

TRAFFIC IMPACT ANALYSIS
FOR
Heights Church Expansion
PRESCOTT, ARIZONA

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HEIGHTS CHURCH EXPANSION

Traffic Impact Analysis

1.0 INTRODUCTION AND SUMMARY

This Traffic Impact Analysis (TIA) report is provided for Prescott Heights Church (Owner) to define the street improvements that are needed to reasonably serve the proposed future Heights Church Expansion (Project) within the City of Prescott. The Owners site improvement plan provides the layout for the Heights Church Expansion (HCE) that includes: a) multi-purpose building (used on Sunday for church services), b) classrooms/meeting buildings, and c) office buildings. Larry Caldwell Drive (LCD) serves as the only access to the property. LCD connects to SR 89A to the southeast, which accounts for virtually all inbound and outbound access to the Project.

During scoping with the City it was agreed that the weekday traffic forms the basis for the number of lanes needed along LCD on the east side of the Project. The *Granite Dells Ranch, Phase 1 Zoning - Traffic & Roadway Assessment*, by CTE, June 5, 2008, as approved by the City, defines the 4-lane roadway for LCD east of the Project. The HCE TIA study area is LCD and the driveways that serve Heights Church along the north frontage of the Project.

1.1 Purpose of Report and Study Objectives

The Owner will provide the street improvements for the street system adjacent to the Project. The purpose of this report is to provide data to the City and the Owner, so that they may reasonably conclude that the proposed street system and driveways with LCS will function adequately and safely.

The objective of this study is to identify the buildout traffic forecast for LCD north of the Project; then, provide the criteria for the development of the street system to safely and efficiently accommodate the traffic.

1.2 Findings and Recommendations

The HCE Dev is located north of SR 89A, south and west of LCD and east of SR 89 in Prescott, Arizona. The Project parcel is 24.86-acres in size.

Based on the analysis contained in this report, the roadway network, as defined in *Section 6.1*, and traffic control system, as defined in *Section 6.4*, will provide for satisfactory capacity and intersection control. During design, the design engineer shall ensure adequate SSD and preferably ISD is provided at the location of future driveways, based on design speed and sight distances as defined herein. The evaluation of the proposed roadway network has been completed with the following observations:

- Along LCD north of the Project, the 3-lane section between the Wilkinson Dr intersection and D5 along with the right turn lane between D1 and the Wilkinson Dr intersection will provide adequate capacity for the projected future travel demand.
- Along NB LCC, modifying the island at the Wilkinson Dr intersection to provide a shared left/right turn lane will provide adequate capacity for the projected future travel demand.

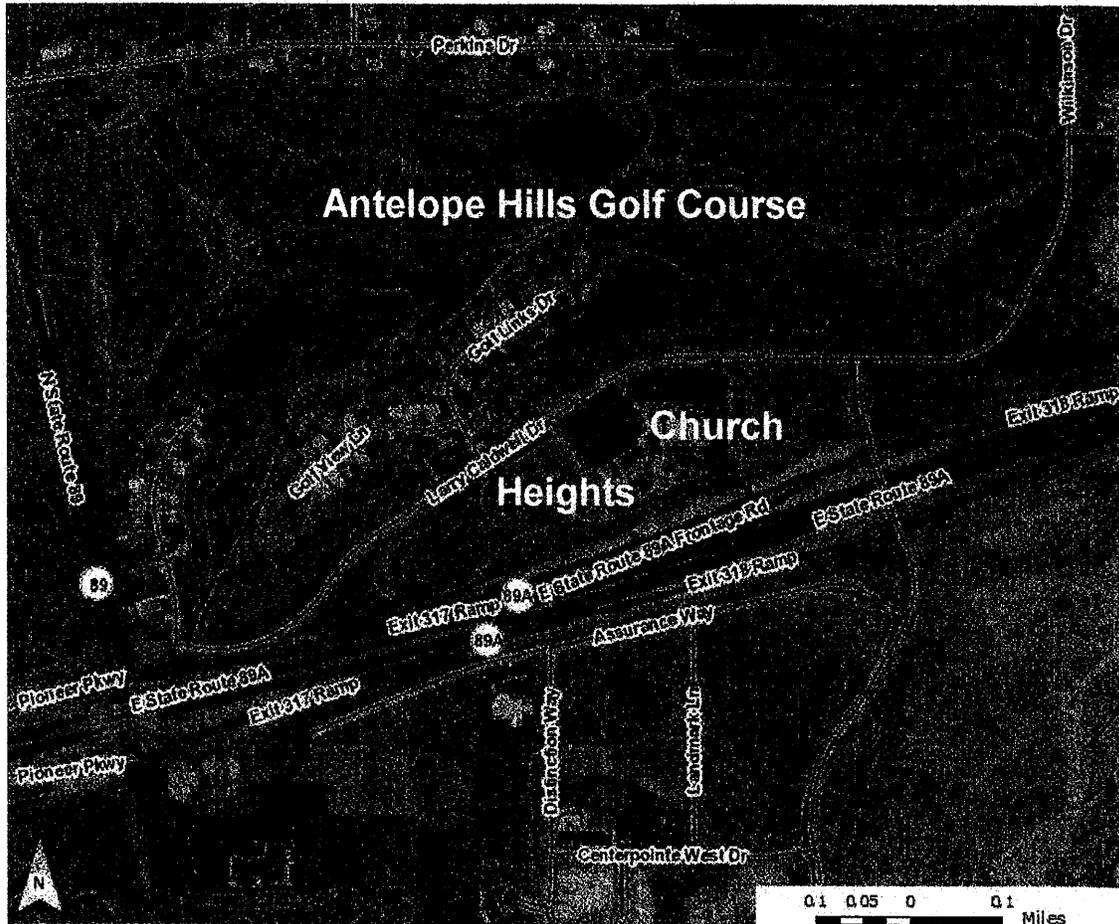
Incorporating the following recommendations will ensure the roads meet the design, operational and safety requirements set forth by the City through the year 2022:

- In order to prevent conflict between vehicles departing from church and arriving at church, D1, D2, and D3 shall be used only as exit driveways on Sunday. D4, D5, and D6 will be the driveways used to access the Project.
- To the north of the Project, LCD shall be reconstructed to provide two WB lanes from the LCD/Wilkinson Dr intersection to D5. At D4 and D5, the inner lane will be used as a left turn lane and the outer lane will be used for thru vehicles and motorist destined for D6 and D7. A fourth lane shall be added for EB traffic between D1 and the Wilkinson Dr intersection.
- To the east of the Project, LCD shall be re striped in the NB direction between SR89A and Wilkinson Dr. The existing pavement is wide enough to allow for a NB left lane and a NB left/right lane.
- With the above improvements, the LCD/Wilkinson Dr intersection should provide two NB to WB left turn lanes and two EB to SB right turn lanes.
- STOP signs shall be provided for all the driveways.
- Phasing – when the next maintenance striping occurs along LCD between SR 89A and Wilkinson Dr, the existing painted median should be restriped to extend the existing NB to WB left turn lane as far south as possible. With the addition of any building, D2 shall be modified (narrowed and directional reconstructed) to provide for an existing right turn movement only. All the other improvements shown on the site plans shall be added when Building D is built.

2.0 PROPOSED DEVELOPMENT

2.1 Site Location

Heights Church is located north of SR 89A, south and west of LCD and east of SR 89 in Prescott as shown by **Figure 2.1** below.



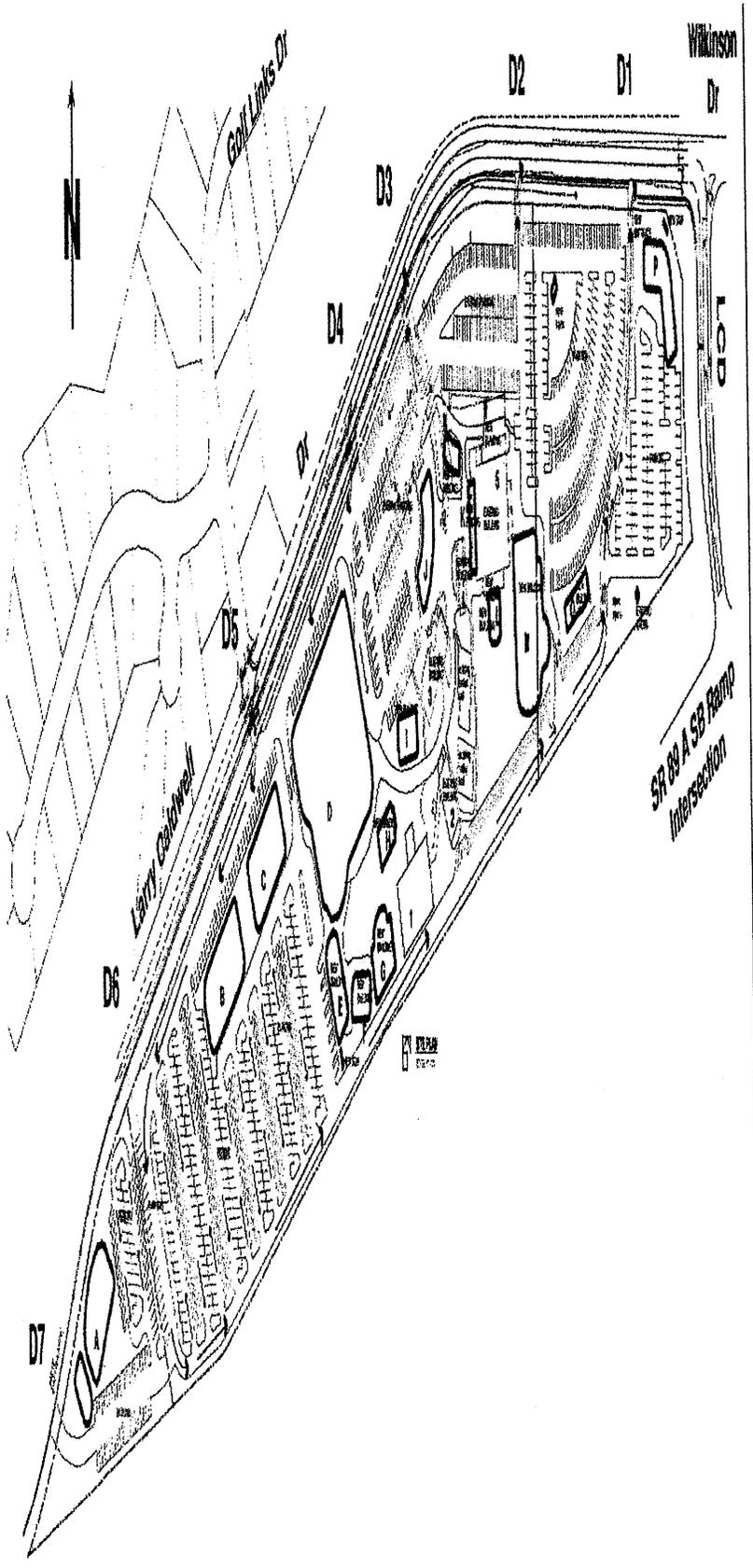
Site Location and Existing Land Use Aerial Map

Figure 2.1

2.2 Site Plan

Figure 2.2 shows the site plan for the Heights Church. There are five existing buildings (numbered 1 through 5), an existing basketball court, an existing volleyball court, and the existing parking lot. The proposed buildings (labeled A through O) and the proposed parking lot expansion that will accommodate the addition of the proposed buildings.

Access geometrics to Heights Church will be provided along LCD. There will be a total of seven (7) driveways at buildout to the Project. There are three existing driveways (D2, D3, and D4) at the site that currently provide left in/out and right in/out access. At buildout, D1, D2 and D3 will



Heights Church Site Plan

Figure 2.2

only provide for right out exiting movements. The remaining driveways will provide for left in/out and right in/out movements during the weekday and Saturday. On Sunday, traffic control or gates at D4 and D5 will eliminate exiting movements and all exiting movements will be via D1, D2 and D3. On Sunday all entering movements will be via D4, D5, D6 and D7.

2.3 Land Use and Intensity

Heights Church is situated on 24.86 acres of land. Table 2.1 details existing and proposed buildings area and useable capacity:

**Table 2.1
HCE Land Use and Intensity**

New Buildings	Area Sq. Ft.	Seats		Employees		Use (Church, Office, Classroom)
		Weekday	Sunday	Weekday	Sunday	
A	11,000	40	40	2	0	Classroom / Office
B	10,000	100	100	2	0	Classroom / Office
C	10,000	100	100	2	0	Classroom / Office
D	50,000	40	3,000	15	15	Church ✓
E	4,500	60	60	0	0	Classroom
F	3,000	40	40	0	0	Classroom
G	5,000	60	60	0	0	Classroom
H	2,5000	-	-	-	-	Ramada (Outdoor)
I	3,000	40	40	0	0	Classroom
J	5,000	50	50	60	10	Classroom / Office
K	2,000	0	0	1	0	Church ✓
L	2,000	80	80	1	0	Church ✓
M	16,000	200	200	5	0	Classroom / Office
N	1,500	0	0	0	0	Restroom
O	1,000	20	20	1	0	Classroom
P	13,000	40	40	20	5	Classroom / Office
Existing Buildings						
1		40	200	0	5	Classroom
2		10	40	1	3	Classroom
3		40	100	1	3	Classroom
4		-	-	-	-	Ramada (Outdoor)
5		40	1,000	1	10	Church

2.4 Phasing Plan

The church officials have stated the next step in the growth of their campus would be the addition of one or more of the classroom/office buildings. They believe these buildings would attract very few additional trips during the Sunday peak hour. The addition of Building D (the church) is in their opinion when there would be the next increase in Sunday peak hour traffic to the site.

3. STUDY AREA CONDITIONS

3.1 Study Area

The study area is shown in **Figure 3.1**. The study area will include:

- 1 street: Larry Caldwell Dr (minor collector) along the north side of the Project
- 1 major intersection: Caldwell Dr/Wilkinson Dr
- 7 project driveways: 3 existing plus 4 proposed



Study Area

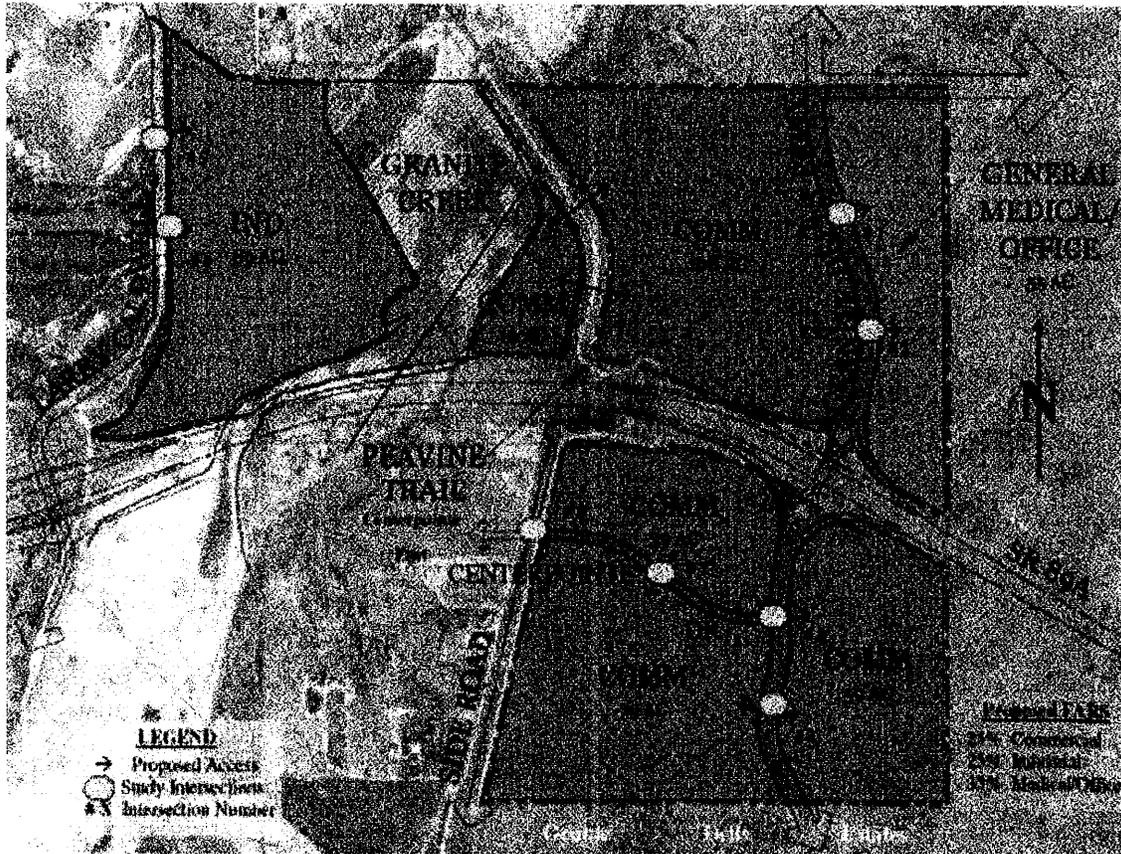
Figure 3.1

3.2 Existing, Proposed and Future Land Use

The proposed Project site is a combination of developed and underdeveloped land. There are 5 existing buildings on the Project site: the main sanctuary building, three multi-use classroom/office buildings and an outdoor Ramada. **Figure 2.1** shows the *existing land use* in the vicinity of the Project. The area north and west of the Project is residential, the Antelope Hills Golf Course and the Ernest A. Love Field Airport. To the south is SR 89A and existing/planned light industrial/business park land use. To the east is existing/planned light industrial/business park land use.

The *proposed land use* for this parcel was previously presented in *Section 2* of this report as shown on **Figure 2.2** and **Table 2.1**. This land is currently zoned for R1-9 (with C.U.P in the middle portion of the site), NOB (extreme eastern side), and RO (western most parcel). The church desires to rezone the center portion of the site to NOB.

The *future land use* in the region is in a state of transition and is becoming an urbanized area. The area to the east of LCD and Wilkinson Dr is planned as industrial use within Granite Dells Ranch, from the *Granite Dells Ranch, Phase 1 Zoning – Traffic & Roadway Assessment*, see **Figure 3.2**. The balance of the surrounding area and south of the Ernest A. Love Field is expected to develop as mixed use industrial, light industrial and business park.



Conceptual Land Use Bubble Plan

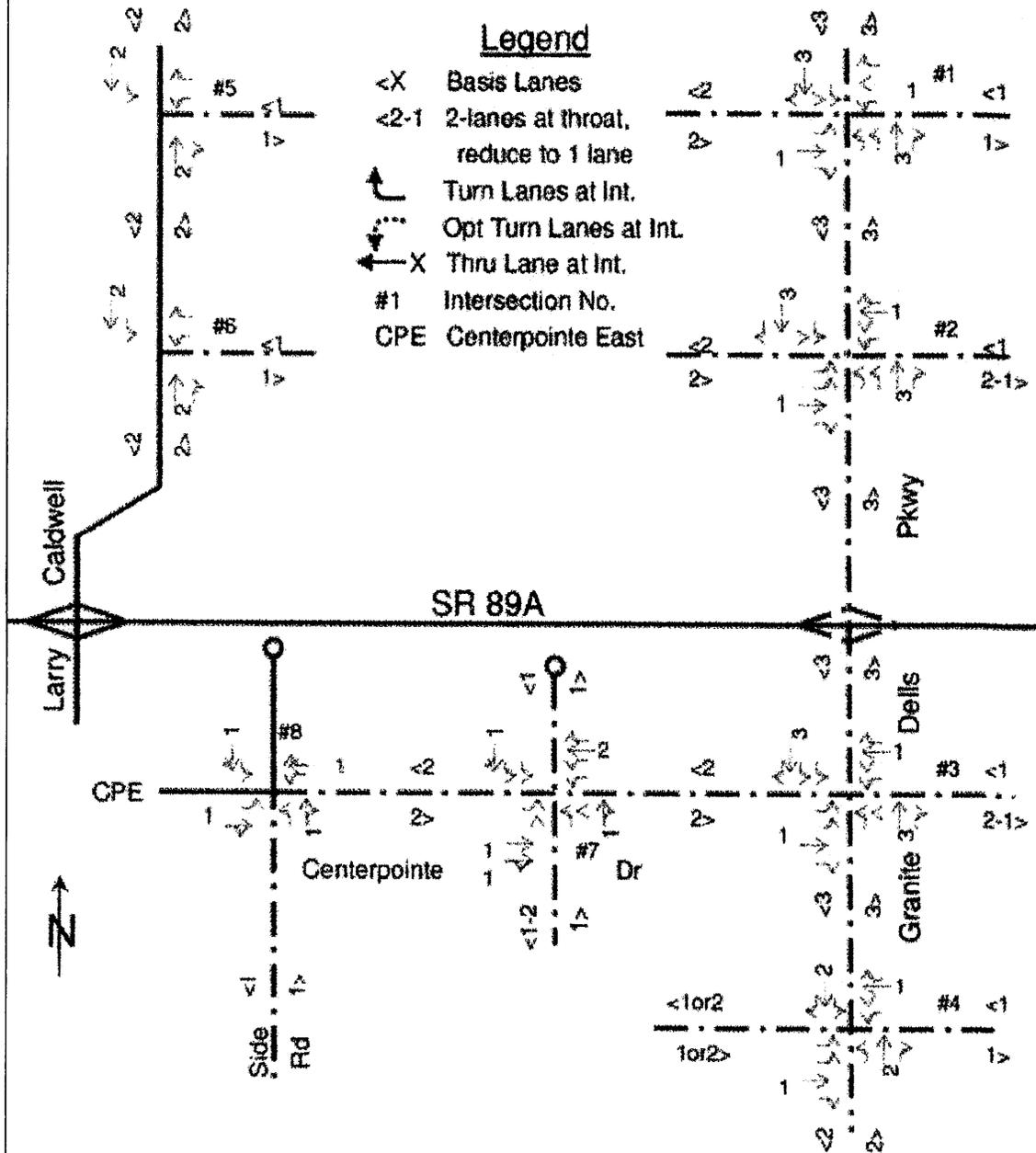
Granite Dells Ranch – Conceptual Land Use Plan

Figure 3.2

3.3 Existing and Known Proposed Future Site Accessibility

There are three existing driveways (D2, D3, and D4) at the site that all provide left in/out and right in/out access. The Project site plan includes four new access driveways and a 3rd lane to provide for queuing and WB left turn movements between Golf Links Dr and Wilkinson Dr. The Project also provides for a 4th lane to provide for EB right turns between D1 and the Wilkinson Dr intersection. As previously documented no new access is planned by other projects that will impact this Project. The **figure** on page 8 from the *Granite Dells Ranch, Phase 1 Zoning – Traffic & Roadway Assessment*, shows the number of lanes (4, 2-NB and 2-SB) planned at buildout for LCD north of SR 89A and Wilkinson Dr.

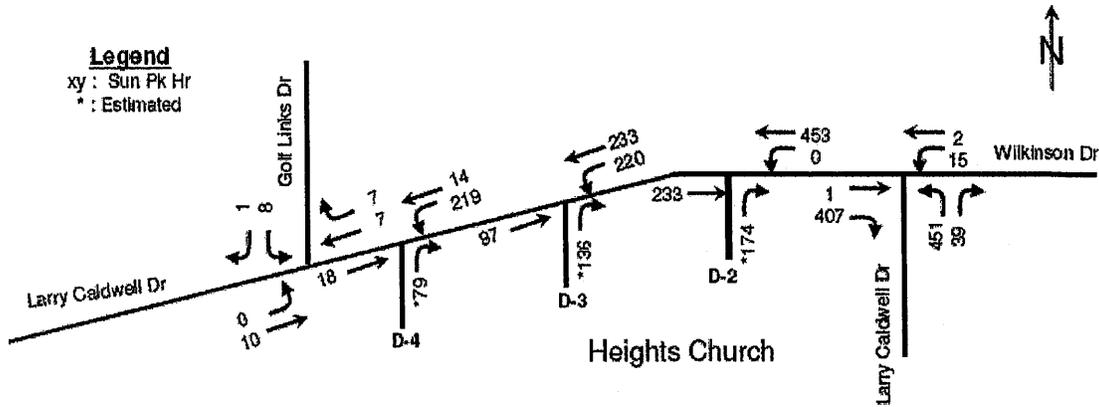
Traffic and Improvement Analysis. The analysis for this traffic study is limited to extent allowed by the traffic forecast in the terms of vehicles per day. Engineering judgment based on experience was used to render the following opinions. The basis & turn lane recommendations figure below summarized the recommendations for roadway geometry to provide a satisfactory level of service. The turn lane recommendations table on the next page clarifies the graphics in the figure below.



Basis & Turn Lane Recommendations

3.4 Existing and Known Future Traffic

Traffic counts were collected at the Wilkinson Dr and Golf Links Dr intersections along LCD on Sunday, March 27 from 7:30 am to 1:00 pm. The data collected from these counts are shown in the *appendix*, see page A-1. The results of these counts show that the peak hour on Sunday is from 10:30 am to 11:30 am as shown in **Figure 3.3**.

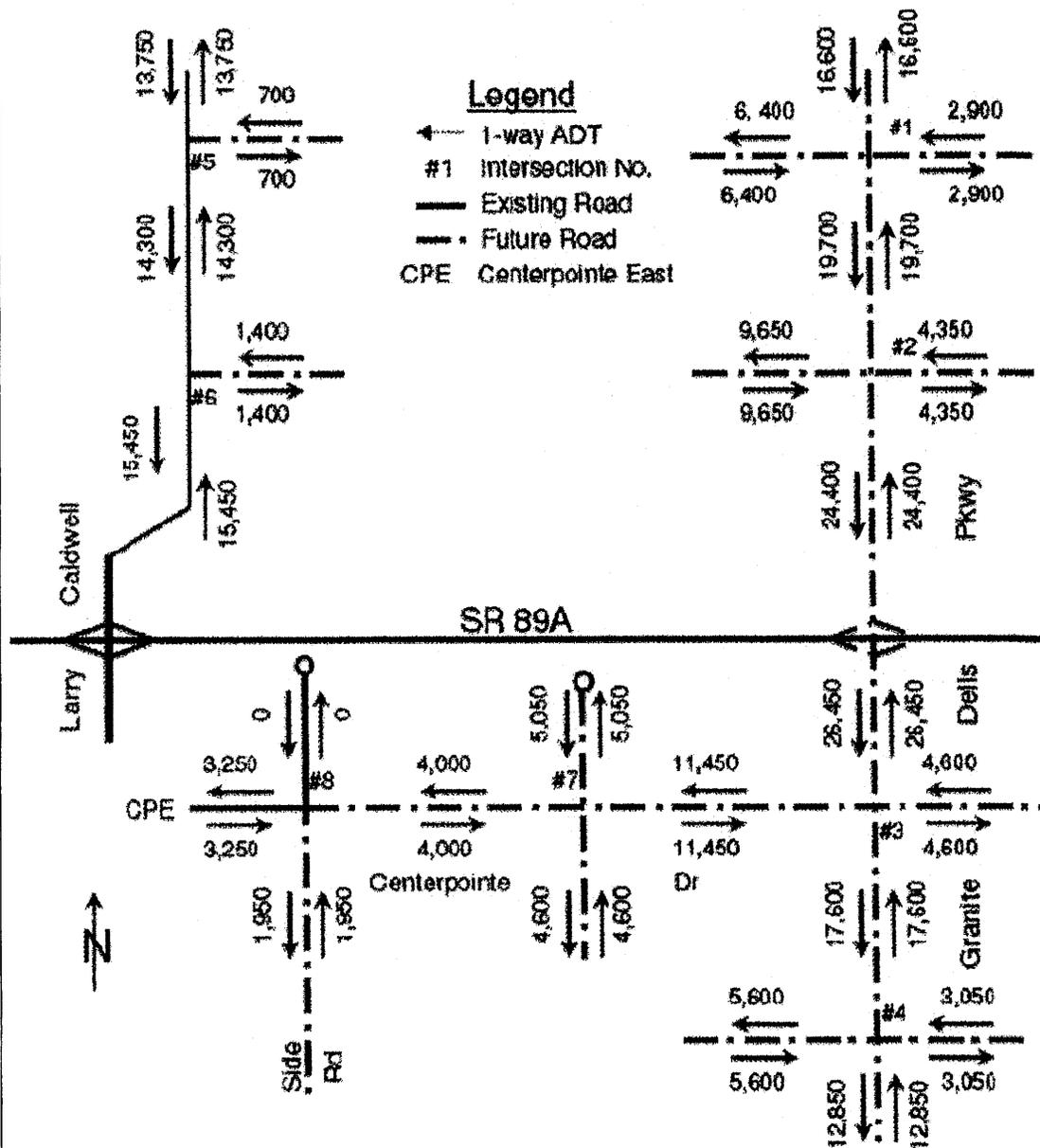


LCD Existing Traffic Volumes

Figure 3.3

Known future traffic was obtained from the *Granite Dells Ranch, Phase 1 Zoning – Traffic & Roadway Assessment* see the figure on the next page. The *Granite Dells Ranch, Phase 1 Zoning - Traffic & Roadway Assessment* was based on a study, traffic model and memo dated February 28, 2007 and a second memo dated August 19, 2008 for the CYMPO by Lima and Associates.

projected for the Subject Parcel was assumed to be included in the $(32,224 / 2)$ 16,600 vpd estimate for the background traffic. From the work sheet, the difference in volumes north of Intersection # 1 (10,050 vpd) and south of Intersection # 1 (13,150 vpd) was added to the background volume north of Intersection # 1 (16,600 vpd) to develop the total forecast volume between Intersections # 1 and # 2 of $[16,600 + (13,150 - 10,050)]$ 19,700 vpd. This approach was used along the balance of roadway system in the study area.

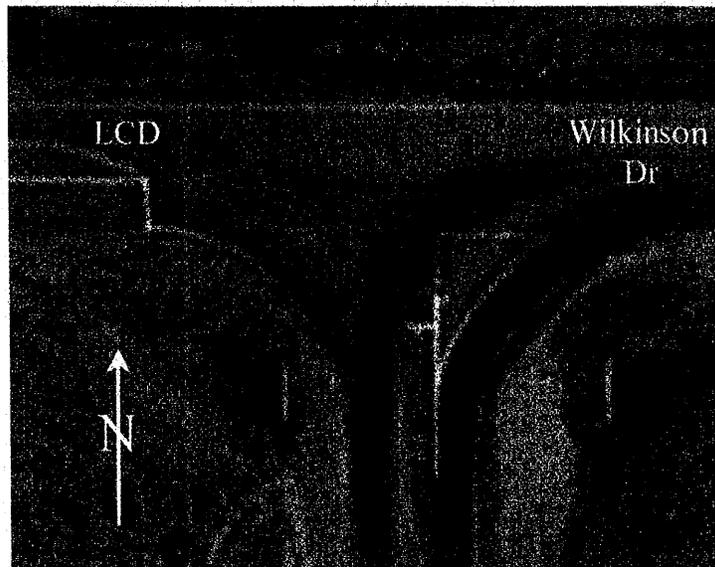


Total Traffic Forecast

4. ANALYSIS OF EXISTING AND KNOWN IMPROVEMENT CONDITIONS

4.1 Physical Characteristics

Heights Church has 3 existing driveways to provide entry and exit off of LCD. LCD is a two lane road with a posted speed limit of 30 mph and no turn lanes into the Project. There is an 8' dirt shoulder on the north side of LCD and a sidewalk that fronts the church on the south side of the street. The driveways exiting the Project are STOP sign controlled. The LCD/Wilkinson Dr intersection, see the photo to the right, provides a shared EB thru/right, a shared WB thru/left lane and separate NB left and right turn lanes



4.2 Traffic Analysis

During the weekdays the heavy traffic flow through the LCD/Wilkinson Dr intersection is between the south and east legs of the intersection. Therefore the west leg (EB approach) and NB to WB left turn movement are STOP controlled and the NB to EB right turn and WB to SB left turn are free flow. On Sunday the traffic counts show this movement is very light and the heavy movement is between the south and west legs. A police officer is provided to STOP the WB approach and allow free flow for the aforementioned heavy movements.

To convert this into the HCS analysis, the NB left/right and EB thru/right were used as the major streets (E-W orientation) for the analysis since the police over ruled the STOP signed control and made these movements the free flow movements. The WB thru/left has been labeled as a SB thru/left. The table to the left shows how each leg of the

Actual	HCS Analysis
WB Left/Thru	SB Left/Right
NB Left/Right	WB Thru/Right
EB Thru/Right	EB Left/Thru

intersection is labeled in the HCS analysis.

The year 2011 traffic for the thru movement at the EB approach (EB left in the *Highway Capacity Software (HCS)* analysis) of the LCD/Wilkinson Dr operates at a LOS A and the EB approach (SB approach in the *HCS* analysis) operates at a LOS C. Complete details of the *HCS* analysis are shown in the *appendix*, see page A-2.

4.3 Safety

There are no known safety deficiencies in the area at this time.

5. PROJECTED TRAFFIC

The trip generation is based on the land uses provided by the Owner and trip generation rates from the *ITE Trip Generation Manual* land uses approved by the City.

5.1 Site Traffic Forecast

Table 5.1 shows the Sunday peak hour trip generation for the HCE per the *ITE Trip Generation Manual*. The table shows four different land uses for the HCE Project, Church and General Office Building. The table documents the area, number of seats, and employees per each building on a Sunday during the peak hour. This trip generation used the area as the determining factor for the buildings described as General Office and seats for buildings described as a Church. The Ramada and Restroom are marked as stand alone buildings but do not generate any traffic.

**Table 5.1
HCE Business Industrial Development Trip Generation**

Heights Church											
ITE Trip Generation Data		Land Use				Sunday Pk Hr ITE Rate			Sunday Trip Gen		
Code	Description	Description	Employees	Seats	Sq. Ft.	T/1K SF	Ent	Ext	Tot	Ent	Ext
710	General Office	A	0	40	11,000	0.14	58%	42%	2	1	1
710	General Office	B	0	100	10,000	0.14	58%	42%	1	1	1
710	General Office	C	0	100	10,000	0.14	58%	42%	1	1	1
560	Church	D	15	3,000	50,000	0.61	51%	49%	1,830	933	897
710	General Office	E	0	60	4,500	0.14	58%	42%	1	0	0
710	General Office	F	0	40	3,000	0.14	58%	42%	0	0	0
710	General Office	G	0	60	5,000	0.14	58%	42%	1	0	0
	Ramada Outdoor	H	0	0	2,500	-	-	-	-	-	-
710	General Office	I	0	40	3,000	0.14	58%	42%	0	0	0
710	General Office	J	10	50	5,000	0.14	58%	42%	1	0	0
560	Church	K	0	0	2,000	0.61	51%	49%	-	-	-
560	Church	L	0	80	2,000	0.61	51%	49%	49	25	24
710	General Office	M	0	200	16,000	0.14	58%	42%	2	1	1
	Rest Room	N	0	0	1,500	-	-	-	-	-	-
710	General Office	O	0	20	1,000	0.14	58%	42%	0	0	0
710	General Office	P	5	40	13,000	0.14	58%	42%	2	1	1
710	General Office	1	5	200	8,600	0.14	58%	42%	1	1	1
710	General Office	2	3	40	2,900	0.14	58%	42%	0	0	0
710	General Office	3	3	100	5,000	0.14	58%	42%	1	0	0
	Ramada Outdoor	4	0	0	2,500	-	-	-	-	-	-
560	Church	5	10	1,000	14,100	0.61	51%	49%	610	311	299
			51	5,170	172,600				2,503	1,277	1,225

The tables on the next page, collectively called 5.2, shows the percent trip distribution and assignment for the entering and exiting movements. They are different due to the one way operations of the driveways.

**Table 5.2
HCE Trip Distribution and Assignment**

Existing					Existing					Existing				Existing			
	D-1	D-2	D-3	D-4		D-1	D-2	D-3	D-4		D-4	D-5	D-6		D-4	D-5	D-6
	NB Rt	NB Rt	NB Rt	NB Rt		NB Rt	NB Rt	NB Rt	NB Rt		WB Lt	WB Lt	WB Lt		WB Lt	WB Lt	WB Lt
A	95%	5%			A	1	0	0	0	A	0%	10%	90%	A	0	0	1
B	95%	5%			B	1	0	0	0	B	0%	80%	20%	B	0	1	0
C	95%	5%			C	1	0	0	0	C	0%	80%	20%	C	0	1	0
D	50%	25%	25%		D	448	224	224	0	D	20%	50%	30%	D	187	467	280
E	50%	25%	25%		E	0	0	0	0	E	0%	60%	40%	E	0	0	0
F	50%	25%	25%		F	0	0	0	0	F	0%	60%	40%	F	0	0	0
G	50%	25%	25%		G	0	0	0	0	G	0%	60%	40%	G	0	0	0
H	-	-	-		H	0	0	0	0	H	100%	0%	0%	H	0	0	0
I	10%	40%	50%		I	0	0	0	0	I	100%	0%	0%	I	0	0	0
J	10%	40%	50%		J	0	0	0	0	J	100%	0%	0%	J	0	0	0
K	-	-	-		K	0	0	0	0	K	100%	0%	0%	K	0	0	0
L	30%	60%	10%		L	7	14	2	0	L	100%	0%	0%	L	25	0	0
M	70%	30%	0%		M	1	0	0	0	M	100%	0%	0%	M	1	0	0
N	-	-	-		N	0	0	0	0	N	100%	0%	0%	N	0	0	0
O	95%	5%	0%		O	0	0	0	0	O	100%	0%	0%	O	0	0	0
P	100%	0%	0%		P	1	0	0	0	P	100%	0%	0%	P	1	0	0
1	50%	25%	25%		1	0	0	0	0	1	90%	10%	0%	1	1	0	0
2	50%	25%	25%		2	0	0	0	0	2	90%	10%	0%	2	0	0	0
3	50%	25%	25%		3	0	0	0	0	3	100%	0%	0%	3	0	0	0
4	-	-	-		4	0	0	0	0	4	100%	0%	0%	4	0	0	0
5	50%	35%	15%		5	149	106	45	0	5	100%	0%	0%	5	311	0	0
					Total	609	344	272	0					Total	527	466	282

5.2 Background Traffic Forecast

The background traffic forecast was previously provided in Figure 3.3.

5.3 Combined Total Traffic Forecast

Figure 5.1 shows the buildout combined total traffic forecast. The data presented in Figure 5.1 represents the sum of Table 5.2 and the background traffic (minus that coming and going to the existing Project) shown in Figure 3.3.

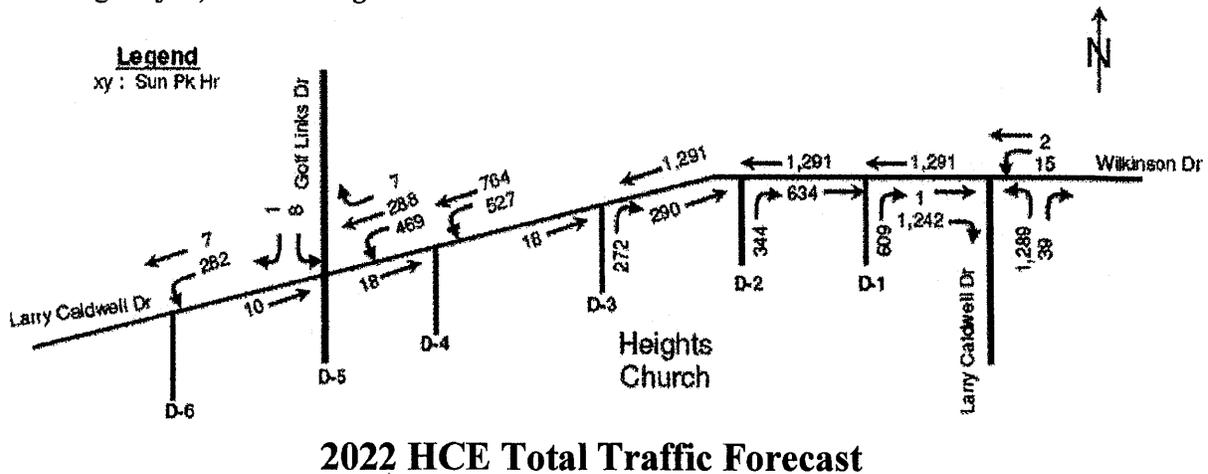
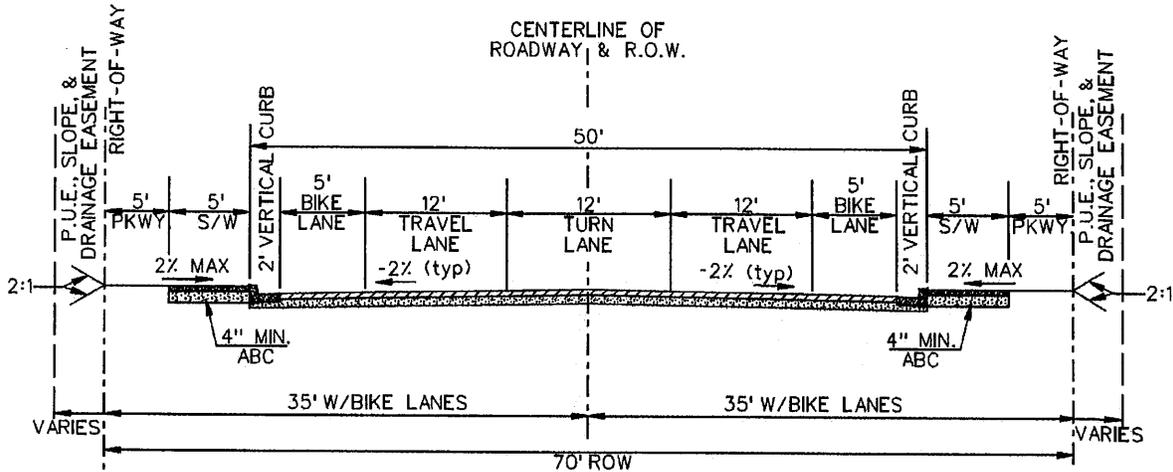


Figure 5.1

6. TRAFFIC AND IMPROVEMENT ANALYSIS

Based on the expected traffic forecast, Heights Church proposes a 3-lane between D-1 and D-5. They proposed adding a 4th EB lane between D-1 and LCD. The 3-lane local commercial street (602P-modified) typical section as shown in the **Figure 6.1** is proposed along LCD. Disregard the bike lines shown in the figure as bike lanes will not be added along LCD.



3-Lane Local Commercial Street (602P-Modified)

Figure 6.1

Phasing Street Construction. The Owner will build the LCD improvements, add the parking lot east of the existing church and D1, convert D2 and D3 to one-way out only operations, and add a gate to D4 to eliminate exiting movements on Sunday concurrent to the first building improvement from the Project. The Owner will add the other driveways when the additional parking lots are built with the addition of the new church, Building D.

6.1 Site Access

Site access was previously described in *Section 2.2*.

Proposed Improvements Adjacent to HCE Dev - Not Included in the Preliminary Plat. As presented in the *Granite Dells Ranch, Phase 1 Zoning – Traffic & Roadway Assessment* adjacent developments will provide for 4-lanes on LDC south of Wilkinson Dr as well additional turn lanes at the ramp intersections. In scoping with the City it was agreed these improvements by Granite Dells Ranch or others would be sufficient in this area.

Design Speed Along LCD. The existing posted speed limit along LCD north of the Church is 30 mph. Based on the short length of LCD and the low speed limit, it is within the standard of practice to provide a design speed equal to the posted speed limit.

6.2 Level of Service

The LOS analysis for the year 2022 background traffic is not necessary for the LCD/Wilkinson Dr intersection because traffic volumes will be so low without the traffic from the Project.

The year 2022 traffic for the thru movement at the EB approach (EB left in the *Highway Capacity Software (HCS)* analysis) of the LCD/Wilkinson Dr operates at a LOS B and the EB approach (SB approach in the *HCS* analysis) operates at a LOS F. Complete details of the *HCS* analysis are shown in the *appendix*, see page A-3.

Level of Service Conclusions. There are six driveways off LCD that will be used for entering and/or exiting movements to the Project. All six of these driveways will be STOP sign controlled. An analysis was not done for these driveways because the proposed roadway improvements eliminate conflicts between inbound and outbound movements. The proposed improvements keep WB thru traffic separated from the left turn traffic thereby eliminating delay for thru movements. The queuing for outbound movements will occur within the Project parking lots, thereby eliminating delay on the public streets. These conditions are optimal given the peaking characteristics at a church facility.

The movements between the east and south legs of the LCD/Wilkinson Dr intersection will operate at an acceptable LOS B or better at buildout. The WB left turn will operate at a LOS F. While this is not desirable, as occurs today a police officer will be there to monitor the situation and stop the NB and EB movements to allow the WB left turn to occur as they deem appropriate. With the presence of the police officer, safety is not a concern.

6.3 Traffic Safety

In this section sight distance and the need for left and right turn speed change lanes are reviewed.

Sight Distances. Sight distance is an important feature for the design of a safe facility. Both stopping sight distance (SSD) and “departure” intersection sight distance (ISD) should be evaluated during final design. “*Exhibit 9-50*” from the *AASHTO Green Book* shows the ISD layout for the “departure sight triangles.” While the minimum intersection sight distance is defined by SSD, it is desirable to also provide ISD at an intersection. Please reference the *Green Book* for a detailed explanation of *Exhibit 9-50*.

Stopping sight distance shall be maintained for horizontal curve and vertical curve design. **Table 6.2** shows the SSD and ISD that should be provided along the free flow roads at their approach to the stop controlled legs of the intersection.

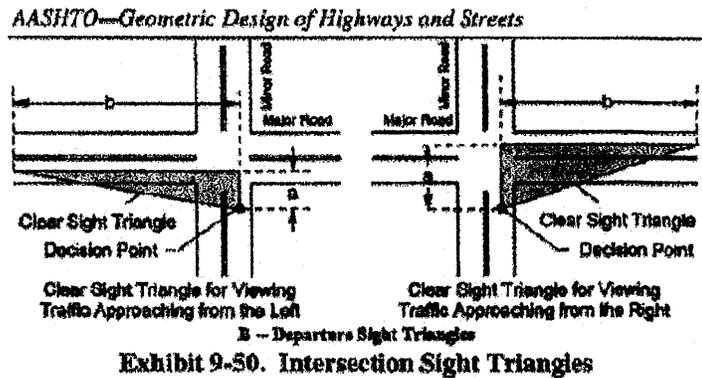


Table 6.2
Recommended Sight Distances

Number of Lanes	Design Speed	SSD	ISD ⁽¹⁾ Looking Left	ISD ⁽²⁾ Looking Right
3-Lane Road	30 mph	200'	290'	355'
	35 mph	250'	335'	415'

SSD – Stopping Sight Distance (AASHTO “Green Book” Exhibit 9-56)

ISD⁽¹⁾ – Intersection Sight Distance – Case B2 – Right Turn From Stop (AASHTO Green Book” Exhibit 9-57 and 9-58)

ISD⁽²⁾ – Intersection Sight Distance – Case B1 – Left Turn From Stop, from AASHTO Green Book Eq. 9-1 and Exhibit 9-54.

Left Turn Lanes. A left turn lane is proposed along for the NB LCD approaching Wilkinson Dr by modifying the existing island to use the existing right turn lane for queuing. This shared left/right turn lane start at the SR 89A WB off-ramp. The length of the existing left turn lane should be lengthened to the maximum length possible by utilizing the existing painted median.

Along WB LCD a left turn lane should also be added from the LCD/Wilkinson Dr intersection west to D5.

Left Turn Lane Conclusions. Based on the observed queue lengths during the data collection, engineering judgment was used to suggest the maximum possible distance for a left turn lane along NB LCD between SR 89A and Wilkinson Dr should be provided. The existing lane should be kept as a shared left turn/right turn lane to help maintain traffic flow towards the Project. The left turn lane for D4 and D5 will allow WB thru traffic and vehicles destined for D6 and D7 to proceed without being interrupted by the queue created by the traffic entering the Project.

It is suggested the existing painted median along NB LDC be used to extend the existing left turn lane when the striping needs to be redone due to age. The balance of the improvements should be completed when the new church is built.

Right Turn Auxiliary Speed Change Lanes. A right turn lane should be added along EB LCD to its approach to Wilkinson Dr. The right turn lane shall begin at D1 as a dedicated exit lane for traffic exiting the Project from this driveway.

Right Turn Lane Conclusions. The right turn lane added along EB LCD will allow traffic to exit D1 without being interrupted by other EB traffic and add capacity at the Wilkinson intersection by provided for a dual right turn movement.

It is suggested the turn lane be added when the parking lot and D1 are added to the Project when the new church is built.

6.4 Traffic Control, Regulatory and Warning Sign Needs

A signal warrant study will not be done for the LCD/Wilkinson Dr intersection as the traffic pattern shows the primary movements, NB to WB left turn and EB to SB right turn, do not conflict.

Stop Sign Needs. As previously stated in *Section 6.2*, a STOP sign should be placed at each driveway exiting the Project along LCD.

While it would be to the churches advantage to place a STOP sign along WB Wilkinson Dr at it's intersection with LCD, this would not be acceptable for weekday traffic. Therefore no change is proposed at the LCD/Wilkinson Dr intersection.

7. CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis contained in this report, the roadway network, as defined in *Section 6.1*, and traffic control system, as defined in *Section 6.4*, will provide for satisfactory capacity and intersection control. During design, the design engineer shall ensure adequate SSD and preferably ISD is provided at the location of future driveways, based on design speed and sight distances as defined herein. The evaluation of the proposed roadway network has been completed with the following observations:

- Along LCD north of the Project, the 3-lane section between the Wilkinson Dr intersection and D5 along with the right turn lane between D1 and the Wilkinson Dr intersection will provide adequate capacity for the projected future travel demand.
- Along NB LCC, modifying the island at the Wilkinson Dr intersection to provide a shared left/right turn lane will provide adequate capacity for the projected future travel demand.

Incorporating the following recommendations will ensure the roads meet the design, operational and safety requirements set forth by the City through the year 2022:

- In order to prevent conflict between vehicles departing from church and arriving at church, D1, D2, and D3 shall be used only as exit driveways on Sunday. D4, D5, and D6 will be the driveways used to access the Project.
- To the north of the Project, LCD shall be reconstructed to provide two WB lanes from the LCD/Wilkinson Dr intersection to D5. At D4 and D5, the inner lane will be used as a left turn lane and the outer lane will be used for thru vehicles and motorist destined for D6 and D7. A fourth lane shall be added for EB traffic between D1 and the Wilkinson Dr intersection.
- To the east of the Project, LCD shall be re striped in the NB direction between SR89A and Wilkinson Dr. The existing pavement is wide enough to allow for a NB left lane and a NB left/right lane.
- With the above improvements, the LCD/Wilkinson Dr intersection should provide two NB to WB left turn lanes and two EB to SB right turn lanes.
- STOP signs shall be provided for all the driveways.
- Phasing – when the next maintenance striping occurs along LCD between SR 89A and Wilkinson Dr, the existing painted median should be restriped to extend the existing NB to WB left turn lane as far south as possible. With the addition of any building, D2 shall be modified (narrowed and directional reconstructed) to provide for an existing right turn movement only. All the other improvements shown on the site plans shall be added when Building D is built.

Note: These evaluations, conclusions and recommendations are based on future traffic volumes, physical conditions and proposed land uses and site improvements. As improvements to surrounding roadways and/or additional development or changes in adjacent properties land use occur, the travel demand may increase or decrease resulting in more or less impacts at the locations evaluated in this study. Therefore the recommendations in this study reflect the standard of care for the information known to be true today, and may need to be re-evaluated by others as changes occur.

Appendix

2011 Traffic Count Summary

Caldwell Dr / Golf Links Dr Intersection																
Count Time	EB Thru		EB Lt		EB Total	WB Thru		WB Rt		WB Total	SB Rt		SB Lt		SB Total	Total 1-hr
	15-min	1-hr	15-min	1-hr		15-min	1-hr	15-min	1-hr		15-min	1-hr	15-min	1-hr		
7:30 - 7:45 AM	1		0			0		1			0		1			
7:45 - 8:00 AM	0		0			0		1			0		2			
8:00 - 8:15 AM	1		0			0		0			0		2			
8:15 - 8:30 AM	0	2	0	0	2	1	1	0	2	3	0	0	0	5	5	10
8:30 - 8:45 AM	1	2	0	0	2	1	2	1	2	4	0	0	1	5	5	11
8:45 - 9:00 AM	1	3	0	0	3	1	3	1	2	5	0	0	2	5	5	13
9:00 - 9:15 AM	0	2	0	0	2	0	3	1	3	6	0	0	1	4	4	12
9:15 - 9:30 AM	0	2	0	0	2	1	3	1	4	7	0	0	2	6	6	15
9:30 - 9:45 AM	1	2	1	1	3	0	2	2	5	7	0	0	3	8	8	18
9:45 - 10:00 AM	0	1	0	1	2	0	1	2	6	7	1	1	0	6	7	18
10:00 - 10:15 AM	5	6	0	1	7	1	2	3	8	10	0	1	2	7	8	25
10:15 - 10:30 AM	1	7	0	1	8	0	1	0	7	8	1	2	0	5	7	23
10:30 - 10:45 AM	4	10	0	0	10	3	4	3	8	12	1	3	1	3	6	28
10:45 - 11:00 AM	4	14	0	0	14	2	6	2	8	14	0	2	0	3	5	33
11:00 - 11:15 AM	0	9	0	0	9	1	6	1	6	12	0	2	5	6	8	29
11:15 - 11:30 AM	2	10	0	0	10	1	7	1	7	14	0	1	2	8	9	33
11:30 - 11:45 AM	0	6	0	0	6	2	6	1	5	11	0	0	1	8	8	25
11:45 - 12:00 PM	1	3	0	0	3	0	4	1	4	8	0	0	1	9	9	20
12:00 - 12:15 PM	1	4	0	0	4	1	4	1	4	8	0	0	1	5	5	17
12:15 - 12:30 PM	0	2	0	0	2	0	3	1	4	7	0	0	1	4	4	13
12:30 - 12:45 PM	3	5	0	0	5	3	4	0	3	7	1	1	0	3	4	15
12:45 - 1:00 PM	0	4	0	0	4	0	4	2	4	8	0	1	0	2	3	15

2011 Traffic Count Summary

Caldwell Dr / Wilkinson Dr Intersection																
Count Time	EB Thru		EB Rt		EB Total	WB Thru		WB Lt		WB Total	NB Rt		NB Lt		NB Total	Total 1-hr
	15-min	1-hr	15-min	1-hr		15-min	1-hr	15-min	1-hr		15-min	1-hr	15-min	1-hr		
7:30 - 7:45 AM	0		4			1		0			3		24			
7:45 - 8:00 AM	0		4			0		3			5		92			
8:00 - 8:15 AM	0		4			0		1			3		28			
8:15 - 8:30 AM	0	0	0	12	12	0	1	2	6	7	7	18	9	163	171	190
8:30 - 8:45 AM	0	0	4	12	12	0	0	5	11	11	11	26	8	137	163	186
8:45 - 9:00 AM	0	0	7	15	15	0	0	3	11	11	11	32	28	73	105	131
9:00 - 9:15 AM	0	0	103	114	114	0	0	1	11	11	3	32	105	150	182	307
9:15 - 9:30 AM	0	0	28	142	142	0	0	1	10	10	3	28	212	353	381	533
9:30 - 9:45 AM	0	0	18	156	156	0	0	8	13	13	14	31	54	399	490	599
9:45 - 10:00 AM	0	0	2	151	151	0	0	1	11	11	5	25	12	383	408	570
10:00 - 10:15 AM	3	3	5	53	58	3	3	4	14	17	3	25	12	290	315	388
10:15 - 10:30 AM	0	3	2	27	30	0	3	2	15	18	0	22	28	105	128	176
10:30 - 10:45 AM	0	3	83	102	105	0	3	2	9	12	10	18	101	153	171	288
10:45 - 11:00 AM	0	3	244	344	347	1	4	4	12	16	12	25	201	342	367	730
11:00 - 11:15 AM	0	0	49	388	388	0	1	4	12	13	3	30	131	461	491	892
11:15 - 11:30 AM	1	1	21	407	408	1	2	5	15	17	9	30	18	451	490	915
11:30 - 11:45 AM	0	1	5	319	320	0	2	7	20	22	3	32	4	354	388	728
11:45 - 12:00 PM	1	2	8	83	85	0	1	5	21	22	5	25	3	156	181	288
12:00 - 12:15 PM	0	2	10	44	48	0	1	5	22	23	4	21	6	31	52	121
12:15 - 12:30 PM	0	1	65	88	89	0	0	4	21	21	3	15	1	14	29	139
12:30 - 12:45 PM	0	1	200	283	284	0	0	3	17	17	7	19	3	13	32	333
12:45 - 1:00 PM	0	0	156	431	431	0	0	4	16	16	0	14	2	12	26	473

SOURCE: CTE, LLC

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: Garrett Clatanoff
 Agency/Co.: Lyon Engineering
 Date Performed: 4/7/2011
 Analysis Time Period: **Sunday Peak Hour**
 Intersection: LCD & Wilkinson Dr
 Jurisdiction: Yavapai County
 Units: U. S. Customary
 Analysis Year: **Existing - Year 2011**
 Project ID: Heights Church Expansion
 East/West Street: **Larry Caldwell Dr**
 North/South Street: **Wilkinson Dr**
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound			Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		1	407			451	39
Peak-Hour Factor, PHF		0.92	0.92			0.92	0.92
Hourly Flow Rate, HFR		1	442			490	42
Percent Heavy Vehicles		0	--	--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							No
Lanes		0	1			1	1
Configuration		LT				T	R
Upstream Signal?		No				No	

Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume					15		2
Peak Hour Factor, PHF					0.92		0.92
Hourly Flow Rate, HFR					16		2
Percent Heavy Vehicles					0		0
Percent Grade (%)		0				0	
Flared Approach: Exists?/Storage					/		/
Lanes					1		1
Configuration					L		R

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound			Southbound				
			4	7	8	9	10	11	12	
Lane Config	1	4		7	8	9		10	11	12
	LT							L		R
v (vph)	1							16		2
C(m) (vph)	1046							297		582
v/c	0.00							0.05		0.00
95% queue length	0.00							0.17		0.01
Control Delay	8.4							17.8		11.2
LOS	A							C		B
Approach Delay									17.1	
Approach LOS									C	

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: Garrett Clatanoff
 Agency/Co.: Lyon Engineering
 Date Performed: 4/7/2011
 Analysis Time Period: **Sunday Peak Hour**
 Intersection: LCD & Wilkinson Dr
 Jurisdiction: Yavapai County
 Units: U. S. Customary
 Analysis Year: **Buildout - Year 2022**
 Project ID: Heights Church Expansion
 East/West Street: **Larry Caldwell Dr**
 North/South Street: **Wilkinson Dr**
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	1	621			1289	39
Peak-Hour Factor, PHF	0.92	0.92			0.92	0.92
Hourly Flow Rate, HFR	1	674			1401	42
Percent Heavy Vehicles	0	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						No
Lanes	0	2			2	1
Configuration	LT T				T	R
Upstream Signal?	No				No	

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				15		2
Peak Hour Factor, PHF				0.92		0.92
Hourly Flow Rate, HFR				16		2
Percent Heavy Vehicles				0		0
Percent Grade (%)	0				0	
Flared Approach: Exists?/Storage				/		/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound			Southbound		
	1	4	7	8	9	10	11	12
Lane Config	LT						L	R
v (vph)	1					16		2
C(m) (vph)	476					80		386
v/c	0.00					0.20		0.01
95% queue length	0.01					0.69		0.02
Control Delay	12.6					60.9		14.4
LOS	B					F		B
Approach Delay							55.7	
Approach LOS							F	