

TECHNICAL MEMORANDUM

Date: September 3, 2020

To: Bryan Lindgren
Neumann Companies

From: Tammi Czewski, P.E., PTOE
Traffic Analysis & Design, Inc.

Subject: Lake Country Lutheran East Lands Traffic Impact Analysis
Hartland, WI

Introduction

Lake Country Lutheran has about 50 acres ("Lake Country Lutheran East Lands") of land that is proposed to be developed with residential housing. Some commercial development may also occur on site to follow the Village of Hartland's Comprehensive Master Plan. The East 50 Acres land is located east of Campus Drive, directly east of the Lake Country Lutheran High School in Hartland, Wisconsin (Exhibit 1). Access to the land is proposed to occur at several locations along Campus Drive and along Scenic Drive, a new public road connecting to Campus Drive.

This technical memorandum was prepared to address the traffic impacts of the proposed development traffic to the Campus Drive intersections with STH 83 and the proposed Scenic Drive.

Study Area

Campus Drive is mostly a two-lane, north/south Collector roadway that extends to just over a mile between STH 83 and CTH K to the north. Development along Campus Drive consists of the Lake Country Lutheran High School and Family Church, which has four access driveways to the building's parking areas and sports fields. The posted speed limit along Campus Drive is 25 mph, and there is a paved multi-use trail that runs along the east side of the roadway between the four access driveways. The trail also runs between Campus Drive and Willow Drive, along what will be the alignment for the new public road.

STH 83 is a Principal Arterial that generally runs north/south through Waukesha County. In the study area, STH 83 extends north from STH 16 and then continues west along Hill Street. STH 83 has a 35-mph posted speed limit and no sidewalks. Development along STH

83 (Hill Street) is mostly single-family residential, with two churches (one with a school) located less than ½ mile west of the signalized intersection with Campus Drive. The intersection with STH 83 and Campus Drive is signalized.

Data Collection

At the start of this traffic study project, the State of Wisconsin was operating on the Governor’s “stay-at-home” order for the Coronavirus Pandemic. Because this resulted in school closures and significantly lower traffic volumes than normal, TADI utilized WisDOT traffic counts collected in prior years for the intersections and roadways evaluated in this study. This data included a weekday turning movement traffic count at the STH 83/Campus Drive intersection (collected from 6:00 a.m. to 7:00 p.m. in October 2016), and annual average daily traffic volumes (AADT) on STH 83 (reported every three years from 2006 to 2018).

Based on the turning movement traffic count, the peak traffic hours at the STH 83/Campus Drive intersection occurs from 7:30-8:30 a.m. (AM peak hour) and from 3:00-4:00 p.m. (PM peak hour). These peak hours coincide with peak traffic periods for the schools located to the east and west of the intersection. The WisDOT traffic count data is located in Appendix A.

Because turning movement counts were not able to be collected at the Lake Country Lutheran High School driveways, this traffic was estimated in order to determine the Campus Drive through traffic that passes through the future public road intersection to the north of the school driveways. Using trip rates from the Institute of Transportation Engineer’s (ITE) *Trip Generation Manual, 10th Edition*, the 193-student school is estimated to generate about 155 trips during the weekday AM peak hour and 110 trips during the weekday PM peak hour. These trips were assigned to/from the school based on existing traffic patterns on the study roadways. The school trip generation table and resulting 2016 peak hour turning movement volumes at the combined school driveways and study intersections are shown on Exhibit 2.

The historical WisDOT AADT data was compiled to forecast growth trends along STH 83, just west of the intersection with Campus Drive. Along that stretch of STH 83, the linear trendline shows that traffic has been relatively stagnant between 2006 and 2018. The calculated traffic growth (non-compounded) from 2006 to 2018 was only 0.1% per year. Since the most-recent data from 2018 shows a jump in traffic from 2015, however, this study estimates a more conservative traffic growth of 0.5% per year. This rate of growth was applied to the 2016 turning movement volumes at the study intersections to forecast traffic to 2020. The historical AADT volumes, plotted graph, and 2020 “background” peak hour turning movement volumes are shown on Exhibit 3.

Proposed Development

The conceptual site plan for the proposed development is shown on Exhibit 4. The plan includes a new public road (Scenic Drive) that will be constructed along the existing alignment of the paved mixed-use trail through the property. Scenic Drive will not continue east to connect to Willow Drive, but the paved path for pedestrians and bikes will remain to provide a non-motorized connection between the two roadways.

The site plan includes 47 single-family residential units on the north side of Scenic Drive, and 150 multi-family residential units on the south side. Both residential areas are proposed to have access driveways to Campus Drive and Scenic Drive.

The Village of Hartland's Comprehensive Plan shows commercial development on the southern 8.9 acres of the Lake Country Lutheran East Lands. Although no development plans currently exist for this site, the site plan shows an approximate layout for buildings and parking areas that would work within the site constraints (grades, setback, wetland, etc.). For the purposes of this study, about 15,000 square feet of general office space was assumed for the commercial portion of the site.

The trip generation table for the proposed development is shown on Exhibit 5. Based on the development assumptions and on the trip rates and fitted curve equations published in the *ITE Trip Generation Manual, 10th Edition*, full buildout of the East 50 Acres site is expected to generate 1,780 weekday daily trips, with 150 trips (60 in/90 out) during the weekday AM peak hour and 155 trips (90 in/65 out) during the weekday PM peak hour.

Based on the existing traffic patterns and routes to/from nearby population centers, it is expected that the new trips will travel to/from the site via the west on STH 83/Hill Street (10%), the north on Campus Drive (15%), and the south on STH 83, including STH 16 (75%). The trip generation and trip distribution tables are shown on Exhibit 5. The new site trips were assigned to the site driveways and study intersections based on trip distribution as shown on Exhibit 6.

The new trips shown on Exhibit 6 were added to the 2020 background traffic volumes from Exhibit 3. The resulting build traffic volumes are shown on Exhibit 7. Exhibit 7 also shows the estimated daily traffic volumes for the new public road as 750 vehicles per day. This was calculated based on the expected number of daily site trips (from the trip generation table) that were assigned to/from the driveways along Scenic Drive. At this daily traffic volume level, it is considered a "low-volume" residential street that would likely operate with good traffic flow and low vehicle delays at the intersections with the residential access driveways.

Peak Hour Traffic Operations & Queues

The Campus Drive intersections with STH 83 and Scenic Drive were analyzed using the Synchro 10 traffic analysis model (outputs based on the Highway Capacity Manual, 6th Edition) and the peak hour turning movement volumes estimated for each intersection. Intersection operation is defined by "level of service". Level of Service (LOS) is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. For the purposes of this study, LOS D or better was used to define acceptable peak hour operating conditions.

The Campus Drive/STH 83 intersection was evaluated with the existing geometrics and existing actuated-coordinated traffic signal control. The Campus Drive/Scenic Drive intersection was evaluated with single lanes at each approach and stop sign control for

traffic turning from Scenic Drive. Turning volumes at Scenic Drive are not expected to be high enough to warrant separate left or right turn storage lanes on Campus Drive.

As shown on Exhibit 8, the study intersections are expected to operate acceptably at LOS C or better for all traffic movements during the peak hours, with both the 2020 background and the 2020 build traffic volumes. Traffic queues at the Campus Drive/STH 83 intersection are not expected to extend beyond the available turn lane storage. The Synchro peak hour traffic capacity analysis worksheets for the background and build conditions are located in Appendix B.

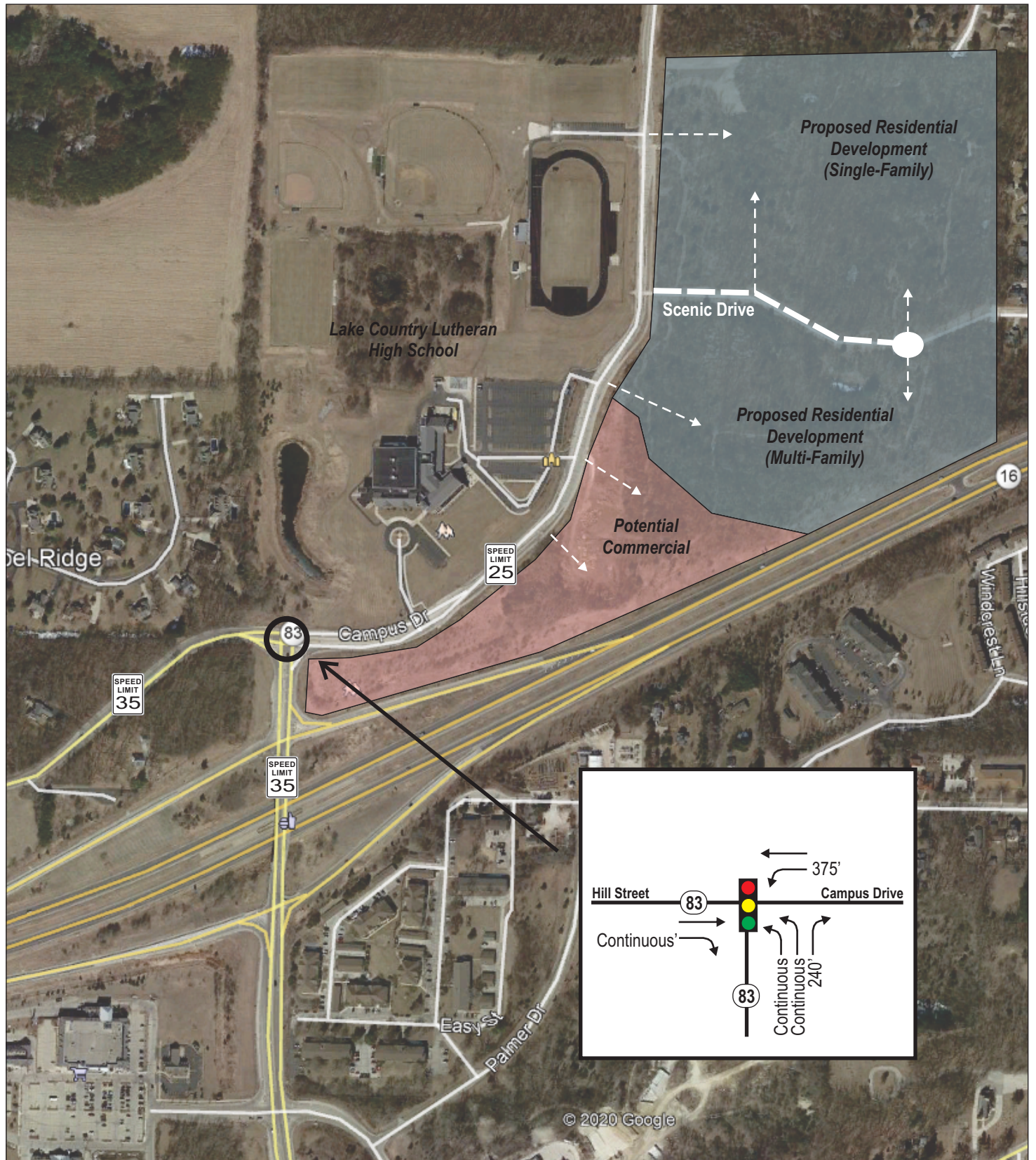
Recommendations/Conclusions

The Campus Drive/STH 83 intersection is expected to continue to operate acceptably during the peak hours with the additional traffic expected from full buildout of the Lake Country Lutheran East Lands. Therefore, no changes to the geometrics or traffic control is recommended at this intersection.

The Campus Drive/Scenic Drive intersection is also expected to operate acceptably during the peak hours with the additional traffic expected from full buildout of the Lake Country Lutheran East Lands. This new intersection is recommended to be constructed with the following geometrics:

- Single shared through/left-turn lane on southbound Campus Drive
- Single shared through/right-turn lane on northbound Campus Drive
- Single shared left-turn/right-turn lane on westbound Scenic Drive
- Stop sign control on the westbound approach of Scenic Drive
- Two-lane, undivided cross-section on the Scenic Drive

It is recommended that the Scenic Drive intersection with Campus Drive be designed according to the geometric standards for the respective road agency requirements.

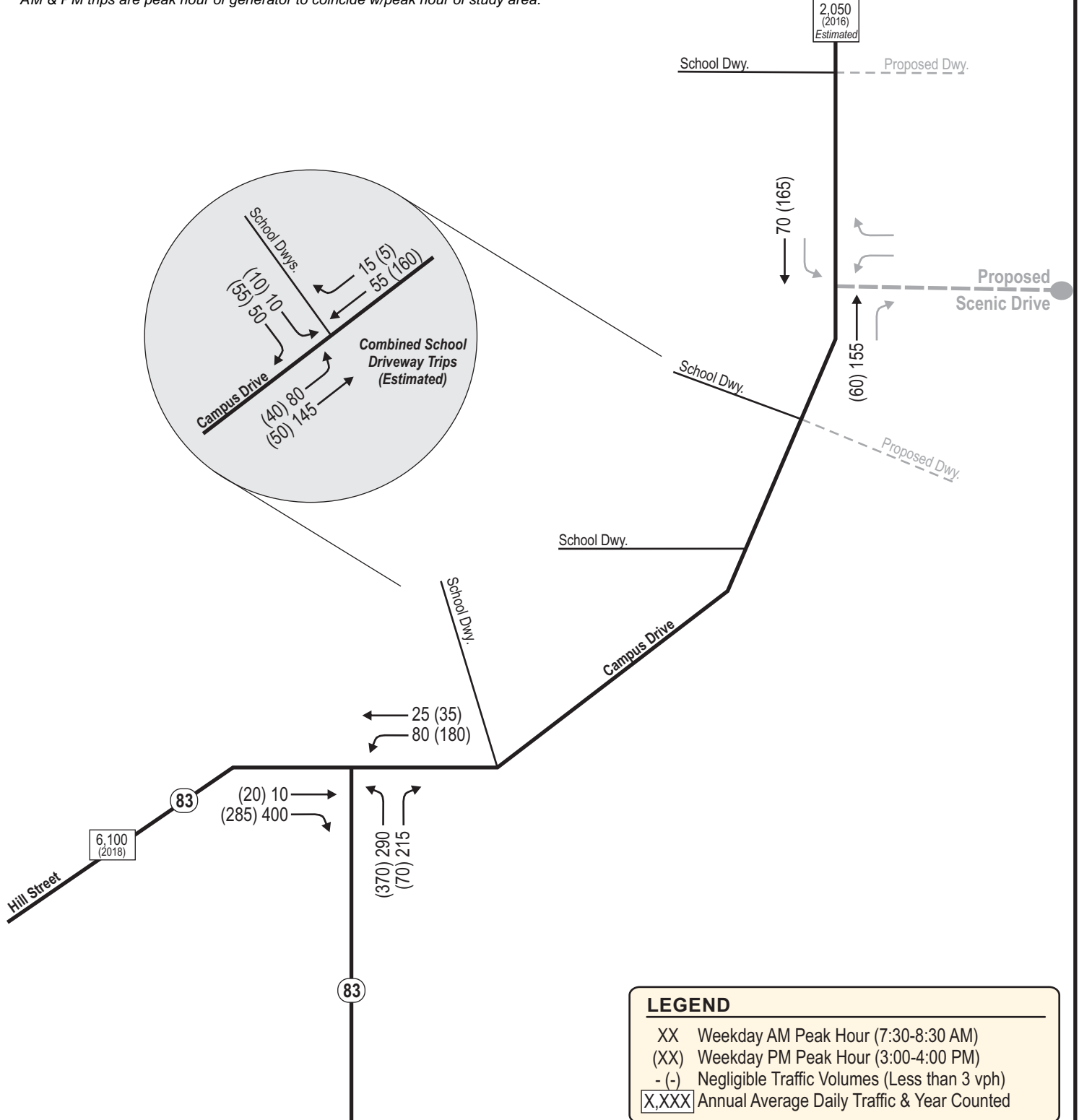


Lake Country Lutheran High School Trip Generation Table¹

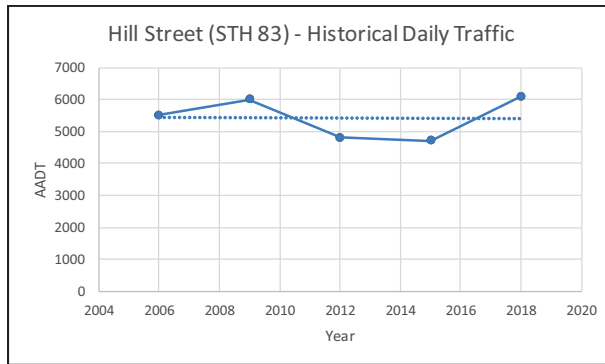
Land Use	ITE Code	Size	Weekday Daily	AM Peak			PM Peak		
				In	Out	Total	In	Out	Total
Private School (K-12) ²	536	193 Students	480 (2.48)	95 (61%)	60 (39%)	155 (0.81)	45 (43%)	65 (57%)	110 (0.58)

¹ ITE Trip Rates (X.XX) and/or Fitted Curve Equations (FCE) are from the ITE Trip Generation Manual, 10th Edition.

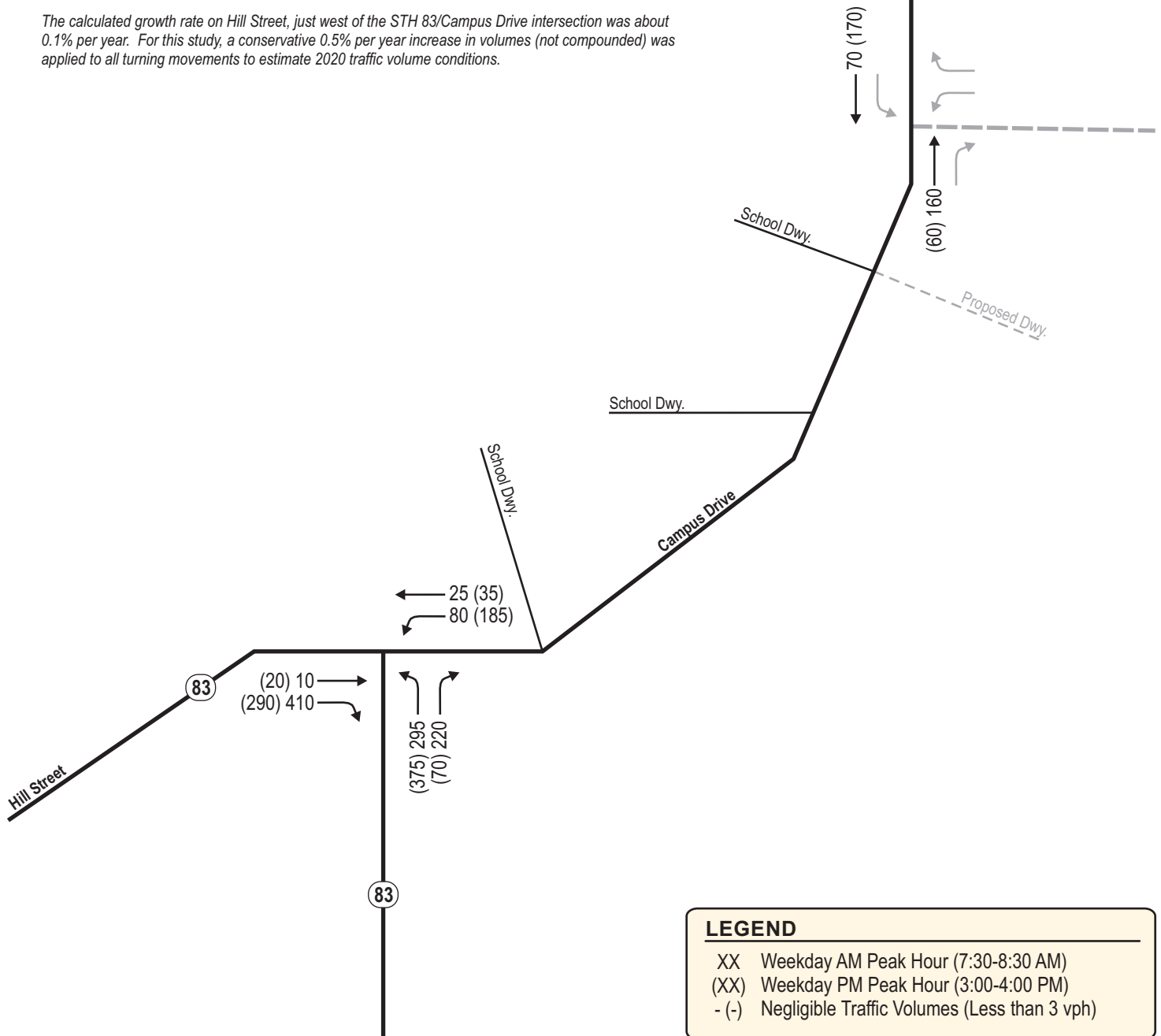
² AM & PM trips are peak hour of generator to coincide w/peak hour of study area.

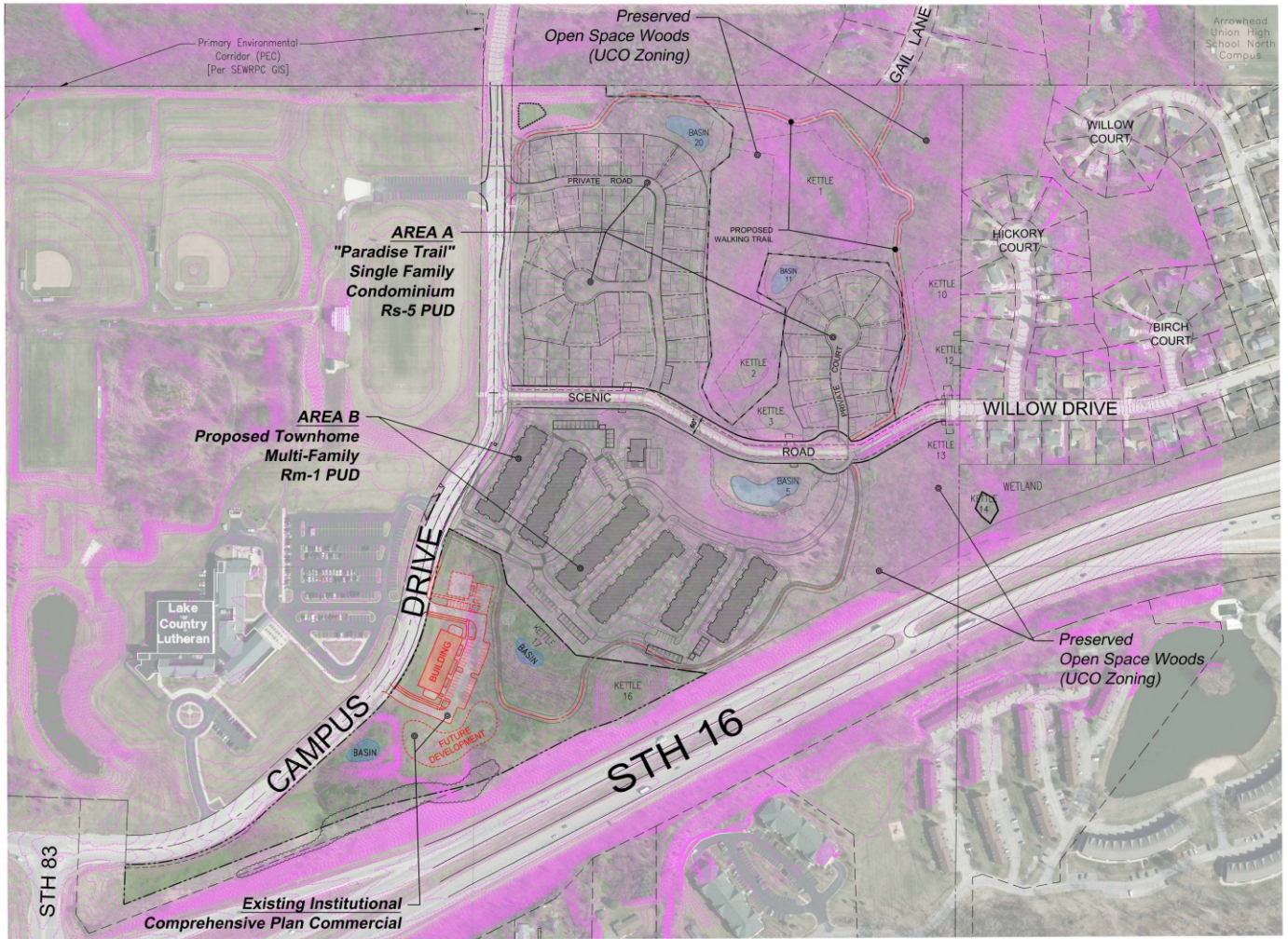


WisDOT AADT	
Year	Hill Street
2006	5500
2009	6000
2012	4800
2015	4700
2018	6100
Growth/Yr.	0.1%
Est. Growth	0.5%



The calculated growth rate on Hill Street, just west of the STH 83/Campus Drive intersection was about 0.1% per year. For this study, a conservative 0.5% per year increase in volumes (not compounded) was applied to all turning movements to estimate 2020 traffic volume conditions.





MASTER PLAN - Lake Country Lutheran East Lands

Village of Hartland Wisconsin



WEST



NOT TO SCALE

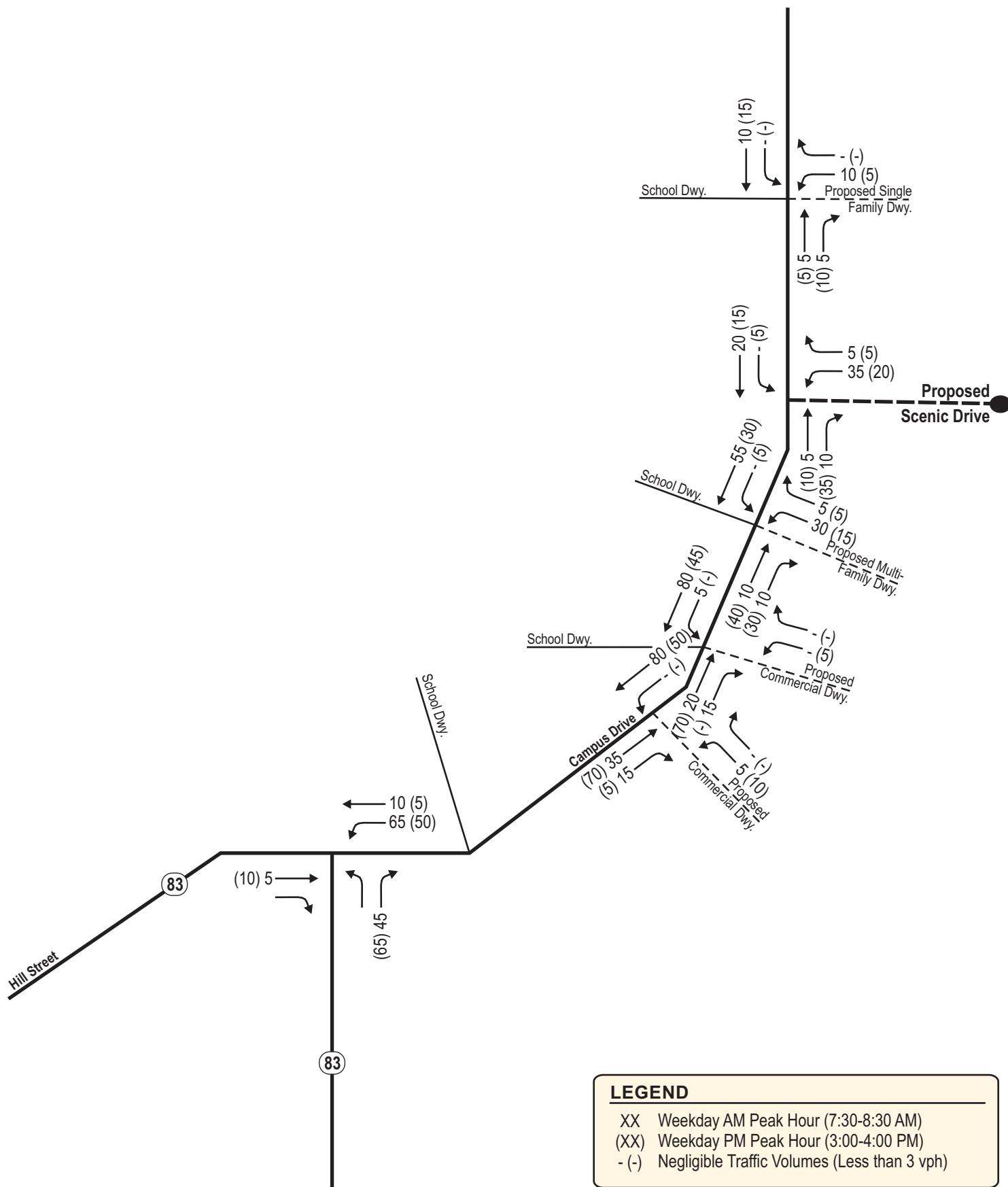
On-Site Development Trip Generation Table¹

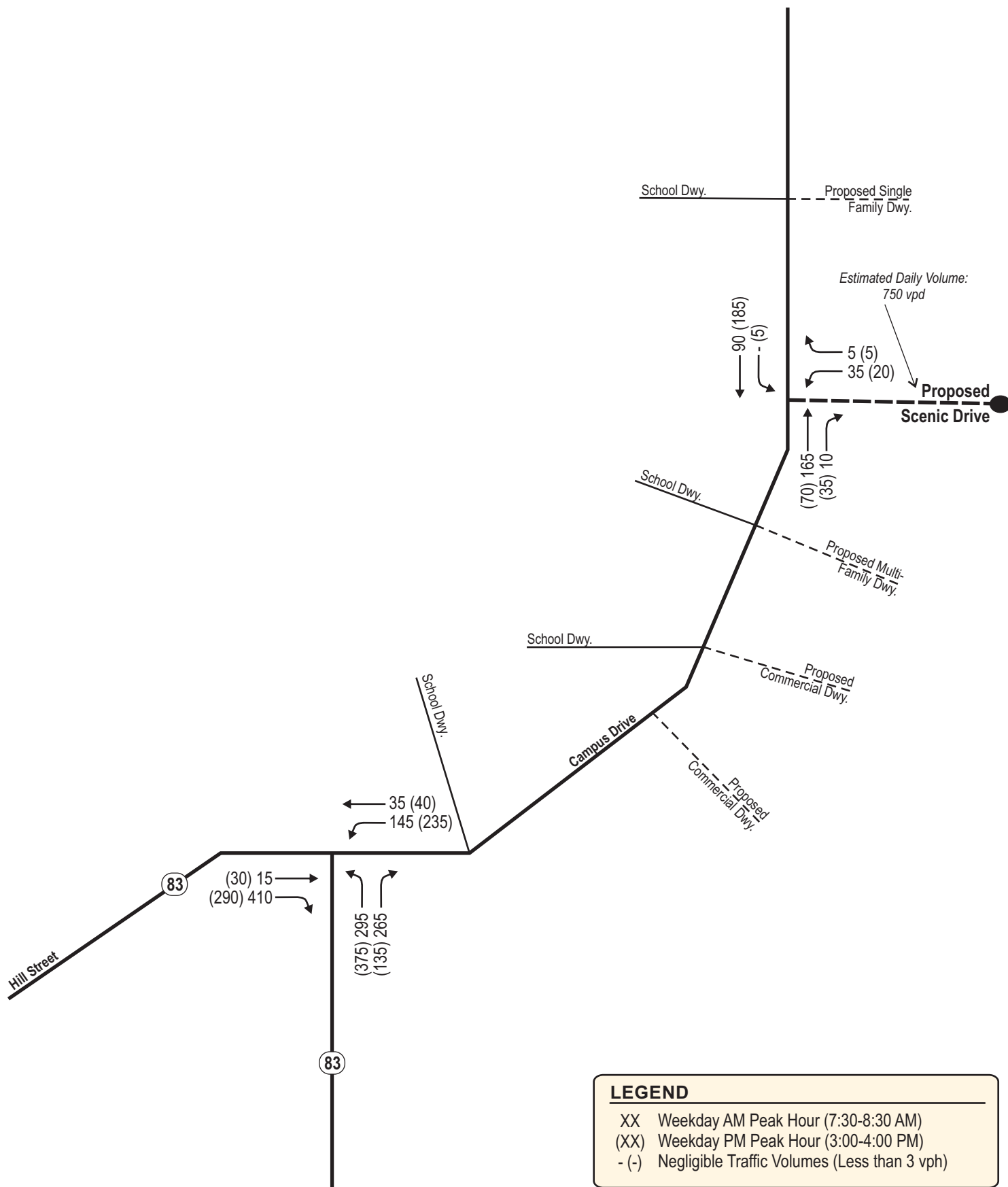
Land Use	ITE Code	Proposed Size	Weekday Daily	AM Peak			PM Peak		
				In	Out	Total	In	Out	Total
Single-Family Detached Housing	210	47 Units	520 FCE	10 (25%)	30 (75%)	40 FCE	30 (63%)	20 (37%)	50 FCE
Multi-Family Housing (Low-Rise)	220	150 Units	1,090 FCE	15 (23%)	55 (77%)	70 FCE	55 (63%)	30 (37%)	85 FCE
General Office	710	15,000 SF	170 FCE	35 (86%)	5 (14%)	40 FCE	5 (16%)	15 (84%)	20 FCE
Total Trips			1,780	60	90	150	90	65	155

¹ ITE Trip Rates (X.XX) and/or Fitted Curve Equations (FCE) are from the ITE Trip Generation Manual, 10th Edition.

TRIP DISTRIBUTION (New Trips)

W. on Hill Street	10%	180	5	10	10	5
N. on Campus Drive	15%	265	10	15	15	10
S. on STH 83	75%	1335	45	65	65	50
	100%	1780	60	90	90	65





Year 2020 Background Traffic Operations & Queues

Intersection	Peak Hour	MOE ^{1,2}	Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Hill Street (STH 83)/Campus Drive & STH 83 (Traffic Signal)	AM	LOS	-	C	A	C	C	-	A	-	A	-	-	-
		Queue	-	15	125	55	25	-	60	-	35	-	-	-
	PM	LOS	-	C	A	C	B	-	B	-	A	-	-	-
		Queue	-	30	45	110	30	-	75	-	15	-	-	-

¹ (--) indicates a movement that is prohibited, not analyzed, or does not exist; All free-flow movements shown as LOS A.

² Queue is maximum of the 50th & 95th percentile queue, measured in feet.

Year 2020 Build Traffic Operations & Queues

Intersection	Peak Hour	MOE ^{1,2}	Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Hill Street (STH 83)/Campus Drive & STH 83 (Traffic Signal)	AM	LOS	-	C	A	C	B	-	A	-	A	-	-	-
		Queue	-	25	60	95	30	-	60	-	45	-	-	-
	PM	LOS	-	C	A	C	B	-	B	-	A	-	-	-
		Queue	-	35	45	140	35	-	75	-	25	-	-	-
Campus Drive & Proposed Scenic Drive (Stop Sign)	AM	LOS	-	-	-	B	-	-	A	-	A	-	-	-
		Queue	-	-	-	5	-	-	0	-	0	-	-	-
	PM	LOS	-	-	-	B	-	-	A	-	A	-	-	-
		Queue	-	-	-	5	-	-	0	-	0	-	-	-

¹ (--) indicates a movement that is prohibited, not analyzed, or does not exist; All free-flow movements shown as LOS A.

² Queue is maximum of the 50th & 95th percentile queue, measured in feet.

APPENDIX A

TRAFFIC COUNTS

Intersection Traffic Volume Report

Count Basics		Version 2013.J4.1	Page 1 of 11
Start Date:	Wednesday, October 26, 2016	Weekday	Schools in Session
Total Number of Hours Counted:	13	Non-Holiday	No Special Events



Base Information, Observed (13) Hour and Estimated (24) Hour Volume Summaries

Intersection of: **STH 83 and Hill Street**

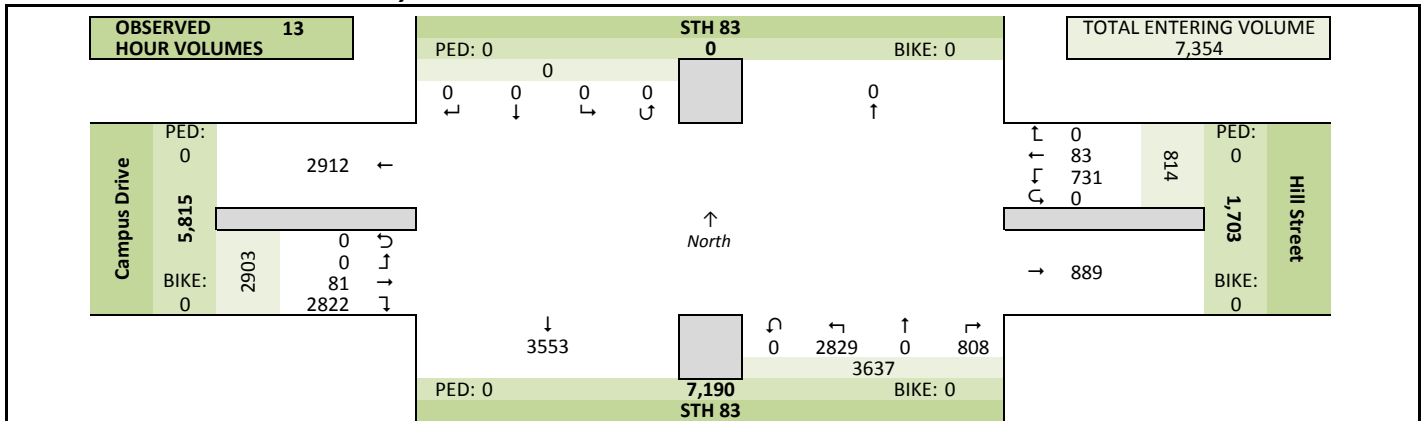
Site Information

Municipality	Hartland		
County	Waukesha	WisDOT Region	SE
Traffic Control	Traffic Signal		
Roadway Names	North Direction	↑	
North Leg	STH 83		
East Leg	Hill Street		
South Leg	STH 83		
West Leg	Campus Drive		
Special Considerations			
Schools	In Session		
Holidays	None		
Special Events	None		
Special Pedestrians Observed			
	Pre-school children	None	
	Elementry school age children	None	
	Visually impaired (white cane/helper dog)	None	
	Elderly/disabled (except wheelchairs)	None	
	Wheelchairs/electric scooters	None	
	Other (describe)	None	None

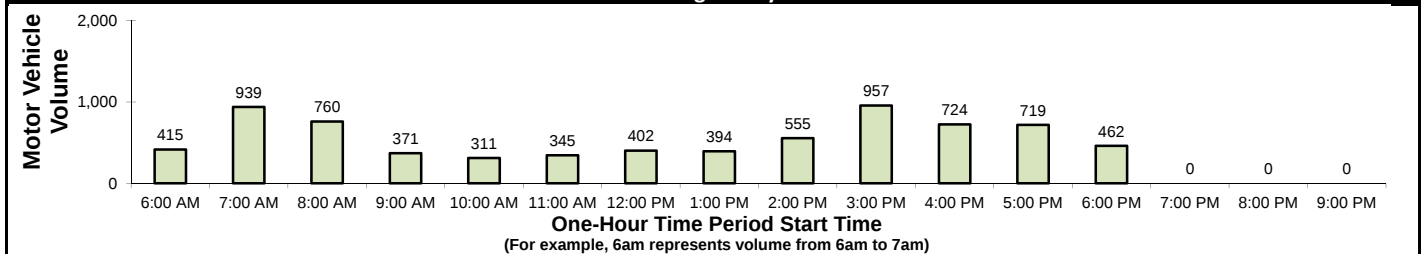
Count Information

Hrs Counted: 6:00 AM-7:00 PM					
1st Day of Count		Wednesday, October 26, 2016			Weather
AM Peak Period		Thursday, October 27, 2016			Clear & Dry
Midday Peak Period		Wednesday, October 26, 2016			Clear & Dry
PM Peak Period		Thursday, October 27, 2016			Clear & Dry
Calculated Peak Hours					
	AM	7:30-8:30am	MD	12:15-1:15pm	PM 3:00-4:00pm
Peak Hours Selected for Analysis					
	AM	7:30-8:30am	MD	12:15-1:15pm	PM 3:00-4:00pm
Daily/Seasonal Adjustment Group			(2) Urban Arterials & Collectors		
Count Expansion Group			(2) Urban Arterials & Collectors		
Daily/Seasonal Adjustment Factor			0.876	Count Expansion Factor	1.196
Company Name			TADI	Manual Adj.	1.000
Observers	AM Peak Period		Amy Scheuerlein		
	Midday Peak Period		Karlyn Bieberitz		
	PM Peak Period		Ted Atwell		
Comments	Version 2014.J4 [2014 DOT Factors]				

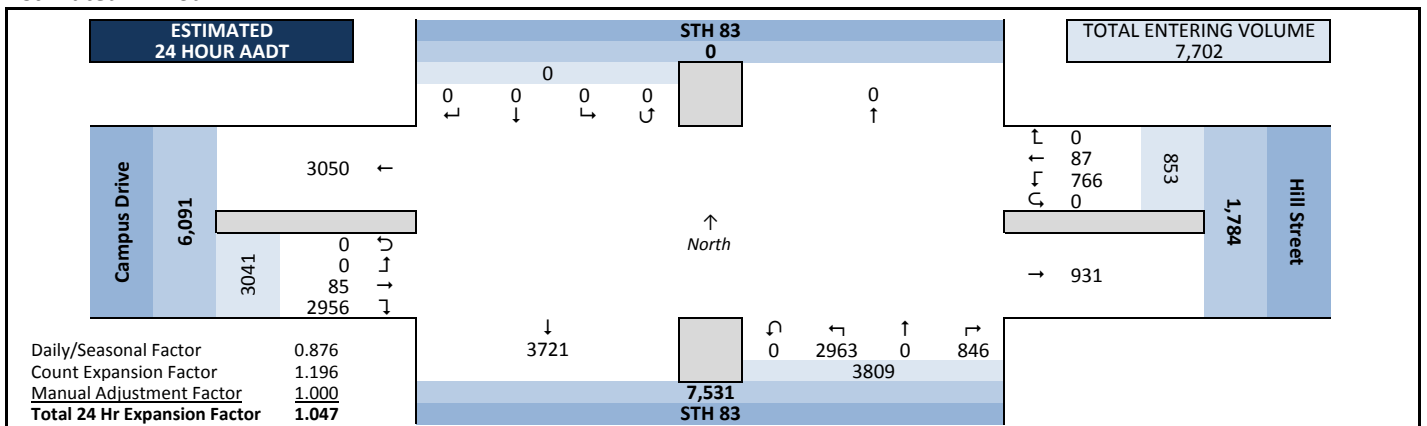
Observed 13 Hour Volume Summary



Total Entering Hourly Volume



Estimated 24 Hour AADT



Daily/Seasonal Factor	0.876
Count Expansion Factor	1.196
Manual Adjustment Factor	1.000
Total 24 Hr Expansion Factor	1.047

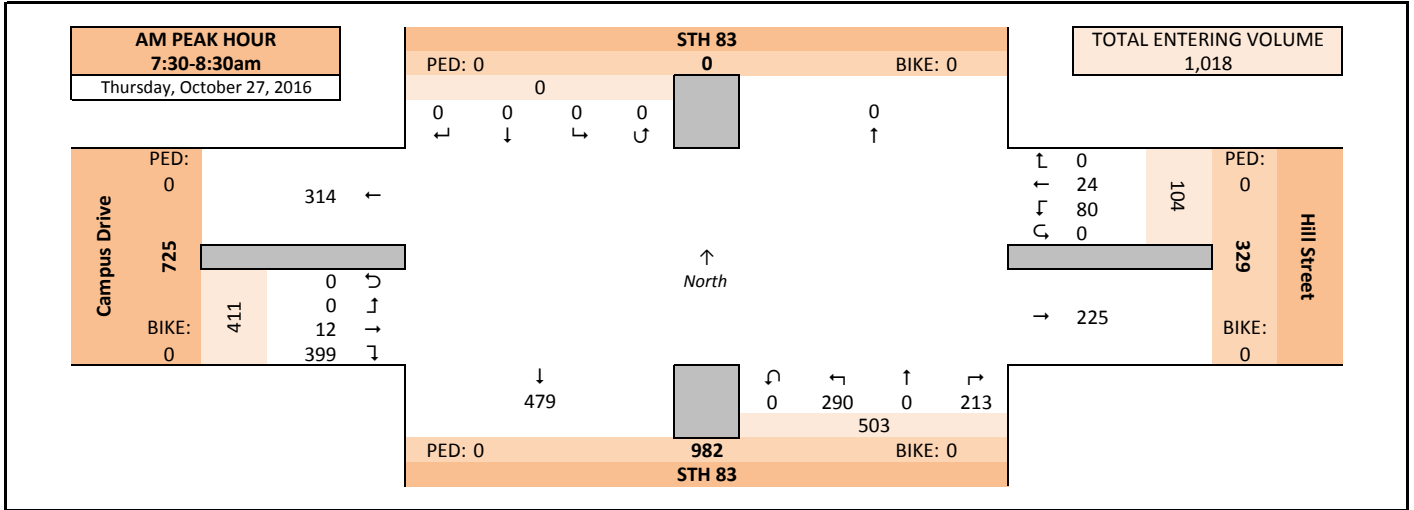
Intersection Traffic Volume Report

Count Basics		Page 2 of 11	
Start Date:	Wednesday, October 26, 2016	Weekday	Schools in Session
Total Number of Hours Counted:	13	Non-Holiday	No Special Events

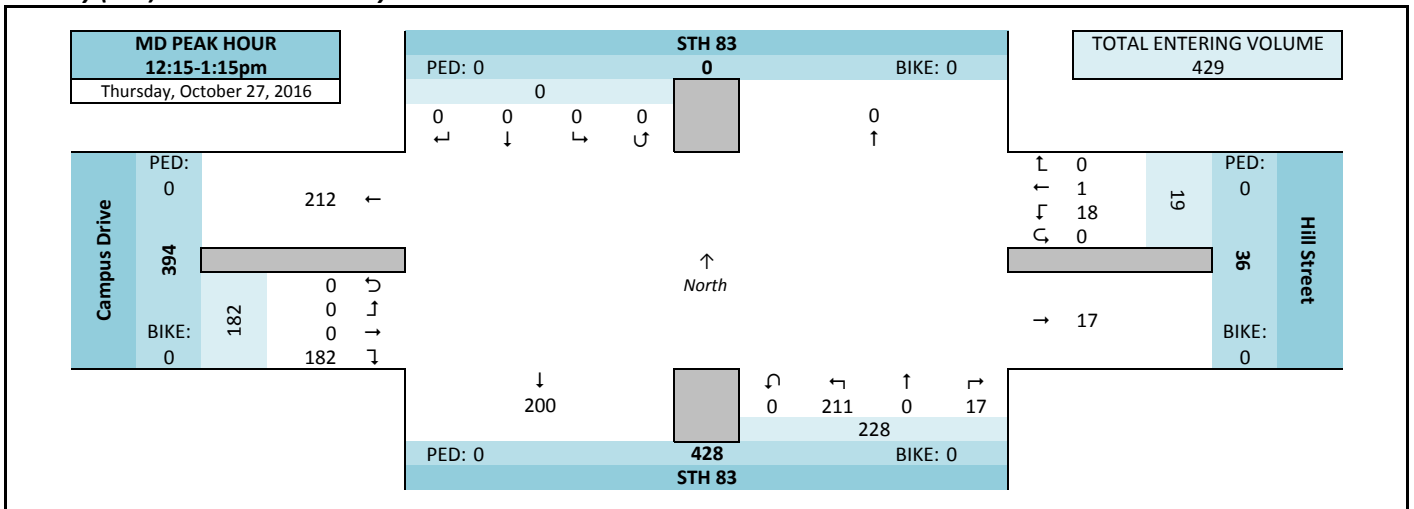
Peak Hour Volume Graphical Summary

STH 83 and Hill Street

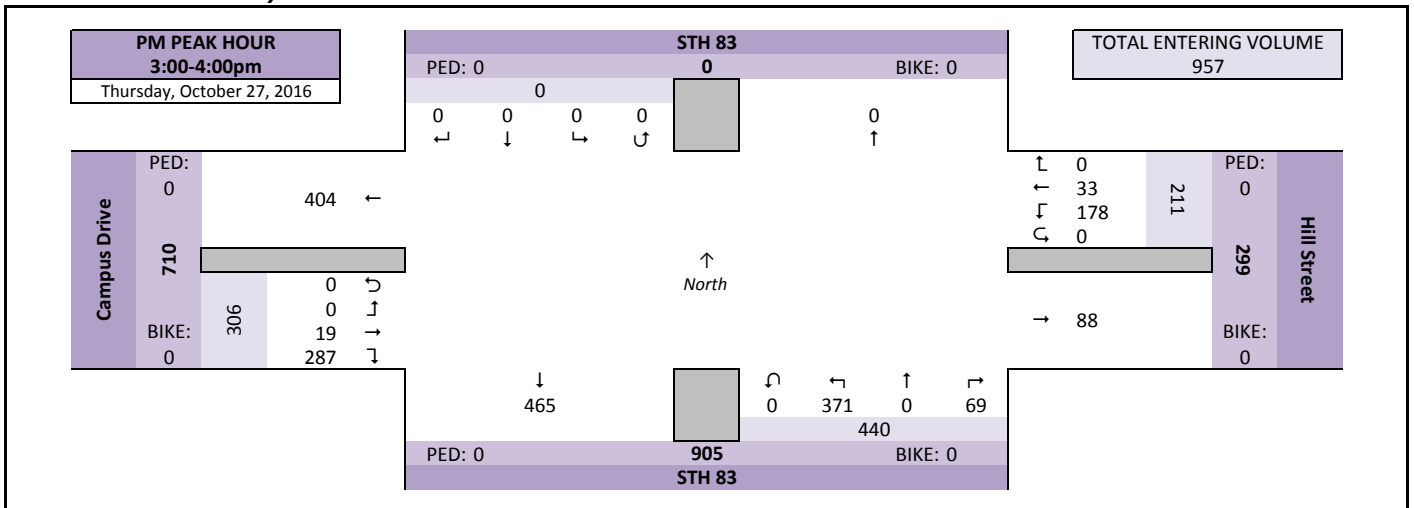
AM Peak Hour Summary



Midday (MD) Peak Hour Summary



PM Peak Hour Summary



Intersection Traffic Volume Report

Peak Hour Volume Summary

STH 83 and Hill Street

Peak Hour Volumes, Truck Percentages, and PHFs

Count Basics			Page 3 of 11
Start Date:	Wednesday, October 26, 2016	Weekday	Schools in Session
Total Number of Hours Counted:	13	Non-Holiday	No Special Events

All Motor Vehicles

Thursday, October 27, 2016		 From North					 From East					 From South					 From West					Totals
AM Peak Hour	AM Peak Hour	STH 83					Hill Street					STH 83					Campus Drive					
	Start Time	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
	7:30 AM	0	0	0	0	0	0	2	28	0	30	73	0	33	0	106	88	3	0	0	91	227
	7:45 AM	0	0	0	0	0	0	8	38	0	46	117	0	63	0	180	86	2	0	0	88	314
	8:00 AM	0	0	0	0	0	0	9	8	0	17	17	0	93	0	110	84	0	0	0	84	211
	8:15 AM	0	0	0	0	0	0	5	6	0	11	6	0	101	0	107	141	7	0	0	148	266
	Peak Hour Volume	0	0	0	0	0	0	24	80	0	104	213	0	290	0	503	399	12	0	0	411	1018
	Rounded Hourly Volume	0	0	0	0	0	0	25	80	0	105	215	0	290	0	505	400	10	0	0	410	1020
	% Single Unit Trucks	0.0	0.0	0.0	0.0	0.0	0.0	12.5	0.0	0.0	2.9	0.0	0.0	3.8	0.0	2.2	3.5	0.0	0.0	0.0	3.4	2.8
	% Heavy Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.0	0.9	0.0	5.5	0.0	3.6	1.3	0.0	0.0	0.0	1.2	2.4
% Trucks (Total)	0.0	0.0	0.0	0.0	0.0	0.0	12.5	1.2	0.0	3.8	0.9	0.0	9.3	0.0	5.8	4.8	0.0	0.0	0.0	4.6	5.1	
Peak Hour Factor (PHF)	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.53	0.00	0.57	0.46	0.00	0.72	0.00	0.70	0.71	0.43	0.00	0.00	0.69	0.81	

Thursday, October 27, 2016		↓ From North					← From East					↑ From South					→ From West						
Midday (MD) Peak Hour	MD Peak Hour	STH 83					Hill Street					STH 83					Campus Drive						
	Start Time	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Totals	
	12:15 PM	0	0	0	0	0	0	0	1	0	1	6	0	50	0	56	55	0	0	0	0	55	112
	12:30 PM	0	0	0	0	0	0	0	7	0	7	3	0	60	0	63	39	0	0	0	0	39	109
	12:45 PM	0	0	0	0	0	0	0	6	0	6	3	0	50	0	53	41	0	0	0	0	41	100
	1:00 PM	0	0	0	0	0	0	1	4	0	5	5	0	51	0	56	47	0	0	0	0	47	108
	Peak Hour Volume	0	0	0	0	0	0	1	18	0	19	17	0	211	0	228	182	0	0	0	0	182	429
	Rounded Hourly Volume	0	0	0	0	0	0	0	20	0	20	15	0	210	0	225	180	0	0	0	0	180	425
	% Single Unit Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	0.0	3.3	0.0	3.9	5.5	0.0	0.0	0.0	0.0	5.5	4.4
	% Heavy Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	5.3	5.9	0.0	5.2	0.0	5.3	1.6	0.0	0.0	0.0	0.0	1.6	3.7
% Trucks (Total)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	5.3	17.6	0.0	8.5	0.0	9.2	7.1	0.0	0.0	0.0	0.0	7.1	8.2	
Peak Hour Factor (PHF)	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.64	0.00	0.68	0.71	0.00	0.88	0.00	0.90	0.83	0.00	0.00	0.00	0.00	0.83	0.96	

Thursday, October 27, 2016		↓ From North					← From East					↑ From South					→ From West						
PM Peak Hour	PM Peak Hour	STH 83					Hill Street					STH 83					Campus Drive						
	Start Time	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Totals	
	3:00 PM	0	0	0	0	0	0	17	79	0	96	27	0	76	0	103	50	0	0	0	0	50	249
	3:15 PM	0	0	0	0	0	0	9	38	0	47	17	0	116	0	133	47	0	0	0	0	47	227
	3:30 PM	0	0	0	0	0	0	6	28	0	34	11	0	106	0	117	91	7	0	0	0	98	249
	3:45 PM	0	0	0	0	0	0	1	33	0	34	14	0	73	0	87	99	12	0	0	0	111	232
	Peak Hour Volume	0	0	0	0	0	0	33	178	0	211	69	0	371	0	440	287	19	0	0	0	306	957
	Rounded Hourly Volume	0	0	0	0	0	0	35	180	0	215	70	0	370	0	440	285	20	0	0	0	305	960
	% Single Unit Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	1.8	4.9	21.1	0.0	0.0	0.0	5.9	2.7
	% Heavy Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.5	1.4	0.0	1.6	0.0	1.6	0.7	0.0	0.0	0.0	0.7	1.0	
% Trucks (Total)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.5	1.4	0.0	3.8	0.0	3.4	5.6	21.1	0.0	0.0	0.0	6.5	3.8	
Peak Hour Factor (PHF)	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.56	0.00	0.55	0.64	0.00	0.80	0.00	0.83	0.72	0.40	0.00	0.00	0.69	0.96		

Peak Hour Pedestrian and Bicyclist Volumes

[illegible]

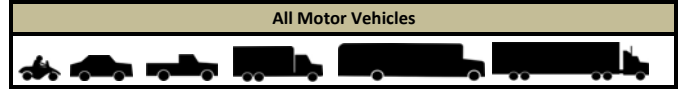
Intersection Traffic Volume Report

15-Minute Motor Vehicle Data

STH 83 and Hill Street

15-Minute Motor Vehicle Data

Count Basics			Page 5 of 11
Start Date:	Wednesday, October 26, 2016	Weekday	Schools in Session
Total Number of Hours Counted:	13	Non-Holiday	No Special Events



15-Minute Time Period Start Time	From North					From East					From South					From West					15-Min Totals	Hourly Sum	PHF		
	STH 83					Hill Street					STH 83					Campus Drive									
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total					
AM Peak Period	6:00 AM	0	0	0	0	0	0	0	4	0	4	1	0	19	0	20	38	0	0	0	0	38	62	415	0.66
	6:15 AM	0	0	0	0	0	0	1	5	0	6	2	0	34	0	36	57	0	0	0	0	57	99	561	0.67
	6:30 AM	0	0	0	0	0	0	1	1	0	2	13	0	30	0	43	49	2	0	0	0	51	96	652	0.78
	6:45 AM	0	0	0	0	0	0	1	7	0	8	49	0	29	0	78	71	1	0	0	0	72	158	783	0.86
	7:00 AM	0	0	0	0	0	0	0	13	0	13	85	0	43	0	128	64	3	0	0	0	67	208	939	0.75
	7:15 AM	0	0	0	0	0	0	1	15	0	16	47	0	52	0	99	73	2	0	0	0	75	190	942	0.75
	7:30 AM	0	0	0	0	0	0	2	28	0	30	73	0	33	0	106	88	3	0	0	0	91	227	1018	0.81
	7:45 AM	0	0	0	0	0	0	8	38	0	46	117	0	63	0	180	86	2	0	0	0	88	314	946	0.75
	8:00 AM	0	0	0	0	0	0	9	8	0	17	17	0	93	0	110	84	0	0	0	0	84	211	760	0.71
	8:15 AM	0	0	0	0	0	0	5	6	0	11	6	0	101	0	107	141	7	0	0	0	148	266	658	0.62
	8:30 AM	0	0	0	0	0	0	0	13	0	13	3	0	39	0	42	97	3	0	0	0	100	155	477	0.77
	8:45 AM	0	0	0	0	0	0	2	14	0	16	5	0	35	0	40	72	0	0	0	0	72	128	410	0.80
	9:00 AM	0	0	0	0	0	0	0	6	0	6	9	0	38	0	47	55	1	0	0	0	56	109	371	0.85
	9:15 AM	0	0	0	0	0	0	0	6	0	6	6	0	28	0	34	43	2	0	0	0	45	85	342	0.96
	9:30 AM	0	0	0	0	0	0	0	4	0	4	4	0	37	0	41	43	0	0	0	0	43	88	345	0.97
	9:45 AM	0	0	0	0	0	0	0	4	0	4	3	0	42	0	45	40	0	0	0	0	40	89	323	0.91
Midday Peak Period	10:00 AM	0	0	0	0	0	0	0	2	0	2	5	0	41	0	46	31	1	0	0	0	32	80	311	0.88
	10:15 AM	0	0	0	0	0	0	0	4	0	4	4	0	33	0	37	46	1	0	0	0	47	88	289	0.82
	10:30 AM	0	0	0	0	0	0	0	3	0	3	7	0	32	0	39	23	1	0	0	0	24	66	293	0.80
	10:45 AM	0	0	0	0	0	0	1	7	0	8	7	0	34	0	41	28	0	0	0	0	28	77	344	0.74
	11:00 AM	0	0	0	0	0	0	0	5	0	5	1	0	25	0	26	27	0	0	0	0	27	58	345	0.74
	11:15 AM	0	0	0	0	0	0	1	2	0	3	6	0	39	0	45	43	1	0	0	0	44	92	368	0.79
	11:30 AM	0	0	0	0	0	0	2	7	0	9	6	0	58	0	64	43	1	0	0	0	44	117	388	0.83
	11:45 AM	0	0	0	0	0	0	0	0	0	0	3	0	38	0	41	37	0	0	0	0	37	78	380	0.85
	12:00 PM	0	0	0	0	0	0	0	6	0	6	3	0	27	0	30	42	3	0	0	0	45	81	402	0.90
	12:15 PM	0	0	0	0	0	0	0	1	0	1	6	0	50	0	56	55	0	0	0	0	55	112	429	0.96
	12:30 PM	0	0	0	0	0	0	0	7	0	7	3	0	60	0	63	39	0	0	0	0	39	109	421	0.97
	12:45 PM	0	0	0	0	0	0	0	6	0	6	3	0	50	0	53	41	0	0	0	0	41	100	395	0.91
	1:00 PM	0	0	0	0	0	0	1	4	0	5	5	0	51	0	56	47	0	0	0	0	47	108	394	0.91
	1:15 PM	0	0	0	0	0	0	1	8	0	9	7	0	47	0	54	41	0	0	0	0	41	104	398	0.89
	1:30 PM	0	0	0	0	0	0	1	7	0	8	5	0	33	0	38	35	2	0	0	0	37	83	401	0.90
	1:45 PM	0	0	0	0	0	0	0	9	0	9	11	0	38	0	49	41	0	0	0	0	41	99	457	0.82
PM Peak Period	2:00 PM	0	0	0	0	0	0	0	11	0	11	5	0	54	0	59	40	2	0	0	0	42	112	555	0.70
	2:15 PM	0	0	0	0	0	0	1	17	0	18	4	0	43	0	47	40	2	0	0	0	42	107	692	0.69
	2:30 PM	0	0	0	0	0	0	2	41	0	43	7	0	51	0	58	37	1	0	0	0	38	139	812	0.82
	2:45 PM	0	0	0	0	0	0	0	55	0	55	22	0	58	0	80	62	0	0	0	0	62	197	922	0.93
	3:00 PM	0	0	0	0	0	0	17	79	0	96	27	0	76	0	103	50	0	0	0	0	50	249	957	0.96
	3:15 PM	0	0	0	0	0	0	9	38	0	47	17	0	116	0	133	47	0	0	0	0	47	227	887	0.89
	3:30 PM	0	0	0	0	0	0	6	28	0	34	11	0	106	0	117	91	7	0	0	0	98	249	852	0.86
	3:45 PM	0	0	0	0	0	0	1	33	0	34	14	0	73	0	87	99	12	0	0	0	111	232	763	0.82
	4:00 PM	0	0	0	0	0	0	1	22	0	23	20	0	78	0	98	57	1	0	0	0	58	179	724	0.94
	4:15 PM	0	0	0	0	0	0	1	16	0	17	16	0	92	0	108	65	2	0	0	0	67	192	736	0.95
	4:30 PM	0	0	0	0	0	0	0	15	0	15	13	0	68	0	81	61	3	0	0	0	64	160	774	0.84
	4:45 PM	0	0	0	0	0	0	3	21	0	24	15	0	100	0	115	52	2	0	0	0	54	193	774	0.84
	5:00 PM	0	0	0	0	0	0	1	20	0	21	26	0	88	0	114	53	3	0	0	0	56	191	719	0.78
	5:15 PM	0	0	0	0	0	0	2	24	0	26	15	0	94	0	109	89	6	0	0	0	95	230	662	0.72
	5:30 PM	0	0	0	0	0	0	1	19	0	20	18	0	66	0	84	55	1	0	0	0	56	160	550	0.86
	5:45 PM	0	0	0	0	0	0	0	11	0	11	10	0	72	0	82	45	0	0	0	0	45	138	487	0.88
	6:00 PM	0	0	0	0	0	0	0	5	0	5	15	0	71	0	86	43	0	0	0	0	43	134	462	0.86
	6:15 PM	0	0	0	0	0	0	0	12	0	12	12	0	56	0	68	37	1	0	0	0	38	118		
	6:30 PM	0	0	0	0	0	0	0	6	0	6	10	0	46	0	56	34	1	0	0	0	35	97		
	6:45 PM	0	0	0	0	0	0	1	8	0	9	9	0	49	0	58	45	1	0	0	0	46	113		
	7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	7:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	7:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	7:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	8:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	8:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	8:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Totals	0	0	0	0	0	0	83	731	0	814	808	0	2829	0	3637	2822	81	0	0	0	2903	7354			

Intersection Traffic Volume Report

15-Minute Heavy Vehicle Data

STH 83 and Hill Street

Count Basics			Page 9 of 11
Start Date:	Wednesday, October 26, 2016	Weekday	Schools in Session
Total Number of Hours Counted:	13	Non-Holiday	No Special Events

Heavy Vehicles (Single-Unit Trucks, Buses & Semi-Trucks)



15-Minute Heavy Vehicle Data

15-Minute Time Period Start Time	From North							From East							From South							From West							15-Min Totals	Hourly Sum
	STH 83							Hill Street							STH 83							Campus Drive								
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total										
AM Peak Period	6:00 AM	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	2	0	0	0	2	4	20							
	6:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	1	4	0	0	0	0	4	5	22							
	6:30 AM	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	0	0	0	0	0	2	25							
	6:45 AM	0	0	0	0	0	0	0	0	0	2	0	2	0	4	5	0	0	0	0	5	9	34							
	7:00 AM	0	0	0	0	0	0	0	0	0	1	0	4	0	5	1	0	0	0	0	1	6	40							
	7:15 AM	0	0	0	0	0	0	0	2	0	2	1	0	3	0	4	2	0	0	0	0	2	8	47						
	7:30 AM	0	0	0	0	0	0	0	0	0	1	0	5	0	6	5	0	0	0	0	5	11	52							
	7:45 AM	0	0	0	0	0	0	2	0	0	2	1	0	9	0	10	3	0	0	0	3	15	51							
	8:00 AM	0	0	0	0	0	0	1	1	0	2	0	0	7	0	7	4	0	0	0	4	13	50							
	8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	7	0	0	0	7	13	50							
	8:30 AM	0	0	0	0	0	0	0	0	0	0	0	3	0	3	7	0	0	0	0	7	10	49							
	8:45 AM	0	0	0	0	0	0	0	1	0	1	0	0	7	0	7	6	0	0	0	6	14	46							
	9:00 AM	0	0	0	0	0	0	0	2	0	2	1	0	4	0	5	6	0	0	0	6	13	42							
	9:15 AM	0	0	0	0	0	0	0	2	0	2	2	0	2	0	4	6	0	0	0	6	12	37							
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	6	0	0	0	6	7	29								
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5	0	0	0	5	10	25								
Midday Peak Period	10:00 AM	0	0	0	0	0	0	0	0	0	0	0	7	0	7	1	0	0	0	0	1	8	20							
	10:15 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	0	0	0	2	4	16							
	10:30 AM	0	0	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	3	18							
	10:45 AM	0	0	0	0	0	0	0	2	0	2	0	0	2	0	2	1	0	0	0	1	5	20							
	11:00 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0	0	0	0	3	4	17							
	11:15 AM	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4	0	0	0	0	4	6	25							
	11:30 AM	0	0	0	0	0	0	0	0	0	0	0	3	0	3	2	0	0	0	0	2	5	32							
	11:45 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	2	37							
	12:00 PM	0	0	0	0	0	0	0	2	0	2	0	4	0	4	5	1	0	0	0	6	12	37							
	12:15 PM	0	0	0	0	0	0	0	0	0	1	0	8	0	9	4	0	0	0	0	4	13	35							
	12:30 PM	0	0	0	0	0	0	0	0	0	0	0	6	0	6	4	0	0	0	0	4	10	28							
	12:45 PM	0	0	0	0	0	0	0	1	0	1	1	0	0	1	1	0	0	0	0	0	2	22							
	1:00 PM	0	0	0	0	0	0	0	0	0	1	0	4	0	5	5	0	0	0	0	5	10	25							
	1:15 PM	0	0	0	0	0	0	0	0	0	0	0	4	0	4	2	0	0	0	0	2	6	24							
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	3	0	3	1	0	0	0	0	1	4	26								
1:45 PM	0	0	0	0	0	0	0	1	0	1	0	0	3	0	3	1	0	0	0	1	5	30								
PM Peak Period	2:00 PM	0	0	0	0	0	0	0	0	0	0	0	4	0	4	5	0	0	0	0	5	9	38							
	2:15 PM	0	0	0	0	0	0	0	1	0	1	0	5	0	5	2	0	0	0	0	2	8	37							
	2:30 PM	0	0	0	0	0	0	0	0	0	0	0	3	0	3	5	0	0	0	0	5	8	33							
	2:45 PM	0	0	0	0	0	0	0	4	0	4	0	3	0	3	6	0	0	0	0	6	13	36							
	3:00 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	2	6	0	0	0	0	6	8	36							
	3:15 PM	0	0	0	0	0	0	0	0	0	1	0	3	0	4	0	0	0	0	0	0	4	32							
	3:30 PM	0	0	0	0	0	0	0	1	0	1	0	7	0	7	3	0	0	0	0	3	11	38							
	3:45 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	2	7	4	0	0	0	11	13	35							
	4:00 PM	0	0	0	0	0	0	0	0	0	2	0	2	0	4	0	0	0	0	0	0	4	30							
	4:15 PM	0	0	0	0	0	0	0	0	0	1	0	8	0	9	1	0	0	0	0	1	10	29							
	4:30 PM	0	0	0	0	0	0	0	1	0	1	0	5	0	5	2	0	0	0	0	2	8	21							
	4:45 PM	0	0	0	0	0	0	0	1	0	1	0	6	0	6	1	0	0	0	0	1	8	19							
	5:00 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0	0	0	0	1	3	14							
	5:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	2	11							
	5:30 PM	0	0	0	0	0	0	0	0	0	0	0	5	0	5	1	0	0	0	0	1	6	16							
	5:45 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0	0	0	0	1	3	11							
	6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9							
	6:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	1	6	0	0	0	0	6	7								
	6:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1								
	6:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1								
	7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
	7:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
	7:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
	7:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
8:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
8:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
8:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
9:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
9:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
9:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
Totals		0	0	0	0	0	0	3	23	0	26	17	0	176	0	193	154	5	0	0	159	378								

Peak Hour Heavy Vehicle Volume Summary

Hourly Time Period Start Time	From North					From East					From South					From West					Total Hourly Volume
	STH 83					Hill Street					STH 83					Campus Drive					
	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	Right	Thru	Left	U-Tn	Total	
AM 7:30 AM	0	0	0	0	0	0	3	1	0	4	2	0	27	0	29	19	0	0	0	19	52
MD 12:15 PM	0	0	0	0	0	0	0	1	0	1	3	0	18	0	21	13	0	0	0	13	35
PM 3:00 PM	0	0	0	0	0	0	0	1	0	1	1	0	14	0	15	16	4	0	0	20	36

APPENDIX B

SYNCHRO TRAFFIC ANALYSIS

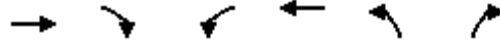
Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Background
AM Peak Hour

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↙	↑	↖	↗
Traffic Volume (vph)	10	410	80	25	295	220
Future Volume (vph)	10	410	80	25	295	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	240
Storage Lanes		1	1		2	1
Taper Length (ft)			25		25	
Right Turn on Red		No				No
Link Speed (mph)	35			25	35	
Link Distance (ft)	507			460	758	
Travel Time (s)	9.9			12.5	14.8	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Growth Factor	100%	62%	100%	100%	100%	62%
Heavy Vehicles (%)	5%	5%	4%	4%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	12	314	99	31	364	168
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA	pm+ov	pm+pt	NA	Prot	pt+ov
Protected Phases	4	6	3	8	6	6 3
Permitted Phases		4	8			
Detector Phase	4	6	3	8	6	6 3
Switch Phase						
Minimum Initial (s)	10.0	15.0	6.0	10.0	15.0	
Minimum Split (s)	16.5	21.9	10.5	16.5	21.9	
Total Split (s)	18.0	43.0	14.0	32.0	43.0	
Total Split (%)	24.0%	57.3%	18.7%	42.7%	57.3%	
Maximum Green (s)	11.5	36.1	9.5	25.5	36.1	
Yellow Time (s)	3.5	3.9	3.5	3.5	3.9	
All-Red Time (s)	3.0	3.0	1.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.5	6.9	4.5	6.5	6.9	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	1.5	5.3	1.5	1.5	5.3	
Minimum Gap (s)	1.5	2.0	1.5	1.5	2.0	

Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Background
AM Peak Hour



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Time Before Reduce (s)	30.0	26.0	20.0	30.0	26.0	
Time To Reduce (s)	0.0	14.0	0.0	0.0	14.0	
Recall Mode	None	C-Max	None	None	C-Max	
Walk Time (s)						
Flash Dont Walk (s)						
Pedestrian Calls (#/hr)						
v/c Ratio	0.05	0.29	0.31	0.10	0.17	0.12
Control Delay	29.1	5.1	26.9	24.5	6.3	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.1	5.1	26.9	24.5	6.3	1.7
Queue Length 50th (ft)	5	48	42	13	25	0
Queue Length 95th (ft)	17	60	57	25	61	37
Internal Link Dist (ft)	427			380	678	
Turn Bay Length (ft)						240
Base Capacity (vph)	277	1068	315	621	2149	1429
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	0.04	0.29	0.31	0.05	0.17	0.12

Intersection Summary

Area Type: Other

Cycle Length: 75

Actuated Cycle Length: 75

Offset: 35 (47%), Referenced to phase 2: and 6:NBL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Description: EB RT changed to pm+ov to get output in HCM6

Splits and Phases: 100: STH 83 & Hill Street (STH 83)/Campus Drive



HCM 6th Signalized Intersection Summary
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Background
AM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	10	410	80	25	295	220
Future Volume (veh/h)	10	410	80	25	295	220
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1826	1826	1841	1841	1811	1811
Adj Flow Rate, veh/h	12	314	99	31	364	168
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	5	5	4	4	6	6
Cap, veh/h	243	1070	351	484	1868	964
Arrive On Green	0.13	0.13	0.07	0.26	0.56	0.56
Sat Flow, veh/h	1826	1547	1753	1841	3346	1535
Grp Volume(v), veh/h	12	314	99	31	364	168
Grp Sat Flow(s),veh/h/ln	1826	1547	1753	1841	1673	1535
Q Serve(g_s), s	0.4	5.9	3.5	0.9	4.0	3.4
Cycle Q Clear(g_c), s	0.4	5.9	3.5	0.9	4.0	3.4
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	243	1070	351	484	1868	964
V/C Ratio(X)	0.05	0.29	0.28	0.06	0.19	0.17
Avail Cap(c_a), veh/h	280	1101	450	626	1868	964
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.4	4.5	23.6	20.7	8.2	5.8
Incr Delay (d2), s/veh	0.0	0.1	0.2	0.0	0.2	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.3	9.5	2.5	0.7	2.3	1.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	28.4	4.5	23.8	20.7	8.4	6.2
LnGrp LOS	C	A	C	C	A	A
Approach Vol, veh/h	326			130	532	
Approach Delay, s/veh	5.4			23.1	7.7	
Approach LOS	A			C	A	
Timer - Assigned Phs			3	4	6	8
Phs Duration (G+Y+Rc), s			9.7	16.5	48.8	26.2
Change Period (Y+Rc), s			4.5	6.5	6.9	6.5
Max Green Setting (Gmax), s			9.5	11.5	36.1	25.5
Max Q Clear Time (g_c+I1), s			5.5	7.9	6.0	2.9
Green Ext Time (p_c), s			0.0	0.2	5.1	0.0
Intersection Summary						
HCM 6th Ctrl Delay			9.0			
HCM 6th LOS			A			
Notes						
User approved changes to right turn type.						

Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Background
PM Peak Hour

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	20	290	185	35	375	70
Future Volume (vph)	20	290	185	35	375	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	240
Storage Lanes		1	1		2	1
Taper Length (ft)			25		25	
Right Turn on Red		No				No
Link Speed (mph)	35			25	35	
Link Distance (ft)	507			460	758	
Travel Time (s)	9.9			12.5	14.8	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Growth Factor	100%	62%	100%	100%	100%	62%
Heavy Vehicles (%)	7%	7%	1%	1%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	21	187	193	36	391	45
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA	pm+ov	pm+pt	NA	Prot	pt+ov
Protected Phases	4	6	3	8	6	6 3
Permitted Phases		4	8			
Detector Phase	4	6	3	8	6	6 3
Switch Phase						
Minimum Initial (s)	10.0	15.0	6.0	10.0	15.0	
Minimum Split (s)	16.5	21.9	10.5	16.5	21.9	
Total Split (s)	18.0	42.0	15.0	33.0	42.0	
Total Split (%)	24.0%	56.0%	20.0%	44.0%	56.0%	
Maximum Green (s)	11.5	35.1	10.5	26.5	35.1	
Yellow Time (s)	3.5	3.9	3.5	3.5	3.9	
All-Red Time (s)	3.0	3.0	1.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.5	6.9	4.5	6.5	6.9	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	1.5	5.3	1.5	1.5	5.3	
Minimum Gap (s)	1.5	2.0	1.5	1.5	2.0	

Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Background
PM Peak Hour



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Time Before Reduce (s)	30.0	26.0	20.0	30.0	26.0	
Time To Reduce (s)	0.0	14.0	0.0	0.0	14.0	
Recall Mode	None	C-Max	None	None	C-Max	
Walk Time (s)						
Flash Dont Walk (s)						
Pedestrian Calls (#/hr)						
v/c Ratio	0.09	0.18	0.55	0.09	0.19	0.03
Control Delay	29.6	4.3	28.9	20.7	8.2	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.6	4.3	28.9	20.7	8.2	2.8
Queue Length 50th (ft)	9	26	86	15	27	0
Queue Length 95th (ft)	28	43	112	30	76	14
Internal Link Dist (ft)	427			380	678	
Turn Bay Length (ft)						240
Base Capacity (vph)	272	1050	349	664	2067	1372
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	0.08	0.18	0.55	0.05	0.19	0.03

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 75
Offset: 35 (47%), Referenced to phase 2: and 6:NBL, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Description: EB RT changed to pm+ov to get output in HCM6

Splits and Phases: 100: STH 83 & Hill Street (STH 83)/Campus Drive



HCM 6th Signalized Intersection Summary
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Background
PM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	20	290	185	35	375	70
Future Volume (veh/h)	20	290	185	35	375	70
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1796	1796	1885	1885	1856	1856
Adj Flow Rate, veh/h	21	187	193	36	391	45
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	7	7	1	1	3	3
Cap, veh/h	238	987	443	576	1769	989
Arrive On Green	0.13	0.13	0.11	0.31	0.52	0.52
Sat Flow, veh/h	1796	1522	1795	1885	3428	1572
Grp Volume(v), veh/h	21	187	193	36	391	45
Grp Sat Flow(s),veh/h/ln	1796	1522	1795	1885	1714	1572
Q Serve(g_s), s	0.8	3.7	6.6	1.0	4.7	0.8
Cycle Q Clear(g_c), s	0.8	3.7	6.6	1.0	4.7	0.8
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	238	987	443	576	1769	989
V/C Ratio(X)	0.09	0.19	0.44	0.06	0.22	0.05
Avail Cap(c_a), veh/h	275	1019	492	666	1769	989
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.6	5.3	22.3	18.5	9.9	5.3
Incr Delay (d2), s/veh	0.1	0.0	0.3	0.0	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.6	5.8	4.9	0.8	2.9	0.5
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	28.6	5.3	22.6	18.5	10.2	5.4
LnGrp LOS	C	A	C	B	B	A
Approach Vol, veh/h	208			229	436	
Approach Delay, s/veh	7.7			21.9	9.7	
Approach LOS	A			C	A	
Timer - Assigned Phs			3	4	6	8
Phs Duration (G+Y+Rc), s			13.0	16.4	45.6	29.4
Change Period (Y+Rc), s			4.5	6.5	6.9	6.5
Max Green Setting (Gmax), s			10.5	11.5	35.1	26.5
Max Q Clear Time (g_c+I1), s			8.6	5.7	6.7	3.0
Green Ext Time (p_c), s			0.0	0.1	4.0	0.1
Intersection Summary						
HCM 6th Ctrl Delay			12.4			
HCM 6th LOS			B			
Notes						
User approved changes to right turn type.						

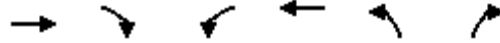
Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Build
AM Peak Hour

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	15	410	145	35	295	265
Future Volume (vph)	15	410	145	35	295	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	240
Storage Lanes		1	1		2	1
Taper Length (ft)			25		25	
Right Turn on Red		No				No
Link Speed (mph)	35			25	35	
Link Distance (ft)	507			460	758	
Travel Time (s)	9.9			12.5	14.8	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Growth Factor	100%	62%	100%	100%	100%	62%
Heavy Vehicles (%)	5%	5%	4%	4%	6%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	19	314	179	43	364	203
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA	pm+ov	pm+pt	NA	Prot	pt+ov
Protected Phases	4	6	3	8	6	6 3
Permitted Phases		4	8			
Detector Phase	4	6	3	8	6	6 3
Switch Phase						
Minimum Initial (s)	10.0	15.0	6.0	10.0	15.0	
Minimum Split (s)	16.5	21.9	10.5	16.5	21.9	
Total Split (s)	18.0	43.0	14.0	32.0	43.0	
Total Split (%)	24.0%	57.3%	18.7%	42.7%	57.3%	
Maximum Green (s)	11.5	36.1	9.5	25.5	36.1	
Yellow Time (s)	3.5	3.9	3.5	3.5	3.9	
All-Red Time (s)	3.0	3.0	1.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.5	6.9	4.5	6.5	6.9	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	1.5	5.3	1.5	1.5	5.3	
Minimum Gap (s)	1.5	2.0	1.5	1.5	2.0	

Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Build
AM Peak Hour



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Time Before Reduce (s)	30.0	26.0	20.0	30.0	26.0	
Time To Reduce (s)	0.0	14.0	0.0	0.0	14.0	
Recall Mode	None	C-Max	None	None	C-Max	
Walk Time (s)						
Flash Dont Walk (s)						
Pedestrian Calls (#/hr)						
v/c Ratio	0.08	0.29	0.57	0.14	0.17	0.14
Control Delay	29.5	5.1	33.3	25.2	6.3	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.5	5.1	33.3	25.2	6.3	1.7
Queue Length 50th (ft)	8	48	79	18	25	0
Queue Length 95th (ft)	24	60	95	32	61	45
Internal Link Dist (ft)	427			380	678	
Turn Bay Length (ft)						240
Base Capacity (vph)	277	1068	315	621	2149	1429
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	0.07	0.29	0.57	0.07	0.17	0.14

Intersection Summary

Area Type: Other

Cycle Length: 75

Actuated Cycle Length: 75

Offset: 35 (47%), Referenced to phase 2: and 6:NBL, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Description: EB RT changed to pm+ov to get output in HCM6

Splits and Phases: 100: STH 83 & Hill Street (STH 83)/Campus Drive



HCM 6th Signalized Intersection Summary

100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Build
AM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	15	410	145	35	295	265
Future Volume (veh/h)	15	410	145	35	295	265
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1826	1826	1841	1841	1811	1811
Adj Flow Rate, veh/h	19	314	179	43	364	203
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Percent Heavy Veh, %	5	5	4	4	6	6
Cap, veh/h	243	1012	413	554	1741	964
Arrive On Green	0.13	0.13	0.11	0.30	0.52	0.52
Sat Flow, veh/h	1826	1547	1753	1841	3346	1535
Grp Volume(v), veh/h	19	314	179	43	364	203
Grp Sat Flow(s),veh/h/ln	1826	1547	1753	1841	1673	1535
Q Serve(g_s), s	0.7	6.6	6.2	1.3	4.4	4.3
Cycle Q Clear(g_c), s	0.7	6.6	6.2	1.3	4.4	4.3
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	243	1012	413	554	1741	964
V/C Ratio(X)	0.08	0.31	0.43	0.08	0.21	0.21
Avail Cap(c_a), veh/h	280	1043	446	626	1741	964
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.5	5.6	22.5	18.8	9.7	6.0
Incr Delay (d2), s/veh	0.1	0.1	0.3	0.0	0.3	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.5	9.5	4.6	0.9	2.6	2.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	28.5	5.7	22.7	18.8	9.9	6.5
LnGrp LOS	C	A	C	B	A	A
Approach Vol, veh/h	333			222	567	
Approach Delay, s/veh	7.0			22.0	8.7	
Approach LOS	A			C	A	
Timer - Assigned Phs			3	4	6	8
Phs Duration (G+Y+Rc), s			12.6	16.5	45.9	29.1
Change Period (Y+Rc), s			4.5	6.5	6.9	6.5
Max Green Setting (Gmax), s			9.5	11.5	36.1	25.5
Max Q Clear Time (g_c+I1), s			8.2	8.6	6.4	3.3
Green Ext Time (p_c), s			0.0	0.1	5.4	0.1
Intersection Summary						
HCM 6th Ctrl Delay			10.8			
HCM 6th LOS			B			

Notes

User approved changes to right turn type.

Lanes, Volumes, Timings
200: Campus Drive & New Public Road

2020 Build
AM Peak Hour

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	35	5	165	10	1	90
Future Volume (vph)	35	5	165	10	1	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%		0%			0%
Storage Length (ft)	0	0		0	0	
Storage Lanes	1	0		0	0	
Taper Length (ft)	25				25	
Link Speed (mph)	25		25			25
Link Distance (ft)	642		203			449
Travel Time (s)	17.5		5.5			12.2
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	1%	1%	4%	4%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%			0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	49	0	216	0	0	112
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

Intersection						
Int Delay, s/veh	1.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	35	5	165	10	1	90
Future Vol, veh/h	35	5	165	10	1	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	81	81	81	81	81	81
Heavy Vehicles, %	2	2	1	1	4	4
Mvmt Flow	43	6	204	12	1	111
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	323	210	0	0	216	0
Stage 1	210	-	-	-	-	-
Stage 2	113	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.14	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.236	-
Pot Cap-1 Maneuver	671	830	-	-	1342	-
Stage 1	825	-	-	-	-	-
Stage 2	912	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	670	830	-	-	1342	-
Mov Cap-2 Maneuver	670	-	-	-	-	-
Stage 1	825	-	-	-	-	-
Stage 2	911	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	10.6	0		0.1		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-		687	1342	
HCM Lane V/C Ratio	-	-		0.072	0.001	
HCM Control Delay (s)	-	-		10.6	7.7	
HCM Lane LOS	-	-		B	A	
HCM 95th %tile Q(veh)	-	-		0.2	0	

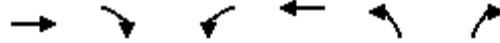
Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Build
PM Peak Hour

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑↑	↑
Traffic Volume (vph)	30	290	235	40	375	135
Future Volume (vph)	30	290	235	40	375	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	240
Storage Lanes		1	1		2	1
Taper Length (ft)			25		25	
Right Turn on Red		No				No
Link Speed (mph)	35			25	35	
Link Distance (ft)	507			460	758	
Travel Time (s)	9.9			12.5	14.8	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Growth Factor	100%	62%	100%	100%	100%	62%
Heavy Vehicles (%)	7%	7%	1%	1%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	31	187	245	42	391	87
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA	pm+ov	pm+pt	NA	Prot	pt+ov
Protected Phases	4	6	3	8	6	6 3
Permitted Phases		4	8			
Detector Phase	4	6	3	8	6	6 3
Switch Phase						
Minimum Initial (s)	10.0	15.0	6.0	10.0	15.0	
Minimum Split (s)	16.5	21.9	10.5	16.5	21.9	
Total Split (s)	18.0	42.0	15.0	33.0	42.0	
Total Split (%)	24.0%	56.0%	20.0%	44.0%	56.0%	
Maximum Green (s)	11.5	35.1	10.5	26.5	35.1	
Yellow Time (s)	3.5	3.9	3.5	3.5	3.9	
All-Red Time (s)	3.0	3.0	1.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.5	6.9	4.5	6.5	6.9	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	1.5	5.3	1.5	1.5	5.3	
Minimum Gap (s)	1.5	2.0	1.5	1.5	2.0	

Lanes, Volumes, Timings
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Build
PM Peak Hour

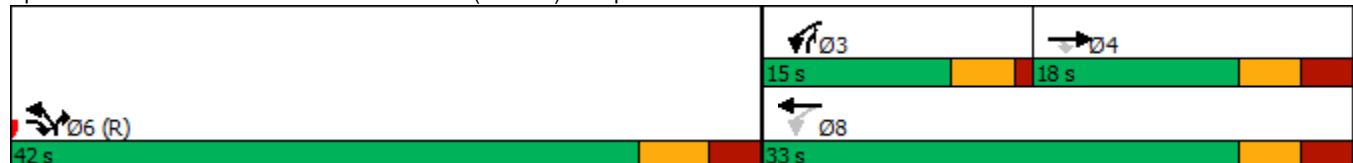


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Time Before Reduce (s)	30.0	26.0	20.0	30.0	26.0	
Time To Reduce (s)	0.0	14.0	0.0	0.0	14.0	
Recall Mode	None	C-Max	None	None	C-Max	
Walk Time (s)						
Flash Dont Walk (s)						
Pedestrian Calls (#/hr)						
v/c Ratio	0.13	0.18	0.70	0.10	0.19	0.06
Control Delay	30.3	4.3	35.1	21.0	8.2	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.3	4.3	35.1	21.0	8.2	2.8
Queue Length 50th (ft)	13	26	112	18	27	0
Queue Length 95th (ft)	37	43	141	34	76	24
Internal Link Dist (ft)	427			380	678	
Turn Bay Length (ft)						240
Base Capacity (vph)	272	1050	349	664	2067	1372
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	0.11	0.18	0.70	0.06	0.19	0.06

Intersection Summary

Area Type: Other
Cycle Length: 75
Actuated Cycle Length: 75
Offset: 35 (47%), Referenced to phase 2: and 6:NBL, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Description: EB RT changed to pm+ov to get output in HCM6

Splits and Phases: 100: STH 83 & Hill Street (STH 83)/Campus Drive



HCM 6th Signalized Intersection Summary
100: STH 83 & Hill Street (STH 83)/Campus Drive

2020 Build
PM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	30	290	235	40	375	135
Future Volume (veh/h)	30	290	235	40	375	135
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1796	1796	1885	1885	1856	1856
Adj Flow Rate, veh/h	31	187	245	42	391	87
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	7	7	1	1	3	3
Cap, veh/h	238	950	480	622	1685	988
Arrive On Green	0.13	0.13	0.14	0.33	0.49	0.49
Sat Flow, veh/h	1796	1522	1795	1885	3428	1572
Grp Volume(v), veh/h	31	187	245	42	391	87
Grp Sat Flow(s),veh/h/ln	1796	1522	1795	1885	1714	1572
Q Serve(g_s), s	1.1	3.9	8.3	1.1	4.9	1.6
Cycle Q Clear(g_c), s	1.1	3.9	8.3	1.1	4.9	1.6
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	238	950	480	622	1685	988
V/C Ratio(X)	0.13	0.20	0.51	0.07	0.23	0.09
Avail Cap(c_a), veh/h	275	982	485	666	1685	988
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.7	6.0	21.6	17.2	10.9	5.5
Incr Delay (d2), s/veh	0.1	0.0	0.3	0.0	0.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.9	5.8	6.2	0.9	3.1	0.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	28.8	6.1	21.9	17.2	11.3	5.7
LnGrp LOS	C	A	C	B	B	A
Approach Vol, veh/h	218			287	478	
Approach Delay, s/veh	9.3			21.2	10.2	
Approach LOS	A			C	B	
Timer - Assigned Phs			3	4	6	8
Phs Duration (G+Y+Rc), s			14.8	16.5	43.8	31.2
Change Period (Y+Rc), s			4.5	6.5	6.9	6.5
Max Green Setting (Gmax), s			10.5	11.5	35.1	26.5
Max Q Clear Time (g_c+I1), s			10.3	5.9	6.9	3.1
Green Ext Time (p_c), s			0.0	0.1	4.4	0.1
Intersection Summary						
HCM 6th Ctrl Delay			13.2			
HCM 6th LOS			B			
Notes						
User approved changes to right turn type.						

Lanes, Volumes, Timings
200: Campus Drive & New Public Road

2020 Build
PM Peak Hour

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	20	5	70	35	5	185
Future Volume (vph)	20	5	70	35	5	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%		0%			0%
Storage Length (ft)	0	0		0	0	
Storage Lanes	1	0		0	0	
Taper Length (ft)	25				25	
Link Speed (mph)	25		25			25
Link Distance (ft)	642		203			449
Travel Time (s)	17.5		5.5			12.2
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	6%	6%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%			0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	26	0	109	0	0	198
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		0			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

Intersection						
Int Delay, s/veh	0.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	5	70	35	5	185
Future Vol, veh/h	20	5	70	35	5	185
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	6	6	1	1
Mvmt Flow	21	5	73	36	5	193

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	294	91	0	0	109
Stage 1	91	-	-	-	-
Stage 2	203	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.11
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.209
Pot Cap-1 Maneuver	697	967	-	-	1488
Stage 1	933	-	-	-	-
Stage 2	831	-	-	-	-
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	694	967	-	-	1488
Mov Cap-2 Maneuver	694	-	-	-	-
Stage 1	933	-	-	-	-
Stage 2	828	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.1	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	736	1488
HCM Lane V/C Ratio	-	-	0.035	0.004
HCM Control Delay (s)	-	-	10.1	7.4
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.1	0

TECHNICAL MEMORANDUM

Date: September 21, 2020

To: Bryan Lindgren
Neumann Companies

From: Tammi Czewski, P.E., PTOE
Traffic Analysis & Design, Inc.

Subject: Lake Country Lutheran East Lands – Multi-Family Driveway Analysis
Hartland, WI

Introduction

This technical memorandum was prepared to evaluate future traffic operations at the multi-family driveway to Campus Drive that is being proposed for the Lake Country Lutheran East Lands development in Hartland, Wisconsin. This intersection was not previously evaluated in the September 3, 2020 *Lake Country Lutheran East Lands – Traffic Impact Analysis* (TIA) technical memorandum. It is included here to address the Village of Hartland's concerns about peak hour delays and queues as the multi-family driveway will line up directly across from the northern driveway for the Lake Country Lutheran High School (LCLHS)

Traffic Volumes

Per the Village engineer, the traffic volumes evaluated at the multi-family driveway to Campus drive should include the following changes from volumes evaluated in the TIA:

- Update the existing number of students at LCLHS that were used to generate Year 2020 Background traffic volumes on Campus Drive (updated from 193 students to 325, as found online for 2020 enrollment).
- Further increase the number of students at LCLHS to 450 to account for future enrollment at the school.
- Approximate the distribution of the trips generated by the school to the three existing driveways based on feedback from school officials.

In addition, the traffic assignment of the new site trips for the “East Lands” were slightly adjusted to better match the trip distribution of traffic to/from the north on Campus Drive (15%) and to/from the south on Campus Drive (85%).

The LCLHS trips were estimated using data from the *ITE Trip Generation Manual, 10 Edition*. Based on that data, the 325-student school generates about 805 weekday daily trips with 265 trips during the AM peak hour and 190 trips during the PM peak hour. Expansion of the school to 450 students (125 additional students) is expected to generate an additional 310 weekday daily trips, with an additional 100 trips during the AM peak hour and an additional 75 trips during the PM peak hour.

The “existing” and future additional trips for the LCLHS were distributed to the school driveways based on the trip distribution developed for the TIA. Based on conversations with school staff and a parent of a current high school student, the school trips were assigned to each driveway as follows:

- 10% to the south driveway (staff driveway)
- 65% to the middle/main driveway
- 25% to the north driveway

The revised 2020 Background traffic volumes, revised “East Lands” new trips traffic assignment, and additional high school trips (future expansion) were added together to develop the “Future Build” traffic volumes evaluated in this technical memorandum.

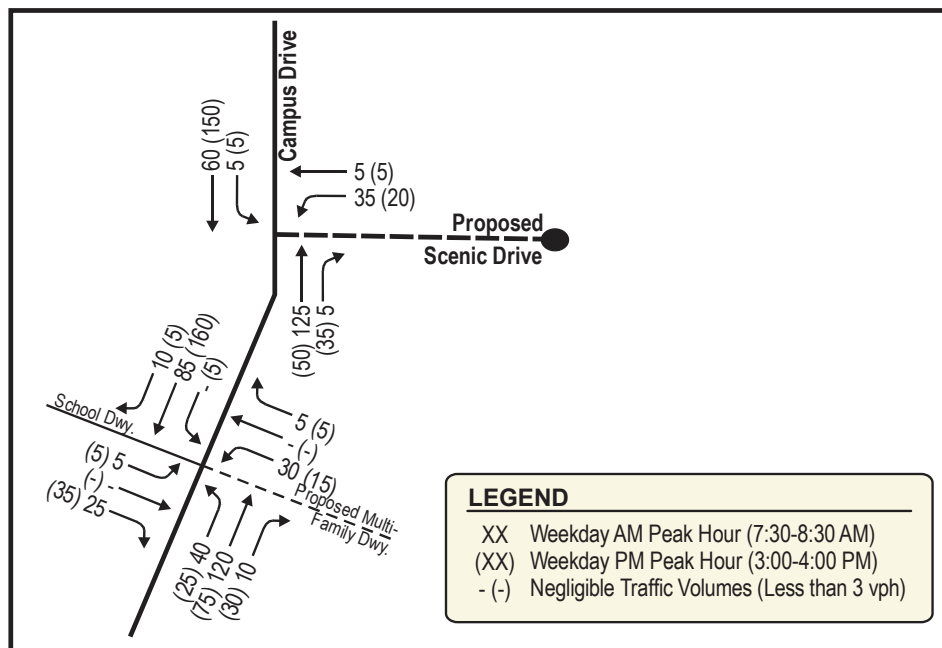


Figure 1. Build Traffic Volumes

Peak Hour Traffic Operations & Queues

The Campus Drive intersections with the proposed Scenic Drive and the multi-family driveway/LCLHS north driveway were analyzed using the Synchro 10 traffic analysis

model (outputs based on the Highway Capacity Manual, 6th Edition) and the Future Build peak hour turning movement volumes estimated for each intersection. Intersection operation is defined by “level of service”. Level of Service (LOS) is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS ‘A’, to very poor, represented by LOS ‘F’. For the purposes of this study, LOS D or better was used to define acceptable peak hour operating conditions.

Both intersections were evaluated with the existing geometrics and traffic control on Campus Drive and at the LCLHS north driveway. Scenic Drive was evaluated with a single shared westbound left-turn/right-turn lane and stop sign control on the westbound approach. The multi-family apartments driveway was evaluated with a single westbound left-turn/through/right-turn lane and stop sign control on the westbound approach. Turning volumes are not expected to be high enough to warrant separate left or right turn storage lanes on Campus Drive at either of these roadways.

Heavy traffic flow for schools typically occur in a short time period (less than 30 minutes) in the peak hours. Existing peaking patterns for Campus Drive school driveway traffic were calculated from the 15-minute traffic patterns to/from the east approach on Campus Drive at the Hill Road/Campus Drive/STH 83 intersection turning movement traffic count included in the TIA report. Based on this data, the peak hour factors evaluated in this technical memorandum were 0.50 for the AM peak hour and 0.60 for the PM peak hour. Using these very low peak hour factors for estimated traffic operations at the entire intersection is considered a very conservative/worst-case estimate of traffic operations as non-school traffic typically spreads more evenly throughout the entire peak hour.

Conclusions

As shown in the table below, the Full Build traffic volumes and school peak hour factors are expected to result in acceptable LOS C or better traffic operations for all movements at the Campus Drive intersections with Scenic Drive and the multi-family driveway/LCLHS north driveway. Peak hour traffic queues are not expected to exceed 20 feet (one vehicle) on any approaches to these intersections. Based on the existing and proposed geometrics for these intersections, there is expected to be ample storage space to accommodate these traffic queues.

Future Build Traffic Operations & Queues

Intersection	Peak Hour	MOE ^{1,2}	Level of Service per Movement by Approach											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Campus Drive & Proposed Scenic Drive (Stop Sign)	AM	LOS	-	-	-	B	-	-	A	-	-	A	-	-
		Queue	-	-	-	10	-	-	0	-	-	0	-	-
	PM	LOS	-	-	-	B	-	-	A	-	-	A	-	-
		Queue	-	-	-	5	-	-	0	-	-	0	-	-
Campus Drive & LCLHS North Driveway/Proposed Multi-Family Driveway (Stop Sign)	AM	LOS	B	A	-	C	A	A	A	A	-	A	A	A
		Queue	5	5	-	20	5	0	0	0	-	0	0	0
	PM	LOS	B	B	-	B	A	A	A	A	-	A	A	A
		Queue	5	5	-	5	5	0	0	0	-	0	0	0

¹ (--) indicates a movement that is prohibited, not analyzed, or does not exist; All free-flow movements shown as LOS A.

² Queue is maximum of the 50th & 95th percentile queue, measured in feet.

APPENDIX

SYNCHRO TRAFFIC ANALYSIS

Intersection						
Int Delay, s/veh	2.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	35	5	125	5	5	60
Future Vol, veh/h	35	5	125	5	5	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	50	50	50	50	50	50
Heavy Vehicles, %	2	2	1	1	4	4
Mvmt Flow	70	10	250	10	10	120
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	395	255	0	0	260	0
Stage 1	255	-	-	-	-	-
Stage 2	140	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.14	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.236	-
Pot Cap-1 Maneuver	610	784	-	-	1293	-
Stage 1	788	-	-	-	-	-
Stage 2	887	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	605	784	-	-	1293	-
Mov Cap-2 Maneuver	605	-	-	-	-	-
Stage 1	788	-	-	-	-	-
Stage 2	880	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	11.6	0		0.6		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-	623	1293	-	
HCM Lane V/C Ratio	-	-	0.128	0.008	-	
HCM Control Delay (s)	-	-	11.6	7.8	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	0.4	0	-	

Intersection												
Int Delay, s/veh	3.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↱			↰	↱
Traffic Vol, veh/h	5	1	25	30	1	5	40	120	10	1	85	10
Future Vol, veh/h	5	1	25	30	1	5	40	120	10	1	85	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	0	-	-	-	-	50
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	50	50	50	50	50	50	50	50	50	50	50	50
Heavy Vehicles, %	0	0	0	2	2	2	1	1	1	4	4	4
Mvmt Flow	10	2	50	60	2	10	80	240	20	2	170	20

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	590	594	170	620	604	250	190	0	0	260	0	0
Stage 1	174	174	-	410	410	-	-	-	-	-	-	-
Stage 2	416	420	-	210	194	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.52	6.22	4.11	-	-	4.14	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4.018	3.318	2.209	-	-	2.236	-	-
Pot Cap-1 Maneuver	422	421	879	400	412	789	1390	-	-	1293	-	-
Stage 1	833	759	-	619	595	-	-	-	-	-	-	-
Stage 2	618	593	-	792	740	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	396	396	879	359	387	789	1390	-	-	1293	-	-
Mov Cap-2 Maneuver	396	396	-	359	387	-	-	-	-	-	-	-
Stage 1	785	757	-	583	560	-	-	-	-	-	-	-
Stage 2	573	559	-	743	739	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	10.3		16.3		1.8		0.1	
HCM LOS	B		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1390	-	-	396	879	389	1293	-	-
HCM Lane V/C Ratio	0.058	-	-	0.03	0.057	0.185	0.002	-	-
HCM Control Delay (s)	7.7	-	-	14.4	9.3	16.3	7.8	0	-
HCM Lane LOS	A	-	-	B	A	C	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.1	0.2	0.7	0	-	-

Intersection						
Int Delay, s/veh	1.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	20	5	50	35	5	150
Future Vol, veh/h	20	5	50	35	5	150
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	60	60	60	60
Heavy Vehicles, %	2	2	6	6	1	1
Mvmt Flow	33	8	83	58	8	250
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	378	112	0	0	141	0
Stage 1	112	-	-	-	-	-
Stage 2	266	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.11	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.209	-
Pot Cap-1 Maneuver	624	941	-	-	1448	-
Stage 1	913	-	-	-	-	-
Stage 2	779	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	620	941	-	-	1448	-
Mov Cap-2 Maneuver	620	-	-	-	-	-
Stage 1	913	-	-	-	-	-
Stage 2	774	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	10.8	0	0.2			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	665	1448	-	
HCM Lane V/C Ratio	-	-	0.063	0.006	-	
HCM Control Delay (s)	-	-	10.8	7.5	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	0.2	0	-	

Intersection												
Int Delay, s/veh	2.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↱			↰	↱
Traffic Vol, veh/h	5	1	35	15	1	5	25	75	30	5	160	5
Future Vol, veh/h	5	1	35	15	1	5	25	75	30	5	160	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	0	-	-	-	-	50
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	60	60	60	60	60	60	60	60	60
Heavy Vehicles, %	0	0	0	2	2	2	6	6	6	1	1	1
Mvmt Flow	8	2	58	25	2	8	42	125	50	8	267	8

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	522	542	267	551	525	150	275	0	0	175	0	0
Stage 1	283	283	-	234	234	-	-	-	-	-	-	-
Stage 2	239	259	-	317	291	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.52	6.22	4.16	-	-	4.11	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4.018	3.318	2.254	-	-	2.209	-	-
Pot Cap-1 Maneuver	468	450	777	445	458	896	1265	-	-	1407	-	-
Stage 1	728	681	-	769	711	-	-	-	-	-	-	-
Stage 2	769	697	-	694	672	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	448	432	777	398	440	896	1265	-	-	1407	-	-
Mov Cap-2 Maneuver	448	432	-	398	440	-	-	-	-	-	-	-
Stage 1	704	676	-	744	688	-	-	-	-	-	-	-
Stage 2	735	674	-	636	667	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	10.5		13.5		1.5		0.2	
HCM LOS	B		B					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1265	-	-	445	777	461	1407	-	-
HCM Lane V/C Ratio	0.033	-	-	0.022	0.075	0.076	0.006	-	-
HCM Control Delay (s)	7.9	-	-	13.3	10	13.5	7.6	0	-
HCM Lane LOS	A	-	-	B	B	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	0.2	0.2	0	-	-