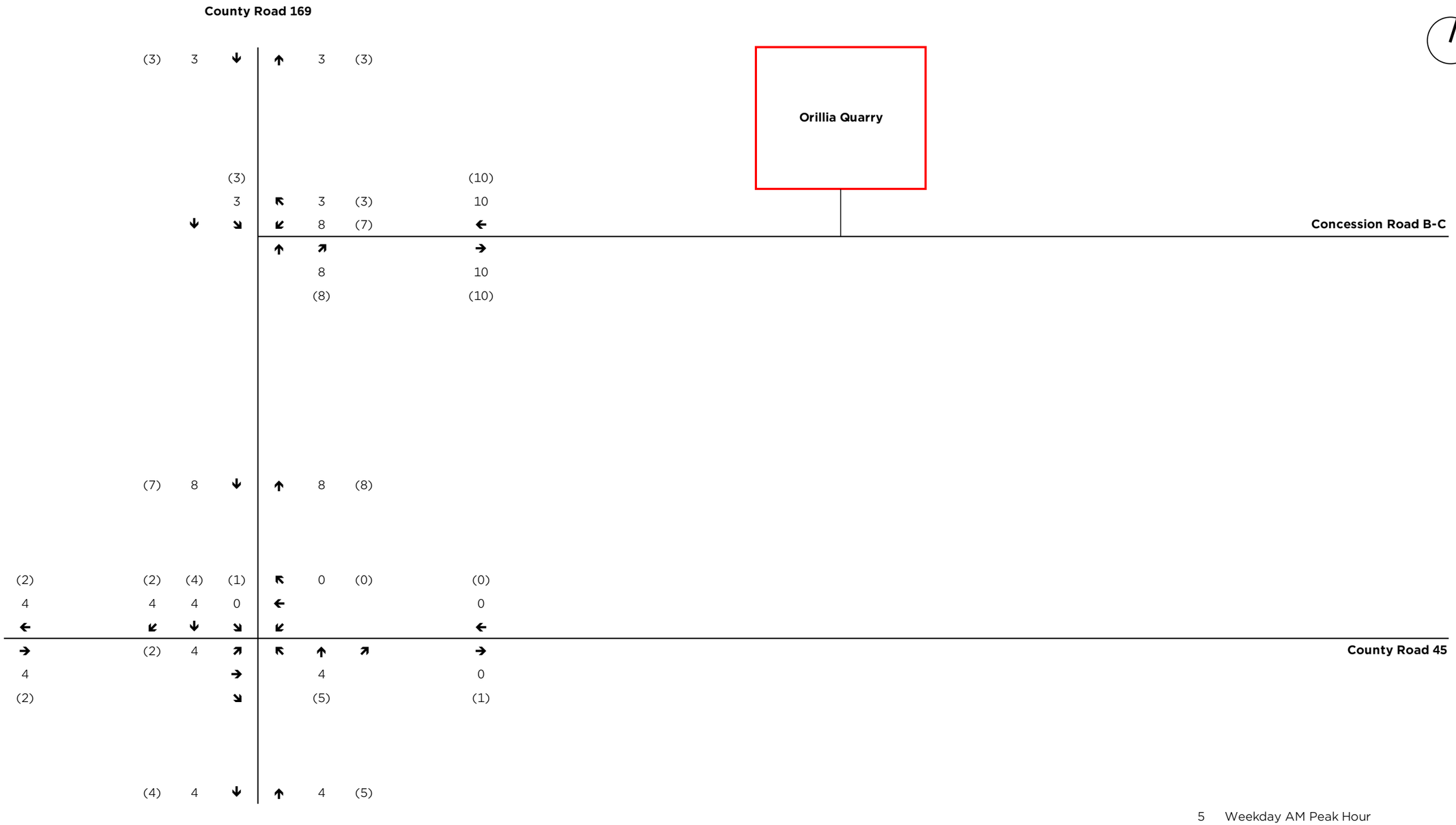


5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure : Background Development – NRK Traffic Volumes



5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure : Background Development – Orillia Traffic Volumes

5 Weekday AM Peak Hour

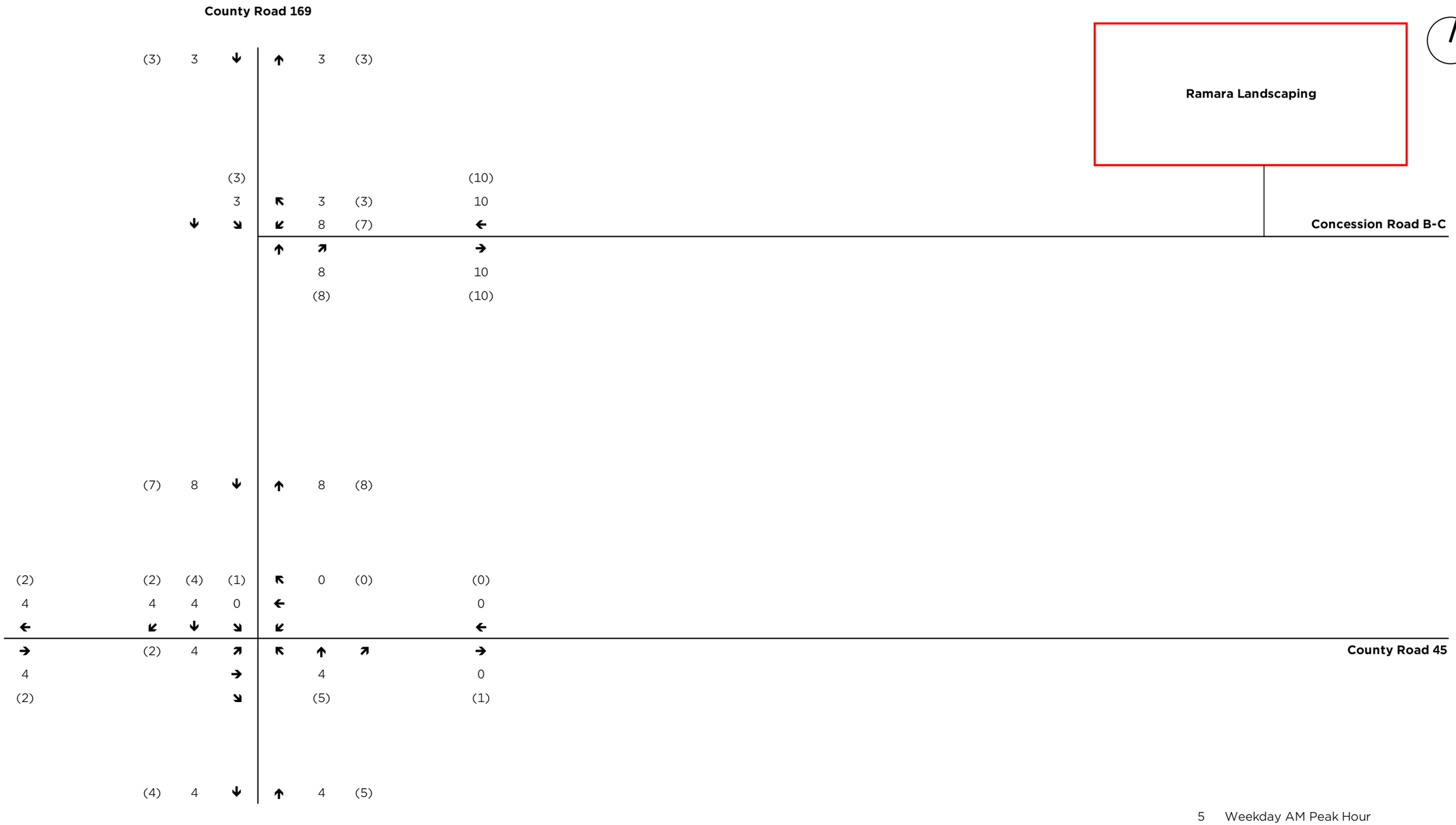
(5) Weekday PM Peak Hour

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure : Background Development – Rama Limestone Traffic Volumes

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

Figure : Background Development – Bott Aggregates Traffic Volumes



5 Weekday AM Peak Hour

(5) Weekday PM Peak Hour

RAMARA QUARRY – TRANSPORTATION IMPACT STUDY

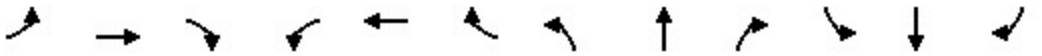
Figure : Background Development – Ramara Landscaping Traffic Volumes

Appendix E:
Future Background Conditions

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	68	23	258	68	22	141
Future Volume (Veh/h)	68	23	258	68	22	141
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	74	25	280	74	24	153
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	481	280			354	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	481	280			354	
tC, single (s)	7.2	7.0			5.1	
tC, 2 stage (s)						
tF (s)	4.2	4.0			3.1	
p0 queue free %	82	96			97	
cM capacity (veh/h)	410	600			816	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	99	280	74	24	153
Volume Left	74	0	0	24	0
Volume Right	25	0	74	0	0
cSH	446	1700	1700	816	1700
Volume to Capacity	0.22	0.16	0.04	0.03	0.09
Queue Length 95th (m)	6.4	0.0	0.0	0.7	0.0
Control Delay (s/veh)	15.4	0.0	0.0	9.5	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	15.4	0.0		1.3	
Approach LOS	C				

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		



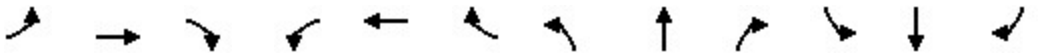
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	56	104	8	1	114	20	9	251	5	11	147	49
Future Volume (vph)	56	104	8	1	114	20	9	251	5	11	147	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1120	1814		913	1782		1615	1746	1306	1615	1619	1021
Flt Permitted	0.66	1.00		0.68	1.00		0.65	1.00	1.00	0.59	1.00	1.00
Satd. Flow (perm)	783	1814		652	1782		1101	1746	1306	1006	1619	1021
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	61	113	9	1	124	22	10	273	5	12	160	53
RTOR Reduction (vph)	0	5	0	0	13	0	0	0	4	0	3	34
Lane Group Flow (vph)	61	117	0	1	133	0	10	273	1	12	162	14
Heavy Vehicles (%)	63%	4%	14%	100%	4%	13%	13%	10%	25%	13%	11%	52%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	11.2	11.2		11.2	11.2		8.2	8.2	8.2	8.2	8.2	8.2
Effective Green, g (s)	11.2	11.2		11.2	11.2		8.2	8.2	8.2	8.2	8.2	8.2
Actuated g/C Ratio	0.39	0.39		0.39	0.39		0.29	0.29	0.29	0.29	0.29	0.29
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	308	715		257	702		317	504	377	290	467	294
v/s Ratio Prot		0.06			0.07			c0.16			0.10	
v/s Ratio Perm	c0.08			0.00			0.01		0.00	0.01		0.01
v/c Ratio	0.20	0.16		0.00	0.19		0.03	0.54	0.00	0.04	0.35	0.05
Uniform Delay, d1	5.6	5.6		5.2	5.6		7.2	8.5	7.2	7.3	8.0	7.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1		0.0	0.1		0.0	1.2	0.0	0.1	0.5	0.1
Delay (s)	6.0	5.7		5.2	5.8		7.3	9.7	7.2	7.3	8.4	7.3
Level of Service	A	A		A	A		A	A	A	A	A	A
Approach Delay (s/veh)		5.8			5.8			9.6			8.1	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	28.4	Sum of lost time (s)	9.0
Intersection Capacity Utilization	35.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	71	32	264	67	24	284
Future Volume (Veh/h)	71	32	264	67	24	284
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	77	35	287	73	26	309
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	648	287			360	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	648	287			360	
tC, single (s)	6.8	6.6			4.6	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.7	
p0 queue free %	79	95			97	
cM capacity (veh/h)	364	662			976	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	112	287	73	26	309
Volume Left	77	0	0	26	0
Volume Right	35	0	73	0	0
cSH	424	1700	1700	976	1700
Volume to Capacity	0.26	0.17	0.04	0.03	0.18
Queue Length 95th (m)	8.0	0.0	0.0	0.6	0.0
Control Delay (s/veh)	16.5	0.0	0.0	8.8	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	16.5	0.0		0.7	
Approach LOS	C				

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	32.5%	ICU Level of Service	A
Analysis Period (min)	15		



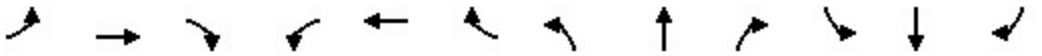
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	189	23	2	146	20	32	278	9	41	251	45
Future Volume (vph)	54	189	23	2	146	20	32	278	9	41	251	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1630	1857		1825	1822		1825	1830	1633	1659	1729	1304
Flt Permitted	0.64	1.00		0.62	1.00		0.58	1.00	1.00	0.58	1.00	1.00
Satd. Flow (perm)	1103	1857		1182	1822		1116	1830	1633	1006	1729	1304
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	205	25	2	159	22	35	302	10	45	273	49
RTOR Reduction (vph)	0	13	0	0	14	0	0	0	5	0	1	16
Lane Group Flow (vph)	59	217	0	2	167	0	35	302	5	45	277	28
Heavy Vehicles (%)	12%	2%	0%	0%	4%	0%	0%	5%	0%	10%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	8.4	8.4		8.4	8.4		21.1	21.1	21.1	21.1	21.1	21.1
Effective Green, g (s)	8.4	8.4		8.4	8.4		21.1	21.1	21.1	21.1	21.1	21.1
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.55	0.55	0.55	0.55	0.55	0.55
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	240	405		257	397		611	1002	894	551	947	714
v/s Ratio Prot		c0.12			0.09			c0.17			0.16	
v/s Ratio Perm	0.05			0.00			0.03		0.00	0.04		0.02
v/c Ratio	0.25	0.54		0.01	0.42		0.06	0.30	0.01	0.08	0.29	0.04
Uniform Delay, d1	12.4	13.3		11.8	13.0		4.1	4.7	3.9	4.1	4.7	4.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.4		0.0	0.7		0.2	0.8	0.0	0.3	0.8	0.1
Delay (s)	13.0	14.7		11.8	13.7		4.2	5.5	4.0	4.4	5.5	4.1
Level of Service	B	B		B	B		A	A	A	A	A	A
Approach Delay (s/veh)		14.3			13.7			5.3			5.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	38.5	Sum of lost time (s)	9.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	68	23	299	68	22	163
Future Volume (Veh/h)	68	23	299	68	22	163
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	74	25	325	74	24	177
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	550	325			399	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	550	325			399	
tC, single (s)	7.2	7.0			5.1	
tC, 2 stage (s)						
tF (s)	4.2	4.0			3.1	
p0 queue free %	80	96			97	
cM capacity (veh/h)	370	563			780	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	99	325	74	24	177
Volume Left	74	0	0	24	0
Volume Right	25	0	74	0	0
cSH	405	1700	1700	780	1700
Volume to Capacity	0.24	0.19	0.04	0.03	0.10
Queue Length 95th (m)	7.2	0.0	0.0	0.7	0.0
Control Delay (s/veh)	16.7	0.0	0.0	9.8	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	16.7	0.0		1.2	
Approach LOS	C				

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		



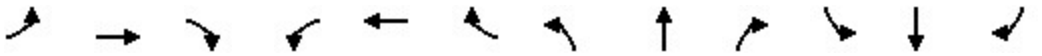
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	120	9	1	132	23	10	286	5	12	165	52
Future Volume (vph)	60	120	9	1	132	23	10	286	5	12	165	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1120	1815		913	1783		1615	1746	1306	1615	1617	1021
Flt Permitted	0.65	1.00		0.67	1.00		0.64	1.00	1.00	0.57	1.00	1.00
Satd. Flow (perm)	767	1815		641	1783		1080	1746	1306	971	1617	1021
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	130	10	1	143	25	11	311	5	13	179	57
RTOR Reduction (vph)	0	7	0	0	15	0	0	0	3	0	3	33
Lane Group Flow (vph)	65	133	0	1	153	0	11	311	2	13	182	18
Heavy Vehicles (%)	63%	4%	14%	100%	4%	13%	13%	10%	25%	13%	11%	52%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	9.6	9.6		9.6	9.6		10.5	10.5	10.5	10.5	10.5	10.5
Effective Green, g (s)	9.6	9.6		9.6	9.6		10.5	10.5	10.5	10.5	10.5	10.5
Actuated g/C Ratio	0.33	0.33		0.33	0.33		0.36	0.36	0.36	0.36	0.36	0.36
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	253	598		211	588		389	630	471	350	583	368
v/s Ratio Prot		0.07			c0.09			c0.18			0.11	
v/s Ratio Perm	0.08			0.00			0.01		0.00	0.01		0.02
v/c Ratio	0.26	0.22		0.00	0.26		0.03	0.49	0.00	0.04	0.31	0.05
Uniform Delay, d1	7.1	7.1		6.5	7.1		6.0	7.2	6.0	6.0	6.7	6.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.2		0.0	0.2		0.0	0.6	0.0	0.0	0.3	0.1
Delay (s)	7.7	7.2		6.6	7.4		6.0	7.8	6.0	6.1	7.0	6.1
Level of Service	A	A		A	A		A	A	A	A	A	A
Approach Delay (s/veh)		7.4			7.4			7.8			6.8	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	29.1	Sum of lost time (s)	9.0
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	71	32	307	67	24	329
Future Volume (Veh/h)	71	32	307	67	24	329
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	77	35	334	73	26	358
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	744	334			407	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	744	334			407	
tC, single (s)	6.8	6.6			4.6	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.7	
p0 queue free %	76	94			97	
cM capacity (veh/h)	317	621			935	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	112	334	73	26	358
Volume Left	77	0	0	26	0
Volume Right	35	0	73	0	0
cSH	374	1700	1700	935	1700
Volume to Capacity	0.30	0.20	0.04	0.03	0.21
Queue Length 95th (m)	9.4	0.0	0.0	0.7	0.0
Control Delay (s/veh)	18.7	0.0	0.0	9.0	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	18.7	0.0		0.6	
Approach LOS	C				

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	32.5%	ICU Level of Service	A
Analysis Period (min)	15		



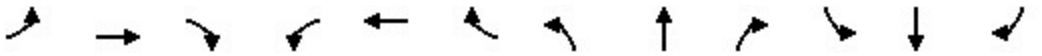
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	219	26	3	170	23	37	315	10	46	285	49
Future Volume (vph)	59	219	26	3	170	23	37	315	10	46	285	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1630	1858		1825	1823		1825	1830	1633	1659	1730	1304
Flt Permitted	0.63	1.00		0.55	1.00		0.56	1.00	1.00	0.56	1.00	1.00
Satd. Flow (perm)	1075	1858		1062	1823		1077	1830	1633	970	1730	1304
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	64	238	28	3	185	25	40	342	11	50	310	53
RTOR Reduction (vph)	0	12	0	0	14	0	0	0	5	0	1	17
Lane Group Flow (vph)	64	254	0	3	196	0	40	342	6	50	314	31
Heavy Vehicles (%)	12%	2%	0%	0%	4%	0%	0%	5%	0%	10%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	8.9	8.9		8.9	8.9		20.6	20.6	20.6	20.6	20.6	20.6
Effective Green, g (s)	8.9	8.9		8.9	8.9		20.6	20.6	20.6	20.6	20.6	20.6
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.54	0.54	0.54	0.54	0.54	0.54
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	248	429		245	421		576	979	873	519	925	697
v/s Ratio Prot		c0.14			0.11			c0.19			0.18	
v/s Ratio Perm	0.06			0.00			0.04		0.00	0.05		0.02
v/c Ratio	0.26	0.59		0.01	0.47		0.07	0.35	0.01	0.10	0.34	0.04
Uniform Delay, d1	12.1	13.2		11.4	12.8		4.3	5.1	4.2	4.4	5.1	4.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	2.2		0.0	0.8		0.2	1.0	0.0	0.4	1.0	0.1
Delay (s)	12.7	15.4		11.4	13.6		4.6	6.1	4.2	4.8	6.1	4.4
Level of Service	B	B		B	B		A	A	A	A	A	A
Approach Delay (s/veh)		14.8			13.5			5.9			5.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	38.5	Sum of lost time (s)	9.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	68	23	346	68	22	189
Future Volume (Veh/h)	68	23	346	68	22	189
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	74	25	376	74	24	205
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	629	376			450	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	629	376			450	
tC, single (s)	7.2	7.0			5.1	
tC, 2 stage (s)						
tF (s)	4.2	4.0			3.1	
p0 queue free %	77	95			97	
cM capacity (veh/h)	328	523			740	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	99	376	74	24	205
Volume Left	74	0	0	24	0
Volume Right	25	0	74	0	0
cSH	363	1700	1700	740	1700
Volume to Capacity	0.27	0.22	0.04	0.03	0.12
Queue Length 95th (m)	8.3	0.0	0.0	0.8	0.0
Control Delay (s/veh)	18.6	0.0	0.0	10.0	0.0
Lane LOS	C			B	
Approach Delay (s/veh)	18.6	0.0		1.1	
Approach LOS	C				

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	64	139	11	2	153	26	12	326	6	14	187	55
Future Volume (vph)	64	139	11	2	153	26	12	326	6	14	187	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1120	1814		913	1785		1615	1746	1306	1615	1620	1021
Flt Permitted	0.64	1.00		0.65	1.00		0.62	1.00	1.00	0.55	1.00	1.00
Satd. Flow (perm)	749	1814		628	1785		1055	1746	1306	933	1620	1021
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	151	12	2	166	28	13	354	7	15	203	60
RTOR Reduction (vph)	0	8	0	0	15	0	0	0	4	0	2	33
Lane Group Flow (vph)	70	155	0	2	179	0	13	354	3	15	207	21
Heavy Vehicles (%)	63%	4%	14%	100%	4%	13%	13%	10%	25%	13%	11%	52%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	9.4	9.4		9.4	9.4		11.4	11.4	11.4	11.4	11.4	11.4
Effective Green, g (s)	9.4	9.4		9.4	9.4		11.4	11.4	11.4	11.4	11.4	11.4
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.38	0.38	0.38	0.38	0.38	0.38
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	236	572		198	563		403	667	499	356	619	390
v/s Ratio Prot		0.09			c0.10			c0.20			0.13	
v/s Ratio Perm	0.09			0.00			0.01		0.00	0.02		0.02
v/c Ratio	0.30	0.27		0.01	0.32		0.03	0.53	0.01	0.04	0.33	0.05
Uniform Delay, d1	7.7	7.6		7.0	7.8		5.8	7.1	5.7	5.8	6.5	5.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.3		0.0	0.3		0.0	0.8	0.0	0.0	0.3	0.1
Delay (s)	8.4	7.9		7.0	8.1		5.8	7.9	5.7	5.8	6.8	5.9
Level of Service	A	A		A	A		A	A	A	A	A	A
Approach Delay (s/veh)		8.0			8.1			7.8			6.6	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	29.8	Sum of lost time (s)	9.0
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	71	32	355	67	24	381
Future Volume (Veh/h)	71	32	355	67	24	381
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	77	35	386	73	26	414
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	852	386			459	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	852	386			459	
tC, single (s)	6.8	6.6			4.6	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.7	
p0 queue free %	72	94			97	
cM capacity (veh/h)	271	579			891	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	112	386	73	26	414
Volume Left	77	0	0	26	0
Volume Right	35	0	73	0	0
cSH	325	1700	1700	891	1700
Volume to Capacity	0.34	0.23	0.04	0.03	0.24
Queue Length 95th (m)	11.3	0.0	0.0	0.7	0.0
Control Delay (s/veh)	21.8	0.0	0.0	9.2	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	21.8	0.0		0.5	
Approach LOS	C				

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	32.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	254	30	3	197	27	42	358	12	52	326	55
Future Volume (vph)	66	254	30	3	197	27	42	358	12	52	326	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1630	1857		1825	1823		1825	1830	1633	1659	1730	1304
Flt Permitted	0.61	1.00		0.51	1.00		0.51	1.00	1.00	0.50	1.00	1.00
Satd. Flow (perm)	1043	1857		987	1823		980	1830	1633	873	1730	1304
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	276	33	3	214	29	46	389	13	57	354	60
RTOR Reduction (vph)	0	11	0	0	13	0	0	0	7	0	1	19
Lane Group Flow (vph)	72	298	0	3	230	0	46	389	6	57	359	35
Heavy Vehicles (%)	12%	2%	0%	0%	4%	0%	0%	5%	0%	10%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	11.3	11.3		11.3	11.3		18.3	18.3	18.3	18.3	18.3	18.3
Effective Green, g (s)	11.3	11.3		11.3	11.3		18.3	18.3	18.3	18.3	18.3	18.3
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.47	0.47	0.47	0.47	0.47	0.47
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	305	543		288	533		464	867	774	413	820	618
v/s Ratio Prot		c0.16			0.13			c0.21			0.21	
v/s Ratio Perm	0.07			0.00			0.05		0.00	0.07		0.03
v/c Ratio	0.24	0.55		0.01	0.43		0.10	0.45	0.01	0.14	0.44	0.06
Uniform Delay, d1	10.4	11.5		9.7	11.1		5.6	6.8	5.4	5.7	6.7	5.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	1.1		0.0	0.6		0.4	1.7	0.0	0.7	1.7	0.2
Delay (s)	10.8	12.6		9.7	11.6		6.0	8.5	5.4	6.4	8.4	5.7
Level of Service	B	B		A	B		A	A	A	A	A	A
Approach Delay (s/veh)		12.3			11.6			8.1			7.9	
Approach LOS		B			B			A			A	

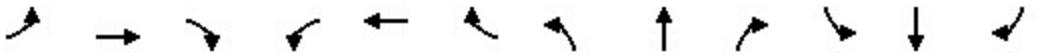
Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	38.6	Sum of lost time (s)	9.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Appendix F:
Future Total Conditions

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	75	25	258	75	24	141
Future Volume (Veh/h)	75	25	258	75	24	141
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	27	280	82	26	153
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	485	280			362	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	485	280			362	
tC, single (s)	7.2	7.0			5.1	
tC, 2 stage (s)						
tF (s)	4.2	4.0			3.1	
p0 queue free %	80	96			97	
cM capacity (veh/h)	407	600			809	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	109	280	82	26	153
Volume Left	82	0	0	26	0
Volume Right	27	0	82	0	0
cSH	442	1700	1700	809	1700
Volume to Capacity	0.25	0.16	0.05	0.03	0.09
Queue Length 95th (m)	7.3	0.0	0.0	0.8	0.0
Control Delay (s/veh)	15.8	0.0	0.0	9.6	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	15.8	0.0		1.4	
Approach LOS	C				

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		



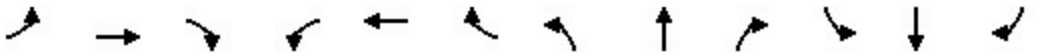
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	63	104	8	1	114	20	9	251	5	11	147	56
Future Volume (vph)	63	104	8	1	114	20	9	251	5	11	147	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	0.99	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1120	1814		913	1782		1615	1746	1306	1615	1614	1021
Flt Permitted	0.66	1.00		0.68	1.00		0.65	1.00	1.00	0.59	1.00	1.00
Satd. Flow (perm)	783	1814		652	1782		1100	1746	1306	1006	1614	1021
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	68	113	9	1	124	22	10	273	5	12	160	61
RTOR Reduction (vph)	0	5	0	0	13	0	0	0	4	0	4	39
Lane Group Flow (vph)	68	117	0	1	133	0	10	273	1	12	162	16
Heavy Vehicles (%)	63%	4%	14%	100%	4%	13%	13%	10%	25%	13%	11%	52%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	11.6	11.6		11.6	11.6		8.3	8.3	8.3	8.3	8.3	8.3
Effective Green, g (s)	11.6	11.6		11.6	11.6		8.3	8.3	8.3	8.3	8.3	8.3
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.29	0.29	0.29	0.29	0.29	0.29
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	314	728		261	715		315	501	375	288	463	293
v/s Ratio Prot		0.06			0.07			c0.16			0.10	
v/s Ratio Perm	c0.09			0.00			0.01		0.00	0.01		0.02
v/c Ratio	0.22	0.16		0.00	0.19		0.03	0.54	0.00	0.04	0.35	0.05
Uniform Delay, d1	5.7	5.5		5.2	5.6		7.4	8.7	7.3	7.4	8.2	7.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.1		0.0	0.1		0.0	1.2	0.0	0.1	0.5	0.1
Delay (s)	6.0	5.6		5.2	5.7		7.5	9.9	7.4	7.5	8.6	7.5
Level of Service	A	A		A	A		A	A	A	A	A	A
Approach Delay (s/veh)		5.8			5.7			9.8			8.3	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	28.9	Sum of lost time (s)	9.0
Intersection Capacity Utilization	35.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	78	34	264	74	26	284
Future Volume (Veh/h)	78	34	264	74	26	284
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	85	37	287	80	28	309
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	652	287			367	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	652	287			367	
tC, single (s)	6.8	6.6			4.6	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.7	
p0 queue free %	76	94			97	
cM capacity (veh/h)	361	662			970	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	122	287	80	28	309
Volume Left	85	0	0	28	0
Volume Right	37	0	80	0	0
cSH	419	1700	1700	970	1700
Volume to Capacity	0.29	0.17	0.05	0.03	0.18
Queue Length 95th (m)	9.1	0.0	0.0	0.7	0.0
Control Delay (s/veh)	17.1	0.0	0.0	8.8	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	17.1	0.0		0.7	
Approach LOS	C				

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		



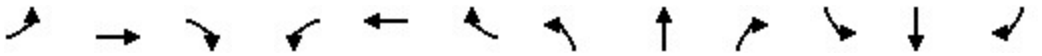
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	189	23	2	146	20	32	278	9	41	251	52
Future Volume (vph)	61	189	23	2	146	20	32	278	9	41	251	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1630	1857		1825	1822		1825	1830	1633	1659	1728	1304
Flt Permitted	0.64	1.00		0.62	1.00		0.58	1.00	1.00	0.58	1.00	1.00
Satd. Flow (perm)	1103	1857		1182	1822		1115	1830	1633	1006	1728	1304
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	66	205	25	2	159	22	35	302	10	45	273	57
RTOR Reduction (vph)	0	13	0	0	14	0	0	0	5	0	1	19
Lane Group Flow (vph)	66	217	0	2	167	0	35	302	5	45	278	32
Heavy Vehicles (%)	12%	2%	0%	0%	4%	0%	0%	5%	0%	10%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	8.4	8.4		8.4	8.4		21.1	21.1	21.1	21.1	21.1	21.1
Effective Green, g (s)	8.4	8.4		8.4	8.4		21.1	21.1	21.1	21.1	21.1	21.1
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.55	0.55	0.55	0.55	0.55	0.55
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	240	405		257	397		611	1002	894	551	947	714
v/s Ratio Prot		c0.12			0.09			c0.17			0.16	
v/s Ratio Perm	0.06			0.00			0.03		0.00	0.04		0.02
v/c Ratio	0.28	0.54		0.01	0.42		0.06	0.30	0.01	0.08	0.29	0.05
Uniform Delay, d1	12.5	13.3		11.8	13.0		4.1	4.7	3.9	4.1	4.7	4.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	1.4		0.0	0.7		0.2	0.8	0.0	0.3	0.8	0.1
Delay (s)	13.1	14.7		11.8	13.7		4.2	5.5	4.0	4.4	5.5	4.2
Level of Service	B	B		B	B		A	A	A	A	A	A
Approach Delay (s/veh)		14.4			13.7			5.3			5.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	38.5	Sum of lost time (s)	9.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	75	25	299	75	24	163
Future Volume (Veh/h)	75	25	299	75	24	163
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	27	325	82	26	177
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	554	325			407	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	554	325			407	
tC, single (s)	7.2	7.0			5.1	
tC, 2 stage (s)						
tF (s)	4.2	4.0			3.1	
p0 queue free %	78	95			97	
cM capacity (veh/h)	367	563			773	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	109	325	82	26	177
Volume Left	82	0	0	26	0
Volume Right	27	0	82	0	0
cSH	401	1700	1700	773	1700
Volume to Capacity	0.27	0.19	0.05	0.03	0.10
Queue Length 95th (m)	8.3	0.0	0.0	0.8	0.0
Control Delay (s/veh)	17.3	0.0	0.0	9.8	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	17.3	0.0		1.3	
Approach LOS	C				

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		



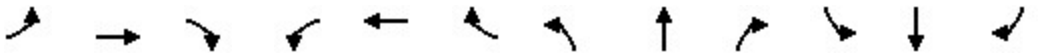
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	120	9	1	132	23	10	286	5	12	165	59
Future Volume (vph)	67	120	9	1	132	23	10	286	5	12	165	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1120	1815		913	1783		1615	1746	1306	1615	1617	1021
Flt Permitted	0.65	1.00		0.67	1.00		0.64	1.00	1.00	0.57	1.00	1.00
Satd. Flow (perm)	767	1815		641	1783		1080	1746	1306	971	1617	1021
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	130	10	1	143	25	11	311	5	13	179	64
RTOR Reduction (vph)	0	7	0	0	15	0	0	0	3	0	3	37
Lane Group Flow (vph)	73	133	0	1	153	0	11	311	2	13	182	21
Heavy Vehicles (%)	63%	4%	14%	100%	4%	13%	13%	10%	25%	13%	11%	52%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	9.8	9.8		9.8	9.8		10.5	10.5	10.5	10.5	10.5	10.5
Effective Green, g (s)	9.8	9.8		9.8	9.8		10.5	10.5	10.5	10.5	10.5	10.5
Actuated g/C Ratio	0.33	0.33		0.33	0.33		0.36	0.36	0.36	0.36	0.36	0.36
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	607		214	596		387	625	468	347	579	365
v/s Ratio Prot		0.07			0.09			c0.18			0.11	
v/s Ratio Perm	c0.10			0.00			0.01		0.00	0.01		0.02
v/c Ratio	0.29	0.22		0.00	0.26		0.03	0.50	0.00	0.04	0.32	0.06
Uniform Delay, d1	7.2	7.0		6.5	7.1		6.1	7.3	6.0	6.1	6.8	6.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.2		0.0	0.2		0.0	0.6	0.0	0.0	0.3	0.1
Delay (s)	7.8	7.2		6.5	7.3		6.1	8.0	6.0	6.2	7.1	6.2
Level of Service	A	A		A	A		A	A	A	A	A	A
Approach Delay (s/veh)		7.4			7.3			7.9			6.9	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	29.3	Sum of lost time (s)	9.0
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	78	34	307	74	26	329
Future Volume (Veh/h)	78	34	307	74	26	329
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	85	37	334	80	28	358
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	748	334			414	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	748	334			414	
tC, single (s)	6.8	6.6			4.6	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.7	
p0 queue free %	73	94			97	
cM capacity (veh/h)	314	621			929	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	122	334	80	28	358
Volume Left	85	0	0	28	0
Volume Right	37	0	80	0	0
cSH	370	1700	1700	929	1700
Volume to Capacity	0.33	0.20	0.05	0.03	0.21
Queue Length 95th (m)	10.7	0.0	0.0	0.7	0.0
Control Delay (s/veh)	19.4	0.0	0.0	9.0	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	19.4	0.0		0.7	
Approach LOS	C				

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		



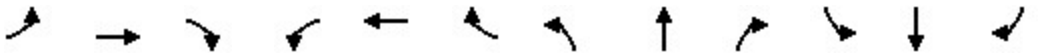
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	219	26	3	170	23	37	315	10	46	285	57
Future Volume (vph)	67	219	26	3	170	23	37	315	10	46	285	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1630	1858		1825	1823		1825	1830	1633	1659	1729	1304
Flt Permitted	0.63	1.00		0.55	1.00		0.56	1.00	1.00	0.56	1.00	1.00
Satd. Flow (perm)	1075	1858		1062	1823		1076	1830	1633	970	1729	1304
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	238	28	3	185	25	40	342	11	50	310	62
RTOR Reduction (vph)	0	12	0	0	14	0	0	0	5	0	1	19
Lane Group Flow (vph)	73	254	0	3	196	0	40	342	6	50	315	37
Heavy Vehicles (%)	12%	2%	0%	0%	4%	0%	0%	5%	0%	10%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	8.9	8.9		8.9	8.9		20.6	20.6	20.6	20.6	20.6	20.6
Effective Green, g (s)	8.9	8.9		8.9	8.9		20.6	20.6	20.6	20.6	20.6	20.6
Actuated g/C Ratio	0.23	0.23		0.23	0.23		0.54	0.54	0.54	0.54	0.54	0.54
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	248	429		245	421		575	979	873	519	925	697
v/s Ratio Prot		c0.14			0.11			c0.19			0.18	
v/s Ratio Perm	0.07			0.00			0.04		0.00	0.05		0.03
v/c Ratio	0.29	0.59		0.01	0.47		0.07	0.35	0.01	0.10	0.34	0.05
Uniform Delay, d1	12.2	13.2		11.4	12.8		4.3	5.1	4.2	4.4	5.1	4.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	2.2		0.0	0.8		0.2	1.0	0.0	0.4	1.0	0.1
Delay (s)	12.9	15.4		11.4	13.6		4.6	6.1	4.2	4.8	6.1	4.4
Level of Service	B	B		B	B		A	A	A	A	A	A
Approach Delay (s/veh)		14.8			13.5			5.9			5.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	38.5	Sum of lost time (s)	9.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	75	25	346	75	24	189
Future Volume (Veh/h)	75	25	346	75	24	189
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	27	376	82	26	205
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	633	376			458	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	633	376			458	
tC, single (s)	7.2	7.0			5.1	
tC, 2 stage (s)						
tF (s)	4.2	4.0			3.1	
p0 queue free %	75	95			96	
cM capacity (veh/h)	326	523			734	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	109	376	82	26	205
Volume Left	82	0	0	26	0
Volume Right	27	0	82	0	0
cSH	359	1700	1700	734	1700
Volume to Capacity	0.30	0.22	0.05	0.04	0.12
Queue Length 95th (m)	9.6	0.0	0.0	0.8	0.0
Control Delay (s/veh)	19.3	0.0	0.0	10.1	0.0
Lane LOS	C			B	
Approach Delay (s/veh)	19.3	0.0		1.1	
Approach LOS	C				

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		



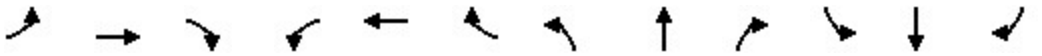
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	72	139	11	2	153	26	12	326	6	14	187	62
Future Volume (vph)	72	139	11	2	153	26	12	326	6	14	187	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1120	1814		913	1785		1615	1746	1306	1615	1616	1021
Flt Permitted	0.64	1.00		0.65	1.00		0.62	1.00	1.00	0.55	1.00	1.00
Satd. Flow (perm)	749	1814		628	1785		1054	1746	1306	929	1616	1021
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	151	12	2	166	28	13	354	7	15	203	67
RTOR Reduction (vph)	0	7	0	0	15	0	0	0	4	0	3	37
Lane Group Flow (vph)	78	156	0	2	179	0	13	354	3	15	207	23
Heavy Vehicles (%)	63%	4%	14%	100%	4%	13%	13%	10%	25%	13%	11%	52%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	9.6	9.6		9.6	9.6		11.5	11.5	11.5	11.5	11.5	11.5
Effective Green, g (s)	9.6	9.6		9.6	9.6		11.5	11.5	11.5	11.5	11.5	11.5
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.38	0.38	0.38	0.38	0.38	0.38
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	238	578		200	569		402	667	498	354	617	390
v/s Ratio Prot		0.09			0.10			c0.20			0.13	
v/s Ratio Perm	c0.10			0.00			0.01		0.00	0.02		0.02
v/c Ratio	0.33	0.27		0.01	0.31		0.03	0.53	0.01	0.04	0.34	0.06
Uniform Delay, d1	7.8	7.6		7.0	7.8		5.8	7.2	5.8	5.8	6.6	5.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.3		0.0	0.3		0.0	0.8	0.0	0.0	0.3	0.1
Delay (s)	8.6	7.9		7.0	8.1		5.9	8.0	5.8	5.9	6.9	5.9
Level of Service	A	A		A	A		A	A	A	A	A	A
Approach Delay (s/veh)		8.1			8.1			7.9			6.7	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	7.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	30.1	Sum of lost time (s)	9.0
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	78	34	355	74	26	381
Future Volume (Veh/h)	78	34	355	74	26	381
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	85	37	386	80	28	414
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	856	386			466	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	856	386			466	
tC, single (s)	6.8	6.6			4.6	
tC, 2 stage (s)						
tF (s)	3.9	3.7			2.7	
p0 queue free %	68	94			97	
cM capacity (veh/h)	269	579			885	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	122	386	80	28	414
Volume Left	85	0	0	28	0
Volume Right	37	0	80	0	0
cSH	321	1700	1700	885	1700
Volume to Capacity	0.38	0.23	0.05	0.03	0.24
Queue Length 95th (m)	13.1	0.0	0.0	0.7	0.0
Control Delay (s/veh)	22.9	0.0	0.0	9.2	0.0
Lane LOS	C			A	
Approach Delay (s/veh)	22.9	0.0		0.6	
Approach LOS	C				

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	73	254	30	3	197	27	42	358	12	52	326	62
Future Volume (vph)	73	254	30	3	197	27	42	358	12	52	326	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	0.95	0.95
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1630	1857		1825	1823		1825	1830	1633	1659	1729	1304
Flt Permitted	0.61	1.00		0.51	1.00		0.51	1.00	1.00	0.50	1.00	1.00
Satd. Flow (perm)	1043	1857		987	1823		978	1830	1633	873	1729	1304
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	276	33	3	214	29	46	389	13	57	354	67
RTOR Reduction (vph)	0	11	0	0	13	0	0	0	7	0	2	19
Lane Group Flow (vph)	79	298	0	3	230	0	46	389	6	57	359	41
Heavy Vehicles (%)	12%	2%	0%	0%	4%	0%	0%	5%	0%	10%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	11.3	11.3		11.3	11.3		18.3	18.3	18.3	18.3	18.3	18.3
Effective Green, g (s)	11.3	11.3		11.3	11.3		18.3	18.3	18.3	18.3	18.3	18.3
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.47	0.47	0.47	0.47	0.47	0.47
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	305	543		288	533		463	867	774	413	819	618
v/s Ratio Prot		c0.16			0.13			c0.21			0.21	
v/s Ratio Perm	0.08			0.00			0.05		0.00	0.07		0.03
v/c Ratio	0.26	0.55		0.01	0.43		0.10	0.45	0.01	0.14	0.44	0.07
Uniform Delay, d1	10.4	11.5		9.7	11.1		5.6	6.8	5.4	5.7	6.7	5.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.1		0.0	0.6		0.4	1.7	0.0	0.7	1.7	0.2
Delay (s)	10.9	12.6		9.7	11.6		6.0	8.5	5.4	6.4	8.4	5.7
Level of Service	B	B		A	B		A	A	A	A	A	A
Approach Delay (s/veh)		12.3			11.6			8.1			7.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay (s/veh)	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	38.6	Sum of lost time (s)	9.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Appendix G:
Project Team CVs

Experience & Expertise

- Transportation Engineering
- Municipal Engineering
- Transportation/Parking Studies
- Travel Demand Forecasting
- Route Planning
- Traffic Impact Studies
- Class Environmental Assessments
- Team Management
- Strategic Business Advice
- Expert Witness Testimony

Designations & Registrations

- Professional Engineers Ontario

Affiliations & Membership

- Institute of Transportation Engineers

Education & Training

1996 Master of Engineering (Transportation), McMaster University Hamilton, Ontario

1994 Bachelor Engineering & Management, McMaster University Hamilton, Ontario

TATHAM ENGINEERING

Michael Cullip

P.Eng.

Vice President

Department

Executive

With Tatham Engineering
22 years (2001 – 2006, 2008 - Present)

Industry Experience
31 Years

CAREER HIGHLIGHTS

Michael currently serves as Vice President at Tatham Engineering Limited, where he oversees the Bridge, Municipal, Transportation and Water & Wastewater Engineering departments. In addition to his operational leadership, he chairs the Tatham Quality Committee, guiding the development and implementation of the firm's corporate quality assurance program.

Prior to joining Tatham, Michael held the position of Manager of Transportation Planning at Cansult Maunsell (AECOM), where he was responsible for all transportation projects across the Gulf Region. He also served as General Manager of Cansult Tatham Transportation Consultants, a joint venture focused on comprehensive transportation engineering and planning services. In this role, he successfully established and grew a transportation department in a new and emerging market.

Throughout his career, Michael has led multidisciplinary teams of engineering professionals and engaged in extensive consultation and negotiation with a wide range of stakeholders. He has consistently delivered complex transportation programs and projects, while also providing strategic and business advisory services to governments, infrastructure providers, operators, and private developers. More specifically, this experience includes transportation studies, travel demand forecasting, route planning, public transport studies, parking studies, traffic impact assessments, access and circulation reviews and class environmental assessments.

PROJECT EXPERIENCE

Transportation Studies & Master Plans

Comprehensive Transportation Strategic Plan — **Town of the Blue Mountains**

In conjunction with AECOM, prepared a transportation strategic plan for the Town of The Blue Mountains, to review their existing transportation system and provide recommendations to meet future travel demands. The study also included a detailed review of traffic operations in several key areas, the development of an access management plan for Highway 26 with the Town and input to the Town's Development Charge study for applicable improvements.

Orillia West Transportation Study — **Orillia**

A comprehensive transportation study was undertaken to address the growing development pressures and corresponding travel demand within the Orillia West Planning Area. The study evaluated a range of transportation infrastructure, including local roads, County Road 11 (Old Barrie Road), and Provincial Highways 11 and 12, and their respective intersections. Serving as a foundational document, the study has guided all subsequent development in the area - residential, commercial, industrial, and institutional. A recent update was completed to reflect current development levels and to incorporate changes to the road network that now serves the area.

Road Network Plan — **Oro-Medonte**

Completed a *Road Network Plan* review, the key components and requirements of which included road system and operations review, travel speed and speed limit review, and road needs study to identify physical road conditions and infrastructure needs.

Simcoe Road 90 Transportation Needs Study **Simcoe**

This Transportation Needs Study defined the long-term needs of County Road 90 from the City of Barrie to Angus (13 km). Responsible for traffic data collection, development of future traffic estimates, and identification of future road and intersection improvements and associated costs.

Speed Limit Review **Oro-Medonte**

Study established and documented guidelines and criteria to review road sections with the Township and determine the appropriateness of the existing speed limit, as well as the need for additional measures. Following a review of select road sections, on which speeding was considered prevalent, recommendations for improvements were provided. Consideration was given to road geometry and alignment, adjacent development, other road users and increased enforcement.

Transportation Master Plan **Grey County**

In partnership with Cole Engineering, completed the Grey County Transportation Master Plan. The study involved a comprehensive review of the County's transportation network, identifying needs and opportunities to support existing and future growth. Tatham was directly responsible for inventorying the existing transportation system, rationalization of the County's road and bridge network, establishing the framework for a potential connecting link program for the County and its municipalities and developing a County-wide transit strategy, goods movement strategy and rail trail protection policy.

Transportation Master Plan **Midland**

To assist the Town with the future planning and development of their road system, this study reviewed the existing network and operations, and identified road system improvements necessary to accommodate future travel demands. Traffic projections, based on historic growth and considering new development, were prepared for a 20-year planning horizon.

Transportation Master Plan **York Region**

Assisted in the development of a Transportation Master Plan for York Region. Key areas of involvement included development of background policy papers addressing travel demand management, air quality and goods movement; identification of key issues and strategic options for the transportation system.

Transportation Study **Collingwood**

Study reviewed the Town's road system network and operations, and outlined existing, medium and long-term recommendations including improvements to the road network and identification of potential new arterial routes to ensure future travel demands can be adequately accommodated. While several modes of travel are available within the Town, the primary focus was on addressing vehicular travel by road and the infrastructure necessary to accommodate such.

Other Studies

- Church Street Transportation Study, Alliston
- District of Muskoka Transportation Study & Road Rationalization
- Dufferin County Road Rationalization
- Midhurst Secondary Plan NE Quadrant Transportation Study
- Midland Downtown Master Plan
- Orillia West Transportation Study, Orillia
- Oro-Medonte Stop Sign Review

Class Environmental Assessments

Responsible for Class Environmental Assessments (EAs) to identify and evaluate transportation system improvements. In accordance with MEA guidelines, improvement options were identified and evaluated in consideration of impacts to existing development, the natural environment, socio-economics, engineering feasibility, associated costs, and input received from the public, stakeholder groups, and government agencies.

Environmental Assessments have been completed for:

- 5 Points Intersection, Barrie
- Bayview Dr & Big Bay Point Road Widening, Barrie
- Concessions B & C Truck Haul Route, Ramara
- District Road 25 Realignment, District of Muskoka
- District Road 50 Realignment, District of Muskoka
- Duckworth Street Widening, Barrie
- Grey Road 19/21 Intersection, Grey County
- Hidden Lake Road, Town of the Blue Mountains
- Hurst Drive Widening, Barrie
- Huronia Road Widening, Barrie
- Inch Farm Arterial Road Extension, Orillia
- Ferndale Road Realignment, Muskoka Lakes
- Leslie Drive Extension, Innisfil
- Main Street & Beach Areas 1 & 2, Wasaga Beach
- Mosley Street Widening, Wasaga Beach
- Nottawasaga River Dredging, Wasaga Beach
- Salmon Avenue Extension, Bracebridge
- Slabtown Community Access, Town of the Blue Mountains
- Simcoe Road 10 Improvements, Springwater
- Simcoe Road 21 Widening, Innisfil
- Simcoe Road 27 & 90 Intersection, Essa
- Simcoe Road 43 & Wilson Drive Intersection, Springwater
- Simcoe Road 45 Improvements, Ramara
- Simcoe Road 53 Improvements, Innisfil
- Simcoe Road 54 & 21 Intersection, Innisfil
- Simcoe Road 93 Complete Streets, Midland & Penetanguishene
- Sunnyside Drive/Harbourview Drive/Fuller Avenue Corridor Improvements, Midland

Parking Studies & Reviews

Completed numerous studies to address parking requirements of specific developments, which included a review of parking supply and requirements, operations, capacity, geometrics and circulation.

Completed studies addressing existing and future parking requirements with municipal downtown, waterfront and development areas. These included completion of occupancy and duration counts to establish existing parking patterns, estimation of future demands, assessment of parking supplies, recommendations for improvements, review of parking fees and review of municipal parking rates and by-laws.

The following studies have been completed:

- Barrie Waterfront Parking Study
- Collingwood Downtown Parking Study
- Collingwood Parking Rate Review
- Cranberry Marina Development, Collingwood
- Beachfront Area Parking Study, Wasaga Beach
- Pine Street Campus, District of Muskoka
- Urban Commercial Core Parking Study, Alliston, Beeton & Tottenham

Pedestrian Crossings

Involved in planning studies, preliminary design and/or final design to support the implementation of structured pedestrians crossing facilities including:

- Beavercrest Public School PXO, Markdale
- Hurontario Street MPS, Collingwood
- Grey Road 119 PXO, Blue Mountains
- Marchmont School IPS, Severn
- Muskoka Road 118W, Port Carling
- Niagara Street IPS, Collingwood
- Sixth Street MPS, Collingwood
- Various Locations, Muskoka
- Warminster School IPS, Oro-Medonte

Traffic Calming Guidelines

Prepared traffic calming guidelines and policies for:

- Town of Collingwood
- Town of New Tecumseth
- Township of Springwater

Traffic Impact Studies/Assessments

Involved in numerous traffic impact studies/assessments to address operations and traffic impacts associated with new development, including external and internal road circulation, parking assessment and site access review. Wide range of land uses have been addressed (residential, retail, office, landfills, quarries, vacation, institution, mixed-use) with peak hour trips ranging from 100 to 100,000.

Studies have been completed in Simcoe County, Grey County, Dufferin County, York Region, District of Muskoka, District of Parry Sound, Nippising District and municipalities within such.

Traffic Impact Study Guidelines

Prepared Traffic Impact Study Guidelines for:

- District of Muskoka
- Town of Innisfil
- Town of New Tecumseth

Road & Highway Design

Responsible for road design to address various road and intersection improvements. Where required, construction specifications and contract documents were prepared for tendering of the design works.

Design works have been completed for the following:

- 20th Sideroad Reconstruction, Innisfil
- 27/28 Sideroad Reconstruction, Clearview
- 33rd Sideroad, Town of the Blue Mountains
- 5th Sideroad Reconstruction, Adjala- Tosorontio
- Batteaux Creek Intersection, Clearview
- Blue Shores & Hwy 26 Intersection, Collingwood
- Airport Pavement Resurfacing, Collingwood
- Cyprus Lake Road Upgrades, Tobermory
- District Road 169 Widening & Intersection Improvements, Muskoka
- Dunlop Street Improvements; Barrie
- French Road Reconstruction, Tiny
- Fuller Avenue Preliminary Design, Midland
- Grey Road 30 Resurfacing, Grey Highlands
- Grey Road 31 Improvements, Grey Highlands
- Highway 11 & Old Barrie Road Interchange Improvements, Orillia
- Highway 11 Improvements at Webers, Severn
- Highway 26 Resurfacing, Collingwood
- Highway 60 & Centre Street Intersection, Huntsville
- King Street Rejuvenation, Midland
- Mill Street Improvements, Town of the Blue Mountains
- Monarch Drive/Wal-Mart Signalization, Orillia
- Poplar Sideroad Reconstruction, Collingwood
- Simcoe Road 4 & 10th Line Signalization, Innisfil
- Simcoe Road 21 Widening, Innisfil
- Simcoe Road 21 & 4 Intersection, Innisfil
- Simcoe Road 21 & 5 Sideroad Intersection, Innisfil
- Simcoe Road 22 & Fox Farm Road, Simcoe County
- Simcoe Road 27 & 21 Intersection, Simcoe County
- Simcoe Road 27 & 90 Intersection, Simcoe County
- Simcoe Road 29 & Conc 3 Intersection, Tiny
- Simcoe Road 93 & French Road Improvements, Tiny
- Western Commercial Node Road Improvements & Signalization, Collingwood

Roundabout Design

Involved in planning studies, preliminary design and/or final design to support the implementation of roundabouts, including:

- Grey Road 19 & Crosswinds Boulevard, Town of the Blue Mountains
- Grey Road 19 & Grey Road 21 (Simcoe Road 34), Town of the Blue Mountains
- Grey Road 19 & Scenic Caves Road, Town of the Blue Mountains
- High Street & Poplar Sideroad, Collingwood
- River's Edge & Pacific Developments, Wasaga Beach
- Simcoe Road 4 & 9th Line, Innisfil

Engineering Standards Review

Provide input to the municipalities relating to current or proposed engineering standards relating to transportation, including:

- Town of Collingwood
- Township of Oro-Medonte
- Town of The Blue Mountains
- Town of Wasaga Beach
- District of Muskoka

Peer Review Services

Provided peer review services relating to traffic impact studies as required for:

- Town of Bracebridge
- Town of Collingwood
- Town of Gravenhurst
- Town of Innisfil
- Town of Midland
- Town of New Tecumseth
- Town of The Blue Mountains
- District of Muskoka

Municipal Engineering & Infrastructure Renewal

Responsible for senior input regarding road design and geometrics, and/or quality review of other Municipal road reconstruction projects including:

- Dunlop Street, Barrie
- Elma & Alice Streets, Town of the Blue Mountains
- Hanna Street, Midland
- King Street, Midland
- Main Street, Penetanguishene
- Mill Street, Springwater
- Sykes Street, Meaford
- Patterson Street, Springwater
- Trout Lake Road, North Bay
- Victoria & Louisa Streets, Town of the Blue Mountains

Engineering Services **Town of The Blue Mountains**

Provision of consulting engineering services for the Town involving peer review of development applications, design services for municipal infrastructure projects and advice related to municipal design standards and the development review and approval process.

State of City Infrastructure **Owen Sound**

Project Director for the detailed inventory assessment of the City's road, water and storm sewer networks. Established inventory and assessment protocol for curb, sidewalk and guiderail systems and oversaw development of the database containing 13,000 data entries for the 135 km road system, 75 km storm sewer system and 140 km watermain system. The database is the foundation for the City's Asset Management Plan and infrastructure renewal program.

8th Street East Reconstruction **Owen Sound**

Responsible for quality review and traffic engineering for the reconstruction of 450m of 8th Street including replacement of watermain, sanitary and storm sewers, combined sewers, and reconstruction of a two-lane paved road platform with significant grade challenges. Various road cross sections have been explored in consideration of steep side slopes, property impacts and the desire to accommodate active transportation (sidewalks and bike lanes).

Sanitary Sewer Renewal Program Ph. 2 **Collingwood**

Project Director relating to the replacement and/or relining of approximately 3.3 km of existing sanitary sewer and associated water main throughout Collingwood. The project also includes local drainage improvements and storm sewer design to eliminate existing catch basins connected to the sanitary sewer.

Professional Experience

2006 – 2007	Cansult Maunsell Limited Dubai, UAE Manager, Transportation Planning
2001 – 2005	Cansult Tatham Transportation Consultants Collingwood, ON General Manager
1997 – 2001	Cansult Limited Markham, ON Transportation Planner
1996 – 1997	Centre for Research on Transportation & Society Borlänge, Sweden Principal Researcher
1996	Waylaw Technical Services Paris, ON Survey Crew Chief
1994 – 1996	McMaster University Hamilton, ON Teaching Assistant

Experience & Expertise

- Transportation Planning
- Traffic Impact Studies
- Transportation Studies
- Road Network Reviews
- Parking Justification Studies
- Transit Planning

Education & Training

2015 M.Sc. Transportation Systems
Technical University Munich, Germany

2007 Bachelor of Mechanical Eng.
NUST, Pakistan

Hassan Naeem

M.Sc. Transportation Systems

Transportation Planner

Department

Transportation

With Tatham Engineering
1 year (2024 – Present)

Industry Experience
15 Years

CAREER HIGHLIGHTS

Hassan is a Transportation Planner working within the Transportation Engineering Department at Tatham Engineering Limited, where he completes traffic impact studies, transportation studies, parking justification studies and transportation reviews.

Previously, Hassan worked in Pakistan in the field of transit planning, contributing to the planning and piloting of electric bus project, including fleet specifications, route optimization, depot design and procurement strategies.

PROJECT EXPERIENCE

Traffic Impact Studies

Hassan has worked on numerous traffic impact studies to address operations and traffic impacts associated with new developments, including internal and external road circulation, parking assessment and site access reviews. Several studies are highlighted below:

Craighurst Subdivision **Craighurst (2025)**

Transportation Impact Study for a large mixed-use development in Craighurst, in the Township of Oro-Medonte. The study assessed transportation impacts for 168 two-bedroom condominium units, 158 single-detached residential units, and an elementary school with a projected enrolment of 400 students. The development also includes multiple commercial uses such as Tim Hortons, grocery and liquor store, restaurants, and a pet supply store. The analysis evaluated existing and future traffic conditions, site access, and intersection operations to support municipal review and approval.

Project Role: Technical Support

Subdivision Development **Dundalk (2025)**

Prepared a Transportation Impact Study for a large residential and mixed-use development located at 772082 Highway 10. The proposed development included 135 townhouse units, 90 semi-detached dwellings, 134 single-detached homes, and 526 apartment units with ground-floor office space. The study assessed transportation impacts across multiple future horizons and recommended road network improvements including traffic signalization, roadway widening, and additional turning lanes on Highway 10 to support the development.

Project Role: Technical Support

Linksview Subdivision **Collingwood (2025)**

Prepared a Transportation Impact Study for the proposed Linksview Subdivision located at 780 Tenth Line in the Town of Collingwood. The development included 177 single-detached residential units, 184 townhouses, and 189 apartment units. The study evaluated transportation impacts under existing and future conditions and incorporated planned municipal road network improvements across multiple future horizons.

Project Role: Technical Support

Subdivision Development **Springwater (2025)**

Transportation Impact Study for a phased subdivision development located at 2842, 2636, 2694 Wilson Drive, and 1643 Snow Valley Road in Springwater Township. Phase 1, with an anticipated buildout by 2031, includes 202 single-detached residential units, 144 townhouses, and 102 mixed-use residential units with ground-floor commercial uses. Phase 2, with a full buildout horizon of 2036, consists of 119 single-detached units, 33 townhouses, 175 medium-density residential units, and two commercial blocks.

Project Role: Technical Support

Mineral Aggregate Quarries **Ramara (2025)**

Transportation impact review for a proposed mineral aggregate operation located at 6059 Pearl Carrick Road in the Township of Ramara. Site-generated truck traffic was assessed based on the maximum licensed extraction rate of 500,000 tonnes per year, representing a worst-case scenario, using trucks with an average payload of 40 tonnes. The review evaluated heavy truck impacts on the surrounding road network to support municipal and agency reviews.

Project Role: Technical Support

Signal Timing Plan **Collingwood (2025)**

The assessment reviewed signal timing at the Highway 26 and Harbour Street/Balsam Street intersection in Collingwood following the Cranberry Harbour Castle Hotel development. Traffic data and intersection operations were analyzed, showing current delays primarily on the westbound left turn. Instead of implementing the previously recommended advanced green phase for that movement, signal timing adjustments were proposed and shown to significantly improve delays and capacity. The recommendation was to adopt the revised signal timing plan without adding the advanced green phase at this time. The assessment supports maintaining efficient and safe intersection operations under current and near-future conditions.

Project Role: Technical Support

Transit Planning

Hassan has experience in both public and private sectors in Pakistan, focusing on sustainable transit solutions. He has supported electric bus planning, including route optimization and fleet specifications. His work involves collaborating with stakeholders to improve transit operations and environmental outcomes.

Feasibility Studies of Electric Buses **Pakistan (2024)**

Consulting role supporting feasibility studies for the induction of electric buses in urban transit systems. Responsibilities included development of technical specifications for electric buses, optimization of routes based on passenger demand and operating conditions, and preliminary depot planning to support overnight charging operations. Business models were developed to assess procurement and operational options, including capital and operating cost considerations.

Project Role: Senior Transportation Engineer

Assessment of Transit Network **Pakistan (2024)**

Assessing the performance of the existing public transit network. The work involved reviewing route coverage, service frequency, and operational performance at major intersections affecting bus reliability. The assessment identified network gaps and opportunities for improvement, supporting recommendations to enhance service efficiency and connectivity.

Project Role: Senior Transportation Engineer

Piloting of Electric Buses in Lahore **Pakistan (2021)**

Public-sector role as Manager Planning in Pakistan for the pilot project introducing electric buses into Lahore's public transit system. Responsibilities included initiating the project concept, supporting internal approvals, and coordinating with multiple government departments and external consultants.

Tasks included defining project requirements for depot locations, charging strategies, and fleet allocation based on route lengths and daily operating cycles. Consultant deliverables were reviewed from an operator and owner's perspective to ensure alignment with regulatory requirements, public-sector constraints, and long-term operational needs, supporting progression from concept to feasibility and procurement planning stages.

Project Role: Manager Planning

Professional Experience

2024	National Engineer Services Pakistan Lahore, Pakistan Senior Transportation Engineer
2016 - 2023	Punjab Transport Company Lahore, Pakistan Manager Planning
2007 - 2012	Fauji Fertilizer Bin Qasim Limited Karachi, Pakistan Maintenance Engineer