

1 April 2020
Project: 190038

Rick Esbaugh
Jackson Harvest Farms Ltd.
c/o David Sisco BA MCIP RPP
Associate, Senior Planner
IBI Group
410 Albert Street, Suite 101
Waterloo ON N2L 3V3

Dear Mr. Esbaugh:

**RE: JACKSON HARVEST FARMS, 1894 WITMER ROAD
PEER REVIEW RESPONSES**

Jackson Harvest Farms Ltd. retained Paradigm Transportation Solutions Limited (Paradigm) to conduct a Transportation Impact Study (TIS) for the development of the 1894 Witmer Road, Wilmot Township gravel pit development. This study was completed in August 2019¹ and submitted to the Township of Wilmot and Region of Waterloo in support of the planning applications.

The Township of Wilmot retained AECOM to perform a peer review and the results of the peer review were provided 4 February 2020. This letter provides responses to the comments made in the peer review.

¹ Jackson Harvest Farms, 1894 Witmer Road: Transportation Impact Study, *Paradigm Transportation Solutions Limited*, August 2019

AECOM Comments

Comment 2.1.1

“The RoW TIS Guidelines indicate that “any factors utilized in the transportation impact study that are not in concurrence with the recognized standards must be agreed upon with Regional Staff prior to submission of the final report”. It is not clear if the Peak Hour Factor of 2 referenced in Table 3.1 of the TIS Report was confirmed with Regional or Township staff. This Peak Hour Factor was used in the analysis to convert average hourly truck volume accessing/egressing the site to a peak hour volume. This Peak Hour Factor can significantly affect the magnitude of site-generated traffic assessed in the Synchro analysis and in turn inform the level and degree of mitigation required. The Consultant is asked to provide documented support or justification for use of this conversion factor of 2.”

Response

The trip generation for the site was calculated using first principles, involving the following methodology:

- ▶ determining the average number of loads per hour based on annual extraction rates;
- ▶ operating days per year; and
- ▶ operating hours per day.

To account for potential uneven distribution of daily truck traffic, a factor of 2 was used to provide the operational analysis. A scenario in which double the number of trips were made during both the peak hours.

A factor of 2 was used as it is a very conservative approach in anticipating trip variations throughout the day. Since the annual extraction, operating days and hours would not change, maintaining the average rate would mean that for every hour the trips are doubled, there would be 2 hours of half the average trip amount.

This “trip variation factor” of 2 was only applied to be used in the operational analyses of the intersections, as done with Synchro. The Synchro analyses indicate that the intersections are operating well below capacity, even with the factoring. This factor was not meant to indicate how many trucks would be likely seen on the road throughout the day, as that would follow the average number of trucks calculation.

Comment 2.1.2

“The calculation of truck demand for the subject development (as shown in Table 3.1 of the TIS Report) and the calculation of truck demand for the adjacent Spring Valley Trout Farm site (as shown in Table 4.1 of the TIS) use inconsistent parameters.

The Consultant is asked to verify and explain the differences in inputs for the number of operating days per year and the operating hours per day.”



Response

The parameters used in Table 3.1 were provided by the owner for the extraction rates and operating schedule which are being applied for.

The assumed parameters used in Table 4.1 were provided to us based on the Spring Valley Trout Farm's assumed operations.

Comments 2.1.3

"The TIS Report utilizes a Passenger Car Equivalent factor of 3.2 PCE/Truck. The peer review was unable to find a source and/or justification for use of this value in the analysis."

It is advised and important that any assumption(s) or calculation(s) relating to the use of PCE factors be included in the TIS Report."

Response

Passenger car equivalents (PCE) were used to calculate the average hourly trucks as well as to approximate the impacts on intersection operations by increasing the volume in Synchro, rather than leaving the volumes as-is and increasing the truck percentages.

There are not universally accepted values for PCE. In this TIS, PCEs were taken from the Canadian Capacity Guide², which lists PCE for Single Unit Trucks as 1.5, Multi-unit Trucks as 2.5, and Multi-unit Trucks Heavily Loaded as 3.5. The PCE 3.2 used in this was based on a mix of 30% single-unit trucks and 70% multi-unit trucks (tractor trailers), as provided as an estimate of future truck traffic by the operator. As the trucks are expected to be "heavily loaded", a PCE of 3.5 was assumed for multi-unit trucks, and a PCE of 2.5 was assumed for single-unit trucks, as the referenced source did not have a separate PCE for heavily loaded single-unit trucks (and the multi-unit truck PCE increased by 1 between the non-heavily loaded PCE and the heavily-loaded PCE).

Comment 2.1.4

"The TIS Report does not account for receiving operations of the development site, including the deliveries of recycled asphalt and concrete and the resulting truck traffic volumes. These additional volumes should be included in the traffic analysis."

Response

Information on the recycling operations were not available at the time of writing the TIS. A revised analysis including the expected trucks for the recycling operation was completed.

² Canadian Capacity Guide for Signalized Intersections: Table 3.2, *Institute of Transportation Engineers*, February 2008



Recycled material operations will produce 30,000 tonnes per year in addition to the aggregates noted in the analysis contained within the TIS. **Table 1** summarizes the trip generation for the recycled materials.

TABLE 1: RECYCLED MATERIAL TRUCK TRIP GENERATION

Measure	Units	Input	Calculation
Annual Rate of Extraction	tonnes/year	30,000	
Operating Days per year	day/year	300	
Average Extraction per day	tonnes/day		100
Average Payload per truck	tonnes/truck	34.3	
Average Number of Trucks per day	trucks/day		3
Operating Hours per day	hours/day	13	
Average number of trucks per hour	trucks/hour		0.2
Average Truck Increase Factor	dimensionless	2	
Peak Hour Truck Volume	trucks/hour		0.4
Passenger Car Equivalents per Truck	PCE/truck	3.2	
Peak Hour Entering Volume	PCE/hour		1
Peak Hour Exiting Volume	PCE/hour		1

Figure 1 (attached) illustrates the site generated traffic volumes for the AM and PM peak hours.

Figure 2 (attached) illustrates the 2023 total traffic volumes for the AM and PM peak hours.

Table 2 summarizes the LOS results for the 2023 total traffic horizons during the AM and PM peak hour.



TABLE 2: 2023 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				OVERALL
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Queen Street & Witmer Road	TWSC	LOS Delay V/C 95th	<	B	>	B	<	A	>	A	<	A	>	A	<	A	>	A	2
				<	12	>	12	<	10	>	10	<	0	>	0	<	0	>	0	
				<	0.10	>		<	0.00	>		<	0.01	>		<	0.00	>		
				<	3	>		<	0	>		<	0	>		<	0	>		
2 - Pit Access & Witmer Road	TWSC	LOS Delay V/C 95th	<	A		A		A	>	A					A		>	A	2	
			<	0		0	>	0					9		>	9				
			<	0.00		0.03	>					0.02		>						
			<	0		0	>				1		>							
PM Peak Hour	1 - Queen Street & Witmer Road	TWSC	LOS Delay V/C 95th	<	B	>	B	<	B	>	B	<	A	>	A	<	A	>	A	2
				<	13	>	13	<	11	>	11	<	0	>	0	<	0	>	0	
				<	0.10	>		<	0.00	>		<	0.01	>		<	0.00	>		
				<	3	>		<	0	>		<	0	>		<	0	>		
2 - Pit Access & Witmer Road	TWSC	LOS Delay V/C 95th	<	A		A		A	>	A					A		>	A	2	
			<	0		0	>	0					9		>	9				
			<	0.00		0.03	>					0.02		>						
			<	0		0	>				1		>							

MOE - Measure of Effectiveness

V/C - Volume to Capacity Ratio

> - Shared Right-Turn Lane

TWSC - Two-Way Stop Control

95th - 95th Percentile Queue Length

< - Shared Left-Turn Lane

LOS - Level of Service

All observed intersections within the study area are forecast to operate acceptably.

Appendix A contains the detailed synchro reports.

Comment 2.1.5

"The turning movement counts on which the Consultant based the analysis were collected on June 21, 2018. The TIS Report does not include any discussion regarding seasonal variation of traffic volumes and the appropriateness of utilizing traffic counts collected during the summer months."

Response

The counts used in this study were performed on June 21, 2018, which is still within the school year. Generally, counts performed in the summer months can be deemed representative. Variation in summer counts usually occur in tourist areas or near schools, either of which would likely apply in this location. A seasonal variance factor would be inappropriate in this instance.



Comment 2.2.1

“The TIS Report states that 5 to 10 percent of the site-generated demand will be routed to/from the subject site via Sandhills Road for local deliveries. However, Figure 3.1 in the TIS Report illustrates all trips entering/exiting the pit access to/from the east (i.e. via Queen St), with no vehicles entering/exiting the site to/from the west (via Sandhills Road).”

The Consultant is asked to clarify the discrepancy between the described trip assignment methodology and the volumes shown in Figure 3.1, and to confirm if traffic originating in/destined to the west is included in the Synchro analysis. Specifically, the Consultant should confirm if truck traffic is intended to travel west on Witmer Road to Sandhills Road.”

Response

It is expected that all truck traffic will be to/from the east (towards Queen Street), with the exception of local deliveries going west. For the operational analysis done in Synchro, 100% of the traffic was assigned to travel through the intersection Queen Street and Witmer Road, to present a conservative analysis. Any trips routed to/from the west would only decrease the amount of traffic at this intersection. Trips to/from the west was mentioned in the body of the report to be transparent for this small possibility. Regardless of the origin/destination of the trips, load restrictions will be followed by trucks using this site and will be expected to operate in a safe manner.

Comment 2.2.2

“The eastbound and westbound through volumes as depicted in Figure 4.3 of the TIS Report for both the AM and PM peak hours are not consistent with those utilized in the Synchro analysis, as provided in Appendix E.

The consultant is asked to review and address this discrepancy and to confirm which volumes the results of the Synchro analysis are based on.”

Response

A typo in the Synchro files was found at the driveway location on Witmer Road in which the east leg volumes were used as the eastbound and westbound through volumes (e.g. the west leg in Figure 4.3 for the AM peak hour is 57 westbound, which includes both the westbound through volume and right-turn volume, but was entered as westbound through volumes in addition to the actual westbound right-turn volumes) resulting in a higher volume of through vehicles being included in the analysis of the operations of the driveway. With volumes so low on Witmer Road, correcting this typo would result in a very insignificant improvement in operations shown in Synchro.

As the Synchro analyses were redone due to the inclusion of trips from the recycling operations (as noted in Comment 2.1.4), this typo has been fixed.



Comment 2.2.3

“The Synchro analysis utilizes Peak Hour Factor (PHF) values of 1.0 for every turning movement. The collected turning movement count data provided in Appendix B includes PHF calculated from the counts collected by the Consultant.

The Consultant is asked to provide justification for why a PHF of 1.0 was utilized for all turning movements when actual PHF data is available.”

Response

A PHF of 1.0 is used by the Region of Waterloo in their TIS guideline standards. Given the low volumes and ample capacity, adjustment of the PHF would not result in a change in conclusions.

Comment 2.3.1

“The TIS Report recommends the site access to the proposed Pit be placed approximately 220 m east of the western border of the property as this is “the crest of a hill, giving the furthest possible site in both directions”.

The RoW TIS Guidelines indicate that “sight distances should be evaluated to ensure safe conditions in accordance with Transportation of Canada Geometric Design Guide for Canadian Roads”. The TIS Report does not provide an evaluation of sight distance from this location. Furthermore, it should also be noted that the presence of a vertical curve in this section of Witmer Rd may reduce available sight distance to/from the site access.

The Consultant is advised to perform a sightline assessment as part of this TIS Report as per TAC standards if not already done so, specifically showing required and provided stopping sight distances and the proposed location of the entrance relative to the west property line of the subject site.”

Response

Sight distance for a stopped left-turning vehicle at a design speed of 100 km/h (20km/h over the posted speed limit) is 210 metres for a passenger car and 320 metres for a multi-unit truck.

A sight distance analysis was conducted in March 2020 at the recommended driveway location for the development and it was found that all sight-distances are adequate for the proposed Pit Access. **Table 3** summarizes the sight distance requirements and in-field measurements.



TABLE 3: SIGHT DISTANCE SUMMARY

Requirement	Required Distance (m)		Measured Distance (m)
	Passenger Vehicle	Truck	
Stopping Sight Distance	185	185	400
Right-Turn from Stop	185	300	400
Left-Turn from Stop	210	320	760

Comment 2.3.2

“Section 5.1 of the TIS Report concludes that since traffic volumes are forecast to be less than 100 vehicles/hour for both approaches in the AM and PM peaks, there is no requirement for auxiliary lanes.

The Consultant is advised to revisit this conclusion based on outcomes of all previous referenced comments in this peer review and cite all applicable standards or guidelines in support of their conclusion(s).”

Response

Volumes did not increase in a significant manner as a result previous comments and volumes on Witmer Road are not over 100 vph during the peak hours. Also, as traffic is expected to come from the east, these will be right-turns that will be entering the site.

The need for designated left turning lanes at intersections within the study area are assessed using MTO procedures detailed in the Geometric Design Manual³. The southbound left-turn lane for the intersection of Pit Access and Witmer Road is identified as unwarranted under 2023 total traffic conditions.

Figure 3 (attached) illustrates the left-turn lane warrant nomograph for the intersection of Pit Access and Witmer Road.

Comment 2.3.3

“The RoW TIS Guidelines require an evaluation of site circulation to “demonstrate a high safety factor with respect to queuing...”.

The Consultant is advised to include input in the TIS report on the Pit operator's functional site plan/layout, with discussion on internal circulation, acceleration, deceleration and queuing on Witmer Road.”

³ Geometric Design Manual for Ontario Highways, Ministry of Transportation of Ontario, Queen's Printer for Ontario, 1986



Response

Analysis of internal circulation was not done as a detailed site plan was not available at the time of writing the TIS. When the site plan is designed, the internal site circulation should be designed with tractor-trailer movements in mind.

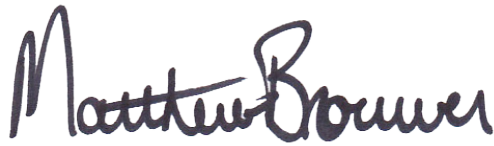
Queueing analysis on Witmer Road is included in the Synchro analysis and is not expected to be an issue, as the volumes are low, and the inbound truck traffic are expected to be right-turns with no opposing movements.

Conclusions

I hope that the above responses and additional information is satisfactory. Please contact me if you have any questions or comments on the above analysis.

Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED

A handwritten signature in dark ink that reads "Matt Brouwer". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

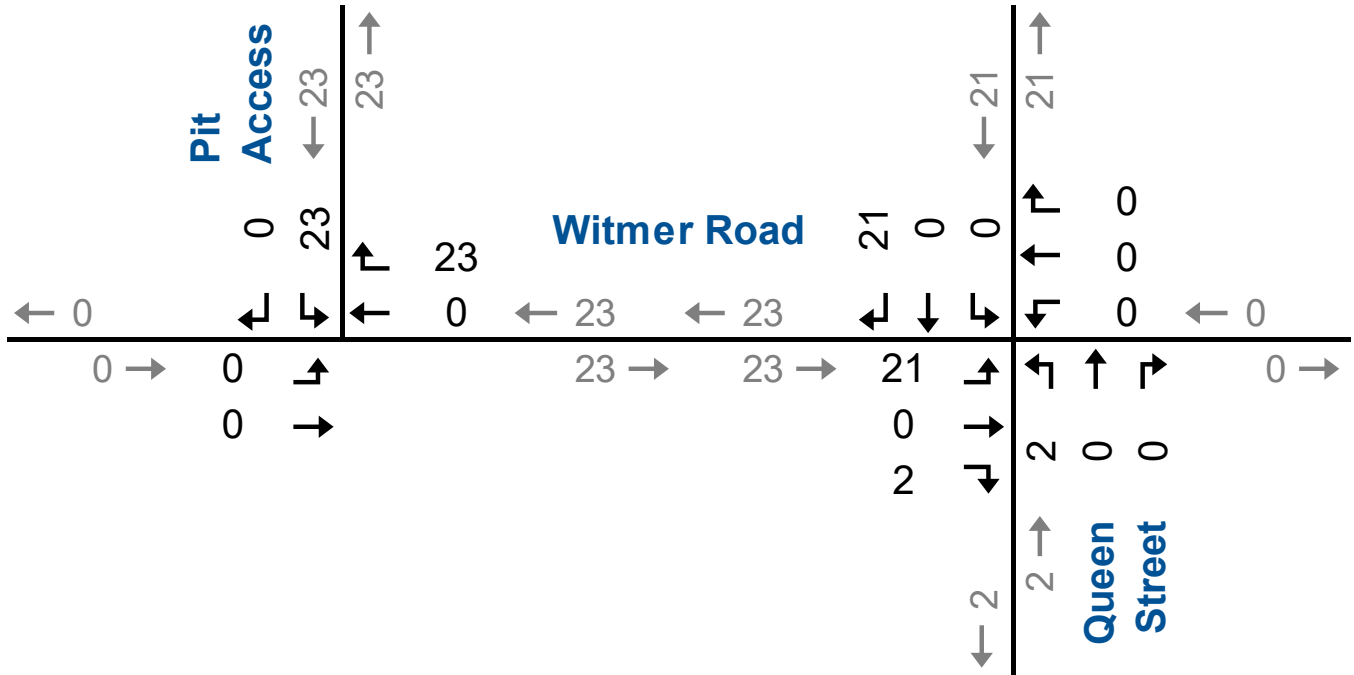
Matt Brouwer

P.Eng.

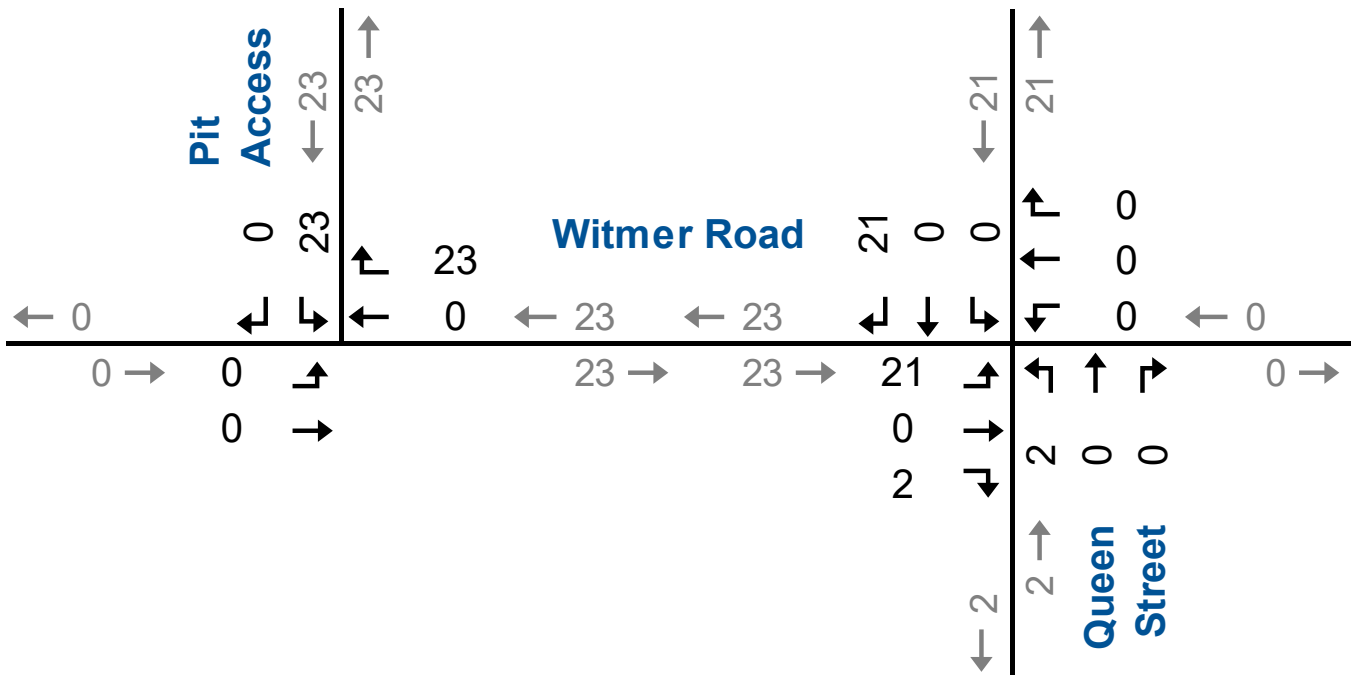
Senior Project Manager



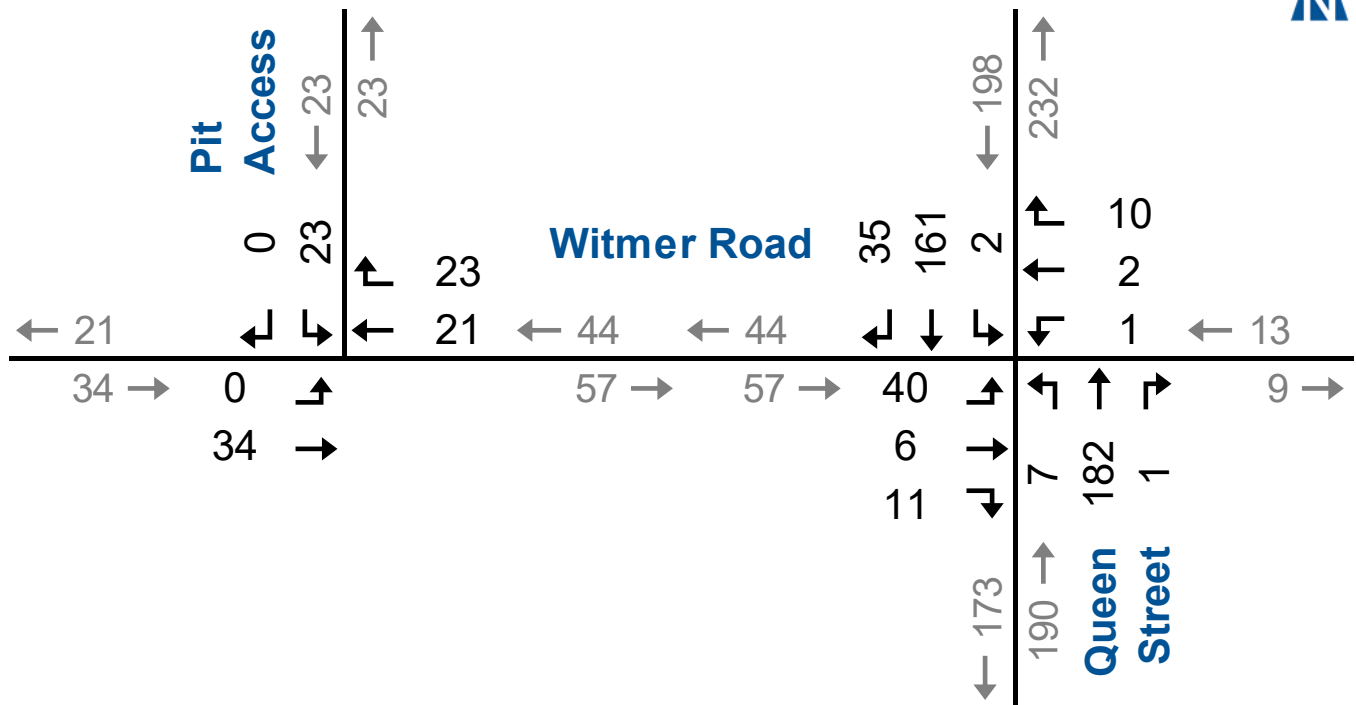
AM Peak Hour



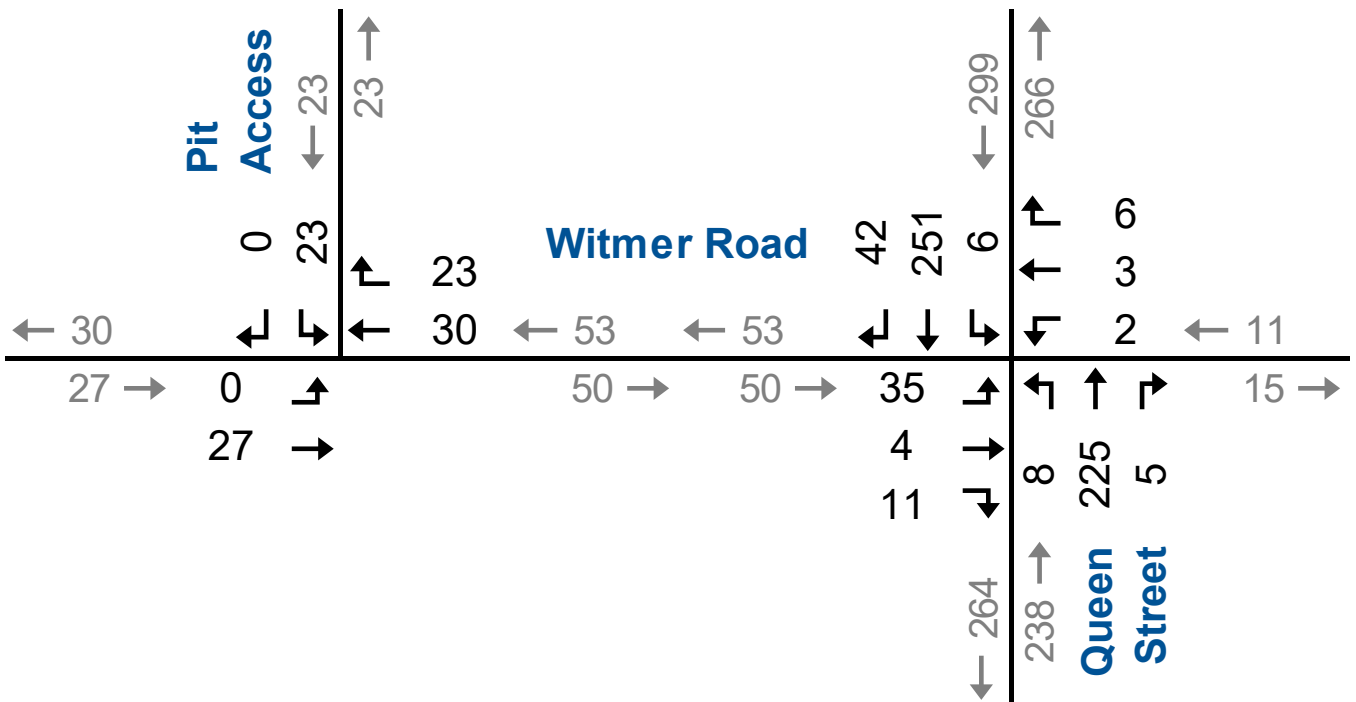
PM Peak Hour

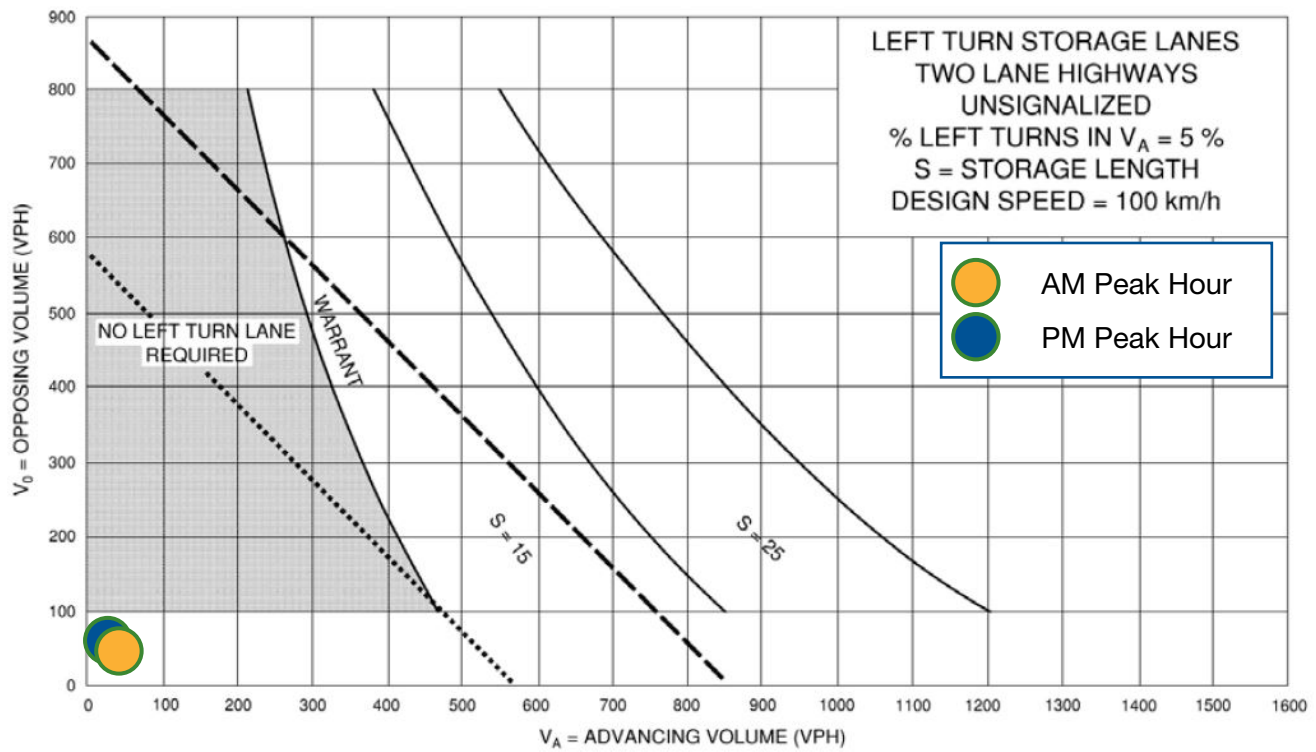


AM Peak Hour



PM Peak Hour





Appendix A

2023 Total Traffic Operations Reports



Lanes, Volumes, Timings
1: Witmer Road & Queen Street

180124-1 - 1894 Witmer Road
Total 2023 AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	6	11	1	2	10	7	182	1	2	161	35
Future Volume (vph)	40	6	11	1	2	10	7	182	1	2	161	35
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.974			0.896			0.999			0.976	
Flt Protected		0.966			0.996			0.998			0.999	
Satd. Flow (prot)	0	1264	0	0	1284	0	0	1423	0	0	1166	0
Flt Permitted		0.966			0.996			0.998			0.999	
Satd. Flow (perm)	0	1264	0	0	1284	0	0	1423	0	0	1166	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		2128.4			444.6			391.5			246.4	
Travel Time (s)		95.8			20.0			17.6			11.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	14%	0%	29%	100%	0%	0%	25%	8%	0%	50%	14%	100%
Adj. Flow (vph)	40	6	11	1	2	10	7	182	1	2	161	35
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	57	0	0	13	0	0	190	0	0	198	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 34.5%

ICU Level of Service A

Analysis Period (min) 15

HCM Unsignalized Intersection Capacity Analysis

1: Witmer Road & Queen Street

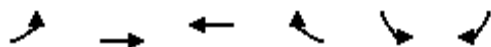
180124-1 - 1894 Witmer Road

Total 2023 AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	6	11	1	2	10	7	182	1	2	161	35
Future Volume (Veh/h)	40	6	11	1	2	10	7	182	1	2	161	35
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	6	11	1	2	10	7	182	1	2	161	35
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	390	380	178	393	396	182	196			183		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	390	380	178	393	396	182	196			183		
tC, single (s)	7.2	6.5	6.5	8.1	6.5	6.2	4.3			4.6		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.6	4.4	4.0	3.3	2.4			2.7		
p0 queue free %	93	99	99	100	100	99	99			100		
cM capacity (veh/h)	537	552	799	414	540	865	1251			1149		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	57	13	190	198								
Volume Left	40	1	7	2								
Volume Right	11	10	1	35								
cSH	575	735	1251	1149								
Volume to Capacity	0.10	0.02	0.01	0.00								
Queue Length 95th (m)	2.6	0.4	0.1	0.0								
Control Delay (s)	11.9	10.0	0.3	0.1								
Lane LOS	B	A	A	A								
Approach Delay (s)	11.9	10.0	0.3	0.1								
Approach LOS	B	A										
Intersection Summary												
Average Delay	2.0											
Intersection Capacity Utilization	34.5%			ICU Level of Service					A			
Analysis Period (min)	15											

Lanes, Volumes, Timings
2: Witmer Road

180124-1 - 1894 Witmer Road
Total 2023 AM



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	34	21	23	23	0
Future Volume (vph)	0	34	21	23	23	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.929				
Flt Protected					0.950	
Satd. Flow (prot)	0	1650	1533	0	1644	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	1650	1533	0	1644	0
Link Speed (k/h)		80	80		80	
Link Distance (m)		158.6	2128.4		229.2	
Travel Time (s)		7.1	95.8		10.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	2%	2%
Adj. Flow (vph)	0	34	21	23	23	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	34	44	0	23	0
Sign Control		Free	Free		Stop	

Intersection Summary

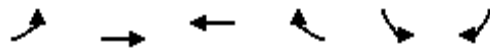
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	13.3%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis

2: Witmer Road

180124-1 - 1894 Witmer Road

Total 2023 AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	34	21	23	23	0
Future Volume (Veh/h)	0	34	21	23	23	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	34	21	23	23	0
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	44				66	32
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	44				66	32
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	1577				939	1041
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	34	44	23			
Volume Left	0	0	23			
Volume Right	0	23	0			
cSH	1577	1700	939			
Volume to Capacity	0.00	0.03	0.02			
Queue Length 95th (m)	0.0	0.0	0.6			
Control Delay (s)	0.0	0.0	8.9			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	8.9			
Approach LOS			A			
Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			13.3%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings
1: Witmer Road & Queen Street

180124-1 - 1894 Witmer Road
Total 2023 PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	4	11	2	3	6	8	225	5	6	251	42
Future Volume (vph)	35	4	11	2	3	6	8	225	5	6	251	42
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.970			0.926			0.997			0.981	
Flt Protected		0.966			0.991			0.998			0.999	
Satd. Flow (prot)	0	1409	0	0	1422	0	0	1486	0	0	1446	0
Flt Permitted		0.966			0.991			0.998			0.999	
Satd. Flow (perm)	0	1409	0	0	1422	0	0	1486	0	0	1446	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		2128.4			444.6			391.5			246.4	
Travel Time (s)		95.8			20.0			17.6			11.1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	14%	0%	0%	0%	0%	4%	0%	0%	6%	0%
Adj. Flow (vph)	35	4	11	2	3	6	8	225	5	6	251	42
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	50	0	0	11	0	0	238	0	0	299	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 39.1%

ICU Level of Service A

Analysis Period (min) 15

HCM Unsignalized Intersection Capacity Analysis

1: Witmer Road & Queen Street

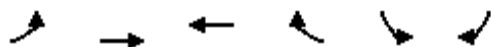
180124-1 - 1894 Witmer Road

Total 2023 PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	4	11	2	3	6	8	225	5	6	251	42
Future Volume (Veh/h)	35	4	11	2	3	6	8	225	5	6	251	42
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	35	4	11	2	3	6	8	225	5	6	251	42
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	535	530	272	540	548	228	293			230		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	535	530	272	540	548	228	293			230		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	99	99	100	99	99	99			100		
cM capacity (veh/h)	450	452	739	442	442	817	1280			1350		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	50	11	238	299								
Volume Left	35	2	8	6								
Volume Right	11	6	5	42								
cSH	492	589	1280	1350								
Volume to Capacity	0.10	0.02	0.01	0.00								
Queue Length 95th (m)	2.7	0.5	0.2	0.1								
Control Delay (s)	13.1	11.2	0.3	0.2								
Lane LOS	B	B	A	A								
Approach Delay (s)	13.1	11.2	0.3	0.2								
Approach LOS	B	B										
Intersection Summary												
Average Delay			1.5									
Intersection Capacity Utilization			39.1%	ICU Level of Service					A			
Analysis Period (min)			15									

Lanes, Volumes, Timings
2: Witmer Road

180124-1 - 1894 Witmer Road
Total 2023 PM



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	27	30	23	23	0
Future Volume (vph)	0	27	30	23	23	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1765	1765
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.941				
Flt Protected					0.950	
Satd. Flow (prot)	0	1618	1522	0	1644	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	1618	1522	0	1644	0
Link Speed (k/h)		80	80		80	
Link Distance (m)		158.6	2128.4		229.2	
Travel Time (s)		7.1	95.8		10.3	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	27	30	23	23	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	27	53	0	23	0
Sign Control		Free	Free		Stop	

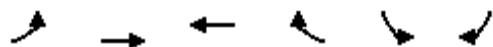
Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	13.4%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis

2: Witmer Road

180124-1 - 1894 Witmer Road
Total 2023 PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	27	30	23	23	0
Future Volume (Veh/h)	0	27	30	23	23	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	27	30	23	23	0
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	53				68	42
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	53				68	42
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	1553				936	1029
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	27	53	23			
Volume Left	0	0	23			
Volume Right	0	23	0			
cSH	1553	1700	936			
Volume to Capacity	0.00	0.03	0.02			
Queue Length 95th (m)	0.0	0.0	0.6			
Control Delay (s)	0.0	0.0	8.9			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	8.9			
Approach LOS			A			
Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			13.4%	ICU Level of Service		A
Analysis Period (min)			15			