

DECEMBER 7, 2022

PROJECT NO: 1688-5162

SENT VIA: EMAIL

Villarboit (Owen Sound) Holdings Limited Partnership
500 Cochrane Drive, Unit 4
Markham, Ontario, L3R 8E2

**Attention: Guery Goyo
President**

**RE: TRAFFIC OPINION LETTER
2125 16TH STREET EAST (HERITAGE GROVE) COMMERCIAL DEVELOPMENT
CITY OF OWEN SOUND**

Dear Guery,

C.F. Crozier & Associates Inc. (Crozier) has been retained by Villarboit (Owen Sound) Holdings Limited Partnership (Client) to prepare a Traffic Opinion Letter (TOL) in support of the Site Plan Amendment (SPA) for the commercial development, located at 2125 16th Street East (Heritage Grove) in the City of Owen Sound (City).

As requested by the Client, this Traffic Opinion Letter will:

- Forecast the trip generation characteristics of the proposed development with the updated land uses.
- Assess intersection operations and recommended improvements, if required, to determine if the approved lane configuration is adequate to support the grocery store.

This TOL will identify any required changes to the road improvements identified in the Traffic Impact Study submission prepared by Crozier, dated April 2019 (2019 HG TIS).

Background

Heritage Grove is located at 2125 16th Street East, in the City of Owen Sound. A Traffic Impact Study was initially submitted by Paradigm Transportation Solutions Limited (Paradigm) in 2011 in support of the commercial development (2011 PTSL TIS). A grocery store and retail land uses are now being considered at the hotel location noted in the 2019 HG TIS.

Trip Generation

The trip generation of the site was estimated using Institute of Transportation Engineers (ITE) Trip Generation Manual 11th Edition (ITE Trip Generation Manual) methodology and the site plan prepared by Greystone Architectural Partners Inc. issued for review on March 9, 2022.

The following Land Use Codes (LUC) were used to estimate the trip generation of the proposed buildings:

- LUC 821 "Shopping Plaza (40-150k GFA)" for the retail buildings K2 and G with unidentified land uses
- LUC 850 "Supermarket" for Building K1
- LUC 882 "Marijuana Dispensary" for Building H3
- LUC 932 "High-Turnover (Sit-Down) Restaurant" for Buildings H1 and H2
- LUC 933 "Fast-Food Restaurant without Drive-Through Window" for Building H4 and I2
- LUC 934 "Fast-Food Restaurant with Drive-Through Window" for Building I1

As interaction between land uses are expected within the Heritage Grove site, the internal capture was estimated using NCHRP Project 8-51 methodology. **Attachment A** contains the internal capture worksheets.

Some trips to Heritage Grove are expected as intermediary stops on the way to the primary destination. These pass-by trips do not increase the traffic volumes on the boundary road network. **Table 1** summaries the pass-by rates identified in the ITE Trip Generation Manual.

Table 1: Pass-By Trip Rates

Land Use Category	Pass-By Trip Rate	
	Weekday P.M. Peak	Saturday Peak
LUC 821 "Shopping Plaza"	40%	31%
LUC 850 "Supermarket"	24%	19%
LUC 882 "Marijuana Dispensary"	0% ¹	0% ¹
LUC 932 "High-Turnover (Sit-Down) Restaurant"	43%	32% ²
LUC 933 "Fast-Food Restaurant without Drive-Through Window"	43% ³	32% ³
LUC 934 "Fast-Food Restaurant with Drive-Through Window"	55%	41% ²

Note 1: No pass-by rate data was available.

Note 2: No pass-by data was available. Pass-by rate of 75% of PM peak hour rate was applied, which was similar to LUC 821 and LUC 850.

Note 3: No pass-by data was available. LUC 932 rates were applied, which were more conservative than LUC 934 rate.

Table 2 summarizes the estimated primary, internal capture, and pass-by trip generation rates of the proposed buildings.

Table 2: Estimated Trip Generation

Land Use	PM Peak Hour		Saturday Peak Hour	
	In	Out	In	Out
821 - Shopping Plaza (40-150k)	145	151	184	170
850 - Supermarket	165	165	210	210
882 - Marijuana Dispensary	13	13	20	20
932 - High-Turnover (Sit-Down) Restaurant	31	20	32	31
933 - Fast-Food Restaurant without Drive-Through Window	56	57	91	95
934 - Fast-Food Restaurant with Drive-Through Window	46	42	74	72
Total Unadjusted Trip Generation	456	448	611	598
Internal Trips	-87	-87	-138	-138
Total External Trip Generation	369	361	473	460
Pass-By	-122	-122	-111	-111
Total New External Trip Generation	247	239	362	349

The proposed land uses are estimated to generate approximately 486 and 711 new external two-way p.m. and Saturday peak hour trips, respectively. In the 2019 HG TIS, the land uses analyzed were estimated to generate approximately 293 and 367 two-way p.m. and Saturday peak hour trips, respectively. As can be seen, the introduction of the grocery store and the removal of the hotel results in a large increase in traffic volumes.

Trip Assignment and Distribution

The site-generated trips were assigned to the study area road network consistent with the methodology identified in the 2019 HG TIS. **Attachment B** contains excerpts of the 2019 HG TIS.

Figure 1 illustrates the site-generated traffic volumes inclusive of internal trip capture. **Figure 2** illustrates the pass-by site-generated traffic volumes. **Figure 3** illustrates the total external trip generation of the proposed buildings.

Signal Warrants

Traffic signal warrants were conducted using Ontario Traffic Manual (OTM) Book 12 Justification 7 methodology with 2024 total traffic volumes. The results indicate that traffic signals are not warranted at the 16th Street East and 22nd Avenue East intersection.

Attachment C contains the traffic signal warrants.

Left-Turn Lanes

The need for left-turn lanes on 16th Street East at 22nd Avenue East was assessed using Ontario Ministry of Transportation (MTO) Design Supplement for Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR) dated June 2017.

As the posted speed limit decreases at the approximate location of 22nd Avenue East from 80 km/h to 60 km/h, it is assumed that speed transition zone will occur further east upon build-out of the intersection. Therefore, a design speed of 80 km/h (posted + 20 km/h) speed was assumed for the left-turn lane analysis.

Based on the updated land uses included in the most recent site plan, the left-turn lane recommendations at the study area intersections are consistent with the 2019 HG TIS. A westbound left-turn lane with 15 metres of storage is warranted on 16th Street East at 22nd Avenue East under 2024 total conditions without the "Strain" property and 25 metres of storage is warranted with the "Strain" property.

Attachment D contains the left-turn lane warrant nomographs.

Total Operations

The total operations consist of the site-generated and forecast 2024 background traffic volumes. The 2024 horizon is consistent with the 2019 HG TIS and the 2024 background traffic volumes, which includes the "Strain" property, are illustrated in **Figure 4**. The 2024 total traffic volumes are illustrated in **Figure 5**.

The operations of the study area intersections were analyzed using Synchro 11 and HCM 2000 methodology. Signal timings were not optimized. **Table 3** summarizes the 2024 total Levels of Service (LOS). **Attachment E** contains LOS definitions and **Attachment F** contains the Synchro operations reports.

Table 3: 2024 Total Operations

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	Critical v/c ratio ²	95 th Percentile Queue Length > Storage Length
16 th Street East and 20 th Avenue East	Signal	P.M.	B	12.0 s	0.57 (NBLT)	None
		SAT.	B	17.1 s	0.76 (NBLT)	None
20 th Avenue East and Site Access / Smart Centres	Stop (Minor Street)	P.M.	D	28.0 s (WBLTR)	0.75 (WBLTR)	None
		SAT.	F	55.3 s (EBLT) 191.7 s (WBLTR)	0.67 (EBLT) 1.33 (WBLTR)	None
16 th Street East and RI/RO Site Access	Stop (Minor Street)	P.M.	B	10.9 s (NBR)	0.15 (NBR)	None
		SAT.	B	10.8 s (NBR)	0.13 (NBR)	None
16 th Street East and 22 nd Avenue East	Stop (Minor Street)	P.M.	C	16.1 s (NBL)	0.31 (NBL)	None
		SAT.	C	17.6 s (NBLR)	0.37 (NBL)	None

Note 1: The Level of Service of a signalized intersection is based on the average control delay per vehicle (Synchro/ICU).

The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM2000).

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection. In addition, all v/c ratios greater than 0.90 for through movements or shared through/turning movements, and v/c ratios greater than 1.00 for exclusive turning movements are outlined and highlighted.

Based on the analysis, the minor approaches at the 20th Avenue East and Site Access / Smart Centres Access are forecasted to be critical during the Saturday peak hour under 2024 total conditions. The eastbound through-left turn movement is forecasted to operate at LOS F with v/c of approximately 0.67. The shared westbound movement is forecasted to operate at LOS F with v/c exceeding 1.00. This is a result of the large outbound site-generated traffic volumes travelling to the west and south. Recommendations to improve the operations of this intersection are given in the following section.

No critical movement were identified at the other study area intersections. All other movements are forecasted to operate at LOC D or better with v/c of ratios of less than 0.80.

Sensitivity Analysis

Due to the poor operations of the minor approaches at the 20th Avenue East and Site Access / Smart Centres Access, a sensitivity analysis was conducted to assess the impacts of implementing All-Way Stop Control at the intersection. The intersection was assessed using Synchro 11 with HCM 2000 methodology and 2024 total traffic volumes. A second analysis was conducted with a shared westbound through-left turn lane and a westbound right-turn lane.

Table 4 summarizes the 2024 total Levels of Service (LOS). **Attachment F** contains the Synchro operations reports.

Table 4: 2024 Total Operations – Sensitivity Analysis

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	Critical v/c ratio ¹	95 th Percentile Queue Length > Storage Length
20 th Avenue East and Site Access / Smart Centres	All-Way Stop Control	P.M.	C	21.0 s (WBLTR)	0.69 (WBLTR)	None
		SAT.	F	84.1 s (WBLTR)	1.06 (WBLTR)	None
	All-Way Stop Control with 2 Westbound Lanes	P.M.	B	12.5 s (WBLT)	0.39 (WBLT)	None
		SAT.	B	19.1 s (WBLT)	0.47 (WBLT)	None

Note 1: Only the critical movement(s) are noted. Where there are no critical movements, the movement with the highest delay is noted.

The results indicated that implementing AWSC reduces the delay for eastbound and westbound approaches. Implementing AWSC is forecasted to reduce the delay of the westbound movement by approximately 107.6 s. Therefore, it is recommended to implement AWSC at the 20th Avenue East and Site Access / Smart Centres Access

Conclusion

The most recent concept plan replaces the hotel land uses identified in the 2019 HG TIS with proposed grocery store and generic retail land uses. This is estimated to increase the trip generation of the site and is forecasted to result in poor operations on the minor approaches at the 20th Avenue East and Site Access / Smart Centres Access intersection.

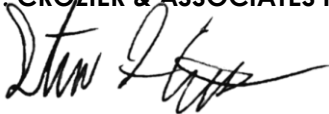
Based on the updated land uses included in the most recent site plan, the left-turn lane recommendations at the study area intersections are consistent with the 2019 HG TIS. A westbound left-turn lane with 15 metres of storage is warranted on 16th Street East at 22nd Avenue East under 2024 total conditions without the "Strain" property and 25 metres of storage is warranted with the "Strain" property.

It is recommended to implement all-way stop control at the 20th Avenue East and Site Access / Smart Centres Access intersection based on a sensitivity analysis to improve operations.

Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.



Stefan Hajgato, P.Eng.
Project Engineer, Transportation

SH/AF

C.C.

Enclosure

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Attachment A

Internal Capture Worksheets

New Internal Trip Capture Methodology for Multi-Use Developments

Based on NCHRP Project 8-51

Note: Saturday is assumed to be the same as PM Peak Hour for Multi-Use Reductions, if Saturday Multi-Use is assumed, this must be disclosed
Do not modify values in Grey Cells

INPUTS

Volumes

Use	AM Volumes		PM Volumes		Saturday Volumes	
	Entering	Exiting	Entering	Exiting	Entering	Exiting
Office						
Retail			323	329	414	400
Restaurant			133	119	197	198
Cinema/ Entertainment						
Residential						
Hotel						

Proximity of Uses

Use	Separation Distance (In Feet)					
	Office	Retail	Restaurant	Cinema/ Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail			600	0	0	0
Restaurant		600		0	0	0
Cinema/ Entertainment					0	0
Residential						0
Hotel						

OUTPUTS

AM Peak Hour Multi-Use Reduction Summary

	Office	Retail	Restaurant	Cinema/ Entertainment	Residential	Hotel	In	In%
Office	0	0	0	0	0	0	0	0%
Retail	0	0	0	0	0	0	0	0%
Restaurant	0	0	0	0	0	0	0	0%
Cinema/ Entertainment	0	0	0	0	0	0	0	0%
Residential	0	0	0	0	0	0	0	0%
Hotel	0	0	0	0	0	0	0	0%
Out	0	0	0	0	0	0		
Out %	0%	0%	0%	0%	0%	0%		

PM Peak Hour Multi-Use Reduction Summary (Contains Proximity Factors)

	Office	Retail	Restaurant	Cinema/ Entertainment	Residential	Hotel	In	In%
Office	0	0	0	0	0	0	0	0%
Retail	0	0	49	0	0	0	49	15%
Restaurant	0	39	0	0	0	0	39	29%
Cinema/ Entertainment	0	0	0	0	0	0	0	0%
Residential	0	0	0	0	0	0	0	0%
Hotel	0	0	0	0	0	0	0	0%
Out	0	39	49	0	0	0		
Out %	0%	12%	41%	0%	0%	0%		

Saturday Peak Hour Multi-Use Reduction Summary (Contains Proximity Factors)

	Office	Retail	Restaurant	Cinema/ Entertainment	Residential	Hotel	In	In%
Office	0	0	0	0	0	0	0	0%
Retail	0	0	81	0	0	0	81	20%
Restaurant	0	57	0	0	0	0	57	29%
Cinema/ Entertainment	0	0	0	0	0	0	0	0%
Residential	0	0	0	0	0	0	0	0%
Hotel	0	0	0	0	0	0	0	0%
Out	0	57	81	0	0	0		
Out %	0%	17%	68%	0%	0%	0%		

Supporting Data

Percentages from ITE Journal August 2010: "Improved Estimation of Internal Trip Capture for Mixed-Use Developments"

Residential	1.00	1.00	1.00	1.00	1.00	1.00
Hotel	1.00	1.00	1.00	1.00	1.00	1.00

Red numbers for those land use pairs with proximity factors

Attachment B

2019 Heritage Grove TIS Excerpts

TRAFFIC IMPACT STUDY

**2125 16TH STREET EAST (HERITAGE GROVE)
COMMERCIAL DEVELOPMENT
CITY OF OWEN SOUND**

**PREPARED FOR:
VILLARBOIT (OWEN SOUND) HOLDINGS
LIMITED PARTNERSHIP**

**PREPARED BY:
C.F. CROZIER & ASSOCIATES INC.
40 HURON STREET, SUITE 301
COLLINGWOOD, ON
L9Y 4R3**

APRIL 2019

CFCA FILE NO. 1688-5162

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3.9 Intersection Operations

The existing intersection operations at the study intersections were analyzed using the existing traffic volumes illustrated in **Figure 5**. Detailed capacity analysis worksheets are included in **Appendix F**.

Table 5 outlines the 2019 existing traffic operations.

Table 5
2019 Existing Traffic Operations

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	Critical v/c ratio ²	95 th Percentile Queue Length > Storage Length
16 th Street East and 20 th Avenue East	Signal	P.M.	A	9.1 s	0.43 (NBLT)	None
		SAT.	B	13.6 s	0.65 (NBLT)	None
20 th Avenue East and Site Access / Smart Centres	Stop (Minor Street)	P.M.	B	12.5 s (EBLTR)	0.23 (EBLT)	None
		SAT.	C	20.3 s (EBLTR)	0.54 (EBLT)	None
16 th Street East and RI/RO Site Access	Stop (Minor Street)	P.M.	A	9.7 s (NBR)	0.04 (NBR)	None
		SAT.	A	9.4 s (NBR)	0.03 (NBR)	None

Note 1: The Level of Service of a signalized intersection is based on the average control delay per vehicle (Synchro/ICU). The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM2000).

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection. In addition, all v/c ratios greater than 0.90 for through movements or shared through/turning movements, and v/c ratios greater than 1.00 for exclusive turning movements are outlined and highlighted.

The boundary road network is currently operating at LOS “C” or better during the weekday p.m. and Saturday peak hours with minor control delays and no critical volume-to-capacity ratios or 95th percentile queue lengths. These operations indicate that there is reserve capacity on the boundary road network for future traffic growth.

4.0 Future Background Conditions

4.1 Horizon Years

It is assumed that the proposed addition to the existing commercial development will be fully built-out within the five-year horizon (2024). Thus, the 2024 horizon year was analyzed, as confirmed by City staff in the established Terms of Reference.

4.2 Growth Rate

Background studies that have been prepared for the Sydenham Heights Planning Area have applied a growth rate of 1% compounded annually. For consistency, a 1% growth rate compounded annually was applied to the boundary road network for this analysis, as confirmed by City staff in the established Terms of Reference.

4.3 Future Roadway Improvements

Several new roadways in the Sydenham Heights Planning Area are proposed to serve the future developments in the area and increase roadway connectivity. **Table 6** outlines the future roadway improvements planned in the area.

Table 6
Future Roadway Improvements

Roadway	Segment or Intersection	Improvement	Assumed Year of Completion
20 th Avenue East	South of 16 th Street East	Extend from current southerly limit to 8 th Street East	By 2024 ¹
	North of 16 th Street East	Extend from 16 th Street East northerly	Unknown
18 th Avenue East	South of 16 th Street East	Extend from 10 th Street East to connect to future 20 th Avenue East extension	By 2024 ¹
Future N/S Roadway (assumed to be designated 24 th Avenue East or 26 th Avenue East)	New roadway (to the west of 28 th Avenue East)	New roadway from 16 th Street East to 8 th Street East	By 2024 ¹

Note 1: Phase 1 of the Sydenham Heights Planning Area is expected to be complete by the 2024 horizon year after full build-out of the additional development on the Heritage Grove property.

Appendix G contains excerpts of the Official Plan Amendment for the Sydenham Heights Phase 1 and 2 Planning Areas and illustrates the future roadway alignments.

The primary purpose of the future roadway improvements is to serve future developments local to the Sydenham Heights Planning Area, and thus are not expected to materially affect background travel patterns in the area, except for traffic using the access in the Smart Centre plaza (see Section 4.4 for expected diversions). These improvements were accounted for under future background and total conditions.

The status and timing of the extension of 20th Avenue East north of 16th Street East is unknown at this time. City staff have indicated that the extension of 20th Avenue East north of 16th Street East is not likely to occur within the next five years, and thus have advised Crozier not to account for the extension in this analysis (see **Appendix A** for correspondence).

4.4 Traffic Diversions

Existing travel patterns on the boundary road indicates that between half to two-thirds of the inbound traffic to the Heritage Grove site coming from the west is turning from 16th Street East and that the remaining traffic from the west is cutting through the access in the Smart Centre plaza. It is assumed that some of the traffic cutting through the Smart Centre plaza to access the Heritage Grove site is turning from 18th Avenue East into the Smart Centre site to bypass 16th Street East.

With the future extension of 18th Avenue East from its existing intersection with 10th Street East to the future 20th Avenue East extension, it is assumed that traffic cutting through the Smart Centre plaza to and from the Heritage Grove site will divert and use the 18th Avenue East extension. Trips travelling between the Smart Centres commercial plaza and the Heritage Grove plaza will continue using the

access to 20th Avenue East.

Internal synergy trip capture rates from the ITE Trip Generation Handbook, 2nd Edition, were reviewed to quantify trips travelling between the commercial plazas. The most recent edition of the Trip Generation Handbook (3rd Edition) does not contain internal trip capture rates between the same land uses.

Per Tables 7.1 and 7.2 of the 2nd Edition, retail-to-retail trips may account for 20% of inbound and outbound trips during the weekday p.m. peak hour of adjacent street traffic. Internal capture rates for the Saturday p.m. peak hour are not provided in the 2nd Edition; therefore, a 20% internal trip capture rate was assumed for the Saturday peak hour. Therefore, it was assumed that approximately 80% of traffic entering the Heritage Grove site from the Smart Centres Access will divert to the 18th Avenue East extension during the weekday p.m. and Saturday peak hours. This diversion was applied in the calculation of 2024 future background traffic volumes.

Figure 6 outlines the assumed traffic diversions resulting from the 18th Avenue East extension.

4.5 Background Developments

The Sydenham Heights Planning Area will consist of several future developments in the area that will add traffic to the surrounding road network. **Table 7** outlines the background developments have been accounted for in the calculation of future background volumes, as confirmed by City staff.

Table 7
Background Developments

Development	Location	Proposal
Telfer Creek	Sydenham Heights Phase 1 Planning Area – north of 8 th Street East (on 20 th Avenue East extension)	<ul style="list-style-type: none"> • 49 single-detached residential units • 22 semi-detached residential units • 87 townhouse residential units • Five-storey retirement building with 90 units • Six-storey residential condominium with 96 units and approximately 15,000 sq. ft of ground floor retail.
Redhawk	Sydenham Heights Phase 1 Planning Area – south of 8 th Street East	<ul style="list-style-type: none"> • 50 single-detached residential units • 264 apartment units • 70 townhouse units

Crozier prepared a Traffic Impact Study in 2015 in support of the Redhawk residential development and prepared a Traffic Impact Study 2017 in support of the Telfer Creek development (which also included the Redhawk development as a background development). This 2017 study will herein be referred to as the Telfer Creek TIS.

The Telfer Creek TIS assumed that the developments would be built-out by 2019. Thus, these developments were accounted for under 2024 future background conditions.

4.5.1. Trip Generation

Trip generation for the background developments was forecasted in the Telfer Creek TIS for the weekday a.m. and p.m. peak hours using published data from the ITE Trip Generation Manual, 8th Edition. The ITE Trip Generation Manual is a compendium of industry collected trip generation data across North America for a variety of land uses, and is used industry-wide as a source for trip generation forecasts.

However, the 10th Edition of the Trip Generation Manual has been released since the preparation of the Telfer Creek TIS, and includes updated trip generation data and new land use designations. Accordingly, trip generation was recalculated for the Telfer Creek and Redhawk developments using the Trip Generation Manual, 10th Edition, and also forecasted for the Saturday peak hour for the purposes of this analysis.

The following land use categories were applied to the background developments:

- LUC 210 "Single Family Detached Housing" was applied to the single-detached and semi-detached units for both developments.
- LUC 220 "Multifamily Housing – Low-Rise" was applied to the 87 townhouse units for the Telfer Creek development.
- LUC 221 "Multifamily Housing – Mid-Rise" was applied to the 96 condominium units for the Telfer Creek development.
- LUC 222 "Multifamily Housing – High-Rise" was applied to the 264 apartment units for the Redhawk development.
- LUC 252 "Senior Adult Housing – Attached" was applied to the 90 retirement units for the Telfer Creek development.
- LUC 820 "Shopping Centre" was applied to the ground floor retail area for the Telfer Creek development.

Table 8 outlines the forecasted trip generation for the background developments.

**Table 8
 Background Development Trip Generation**

Development	ITE Land Use Category	Units	Peak Hour	Trips Generated		
				In	Out	Total
Telfer Creek	LUC 210 "Single Family Detached Housing"	71	P.M.	46	27	73
			SAT.	42	36	78
	LUC 220 "Multifamily Housing – Low-Rise"	87	P.M.	33	19	52
			SAT.	33 ¹	19 ¹	52 ¹
	LUC 252 "Senior Adult Housing – Attached"	90	P.M.	13	11	24
			SAT.	18	12	30
	LUC 820 "Shopping Centre"	15,000 sq. ft	P.M.	64	69	133
			SAT.	72	66	138
	LUC 221 "Multifamily Housing – Mid-Rise"	96	P.M.	26	17	43
			SAT.	23	24	47
Total	--	P.M.	182	143	325	
		SAT.	188	157	345	
Redhawk	LUC 210 "Single Family Detached Housing"	50	P.M.	33	19	52
			SAT.	32	28	60
	LUC 222 "Multifamily Housing – High-Rise"	264	P.M.	60	38	98
			SAT.	58	48	106
	LUC 220 "Multifamily Housing – Low-Rise"	70	P.M.	27	16	43
			SAT.	27 ¹	16 ¹	43 ¹
	Total	--	P.M.	120	73	193
			SAT.	117	92	209
Background Development Total	--	P.M.	302	216	518	
		SAT.	305	249	554	

Note 1: Saturday trip generation data was not available for this land use category. The trip generation for the weekday p.m. peak period was applied to the Saturday peak period.

It is not expected that a significant portion of the trips generated by these developments will utilize the boundary road network surrounding the Heritage Grove site (see Section 4.4.2 for Trip Distribution). Thus, for the purposes of conservative analysis, internal trip synergy reductions and pass-by trips were not accounted for in the trip generation forecasts for the Telfer Creek and Redhawk developments.

4.5.2. Trip Distribution

The trips generated by the Telfer Creek and Redhawk developments were distributed to the boundary road network in the Telfer Creek TIS using the following trip distribution:

- 60% arriving from and departing to the west via 8th Street East
- 20% arriving from and departing to the north via 28th Avenue East (Grey County Road 5)
- 20% arriving from and departing to the north via 16th Avenue East

It was assumed that development generated traffic would primarily travel to and from the west via 8th Street East to and from the Downtown area and surrounding areas within Owen Sound. It was also assumed that a portion of trips would arrive from and depart to the east via 28th Avenue East and Highway 26. These traffic volumes would not be expected to access the boundary road network at the Heritage Grove site frontage, and thus were not added to the 2024 future background traffic volumes.

Traffic assigned to 16th Avenue East would be expected to travel to and from the industrial and commercial areas on and north of 16th Street East. However, with the extension of 20th Avenue East to 8th Street East, any local traffic from the Sydenham Heights Planning Area travelling to and from the existing Smart Centres plaza or Heritage Grove property can easily do so via the 20th Avenue Extension.

For this analysis, it was assumed that of the 20% of traffic travelling to the north, 5% would travel to and from the Smart Centres plaza, and 5% would travel to and from the existing Heritage Grove plaza. The remaining 10% are assumed to travel north via 16th Avenue East or the future 18th Avenue East extension connecting to 20th Avenue East.

Figures 7 and 8 outline the background development trip distribution and trip assignment, respectively, on the boundary road network.

4.6 Intersection Operations

The future background intersection operations at the study intersections were analyzed using the 2024 future background traffic volumes illustrated in **Figure 5**. Detailed capacity analysis worksheets are included in **Appendix F**.

Table 9 outlines the 2024 future background traffic operations on the boundary road network.

Table 9
2024 Future Background Traffic Operations

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	Critical v/c ratio ²	95 th Percentile Queue Length > Storage Length
16 th Street East and 20 th Avenue East	Signal	P.M.	A	9.4 s	0.44 (NBLT)	None
		SAT.	B	13.9 s	0.67 (NBLT)	None
20 th Avenue East and Site Access / Smart Centres	Stop (Minor Street)	P.M.	B	11.9 s (EBLTR)	0.21 (WBLTR)	None
		SAT.	C	16.7 s (EBLTR)	0.36 (WBLTR)	None
16 th Street East and RI/RO Site Access	Stop (Minor Street)	P.M.	A	9.7 s (NBR)	0.04 (NBR)	None
		SAT.	A	9.4 s (NBR)	0.03 (NBR)	None

Note 1: The Level of Service of a signalized intersection is based on the average control delay per vehicle (Synchro/ICU). The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM2000).

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection. In addition, all v/c ratios greater than 0.90 for through movements or shared through/turning movements, and v/c ratios greater than 1.00 for exclusive turning movements are outlined and highlighted.

The boundary road network is expected to operate at unchanged levels of service under 2024 future background conditions, with minor delays and no critical volume-to-capacity ratios or 95th percentile queue lengths. Intersection delays on 16th Street East at 20th Avenue East and the RI/RO access are expected to increase by a maximum of 0.3 seconds and volume-to-capacity ratios are expected to increase by a maximum of 0.02.

The intersection delays at 20th Avenue East and Site Access / Smart Centres Access are expected to improve under 2024 future background conditions with the extension of 18th Avenue East to the future 20th Avenue East extension. This extension would be expected to reduce traffic cutting through the Smart Centres plaza, thus reducing intersection approach delays.

These operations indicate that the boundary road network is expected to operate at satisfactory levels of service under 2024 future background conditions.

5.0 Site Generated Traffic

The proposed development will result in additional vehicles on the boundary road network that would otherwise not exist. The proposed development will also result in additional turning movements at the study intersections.

5.1 Unadjusted Trip Generation

Trip generation for the proposed development was forecasted using published data from the ITE Trip Generation Manual, 10th Edition.

The following land uses were applied:

- LUC 945 "Gasoline/Service Station with Convenience Market" for the gas station with eight fuelling stations;
- LUC 932 "High-Turnover (Sit-Down) Restaurant" for the restaurants totalling 23,828 sq. ft of GFA;
- LUC 935 "Fast-Food Restaurant with Drive-Through Window and No Indoor Seating" for the fast-food restaurant.
- LUC 310 "Hotel" for the hotel consisting of 75 rooms; and
- LUC 820 "Shopping Centre" for the future 26,676.2 sq. ft retail building on site.

The shared gas station convenience store and fast-food restaurant building has a GFA 4,099 sq. ft. It is assumed that approximately 75% of the building GFA will be dedicated to the convenience market component and 25% will be dedicated to the fast-food component. Therefore, LUC 935 was applied to a GFA of approximately 1,000 sq. ft, assuming no indoor seating for the fast-food component.

Analysis was conducted using the previous version of the Site Plan dated February 27, 2019, which identified a total restaurant GFA of 23,828 sq. ft. The increase in GFA of 800 sq. ft on the April 2019 Site Plan is expected to result in an increase of 8-9 trips during the weekday p.m. and Saturday peak hours, which would result in negligible impacts to traffic operations. Therefore, the analysis contained within this report was not updated.

As discussed earlier, the restaurant GFA is considered to be overstated, as the proponent has indicated that the expected future restaurant GFA will be less than the total GFA indicated on the Site Plan. Accordingly, trip generation forecasts are expected to be overstated.

Table 10 outlines the unadjusted trip generation for the proposed development.

**Table 10
 Unadjusted Trip Generation**

ITE Land Use Category	GFA / Units	Weekday PM Peak			Saturday Peak		
		In	Out	Total	In	Out	Total
LUC 945 "Gasoline/Service Station with Convenience Market"	8 fuelling stations	57	55	112	77	77	154
LUC 932 "High-Turnover (Sit-Down) Restaurant"	23,828 sq. ft	144	89	233	136	131	267
LUC 935 "Fast-Food Restaurant with Drive-Through Window and No Indoor Seating"	1,000 sq. ft	22	21	43	22 ¹	21 ¹	43 ¹
LUC 310 "Hotel"	75 rooms	15	15	30	31	25	56
LUC 820 "Shopping Centre"	26,680 sq. ft	98	106	204	113	105	208
Total		336	286	622	379	359	738

Note 1: Data was not available for the Saturday peak hour; thus, the weekday p.m. peak hour trip generation forecasts were applied to the Saturday peak hour.

5.2 Internal Trip Capture

As with many multiuse integrated sites, internal interaction between the facilities is expected to occur.

Tables 7.1 and 7.2 of the ITE Trip Generation Handbook, 2nd Edition, outline an internal trip capture rate of 20% for retail-to-retail uses during the weekday p.m. peak hour of adjacent street traffic, which is also assumed for the Saturday peak hour. Accordingly, it can be reasonably assumed that approximately 20% of site generated traffic will be internal amongst the additional uses on the subject property. Thus, an internal trip capture reduction of 20% was applied to the trip generation forecasts outlined in **Table 10**.

Table 11 outlines the external trip generation for the proposed development.

Table 11
Trip Generation - External Trips

Land Use	GFA / Units	Weekday PM Peak			Saturday Peak		
		In	Out	Total	In	Out	Total
Gasoline Station with Convenience Market	8 pumps	46	44	90	62	62	124
Sit-Down Restaurant	23,828 sq. ft	115	71	186	109	105	214
Fast-Food Restaurant	1,000 sq. ft	18	17	35	18	17	35
Hotel	75 rooms	12	12	24	25	20	45
Retail	26,680 sq. ft	78	85	163	90	84	174
Total		269	229	498	304	288	592

The proposed additional uses are expected to generate approximately 498 and 592 total two-way external trips during the weekday p.m. and Saturday peak hours, respectively.

5.3 Pass-By Trips

As defined by the ITE Trip Generation Handbook, 3rd Edition, primary trips are trips made for the specific purpose of visiting the generator and pass-by trips are made as intermediate stops on the way from an origin to a primary trip destination. Accordingly, these trips do not increase the volume of vehicles on the roadway.

Table 12 outlines the pass-by trip rates for the applicable ITE land use categories.

Table 13
Trip Generation – Primary and Pass-By Trips

Land Use	Trip Type	Weekday PM Peak			Saturday Peak		
		In	Out	Total	In	Out	Total
Gasoline Station with Convenience Market	Primary	20	19	39	27	27	54
	Pass-By	26	25	51	35	35	70
Sit-Down Restaurant	Primary	66	40	106	62	60	122
	Pass-By	49	31	80	47	45	92
Fast-Food Restaurant	Primary	9	8	17	9	8	17
	Pass-By	9	9	18	9	9	18
Hotel	Primary	12	12	24	25	20	45
	Pass-By	0	0	0	0	0	0
Retail	Primary	51	56	107	67	62	129
	Pass-By	27	29	56	23	22	45
Total	Primary	158	135	293	190	177	367
	Pass-By	111	94	205	114	111	225

The proposed additional uses are expected to generate approximately 293 and 367 total two-way primary trips during the weekday p.m. and Saturday peak hours, respectively; and approximately 205 and 225 total two-way pass-by trips during the weekday p.m. and Saturday peak hours, respectively.

5.4 Trip Distribution

5.4.1 Primary Trips

The primary trips generated by the proposed additional uses were assigned to the boundary road network based on expected catchment areas and existing travel patterns to and from the existing Heritage Grove site.

It is assumed that all primary trips generated by the proposed additional uses will be primarily local to Owen Sound. Thus, trips would primarily be expected to arrive from and depart to the west via 16th Street East and the new 18th Avenue East extension, and the south from the proximate Sydenham Heights area via 20th Avenue East.

The following primary trip distribution was assumed for the proposed additional uses.

- 40% arriving from and departing to the west via the 18th Avenue East extension and 20th Avenue East extension;
- 20% arriving from the south from the Sydenham Height planning area via the 20th Avenue East extension
- 30% arriving from and departing to the west via 16th Street East.
- 10% arriving from and departing to the east via Highway 26.

Trips generated by the gas-station, fast-food restaurant or the sit-down restaurants on the west side of the site arriving from the west on 16th Street East would be expected to primarily enter via the proposed RI-only access on 16th Street East. Trips generated by the future retail building or the sit-down restaurants on the east side of the site arriving from the west on 16th Street East would be expected to enter via the existing RI/RO access.

It is assumed that trips generated by the hotel arriving from the west via 16th Street East would be diffused between the existing RI/RO access and the future 22nd Avenue East roadway. All trips generated by the hotel departing to the west, and all trips arriving from and departing to the east are assumed to do so via the future 22nd Avenue East roadway.

Figure 10 outlines the primary trip distribution for the gas-station, fast-food restaurant, sit-down restaurants and retail component uses. **Figure 11** outlines the primary trip distribution for the hotel use.

5.4.2. Pass-By Trips

The pass-by trips generated by the fast-food restaurant and gas station were distributed to the boundary road network based on existing travel patterns on 16th Street East.

For eastbound traffic, it was assumed that the majority of the pass-by trips would enter the site from the west via the proposed RI-only access on 16th Street East, but that a portion would also enter from the west via the existing RI/RO access. It was assumed that the majority of the pass-by trips would exit the site to the east via the existing RI/RO access, but that a portion would also exit to the east via the future 22nd Avenue East roadway.

Trip diversions for westbound traffic were accounted for with the extension of 18th Avenue East to the 20th Avenue East extension. For example, a portion of the pass-by trips originating from the east that would initially travel westbound on 16th Street East and then on 18th Avenue East may divert to 22nd Avenue East to access the site, and then exit to continue westbound via the 18th Avenue East Extension. This would result in a reduction of through traffic to the west of the site on 16th Street East, and an increase to traffic on the future 18th Avenue East extension.

Figure 12 outlines the pass-by trip distribution for the proposed additional uses.

5.4.3. Trip Assignment

The trip distributions outlined in Sections 5.4.1 and 5.4.2 were applied to the external trip generation to calculate the trip assignment for the proposed additional uses.

Figure 13 outlines the primary trip assignment for the gas-station, fast-food restaurant, sit-down restaurants and retail component uses. **Figure 14** outlines the primary trip assignment for the hotel use. **Figure 15** outlines the pass-by trip assignment for the proposed additional uses.

Attachment C

Traffic Signal Warrants

Major Road: 22nd Avenue
 Minor Road: 16th Street East
 Horizon Year: 2024

Condition: Restricted Flow
 Major Rd. Lanes: 1
 Intersection Type: Proposed

Date: Nov 2022
 Project No.: 1688-5162
 Analyst: SDH

OTM Book 12 - Table 19 - Justification 7 - Projected Volumes (Traffic Signal Justification for Future Development - Traffic Impact Studies)

JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT 1 LANE HIGHWAYS		MINIMUM REQUIREMENT 2 OR MORE LANE HIGHWAYS		COMPLIANCE		
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	Sectional		Entire Percentage
						Numerical	Percentage	
1. Minimum Vehicular Volume	A. Vehicle Volume, All Approaches (Avg. Hour)	1080	1620	1350	2025	1030	64%	44%
	B. Vehicle Volume, Along Minor Streets (Avg. Hour)	270	383	270	383	170	44%	
2. Delay to Cross Traffic	A. Vehicle Volume, Major Street (Avg. Hour)	1080	1620	1350	2025	860	53%	53%
	B. Combined Vehicle and Pedestrian Volume Crossing Artery From Minor Streets (Avg. Hour)	113	169	270	383	146	86%	

Note:

Existing Intersection Requires 120 % Justification
 Proposed Intersection Requires 150 % Justification

Signal Justification 7 Met: Yes No

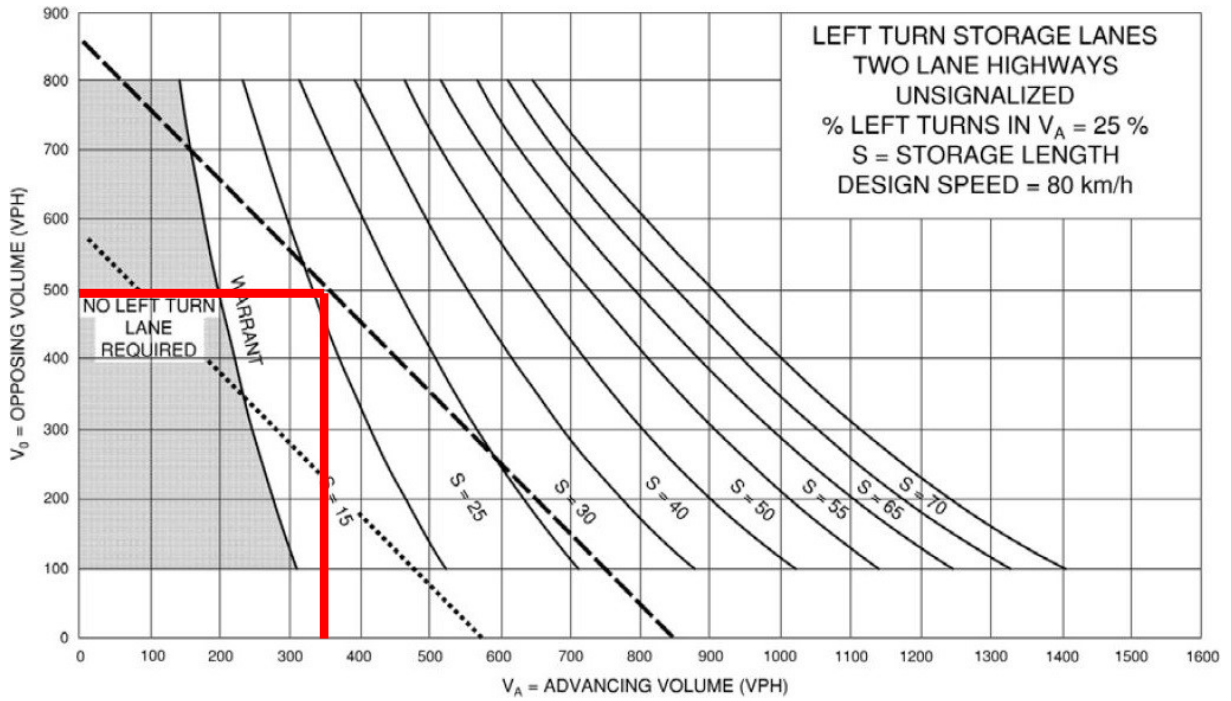
Attachment D

Left-Turn Lane Nomographs

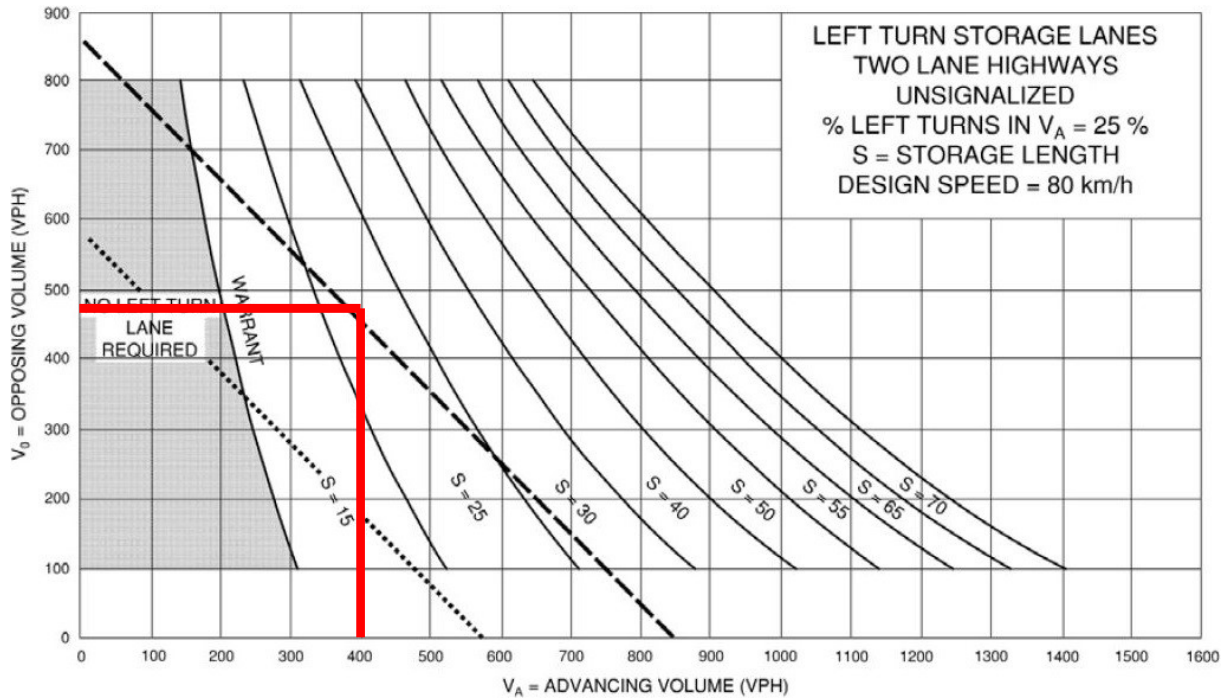
Left-Turn Lane Warrant – 2024 Total Traffic Volumes

16th Street East at 22nd Avenue East

PM Peak Hour



Saturday Peak Hour



Attachment E

Level of Service Definitions

Level of Service Definitions

Two-Way Stop Controlled Intersections

Level of Service	Control Delay per Vehicle (seconds)	Interpretation
A	≤ 10	EXCELLENT. Large and frequent gaps in traffic on the main roadway. Queuing on the minor street is rare.
B	> 10 and ≤ 15	VERY GOOD. Many gaps exist in traffic on the main roadway. Queuing on the minor street is minimal.
C	> 15 and ≤ 25	GOOD. Fewer gaps exist in traffic on the main roadway. Delay on minor approach becomes more noticeable.
D	> 25 and ≤ 35	FAIR. Infrequent and shorter gaps in traffic on the main roadway. Queue lengths develop on the minor street.
E	> 35 and ≤ 50	POOR. Very infrequent gaps in traffic on the main roadway. Queue lengths become noticeable.
F	> 50	UNSATISFACTORY. Very few gaps in traffic on the main roadway. Excessive delay with significant queue lengths on the minor street.




















Adapted from Highway Capacity Manual 2000, Transportation Research Board

Attachment F

Synchro Operations Reports

Lanes, Volumes, Timings
1: 20th Avenue East/Private Access & 16th Street East

2024 Future Total PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	425	130	56	324	1	175	0	80	0	0	0
Future Volume (vph)	0	425	130	56	324	1	175	0	80	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		5%			0%			0%			0%	
Storage Length (m)	0.0		0.0	40.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		1	1		0	0		1	0		0
Taper Length (m)	7.5			100.0			7.5			7.5		
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		0.850						0.850				
Flt Protected				0.950				0.950				
Satd. Flow (prot)	0	1816	1575	1703	1760	0	0	1805	1615	0	1900	0
Flt Permitted				0.464				0.757				
Satd. Flow (perm)	0	1816	1575	832	1760	0	0	1438	1615	0	1900	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			140						86			
Link Speed (k/h)		60			60			50			50	
Link Distance (m)		109.2			158.3			80.3			54.9	
Travel Time (s)		6.6			9.5			5.8			4.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	2%	0%	6%	8%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	457	140	60	348	1	188	0	86	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	457	140	60	349	0	0	188	86	0	0	0
Turn Type		NA	Perm	Perm	NA		Perm	NA	Perm			
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6			4		4	8		
Detector Phase	2	2	2	6	6		4	4	4	8	8	
Switch Phase												
Minimum Initial (s)	40.0	40.0	40.0	40.0	40.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	47.0	47.0	47.0	47.0	47.0		41.0	41.0	41.0	41.0	41.0	
Total Split (s)	47.0	47.0	47.0	47.0	47.0		41.0	41.0	41.0	41.0	41.0	
Total Split (%)	53.4%	53.4%	53.4%	53.4%	53.4%		46.6%	46.6%	46.6%	46.6%	46.6%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)		7.0	7.0	7.0	7.0			6.0	6.0		6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	None	None	None	None	
Act Effct Green (s)		40.6	40.6	40.6	40.6			16.1	16.1			
Actuated g/C Ratio		0.58	0.58	0.58	0.58			0.23	0.23			
v/c Ratio		0.43	0.14	0.12	0.34			0.57	0.20			
Control Delay		10.6	2.1	8.8	9.6			30.4	6.4			
Queue Delay		0.0	0.0	0.0	0.0			0.0	0.0			
Total Delay		10.6	2.1	8.8	9.6			30.4	6.4			
LOS		B	A	A	A			C	A			
Approach Delay		8.6			9.5			22.9				
Approach LOS		A			A			C				

Lanes, Volumes, Timings
 1: 20th Avenue East/Private Access & 16th Street East

2024 Future Total PM

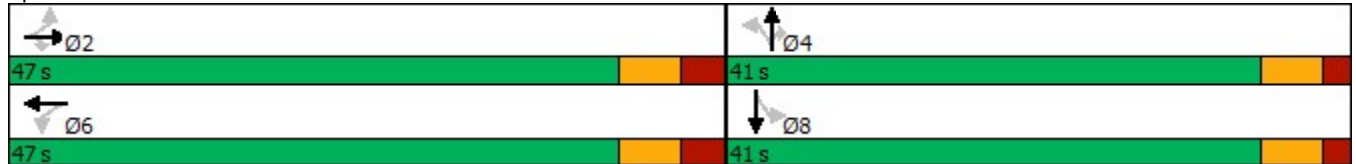


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)		30.9	0.0	3.3	22.1			22.6	0.0			
Queue Length 95th (m)		64.5	7.7	10.6	47.2			41.2	9.5			
Internal Link Dist (m)		85.2			134.3			56.3			30.9	
Turn Bay Length (m)				40.0								
Base Capacity (vph)		1057	975	484	1024			723	855			
Starvation Cap Reductn		0	0	0	0			0	0			
Spillback Cap Reductn		0	0	0	0			0	0			
Storage Cap Reductn		0	0	0	0			0	0			
Reduced v/c Ratio		0.43	0.14	0.12	0.34			0.26	0.10			

Intersection Summary




















Area Type:	Other
Cycle Length:	88
Actuated Cycle Length:	69.7
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.57
Intersection Signal Delay:	12.0
Intersection LOS:	B
Intersection Capacity Utilization	78.3%
ICU Level of Service	D
Analysis Period (min)	15

Splits and Phases: 1: 20th Avenue East/Private Access & 16th Street East



Lanes, Volumes, Timings
 2: 20th Avenue/20th Avenue East & Service Road/Site Access




















2024 Future Total PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Future Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	0		1	0		0	1		0	0		1
Taper Length (m)	7.5			7.5			75.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor												
Frt			0.850		0.935			0.881				0.850
Flt Protected		0.956			0.976			0.996			0.971	
Satd. Flow (prot)	0	1816	1615	0	1734	0	0	3154	0	0	1812	1509
Flt Permitted		0.956			0.976			0.996			0.971	
Satd. Flow (perm)	0	1816	1615	0	1734	0	0	3154	0	0	1812	1509
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		59.1			70.6			121.6			80.3	
Travel Time (s)		4.3			5.1			8.8			5.8	
Confl. Peds. (#/hr)			1	1								
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	0%	0%	3%	0%	7%
Adj. Flow (vph)	82	7	30	205	11	199	20	38	219	102	69	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	89	30	0	415	0	0	277	0	0	171	54
Sign Control		Stop			Stop			Free			Free	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	52.0% ICU Level of Service A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
 2: 20th Avenue/20th Avenue East & Service Road/Site Access

2024 Future Total PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	69	6	25	172	9	167	17	32	184	86	58	45
Future Volume (Veh/h)	69	6	25	172	9	167	17	32	184	86	58	45
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	82	7	30	205	11	199	20	38	219	102	69	54
Pedestrians								1				
Lane Width (m)								3.6				
Walking Speed (m/s)								1.2				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											80	
pX, platoon unblocked												
vC, conflicting volume	536	570	70	495	514	128	123			257		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	536	570	70	495	514	128	123			257		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	73	98	97	50	97	78	99			92		
cM capacity (veh/h)	307	394	984	411	424	904	1433			1298		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total	89	30	415	39	238	171	54					
Volume Left	82	0	205	20	0	102	0					
Volume Right	0	30	199	0	219	0	54					
cSH	312	984	557	1433	1700	1298	1700					
Volume to Capacity	0.28	0.03	0.75	0.01	0.14	0.08	0.03					
Queue Length 95th (m)	9.2	0.8	51.5	0.3	0.0	2.0	0.0					
Control Delay (s)	21.0	8.8	28.0	3.9	0.0	5.0	0.0					
Lane LOS	C	A	D	A		A						
Approach Delay (s)	18.0		28.0	0.6		3.8						
Approach LOS	C		D									
Intersection Summary												
Average Delay			14.3									
Intersection Capacity Utilization			52.0%	ICU Level of Service		A						
Analysis Period (min)			15									

Lanes, Volumes, Timings
 3: Site Access & 16th Street East

2024 Future Total PM



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑		↗
Traffic Volume (vph)	405	115	0	392	0	96
Future Volume (vph)	405	115	0	392	0	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00
Frt	0.967			0.865		
Flt Protected						
Satd. Flow (prot)	3287	0	0	1792	0	1644
Flt Permitted						
Satd. Flow (perm)	3287	0	0	1792	0	1644
Link Speed (k/h)	60			60	50	
Link Distance (m)	158.3			141.1	84.6	
Travel Time (s)	9.5			8.5	6.1	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	2%	21%	0%	6%	0%	0%
Adj. Flow (vph)	445	126	0	431	0	105
Shared Lane Traffic (%)						
Lane Group Flow (vph)	571	0	0	431	0	105
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	27.5%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis

3: Site Access & 16th Street East

2024 Future Total PM



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑		↗
Traffic Volume (veh/h)	405	115	0	392	0	96
Future Volume (Veh/h)	405	115	0	392	0	96
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	445	126	0	431	0	105
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		TWLTL			
Median storage veh	2					
Upstream signal (m)	158					
pX, platoon unblocked						
vC, conflicting volume			571		939	286
vC1, stage 1 conf vol					508	
vC2, stage 2 conf vol					431	
vCu, unblocked vol			571		939	286
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	85
cM capacity (veh/h)			1012		476	717
Direction, Lane #	EB 1	EB 2	WB 1	NB 1		
Volume Total	297	274	431	105		
Volume Left	0	0	0	0		
Volume Right	0	126	0	105		
cSH	1700	1700	1700	717		
Volume to Capacity	0.17	0.16	0.25	0.15		
Queue Length 95th (m)	0.0	0.0	0.0	4.1		
Control Delay (s)	0.0	0.0	0.0	10.9		
Lane LOS					B	
Approach Delay (s)	0.0		0.0	10.9		
Approach LOS					B	
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			27.5%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings
4: 22nd Avenue East & 16th Street East

2024 Future Total PM



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	79	82	257	135	23
Future Volume (vph)	422	79	82	257	135	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)		0.0	25.0		30.0	0.0
Storage Lanes		0	1		1	1
Taper Length (m)			7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.979					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	0	1770	1863	1770	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	1824	0	1770	1863	1770	1583
Link Speed (k/h)	60			60	50	
Link Distance (m)	141.1			156.3	140.9	
Travel Time (s)	8.5			9.4	10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	459	86	89	279	147	25
Shared Lane Traffic (%)						
Lane Group Flow (vph)	545	0	89	279	147	25
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	49.0%
	ICU Level of Service A
Analysis Period (min)	15




















HCM Unsignalized Intersection Capacity Analysis
4: 22nd Avenue East & 16th Street East

2024 Future Total PM

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗		↘	↖	↘	↗
Traffic Volume (veh/h)	422	79	82	257	135	23
Future Volume (Veh/h)	422	79	82	257	135	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	459	86	89	279	147	25
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh	2					
Upstream signal (m)	299					
pX, platoon unblocked			0.94	0.94	0.94	
vC, conflicting volume			545	959	502	
vC1, stage 1 conf vol				502		
vC2, stage 2 conf vol				457		
vCu, unblocked vol			487	926	442	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)			2.2	3.5	3.3	
p0 queue free %			91	69	96	
cM capacity (veh/h)			1014	471	581	
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	
Volume Total	545	89	279	147	25	
Volume Left	0	89	0	147	0	
Volume Right	86	0	0	0	25	
cSH	1700	1014	1700	471	581	
Volume to Capacity	0.32	0.09	0.16	0.31	0.04	
Queue Length 95th (m)	0.0	2.3	0.0	10.5	1.1	
Control Delay (s)	0.0	8.9	0.0	16.1	11.5	
Lane LOS		A		C	B	
Approach Delay (s)	0.0	2.1		15.4		
Approach LOS				C		
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization			49.0%	ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings
1: 20th Avenue East/Private Access & 16th Street East

2024 Future Total SAT

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	392	237	71	353	0	326	0	97	0	0	0
Future Volume (vph)	0	392	237	71	353	0	326	0	97	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		5%			0%			0%			0%	
Storage Length (m)	0.0		0.0	40.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		1	1		0	0		1	0		0
Taper Length (m)	7.5			100.0			7.5			7.5		
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		0.850							0.850			
Flt Protected				0.950				0.950				
Satd. Flow (prot)	0	1816	1559	1805	1827	0	0	1805	1599	0	1900	0
Flt Permitted				0.445				0.757				
Satd. Flow (perm)	0	1816	1559	846	1827	0	0	1438	1599	0	1900	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			260						107			
Link Speed (k/h)		60			60			50			50	
Link Distance (m)		109.2			158.3			80.3			54.9	
Travel Time (s)		6.6			9.5			5.8			4.0	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	2%	1%	0%	4%	0%	0%	0%	1%	0%	0%	0%
Adj. Flow (vph)	0	431	260	78	388	0	358	0	107	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	431	260	78	388	0	0	358	107	0	0	0
Turn Type		NA	Perm	Perm	NA		Perm	NA	Perm			
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6			4		4	8		
Detector Phase	2	2	2	6	6		4	4	4	8	8	
Switch Phase												
Minimum Initial (s)	40.0	40.0	40.0	40.0	40.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	47.0	47.0	47.0	47.0	47.0		41.0	41.0	41.0	41.0	41.0	
Total Split (s)	47.0	47.0	47.0	47.0	47.0		41.0	41.0	41.0	41.0	41.0	
Total Split (%)	53.4%	53.4%	53.4%	53.4%	53.4%		46.6%	46.6%	46.6%	46.6%	46.6%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0		2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)		7.0	7.0	7.0	7.0			6.0	6.0		6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Max	Max	Max	Max	Max		None	None	None	None	None	
Act Effct Green (s)		40.3	40.3	40.3	40.3			25.9	25.9			
Actuated g/C Ratio		0.51	0.51	0.51	0.51			0.33	0.33			
v/c Ratio		0.47	0.28	0.18	0.42			0.76	0.18			
Control Delay		16.2	2.8	14.2	15.4			35.0	4.6			
Queue Delay		0.0	0.0	0.0	0.0			0.0	0.0			
Total Delay		16.2	2.8	14.2	15.4			35.0	4.6			
LOS		B	A	B	B			C	A			
Approach Delay		11.1			15.2			28.0				
Approach LOS		B			B			C				

Lanes, Volumes, Timings
 1: 20th Avenue East/Private Access & 16th Street East

2024 Future Total SAT

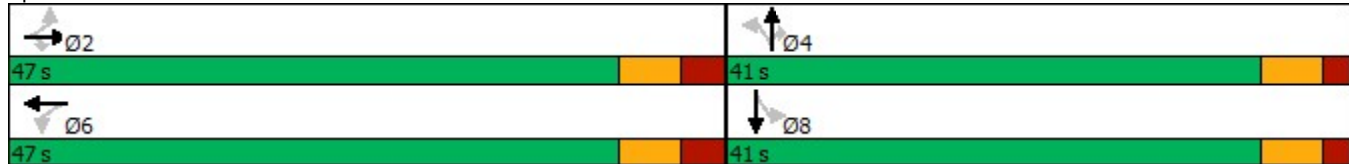


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)		42.5	0.0	6.5	37.1			49.8	0.0			
Queue Length 95th (m)		80.4	12.9	17.6	70.8			80.3	9.6			
Internal Link Dist (m)		85.2			134.3			56.3			30.9	
Turn Bay Length (m)				40.0								
Base Capacity (vph)		922	919	429	927			638	770			
Starvation Cap Reductn		0	0	0	0			0	0			
Spillback Cap Reductn		0	0	0	0			0	0			
Storage Cap Reductn		0	0	0	0			0	0			
Reduced v/c Ratio		0.47	0.28	0.18	0.42			0.56	0.14			

Intersection Summary




















Area Type:	Other
Cycle Length:	88
Actuated Cycle Length:	79.3
Natural Cycle:	90
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.76
Intersection Signal Delay:	17.1
Intersection LOS:	B
Intersection Capacity Utilization	87.9%
ICU Level of Service	E
Analysis Period (min)	15

Splits and Phases: 1: 20th Avenue East/Private Access & 16th Street East



Lanes, Volumes, Timings
 2: 20th Avenue/20th Avenue East & Service Road/Site Access

2024 Future Total SAT

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Future Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	0		1	0		0	1		0	0		1
Taper Length (m)	7.5			7.5			75.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor												
Frt			0.850		0.934			0.890				0.850
Flt Protected		0.957			0.976			0.997			0.980	
Satd. Flow (prot)	0	1802	1615	0	1732	0	0	3186	0	0	1851	1615
Flt Permitted		0.957			0.976			0.997			0.980	
Satd. Flow (perm)	0	1802	1615	0	1732	0	0	3186	0	0	1851	1615
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		59.1			70.6			121.6			80.3	
Travel Time (s)		4.3			5.1			8.8			5.8	
Confl. Peds. (#/hr)	1		3	3		1			1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	0%	0%	0%	5%	1%	0%	0%	1%	0%
Adj. Flow (vph)	114	14	42	264	14	267	26	80	290	110	154	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	128	42	0	545	0	0	396	0	0	264	63
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	70.5%
Analysis Period (min)	15
	ICU Level of Service C

HCM Unsignalized Intersection Capacity Analysis
 2: 20th Avenue/20th Avenue East & Service Road/Site Access

2024 Future Total SAT



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↔			↖↗			↖	↗
Traffic Volume (veh/h)	105	13	39	243	13	246	24	74	267	101	142	58
Future Volume (Veh/h)	105	13	39	243	13	246	24	74	267	101	142	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	14	42	264	14	267	26	80	290	110	154	63
Pedestrians					1			3			1	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (m)											80	
pX, platoon unblocked												
vC, conflicting volume	741	797	157	704	715	187	217			371		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	741	797	157	704	715	187	217			371		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	38	95	95	4	96	68	98			91		
cM capacity (veh/h)	184	286	865	274	319	828	1328			1198		
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total	128	42	545	66	330	264	63					
Volume Left	114	0	264	26	0	110	0					
Volume Right	0	42	267	0	290	0	63					
cSH	191	865	410	1328	1700	1198	1700					
Volume to Capacity	0.67	0.05	1.33	0.02	0.19	0.09	0.04					
Queue Length 95th (m)	32.2	1.2	200.4	0.5	0.0	2.4	0.0					
Control Delay (s)	55.3	9.4	191.7	3.2	0.0	4.0	0.0					
Lane LOS	F	A	F	A		A						
Approach Delay (s)	44.0		191.7	0.5		3.2						
Approach LOS	E		F									
Intersection Summary												
Average Delay			78.7									
Intersection Capacity Utilization			70.5%		ICU Level of Service				C			
Analysis Period (min)			15									

Lanes, Volumes, Timings
 3: Site Access & 16th Street East

2024 Future Total SAT



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑		↗
Traffic Volume (vph)	392	132	0	460	0	89
Future Volume (vph)	392	132	0	460	0	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00
Frt	0.962				0.865	
Flt Protected						
Satd. Flow (prot)	3283	0	0	1845	0	1644
Flt Permitted						
Satd. Flow (perm)	3283	0	0	1845	0	1644
Link Speed (k/h)	60			60	50	
Link Distance (m)	158.3			141.1	84.6	
Travel Time (s)	9.5			8.5	6.1	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	2%	17%	0%	3%	0%	0%
Adj. Flow (vph)	422	142	0	495	0	96
Shared Lane Traffic (%)						
Lane Group Flow (vph)	564	0	0	495	0	96
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	27.5%
Analysis Period (min)	15
	ICU Level of Service A

HCM Unsignalized Intersection Capacity Analysis

3: Site Access & 16th Street East

2024 Future Total SAT



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑		↗
Traffic Volume (veh/h)	392	132	0	460	0	89
Future Volume (Veh/h)	392	132	0	460	0	89
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	422	142	0	495	0	96
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		TWLTL			
Median storage veh	2					
Upstream signal (m)	158					
pX, platoon unblocked						
vC, conflicting volume			564	988	282	
vC1, stage 1 conf vol				493		
vC2, stage 2 conf vol				495		
vCu, unblocked vol			564	988	282	
tC, single (s)			4.1	6.8	6.9	
tC, 2 stage (s)				5.8		
tF (s)			2.2	3.5	3.3	
p0 queue free %			100	100	87	
cM capacity (veh/h)			1018	461	721	
Direction, Lane #	EB 1	EB 2	WB 1	NB 1		
Volume Total	281	283	495	96		
Volume Left	0	0	0	0		
Volume Right	0	142	0	96		
cSH	1700	1700	1700	721		
Volume to Capacity	0.17	0.17	0.29	0.13		
Queue Length 95th (m)	0.0	0.0	0.0	3.7		
Control Delay (s)	0.0	0.0	0.0	10.8		
Lane LOS					B	
Approach Delay (s)	0.0		0.0	10.8		
Approach LOS					B	
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			27.5%	ICU Level of Service	A	
Analysis Period (min)			15			

Lanes, Volumes, Timings
 4: 22nd Avenue East & 16th Street East

2024 Future Total SAT



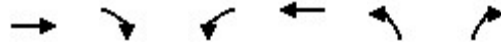
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Traffic Volume (vph)	368	113	92	304	156	26
Future Volume (vph)	368	113	92	304	156	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)		0.0	25.0		30.0	0.0
Storage Lanes		0	1		1	1
Taper Length (m)			7.5		7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.968					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1803	0	1770	1863	1770	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	1803	0	1770	1863	1770	1583
Link Speed (k/h)	60			60	50	
Link Distance (m)	141.1			156.3	140.9	
Travel Time (s)	8.5			9.4	10.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	400	123	100	330	170	28
Shared Lane Traffic (%)						
Lane Group Flow (vph)	523	0	100	330	170	28
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	50.0%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
4: 22nd Avenue East & 16th Street East

2024 Future Total SAT























Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	368	113	92	304	156	26
Future Volume (Veh/h)	368	113	92	304	156	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	400	123	100	330	170	28
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh	2					
Upstream signal (m)	299					
pX, platoon unblocked			0.92		0.92	0.92
vC, conflicting volume			523		992	462
vC1, stage 1 conf vol					462	
vC2, stage 2 conf vol					530	
vCu, unblocked vol			442		949	375
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			90		63	95
cM capacity (veh/h)			1032		453	620
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	
Volume Total	523	100	330	170	28	
Volume Left	0	100	0	170	0	
Volume Right	123	0	0	0	28	
cSH	1700	1032	1700	453	620	
Volume to Capacity	0.31	0.10	0.19	0.37	0.05	
Queue Length 95th (m)	0.0	2.6	0.0	13.7	1.1	
Control Delay (s)	0.0	8.9	0.0	17.6	11.1	
Lane LOS		A		C	B	
Approach Delay (s)	0.0	2.1		16.7		
Approach LOS				C		
Intersection Summary						
Average Delay			3.6			
Intersection Capacity Utilization			50.0%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings

2024 Total PM Sensitivity AWSC

2: 20th Avenue/20th Avenue East & Service Road/Site Access





















												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Future Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	0		1	0		1	1		0	0		1
Taper Length (m)	7.5			7.5			75.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor												
Frt			0.850			0.850		0.881				0.850
Flt Protected		0.956			0.955			0.996			0.971	
Satd. Flow (prot)	0	1816	1615	0	1814	1615	0	3154	0	0	1812	1509
Flt Permitted		0.956			0.955			0.996			0.971	
Satd. Flow (perm)	0	1816	1615	0	1814	1615	0	3154	0	0	1812	1509
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		59.1			70.6			121.6			80.3	
Travel Time (s)		4.3			5.1			8.8			5.8	
Confl. Peds. (#/hr)			1	1								
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	0%	0%	3%	0%	7%
Adj. Flow (vph)	82	7	30	205	11	199	20	38	219	102	69	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	89	30	0	216	199	0	277	0	0	171	54
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	41.8%
Analysis Period (min)	15
	ICU Level of Service A





















HCM Unsignalized Intersection Capacity Analysis
 2: 20th Avenue/20th Avenue East & Service Road/Site Access

2024 Total PM Sensitivity AWSC

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Future Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	82	7	30	205	11	199	20	38	219	102	69	54
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	89	30	216	199	39	238	171	54				
Volume Left (vph)	82	0	205	0	20	0	102	0				
Volume Right (vph)	0	30	0	199	0	219	0	54				
Hadj (s)	0.46	-0.70	0.47	-0.70	0.31	-0.64	0.33	-0.58				
Departure Headway (s)	6.9	5.8	6.5	5.4	6.6	5.6	6.7	5.7				
Degree Utilization, x	0.17	0.05	0.39	0.30	0.07	0.37	0.32	0.09				
Capacity (veh/h)	481	570	526	636	515	604	511	584				
Control Delay (s)	10.2	7.9	12.5	9.4	8.9	10.8	11.5	8.1				
Approach Delay (s)	9.6		11.0		10.5		10.7					
Approach LOS	A		B		B		B					
Intersection Summary												
Delay			10.7									
Level of Service			B									
Intersection Capacity Utilization			41.8%		ICU Level of Service			A				
Analysis Period (min)			15									

Lanes, Volumes, Timings
 2: 20th Avenue/20th Avenue East & Service Road/Site Access

2024 Future Total SAT





















												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Future Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	0		1	0		1	1		0	0		1
Taper Length (m)	7.5			7.5			75.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor												
Frt			0.850			0.850		0.890				0.850
Flt Protected		0.957			0.955			0.997			0.980	
Satd. Flow (prot)	0	1802	1615	0	1814	1615	0	3186	0	0	1851	1615
Flt Permitted		0.957			0.955			0.997			0.980	
Satd. Flow (perm)	0	1802	1615	0	1814	1615	0	3186	0	0	1851	1615
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		59.1			70.6			121.6			80.3	
Travel Time (s)		4.3			5.1			8.8			5.8	
Confl. Peds. (#/hr)	1		3	3		1			1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	0%	0%	0%	5%	1%	0%	0%	1%	0%
Adj. Flow (vph)	114	14	42	264	14	267	26	80	290	110	154	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	128	42	0	278	267	0	396	0	0	264	63
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	55.4%
ICU Level of Service	B
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
 2: 20th Avenue/20th Avenue East & Service Road/Site Access




















2024 Future Total SAT

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Future Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	14	42	264	14	267	26	80	290	110	154	63
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total (vph)	128	42	278	267	66	330	264	63				
Volume Left (vph)	114	0	264	0	26	0	110	0				
Volume Right (vph)	0	42	0	267	0	290	0	63				
Hadj (s)	0.46	-0.70	0.47	-0.70	0.24	-0.61	0.22	-0.70				
Departure Headway (s)	8.1	6.9	7.5	6.3	7.4	6.6	7.5	6.6				
Degree Utilization, x	0.29	0.08	0.58	0.47	0.14	0.60	0.55	0.12				
Capacity (veh/h)	414	476	465	549	462	520	453	518				
Control Delay (s)	13.1	9.4	19.1	13.6	10.4	17.9	18.1	9.2				
Approach Delay (s)	12.2		16.4		16.7		16.4					
Approach LOS	B		C		C		C					
Intersection Summary												
Delay			16.0									
Level of Service			C									
Intersection Capacity Utilization			55.4%		ICU Level of Service				B			
Analysis Period (min)			15									

Lanes, Volumes, Timings

2024 Total PM Sensitivity AWSC

2: 20th Avenue/20th Avenue East & Service Road/Site Access

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Future Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	0		1	0		0	1		0	0		1
Taper Length (m)	7.5			7.5			75.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor												
Frt			0.850		0.935			0.881				0.850
Flt Protected		0.956			0.976			0.996			0.971	
Satd. Flow (prot)	0	1816	1615	0	1734	0	0	3154	0	0	1812	1509
Flt Permitted		0.956			0.976			0.996			0.971	
Satd. Flow (perm)	0	1816	1615	0	1734	0	0	3154	0	0	1812	1509
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		59.1			70.6			121.6			80.3	
Travel Time (s)		4.3			5.1			8.8			5.8	
Confl. Peds. (#/hr)			1	1								
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	6%	0%	0%	3%	0%	7%
Adj. Flow (vph)	82	7	30	205	11	199	20	38	219	102	69	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	89	30	0	415	0	0	277	0	0	171	54
Sign Control		Stop			Stop			Stop			Stop	




















Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	52.0%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis

2024 Total PM Sensitivity AWSC




















2: 20th Avenue/20th Avenue East & Service Road/Site Access

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Future Volume (vph)	69	6	25	172	9	167	17	32	184	86	58	45
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	82	7	30	205	11	199	20	38	219	102	69	54
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	89	30	415	39	238	171	54					
Volume Left (vph)	82	0	205	20	0	102	0					
Volume Right (vph)	0	30	199	0	219	0	54					
Hadj (s)	0.46	-0.70	-0.19	0.31	-0.64	0.33	-0.58					
Departure Headway (s)	7.2	6.0	6.0	6.9	5.9	7.0	6.0					
Degree Utilization, x	0.18	0.05	0.69	0.07	0.39	0.33	0.09					
Capacity (veh/h)	454	534	583	487	565	480	546					
Control Delay (s)	10.5	8.1	21.0	9.3	11.5	12.2	8.5					
Approach Delay (s)	9.9		21.0	11.2		11.3						
Approach LOS	A		C	B		B						
Intersection Summary												
Delay			15.0									
Level of Service			B									
Intersection Capacity Utilization			52.0%		ICU Level of Service				A			
Analysis Period (min)			15									

Lanes, Volumes, Timings

2024 Total Saturday Sensitivity AWSC




















2: 20th Avenue/20th Avenue East & Service Road/Site Access

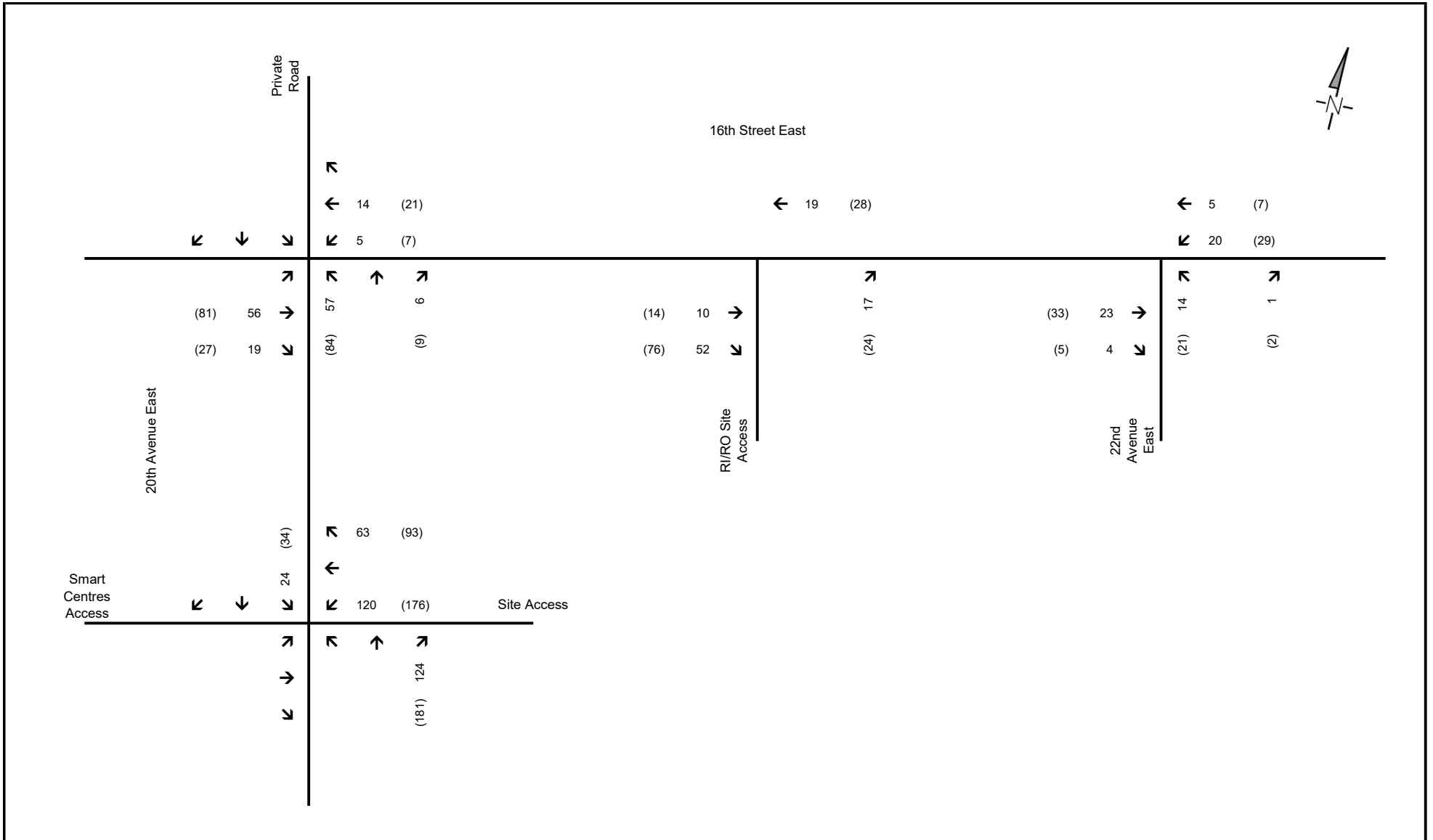
												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Future Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	0		1	0		0	1		0	0		1
Taper Length (m)	7.5			7.5			75.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor												
Frt			0.850		0.934			0.890				0.850
Flt Protected		0.957			0.976			0.997			0.980	
Satd. Flow (prot)	0	1802	1615	0	1732	0	0	3186	0	0	1851	1615
Flt Permitted		0.957			0.976			0.997			0.980	
Satd. Flow (perm)	0	1802	1615	0	1732	0	0	3186	0	0	1851	1615
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		59.1			70.6			121.6			80.3	
Travel Time (s)		4.3			5.1			8.8			5.8	
Confl. Peds. (#/hr)	1		3	3		1			1	1		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	0%	0%	0%	5%	1%	0%	0%	1%	0%
Adj. Flow (vph)	114	14	42	264	14	267	26	80	290	110	154	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	128	42	0	545	0	0	396	0	0	264	63
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	70.5%
ICU Level of Service	C
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis 2024 Total Saturday Sensitivity AWSC
 2: 20th Avenue/20th Avenue East & Service Road/Site Access

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Future Volume (vph)	105	13	39	243	13	246	24	74	267	101	142	58
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	14	42	264	14	267	26	80	290	110	154	63
Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2					
Volume Total (vph)	128	42	545	66	330	264	63					
Volume Left (vph)	114	0	264	26	0	110	0					
Volume Right (vph)	0	42	267	0	290	0	63					
Hadj (s)	0.46	-0.70	-0.20	0.24	-0.61	0.22	-0.70					
Departure Headway (s)	8.6	7.4	7.0	7.9	7.1	8.0	7.1					
Degree Utilization, x	0.31	0.09	1.06	0.15	0.65	0.59	0.12					
Capacity (veh/h)	399	456	502	443	491	430	491					
Control Delay (s)	14.1	9.9	84.1	11.1	21.2	20.6	9.9					
Approach Delay (s)	13.1		84.1	19.5		18.5						
Approach LOS	B		F	C		C						
Intersection Summary												
Delay			43.0									
Level of Service			E									
Intersection Capacity Utilization			70.5%		ICU Level of Service					C		
Analysis Period (min)			15									



Legend
xx P.M. Peak Hour Traffic Volumes
{xx} Weekend Peak Hour Traffic Volumes

Heritage Grove
City of Owen Sound

Site Generated Traffic Volumes
Primary Trips

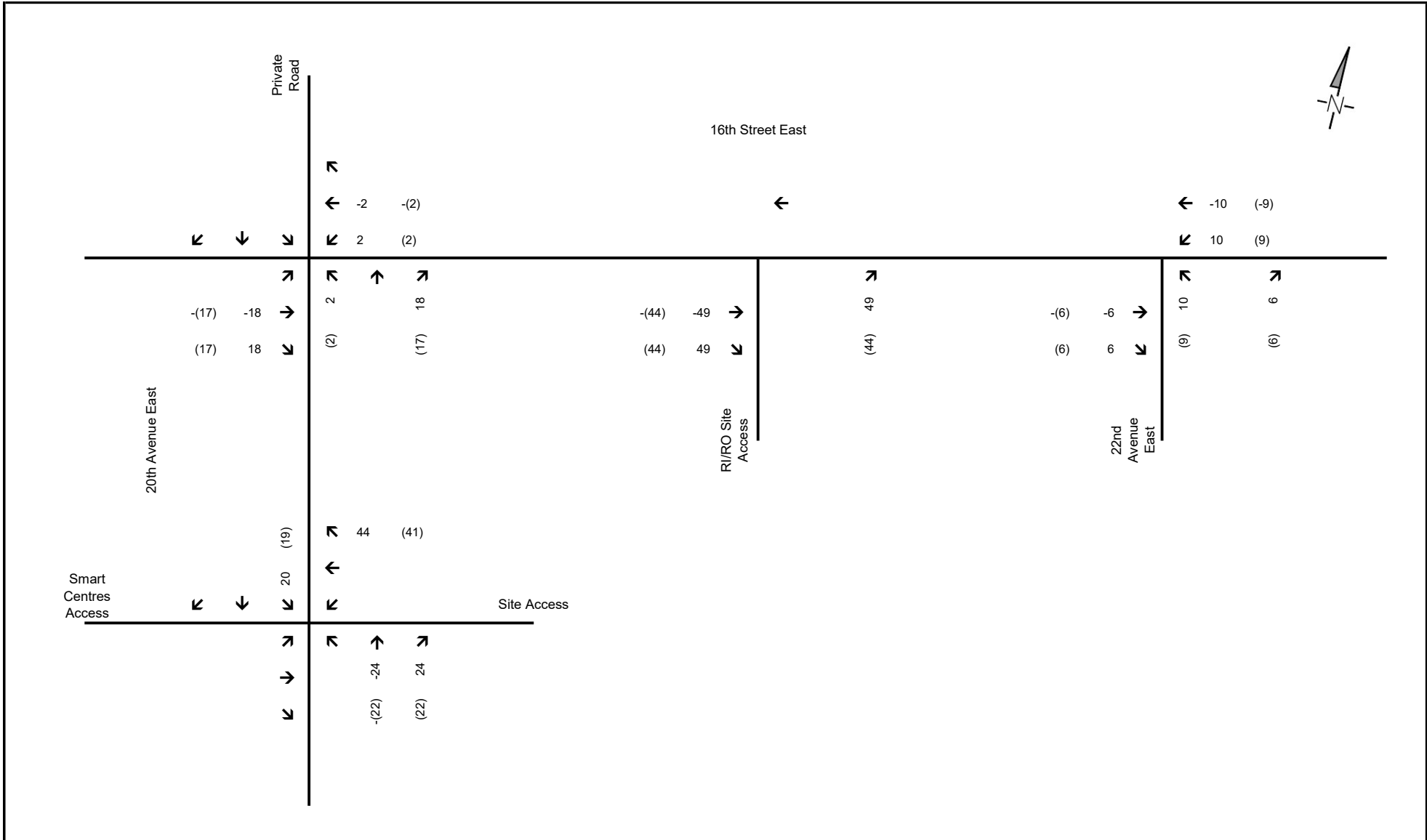


Figure 1

Project Number 1688-5162

Date: 2022.11

Analyst: SDH



Legend
xx P.M. Peak Hour Traffic Volumes
{xx} Weekend Peak Hour Traffic Volumes

Heritage Grove
City of Owen Sound

**Site Generated Traffic Volumes
Pass-By Trips**

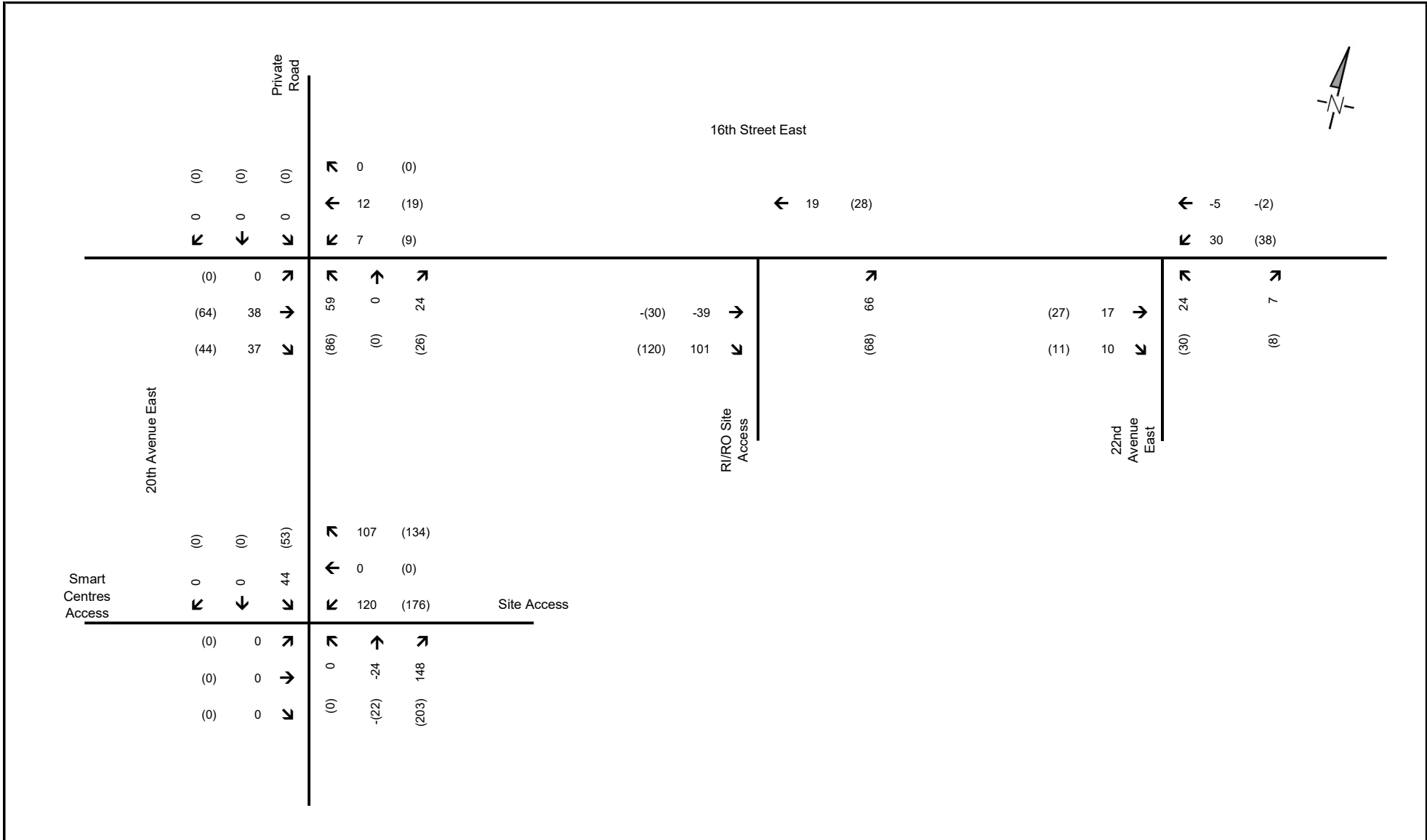


Figure 2

Project Number 1688-5162

Date: 2022.11

Analyst: SDH



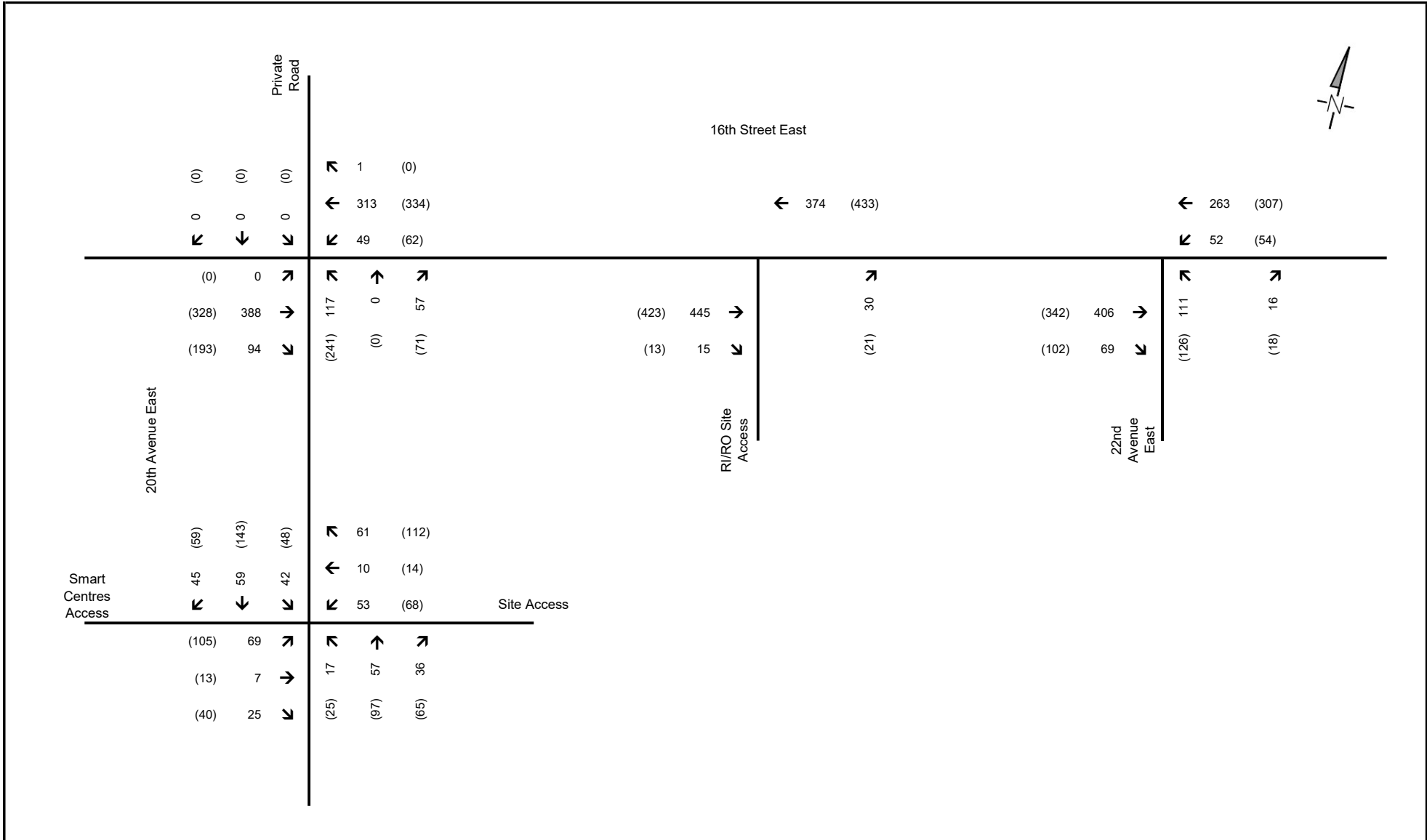
Legend
xx P.M. Peak Hour Traffic Volumes
{xx} Weekend Peak Hour Traffic Volumes

Heritage Grove City of Owen Sound
Site Generated Traffic Volumes

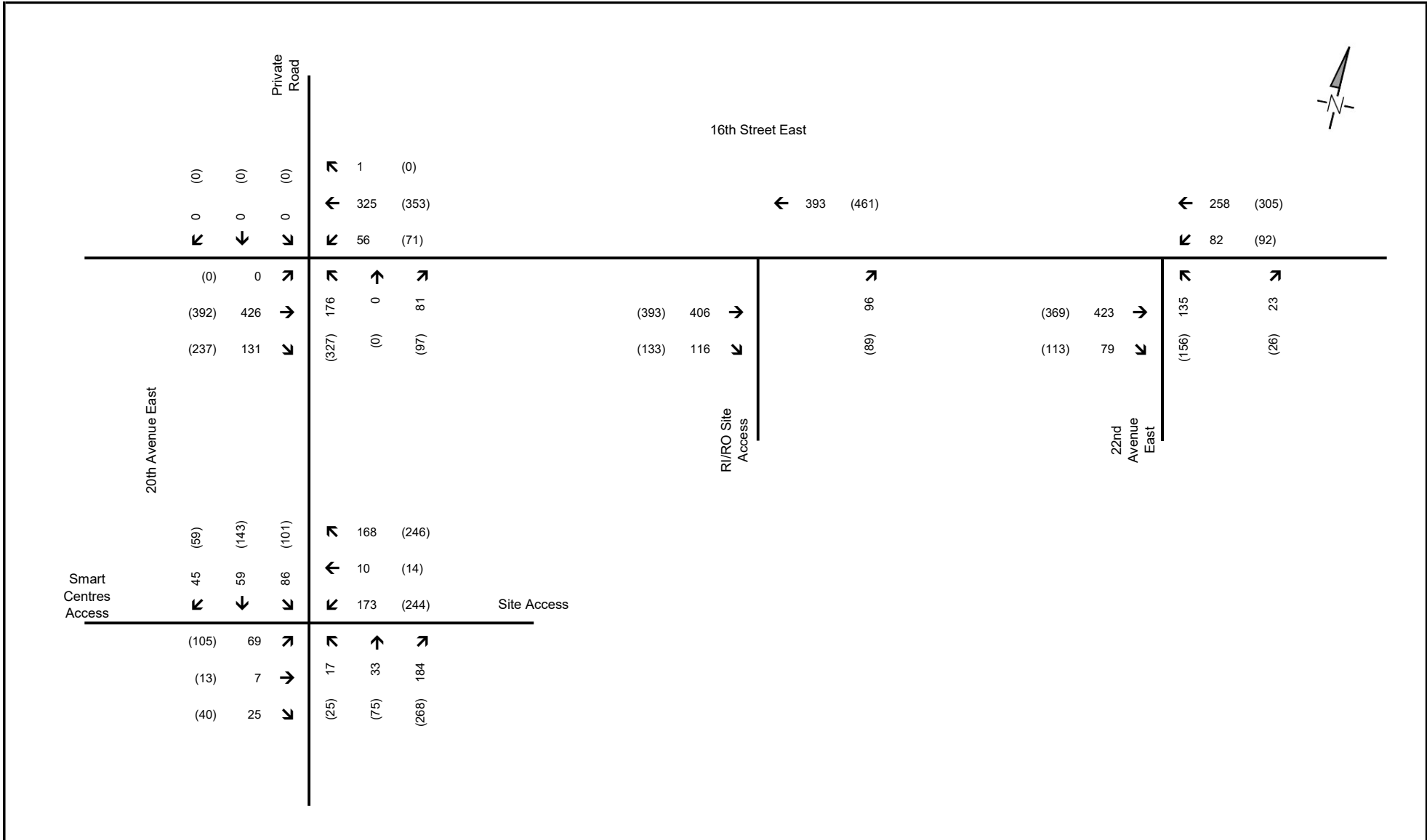


CROZIER
CONSULTING ENGINEERS

Figure 3
Project Number 1688-5162
Date: 2022.11
Analyst: SDH



Legend xx P.M. Peak Hour Traffic Volumes {xx} Weekend Peak Hour Traffic Volumes	Heritage Grove City of Owen Sound		Figure 4
	2024 Background Traffic Volumes		Project Number 1688-5162 Date: 2022.11 Analyst: SDH



Legend
xx P.M. Peak Hour Traffic Volumes
{xx} Weekend Peak Hour Traffic Volumes

Heritage Grove
City of Owen Sound

2024 Total Traffic Volumes

Figure 5

Project Number 1688-5162

Date: 2022.11

Analyst: SDH