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2060 Division Road Subdivision

TRAFFIC IMPACT BRIEF

South Shore Homes

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Issue	Date	Description
1	October 6, 2020	Final Traffic Impact Brief report

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1 Introduction

Tatham Engineering Limited was retained by South Shore Homes to address the traffic impacts associated with the proposed residential development to be located at 2060 Division Road West in the Township of Severn. The location of the development site is illustrated in Figure 1.

The purpose of this study is to review the proposed development from a transportation perspective, addressing site traffic volumes and potential impacts to the adjacent road system. Recognizing that the anticipated trip generation will not be significant - the scope of the study has been limited to a traffic brief. The following will be discussed:

- existing conditions, including a description of the study area road network, traffic volumes, operations and planned/proposed improvements;
- details of the proposed development and anticipated trip generation;
- sight lines at the proposed access, and
- transportation impacts associated with the proposed development.



2 Existing Conditions

This chapter will describe the road network, traffic volumes and operations for the existing conditions.

2.1 ROAD NETWORK

The road network to be addressed by this study consists of Division Road West, Highway 12, Carriage Court and the intersection of Division Road West with Highway 12. Photographs of the road system are provided in Figure 2.

Division Road West

As per *The Corporation of the Township of Severn Official Plan*, Division Road West is designated as a local road. The road is oriented east-west through the study area and has a 2-lane rural cross section, providing one lane of travel per direction with gravel shoulders and open ditches. Division Road West has a posted speed limit of 60 km/h and thus a design speed of 70 km/h has been assumed (posted speed limit + 10 km/h). As a local road, a planning capacity of 400 vehicles per hour per lane (vphpl) has been assumed.

Division Road West & Highway 12

The intersection of Division Road West with Highway 12 is a 4-leg signalized intersection. The north and south approaches (Highway 12) each consist of a left turn lane, a through lane and a right turn lane; whereas the east (Division Road West) and west (County Road 22) approaches consist of a shared left/through/right turn lane (although the approaches are flared and thus can accommodate 2 vehicles side-by-side at the stop bars).

2.2 EXISTING TRAFFIC VOLUMES

To determine existing traffic volumes, traffic counts were obtained from MTO for the intersection of Division Road West with Highway 12, conducted on Thursday July 21, 2016 from 7:00 to 10:00, 12:00 to 14:00 and 15:00 to 18:00. The corresponding traffic count details are provided in Appendix A. While it is acknowledged that traffic data should ideally be no older than 2 years, the current COVID-19 pandemic (and related restrictions) has had a significant impact on traffic volumes - thus, conducting a count at this time may not reflect typical peak conditions. As such, the 2016 volumes have been used in establishing the existing conditions.

To reflect 2020 conditions, an annual growth rate of 2% was applied to the 2016 volumes (additional discussion regarding annual growth is provided in Section 4.1).



For Dunford Drive and Carriage Court, traffic volumes have been estimated based on the level of residential development each road serves (9 single family houses on Dunford Drive and 26 single family houses on Carriage Court. The traffic volumes have been distributed to the road network based on the assumptions detailed in Section 3.5.2, with consideration given to anticipated travel routes.

The resulting 2020 peak hour volumes are illustrated in Figure 3.

2.3 EXISTING TRAFFIC OPERATIONS

2.3.1 Intersection Operations

The existing operations at the intersections of Division Road West with Highway 12, Dunford Drive and Carriage Court have been assessed based on the 2020 traffic volumes, the existing configuration and intersection control and procedures outlined in the 2000 Highway Capacity Manual (using Synchro v.10 software).

The analysis considers the operating conditions for each approach and the overall intersection with respect to average delay (measured in seconds), level of service (LOS) and volume to capacity (v/c). Level of service 'A' corresponds to the best operating condition with minimal delays whereas level of service 'F' corresponds to poor operations resulting from high intersection delays. A v/c ratio of less than 1.0 indicates the intersection movement/approach is operating at less than capacity while v/c of 1.0 indicates capacity has been reached. A summary of the analysis is provided in Table 1, whereas detailed operations worksheets for the existing traffic conditions are included in Appendix B.

As indicated, the subject intersection is currently providing excellent overall operations (LOS B) with minimal delays. No intersection improvements are required to accommodate the existing traffic volumes.

2.3.2 Road Section Operations

As previously noted, a lane capacity of 400 vphpl has been assumed for Division Road West. In consideration of the noted capacity and the peak directional peak hour volumes (113 to 147 vehicles), Division Road West is operating at 37% of capacity or less (i.e. $v/c \leq 0.37$). Thus, the road is operating well within the available capacity. No improvements are recommended to address capacity under existing conditions.



Table 1: Intersection Operations - 2020 Conditions

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			delay	LOS	v/c	delay	LOS	v/c
Division Road West & Highway 12	EB	signal	20	C	0.37	19	B	0.43
	WB	signal	19	B	0.23	19	B	0.39
	NB	signal	4	A	0.30	7	A	0.63
	SB	signal	10	B	0.50	16	B	0.68
	overall	signal	11	B	0.46	13	B	0.64
Division Road West & Dunford Drive	NB	stop	9	A	0.01	10	B	0.00
Division Road West & Carriage Court	SB	stop	9	A	0.01	9	A	0.01



3 Proposed Development

This section will provide additional details with respect to the proposed development, including its location, the projected site generated traffic volumes and the assignment of such to the adjacent road network.

3.1 SITE LOCATION

The subject site is located at 2060 Division Road West in the Township of Severn (as per Figure 1). The property is bounded by Division Road West to the south, commercial development to the west, a residential lot to the north and Carriage Court/residential lots to the east.

3.2 PROPOSED LAND-USE & PHASING

The proposed development will consist of 23 single family detached units. As indicated in the draft plan of Figure 4, the development is divided into two parcels. The west parcel will consist of 16 units, whereas the east parcel will consist of the remaining 7 units.

Full build-out is anticipated by 2022.

3.3 SITE ACCESS

Access to the west parcel will be provided via a new municipal road (Street A) connecting with Division Road West, opposite Dunford Drive (approximately 230 metres east of Highway 12, measured centre of intersection to centre of intersection). The east parcel be served by a cul-de-sac (Street C) with connection to Carriage Court. There will be no internal vehicular connection between the parcels.

Given that the site is located within MTO's permit control area, the proposed location of the Street A connection to Division Road has been reviewed in context of MTO's *Access Management Guidelines* with respect to intersection separation. The *Access Management Guidelines* identify Highway 12 as a Class 2B - Arterial highway. As per the guidelines, the desired separation between a highway intersection and an intersection along a public road is 400 metres, which is intended to promote safety and efficiency of the highway network, and further ensure adequate separation is provided should traffic signals be required at a future date. However, the guidelines also note that intersection spacing requirements for public roads and commercial/private access connections may be decreased based on MTO's review of a traffic impact study. As previously noted, the proposed separation is 230 metres (Dunford Drive is an existing intersection and thus the separation is fixed given the desire to align the new access road with an existing road). While the proposed separation does not satisfy MTO's desired separation, it is not otherwise considered



problematic in that the volumes on Division Road West, and those accessing the site via Street A, are not such that would impact the existing or future operations of Highway 12. The intersection of Division Road West with Street A/Dunford Drive will remain a low volume intersection operating under stop control for the foreseeable future (i.e. traffic signals are not required, nor will they be in the future).

In consideration of the above, the proposed separation of 230 metres is considered appropriate.

3.4 ON-SITE CIRCULATION

The internal road network serving the site will be constructed to the appropriate Township standards for a local road with a 20 metre right-of-way. In this respect, the internal road network will readily accommodate the manoeuvring requirements of passenger vehicles and the appropriate design vehicles (i.e. emergency vehicles, snowplows and garbage trucks).

3.5 SITE TRAFFIC

3.5.1 Trip Generation

The number of vehicle trips to be generated by the proposed development has been determined based on type of use, development size and published ITE trip generation rates. Based on the proposed development, trip rates for the *single family detached* (ITE code 210) land-use have been applied.

The associated trip rates and trip estimates are provided in Table 2. As indicated, the proposed development is expected to generate 17 trips during the weekday AM peak hour and 23 trips during the weekday PM peak hour (total of inbound and outbound trips).

Table 2: Trip Generation Rates - 2060 Division Road West

LAND USE	RATE/ ESTIMATE	VARIABLE / SIZE	AM PEAK HOUR			PM PEAK HOUR		
			IN	OUT	TOTAL	IN	OUT	TOTAL
single family detached (ITE 210)	rate	units	0.19	0.56	0.74	0.62	0.37	0.99
	estimate	23 units	4	13	17	14	9	23

3.5.2 Trip Distribution & Assignment

The distribution of the new trips generated by the site has been developed based on the location of the site in relation to City of Orillia, surrounding development and existing traffic patterns observed at the intersection of Division Road West with Highway 12. The following distribution has been assumed:



- to/from the north - 10%;
- to/from the south - 70%;
- to/from the east - 5%; and
- to/from the west - 15%.

The assignment of the trips generated by the development to the area road network is based on the trip distribution noted above with consideration given to the expected travel routes. Trips generated by units within the west parcel have been assigned to Street A; whereas trips generated by units in the east parcel have been assigned to Street C. The resulting site generated traffic assigned to the road network is illustrated in Figure 5.



4 Transportation Impacts

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

- intersection operations;
- road section operations;
- available sight lines along Division Road West and Carriage Court at the proposed access points; and
- potential improvements to the study area road network, if necessary.

4.1 FUTURE TRAFFIC VOLUMES

While full build-out is anticipated by 2022, the 2025 horizon year has been considered to assess the impact of the development on the road network over a 5-year period.

4.1.1 Background Growth

Population Growth

As per the available census data for the Township of Severn, the population increased from 12,377 in 2011 to 13,477 in 2016, translating to an annual growth rate of 1.7%.

According to *A Place to Grow: Growth Plan for the Greater Golden Horseshoe*¹, the Township's population allocation is 17,000 persons by 2031. When considering the 2016 census data, this translates to an annual growth rate of 1.6%, which is consistent with the historic population growth for the period 2011 to 2016. It is noted that the population provided in the *Growth Plan* reflects an allocation rather than a projection.

Historic Traffic Growth

Historic AADT and SADT volumes (as published by MTO) for Highway 12 through the study area for the period of 2011 to 2016 indicates average annual growth of 2.2% and 1.0%, respectively.

¹*A Place to Grow: Growth Plan for the Greater Golden Horseshoe*. Ministry of Municipal Affairs & Housing, May 2019.



Overall Background Growth

In consideration of the historic growth in the area and future growth projections for the Township, a background growth rate of 2.0% per annum has been applied to the traffic volumes on the study area road network.

4.1.2 2025 Traffic Volumes

The total traffic volumes for the 2025 horizon are provided in Figure 6, reflective of the 2020 volumes adjusted to consider annual growth of 2% and the traffic volumes associated with the proposed development.

4.2 FUTURE TRAFFIC OPERATIONS

4.2.1 Intersection Operations

The intersections of Division Road West with Highway 12, Dunford Drive and Carriage Court were again reviewed to consider the 2025 total conditions, including traffic generated by the proposed development. The results of the assessment are summarized in Table 3 (detailed worksheets are provided in Appendix C). As indicated, the intersections will continue to provide excellent overall operations (LOS B) with minimal delays through the 2025 horizon year. No intersection improvements are required to accommodate the future traffic volumes.

Table 3: Intersection Operations - 2025 Conditions

INTERSECTION, MOVEMENTS & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			delay	LOS	v/c	delay	LOS	v/c
Division Road West & Highway 12	EB	signal	20	C	0.40	29	C	0.67
	WB	signal	20	C	0.34	27	C	0.57
	NB	signal	5	A	0.34	9	A	0.69
	SB	signal	11	B	0.56	19	B	0.70
	overall	signal	11	B	0.51	16	B	0.72
Division Road West & Dunford Drive	NB	stop	9	A	0.01	11	B	0.01
	SB	stop	9	A	0.01	9	A	0.01
Division Road West & Carriage Court	SB	stop	9	A	0.02	9	A	0.02



4.2.2 Road Section Operations

The road section capacity operations for Division Road West have been reviewed for the 2025 horizon period based on the projected total volumes and the existing road network. As previously noted, Division Road West has an assumed capacity of 400 vphpl. As indicated in Figure 6, the peak directional peak hour volumes are in the order of 135 to 169 vehicles. Thus, Division Road West is expected to operate at 42% of capacity or less through the 2025 horizon period ($v/c \leq 0.42$).

4.2.3 Turn Lane Requirements

Despite the otherwise excellent operations provided at the intersections of Division Road West with Street A/Dunford Drive and Carriage Court, the need for exclusive left and right turn lanes on Division Road West to serve turning site traffic has been reviewed in consideration of MTO warrants for exclusive left and right turn lanes at unsignalized intersections on a two lane highway with a design speed of 70 km/h (posted speed + 10 km/h).

MTO guidelines suggest that exclusive right turn lanes be considered where right turn volumes exceed 60 vehicles per hour and impede the operations of through traffic. Based on the existing volume of right turning traffic accessing the site (less than 5 vehicles per hour), exclusive right turn lanes are not warranted.

With respect to left turn lanes to serve the development, the need for such is based on the volume of left turning traffic, the volume of advancing and opposing traffic and the design speed. Given the minimal projected left turn volumes (9 vehicles or less), exclusive left turn lanes are not considered necessary at either intersection.

4.2.4 Need for Improvements

In consideration of the above noted intersection and road section operations, the subject development is not expected to have any material impact on the operations of the adjacent road network. This is not unexpected given the limited volumes to be generated by the site. Overall, the adjacent road network will accommodate the additional volumes generated by the site without issue.

4.3 SIGHT LINE ASSESSMENT

The sight line assessment has considered both minimum stopping sight distance and intersection sight distance, as per Transportation Association of Canada (TAC) standards. The minimum stopping sight distance provides sufficient distance for an approaching motorist to observe a stationary hazard in the road and bring their vehicle to a complete stop prior to the hazard; whereas the intersection sight distance allows a vehicle to enter a main road from a side street



(or site access) and attain the appropriate operating speed without significantly impacting the operating speed of an approaching vehicle. The minimum stopping sight and intersection sight distance requirements are provided in Table 4 for design speeds of 60 km/h (reflective of an assumed speed limit of 50 km/h Carriage Court) and 70 km/h (reflective of the 60 km/h posted speed limit on Division Road West).

The available sight lines along Division Road West and Carriage Court at the site access points were determined from site reconnaissance and are also provided in Table 4.

Table 4: Sight Line Assessment

LOCATION	DESIGN SPEED	STOPPING SIGHT DISTANCE	INTERSECTION SIGHT DISTANCE		AVAILABLE SIGHTLINES TO/FROM	
			LEFT TURN	RIGHT TURN	WEST/SOUTH	EAST/NORTH
Street A	70 km/h	105 m	150 m	130 m	>200 m	>200 m
Street C	60 km/h	85 m	130 m	110 m	60 m	>200 m

As indicated, the available sight distances along Division Road West satisfy the minimum stopping and intersection sight distance requirements for the noted design speed. Thus, the available sight distances along Division Road West are considered appropriate.

With respect to the available sight lines along Carriage Court at Street C, the sight lines to/from the north are adequate whereas the sight lines to/from the south do not satisfy the noted requirements in that they are limited by the terminus of Carriage Court at Division Road West. While the available sight line does not satisfy the TAC requirements, such is not considered problematic in that vehicles approaching from the south will be doing so at a reduced operating speed having just completed a turning movement from Division Road West to Carriage Court. In this instance, the reduced sight lines do not result in an unsafe conditions.

In consideration of the above, the available sight lines are considered appropriate.



5 Summary

Proposed Development

This study has addressed the transportation impacts associated with the proposed residential development to be located at 2060 Division Road West within the Township of Severn. The development is to consist of 23 single family detached units. Upon completion, the development is expected to generate 17 trips during the AM peak hour and 23 trips during the PM peak hour.

Transportation Impacts

The intersection of Division Road West with Highway 12 was reviewed under both existing and future conditions. Based on the existing lane configuration and control, the subject intersection is expected to operating good operating conditions with minimal delays through the 2025 horizon.

The capacity of Division Road West was also reviewed under both existing and future traffic conditions. Division Road West is currently operating, and is expected to continue to operate, well below capacity through the 2025 horizon. As such, no improvements to the road network are required to accommodate the future traffic volumes.

While not explicitly considered in the assessment, the intersections Street A with Division Road West and Street C with Carriage Court are expected to provide excellent overall operations through the 2025 horizon, typical of conditions at a low volume residential intersection.

Overall, the subject site is not expected to have any material impact on the operations of the study area road network. This is not unexpected given the minimal volumes generated by the site.

Turn Lane Requirements

The need for exclusive turn lanes to serve the proposed site was briefly reviewed in consideration of MTO guidelines for auxiliary turn lanes at unsignalized intersections. Based on the low volume of traffic on the area road network and the otherwise limited volumes generated by the development, exclusive turn lanes are not considered necessary to serve the site.

Sight Line Assessment

The available sight lines along Division Road West and Carriage Court at the proposed site access points were reviewed and are considered acceptable in consideration of the existing road network characteristics and the TAC requirements for minimum stopping and intersection sight distance requirements.





2060 Division Road Subdivision

Figure 1: Site Location





Looking north along Highway 12 from Division Road West/County Road 22



Looking south along Highway 12 from Division Road West/County Road 22

2060 Division Road Subdivision
Figure 2A: Area Road Network





Looking east along Division Road West from Highway 12



Looking west along County Road 22 from Highway 12

2060 Division Road Subdivision
Figure 2B: Area Road Network





source: Google Streetview

Looking east along Division Road West from proposed Street A access location



source: Google Streetview

Looking west along Division Road West from proposed Street A access location

2060 Division Road Subdivision

Figure 2C: Area Road Network





Looking north along Carriage Court from proposed Street C access location

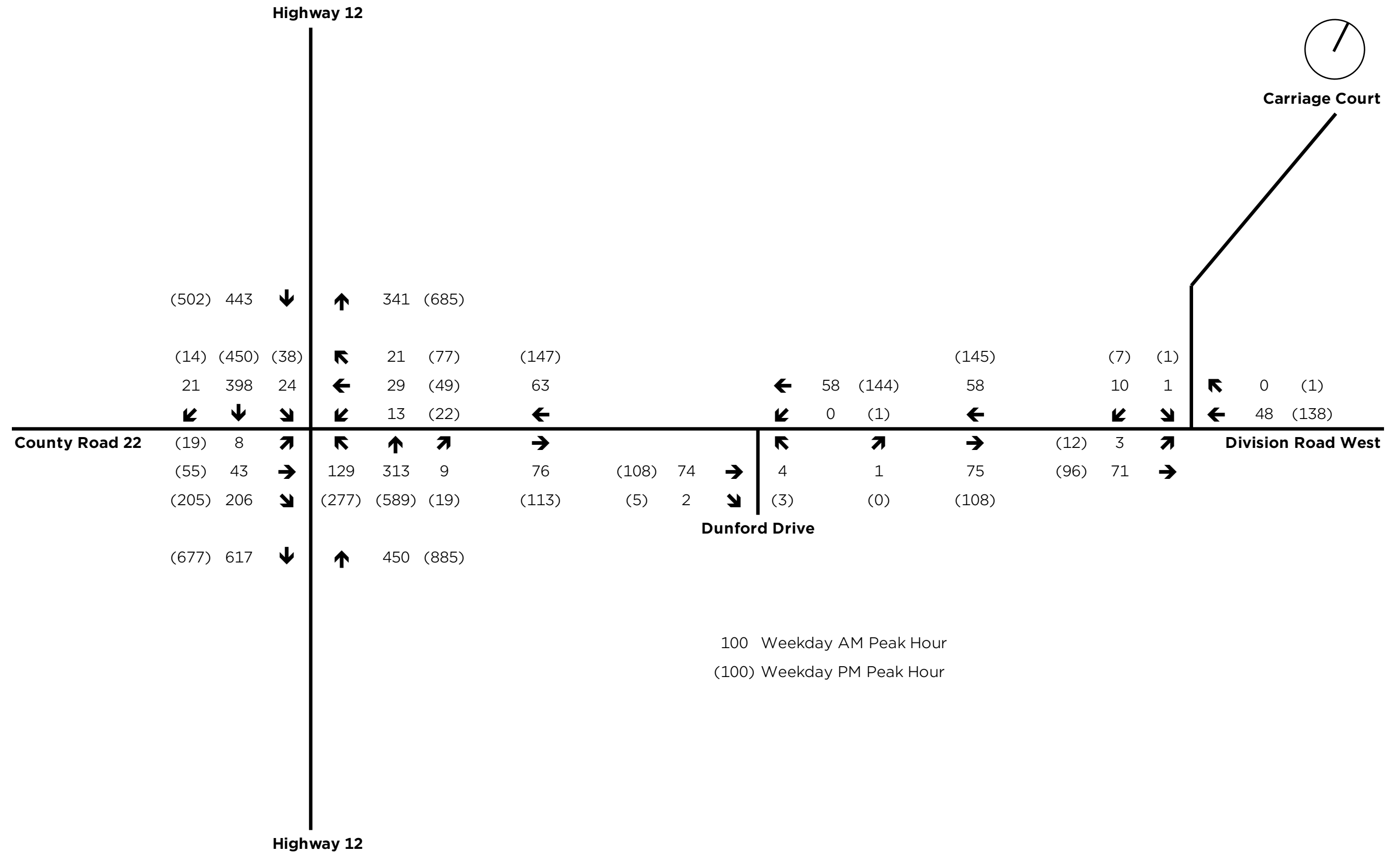


Looking south along Carriage Court from proposed Street C access location

2060 Division Road Subdivision

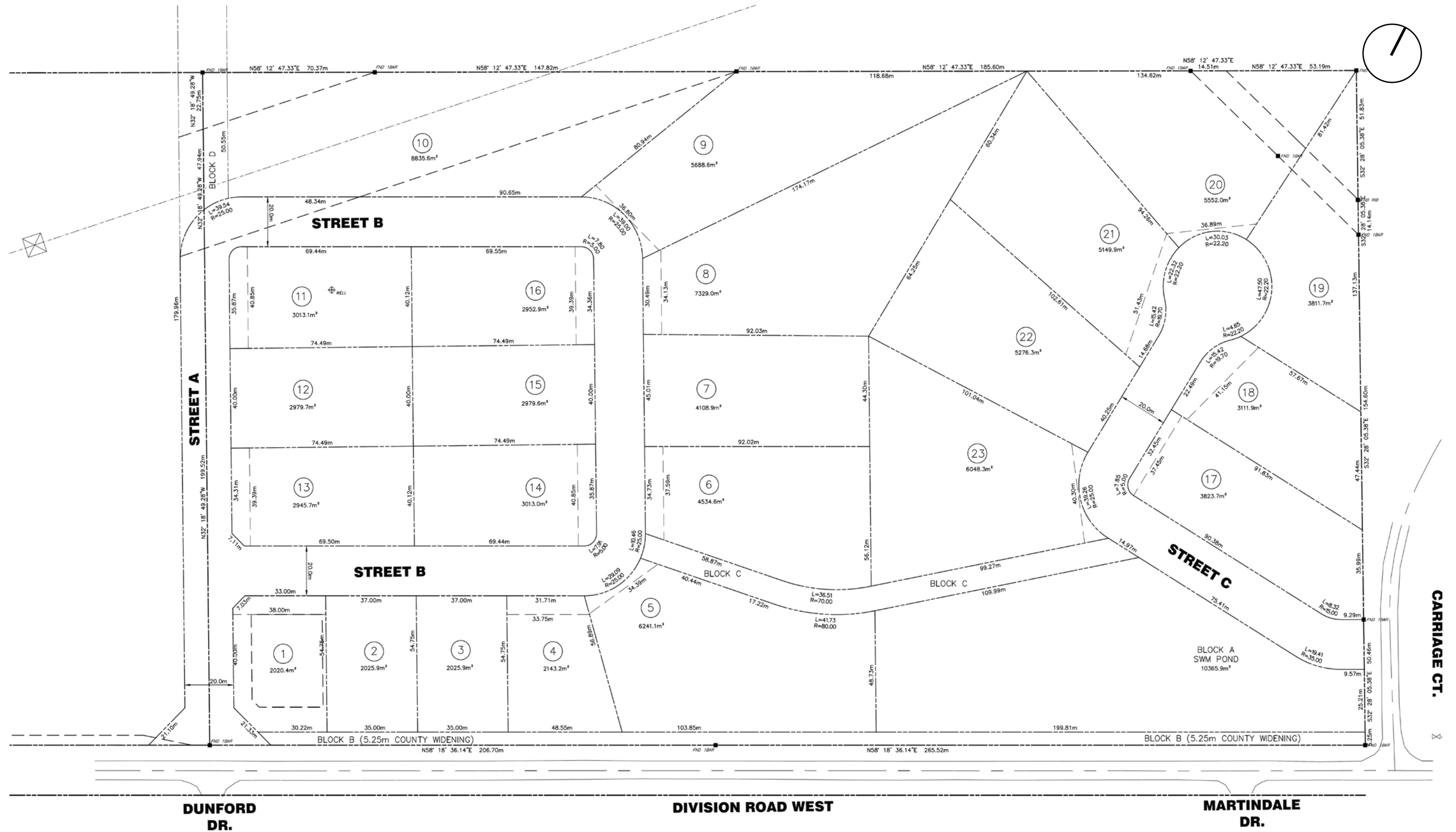
Figure 2D: Area Road Network





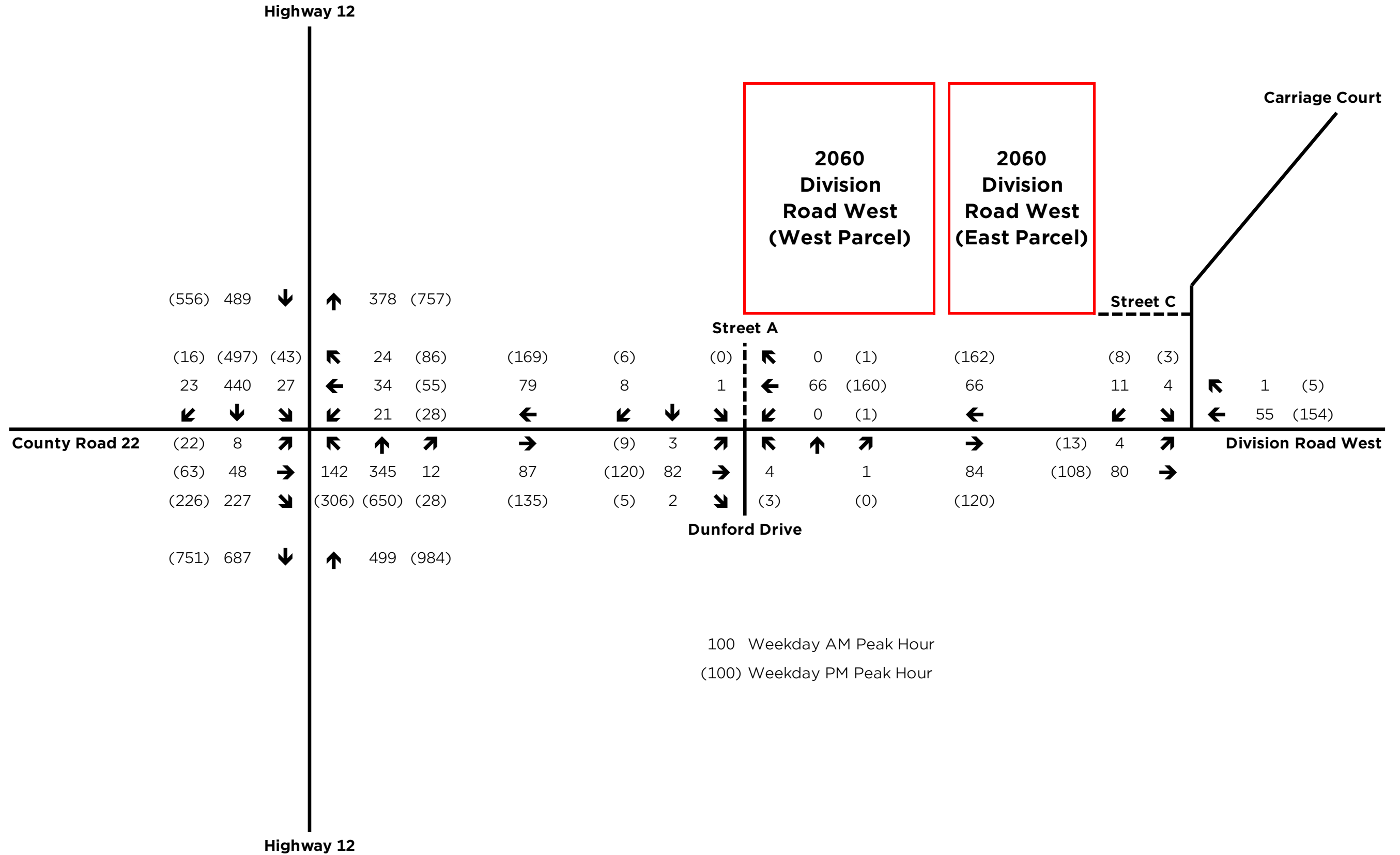
2060 Division Road Subdivision
 Figure 3: 2020 Traffic Volumes





2060 Division Road Subdivision
Figure 4: Draft Plan





2060 Division Road Subdivision
Figure 6: 2025 Traffic Volumes



Appendix A: Traffic Counts



INTERSECTION LAYOUT SHEET

Date: July 21, 2016 Day: Thursday Request # 067 Observer(s) VIDEO

Gretch Code (LHRS O/S): 0194700580 Ramp # n/a

Hwy # 12 Location SIMCOE RD 22

Reg/Mun _____ Town/City Severn

Comments _____

Segment 1 AM or PM (Please Circle ONE) Weather Sun & Clouds

DATASETS	
For office use only:	
Est. File:	_____
AM Peak:	_____
PM Peak:	_____
Processed by:	_____

SIGNALIZED Y or N
(Please Circle)

If intersection is Unsignalized, show the locations of the stop signs.

60 km/h

Division Rd

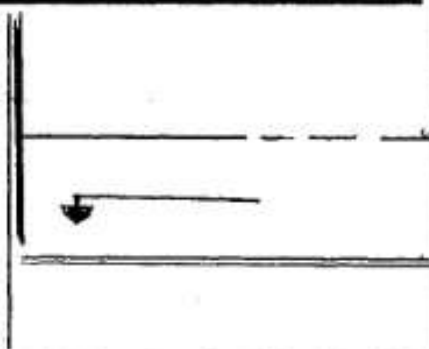
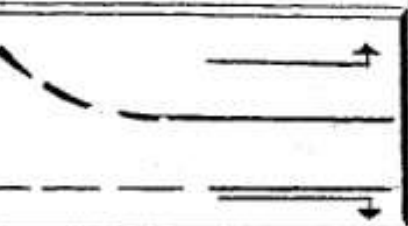
80 km/h

HWY 12

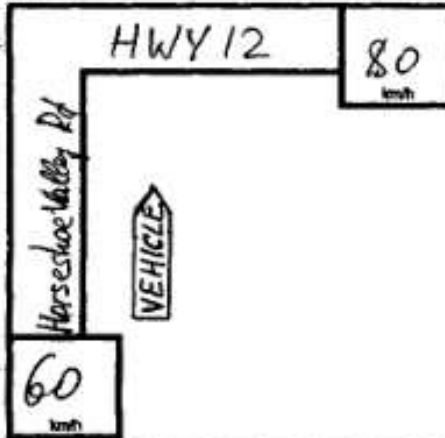


INDICATE LOCATION & DIRECTION OF STUDY VEHICLE

VEHICLE N S E W



- 1) Show all lanes approaching and leaving the intersection.
- 2) Show all channelizations.
- 3) If there are two or more through lanes in one direction, indicate if these lanes are not continuous.
- 4) Show pedestrian crosswalks and sidewalks along crossing roads.
- 5) Show bicycle lanes.
- 6) Show ramp # if applicable.



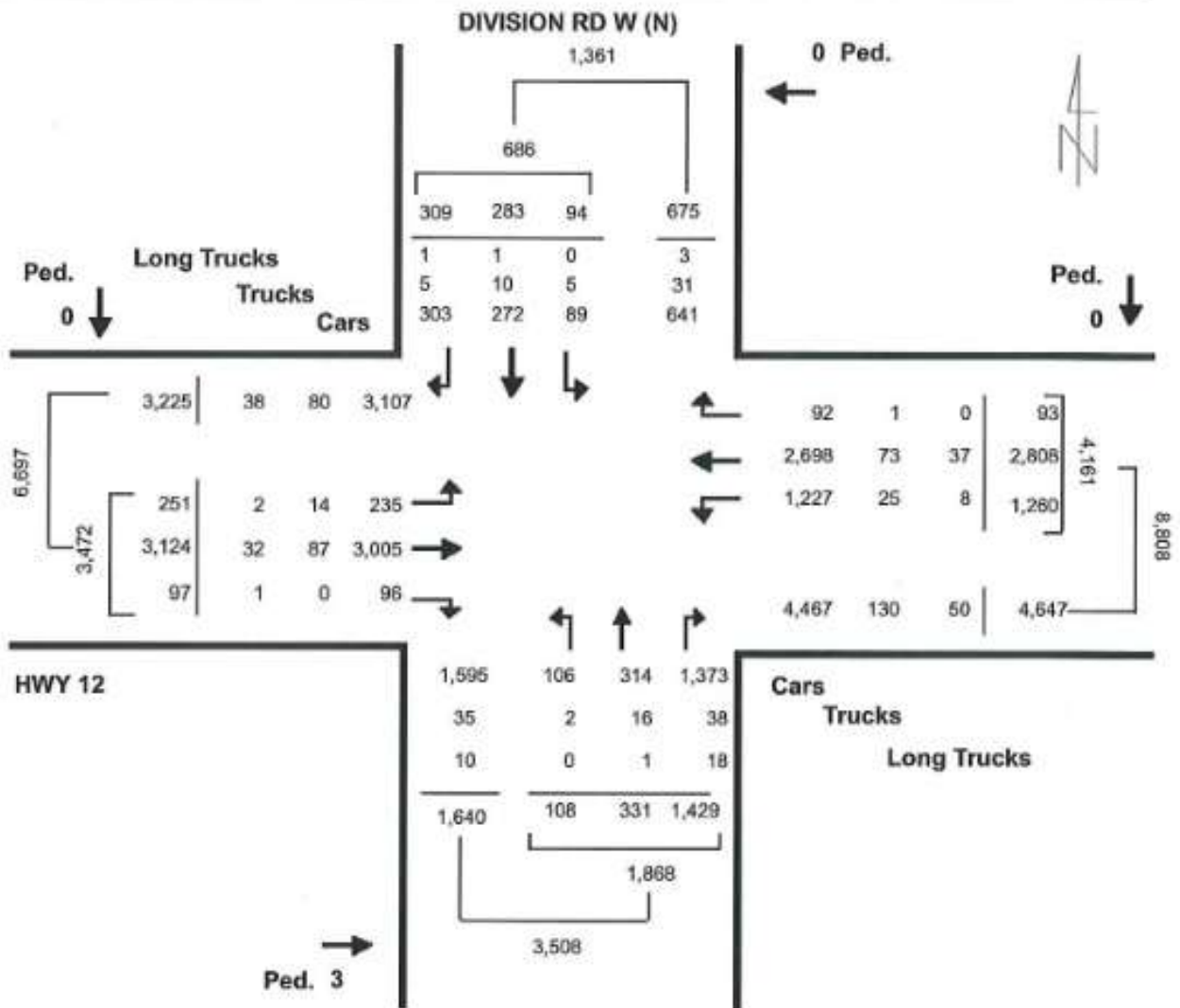
COUNT TOTAL

DIVISION RD W (N) @ HWY 12

Central

Intersection ID:194700580

Date: 21-Jul-2016



15 MIN REPORT

Intersection ID:194700580

DIVISION RD W (N) @ HWY 12

Municipality: Central

Date: 21-Jul-2016

Time	NORTH APPROACH						EAST APPROACH						SOUTH APPROACH						WEST APPROACH																	
	Cars		Trucks		Heavies		Ped	Cars		Trucks		Heavies		Ped	Cars		Trucks		Heavies		Ped	Cars		Trucks		Heavies		Ped	Total							
	Left	Thru/Right	Left	Thru/Right	Left	Thru/Right		Left	Thru/Right	Left	Thru/Right	Left	Thru/Right		Left	Thru/Right	Left	Thru/Right	Left	Thru/Right		Left	Thru/Right	Left	Thru/Right	Left	Thru/Right			Left	Thru/Right					
Period1																																				
7:15	0	4	6	0	0	0	0	21	50	2	1	1	0	0	4	31	0	0	0	0	0	0	0	0	0	4	86	1	0	2	0	0	0	0	214	
7:30	2	6	6	0	0	0	0	22	54	2	0	5	0	1	5	33	0	0	2	0	0	1	0	0	0	9	89	3	0	1	0	0	0	0	243	
7:45	1	6	2	0	1	0	0	23	49	4	1	3	0	1	0	44	0	0	1	0	0	3	0	0	9	143	5	1	3	0	0	2	0	0	315	
8:00	2	6	4	1	1	0	0	23	38	2	2	2	0	0	4	0	0	2	2	0	0	1	0	0	8	115	6	0	2	0	0	1	0	0	267	
8:15	3	4	5	3	0	0	0	23	49	3	1	1	0	0	3	9	34	0	1	0	0	1	0	0	8	121	1	1	6	0	0	5	0	0	284	
8:30	2	5	6	0	1	0	0	17	47	2	0	1	0	0	5	43	0	1	1	0	0	0	0	12	85	4	1	1	0	0	1	0	0	241		
8:45	1	3	4	0	1	0	0	22	55	1	1	4	0	0	4	9	53	0	1	0	0	1	0	8	98	5	0	1	0	1	0	0	0	273		
9:00	0	9	8	0	0	0	0	20	45	1	0	2	0	0	3	6	46	1	2	0	0	1	1	5	105	6	0	1	0	0	0	0	0	265		
9:15	3	8	7	0	0	0	0	23	67	1	0	0	0	1	12	37	0	1	1	0	0	0	0	6	88	1	0	1	0	0	3	0	0	262		
9:30	2	11	2	0	0	0	0	31	66	2	1	3	0	0	3	9	59	0	0	1	0	0	0	2	82	5	0	6	0	0	2	0	0	288		
9:45	5	2	6	0	0	0	0	32	80	3	0	2	0	1	9	39	0	0	4	0	0	1	0	3	96	7	0	0	0	0	0	0	0	291		
10:00	2	6	4	0	0	0	0	30	61	2	1	6	0	0	2	9	46	0	0	2	0	0	0	11	86	6	0	4	0	0	0	0	0	279		
Period2																																				
12:15	2	10	11	0	0	0	0	44	104	5	2	0	0	1	0	0	0	0	2	0	0	0	0	6	95	2	0	0	0	0	3	0	0	0	343	
12:30	1	8	12	0	1	0	0	31	79	0	1	1	1	1	2	0	0	5	6	47	0	3	4	0	3	80	0	0	3	0	0	1	1	0	294	
12:45	2	3	7	0	1	0	0	44	77	3	2	5	0	0	0	0	0	4	10	49	0	0	0	0	6	83	3	0	0	0	0	0	0	0	299	
13:00	2	7	4	0	1	0	0	36	72	5	1	2	0	0	2	0	0	1	7	43	0	0	0	0	10	82	4	0	4	0	0	1	0	0	285	
13:15	2	9	13	0	0	0	0	44	70	4	1	3	0	0	6	8	39	0	0	1	0	0	0	6	99	2	0	3	0	0	0	0	0	0	317	
13:30	5	4	7	0	0	0	0	45	81	2	1	6	0	0	3	11	43	1	1	1	0	0	0	12	72	0	0	0	0	0	1	0	0	0	299	
13:45	2	9	6	0	0	0	0	32	79	1	2	3	0	0	4	14	40	0	1	5	0	0	0	7	66	1	1	7	0	0	2	0	0	0	284	
14:00	1	9	8	0	0	0	0	30	63	1	0	3	0	0	2	9	41	0	0	3	0	0	1	3	79	4	3	2	0	0	3	0	0	0	272	
Period3																																				
15:15	4	11	13	0	2	0	0	49	87	3	0	2	0	0	1	0	0	4	11	50	0	0	0	0	6	94	3	0	5	0	0	2	0	0	348	
15:30	7	14	15	0	0	0	0	36	90	3	1	1	0	0	1	0	0	2	11	35	0	0	4	0	12	86	2	1	5	0	1	0	0	0	328	
15:45	2	17	6	0	0	0	0	49	88	5	0	2	0	1	0	0	0	8	15	36	0	1	0	0	6	97	1	0	3	0	0	1	0	0	342	
16:00	1	14	16	0	0	0	0	36	110	4	3	4	0	0	2	9	50	0	1	0	0	1	0	10	97	3	2	6	0	0	1	0	0	0	373	
16:15	3	13	11	0	1	0	0	58	122	3	0	1	0	0	6	4	34	0	0	1	0	0	1	8	61	3	0	4	0	0	1	0	0	0	355	
16:30	3	5	14	0	0	0	0	60	140	2	0	1	0	1	0	0	0	6	13	46	0	0	1	9	95	3	1	8	0	0	1	0	0	0	409	
16:45	4	11	18	0	1	0	0	83	131	7	1	1	0	0	7	13	52	0	0	1	0	0	0	7	112	3	1	1	0	0	0	0	0	0	454	
17:00	4	10	24	0	0	0	0	46	133	4	1	0	0	0	4	9	37	0	0	0	0	0	0	6	97	5	2	5	0	0	0	0	0	0	388	
17:15	8	18	15	1	0	0	0	65	135	5	0	1	0	0	1	16	51	0	1	1	0	0	0	7	95	2	0	1	0	0	1	0	0	0	425	
17:30	5	13	13	0	0	0	0	62	116	7	0	2	0	0	1	11	40	0	0	0	0	0	1	10	107	1	0	0	0	0	0	0	0	0	389	
17:45	3	10	23	0	0	0	0	44	143	3	0	3	0	1	1	17	51	0	0	0	0	0	0	6	97	2	0	1	0	0	0	0	0	0	412	
18:00	5	7	7	0	0	0	0	45	117	0	1	2	0	0	4	11	43	0	4	11	0	0	0	8	97	2	0	1	0	0	0	0	0	0	352	

Bicycle Count Form





















Location: HWY 12 & SIMCOE RD 22 (HORSESHOE VALLEY RD) - DIVISION RD
 Site ID: 0194700580
 Count Date: 07/21/2016

Time	APPROACH			
	North	East	South	West
06:00 to 06:15				
06:15 to 06:30				
06:30 to 06:45				
06:45 to 07:00				
07:00 to 07:15				
07:15 to 07:30	2			
07:30 to 07:45				
07:45 to 08:00	2	2		
08:00 to 08:15				
08:15 to 08:30				
08:30 to 08:45				
08:45 to 09:00	1			
09:00 to 09:15				
09:15 to 09:30				
09:30 to 09:45				
09:45 to 10:00				
10:00 to 10:15				
10:15 to 10:30				
10:30 to 10:45				
10:45 to 11:00				
11:00 to 11:15				
11:15 to 11:30				
11:30 to 11:45				
11:45 to 12:00				
12:00 to 12:15				
12:15 to 12:30				
12:30 to 12:45				
12:45 to 13:00				
13:00 to 13:15				1
13:15 to 13:30				
13:30 to 13:45				
13:45 to 14:00		1	1	
14:00 to 14:15				
14:15 to 14:30				
14:30 to 14:45				
14:45 to 15:00				
15:00 to 15:15				
15:15 to 15:30				
15:30 to 15:45				
15:45 to 16:00				
16:00 to 16:15				
16:15 to 16:30				
16:30 to 16:45				
16:45 to 17:00				
17:00 to 17:15				
17:15 to 17:30				
17:30 to 17:45				
17:45 to 18:00				
18:00 to 18:15				
18:15 to 18:30				
18:30 to 18:45				
18:45 to 19:00				
19:00 to 19:15				
19:15 to 19:30				
19:30 to 19:45				
19:45 to 20:00				

Appendix B: Existing Traffic Operations

HCM Signalized Intersection Capacity Analysis
 3: Highway 12 & County Road 22/Division Road West

2020 - Existing Conditions
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	43	206	13	29	21	129	313	9	24	398	21
Future Volume (vph)	8	43	206	13	29	21	129	313	9	24	398	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.89			0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1635			1816		1772	1830	1633	1825	1847	1633
Flt Permitted		0.99			0.77		0.35	1.00	1.00	0.55	1.00	1.00
Satd. Flow (perm)		1620			1406		657	1830	1633	1049	1847	1633
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	9	49	237	15	33	24	148	360	10	28	457	24
RTOR Reduction (vph)	0	199	0	0	20	0	0	0	3	0	0	12
Lane Group Flow (vph)	0	96	0	0	52	0	148	360	7	28	457	12
Heavy Vehicles (%)	2%	3%	5%	0%	0%	0%	3%	5%	0%	0%	4%	0%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		8.5			8.5		34.9	34.9	34.9	26.0	26.0	26.0
Effective Green, g (s)		8.5			8.5		34.9	34.9	34.9	26.0	26.0	26.0
Actuated g/C Ratio		0.16			0.16		0.67	0.67	0.67	0.50	0.50	0.50
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		262			228		531	1218	1087	520	916	810
v/s Ratio Prot							0.02	c0.20			c0.25	
v/s Ratio Perm		c0.06			0.04		0.16		0.00	0.03		0.01
v/c Ratio		0.37			0.23		0.28	0.30	0.01	0.05	0.50	0.01
Uniform Delay, d1		19.6			19.1		4.1	3.6	2.9	6.8	8.8	6.7
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9			0.5		0.3	0.6	0.0	0.2	1.9	0.0
Delay (s)		20.4			19.6		4.4	4.3	2.9	7.0	10.8	6.7
Level of Service		C			B		A	A	A	A	B	A
Approach Delay (s)		20.4			19.6			4.3			10.4	
Approach LOS		C			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			10.7				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.46									
Actuated Cycle Length (s)			52.4				Sum of lost time (s)			13.5		
Intersection Capacity Utilization			55.3%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

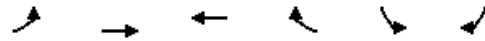
HCM Unsignalized Intersection Capacity Analysis
6: Dunford Drive & Division Road West

2020 - Existing Conditions
AM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶	↷
Traffic Volume (veh/h)	74	2	0	58	4	1
Future Volume (Veh/h)	74	2	0	58	4	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	85	2	0	67	5	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	230					
pX, platoon unblocked						
vC, conflicting volume			87		153	86
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			87		153	86
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		99	100
cM capacity (veh/h)			1509		839	973
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	87	67	6			
Volume Left	0	0	5			
Volume Right	2	0	1			
cSH	1700	1509	858			
Volume to Capacity	0.05	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.2			
Control Delay (s)	0.0	0.0	9.2			
Lane LOS				A		
Approach Delay (s)	0.0	0.0	9.2			
Approach LOS				A		
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			14.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 8: Division Road West & Carriage Court

2020 - Existing Conditions
 AM Peak Hour























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Traffic Volume (veh/h)	3	71	48	0	1	10
Future Volume (Veh/h)	3	71	48	0	1	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	3	82	55	0	1	11
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	55				143	55
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	55				143	55
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				100	99
cM capacity (veh/h)	1550				848	1012
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	85	55	12			
Volume Left	3	0	1			
Volume Right	0	0	11			
cSH	1550	1700	996			
Volume to Capacity	0.00	0.03	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.3	0.0	8.7			
Lane LOS	A		A			
Approach Delay (s)	0.3	0.0	8.7			
Approach LOS			A			
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization			16.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

3: Highway 12 & County Road 22/Division Road West

2020 - Existing Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	55	205	22	49	77	277	589	19	38	450	14
Future Volume (vph)	19	55	205	22	49	77	277	589	19	38	450	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.90			0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1693			1748		1825	1902	1633	1644	1847	1633
Flt Permitted		0.97			0.80		0.25	1.00	1.00	0.41	1.00	1.00
Satd. Flow (perm)		1655			1411		480	1902	1633	705	1847	1633
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	22	63	236	25	56	89	318	677	22	44	517	16
RTOR Reduction (vph)	0	194	0	0	73	0	0	0	8	0	0	9
Lane Group Flow (vph)	0	127	0	0	97	0	318	677	14	44	517	7
Heavy Vehicles (%)	0%	2%	2%	5%	2%	0%	0%	1%	0%	11%	4%	0%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		9.1			9.1		33.2	33.2	33.2	21.2	21.2	21.2
Effective Green, g (s)		9.1			9.1		33.2	33.2	33.2	21.2	21.2	21.2
Actuated g/C Ratio		0.18			0.18		0.65	0.65	0.65	0.41	0.41	0.41
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		293			250		507	1230	1056	291	763	674
v/s Ratio Prot							0.09	c0.36			0.28	
v/s Ratio Perm		c0.08			0.07		c0.31		0.01	0.06		0.00
v/c Ratio		0.43			0.39		0.63	0.55	0.01	0.15	0.68	0.01
Uniform Delay, d1		18.8			18.6		6.1	5.0	3.2	9.4	12.3	8.9
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.0			1.0		2.4	1.8	0.0	1.1	4.8	0.0
Delay (s)		19.8			19.6		8.5	6.7	3.2	10.5	17.1	8.9
Level of Service		B			B		A	A	A	B	B	A
Approach Delay (s)		19.8			19.6			7.2			16.3	
Approach LOS		B			B			A			B	
Intersection Summary												
HCM 2000 Control Delay			12.7				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			51.3				Sum of lost time (s)			13.5		
Intersection Capacity Utilization			69.1%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

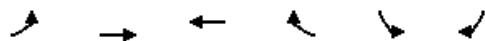
HCM Unsignalized Intersection Capacity Analysis
 6: Dunford Drive & Division Road West

2020 - Existing Conditions
 PM Peak Hour

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶			↷	↶	
Traffic Volume (veh/h)	108	5	1	144	3	0
Future Volume (Veh/h)	108	5	1	144	3	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	124	6	1	166	3	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)	230					
pX, platoon unblocked						
vC, conflicting volume			130	295		127
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			130	295		127
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	100		100
cM capacity (veh/h)			1455	696		923
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	130	167	3			
Volume Left	0	1	3			
Volume Right	6	0	0			
cSH	1700	1455	696			
Volume to Capacity	0.08	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.1			
Control Delay (s)	0.0	0.1	10.2			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	10.2			
Approach LOS			B			
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			18.4%	ICU Level of Service	A	
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
 8: Division Road West & Carriage Court

2020 - Existing Conditions
 PM Peak Hour























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Volume (veh/h)	12	96	138	1	1	7
Future Volume (Veh/h)	12	96	138	1	1	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	14	110	159	1	1	8
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	160				298	160
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	160				298	160
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1419				687	886
Direction, Lane #						
	EB 1	WB 1	SB 1			
Volume Total	124	160	9			
Volume Left	14	0	1			
Volume Right	0	1	8			
cSH	1419	1700	858			
Volume to Capacity	0.01	0.09	0.01			
Queue Length 95th (m)	0.2	0.0	0.2			
Control Delay (s)	0.9	0.0	9.2			
Lane LOS	A		A			
Approach Delay (s)	0.9	0.0	9.2			
Approach LOS			A			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			25.1%		ICU Level of Service	A
Analysis Period (min)			15			

Appendix C: Future Traffic Operations

HCM Signalized Intersection Capacity Analysis

3: Highway 12 & County Road 22/Division Road West

















2025 - Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	48	227	21	34	24	142	345	12	27	440	23
Future Volume (vph)	8	48	227	21	34	24	142	345	12	27	440	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.89			0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1636			1817		1772	1830	1633	1825	1847	1633
Flt Permitted		0.99			0.64		0.31	1.00	1.00	0.53	1.00	1.00
Satd. Flow (perm)		1621			1182		582	1830	1633	1014	1847	1633
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	9	55	261	24	39	28	163	397	14	31	506	26
RTOR Reduction (vph)	0	217	0	0	23	0	0	0	5	0	0	13
Lane Group Flow (vph)	0	108	0	0	68	0	163	397	9	31	506	13
Heavy Vehicles (%)	2%	3%	5%	0%	0%	0%	3%	5%	0%	0%	4%	0%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		8.8			8.8		34.5	34.5	34.5	25.6	25.6	25.6
Effective Green, g (s)		8.8			8.8		34.5	34.5	34.5	25.6	25.6	25.6
Actuated g/C Ratio		0.17			0.17		0.66	0.66	0.66	0.49	0.49	0.49
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		272			198		484	1207	1077	496	904	799
v/s Ratio Prot							0.03	c0.22			c0.27	
v/s Ratio Perm		c0.07			0.06		0.19		0.01	0.03		0.01
v/c Ratio		0.40			0.34		0.34	0.33	0.01	0.06	0.56	0.02
Uniform Delay, d1		19.4			19.2		4.6	3.9	3.0	7.0	9.4	6.9
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.0			1.0		0.4	0.7	0.0	0.2	2.5	0.0
Delay (s)		20.3			20.2		5.0	4.6	3.1	7.3	11.9	6.9
Level of Service		C			C		A	A	A	A	B	A
Approach Delay (s)		20.3			20.2			4.7			11.4	
Approach LOS		C			C			A			B	
Intersection Summary												
HCM 2000 Control Delay			11.3				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			52.3				Sum of lost time (s)			13.5		
Intersection Capacity Utilization			59.6%				ICU Level of Service				B	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

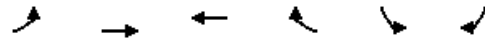
6: Dunford Drive/Street A & Division Road West

2025 - Total Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	82	2	0	66	0	4	0	1	1	0	8
Future Volume (Veh/h)	3	82	2	0	66	0	4	0	1	1	0	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	3	94	2	0	76	0	5	0	1	1	0	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)		230										
pX, platoon unblocked												
vC, conflicting volume	76			96			186	177	95	178	178	76
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	76			96			186	177	95	178	178	76
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	100	100	99
cM capacity (veh/h)	1523			1498			766	715	962	782	714	985
Direction, Lane #												
	EB 1	WB 1	NB 1	SB 1								
Volume Total	99	76	6	10								
Volume Left	3	0	5	1								
Volume Right	2	0	1	9								
cSH	1523	1498	793	960								
Volume to Capacity	0.00	0.00	0.01	0.01								
Queue Length 95th (m)	0.0	0.0	0.2	0.2								
Control Delay (s)	0.2	0.0	9.6	8.8								
Lane LOS	A		A	A								
Approach Delay (s)	0.2	0.0	9.6	8.8								
Approach LOS			A	A								
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization			16.9%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 9: Division Road West & Carriage Court

2025 - Total Conditions
 AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Volume (veh/h)	4	80	55	1	4	11
Future Volume (Veh/h)	4	80	55	1	4	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	5	92	63	1	5	13
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	64				166	64
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	64				166	64
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				99	99
cM capacity (veh/h)	1538				822	1001
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	97	64	18			
Volume Left	5	0	5			
Volume Right	0	1	13			
cSH	1538	1700	944			
Volume to Capacity	0.00	0.04	0.02			
Queue Length 95th (m)	0.1	0.0	0.4			
Control Delay (s)	0.4	0.0	8.9			
Lane LOS	A		A			
Approach Delay (s)	0.4	0.0	8.9			
Approach LOS			A			
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			17.5%	ICU Level of Service	A	
Analysis Period (min)			15			

















HCM Signalized Intersection Capacity Analysis
 3: Highway 12 & County Road 22/Division Road West

2025 - Total Conditions
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	63	226	28	55	86	306	650	26	43	497	16
Future Volume (vph)	22	63	226	28	55	86	306	650	26	43	497	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.90			0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1695			1748		1825	1902	1633	1644	1847	1633
Flt Permitted		0.97			0.72		0.22	1.00	1.00	0.38	1.00	1.00
Satd. Flow (perm)		1647			1268		423	1902	1633	661	1847	1633
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	25	72	260	32	63	99	352	747	30	49	571	18
RTOR Reduction (vph)	0	151	0	0	58	0	0	0	8	0	0	10
Lane Group Flow (vph)	0	206	0	0	136	0	352	747	22	49	571	8
Heavy Vehicles (%)	0%	2%	2%	5%	2%	0%	0%	1%	0%	11%	4%	0%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)		12.1			12.1		43.2	43.2	43.2	28.3	28.3	28.3
Effective Green, g (s)		12.1			12.1		43.2	43.2	43.2	28.3	28.3	28.3
Actuated g/C Ratio		0.19			0.19		0.67	0.67	0.67	0.44	0.44	0.44
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)		3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		309			238		510	1277	1097	290	812	718
v/s Ratio Prot							c0.11	0.39			0.31	
v/s Ratio Perm		c0.13			0.11		c0.35		0.01	0.07		0.00
v/c Ratio		0.67			0.57		0.69	0.58	0.02	0.17	0.70	0.01
Uniform Delay, d1		24.2			23.7		8.0	5.7	3.5	10.9	14.6	10.1
Progression Factor		1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		5.4			3.1		4.0	2.0	0.0	1.3	5.1	0.0
Delay (s)		29.6			26.8		12.0	7.7	3.5	12.1	19.7	10.2
Level of Service		C			C		B	A	A	B	B	B
Approach Delay (s)		29.6			26.8			8.9			18.8	
Approach LOS		C			C			A			B	
Intersection Summary												
HCM 2000 Control Delay			16.3				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			64.3				Sum of lost time (s)			13.5		
Intersection Capacity Utilization			75.1%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

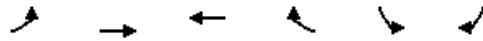
HCM Unsignalized Intersection Capacity Analysis
6: Dunford Drive/Street A & Division Road West

2025 - Total Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	120	5	1	160	1	3	0	0	0	0	6
Future Volume (Veh/h)	9	120	5	1	160	1	3	0	0	0	0	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	10	138	6	1	184	1	3	0	0	0	0	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (m)		230										
pX, platoon unblocked												
vC, conflicting volume	185			144			354	348	141	348	350	184
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	185			144			354	348	141	348	350	184
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	100	100	100	100	99
cM capacity (veh/h)	1390			1438			592	571	907	603	569	858
Direction, Lane #												
	EB 1	WB 1	NB 1	SB 1								
Volume Total	154	186	3	7								
Volume Left	10	1	3	0								
Volume Right	6	1	0	7								
cSH	1390	1438	592	858								
Volume to Capacity	0.01	0.00	0.01	0.01								
Queue Length 95th (m)	0.2	0.0	0.1	0.2								
Control Delay (s)	0.6	0.0	11.1	9.2								
Lane LOS	A	A	B	A								
Approach Delay (s)	0.6	0.0	11.1	9.2								
Approach LOS			B	A								
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			23.0%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 9: Division Road West & Carriage Court

2025 - Total Conditions
 PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Volume (veh/h)	13	108	154	5	3	8
Future Volume (Veh/h)	13	108	154	5	3	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	15	124	177	6	3	9
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	183				334	180
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	183				334	180
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1392				654	863
Direction, Lane #						
	EB 1	WB 1	SB 1			
Volume Total	139	183	12			
Volume Left	15	0	3			
Volume Right	0	6	9			
cSH	1392	1700	799			
Volume to Capacity	0.01	0.11	0.02			
Queue Length 95th (m)	0.2	0.0	0.3			
Control Delay (s)	0.9	0.0	9.6			
Lane LOS	A		A			
Approach Delay (s)	0.9	0.0	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			26.6%		ICU Level of Service	A
Analysis Period (min)			15			