CASTLE HILLS BASIS CHARTER SCHOOL

City of Castle Hills, Texas

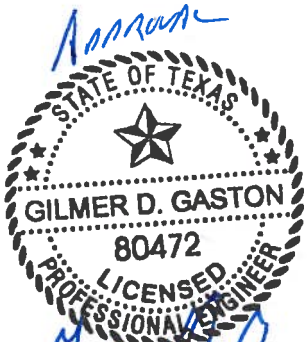
January 2017

CASTLE HILLS BASIS CHARTER SCHOOL

City of Castle Hills, Texas

Content

1/2/2017



1/2/2017

January 2017

Texas Board of Professional Engineers, Firm Registration # 470

PAPE-DAWSON ENGINEERS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

EXECUTIVE SUMMARY

Pape-Dawson Engineers, Inc. was retained to prepare a Traffic Impact Analysis (TIA) for the Castle Hills BASIS Charter School development. The site is located on S. Winston Lane, west of Northwest Military Drive, in the City of Castle Hills, Bexar County, Texas (*MAPSCO®* Map 550, Grid A5)[1]. The site is currently comprised of approximately 4.23 acres of vacant land and it is zoned Church (Tax Exempt). The BASIS Charter School is expected to have an ultimate enrollment of 1,127 students and it is expected to be completed in 2017.

The following key intersections were identified for analysis in this study:

1) Northwest Military Drive at Lockhill-Selma Road
2) Northwest Military Drive at Winston Lane
3) Northwest Military Drive at West Avenue
4) West Avenue at Castle Lane

The AM peak hour generator and roadway network PM peak hour were identified for analysis in this study based on the projected school schedule provided by the BASIS Charter School. The proposed development is estimated to generate 713 AM peak hour generator trips, 191 PM peak hour trips, and a total of 2,795 weekday trips upon completion. Because the City of Castle Hills does not have specific traffic impact analysis requirements, the City has allowed that this analysis follow City of San Antonio requirements in assessing the project's impact on the adjacent street network with an evaluation of the study intersections identified. To meet these requirements, this analysis includes an evaluation of the Existing Condition (year 2016), the No Build Condition (year 2017 without project traffic), and the Build Condition (year 2017 with project traffic). The key findings and recommendations resulting from this study are outlined below:

- Traffic impacts are identified when the Build Condition level of service (LOS) at the study intersections is below LOS C and the intersection delay is increased significantly (more than 20%) compared with the No Build Condition.

- Mitigation improvements and associated probable costs are required for any intersections where impacts have been identified. The results of the analysis show that **two intersections will experience impacts** due to the traffic generated by the proposed Castle Hills BASIS Charter School development; therefore, mitigation improvements are required. The mitigation improvements required to reduce the intersections to an acceptable delay are shown in the following table:

Level of Service Summary & Mitigation – (2017)

Intersections	Condition	AM Peak Hour Generator		PM Peak Hour		Mitigation Improvements
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	
NW Military Dr at Lockhill-Selma Rd	Build	**F**	**77.4**	E	64.4	Modify signal timings (change EB right-turn lane to a free movement), install barrier between add on lane and NW Military Dr main lanes
	Mitigation	C	33.7	E	61.0	
NW Military Dr at Winston Ln	Build	**F**	**103.2**	B	17.4	Install SB right-turn lane, EB left-turn lane, and modify signal timings
	Mitigation	C	33.4	B	13.3	

- Traffic impacts have been identified at the Northwest Military Drive at Lockhill-Selma Road intersection during the AM peak hour of the generator. The eastbound right-turn movement from Lockhill-Selma Road onto Northwest Military Drive currently requires vehicles to stop on red prior to making a right-turn, despite feeding into an add on lane on southbound Northwest Military Drive. Modifying the signal timings and changing the eastbound right-turn lane turn type from permitted overlap to a free movement is expected to mitigate the impacts.

[1] MAPSCO®, Inc. 2011. *Quick Finder MAPSCO® Street Guide and Directory, San Antonio and Surrounding Areas.* Addison, Texas.

Furthermore, a raised median or "candle stick delineators" should be installed along the turning movement on Northwest Military Drive to divide the existing add-on (acceleration) lane and the thru lanes to encourage drivers to continue through the movement without stopping or yielding. However, because signal timing modifications are required and a pedestrian movement currently crosses the add-on lane, coordination with TxDOT may be required. In addition, a driveway for the adjacent Boy Scouts of America McGimsey Boy Scout Park is approximately 150 feet south of the intersection and is located within the add-on lane. Installing a raised median along the add-on lane may affect access into/out of the development and coordination with the Boy Scouts of America may also be required.

- Traffic impacts were also identified at the Northwest Military Drive at Winston Lane intersection during the AM peak hour generator. Installing an eastbound left-turn lane on Winston Lane, a southbound right-turn lane on Northwest Military Drive, and modifying the signal timings are expected to mitigate the impacts.

- In accordance with Section 35-502 (e) (2) B & C of the City of San Antonio Code, left- and right-turn lanes are required at all site driveways or streets with a daily entering right- or left-turn project volume of 500 vehicle trips or 50 peak hour vehicle trips. Furthermore, a left-turn lane is required at all median openings. Based on the projected volumes associated with the proposed development, a right-turn deceleration lane is required at the following site driveway per the TxDOT *Roadway Design Manual* requirements:
    - Winston Lane at Driveway 2: a westbound right-turn lane a minimum of 105 feet in length (75 feet of deceleration length which includes 50 feet of taper, plus 30 feet of storage) based on the posted speed limit of 25 miles per hour.

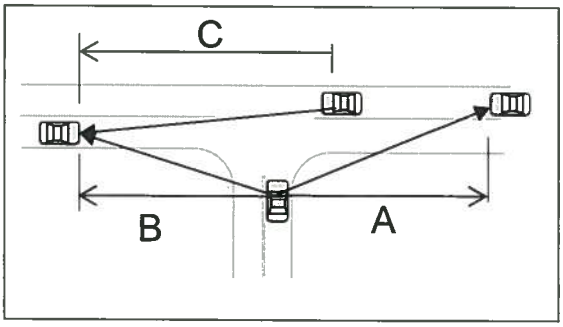
- The intersection sight distance provided should be in accordance with distances cited for each type of maneuver (exiting right-turn, left-turn or crossing, and entering left-turn) in *A Policy on Geometric Design of Highways and Streets, 6th Edition*, 2011 published by

the American Association of State Highway and Transportation Officials (AASHTO)[2]. The posted speed limit on Winston Lane is 25 miles per hour. Landscaping, parking, and signs should be placed so that they do not obstruct visibility for motorists exiting the site. The location of constructed or cut walls should be carefully evaluated in proximity to driveways/streets to prevent creating a sight obstruction. Design of new roadways should provide for adequate stopping sight distance and should consider future driveway and median opening locations. If main roadway is under design, consideration should be given to adjustment of K-factors to provide intersection sight distance versus stopping sight distance.

Intersection Sight Distances at 2-lane Undivided Roadways & Level Conditions (feet)

Speed (mph)	Distance for Exiting Left-Turn (A Leg)	Distance for Exiting Right Turn or Crossing (B Leg)	Distance for Entering Left-Turn (C Leg)
30	335	290	245
35	390	335	285
40	445	385	325
45	500	430	365
50	555	480	405
55	610	530	445

Note: Distances should be adjusted for additional lanes, grades and medians. For adjustments see AASHTO Green Book



- Driveway throat lengths should be constructed in accordance with the City of Castle Hills and TxDOT requirements to facilitate safe and efficient traffic flow.
- Signs and markings should conform to the latest edition of the *Texas Manual on Uniform Traffic Control Devices*[3].

[2] American Association of State Highway and Transportation Officials (AASHTO). *A Policy on Geometric Design of Highways and Streets. 6th Edition*, 2011, Washington, D.C.

[3] Texas Department of Transportation.2011. *Texas Manual on Uniform Traffic Control Devices* (Texas MUTCD). Austin, Texas.

INTRODUCTION

Pape-Dawson Engineers, Inc. was retained to prepare a Traffic Impact Analysis (TIA) for the Castle Hills BASIS Charter School development. The site is located on S. Winston Lane, west of Northwest Military Drive, in the City of Castle Hills, Bexar County, Texas (*MAPSCO®* Map 550, Grid A5)[4]. The site is currently comprised of approximately 4.23 acres of vacant land and it is zoned Church (Tax Exempt). The BASIS Charter School is expected to have an ultimate enrollment of 1,127 students and it is expected to be completed in 2017.

This study assesses the transportation impacts of the proposed development on the area roadway network and reviews site access and circulation as required by Section 35-502 Traffic Impact Analysis and Roughly Proportionate Determination Study of the City of San Antonio Unified Development Code (UDC). The format of this study follows the requirements listed in Appendix B; Subsection 35-B122 (a) (6). This traffic impact analysis 1) addresses and evaluates the project's impact on the adjacent street network, 2) evaluates on-site circulation, and 3) recommends mitigation measures related to any significant impacts of site-generated traffic on the adjacent street network.

Study Procedure

The following sections provide a summary of field data, engineering analyses, and conclusions and recommendations related to this TIA. The methodology is based on analyses of existing and projected site-generated traffic on the area roadways. The following tasks were completed during the study:

- Determined analysis parameters in discussions with City of Castle Hills staff.

[4] MAPSCO®, Inc. 2011. *Quick Finder MAPSCO® Street Guide and Directory, San Antonio and Surrounding Areas.* Addison, Texas.

- Identified the following study intersections for analysis in this study:
    - Northwest Military Drive at Lockhill-Selma Road
    - Northwest Military Drive at Winston Lane
    - Northwest Military Drive at West Avenue
    - West Avenue at Castle Lane
- Completed a field investigation of roadways within the vicinity of the site.
- Obtained average daily traffic (ADT) and turning movement counts (TMC) for the key intersections and site driveways on Wednesday, November 9, 2016.
- Estimated the projected number of trips to be generated by the development during the AM peak hour of the generator and PM peak hour using the trip generation rates provided in *Trip Generation, 9th Edition*, published by the Institute of Transportation Engineers[5].
- Assigned entering and exiting site traffic to site driveways and study intersections based on trip distribution.
- Projected No Build Condition traffic volumes based on the estimated completion date for the year 2017. Existing volumes were increased to the year 2017 by applying an annual growth factor.
- Developed Build Condition volumes by combining the site-generated traffic with the No Build Condition volumes.
- Performed capacity analyses of study intersections for Existing, No Build, and Build Conditions for the AM generator peak hour and PM peak hour.

[5] Institute of Transportation Engineers (ITE). *Trip Generation. 9th Edition*, 2012, Washington, D.C.

- Compared and analyzed the results of the capacity analyses to identify potential traffic impacts and propose suitable mitigation measures.
- Prepared recommendations to enhance site circulation and mitigate impacts where necessary.
- Provided relative costs of proposed mitigation improvements where required.

EXISTING CONDITION

To evaluate the impact of site-generated traffic on the area roadway network, it was first necessary to determine the Existing Condition of the study area. Traffic data, including turning movement counts, signal timing and phasing, and intersection geometry were gathered and reviewed. The traffic volume data is presented in **Appendix A**.

Existing Land Uses

The project site is located along Winston Lane, west of Northwest Military Drive. McGimsey Scout Park borders the north property line, single-family homes border the east and west property lines, and Winston Lane borders the south property line. An aerial view of this area is shown in **Figure 1**.

SCALE: 1"= 500'

500' 0' 250' 500'

LEGEND

SIGNALIZED INTERSECTION

PAPE-DAWSON ENGINEERS

2000 NW LOOP 410 | SAN ANTONIO, TEXAS 78213 | PHONE: 210.375.9000 FAX: 210.375.9010

TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, FIRM REGISTRATION # 10028800

CASTLE HILLS CHARTER SCHOOL

CITY OF SAN ANTONIO, TEXAS

FIGURE 1: LOCATION MAP

JOB NO. 11234-00

DATE NOV 2016

DESIGNER JCH

CHECKED MH

DRAWN JCH

SHEET 1 of 1

Date: Nov 10, 2016, 4:14pm User ID: CMUEBBEN

File: P:\112\34\00\Traffic\Design\Exhibit\Location Map.dwg

Roadway Network

Lockhill-Selma Road, Northwest Military, and West Avenue are expected to provide regional access to the site, while Winston Lane will provide direct access. Descriptions of the area roadways follow. The existing intersection geometries are shown in **Table 1**.

Table 1: Intersection Geometry-Existing Conditions (2016)

Intersection	Approach	Lane Designation*	Traffic Control
NW Military Dr at Lockhill-Selma Rd			
	NB	L-L-T-T-R	Traffic Signal
	SB	L-T-T-R	
	EB	L-T-R	
	WB	L-T-R	
NW Military Dr at Winston Ln			
	NB	LTR	Traffic Signal
	SB	LTR	
	EB	L-T-TR	
	WB	L-T-TR	
NW Military Dr at West Ave			
	NB	L-T-TR	Traffic Signal
	SB	L-T-TR	
	EB	L-T-T-R	
	WB	L-T-T-R	
West Ave at Castle Ln			
	NB	LT-TR	Two-Way Stop-Controlled (TWSC)
	SB	LT-TR	
	EB	LTR	
	WB	LTR	

*L = Left-turn lane; T = Through lane; R = Right-turn lane; LT = Shared Left-/Through lane; TR = Shared Thru/Right lane; LTR = Shared Left/Through/Right lane

Northwest Military Drive (FM 1535)

Northwest Military Drive is a seven-lane roadway with a two-way center left-turn lane, generally oriented in a north-south direction in the vicinity of the site. Northwest Military Drive extends north from Loop 410 to its terminus at Old Camp Bullis Road. The posted speed limit on the roadway near the site is 35 miles per hour. There is a pedestrian crossing with flashing beacons and a recommended 30 MPH speed limit on Northwest Military Drive at Winston Lane, and therefore our study assumed 30 miles per hour during the AM peak hour, and it was analyzed at the posted speed limit of 35 MPH during the PM peak hour. Northwest Military Drive is identified on the City of San Antonio Major Thoroughfare Plan (MTP) as a Primary Arterial Type

A with 120 feet of right-of-way and is under the jurisdiction of the Texas Department of Transportation (TxDOT).

Lockhill-Selma Road

Lockhill-Selma Road is a three-lane undivided roadway, generally oriented in an east-west direction, in the vicinity of the site. Lockhill-Selma Road extends south from Loop 1604 to its terminus at San Pedro Avenue, where it becomes Isom Road. The posted speed limit on the roadway is 35 miles per hour and it is identified on the City of San Antonio MTP as a Secondary Arterial Type A with 86 feet of right-of-way.

West Avenue

West Avenue is a four-lane undivided roadway, generally oriented in a north-south direction in the vicinity of the site. West Avenue extends north from Hildebrand Avenue to its terminus at Bitters Road, where it becomes Tower Drive. The posted speed limit on the roadway is 35 miles per hour. West Avenue has a school zone just south of Northwest Military Drive and was analyzed at 20 miles per hour during the AM peak hour, as it occurs during normal school zone operation hours, and was analyzed at the posted speed limit during the PM peak hour, which occurs outside of school zone operation hours. West Avenue is identified on the City of San Antonio MTP as a Secondary Arterial Type B with 70-86 feet of right-of-way.

Winston Lane

Winston Lane is a two-lane undivided roadway, generally oriented in an east-west direction in the vicinity of the site. Winston Lane extends east from Fox Hall Lane to its terminus at Lockhill-Selma Road. The posted speed limit on the roadway is 25 miles per hour and it is not identified on the City of San Antonio MTP.

The study area includes analysis of the following key intersections (see Intersection Photographs in **Appendix F**):

1) Northwest Military Drive at Lockhill-Selma Road
2) Northwest Military Drive at Winston Lane
3) Northwest Military Drive at West Avenue
4) West Avenue at Castle Lane

Traffic Volumes

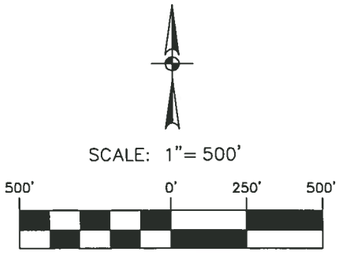
An Automatic Traffic Recorder (ATR) machine was placed on Winston Lane to record hourly bi-direction volumes for a 24-hour period. Intersection turning movement counts (TMC) were also performed during the AM and PM peak hours at the key intersections. The traffic volumes were collected on Wednesday, November 9, 2016. **Figure 2** illustrates the traffic volumes. Detailed traffic count information is contained in **Appendix A.**

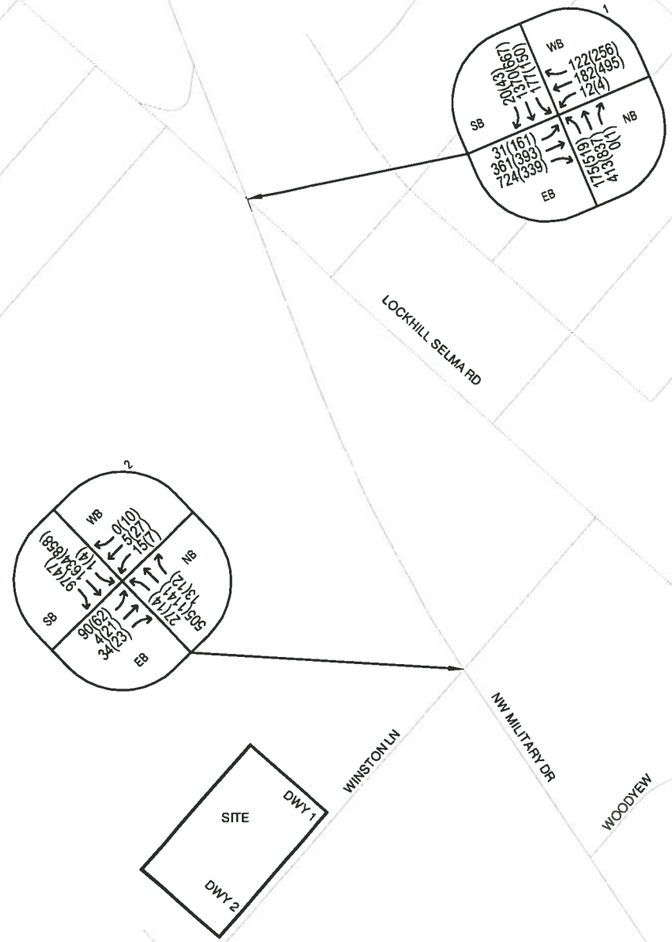
SCALE: 1"= 500'

500' 0' 250' 500'

LEGEND

- INTERSECTING STREETS
- NODE ID NUMBER
- DIRECTION OF TRAVEL
- AM GENERATOR(PM) PEAK HOUR EXISTING TRAFFIC VOLUMES BY ARROW DIRECTION





CASTLE HILLS BASIS CHARTER SCHOOL

CITY OF CASTLE HILLS, TEXAS

FIGURE 2: EXISTING TRAFFIC VOLUMES (2016)

PAPE-DAWSON ENGINEERS

2000 NW LOOP 410 | SAN ANTONIO, TEXAS 78213 | PHONE: 210.375.9000 FAX: 210.375.9010

TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, FIRM REGISTRATION # 10028800

JOB NO. 11234-00

DATE NOV 2016

DESIGNER GRW

CHECKED MH

DRAWN GRW

SHEET 1 of 1

Date: Dec 19, 2016, 2:30pm User ID: GWebben
File: P:\112\34\00\Traffic\Design\Exhibit\Figure 2 to End.dwg

NO BUILD CONDITION

The No Build Condition traffic volumes consist of traffic generated by other planned projects in the area combined with existing traffic volumes projected to the future build year for the project by applying an annual growth rate. The No Build Condition represents the expected future traffic conditions at the study intersections assuming that the proposed project is not constructed. No other future projects were identified in the area at the time of this study.

Background Growth

An annual growth rate was estimated at 4% based on historical average daily traffic (ADT) counts performed by TxDOT between 2011 and 2015. This rate represents the average growth rate for the area surrounding the site. **Table 2** illustrates historical ADT data for Northwest Military Drive.

Table 2: Rate of Traffic Growth

Location	Year	AADT	Rate of Growth (%)	Growth (%)
NW Military Dr, west of Lockhill-Selma Rd	2011	18,700		**4.2%**
	2012	21,000	12.3%	
	2013	23,078	9.9%	
	2014	19,755	-14.4%	
	2015	21,498	8.8%	
NW Military Dr, north of Loop 410	2011	24,000		**3.7%**
	2012	24,000	0.0%	
	2013	25,244	5.2%	
	2014	22,045	-12.7%	
	2015	26,961	22.3%	
Weighted Average				**4%**

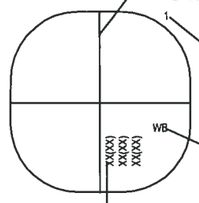
The No Build peak hour traffic volumes were developed by applying the annual growth factor to the existing volumes to project them to the year 2017. The No Build Condition peak hour traffic volumes are presented in **Figure 3**.

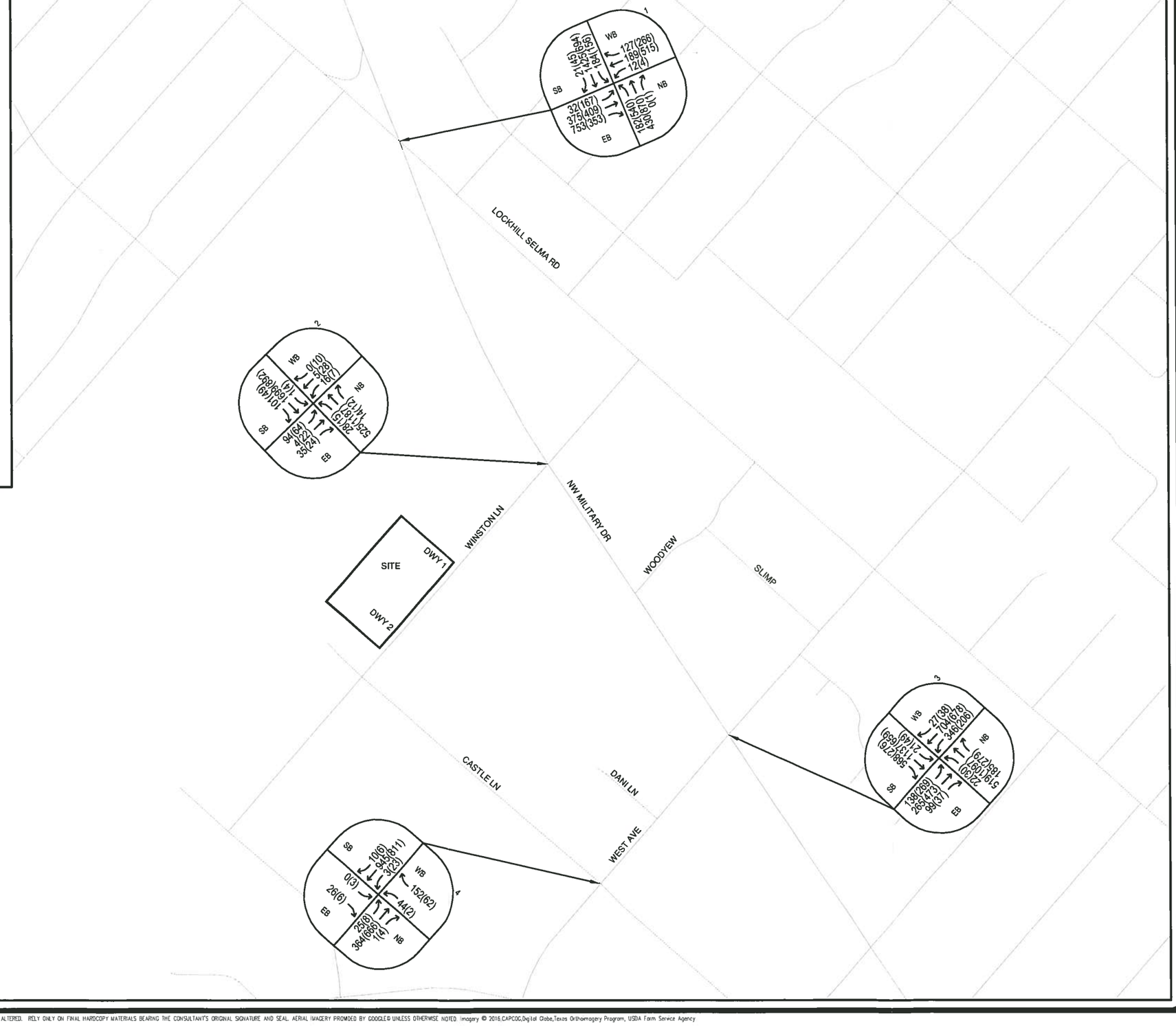
SCALE: 1"= 500'

500' 0' 250' 500'

LEGEND

- INTERSECTING STREETS
- NODE ID NUMBER
- DIRECTION OF TRAVEL
- AM GENERATOR(PM) PEAK HOUR NO BUILD TRAFFIC VOLUMES BY ARROW DIRECTION





CASTLE HILLS BASIS CHARTER SCHOOL

CITY OF CASTLE HILLS, TEXAS

FIGURE 3: NO BUILD CONDITION (2017)

PAPE-DAWSON ENGINEERS

2000 NW LOOP 410 | SAN ANTONIO, TEXAS 78213 | PHONE: 210.375.9000 FAX: 210.375.9010

TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, FIRM REGISTRATION # 10028800

JOB NO. 11234-00
DATE NOV 2016
DESIGNER GRW
CHECKED MH
DRAWN GRW
SHEET 1 of 1

Date: Dec 19, 2016, 2:36pm User ID: GWebben
File: P:\11234\00\Traffic\Design\Exhibit\Figure 2 to End.dwg

BUILD CONDITION

Trip Generation

To evaluate the impact of the development on the adjacent street network, future conditions for year 2017 were analyzed. The project will consist of a private charter school with an ultimate enrollment of 1,127 students to be completed by the 2017-2018 school year. The proposed land use and size are shown in **Table 3**.

Table 3: Proposed Land Use

Land Use	ITE Code	Size	Unit
Private School (K-12)	536	1,127	Students

The amount of site traffic generated by the proposed development is a function of the density and type of land use. The projected number of vehicle trips generated by the proposed development was calculated using statistical data contained in *Trip Generation, 9th Edition*, published by the Institute of Transportation Engineers (ITE) and considered an industry standard.

The traffic generated by the project was calculated for the AM and PM peak hours of traffic on the adjacent roadways, since these periods experience the greatest roadway congestion during an average weekday. The AM and PM peak hours at this location were determined to be from 7:15 AM to 8:15 AM and 5:00 PM to 6:00 PM, respectively, based on the traffic count data collected.

However, based on preliminary school times provided by the BASIS Charter School, the school site AM peak hour of the generator will occur from 7:00 AM to 8:00 AM, with approximately 80% of students arriving during this time period, and the remaining students arriving between 8:00 AM and 8:30 AM (see **Appendix B**). Therefore, although the overall roadway network for the AM peak hour occurs from 7:15 AM to 8:15 AM, the AM peak hour generator from 7:00 AM to 8:00 AM will be analyzed in this study. Furthermore, because the normal school pickup operations do not occur during the roadway network PM peak hours (4:00 PM to 6:00 PM), the roadway network PM peak hour from 5:00 PM to 6:00 PM will be analyzed.

The resulting projected site traffic is shown in **Table 4**. A summary of the trip generation data is provided in **Appendix B**.

Table 4: Projected Site Trip Generation

Land Use (ITE Code)	Size	Unit	AM Peak Hour Generator*			PM Peak Hour			Daily Total
			Enter	Exit	Total	Enter	Exit	Total	
Private School (536)	1,127	Students	446	285	731	82	109	191	2,795

*Assumes 80% of students (902 Students)

Trip Reductions

Internal Trips

Internal trips are defined as trips occurring between uses contained on the site. These internal trips are captured on the site as traffic and are not required to exit the site to use the external roadway network. Internal capture rates are the percentage reductions that can be applied to trip generation estimates based on the relationship of the uses contained on the site. No internal trip reduction was applied to this development.

Pass-By Trips

Pass-by trips are defined as intermediate stops on the way from an origin to a primary destination. The pass-by traffic is traffic already on the roadway traveling by the site. In other words, pass-by traffic is not new traffic added to the local street network. Factoring for pass-by trips does not affect the site driveway volumes but it may reduce the amount of project traffic added to the adjacent street network. No pass-by trip reduction rates were used in this analysis.

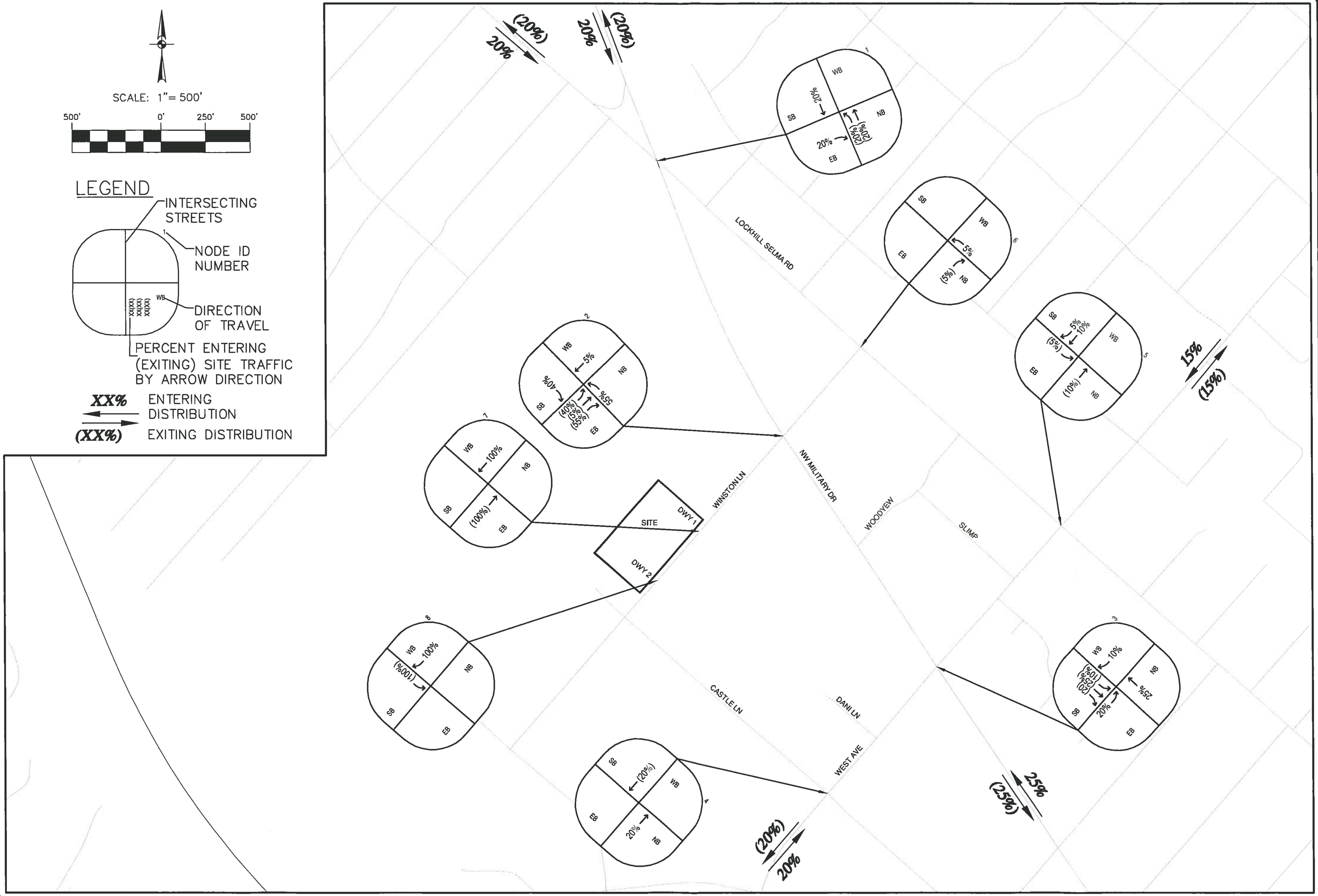
Trip Distribution & Assignment

The directions from which drivers are expected to approach and depart the site are based on several variables. These variables include the configuration and characteristics of the local street network, existing traffic volumes, travel characteristics associated with the land use and the location of access points. A special emphasis is placed on viable arterials and freeways that provide access to the site.

Detailed trip distributions were performed for entering and exiting traffic based on the area roadway system expected to be in place when the development is complete. The detailed entering and exiting trip distributions for the development are presented in **Figure 4**. The projected site traffic contained in **Table 4** was assigned to the local roadway network for the AM peak hour generator and PM peak hour using the trip distribution. The site traffic volumes are shown in **Figure 5** and **Figure 6** for the AM peak hour generator and PM peak hour, respectively. The Build Condition peak hour traffic volumes were developed by combining the No Build Condition volumes with the site-generated volumes. The Build Condition volumes are illustrated in **Figure 7**.

Site Access

Northwest Military Drive, West Avenue, and Lockhill-Selma Road are expected to provide regional access to the site, while Winston Lane will provide direct access. The proposed development will consist of two access driveways. Both Driveways 1 and 2 will be located along Winston Lane and will be two-way stop-controlled with full-access. However, traffic control for pickup/drop-off operations will restrict access to Driveway 1 and force vehicles to enter and exit the development through Driveway 2 during the peak hours. Therefore, while Driveway 1 does not show any vehicles entering or exiting the development during the AM and PM peak hours, it will have full-access during the off-peak period.



CASTLE HILLS BASIS CHARTER SCHOOL

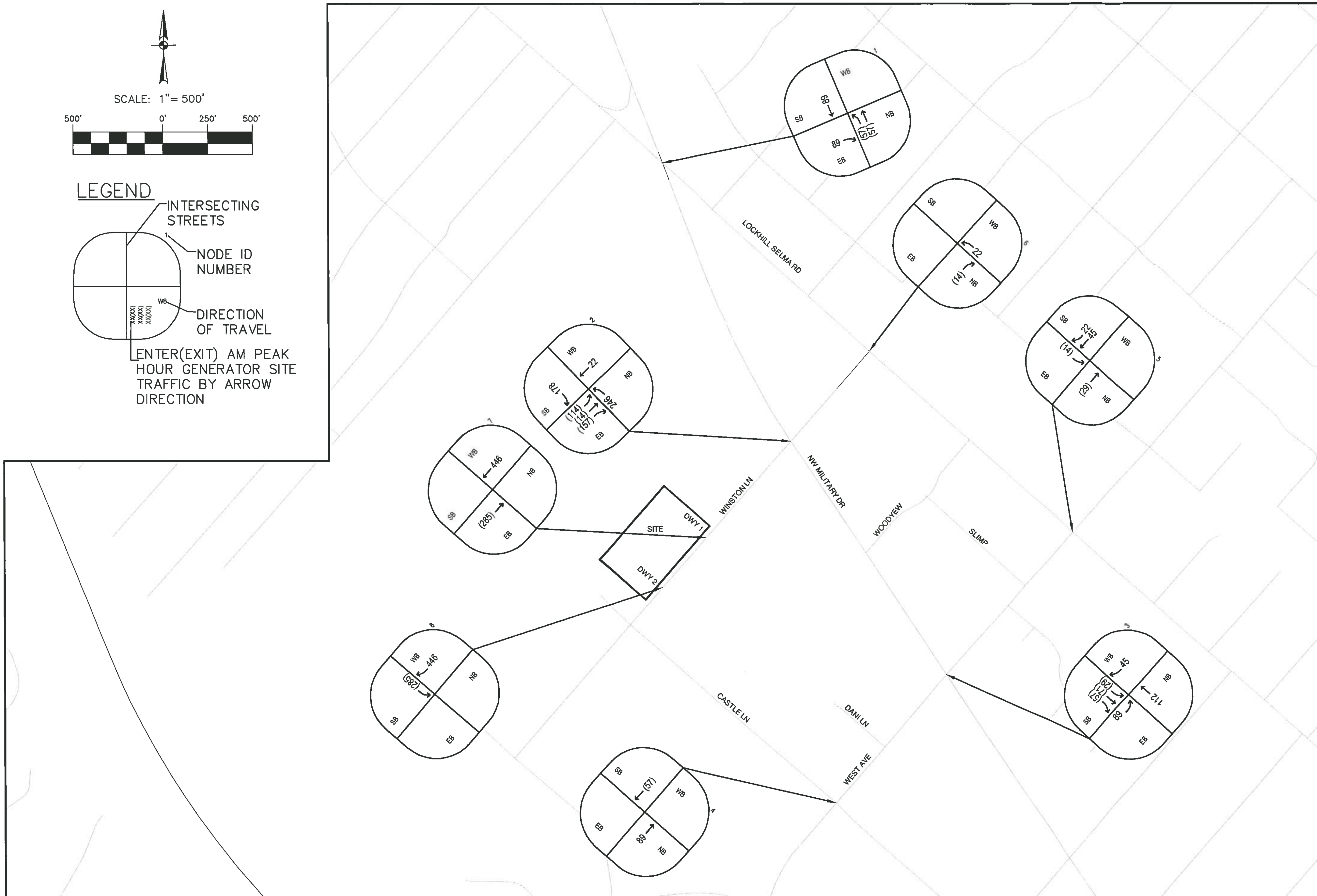
CITY OF CASTLE HILLS, TEXAS

FIGURE 4: TRIP DISTRIBUTION

PAPE-DAWSON ENGINEERS
2000 NW LOOP 410 | SAN ANTONIO, TEXAS 78213 | PHONE: 210.375.9000 FAX: 210.375.9010
TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470
TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, FIRM REGISTRATION # 10028800

JOB NO. 11234-00
DATE NOV 2016
DESIGNER GRW
CHECKED MH
DRAWN GRW
SHEET 1 of 1

Date: Dec 19, 2016, 1:54pm User ID: GWuebben
File: P:\112\34\00\Traffic\Design\Exhibit\Figure 2 to End.dwg



CASTLE HILLS BASIS CHARTER SCHOOL

CITY OF CASTLE HILLS, TEXAS

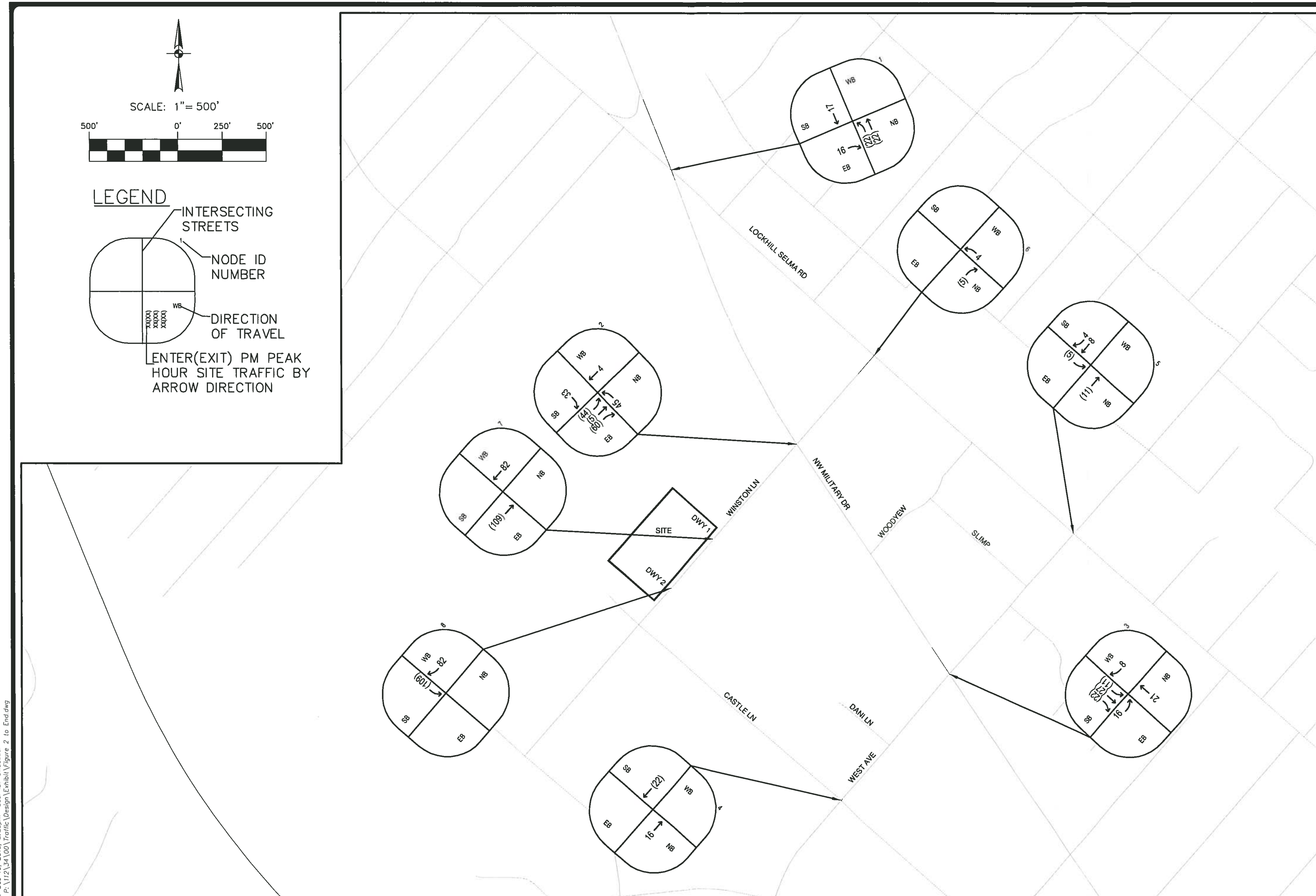
FIGURE 5: SITE TRIPS AM PEAK HOUR GENERATOR

PAPE-DAWSON ENGINEERS
2000 NW LOOP 410 | SAN ANTONIO, TEXAS 78213 | PHONE: 210.375.9000 FAX: 210.375.9010
TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470
TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, FIRM REGISTRATION # 10028800

JOB NO. 11234-00
DATE NOV 2016
DESIGNER GRW
CHECKED MH
DRAWN GRW

SHEET 1 of 1

Date: Dec 19, 2016, 1:58pm User ID: GWuebben
File: P:\112\34\00\Traffic\Design\Exhibit\Figure 2 to End.dwg



CASTLE HILLS BASIS CHARTER SCHOOL

CITY OF CASTLE HILLS, TEXAS

FIGURE 6: SITE TRIPS PM PEAK HOUR

PAPE-DAWSON ENGINEERS
2000 NW LOOP 410 | SAN ANTONIO, TEXAS 78213 | PHONE: 210.375.9000 FAX: 210.375.9010
TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470
TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, FIRM REGISTRATION # 10028800

JOB NO. 11234-00
DATE NOV 2016
DESIGNER GRW
CHECKED MH
DRAWN GRW
SHEET 1 of 1

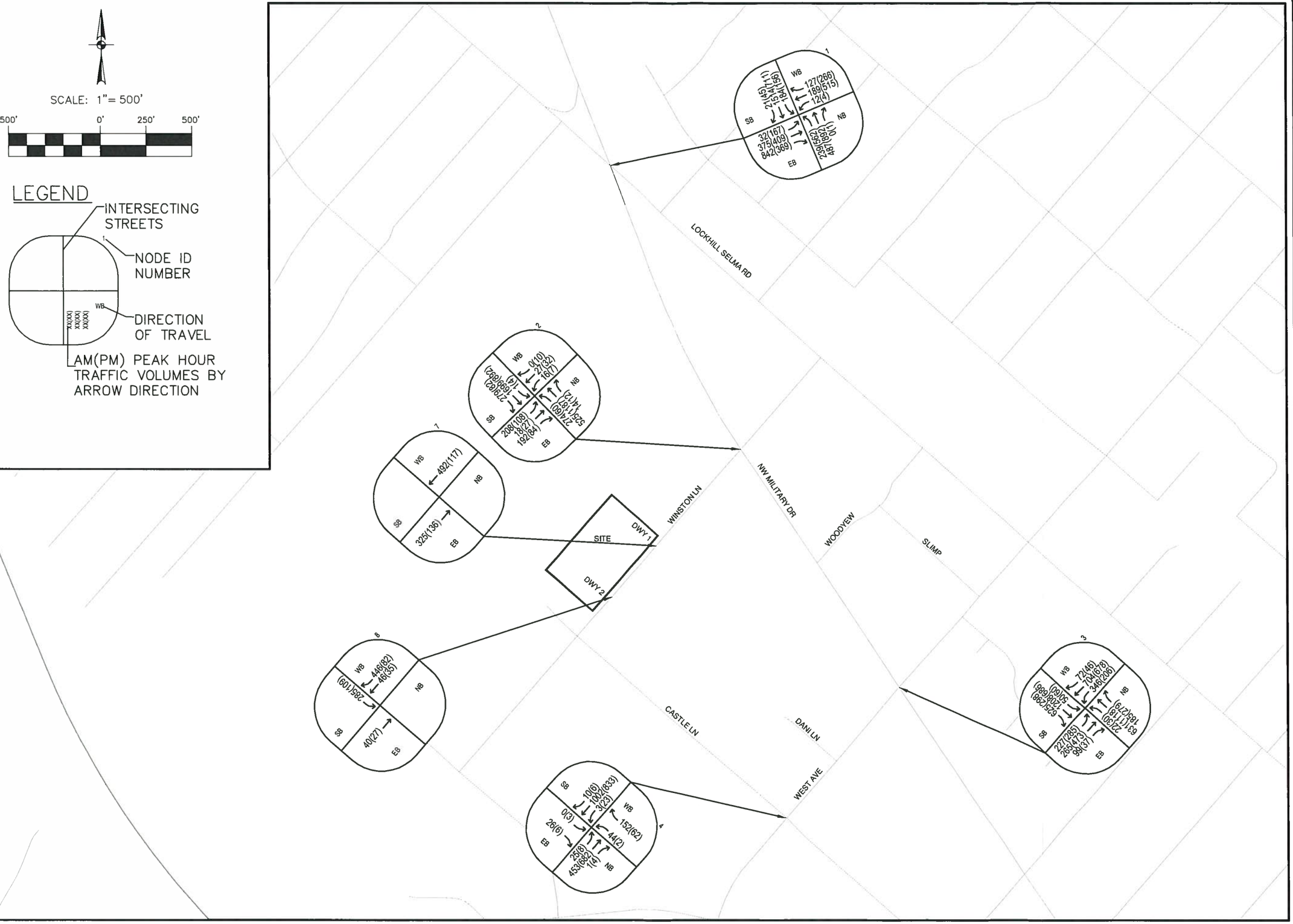
Date: Dec 19, 2016, 3:25pm User ID: GWuebben
File: P:\112\34\00\Traffic\Design\Exhibit\Figure 2 to End.dwg

SCALE: 1"= 500'

500' 0' 250' 500'

LEGEND

- INTERSECTING STREETS
- NODE ID NUMBER
- DIRECTION OF TRAVEL
- AM(PM) PEAK HOUR TRAFFIC VOLUMES BY ARROW DIRECTION



PAPE-DAWSON ENGINEERS

2000 NW LOOP 410 | SAN ANTONIO, TEXAS 78213 | PHONE: 210.375.9000 FAX: 210.375.9010

TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

TEXAS BOARD OF PROFESSIONAL LAND SURVEYING, FIRM REGISTRATION # 100288-00

CASTLE HILLS BASIS CHARTER SCHOOL

CITY OF CASTLE HILLS, TEXAS

FIGURE 7: BUILD CONDITION (2017)

JOB NO. 11234-00

DATE NOV 2016

DESIGNER GRW

CHECKED MH

DRAWN GRW

SHEET 1 of 1

Date: Dec 19, 2016, 3:33pm User ID: GWebben
File: P:\112\34\00\Traffic\Design\Exhibit\Figure 2 to End.dwg

INTERSECTION CAPACITY ANALYSES

Analysis Methodology

Capacity analyses were conducted at the study intersections for the Existing Condition (year 2016), No Build Condition (year 2017), and Build Condition (year 2017). The following key intersections were identified for analysis in this study:

1) Northwest Military Drive at Lockhill-Selma Road
2) Northwest Military Drive at Winston Lane
3) Northwest Military Drive at West Avenue
4) West Avenue at Castle Lane

The evaluation of peak hour operations for each intersection and scenario was performed using *Synchro, Version 8*[6]. All intersections were analyzed with traffic volumes, intersection geometry, and traffic control. Capacity analyses are presented in standard level of service format. Level of service at a signalized intersection is based on the average control-delay measured in seconds per vehicle (sec/veh). The control delay is calculated using an equation that combines the stopped-delay with the vehicle acceleration/deceleration delay that is caused by the signalized intersection.

The capacity of a controlled leg of an unsignalized two-way stop-controlled intersection is established through an estimation of available gaps in traffic on the major roadway, driver judgment in selecting a gap, and required follow-up time by each driver in a queue. The level of service for each stop-controlled approach is determined by the average total delay per vehicle. The total delay represents the time from when the vehicle stops at the end of the queue until the vehicle departs from the stop line.

[6] Trafficware®. 2012. *Synchro Studio 8, Synchro Plus SimTraffic and 3D Viewer*. Sugarland, Texas.

Level of service is designated from A to F, with A representing the best traffic conditions with least delay and F representing poor conditions with the highest delay. The general characteristics associated with each level of service for unsignalized and signalized intersections based on the *Highway Capacity Manual* [7] are presented in **Appendix C,** and the detailed Synchro Capacity Analysis Worksheets can be found in **Appendix D**.

Existing Condition – Year 2016

Capacity analysis results for the Existing Conditions at all key intersections are presented in **Table 5**.

Table 5: Intersection Capacity Analysis – Existing Conditions (2016)

Intersection	Approach	Movement	AM Peak Hour Generator LOS	AM Peak Hour Generator Delay (sec/veh)	PM Peak Hour LOS	PM Peak Hour Delay (sec/veh)
Signalized Intersection:						
NW Military Dr at Lockhill-Selma Rd			E	56.2	E	56.4
NW Military Dr at Winston Ln			B	15.3	B	10.7
NW Military Dr at West Ave			C	28.3	C	30.8
Unsignalized Intersections:						
West Ave at Castle Ln						
	NB	LT	A	1.6	A	0.3
	SB	LT	A	0.0	A	0.8
	EB	LTR	B	10.7	C	16.6
	WB	LTR	C	15.8	B	11.7

As shown in **Table 5**, the Northwest Military Drive at Lockhill-Selma Road intersection currently operates at an unacceptable LOS E during both the AM peak hour generator and PM peak hour. All other signalized and unsignalized intersections currently operate at an acceptable LOS C or better during both peak hours.

Impact Analysis

Traffic impacts are identified when the Build Condition level of service (LOS) at the study intersections is below C and the intersection delay is increased significantly (more than 20%) compared with the No Build Condition.

[7] Transportation Research Board/National Research Council. 2000. *Highway Capacity Manual. Third Edition*, Washington, D.C.

Identification of Impacts

The capacity analyses for the key intersections are summarized in **Tables 6 and 7** for the No Build and Build Conditions. Detailed Capacity Analysis Worksheets are presented in **Appendix D**.

Table 6: Signalized Intersection Capacity Analysis (2017)

Intersection		AM Peak Hour Generator		PM Peak Hour	
	Condition	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
NW Military Dr at Lockhill-Selma Rd					
	No Build	E	60.0	E	61.1
	Build	**F**	**77.4**	E	64.4
	Allowable Delay		72.0		73.3
NW Military Dr at Winston Ln					
	No Build	B	15.8	B	11.2
	Build	**F**	**103.2**	B	17.4
	Allowable Delay		35.0		35.0
NW Military Dr at West Ave					
	No Build	C	28.8	C	32.1
	Build	C	31.2	C	32.2
	Allowable Delay		35.0		38.5

The results in **Table 6** show that the signalized intersections of Northwest Military Drive at Lockhill-Selma Road and Northwest Military Drive at Winston Lane will operate at an unacceptable LOS F during the AM peak hour of the generator. Therefore, mitigation improvements are required. The Northwest Military Drive at West Avenue intersection will operate at an acceptable LOS C during both peak hours under the Build Condition.

Table 7: Unsignalized Intersection Capacity Analysis (2017)

Intersection			AM Peak Hour Generator		PM Peak Hour	
Condition	Approach	Movement	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
West Ave at Castle Ln						
No Build	NB	LT	A	1.6	A	0.3
	SB	LT	A	0.1	A	0.8
	EB	LTR	B	10.6	C	17.2
	WB	LTR	C	16.5	B	11.9
Build	NB	LT	A	1.5	A	0.3
	SB	LT	A	0.1	A	0.8
	EB	LTR	B	10.8	B	17.8
	WB	LTR	C	20.0	B	12.1
Winston Ln at Driveway 1						
Build	EB	L	A	0.0	A	0.0
	SB	LR	A	0.0	A	0.0
Winston Ln at Driveway 2						
Build	EB	L	A	0.0	A	0.0
	SB	LR	B	11.0	A	9.4

The results in **Table 7** show that all unsignalized intersections will operate at an acceptable LOS C or better during both peak hours under the Build Condition. Therefore, mitigation improvements are not required.

MITIGATION

Section 35-502 (d) (3) B of the City's Unified Development Code identifies traffic impacts when the Build Condition level of service (LOS) at the study intersections is below C and the intersection delay is increased significantly (more than 20%) compared with the No Build Condition.

Mitigation Improvements

Mitigation improvements and associated probable costs are required for any intersections where impacts have been identified. As shown in **Tables 6** and **7**, two intersections will experience impacts due to the traffic generated by the proposed Castle Hills BASIS Charter School development; therefore, mitigation improvements are required.

Traffic impacts have been identified at the Northwest Military Drive at Lockhill-Selma Road intersection during the AM peak hour of the generator. The eastbound right-turn movement from Lockhill-Selma Road onto Northwest Military Drive currently requires vehicles to stop on red prior to making a right-turn, despite feeding into an add on lane on southbound Northwest Military Drive. Modifying the signal timings and changing the eastbound right-turn lane turn type from permitted overlap to a free movement is expected to mitigate the impacts. Furthermore, a raised median or "candle stick delineators" should be installed along the turning movement on Northwest Military Drive to divide the existing add-on (acceleration) lane and the thru lanes to encourage drivers to continue through the movement without stopping or yielding (see **Table 8**). However, because signal timing modifications are required and a pedestrian movement currently crosses the add-on lane, coordination with TxDOT may be required. In addition, a driveway for the adjacent Boy Scouts of America McGimsey Boy Scout Park is approximately 150 feet south of the intersection and is located within the add-on lane. Installing a raised median along the add-on lane may affect access into/out of the development and coordination with the Boy Scouts of America may also be required.

Traffic impacts were also identified at the Northwest Military Drive at Winston Lane intersection during the AM peak hour generator. Installing an eastbound left-turn lane on Winston Lane, a southbound right-turn lane on Northwest Military Drive, and modifying the signal timings are expected to mitigate the impacts.

Table 8: Level of Service Summary & Mitigation – (2017)

Intersections	Condition	AM Peak Hour Generator		PM Peak Hour		Mitigation Improvements
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	
NW Military Dr at Lockhill-Selma Rd	Build	**F**	**77.4**	E	64.4	Modify signal timings (change EB right-turn lane to a free movement), install barrier between add on lane and NW Military Dr main lanes
	Mitigation	C	33.7	E	61.0	
NW Military Dr at Winston Ln	Build	**F**	**103.2**	B	17.4	Install SB right-turn lane, EB left-turn lane, and modify signal timings
	Mitigation	C	33.4	B	13.3	

Turn Lane Assessment

In accordance with Section 35-502 (e) (2) B,C of the City of San Antonio Code, left- and right-turn lanes are required at all site driveways or streets with a daily entering right- or left-turn project volume of 500 vehicle trips or 50 peak hour vehicle trips. Furthermore, a left-turn lane is required at all median openings. Based on the projected volumes associated with the proposed development, a right-turn deceleration lane is required at the following site driveway per the TxDOT *Roadway Design Manual* requirements:

- Winston Lane at Driveway 2: a westbound right-turn lane a minimum of 105 feet in length (75 feet of deceleration length which includes 50 feet of taper, plus 30 feet of storage) based on the posted speed limit of 25 miles per hour.

Opinion of Probable Costs of Turn Lane Improvements

An opinion of probable cost to implement the turn lane improvements identified in the previous section is contained in **Table 9**. The cost figures include engineering and construction. No right-of-way acquisition costs, if any, were included in the total.

Table 9: Opinion of Probable Cost of Turn Lane Improvements

Mitigation Improvement	Cost
Signal timing modifications (Free movement); NW Military Dr at Lockhill-Selma Rd	**$10,000**
Install barrier between add-on lane and thru lanes along EB right-turn movement; NW Military Dr at Lockhill-Selma Rd	**$30,000**
Install southbound right-turn lane; NW Military Dr at Winston Ln	**$75,000**
Install eastbound left-turn lane; NW Military Dr at Winston Ln	**$90,000**
Signal timing modifications; NW Military Dr at Winston Ln	**$5,000**
Total Mitigation Improvements Cost	**$210,000**
Turn Lane Improvements	
Southbound right-turn lane; Winston Ln at Driveway 2	**$50,000**
Total Improvement Cost	**$260,000**

*Pending TxDOT review and approval

On Site Circulation and Queue Storage

Based on the *School Queue Calculator*[8] published by the North Carolina DOT, a minimum of 2,474 feet of onsite queue storage is recommended for the Castle Hills BASIS Charter School assuming 1,127 students. This is the minimum on-site queue storage which should be provided on the campus. The on-site circulation should be one-way and circulate in a counter clockwise direction where students are loaded and unloaded directly to the curb/sidewalk. Parent loading and unloading should only occur in designated areas to minimize pedestrian/vehicle conflicts. An onsite circulation exhibit and detailed queuing calculation is shown in **Appendix G**.

[8] Municipal School Transportation assistance. *School Queuing Calculator*. Traffic Engineering and Safety Systems Branch. North Carolina Department of Transportation.

CONCLUSIONS AND RECOMMENDATIONS

Pape-Dawson Engineers, Inc. was retained to prepare a Traffic Impact Analysis (TIA) for the Castle Hills BASIS Charter School development. The site is located on S. Winston Lane, west of Northwest Military Drive, in the City of Castle Hills, Bexar County, Texas (*MAPSCO®* Map 550, Grid A5)[9]. The site is currently comprised of approximately 4.23 acres of vacant land and it is zoned Church (Tax Exempt). The BASIS Charter School is expected to have an ultimate enrollment of 1,127 students and it is expected to be completed in 2017.

This analysis fulfills the City of San Antonio and Bexar County requirements in assessing the project's impact on the adjacent street network with an evaluation of key intersections identified. To meet these requirements, this analysis includes an evaluation of the Existing Condition (year 2016), No Build Condition (year 2017 without project traffic), and the Build Condition (year 2017 with project traffic). The key findings and recommendations resulting from this study are outlined below:

- Traffic impacts are identified when the Build Condition level of service (LOS) at the study intersections is below LOS C and the intersection delay is increased significantly (more than 20%) compared with the No Build Condition.

- Mitigation improvements and associated probable costs are required for any intersections where impacts have been identified. The results of the analysis show that **two intersections will experience impacts** due to the traffic generated by the proposed Castle Hills BASIS Charter School development; therefore, mitigation improvements are required. The mitigation improvements required to reduce the intersections to an acceptable delay are shown in the following table:

[9] MAPSCO®, Inc. 2011. *Quick Finder MAPSCO® Street Guide and Directory, San Antonio and Surrounding Areas.* Addison, Texas.

Level of Service Summary & Mitigation – (2017)

Intersections	Condition	AM Peak Hour Generator		PM Peak Hour		Mitigation Improvements
		LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	
NW Military Dr at Lockhill-Selma Rd	Build	**F**	**77.4**	E	64.4	Modify signal timings (change EB right-turn lane to a free movement), install barrier between add on lane and NW Military Dr main lanes
	Mitigation	C	33.7	E	61.0	
NW Military Dr at Winston Ln	Build	**F**	**103.2**	B	17.4	Install SB right-turn lane, EB left-turn lane, and modify signal timings
	Mitigation	C	33.4	B	13.3	

- Traffic impacts have been identified at the Northwest Military Drive at Lockhill-Selma Road intersection during the AM peak hour of the generator. The eastbound right-turn movement from Lockhill-Selma Road onto Northwest Military Drive currently requires vehicles to stop on red prior to making a right-turn, despite feeding into an add on lane on southbound Northwest Military Drive. Modifying the signal timings and changing the eastbound right-turn lane turn type from permitted overlap to a free movement is expected to mitigate the impacts. Furthermore, a raised median or "candle stick delineators" should be installed along the turning movement on Northwest Military Drive to divide the existing add-on (acceleration) lane and the thru lanes to encourage drivers to continue through the movement without stopping or yielding. However, because signal timing modifications are required and a pedestrian movement currently crosses the add-on lane, coordination with TxDOT may be required. In addition, a driveway for the adjacent Boy Scouts of America McGimsey Boy Scout Park is approximately 150 feet south of the intersection and is located within the add-on lane. Installing a raised median along the add-on lane may affect access into/out of the development and coordination with the Boy Scouts of America may also be required.

- Traffic impacts were also identified at the Northwest Military Drive at Winston Lane intersection during the AM peak hour generator. Installing an eastbound left-turn lane on Winston Lane, a southbound right-turn lane on Northwest Military Drive, and modifying the signal timings are expected to mitigate the impacts.

- In accordance with Section 35-502 (e) (2) B & C of the City of San Antonio Code, left- and right-turn lanes are required at all site driveways or streets with a daily entering right- or left-turn project volume of 500 vehicle trips or 50 peak hour vehicle trips. Furthermore, a left-turn lane is required at all median openings. Based on the projected volumes associated with the proposed development, a right-turn deceleration lane is required at the following site driveway per the TxDOT *Roadway Design Manual* requirements:
    - Winston Lane at Driveway 2: a westbound right-turn lane a minimum of 105 feet in length (75 feet of deceleration length which includes 50 feet of taper, plus 30 feet of storage) based on the posted speed limit of 25 miles per hour.

- The intersection sight distance provided should be in accordance with distances cited for each type of maneuver (exiting right-turn, left-turn or crossing, and entering left-turn) in *A Policy on Geometric Design of Highways and Streets, 6th Edition*, 2011 published by the American Association of State Highway and Transportation Officials (AASHTO)[10]. The posted speed limit on Winston Lane is 25 miles per hour. Landscaping, parking, and signs should be placed so that they do not obstruct visibility for motorists exiting the site. The location of constructed or cut walls should be carefully evaluated in proximity to driveways/streets to prevent creating a sight obstruction. Design of new roadways should provide for adequate stopping sight distance and should consider future driveway

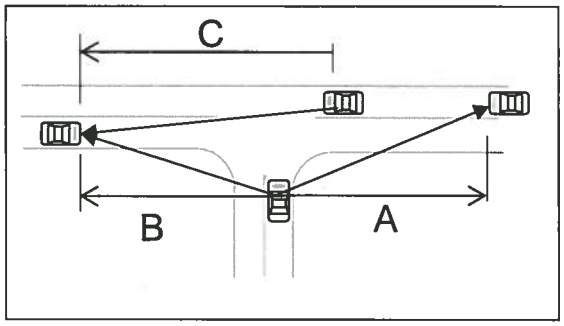
[10] American Association of State Highway and Transportation Officials (AASHTO). *A Policy on Geometric Design of Highways and Streets. 6th Edition*, 2011, Washington, D.C.

and median opening locations. If main roadway is under design, consideration should be given to adjustment of K-factors to provide intersection sight distance versus stopping sight distance.

Intersection Sight Distances at 2-lane Undivided Roadways & Level Conditions (feet)

Speed (mph)	Distance for Exiting Left-Turn (A Leg)	Distance for Exiting Right Turn or Crossing (B Leg)	Distance for Entering Left-Turn (C Leg)
30	335	290	245
35	390	335	285
40	445	385	325
45	500	430	365
50	555	480	405
55	610	530	445

Note: Distances should be adjusted for additional lanes, grades and medians. For adjustments see AASHTO Green Book



- Driveway throat lengths should be constructed in accordance with the City of Castle Hills and TxDOT requirements to facilitate safe and efficient traffic flow.
- Signs and markings should conform to the latest edition of the *Texas Manual on Uniform Traffic Control Devices*[11].

[11] Texas Department of Transportation.2011. *Texas Manual on Uniform Traffic Control Devices* (Texas MUTCD). Austin, Texas.

APPENDICES

APPENDIX A
Traffic Count Data

North/South Street:	NW Military Dr											
East/West Street:	Lockhill Selma											
TOD:	AM	Date:	9-Nov-16		Synchro Node:	1	Raw Data:	P:\112\34\00\Traffic\Data\Raw\site2644-01				
	Northbound			Southbound			Eastbound			Westbound		
	NW Military Dr			NW Military Dr			Lockhill Selma			Lockhill Selma		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
7:00 AM	17	72	0	24	231	4	2	39	108	1	25	13
7:15 AM	37	77	0	35	311	5	4	80	156	4	53	32
7:30 AM	62	127	0	33	416	4	11	101	176	5	48	30
7:45 AM	59	137	0	85	412	7	14	141	284	2	56	47
8:00 AM	89	211	2	68	379	3	12	97	172	1	48	31
8:15 AM	36	98	0	62	284	6	7	105	132	0	42	37
8:30 AM	68	120	0	30	174	4	6	77	103	2	41	29
8:45 AM	48	138	0	42	199	4	6	51	82	3	30	24
Total	416	980	2	379	2406	37	62	691	1213	18	343	243
Peak Hour	246	573	2	248	1491	20	44	444	764	8	194	145

Pedestrians				
	NB	SB	EB	WB
7:00 AM				
7:15 AM				
7:30 AM				
7:45 AM				
8:00 AM				
8:15 AM				
8:30 AM				
8:45 AM				

Diagram for: 07:15 AM-08:15 AM

Peak Hour: 07:30 AM-08:30 AM

PAPE-DAWSON ENGINEERS

North/South Street:	NW Military Dr											
East/West Street:	Lockhill Selma											
TOD:	PM	Date:	9-Nov-16		Synchro Node:		1	Raw Data:	P:\112\34\00\Traffic\Data\Raw\site2644-01			
	Northbound			Southbound			Eastbound			Westbound		
	NW Military Dr			NW Military Dr			Lockhill Selma			Lockhill Selma		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
3:00 PM	73	194	0	59	226	10	7	59	82	1	67	28
3:15 PM	75	207	1	53	221	5	14	69	92	2	54	42
3:30 PM	111	222	0	58	189	19	16	60	68	3	56	43
3:45 PM	90	221	0	47	216	7	20	56	52	2	52	50
4:00 PM	90	197	0	36	173	10	29	62	66	2	62	58
4:15 PM	124	191	0	30	136	8	25	74	63	1	60	42
4:30 PM	134	244	0	23	146	16	34	56	71	5	64	50
4:45 PM	115	218	0	43	150	9	41	105	68	2	79	60
5:00 PM	141	245	1	49	203	6	28	75	78	0	112	82
5:15 PM	128	198	0	45	166	9	39	126	86	2	118	62
5:30 PM	132	198	0	26	136	14	45	92	98	1	157	64
5:45 PM	118	196	0	30	162	14	49	100	77	1	108	48
Total	1331	2531	2	499	2124	127	347	934	901	22	989	629
Peak Hour	519	837	1	150	667	43	161	393	339	4	495	256

Pedestrians

	NB	SB	EB	WB
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM				
4:15 PM				
4:30 PM				
4:45 PM				
5:00 PM				
5:15 PM				
5:30 PM				
5:45 PM				

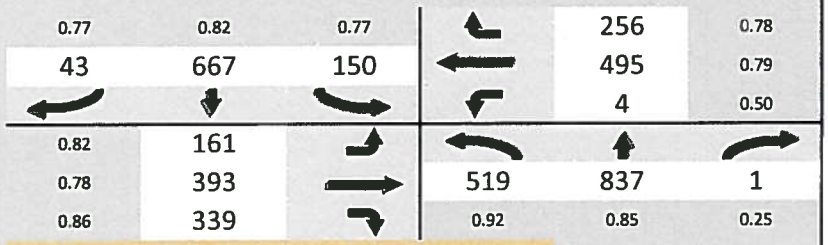


Diagram for: Peak Hour

Peak Hour: 05:00 PM-06:00 PM

PAPE-DAWSON ENGINEERS

North/South Street:	NW Military Dr											
East/West Street:	Winston Ln											
TOD:	AM	Date:	9-Nov-16		Synchro Node:	2	Raw Data:	P:\112\34\00\Traffic\Data\Raw\site2644-02				
	Northbound			Southbound			Eastbound			Westbound		
	NW Military Dr			NW Military Dr			Winston Ln			Winston Ln		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
7:00 AM	4	86	6	0	311	10	7	1	4	1	0	0
7:15 AM	6	127	2	1	385	21	5	0	10	8	1	0
7:30 AM	10	149	4	0	463	32	33	1	13	2	1	0
7:45 AM	7	143	1	0	475	34	45	2	7	4	3	0
8:00 AM	4	217	4	0	357	16	30	1	9	4	1	3
8:15 AM	2	144	5	1	308	12	12	2	8	5	0	0
8:30 AM	2	162	3	0	243	10	6	3	1	1	2	1
8:45 AM	0	159	5	1	242	5	9	0	9	4	0	1
Total	35	1187	30	3	2784	140	147	10	61	29	8	5
Peak Hour	27	636	11	1	1680	103	113	4	39	18	6	3

Pedestrians

	NB	SB	EB	WB
7:00 AM				
7:15 AM				
7:30 AM				
7:45 AM				
8:00 AM				
8:15 AM				
8:30 AM				
8:45 AM				

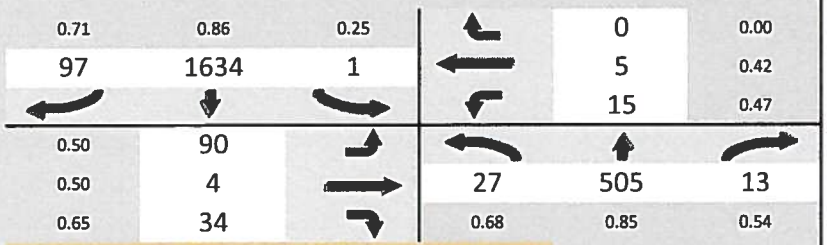


Diagram for: 07:00 AM-08:00 AM

Peak Hour: 07:15 AM-08:15 AM

PAPE-DAWSON ENGINEERS

North/South Street:	NW Military Dr											
East/West Street:	Winston Ln											
TOD:	PM	Date:	9-Nov-16		Synchro Node:		2	Raw Data:	P:\112\34\00\Traffic\Data\Raw\site2644-02			
	Northbound			Southbound			Eastbound			Westbound		
	NW Military Dr			NW Military Dr			Winston Ln			Winston Ln		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
3:00 PM	9	251	5	1	236	21	6	0	4	3	1	1
3:15 PM	7	246	3	1	230	26	23	0	6	2	2	0
3:30 PM	6	261	3	2	187	8	41	3	12	2	0	1
3:45 PM	3	237	0	3	179	5	14	0	6	6	1	0
4:00 PM	2	283	10	0	210	3	8	2	1	4	3	1
4:15 PM	1	274	6	1	179	6	11	1	6	10	0	0
4:30 PM	6	312	8	0	214	8	12	0	3	7	1	1
4:45 PM	4	295	6	2	197	8	11	1	3	2	3	1
5:00 PM	7	318	4	3	227	11	18	0	12	1	2	2
5:15 PM	6	288	2	0	216	14	21	1	4	0	2	2
5:30 PM	1	280	2	1	239	10	11	1	0	4	0	2
5:45 PM	0	255	4	0	176	12	12	19	7	2	23	4
Total	52	3300	53	14	2490	132	188	28	64	43	38	15
Peak Hour	23	1213	20	5	854	41	62	2	22	10	8	6

Pedestrians

	NB	SB	EB	WB
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM				
4:15 PM				
4:30 PM				
4:45 PM				
5:00 PM				
5:15 PM				
5:30 PM				
5:45 PM				

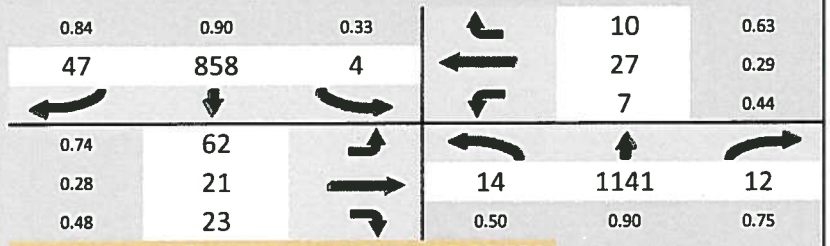


Diagram for: 05:00 PM-06:00 PM

Peak Hour: 04:30 PM-05:30 PM

PAPE-DAWSON ENGINEERS

North/South Street:	NW Military Dr											
East/West Street:	West Ave											
TOD:	AM	Date:	9-Nov-16		Synchro Node:		3	Raw Data:	P:\112\34\00\Traffic\Data\Raw\site2644-03			
	Northbound			Southbound			Eastbound			Westbound		
	NW Military Dr			NW Military Dr			West Ave			West Ave		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
7:00 AM	4	83	30	4	192	90	22	32	4	61	116	3
7:15 AM	3	126	35	3	302	121	26	44	8	88	130	6
7:30 AM	8	141	60	7	291	147	41	56	11	121	261	10
7:45 AM	6	149	53	6	308	188	44	123	72	63	170	7
8:00 AM	5	154	32	11	252	149	55	107	39	61	130	9
8:15 AM	10	115	58	7	234	114	26	67	9	33	115	7
8:30 AM	7	103	65	3	174	72	44	62	8	53	93	9
8:45 AM	7	150	37	9	187	46	41	60	11	38	64	3
Total	50	1021	370	50	1940	927	299	551	162	518	1079	54
Peak Hour	22	570	180	27	1153	605	166	330	130	333	691	32

Pedestrians

	NB	SB	EB	WB
7:00 AM				
7:15 AM				
7:30 AM				
7:45 AM				
8:00 AM				
8:15 AM				
8:30 AM				
8:45 AM				

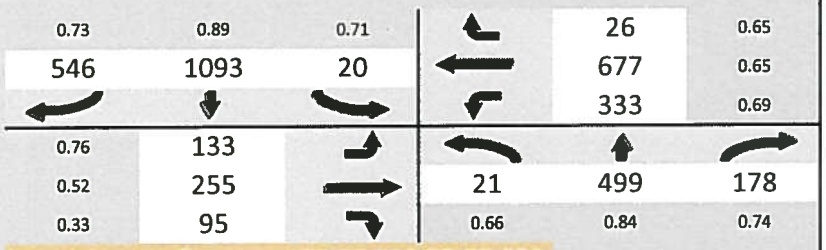


Diagram for: 07:00 AM-08:00 AM

Peak Hour: 07:15 AM-08:15 AM

PAPE-DAWSON ENGINEERS

North/South Street:	NW Military Dr											
East/West Street:	West Ave											
TOD:	PM	Date:	9-Nov-16		Synchro Node:		3	Raw Data:	P:\112\34\00\Traffic\Data\Raw\site2644-03			
	Northbound			Southbound			Eastbound			Westbound		
	NW Military Dr			NW Military Dr			West Ave			West Ave		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
3:00 PM	10	205	56	10	201	58	80	79	36	58	77	14
3:15 PM	7	187	60	10	189	49	62	62	18	67	85	16
3:30 PM	9	224	54	23	189	65	66	61	14	48	91	8
3:45 PM	13	239	69	8	140	66	74	75	14	44	97	8
4:00 PM	6	230	61	9	154	65	58	89	17	42	110	11
4:15 PM	7	253	68	14	125	52	82	90	21	33	129	6
4:30 PM	8	280	55	13	143	77	77	108	12	39	125	5
4:45 PM	9	257	66	3	135	75	63	109	12	29	128	7
5:00 PM	6	263	52	10	149	80	69	110	7	52	160	14
5:15 PM	10	261	78	13	158	65	70	129	17	31	161	5
5:30 PM	10	262	70	15	172	55	55	106	5	64	178	10
5:45 PM	3	269	68	9	155	65	65	110	7	51	153	8
Total	98	2930	757	137	1910	772	821	1128	180	558	1494	112
Peak Hour	29	1055	268	47	634	265	259	455	36	198	652	37

Pedestrians

	NB	SB	EB	WB
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM				
4:15 PM				
4:30 PM				
4:45 PM				
5:00 PM				
5:15 PM				
5:30 PM				
5:45 PM				

Diagram for: Peak Hour

Peak Hour: 05:00 PM-06:00 PM

PAPE-DAWSON ENGINEERS

North/South Street:	Castle Ln											
East/West Street:	West Ave											
TOD:	AM	Date:	9-Nov-16		Synchro Node:		4	Raw Data:	P:\112\34\00\Traffic\Data\Raw\Site2644-04			
	Northbound			Southbound			Eastbound			Westbound		
	Castle Ln			Castle Ln			West Ave			West Ave		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
7:00 AM	0	0	3	0	0	4	3	51	0	2	150	9
7:15 AM	3	0	19	0	0	9	2	67	0	0	229	0
7:30 AM	18	0	54	0	0	7	5	104	0	0	270	1
7:45 AM	21	0	70	0	0	5	14	128	1	1	260	0
8:00 AM	5	0	21	0	0	3	2	96	0	0	206	2
8:15 AM	1	0	3	0	0	4	4	98	0	0	206	6
8:30 AM	0	0	3	1	0	0	2	103	0	0	161	0
8:45 AM	0	0	1	0	0	5	1	92	0	1	106	1
Total	48	0	174	1	0	37	33	739	1	4	1588	19
Peak Hour	47	0	164	0	0	24	23	395	1	1	965	3

Pedestrians				
	NB	SB	EB	WB
7:00 AM				
7:15 AM				
7:30 AM				
7:45 AM				
8:00 AM				
8:15 AM				
8:30 AM				
8:45 AM				

Diagram for: Peak Hour

Peak Hour: 07:15 AM-08:15 AM

PAPE-DAWSON ENGINEERS

North/South Street:	Castle Ln											
East/West Street:	West Ave											
TOD:	PM	Date:	9-Nov-16		Synchro Node:		4	Raw Data:	P:\112\34\00\Traffic\Data\Raw\site2644-04			
	Northbound			Southbound			Eastbound			Westbound		
	Castle Ln			Castle Ln			West Ave			West Ave		
Time	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
3:00 PM	11	0	63	2	0	0	6	92	0	0	121	3
3:15 PM	6	0	36	0	0	6	1	88	0	0	120	1
3:30 PM	7	1	32	0	0	3	1	101	0	0	134	2
3:45 PM	0	0	11	2	0	4	2	130	2	2	156	1
4:00 PM	4	0	18	1	0	1	1	133	3	0	155	0
4:15 PM	5	1	24	0	0	1	6	135	3	2	153	0
4:30 PM	1	0	16	0	0	1	3	168	0	6	177	0
4:45 PM	0	0	7	0	0	1	1	144	3	14	173	1
5:00 PM	2	0	39	1	0	1	3	157	1	7	207	0
5:15 PM	0	0	11	1	0	2	0	176	0	1	195	1
5:30 PM	0	0	3	1	0	2	4	163	0	0	205	4
5:45 PM	0	0	4	0	0	2	1	150	1	0	186	0
Total	36	2	264	8	0	24	29	1637	13	32	1982	13
Peak Hour	2	0	60	3	0	6	8	640	4	22	780	6

Pedestrians

	NB	SB	EB	WB
3:00 PM				
3:15 PM				
3:30 PM				
3:45 PM				
4:00 PM				
4:15 PM				
4:30 PM				
4:45 PM				
5:00 PM				
5:15 PM				
5:30 PM				
5:45 PM				

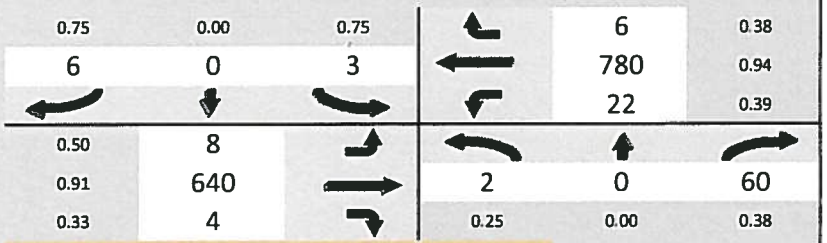


Diagram for: Peak Hour

Peak Hour: 04:45 PM-05:45 PM

PAPE-DAWSON ENGINEERS

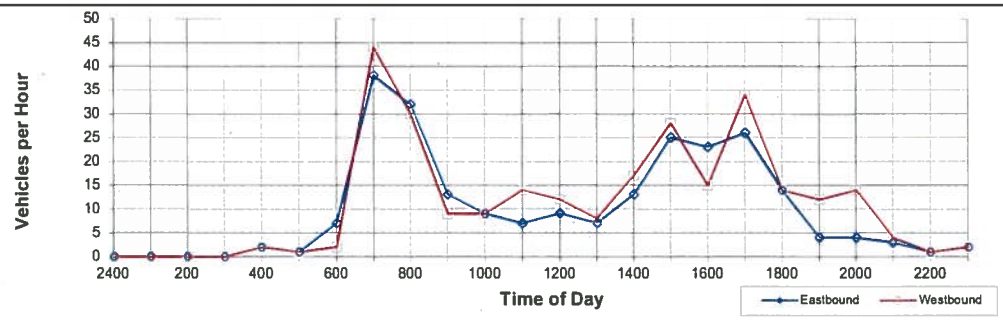
Pape-Dawson Engineers, Inc. **Automatic Traffic Counts**

Average Daily Traffic

Project No. : 11234-00
Station No. :
Counter No. : 1

Location: Winston Ln
City/State: Castle Hills, TX
Date: November 9, 2016
Day of Week: Wednesday

Site: Castle Hills - BASIS



Time	Peak	Eastbound		Westbound		Time	Peak	Eastbound		Westbound	
			TMC		TMC				TMC		TMC
24:00		0		0		12:00		3		3	
0:15		0		0		12:15		3		3	
0:30		0		0		12:30		2		2	
0:45		0	0	0	0	12:45		1	9	4	12
1:00		0		0		13:00		0		1	
1:15		0		0		13:15		2		2	
1:30		0		0		13:30		3		3	
1:45		0	0	0	0	13:45		2	7	2	8
2:00		0		0		14:00	*	1		2	
2:15		0		0		14:15	*	5		4	
2:30		0		0		14:30	*	5		4	
2:45		0	0	0	0	14:45	*	2	13	7	17
3:00		0		0		15:00		9		5	
3:15		0		0		15:15		5		11	
3:30		0		0		15:30		7		6	
3:45		0	0	0	0	15:45		4	25	6	28
4:00		0		0		16:00		2		3	
4:15		2		1		16:15		11		2	
4:30		0		1		16:30		5		9	
4:45		0	2	0	2	16:45		5	23	1	15
5:00		0		1		17:00	*	9		13	
5:15		1		0		17:15	*	6		10	
5:30		0		0		17:30	*	7		7	
5:45		0	1	0	1	17:45	*	4	26	4	34
6:00		1		0		18:00		3		3	
6:15		1		0		18:15		6		4	
6:30		1		1		18:30		2		2	
6:45		4	7	1	2	18:45		3	14	5	14
7:00		4		5		19:00		0		2	
7:15	*	7		13		19:15		1		5	
7:30	*	6		12		19:30		2		3	
7:45	*	21	38	14	44	19:45		1	4	2	12
8:00	*	9		12		20:00		3		3	
8:15		8		6		20:15		0		4	
8:30		7		8		20:30		1		7	
8:45		8	32	4	30	20:45		0	4	0	14
9:00		1		1		21:00		1		3	
9:15		3		2		21:15		0		0	
9:30		4		2		21:30		1		1	
9:45		5	13	4	9	21:45		1	3	0	4
10:00		3		5		22:00		0		1	
10:15		1		1		22:15		0		0	
10:30		3		3		22:30		0		0	
10:45		2	9	0	9	22:45		1	1	0	1
11:00		1		3		23:00		0		1	
11:15		1		5		23:15		0		0	
11:30		2		1		23:30		2		1	
11:45		3	7	5	14	23:45		0	2	0	2

AM Peak Hour	7:15-8:15	Directional Volumes	240	272
% of ADT	18.4%		**24-Hour Volume**	512
PM Peak Hour	17:00-18:00			
% of ADT	11.7%			

APPENDIX B
Trip Generation Data

Land Use (ITE)	Size	Unit	AM Peak Hour		PM Peak Hour		Daily	AM Peak Hour		PM Peak Hour		Daily
			Enter	Exit	Enter	Exit		Enter	Exit	Enter	Exit	
Private School (K-12) (536)	1127	Students	0.49	0.32	0.07	0.10	2.48	557	356	82	109	2795
Total								**557**	**356**	**82**	**109**	**2795**
								913		**191**		**2795**

Land Use (ITE)	Size	Unit	AM Peak Hour		Daily	AM Peak Hour Generator	
			Enter	Exit		Enter	Exit
Private School (K-12) (536)	902	Students	0.49	0.32	2.48	446	285
Total						**446**	**285**
						731	

From: Shauna Weaver @PD [mailto:SWeaver@pape-dawson.com]
Sent: Friday, November 04, 2016 3:15 PM
To: Jonathan Gelbart <jonathan.gelbart@basised.com>
Cc: Lyn Music <lyn.music@basised.com>; Barb DeLisa <barb.delisa@basised.com>
Subject: RE: Traffic study?

Ok - Thanks.

Sent from my Sprint Samsung Galaxy S7.

Shauna Weaver, P.E., LEED AP BD+C | **Sr. Vice President**
Pape-Dawson Engineers, Inc.
TBPE Firm Registration #470 | TBPLS Firm Registration #10028800

2000 NW Loop 410, San Antonio, TX 78213
P: 210.375.9000 | **E:** SWeaver@pape-dawson.com | **vcard**

San Antonio | Austin | Houston | Fort Worth | Dallas

-------- Original message --------
From: Jonathan Gelbart <jonathan.gelbart@basised.com>
Date: 11/4/16 5:14 PM (GMT-06:00)
To: "Shauna Weaver @PD" <SWeaver@pape-dawson.com>
Cc: Lyn Music <lyn.music@basised.com>, Barb DeLisa <barb.delisa@basised.com>
Subject: RE: Traffic study?

Hi Shauna,

We have an updated maximum projected enrollment:

	FY19
	Total
6th	240
7th	237
8th	223
9th	161
10th	108
11th	85
12th	73
Total	**1127**

Thank you,

From: Jonathan Gelbart
Sent: Friday, October 28, 2016 1:24 AM
To: 'Shauna Weaver @PD' <SWeaver@pape-dawson.com>
Cc: Lyn Music <lyn.music@basised.com>; Barb DeLisa <barb.delisa@basised.com>
Subject: RE: Traffic study?

Great, thanks so much.

Maximum projected enrollment as of right now:

6th	184
7th	181
8th	167
9th	119
10th	126
11th	134
12th	92
Total	**1,003**

Note that roughly 75 students take a school bus home. The rest are picked up by parents.

Potential start and stop times (subject to change):

1. 7:35 AM
    a. 1/3 of school expected to arrive between 7:00 and 7:10
    b. 1/3 of school expected to arrive between 7:25 and 7:35
2. 8:30
    a. Final third of school arrives consistently between 7:35 and 8:30
3. 2:55 PM
    a. 1/4 to 1/3 of school dismissed at this time
4. 3:50
    a. 1/2 of school dismissed at this time
5. 5:00 (extracurriculars)
    a. Remainder of school leaves at this time

-----Original Message-----
From: Shauna Weaver @PD [mailto:SWeaver@pape-dawson.com]
Sent: Thursday, October 27, 2016 2:26 PM
To: Jonathan Gelbart <jonathan.gelbart@basised.com>
Subject: RE: Traffic study?

We have traffic engineers in house who can produce Traffic Impact Analysis reports. In fact, we are in process on a few for various charter schools right now.
Please send me your projected student counts and I will get you a proposal tomorrow.

Shauna Weaver, P.E., LEED AP BD+C | Sr. Vice President Pape-Dawson Engineers, Inc.
TBPE Firm Registration #470 | TBPLS Firm Registration #10028800

2000 NW Loop 410, San Antonio, TX 78213
P: 210.375.9000 | E: SWeaver@pape-dawson.com | vcard

San Antonio | Austin | Houston | Fort Worth | Dallas

-----Original Message-----
From: Jonathan Gelbart [mailto:jonathan.gelbart@basised.com]
Sent: Thursday, October 27, 2016 3:53 PM
To: Shauna Weaver @PD <SWeaver@pape-dawson.com>
Subject: Traffic study?

Hi Shauna,

We are moving forward on the castle hills property we spoke about last month, and we need to order a traffic study right away. Who do you normally work with?

Thank you,
Jonathan

Jonathan Gelbart / Director, Charter School Development / BASIS.ed / Scottsdale, AZ / jonathan.gelbart@basised.com / +1-480-356-0293 (m)

APPENDIX C
Level of Service Descriptions

Level of Service at Signalized Intersections

Level of Service	Average Intersection Delay (sec/veh)	Description
A	≤ 10	No delays at intersection, smooth progression of traffic. Uncongested operations. All vehicles clear in a single signal cycle.
B	> 10 and ≤ 20	No delays at intersection, smooth progression of traffic. Uncongested operations. All vehicles clear in a single signal cycle.
C	> 20 and ≤ 35	Moderate delay, satisfactory to good progression of traffic. Light congestion, occasional backups on critical (high volume) approaches.
D	> 35 and ≤ 55	Little or no progression of traffic along the roadway with a high probability of stopping at signalized intersections operating at this level of service. Significant congestion on critical approaches, but intersection is functional. Vehicles required to wait through more than one cycle during short peak periods.
E	> 55 and ≤ 80	Heavy traffic flow conditions. Delays of two or more traffic signal cycles probably. No progression may occur if signal does not provide for protected turning movements.
F	> 80	Unstable traffic flow. Heavy congestion. Traffic moves in forced flow condition. Three or more cycles required to pass intersection. Total breakdown with stop and go conditions.
*	> > 80	Very unstable traffic flow. Very heavy congestion. Traffic moves in forced flow condition. More than three cycles required to pass intersection. Total breakdown. Stop and go only. Delays are beyond the range of the *Highway Capacity Manual* equations. Represents an extreme level of over saturation.

Level of service at signalized intersections is determined by the average vehicle delay at the intersection. Values can be reported for the intersection as a whole or for each individual movement. The general characteristics associated with each level of service for signalized intersections are presented in the table above.

Level of Service at Unsignalized Intersections

Level of Service	Average Intersection Delay (sec/veh)	Description
A	≤ 10	Little or no delay
B	> 10 and ≤ 15	Short traffic delay
C	> 15 and ≤ 25	Average traffic delay
D	> 25 and ≤ 35	Long traffic delay
E	> 35 and ≤ 50	Very long traffic delay
F	> 50	Extreme delays, possibly severe congestion

Level of service at unsignalized intersections is determined by the average delay a vehicle experiences at each intersection approach. An overall intersection delay and LOS is reported for All-Way-Stop-Controlled (AWSC) intersections. However, at Two-Way-Stop-Controlled (TWSC) intersections, delay is primarily experienced by vehicles on the stop-controlled approaches only. Therefore, a different level of service is reported for each stop-controlled approach at TWSC intersections. The general characteristics associated with each level of service for unsignalized intersections are based on the *Highway Capacity Manual.* [1]

[1] Transportation Research Board/National Research Council. 2000. *Highway Capacity Manual. Third Edition*, Washington, D.C.

APPENDIX D
Capacity Analyses Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	361	724	12	182	122	175	413	0	177	1370	20
Future Volume (vph)	31	361	724	12	182	122	175	413	0	177	1370	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539		2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.33	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	610	1863	1583	3433	3539		2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	392	787	13	198	133	190	449	0	192	1489	22
RTOR Reduction (vph)	0	0	53	0	0	109	0	0	0	0	0	11
Lane Group Flow (vph)	34	392	734	13	198	24	190	449	0	192	1489	11
Turn Type	Prot	NA	pm+ov	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5		8		5	2		1	6	
Permitted Phases			4	8		8			2			6
Actuated Green, G (s)	4.2	31.5	44.0	21.8	21.8	21.8	12.5	54.9		14.9	57.3	57.3
Effective Green, g (s)	4.2	31.5	44.0	21.8	21.8	21.8	12.5	54.9		14.9	57.3	57.3
Actuated g/C Ratio	0.04	0.26	0.37	0.18	0.18	0.18	0.10	0.46		0.12	0.48	0.48
Clearance Time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	61	489	652	110	338	287	357	1619		249	1689	755
v/s Ratio Prot	0.02	0.21	c0.12		0.11		0.06	0.13		0.10	c0.42	
v/s Ratio Perm			0.35	0.02		0.02						0.01
v/c Ratio	0.56	0.80	1.13	0.12	0.59	0.08	0.53	0.28		0.77	0.88	0.01
Uniform Delay, d1	57.0	41.3	38.0	41.1	45.0	40.8	51.0	20.2		50.9	28.3	16.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.21	1.71		1.00	1.00	1.00
Incremental Delay, d2	6.1	8.7	75.4	0.2	1.7	0.0	0.8	0.4		12.6	7.0	0.0
Delay (s)	63.1	50.0	113.4	41.2	46.6	40.9	62.7	35.0		63.5	35.3	16.5
Level of Service	E	D	F	D	D	D	E	C		E	D	B
Approach Delay (s)		91.5			44.2			43.2			38.2	
Approach LOS		F			D			D			D	

Intersection Summary				
HCM 2000 Control Delay	56.2	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	1.11			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2	
Intersection Capacity Utilization	103.3%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	4	34	15	5	0	27	505	13	1	1634	97
Future Volume (vph)	90	4	34	15	5	0	27	505	13	1	1634	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.96			1.00		1.00	1.00		1.00	0.99	
Flt Protected		0.97			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1735			1794		1770	3526		1770	3510	
Flt Permitted		0.78			0.82		0.07	1.00		0.43	1.00	
Satd. Flow (perm)		1396			1522		133	3526		806	3510	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	4	37	16	5	0	29	549	14	1	1776	105
RTOR Reduction (vph)	0	12	0	0	0	0	0	1	0	0	3	0
Lane Group Flow (vph)	0	127	0	0	21	0	29	562	0	1	1878	0
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		16.1			16.1		91.9	91.1		91.9	88.3	
Effective Green, g (s)		16.1			16.1		91.9	91.1		91.9	88.3	
Actuated g/C Ratio		0.13			0.13		0.77	0.76		0.77	0.74	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		187			204		150	2676		623	2582	
v/s Ratio Prot							0.01	c0.16		0.00	c0.54	
v/s Ratio Perm		c0.09			0.01		0.14			0.00		
v/c Ratio		0.68			0.10		0.19	0.21		0.00	0.73	
Uniform Delay, d1		49.5			45.6		9.1	4.1		3.7	9.0	
Progression Factor		1.00			1.00		3.35	3.50		0.67	1.23	
Incremental Delay, d2		9.4			0.2		0.6	0.2		0.0	0.6	
Delay (s)		58.9			45.8		31.2	14.7		2.5	11.7	
Level of Service		E			D		C	B		A	B	
Approach Delay (s)		58.9			45.8			15.5			11.7	
Approach LOS		E			D			B			B	

Intersection Summary				
HCM 2000 Control Delay	15.3	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.71			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	62.9%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	255	95	333	677	26	21	499	178	20	1093	546
Future Volume (vph)	133	255	95	333	677	26	21	499	178	20	1093	546
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.96		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3395		1770	3520		1770	3539	1583	1770	3539	1583
Flt Permitted	0.19	1.00		0.40	1.00		0.08	1.00	1.00	0.34	1.00	1.00
Satd. Flow (perm)	361	3395		747	3520		149	3539	1583	635	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	145	277	103	362	736	28	23	542	193	22	1188	593
RTOR Reduction (vph)	0	29	0	0	2	0	0	0	124	0	0	226
Lane Group Flow (vph)	145	351	0	362	762	0	23	542	69	22	1188	367
Turn Type	D.P+P	NA		D.P+P	NA		D.P+P	NA	Perm	D.P+P	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	6			2			4		8	8		4
Actuated Green, G (s)	51.6	30.3		51.6	40.6		52.4	43.2	43.2	52.4	50.0	50.0
Effective Green, g (s)	51.6	30.3		51.6	40.6		52.4	43.2	43.2	52.4	50.0	50.0
Actuated g/C Ratio	0.43	0.25		0.43	0.34		0.44	0.36	0.36	0.44	0.42	0.42
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	284	857		502	1190		97	1274	569	364	1474	659
v/s Ratio Prot	0.05	0.10		c0.13	0.22		0.00	c0.15		0.00	c0.34	
v/s Ratio Perm	0.17			c0.18			0.10		0.04	0.02		0.23
v/c Ratio	0.51	0.41		0.72	0.64		0.24	0.43	0.12	0.06	0.81	0.56
Uniform Delay, d1	23.1	37.4		24.9	33.5		24.2	29.0	25.7	26.1	30.7	26.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.42	0.71	0.75
Incremental Delay, d2	1.5	1.4		5.1	2.6		1.3	0.2	0.1	0.0	2.3	0.7
Delay (s)	24.7	38.8		29.9	36.2		25.4	29.3	25.8	11.0	24.2	20.6
Level of Service	C	D		C	D		C	C	C	B	C	C
Approach Delay (s)		34.9			34.2			28.3			22.8	
Approach LOS		C			C			C			C	

Intersection Summary				
HCM 2000 Control Delay	28.3	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.76			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	68.7%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	25	42	0	146	24	350	1	3	909	10
Future Volume (Veh/h)	0	0	25	42	0	146	24	350	1	3	909	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	27	46	0	159	26	380	1	3	988	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											937	
pX, platoon unblocked	0.92	0.92	0.92	0.92	0.92		0.92					
vC, conflicting volume	1400	1432	500	960	1438	190	999			381		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1258	1293	277	778	1299	190	821			381		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	96	81	100	81	96			100		
cM capacity (veh/h)	92	143	661	245	142	819	738			1174		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	27	205	216	191	497	505
Volume Left	0	46	26	0	3	0
Volume Right	27	159	0	1	0	11
cSH	661	537	738	1700	1174	1700
Volume to Capacity	0.04	0.38	0.04	0.11	0.00	0.30
Queue Length 95th (ft)	3	44	3	0	0	0
Control Delay (s)	10.7	15.8	1.6	0.0	0.1	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	10.7	15.8	0.8		0.0	
Approach LOS	B	C				

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	52.5%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
1: NW Military Drive & Lockhill-Selma Road

Existing PM peak hour
12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	161	393	339	4	495	256	519	837	1	150	667	43
Future Volume (vph)	161	393	339	4	495	256	519	837	1	150	667	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539	1583	2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.50	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	938	1863	1583	3433	3539	1583	2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	175	427	368	4	538	278	564	910	1	163	725	47
RTOR Reduction (vph)	0	0	33	0	0	170	0	0	1	0	0	36
Lane Group Flow (vph)	175	427	335	4	538	108	564	910	0	163	725	11
Turn Type	Prot	NA	pm+ov	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5		8		5	2		1	6	
Permitted Phases			4	8		8			2			6
Actuated Green, G (s)	9.5	48.4	72.9	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Effective Green, g (s)	9.5	48.4	72.9	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Actuated g/C Ratio	0.08	0.40	0.61	0.28	0.28	0.28	0.20	0.35	0.35	0.09	0.24	0.24
Clearance Time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	140	751	1034	261	518	440	700	1250	559	175	837	374
v/s Ratio Prot	c0.10	0.23	0.07		c0.29		c0.16	0.26		0.08	c0.20	
v/s Ratio Perm			0.15	0.00		0.07			0.00			0.01
v/c Ratio	1.25	0.57	0.32	0.02	1.04	0.24	0.81	0.73	0.00	0.93	0.87	0.03
Uniform Delay, d1	55.2	27.7	11.5	31.4	43.3	33.5	45.5	33.8	25.1	54.4	44.0	35.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.06	1.00	1.00	1.00	1.00
Incremental Delay, d2	158.2	0.6	0.1	0.0	49.9	0.1	6.0	3.5	0.0	47.9	11.7	0.1
Delay (s)	213.5	28.3	11.6	31.4	93.2	33.6	51.8	39.2	25.1	102.3	55.6	35.4
Level of Service	F	C	B	C	F	C	D	D	C	F	E	D
Approach Delay (s)		55.4			72.7			44.0			62.7	
Approach LOS		E			E			D			E	

Intersection Summary				
HCM 2000 Control Delay	56.4	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	0.95			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2	
Intersection Capacity Utilization	88.4%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: NW Military Drive & Winston Lane

Existing PM peak hour
12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	62	21	23	7	27	10	14	1141	12	4	858	47
Future Volume (vph)	62	21	23	7	27	10	14	1141	12	4	858	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.97			0.97		1.00	1.00		1.00	0.99	
Flt Protected		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1757			1790		1770	3534		1770	3512	
Flt Permitted		0.82			0.96		0.27	1.00		0.19	1.00	
Satd. Flow (perm)		1479			1733		498	3534		362	3512	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	67	23	25	8	29	11	15	1240	13	4	933	51
RTOR Reduction (vph)	0	10	0	0	10	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	105	0	0	38	0	15	1253	0	4	982	0
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		13.9			13.9		94.1	92.9		94.1	91.7	
Effective Green, g (s)		13.9			13.9		94.1	92.9		94.1	91.7	
Actuated g/C Ratio		0.12			0.12		0.78	0.77		0.78	0.76	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		171			200		415	2735		297	2683	
v/s Ratio Prot							0.00	c0.35		0.00	c0.28	
v/s Ratio Perm		c0.07			0.02		0.03			0.01		
v/c Ratio		0.62			0.19		0.04	0.46		0.01	0.37	
Uniform Delay, d1		50.5			48.0		3.1	4.7		5.9	4.6	
Progression Factor		1.00			1.00		2.16	2.47		0.34	0.37	
Incremental Delay, d2		6.4			0.5		0.0	0.3		0.0	0.3	
Delay (s)		56.9			48.4		6.6	12.0		2.1	2.0	
Level of Service		E			D		A	B		A	A	
Approach Delay (s)		56.9			48.4			11.9			2.0	
Approach LOS		E			D			B			A	

Intersection Summary				
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.49			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	51.2%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	259	455	36	198	652	37	29	1055	268	47	634	265
Future Volume (vph)	259	455	36	198	652	37	29	1055	268	47	634	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3500		1770	3511		1770	3539	1583	1770	3539	1583
Flt Permitted	0.18	1.00		0.34	1.00		0.27	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)	332	3500		637	3511		497	3539	1583	167	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	282	495	39	215	709	40	32	1147	291	51	689	288
RTOR Reduction (vph)	0	5	0	0	3	0	0	0	147	0	0	177
Lane Group Flow (vph)	282	529	0	215	746	0	32	1147	144	51	689	111
Turn Type	D.P+P	NA		D.P+P	NA		D.P+P	NA	Perm	D.P+P	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	6			2			4		8	8		4
Actuated Green, G (s)	55.3	42.3		55.3	37.3		48.7	44.6	44.6	48.7	46.3	46.3
Effective Green, g (s)	55.3	42.3		55.3	37.3		48.7	44.6	44.6	48.7	46.3	46.3
Actuated g/C Ratio	0.46	0.35		0.46	0.31		0.41	0.37	0.37	0.41	0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	368	1233		416	1091		227	1315	588	122	1365	610
v/s Ratio Prot	c0.11	0.15		0.06	0.21		0.00	c0.32		0.01	c0.19	
v/s Ratio Perm	c0.24			0.18			0.05		0.09	0.15		0.07
v/c Ratio	0.77	0.43		0.52	0.68		0.14	0.87	0.24	0.42	0.50	0.18
Uniform Delay, d1	23.4	29.6		20.5	36.2		22.5	35.1	26.1	49.8	28.1	24.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.56	0.47	0.68
Incremental Delay, d2	9.2	1.1		1.1	3.5		0.3	6.6	0.2	2.2	0.3	0.1
Delay (s)	32.6	30.7		21.5	39.7		22.8	41.7	26.3	30.2	13.6	16.8
Level of Service	C	C		C	D		C	D	C	C	B	B
Approach Delay (s)		31.4			35.6			38.2			15.3	
Approach LOS		C			D			D			B	

Intersection Summary				
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.81			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	79.4%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	0	6	2	0	60	8	640	4	22	780	6
Future Volume (Veh/h)	3	0	6	2	0	60	8	640	4	22	780	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	7	2	0	65	9	696	4	24	848	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											937	
pX, platoon unblocked	0.88	0.88	0.88	0.88	0.88		0.88					
vC, conflicting volume	1330	1618	428	1195	1619	350	855			700		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1093	1420	61	938	1422	350	549			700		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	99	100	90	99			97		
cM capacity (veh/h)	129	114	868	185	114	646	890			893		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	67	357	352	448	431
Volume Left	3	2	9	0	24	0
Volume Right	7	65	0	4	0	7
cSH	320	601	890	1700	893	1700
Volume to Capacity	0.03	0.11	0.01	0.21	0.03	0.25
Queue Length 95th (ft)	2	9	1	0	2	0
Control Delay (s)	16.6	11.7	0.3	0.0	0.8	0.0
Lane LOS	C	B	A		A	
Approach Delay (s)	16.6	11.7	0.2		0.4	
Approach LOS	C	B				

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	48.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	375	753	12	189	127	182	430	0	184	1425	21
Future Volume (vph)	32	375	753	12	189	127	182	430	0	184	1425	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539		2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.31	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	586	1863	1583	3433	3539		2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	408	818	13	205	138	198	467	0	200	1549	23
RTOR Reduction (vph)	0	0	52	0	0	112	0	0	0	0	0	12
Lane Group Flow (vph)	35	408	766	13	205	26	198	467	0	200	1549	11
Turn Type	Prot	NA	pm+ov	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5		8		5	2		1	6	
Permitted Phases			4	8		8			2			6
Actuated Green, G (s)	4.3	32.8	45.3	23.0	23.0	23.0	12.5	53.1		15.4	56.0	56.0
Effective Green, g (s)	4.3	32.8	45.3	23.0	23.0	23.0	12.5	53.1		15.4	56.0	56.0
Actuated g/C Ratio	0.04	0.27	0.38	0.19	0.19	0.19	0.10	0.44		0.13	0.47	0.47
Clearance Time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	63	509	670	112	357	303	357	1566		257	1651	738
v/s Ratio Prot	0.02	0.22	c0.12		0.11		0.06	0.13		0.10	c0.44	
v/s Ratio Perm			0.36	0.02		0.02						0.01
v/c Ratio	0.56	0.80	1.14	0.12	0.57	0.09	0.55	0.30		0.78	0.94	0.01
Uniform Delay, d1	56.9	40.6	37.4	40.1	44.1	39.9	51.1	21.5		50.6	30.4	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.24	1.71		1.00	1.00	1.00
Incremental Delay, d2	5.9	8.4	81.6	0.2	1.4	0.0	1.0	0.5		12.7	11.7	0.0
Delay (s)	62.8	48.9	119.0	40.3	45.4	39.9	64.4	37.1		63.3	42.0	17.2
Level of Service	E	D	F	D	D	D	E	D		E	D	B
Approach Delay (s)		94.8			43.1			45.2			44.1	
Approach LOS		F			D			D			D	

Intersection Summary				
HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	1.15			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2	
Intersection Capacity Utilization	106.6%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	4	35	16	5	0	28	525	14	1	1699	101
Future Volume (vph)	94	4	35	16	5	0	28	525	14	1	1699	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.96			1.00		1.00	1.00		1.00	0.99	
Flt Protected		0.97			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1735			1793		1770	3526		1770	3509	
Flt Permitted		0.78			0.81		0.06	1.00		0.42	1.00	
Satd. Flow (perm)		1394			1512		113	3526		784	3509	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	4	38	17	5	0	30	571	15	1	1847	110
RTOR Reduction (vph)	0	11	0	0	0	0	0	1	0	0	3	0
Lane Group Flow (vph)	0	133	0	0	22	0	30	585	0	1	1954	0
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		16.6			16.6		91.4	90.6		91.4	87.9	
Effective Green, g (s)		16.6			16.6		91.4	90.6		91.4	87.9	
Actuated g/C Ratio		0.14			0.14		0.76	0.75		0.76	0.73	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		192			209		134	2662		603	2570	
v/s Ratio Prot							0.01	c0.17		0.00	c0.56	
v/s Ratio Perm		c0.10			0.01		0.16			0.00		
v/c Ratio		0.69			0.11		0.22	0.22		0.00	0.76	
Uniform Delay, d1		49.3			45.2		10.9	4.3		3.9	9.7	
Progression Factor		1.00			1.00		3.29	3.43		0.73	1.20	
Incremental Delay, d2		10.3			0.2		0.8	0.2		0.0	0.6	
Delay (s)		59.5			45.4		36.6	15.0		2.9	12.2	
Level of Service		E			D		D	B		A	B	
Approach Delay (s)		59.5			45.4			16.1			12.1	
Approach LOS		E			D			B			B	

Intersection Summary				
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.73			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	65.0%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
3: NW Military Drive & West Avenue

No Build AM Peak
12/16/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	265	99	346	704	27	22	519	185	21	1137	568
Future Volume (vph)	138	265	99	346	704	27	22	519	185	21	1137	568
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.96		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3394		1770	3520		1770	3539	1583	1770	3539	1583
Flt Permitted	0.17	1.00		0.38	1.00		0.08	1.00	1.00	0.33	1.00	1.00
Satd. Flow (perm)	320	3394		701	3520		147	3539	1583	617	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	150	288	108	376	765	29	24	564	201	23	1236	617
RTOR Reduction (vph)	0	30	0	0	2	0	0	0	127	0	0	221
Lane Group Flow (vph)	150	366	0	376	792	0	24	564	74	23	1236	396
Turn Type	D.P+P	NA		D.P+P	NA		D.P+P	NA	Perm	D.P+P	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	6			2			4		8	8		4
Actuated Green, G (s)	50.9	28.9		50.9	39.7		53.1	44.3	44.3	53.1	50.7	50.7
Effective Green, g (s)	50.9	28.9		50.9	39.7		53.1	44.3	44.3	53.1	50.7	50.7
Actuated g/C Ratio	0.42	0.24		0.42	0.33		0.44	0.37	0.37	0.44	0.42	0.42
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	271	817		493	1164		97	1306	584	357	1495	668
v/s Ratio Prot	0.05	0.11		c0.14	0.23		0.00	c0.16		0.00	c0.35	
v/s Ratio Perm	0.18			c0.18			0.10		0.05	0.02		0.25
v/c Ratio	0.55	0.45		0.76	0.68		0.25	0.43	0.13	0.06	0.83	0.59
Uniform Delay, d1	24.0	38.8		25.7	34.7		24.3	28.4	25.1	26.0	30.8	26.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.46	0.71	0.67
Incremental Delay, d2	2.4	1.8		6.9	3.2		1.3	0.2	0.1	0.1	2.6	0.9
Delay (s)	26.4	40.5		32.6	37.9		25.7	28.6	25.2	12.0	24.3	18.8
Level of Service	C	D		C	D		C	C	C	B	C	B
Approach Delay (s)		36.6			36.2			27.7			22.4	
Approach LOS		D			D			C			C	

Intersection Summary				
HCM 2000 Control Delay	28.8	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.79			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	71.1%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: West Avenue & Castle Lane

No Build AM Peak
12/16/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	26	44	0	152	25	364	1	3	945	10
Future Volume (Veh/h)	0	0	26	44	0	152	25	364	1	3	945	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	28	48	0	165	27	396	1	3	1027	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											937	
pX, platoon unblocked	0.91	0.91	0.91	0.91	0.91		0.91					
vC, conflicting volume	1456	1490	519	998	1494	198	1038			397		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1295	1332	261	790	1338	198	834			397		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	96	80	100	80	96			100		
cM capacity (veh/h)	84	133	668	236	132	809	720			1158		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	28	213	225	199	516	524
Volume Left	0	48	27	0	3	0
Volume Right	28	165	0	1	0	11
cSH	668	523	720	1700	1158	1700
Volume to Capacity	0.04	0.41	0.04	0.12	0.00	0.31
Queue Length 95th (ft)	3	49	3	0	0	0
Control Delay (s)	10.6	16.5	1.6	0.0	0.1	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	10.6	16.5	0.9		0.0	
Approach LOS	B	C				

Intersection Summary				
Average Delay	2.5			
Intersection Capacity Utilization	54.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	409	353	4	515	266	540	870	1	156	694	45
Future Volume (vph)	167	409	353	4	515	266	540	870	1	156	694	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539	1583	2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.48	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	887	1863	1583	3433	3539	1583	2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	182	445	384	4	560	289	587	946	1	170	754	49
RTOR Reduction (vph)	0	0	33	0	0	167	0	0	1	0	0	37
Lane Group Flow (vph)	182	445	351	4	560	122	587	946	0	170	754	12
Turn Type	Prot	NA	pm+ov	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5		8		5	2		1	6	
Permitted Phases			4	8		8			2			6
Actuated Green, G (s)	9.5	48.4	72.9	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Effective Green, g (s)	9.5	48.4	72.9	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Actuated g/C Ratio	0.08	0.40	0.61	0.28	0.28	0.28	0.20	0.35	0.35	0.09	0.24	0.24
Clearance Time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	140	751	1034	246	518	440	700	1250	559	175	837	374
v/s Ratio Prot	c0.10	0.24	0.07		c0.30		c0.17	0.27		0.08	c0.21	
v/s Ratio Perm			0.15	0.00		0.08			0.00			0.01
v/c Ratio	1.30	0.59	0.34	0.02	1.08	0.28	0.84	0.76	0.00	0.97	0.90	0.03
Uniform Delay, d1	55.2	28.1	11.6	31.4	43.3	33.9	45.9	34.2	25.1	54.6	44.4	35.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.04	1.10	1.00	1.00	1.00	1.00
Incremental Delay, d2	177.4	0.8	0.1	0.0	63.2	0.1	7.8	4.0	0.0	59.1	14.7	0.2
Delay (s)	232.6	28.9	11.7	31.4	106.5	34.0	55.4	41.8	25.1	113.7	59.1	35.4
Level of Service	F	C	B	C	F	C	E	D	C	F	E	D
Approach Delay (s)		59.1			81.6			47.0			67.5	
Approach LOS		E			F			D			E	

Intersection Summary				
HCM 2000 Control Delay	61.1	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	0.99			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2	
Intersection Capacity Utilization	91.1%	ICU Level of Service	F	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	64	22	24	7	28	10	15	1187	12	4	892	49
Future Volume (vph)	64	22	24	7	28	10	15	1187	12	4	892	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.97			0.97		1.00	1.00		1.00	0.99	
Flt Protected		0.97			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1757			1792		1770	3534		1770	3512	
Flt Permitted		0.81			0.96		0.25	1.00		0.18	1.00	
Satd. Flow (perm)		1473			1735		475	3534		339	3512	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	24	26	8	30	11	16	1290	13	4	970	53
RTOR Reduction (vph)	0	10	0	0	10	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	110	0	0	39	0	16	1303	0	4	1021	0
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		14.3			14.3		93.7	92.5		93.7	91.3	
Effective Green, g (s)		14.3			14.3		93.7	92.5		93.7	91.3	
Actuated g/C Ratio		0.12			0.12		0.78	0.77		0.78	0.76	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		175			206		396	2724		279	2872	
v/s Ratio Prot							0.00	c0.37		0.00	c0.29	
v/s Ratio Perm		c0.07			0.02		0.03			0.01		
v/c Ratio		0.63			0.19		0.04	0.48		0.01	0.36	
Uniform Delay, d1		50.3			47.6		3.2	5.0		6.5	4.8	
Progression Factor		1.00			1.00		2.12	2.46		0.34	0.40	
Incremental Delay, d2		7.2			0.5		0.0	0.3		0.0	0.3	
Delay (s)		57.5			48.1		6.8	12.6		2.2	2.2	
Level of Service		E			D		A	B		A	A	
Approach Delay (s)		57.5			48.1			12.5			2.2	
Approach LOS		E			D			B			A	

Intersection Summary				
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.51			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	52.7%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	269	473	37	206	678	38	30	1097	279	49	659	276
Future Volume (vph)	269	473	37	206	678	38	30	1097	279	49	659	276
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3501		1770	3511		1770	3539	1583	1770	3539	1583
Flt Permitted	0.15	1.00		0.33	1.00		0.25	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)	280	3501		606	3511		475	3539	1583	165	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	292	514	40	224	737	41	33	1192	303	53	716	300
RTOR Reduction (vph)	0	5	0	0	4	0	0	0	146	0	0	183
Lane Group Flow (vph)	292	549	0	224	774	0	33	1192	157	53	716	117
Turn Type	D.P+P	NA		D.P+P	NA		D.P+P	NA	Perm	D.P+P	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	6			2			4		8	8		4
Actuated Green, G (s)	54.8	41.6		54.8	35.9		49.2	45.2	45.2	49.2	46.8	46.8
Effective Green, g (s)	54.8	41.6		54.8	35.9		49.2	45.2	45.2	49.2	46.8	46.8
Actuated g/C Ratio	0.46	0.35		0.46	0.30		0.41	0.38	0.38	0.41	0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	362	1213		404	1050		220	1333	596	121	1380	617
v/s Ratio Prot	c0.13	0.16		0.06	0.22		0.00	c0.34		0.01	c0.20	
v/s Ratio Perm	c0.24			0.19			0.06		0.10	0.16		0.07
v/c Ratio	0.81	0.45		0.55	0.74		0.15	0.89	0.26	0.44	0.52	0.19
Uniform Delay, d1	25.3	30.4		21.0	37.8		22.3	35.2	25.9	50.9	28.0	24.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.56	0.47	0.63
Incremental Delay, d2	12.4	1.2		1.6	4.6		0.3	8.0	0.2	2.4	0.3	0.1
Delay (s)	37.7	31.6		22.6	42.5		22.6	43.2	26.1	30.8	13.3	15.4
Level of Service	D	C		C	D		C	D	C	C	B	B
Approach Delay (s)		33.7			38.0			39.4			14.8	
Approach LOS		C			D			D			B	

Intersection Summary				
HCM 2000 Control Delay	32.1	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.85			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	81.8%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	0	6	2	0	62	8	666	4	23	811	6
Future Volume (Veh/h)	3	0	6	2	0	62	8	666	4	23	811	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	7	2	0	67	9	724	4	25	882	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											937	
pX, platoon unblocked	0.86	0.86	0.86	0.86	0.86		0.86					
vC, conflicting volume	1382	1682	444	1242	1683	364	889			728		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1121	1468	31	958	1470	364	548			728		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	99	100	89	99			97		
cM capacity (veh/h)	120	105	892	176	104	633	876			871		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	69	371	366	466	448
Volume Left	3	2	9	0	25	0
Volume Right	7	67	0	4	0	7
cSH	305	588	876	1700	871	1700
Volume to Capacity	0.03	0.12	0.01	0.22	0.03	0.26
Queue Length 95th (ft)	3	10	1	0	2	0
Control Delay (s)	17.2	11.9	0.3	0.0	0.8	0.0
Lane LOS	C	B	A		A	
Approach Delay (s)	17.2	11.9	0.2		0.4	
Approach LOS	C	B				

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	49.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	375	842	12	189	127	239	487	0	184	1514	21
Future Volume (vph)	32	375	842	12	189	127	239	487	0	184	1514	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539		2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.31	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	586	1863	1583	3433	3539		2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	408	915	13	205	138	260	529	0	200	1646	23
RTOR Reduction (vph)	0	0	52	0	0	112	0	0	0	0	0	12
Lane Group Flow (vph)	35	408	863	13	205	26	260	529	0	200	1646	11
Turn Type	Prot	NA	pm+ov	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4	5		8		5	2		1	6	
Permitted Phases			4	8		8			2			6
Actuated Green, G (s)	4.3	32.8	45.3	23.0	23.0	23.0	12.5	53.1		15.4	56.0	56.0
Effective Green, g (s)	4.3	32.8	45.3	23.0	23.0	23.0	12.5	53.1		15.4	56.0	56.0
Actuated g/C Ratio	0.04	0.27	0.38	0.19	0.19	0.19	0.10	0.44		0.13	0.47	0.47
Clearance Time (s)	5.5	6.6	5.5	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	63	509	670	112	357	303	357	1566		257	1651	738
v/s Ratio Prot	0.02	0.22	c0.13		0.11		0.08	0.15		0.10	c0.47	
v/s Ratio Perm			0.41	0.02		0.02						0.01
v/c Ratio	0.56	0.80	1.29	0.12	0.57	0.09	0.73	0.34		0.78	1.00	0.01
Uniform Delay, d1	56.9	40.6	37.4	40.1	44.1	39.9	52.1	21.9		50.6	31.9	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.26	1.58		1.00	1.00	1.00
Incremental Delay, d2	5.9	8.4	140.9	0.2	1.4	0.0	5.1	0.5		12.7	21.4	0.0
Delay (s)	62.8	48.9	178.3	40.3	45.4	39.9	71.0	35.1		63.3	53.4	17.2
Level of Service	E	D	F	D	D	D	E	D		E	D	B
Approach Delay (s)		136.4			43.1			46.9			54.0	
Approach LOS		F			D			D			D	

Intersection Summary				
HCM 2000 Control Delay	77.4	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	1.27			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2	
Intersection Capacity Utilization	114.6%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	208	18	192	16	27	0	274	525	14	1	1699	279
Future Volume (vph)	208	18	192	16	27	0	274	525	14	1	1699	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.94			1.00		1.00	1.00		1.00	0.98	
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1705			1829		1770	3526		1770	3464	
Flt Permitted		0.84			0.83		0.05	1.00		0.41	1.00	
Satd. Flow (perm)		1464			1552		94	3526		768	3464	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	226	20	209	17	29	0	298	571	15	1	1847	303
RTOR Reduction (vph)	0	26	0	0	0	0	0	2	0	0	11	0
Lane Group Flow (vph)	0	429	0	0	46	0	298	584	0	1	2139	0
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		
Actuated Green, G (s)		24.0			24.0		84.0	83.2		84.0	79.0	
Effective Green, g (s)		24.0			24.0		84.0	83.2		84.0	79.0	
Actuated g/C Ratio		0.20			0.20		0.70	0.69		0.70	0.66	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		292			310		135	2444		544	2280	
v/s Ratio Prot							c0.09	0.17		0.00	0.62	
v/s Ratio Perm		c0.29			0.03		c1.44			0.00		
v/c Ratio		1.47			0.15		2.21	0.24		0.00	0.94	
Uniform Delay, d1		48.0			39.6		36.7	6.8		6.5	18.3	
Progression Factor		1.00			1.00		0.81	2.78		0.79	1.19	
Incremental Delay, d2		229.5			0.2		562.4	0.2		0.0	1.0	
Delay (s)		277.5			39.8		592.2	19.0		5.2	22.9	
Level of Service		F			D		F	B		A	C	
Approach Delay (s)		277.5			39.8			212.2			22.9	
Approach LOS		F			D			F			C	

Intersection Summary				
HCM 2000 Control Delay	103.2	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	2.03			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	111.9%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	227	265	99	346	704	72	22	631	185	50	1208	625
Future Volume (vph)	227	265	99	346	704	72	22	631	185	50	1208	625
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.96		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3394		1770	3490		1770	3539	1583	1770	3539	1583
Flt Permitted	0.12	1.00		0.37	1.00		0.08	1.00	1.00	0.21	1.00	1.00
Satd. Flow (perm)	227	3394		682	3490		144	3539	1583	396	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	247	288	108	376	765	78	24	686	201	54	1313	679
RTOR Reduction (vph)	0	31	0	0	6	0	0	0	139	0	0	218
Lane Group Flow (vph)	247	365	0	376	837	0	24	686	62	54	1313	461
Turn Type	D.P+P	NA		D.P+P	NA		D.P+P	NA	Perm	D.P+P	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	6			2			4		8	8		4
Actuated Green, G (s)	49.9	27.6		49.9	36.6		54.1	36.9	36.9	54.1	51.7	51.7
Effective Green, g (s)	49.9	27.6		49.9	36.6		54.1	36.9	36.9	54.1	51.7	51.7
Actuated g/C Ratio	0.42	0.23		0.42	0.31		0.45	0.31	0.31	0.45	0.43	0.43
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	265	780		485	1064		97	1088	486	375	1524	682
v/s Ratio Prot	c0.10	0.11		0.14	0.24		0.00	c0.19		0.02	c0.37	
v/s Ratio Perm	c0.28			0.18			0.11		0.04	0.04		0.29
v/c Ratio	0.93	0.47		0.78	0.79		0.25	0.63	0.13	0.14	0.86	0.68
Uniform Delay, d1	29.5	39.9		26.4	38.1		24.8	35.7	29.9	30.8	30.9	27.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.59	0.63	0.33
Incremental Delay, d2	37.3	2.0		7.6	5.9		1.3	1.2	0.1	0.0	1.5	0.7
Delay (s)	66.8	41.9		34.0	44.0		26.2	36.9	30.1	18.4	21.0	9.8
Level of Service	E	D		C	D		C	D	C	B	C	A
Approach Delay (s)		51.5			40.9			35.1			17.2	
Approach LOS		D			D			D			B	

Intersection Summary				
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.90			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	84.4%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	26	44	0	152	25	453	1	3	1002	10
Future Volume (Veh/h)	0	0	26	44	0	152	25	453	1	3	1002	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	28	48	0	165	27	492	1	3	1089	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											937	
pX, platoon unblocked	0.90	0.90	0.90	0.90	0.90		0.90					
vC, conflicting volume	1566	1648	550	1125	1652	246	1100			493		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1407	1498	278	917	1503	246	889			493		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	96	75	100	78	96			100		
cM capacity (veh/h)	67	105	647	189	104	754	682			1067		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	28	213	273	247	548	556
Volume Left	0	48	27	0	3	0
Volume Right	28	165	0	1	0	11
cSH	647	451	682	1700	1067	1700
Volume to Capacity	0.04	0.47	0.04	0.15	0.00	0.33
Queue Length 95th (ft)	3	62	3	0	0	0
Control Delay (s)	10.8	20.0	1.5	0.0	0.1	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	10.8	20.0	0.8		0.0	
Approach LOS	B	C				

Intersection Summary				
Average Delay	2.7			
Intersection Capacity Utilization	56.3%	ICU Level of Service	B	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	325	492	0	0	0
Future Volume (Veh/h)	0	325	492	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	353	535	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			588			
pX, platoon unblocked	0.96				0.96	0.96
vC, conflicting volume	535				888	535
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	493				862	493
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)	1026				312	552

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	353	535	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1026	1700	1700
Volume to Capacity	0.00	0.31	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary				
Average Delay		0.0		
Intersection Capacity Utilization		29.2%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	40	46	446	285	0
Future Volume (Veh/h)	0	40	46	446	285	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	50	485	310	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			986			
pX, platoon unblocked						
vC, conflicting volume	535				93	50
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	535				93	50
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				66	100
cM capacity (veh/h)	1033				907	1018

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	43	50	485	310
Volume Left	0	0	0	310
Volume Right	0	0	485	0
cSH	1033	1700	1700	907
Volume to Capacity	0.00	0.03	0.29	0.34
Queue Length 95th (ft)	0	0	0	38
Control Delay (s)	0.0	0.0	0.0	11.0
Lane LOS				B
Approach Delay (s)	0.0	0.0		11.0
Approach LOS				B

Intersection Summary				
Average Delay		3.8		
Intersection Capacity Utilization		37.6%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	285	473	37	206	678	46	30	1118	279	60	686	298
Future Volume (vph)	285	473	37	206	678	46	30	1118	279	60	686	298
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3501		1770	3505		1770	3539	1583	1770	3539	1583
Flt Permitted	0.14	1.00		0.32	1.00		0.24	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)	259	3501		605	3505		446	3539	1583	164	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	310	514	40	224	737	50	33	1215	303	65	746	324
RTOR Reduction (vph)	0	5	0	0	4	0	0	0	144	0	0	197
Lane Group Flow (vph)	310	549	0	224	783	0	33	1215	159	65	746	127
Turn Type	D.P+P	NA		D.P+P	NA		D.P+P	NA	Perm	D.P+P	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	6			2			4		8	8		4
Actuated Green, G (s)	54.7	41.5		54.7	35.2		49.3	45.3	45.3	49.3	46.9	46.9
Effective Green, g (s)	54.7	41.5		54.7	35.2		49.3	45.3	45.3	49.3	46.9	46.9
Actuated g/C Ratio	0.46	0.35		0.46	0.29		0.41	0.38	0.38	0.41	0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	363	1210		403	1028		209	1335	597	120	1383	618
v/s Ratio Prot	c0.14	0.16		0.06	0.22		0.00	c0.34		0.02	c0.21	
v/s Ratio Perm	c0.25			0.19			0.06		0.10	0.20		0.08
v/c Ratio	0.85	0.45		0.56	0.76		0.16	0.91	0.27	0.54	0.54	0.20
Uniform Delay, d1	28.8	30.5		21.1	38.6		22.4	35.4	25.9	52.2	28.2	24.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.53	0.41	0.15
Incremental Delay, d2	17.4	1.2		1.7	5.3		0.4	9.5	0.2	4.5	0.4	0.2
Delay (s)	46.2	31.7		22.7	43.9		22.8	44.9	26.1	32.2	11.8	3.7
Level of Service	D	C		C	D		C	D	C	C	B	A
Approach Delay (s)		36.9			39.2			40.7			10.7	
Approach LOS		D			D			D			B	

Intersection Summary				
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.88			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	83.6%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	0	6	2	0	62	8	682	4	23	833	6
Future Volume (Veh/h)	3	0	6	2	0	62	8	682	4	23	833	6
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	7	2	0	67	9	741	4	25	905	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											937	
pX, platoon unblocked	0.86	0.86	0.86	0.86	0.86		0.86					
vC, conflicting volume	1414	1722	456	1270	1723	372	912			745		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1152	1510	35	984	1512	372	567			745		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	99	100	89	99			97		
cM capacity (veh/h)	114	98	884	167	98	625	859			859		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	69	380	374	478	460
Volume Left	3	2	9	0	25	0
Volume Right	7	67	0	4	0	7
cSH	291	579	859	1700	859	1700
Volume to Capacity	0.03	0.12	0.01	0.22	0.03	0.27
Queue Length 95th (ft)	3	10	1	0	2	0
Control Delay (s)	17.8	12.1	0.3	0.0	0.8	0.0
Lane LOS	C	B	A		A	
Approach Delay (s)	17.8	12.1	0.2		0.4	
Approach LOS	C	B				

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	50.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	136	117	0	0	0
Future Volume (Veh/h)	0	136	117	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	148	127	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			588			
pX, platoon unblocked						
vC, conflicting volume	127				275	127
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	127				275	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)	1459				715	923

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	148	127	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1459	1700	1700
Volume to Capacity	0.00	0.07	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		10.5%	ICU Level of Service A
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	27	35	82	109	0
Future Volume (Veh/h)	0	27	35	82	109	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	29	38	89	118	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			986			
pX, platoon unblocked						
vC, conflicting volume	127				67	38
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	127				67	38
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				87	100
cM capacity (veh/h)	1459				938	1034

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	29	38	89	118
Volume Left	0	0	0	118
Volume Right	0	0	89	0
cSH	1459	1700	1700	938
Volume to Capacity	0.00	0.02	0.05	0.13
Queue Length 95th (ft)	0	0	0	11
Control Delay (s)	0.0	0.0	0.0	9.4
Lane LOS				A
Approach Delay (s)	0.0	0.0		9.4
Approach LOS				A

Intersection Summary			
Average Delay		4.0	
Intersection Capacity Utilization		16.0%	ICU Level of Service A
Analysis Period (min)		15	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	375	842	12	189	127	239	487	0	184	1514	21
Future Volume (vph)	32	375	842	12	189	127	239	487	0	184	1514	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	4.0	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539		2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.27	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	496	1863	1583	3433	3539		2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	408	915	13	205	138	260	529	0	200	1646	23
RTOR Reduction (vph)	0	0	0	0	0	115	0	0	0	0	0	11
Lane Group Flow (vph)	35	408	915	13	205	23	260	529	0	200	1646	12
Turn Type	Prot	NA	Free	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			Free	8		8			2			6
Actuated Green, G (s)	4.3	30.1	120.0	20.3	20.3	20.3	9.5	56.2		15.0	61.7	61.7
Effective Green, g (s)	4.3	30.1	120.0	20.3	20.3	20.3	9.5	56.2		15.0	61.7	61.7
Actuated g/C Ratio	0.04	0.25	1.00	0.17	0.17	0.17	0.08	0.47		0.12	0.51	0.51
Clearance Time (s)	5.5	6.6		6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	63	467	1583	83	315	267	271	1657		250	1819	813
v/s Ratio Prot	0.02	c0.22			0.11		c0.08	0.15		0.10	c0.47	
v/s Ratio Perm			0.58	0.03		0.01						0.01
v/c Ratio	0.56	0.87	0.58	0.16	0.65	0.09	0.96	0.32		0.80	0.90	0.01
Uniform Delay, d1	56.9	43.1	0.0	42.5	46.5	42.0	55.1	19.9		51.0	26.5	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.89		1.00	1.00	1.00
Incremental Delay, d2	5.9	15.9	1.5	0.3	3.6	0.1	41.0	0.5		15.7	7.9	0.0
Delay (s)	62.8	59.1	1.5	42.9	50.2	42.1	88.8	18.1		66.7	34.4	14.3
Level of Service	E	E	A	D	D	D	F	B		E	C	B
Approach Delay (s)		20.4			46.8			41.4			37.6	
Approach LOS		C			D			D			D	

Intersection Summary				
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.95			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2	
Intersection Capacity Utilization	90.8%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	208	18	192	16	27	0	274	525	14	1	1699	279
Future Volume (vph)	208	18	192	16	27	0	274	525	14	1	1699	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.86			1.00		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1608			1829		1770	3526		1770	3539	1583
Flt Permitted	0.76	1.00			0.75		0.06	1.00		0.42	1.00	1.00
Satd. Flow (perm)	1422	1608			1406		107	3526		775	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	226	20	209	17	29	0	298	571	15	1	1847	303
RTOR Reduction (vph)	0	172	0	0	0	0	0	1	0	0	0	42
Lane Group Flow (vph)	226	57	0	0	46	0	298	585	0	1	1847	261
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		6
Actuated Green, G (s)	21.1	21.1			21.1		86.9	86.1		86.9	69.8	69.8
Effective Green, g (s)	21.1	21.1			21.1		86.9	86.1		86.9	69.8	69.8
Actuated g/C Ratio	0.18	0.18			0.18		0.72	0.72		0.72	0.58	0.58
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	250	282			247		314	2529		567	2058	920
v/s Ratio Prot		0.04					c0.14	0.17		0.00	0.52	
v/s Ratio Perm	c0.16				0.03		c0.55			0.00		0.16
v/c Ratio	0.90	0.20			0.19		0.95	0.23		0.00	0.90	0.28
Uniform Delay, d1	48.5	42.3			42.1		40.8	5.7		5.4	22.0	12.6
Progression Factor	1.00	1.00			1.00		1.14	0.23		1.82	1.21	1.76
Incremental Delay, d2	32.5	0.4			0.4		32.3	0.2		0.0	4.4	0.5
Delay (s)	81.0	42.6			42.5		78.8	1.5		9.9	30.8	22.7
Level of Service	F	D			D		E	A		A	C	C
Approach Delay (s)		61.7			42.5			27.6			29.7	
Approach LOS		E			D			C			C	

Intersection Summary				
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.94			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	90.3%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	409	369	4	515	266	562	892	1	156	711	45
Future Volume (vph)	167	409	369	4	515	266	562	892	1	156	711	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	4.0	6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539	1583	2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.48	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	887	1863	1583	3433	3539	1583	2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	182	445	401	4	560	289	611	970	1	170	773	49
RTOR Reduction (vph)	0	0	0	0	0	167	0	0	1	0	0	37
Lane Group Flow (vph)	182	445	401	4	560	122	611	970	0	170	773	12
Turn Type	Prot	NA	Free	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			Free	8		8			2			6
Actuated Green, G (s)	9.5	48.4	120.0	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Effective Green, g (s)	9.5	48.4	120.0	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Actuated g/C Ratio	0.08	0.40	1.00	0.28	0.28	0.28	0.20	0.35	0.35	0.09	0.24	0.24
Clearance Time (s)	5.5	6.6		6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	140	751	1583	246	518	440	700	1250	559	175	837	374
v/s Ratio Prot	c0.10	0.24			c0.30		c0.18	0.27		0.08	c0.22	
v/s Ratio Perm			0.25	0.00		0.08			0.00			0.01
v/c Ratio	1.30	0.59	0.25	0.02	1.08	0.28	0.87	0.78	0.00	0.97	0.92	0.03
Uniform Delay, d1	55.2	28.1	0.0	31.4	43.3	33.9	46.2	34.6	25.1	54.6	44.7	35.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.11	1.00	1.00	1.00	1.00
Incremental Delay, d2	177.4	0.8	0.4	0.0	63.2	0.1	10.6	4.4	0.0	59.1	17.3	0.2
Delay (s)	232.6	28.9	0.4	31.4	106.5	34.0	59.1	43.0	25.1	113.7	62.0	35.4
Level of Service	F	C	A	C	F	C	E	D	C	F	E	D
Approach Delay (s)		53.9			81.6			49.2			69.6	
Approach LOS		D			F			D			E	

Intersection Summary				
HCM 2000 Control Delay	61.0	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	1.00			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2	
Intersection Capacity Utilization	92.2%	ICU Level of Service	F	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	108	27	84	7	32	10	60	1187	12	4	892	82
Future Volume (vph)	108	27	84	7	32	10	60	1187	12	4	892	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.89			0.97		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1651			1798		1770	3534		1770	3539	1583
Flt Permitted	0.73	1.00			0.96		0.26	1.00		0.18	1.00	1.00
Satd. Flow (perm)	1358	1651			1732		493	3534		336	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	29	91	8	35	11	65	1290	13	4	970	89
RTOR Reduction (vph)	0	79	0	0	9	0	0	0	0	0	0	18
Lane Group Flow (vph)	117	41	0	0	45	0	65	1303	0	4	970	71
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		6
Actuated Green, G (s)	15.4	15.4			15.4		92.6	91.4		92.6	87.2	87.2
Effective Green, g (s)	15.4	15.4			15.4		92.6	91.4		92.6	87.2	87.2
Actuated g/C Ratio	0.13	0.13			0.13		0.77	0.76		0.77	0.73	0.73
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	174	211			222		437	2691		273	2571	1150
v/s Ratio Prot		0.02					0.01	c0.37		0.00	c0.27	
v/s Ratio Perm	c0.09				0.03		0.11			0.01		0.04
v/c Ratio	0.67	0.19			0.20		0.15	0.48		0.01	0.38	0.06
Uniform Delay, d1	49.9	46.7			46.8		3.6	5.4		7.1	6.2	4.7
Progression Factor	1.00	1.00			1.00		2.13	2.36		0.34	0.53	0.03
Incremental Delay, d2	9.8	0.4			0.5		0.1	0.3		0.0	0.3	0.1
Delay (s)	59.7	47.2			47.3		7.8	13.0		2.4	3.6	0.2
Level of Service	E	D			D		A	B		A	A	A
Approach Delay (s)		53.4			47.3			12.8			3.3	
Approach LOS		D			D			B			A	

Intersection Summary				
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.52			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	59.2%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	375	842	12	189	127	239	487	0	184	1514	21
Future Volume (vph)	32	375	842	12	189	127	239	487	0	184	1514	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	4.0	6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539		2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.27	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	496	1863	1583	3433	3539		2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	408	915	13	205	138	260	529	0	200	1646	23
RTOR Reduction (vph)	0	0	0	0	0	115	0	0	0	0	0	11
Lane Group Flow (vph)	35	408	915	13	205	23	260	529	0	200	1646	12
Turn Type	Prot	NA	Free	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			Free	8		8			2			6
Actuated Green, G (s)	4.3	30.1	120.0	20.3	20.3	20.3	9.5	56.2		15.0	61.7	61.7
Effective Green, g (s)	4.3	30.1	120.0	20.3	20.3	20.3	9.5	56.2		15.0	61.7	61.7
Actuated g/C Ratio	0.04	0.25	1.00	0.17	0.17	0.17	0.08	0.47		0.12	0.51	0.51
Clearance Time (s)	5.5	6.6		6.6	6.6	6.6	5.5	6.6		5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	63	467	1583	83	315	267	271	1657		250	1819	813
v/s Ratio Prot	0.02	c0.22			0.11		c0.08	0.15		0.10	c0.47	
v/s Ratio Perm			0.58	0.03		0.01						0.01
v/c Ratio	0.56	0.87	0.58	0.16	0.65	0.09	0.96	0.32		0.80	0.90	0.01
Uniform Delay, d1	56.9	43.1	0.0	42.5	46.5	42.0	55.1	19.9		51.0	26.5	14.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.89		1.00	1.00	1.00
Incremental Delay, d2	5.9	15.9	1.5	0.3	3.6	0.1	41.0	0.5		15.7	7.9	0.0
Delay (s)	62.8	59.1	1.5	42.9	50.2	42.1	88.8	18.1		66.7	34.4	14.3
Level of Service	E	E	A	D	D	D	F	B		E	C	B
Approach Delay (s)		20.4			46.8			41.4			37.6	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	208	18	192	16	27	0	274	525	14	1	1699	279
Future Volume (vph)	208	18	192	16	27	0	274	525	14	1	1699	279
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.86			1.00		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1608			1829		1770	3526		1770	3539	1583
Flt Permitted	0.76	1.00			0.75		0.06	1.00		0.42	1.00	1.00
Satd. Flow (perm)	1422	1608			1406		107	3526		775	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	226	20	209	17	29	0	298	571	15	1	1847	303
RTOR Reduction (vph)	0	172	0	0	0	0	0	1	0	0	0	42
Lane Group Flow (vph)	226	57	0	0	46	0	298	585	0	1	1847	261
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		6
Actuated Green, G (s)	21.1	21.1			21.1		86.9	86.1		86.9	69.8	69.8
Effective Green, g (s)	21.1	21.1			21.1		86.9	86.1		86.9	69.8	69.8
Actuated g/C Ratio	0.18	0.18			0.18		0.72	0.72		0.72	0.58	0.58
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	250	282			247		314	2529		567	2058	920
v/s Ratio Prot		0.04					c0.14	0.17		0.00	0.52	
v/s Ratio Perm	c0.16				0.03		c0.55			0.00		0.16
v/c Ratio	0.90	0.20			0.19		0.95	0.23		0.00	0.90	0.28
Uniform Delay, d1	48.5	42.3			42.1		40.8	5.7		5.4	22.0	12.6
Progression Factor	1.00	1.00			1.00		1.14	0.23		1.82	1.21	1.76
Incremental Delay, d2	32.5	0.4			0.4		32.3	0.2		0.0	4.4	0.5
Delay (s)	81.0	42.6			42.5		78.8	1.5		9.9	30.8	22.7
Level of Service	F	D			D		E	A		A	C	C
Approach Delay (s)		61.7			42.5			27.6			29.7	
Approach LOS		E			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	409	369	4	515	266	562	892	1	156	711	45
Future Volume (vph)	167	409	369	4	515	266	562	892	1	156	711	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	16	12	12
Total Lost time (s)	5.5	6.6	4.0	6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3539	1583	2006	3539	1583
Flt Permitted	0.95	1.00	1.00	0.48	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	887	1863	1583	3433	3539	1583	2006	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	182	445	401	4	560	289	611	970	1	170	773	49
RTOR Reduction (vph)	0	0	0	0	0	167	0	0	1	0	0	37
Lane Group Flow (vph)	182	445	401	4	560	122	611	970	0	170	773	12
Turn Type	Prot	NA	Free	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases			Free	8		8			2			6
Actuated Green, G (s)	9.5	48.4	120.0	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Effective Green, g (s)	9.5	48.4	120.0	33.4	33.4	33.4	24.5	42.4	42.4	10.5	28.4	28.4
Actuated g/C Ratio	0.08	0.40	1.00	0.28	0.28	0.28	0.20	0.35	0.35	0.09	0.24	0.24
Clearance Time (s)	5.5	6.6		6.6	6.6	6.6	5.5	6.6	6.6	5.5	6.6	6.6
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	140	751	1583	246	518	440	700	1250	559	175	837	374
v/s Ratio Prot	c0.10	0.24			c0.30		c0.18	0.27		0.08	c0.22	
v/s Ratio Perm			0.25	0.00		0.08			0.00			0.01
v/c Ratio	1.30	0.59	0.25	0.02	1.08	0.28	0.87	0.78	0.00	0.97	0.92	0.03
Uniform Delay, d1	55.2	28.1	0.0	31.4	43.3	33.9	46.2	34.6	25.1	54.6	44.7	35.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.11	1.00	1.00	1.00	1.00
Incremental Delay, d2	177.4	0.8	0.4	0.0	63.2	0.1	10.6	4.4	0.0	59.1	17.3	0.2
Delay (s)	232.6	28.9	0.4	31.4	106.5	34.0	59.1	43.0	25.1	113.7	62.0	35.4
Level of Service	F	C	A	C	F	C	E	D	C	F	E	D
Approach Delay (s)		53.9			81.6			49.2			69.6	
Approach LOS		D			F			D			E	

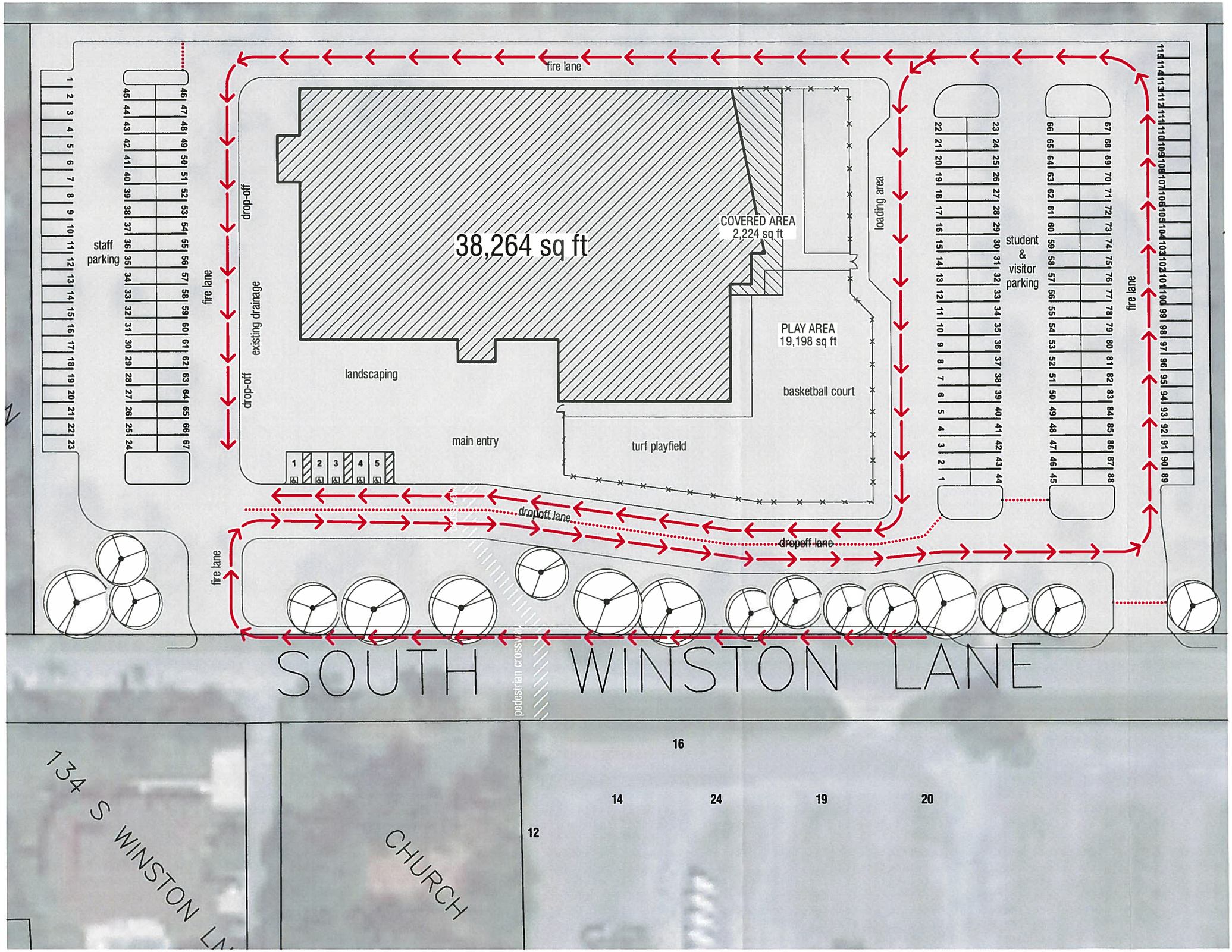
Intersection Summary			
HCM 2000 Control Delay	61.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.2
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	108	27	84	7	32	10	60	1187	12	4	892	82
Future Volume (vph)	108	27	84	7	32	10	60	1187	12	4	892	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.89			0.97		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1651			1798		1770	3534		1770	3539	1583
Flt Permitted	0.73	1.00			0.96		0.26	1.00		0.18	1.00	1.00
Satd. Flow (perm)	1358	1651			1732		493	3534		336	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	29	91	8	35	11	65	1290	13	4	970	89
RTOR Reduction (vph)	0	79	0	0	9	0	0	0	0	0	0	18
Lane Group Flow (vph)	117	41	0	0	45	0	65	1303	0	4	970	71
Turn Type	Perm	NA		Perm	NA		D.P+P	NA		D.P+P	NA	Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4			6			2		6
Actuated Green, G (s)	15.4	15.4			15.4		92.6	91.4		92.6	87.2	87.2
Effective Green, g (s)	15.4	15.4			15.4		92.6	91.4		92.6	87.2	87.2
Actuated g/C Ratio	0.13	0.13			0.13		0.77	0.76		0.77	0.73	0.73
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	174	211			222		437	2691		273	2571	1150
v/s Ratio Prot		0.02					0.01	c0.37		0.00	c0.27	
v/s Ratio Perm	c0.09				0.03		0.11			0.01		0.04
v/c Ratio	0.67	0.19			0.20		0.15	0.48		0.01	0.38	0.06
Uniform Delay, d1	49.9	46.7			46.8		3.6	5.4		7.1	6.2	4.7
Progression Factor	1.00	1.00			1.00		2.13	2.36		0.34	0.53	0.03
Incremental Delay, d2	9.8	0.4			0.5		0.1	0.3		0.0	0.3	0.1
Delay (s)	59.7	47.2			47.3		7.8	13.0		2.4	3.6	0.2
Level of Service	E	D			D		A	B		A	A	A
Approach Delay (s)		53.4			47.3			12.8			3.3	
Approach LOS		D			D			B			A	

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX E
Preliminary Site Plan



LEGEND:

→ QUEUING DIRECTION (REPRESENTS 25ft)

····· TRAFFIC CONTROL DURING PICK-UP AND DROP-OFF

OFF-SITE QUEUING: 400ft

ON-SITE QUEUING: 2,150ft

ON-SITE PARKING: 187 SPACES

ADJACENT PARKING: 105 SPACES

orcutt | winslow

115 S Winston Lane
Castle Hills, TX 78213

Basis Charter Schools

Basis Secondary Academy

site plan

APPENDIX F
Intersection Photographs

NW Military Drive at Lockhill-Selma Road

Southbound

Lockhill-Selma Road

Eastbound

Westbound

Northbound

NW Military Drive

NW Military Drive at Winston Lane

Southbound

NW Military Drive

Eastbound

Westbound

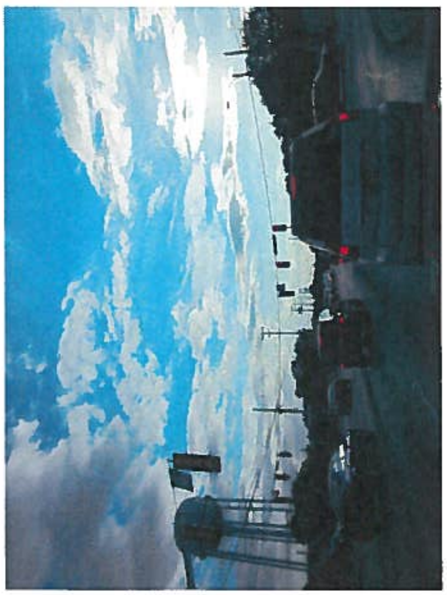
Northbound

Winston Lane

NW Military Drive at West Avenue

NW Military Drive

Westbound



Southbound

Northbound

Eastbound

West Avenue

West Avenue at Castle Lane

Castle Lane

Southbound

Eastbound

Westbound

Northbound

West Avenue

APPENDIX G
On-Site School Queueing

MSTA School Traffic Calculations

AM and PM Peak Traffic Estimates

(These numbers do not reflect peak hour traffic volumes)

School Name: Castle Hills BASIS Charter School

Is this a Typical PUBLIC school? No

Version: BetaV8415

	AM Cars / Student	PM Cars / Student	Avg. Car Length	PM At one Time
	36.56%	16.31%	22.19	45.50%
	34.58%	14.10%	22.70	51.90%
	9.20%	4.30%	24.42	55.71%
P	43.35%	26.30%	22.00	37.87%

Private & Charter school data is based on few to no buses and uses the same percentages for all school types (elementary, middle, & high).

NOTES

- Average Queue Length does not include an alternative traffic pattern required for high traffic demand days.
- Average Queue Length does not include the Student Loading Zone.
- Peak traffic volumes at schools normally occur within a 30-minute time period. (justifying a PHF of 0.5)

MSTA School Queue Input

Calculations

Type School	Student Population	Number of Buses	Staff Members	Student Drivers	PM Total Vehicles	PM Peak Vehicles	Average Queue Length	Total AM Trips	Total PM Trips	High Demand Length
										30%
Private E	1127				297	112	2474	977	594	3217
		16	148							
Private M										
Private H										
							2474	977	594	3217
										742

Elementary School Data

Direction	AM Trips Generated: Parents	Buses	Staff	Trips	PM Trips Generated: Parents	Buses	Staff	Trips
IN	489			489	297			297
OUT	489			489	297			297
		AM Elementary Trips		977		PM Elementary Trips		594

Middle School Data

Direction	AM Trips Generated: Parents	Buses	Staff	Trips	PM Trips Generated: Parents	Buses	Staff	Trips
IN								
OUT								
		AM Middle Trips				PM Middle Trips		

High School Data

Direction	AM Trips Generated: Parents	Buses	Staff		Trips	PM Trips Generated: Parents	Buses	Staff		Trips
IN										
OUT										
			AM Private Trips					PM Private Trips		

All AM TRIPS		
	In	489
	Out	489
	Total	977

All PM TRIPS		
	In	297
	Out	297
	Total	594

ADT
1571
1571

Calculated 12/28/2016 By:_____