




# TRANSPORTATION PLANNING REPORT

## PROPOSED INTERSECTION IMPROVEMENTS STATE ROUTE 106 (U.S. 431) AT STATE ROUTE 46 (HILLSBORO ROAD) WILLIAMSON COUNTY



PREPARED BY  
ARCADIS U.S., INC.  
FOR  
THE TENNESSEE DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

Recommended by:	Signature	DATE
CHIEF OF ENVIRONMENT AND PLANNING		3/15/07
TRANSPORTATION DIRECTOR PROJECT PLANNING DIVISION		3-8-07
TRANSPORTATION MANAGER 2 PROJECT PLANNING DIVISION		3/7/07

*This document is covered by 23 USC § 409 and its production pursuant to fulfilling public planning requirements does not waive the provisions of § 409.*

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## **Project Background Information**

### **Project History**

The Tennessee Department of Transportation (TDOT) is considering a project to improve the intersection of SR-106 and SR-46 in Williamson County, Tennessee. Improvements to the SR-106 corridor have been planned for several years and right-of-way for realignment of SR-46 was acquired by Williamson County during the property platting process for construction of the Grassland Family Care Center. Construction plans for improvements to SR-106 were previously developed but in 2003, the project was put on hold due to public opposition. Since that time Williamson County has been seeking intersection improvements to alleviate the congestion and operational deficiencies at the intersection.

In 2006, Williamson County requested, through the Nashville Metropolitan Planning Organization, that a Transportation Planning Report be performed by TDOT in order to conduct proper planning of the project and to explore possible funding appropriation.

### **Project Study Area**

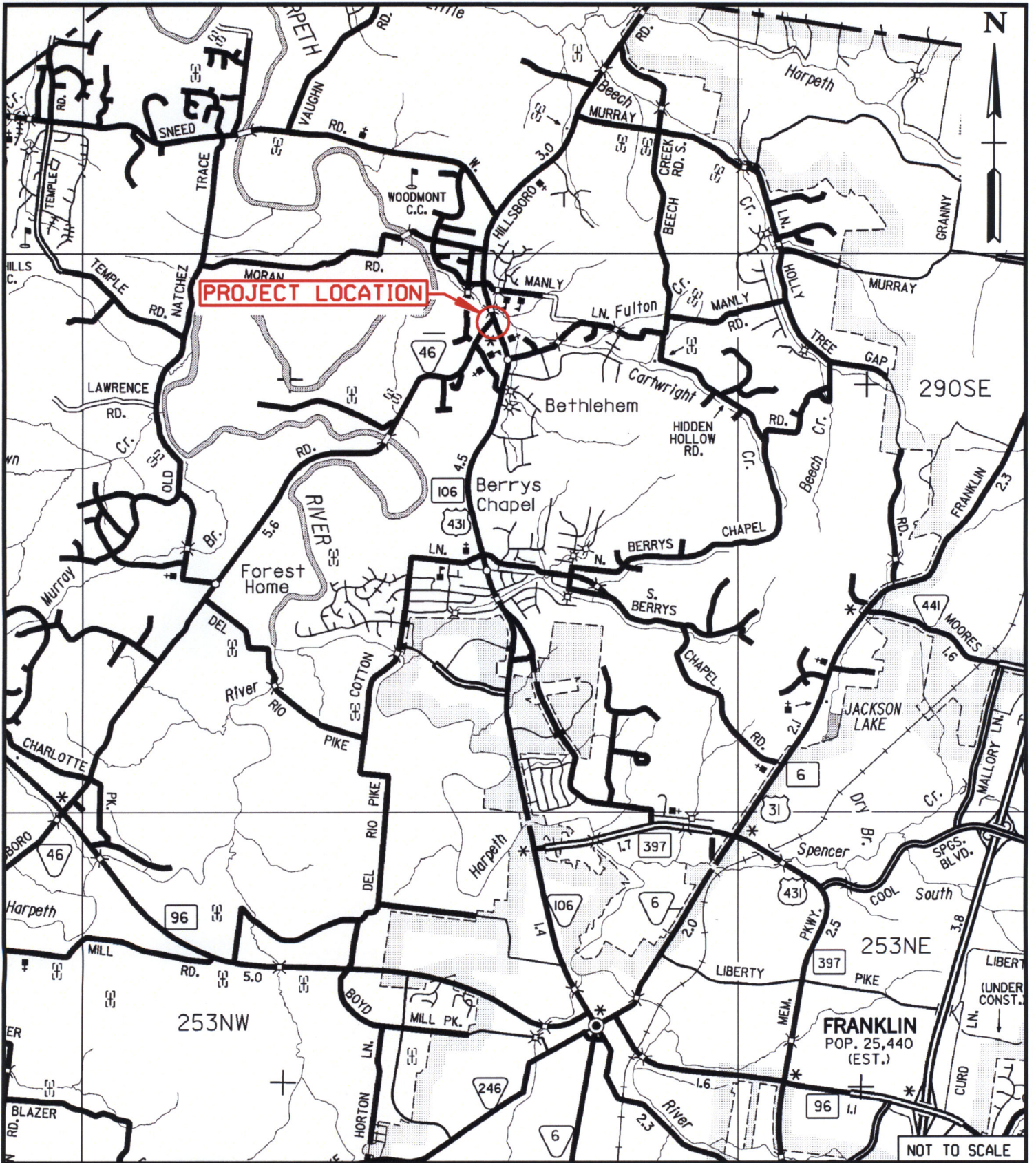
The proposed project is located in the north-central portion of Williamson County, in a residential and light commercial area. Adjacent to the intersection of SR-106 and SR-96 are Grassland Family Care Center and the Community Life Fellowship Church. Grassland elementary and middle schools are also located nearby. The project site is shown on a map of the area depicted in Figure 1.

### **Existing Transportation Conditions**

SR-106 in Williamson County is a major arterial (two-lane) roadway with an increasingly large number of peak hour commuters each day. Williamson County and the City of Franklin are connected to Nashville via this existing north-south highway. SR-46, which intersects SR-106 at an acute angle just south of Cartwright Creek in Williamson County, is a two-lane collector roadway serving several residential areas in addition to some parcels of undeveloped land within the vicinity of its intersection with SR-106.

Traffic volumes in the project study area have increased dramatically over the past few years, largely due to a documented 21.3 percent increase in the population of Williamson County from 2000 to 2005. Truck volumes through the intersection are significant. Trucks comprise 10 percent of the average daily traffic on SR-106 and 2 percent on SR-46.

The Tennessee Roadway Information Management System (TRIMS) showed that the intersection experienced 12 crashes in the three year period from 2003 through 2005. The crash rate for the intersection for this period was 0.58, which is lower than the state wide average rate of 0.75. There were three injury crashes with a total of four injuries. Ten of the crashes were rear-end collisions, which may be due to the congested traffic condition in the area.



NOT TO SCALE



AREA MAP  
 INTERSECTION IMPROVEMENTS  
 SR-106 (US-431) AT SR-46  
 WILLIAMSON COUNTY, TN

DRAWN BY:	TJC	CHECKED BY:	HAM
PROJECT NO.	99107-7086-46		
FIGURE	1	DATE:	01-16-07



Intersection looking from the north on SR-106



Intersection looking south on SR-46



Intersection looking north on SR-46

## Purpose and Need of Project

The purpose of the proposed project is to address the capacity, operational, and safety concerns at the intersection of SR-106 and SR-46, by reducing delay times and improving intersection geometry for cars and trucks traveling in Williamson County, Tennessee.

SR-106 is a major thoroughfare in Williamson County that struggles to accommodate the increasingly large number of peak hour travelers each day going to surrounding communities and to downtown Nashville. Williamson County has proved itself to be one of the fastest growing counties in Tennessee. Between the years 2000 and 2005, there was a 21.3 percent growth in its population. This is a significant increase compared to the overall State of Tennessee, which had a growth rate of only 4.8 percent over the same 5 years. Amongst its population, 71.4 percent of the people in Williamson County (who are 16 years or older) are members of the Tennessee Labor Force. The combination of these factors leads to large numbers of men and women traveling to work and creating high peak hour traffic volumes throughout the county.

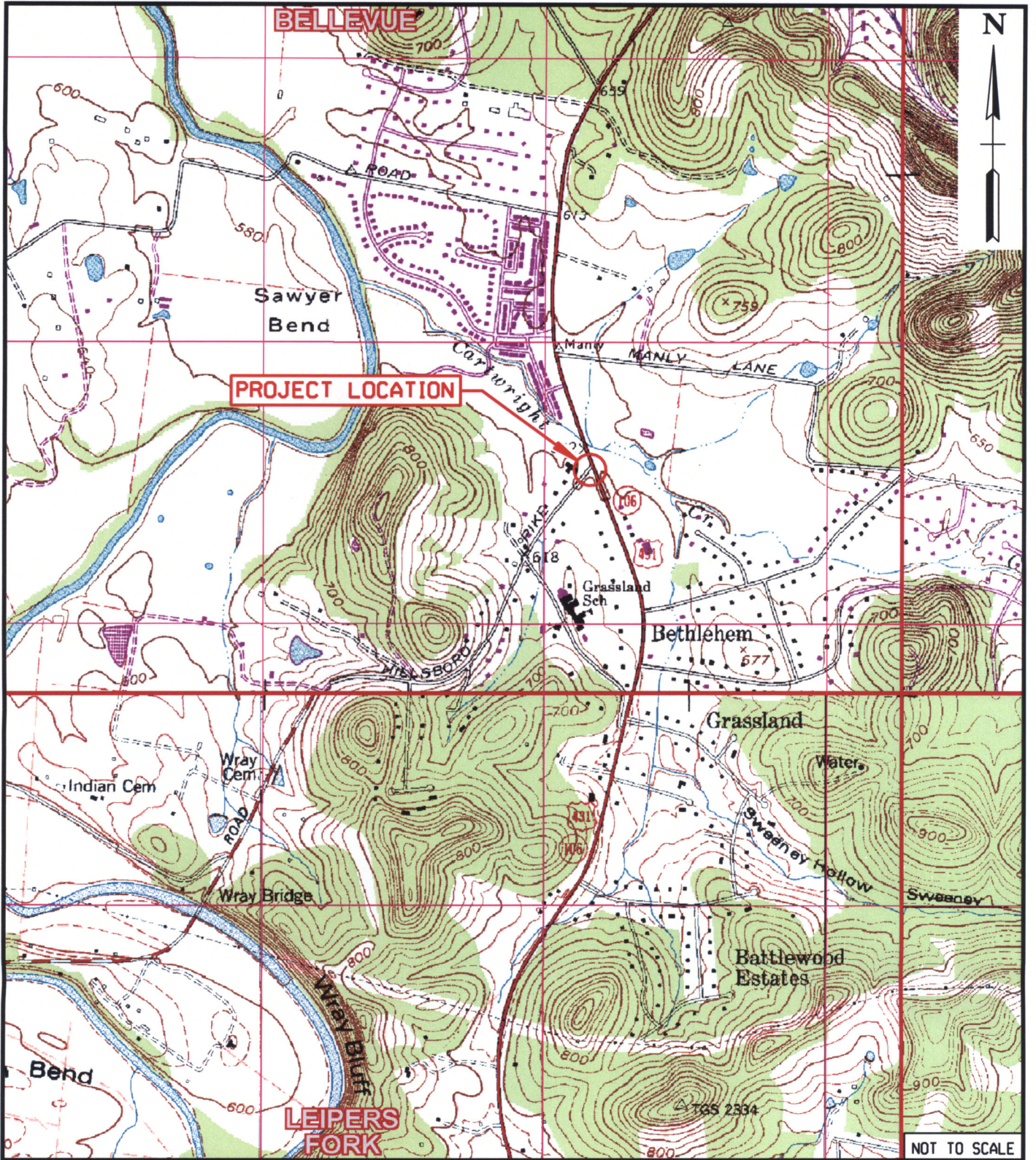


Current traffic capacity analysis reveals that for 2006 peak hour traffic, the intersection of SR-106 and SR-46 operates at a level of service (LOS) D (46 seconds average delay) in the A.M. and a LOS F (95 seconds) in the P.M. A capacity analysis was performed to predict the intersection capacity in the years 2011 and 2031. If no changes are made to the intersection, the result of the analysis indicates a LOS F for all peak hour traffic times. A.M. and P.M. peak traffic analysis predict the Delays in 2031 would be expected to increase to 276 seconds (4.6 min) in the A.M. and 566 seconds (9.4 min) in the P.M. This is approximately a 496 percent increase in delays for afternoon travelers in Williamson County. This substantial increase in delays, if unresolved, will continue to worsen.

In addition to substantial delays through the intersection, SR-106 and SR-46 are not aligned at an optimum angle of 90 degrees. The intersection is situated at an acute angle, which makes for less than desirable turning movements for vehicles, especially for large trucks that pass through the area. While this intersection experiences fewer crashes than the statewide average, improvements in capacity and operations are expected to decrease the crash rate in the future, which benefits all roadway travelers.

An additional benefit of realigning SR-46 is that the intersection will be moved farther away from the Charlie and Marie Franks Memorial Bridge, allowing guardrail on the south side of the bridge to be lengthened. With the addition of curb and gutter, some roadside ditches will be eliminated. Adjacent businesses, neighborhoods, and nearby Grassland elementary and middle schools (current enrollment of approximately 1,580 students) will especially take advantage of safer traveling conditions and reduced delay times.

Figure 2, Project Map, indicates the location of the intersection.



NOT TO SCALE



PROJECT MAP  
 INTERSECTION IMPROVEMENTS  
 SR-106 (US-431) AT SR-46  
 WILLIAMSON COUNTY, TN  
 USGS BELLEVUE AND LEIPERS FORK QUAD

DRAWN BY: TJC	CHECKED BY: HAM
PROJECT NO. 99107-7086-46	
FIGURE 2	DATE: 01-16-07



Photograph 1: Grassland Family Care Center



Photograph 2: Grassland Family Care Center



Photograph 3: Community Life Fellowship Church



Photograph 4: Grassland Elementary and Middle School

## Proposed Intersection Alternatives

Three build alternatives, a Traffic Operations Alternative, and the No-Build Alternative have been investigated for the intersection of SR-106 and SR-46. All three build alternatives include installation of a new traffic signal with phasing appropriate for the proposed lane configurations. A three-lane section is proposed for roadway improvements in all of the build alternatives and typical roadway sections are shown in Figures 3 and 4.

Capacity analyses for the intersection were developed for the No-Build and the three build alternatives, with the existing 2006 volumes and projected volumes for 2011 and 2031. Capacity analyses for the Traffic Operations Alternative would be identical to the No-Build.

The primary output of signalized intersection capacity analysis is level of service (LOS). LOS is a qualitative measure of intersection operations based on control delay per vehicle. General descriptions of intersection LOS are as follows:

LOS A – Not more than 10 seconds average control delay per vehicle. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The general level of physical and psychological comfort provided to the driver is high. Intersection has free flow conditions.

LOS B - Average control delay per vehicle is 10 to 20 seconds. The ability to maneuver within the traffic stream is only slightly restricted. The general level of physical and psychological comfort provided to the driver is still high. Reasonably free flow operation conditions.

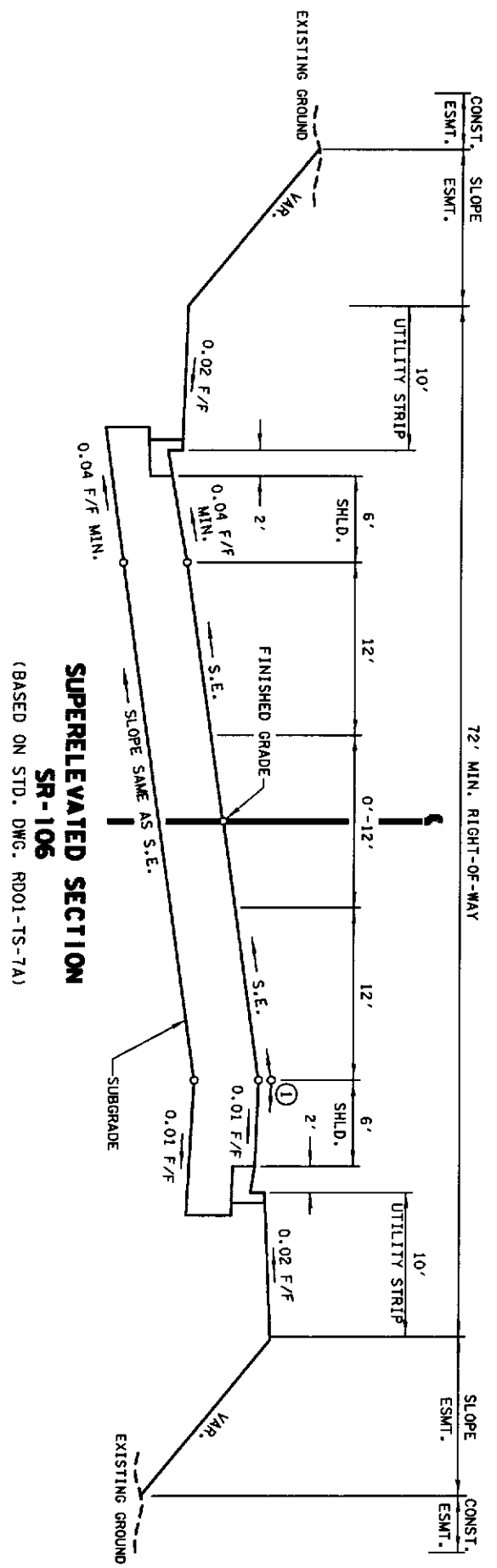
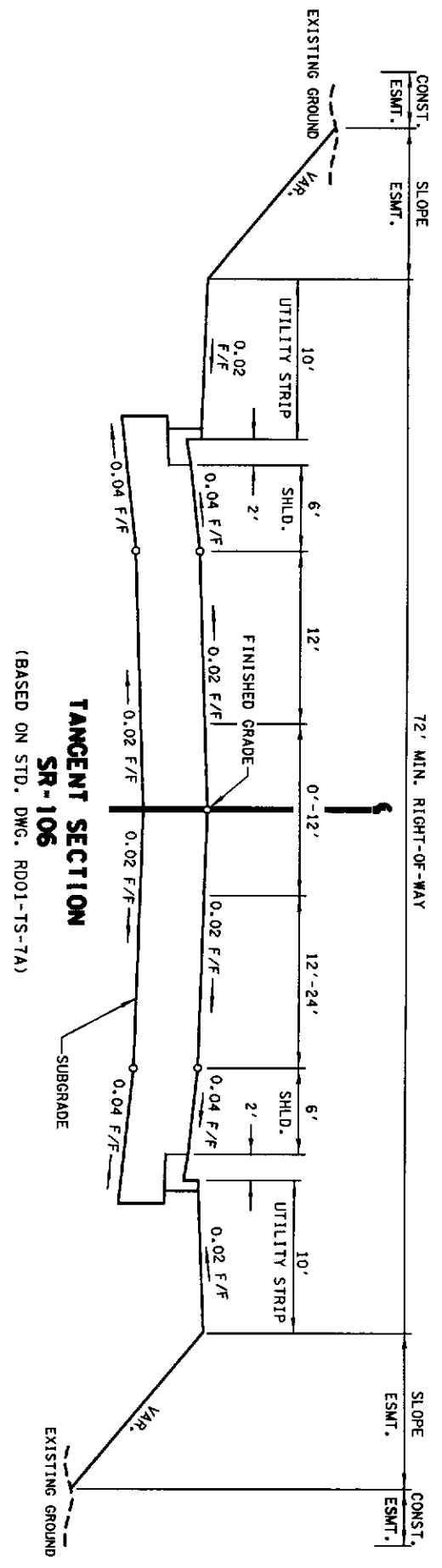
LOS C – Average control delay per vehicle is 20 to 35 seconds. Freedom to maneuver within the traffic stream is noticeably restricted. Driver tension increase due to additional vigilance required. Traffic flow speed is at or near free flow speed.

LOS D – Average control delay per vehicle is 35 to 55 seconds. Maneuvering within the traffic stream is noticeably limited. Drivers experience reduced physical and psychological comfort.

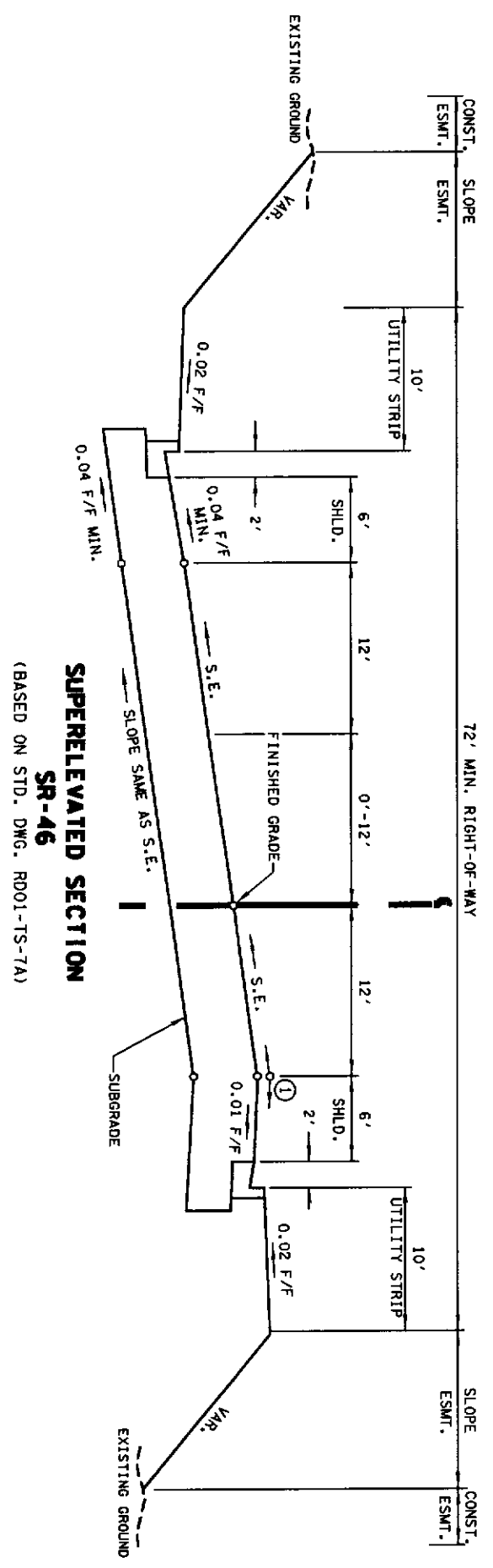
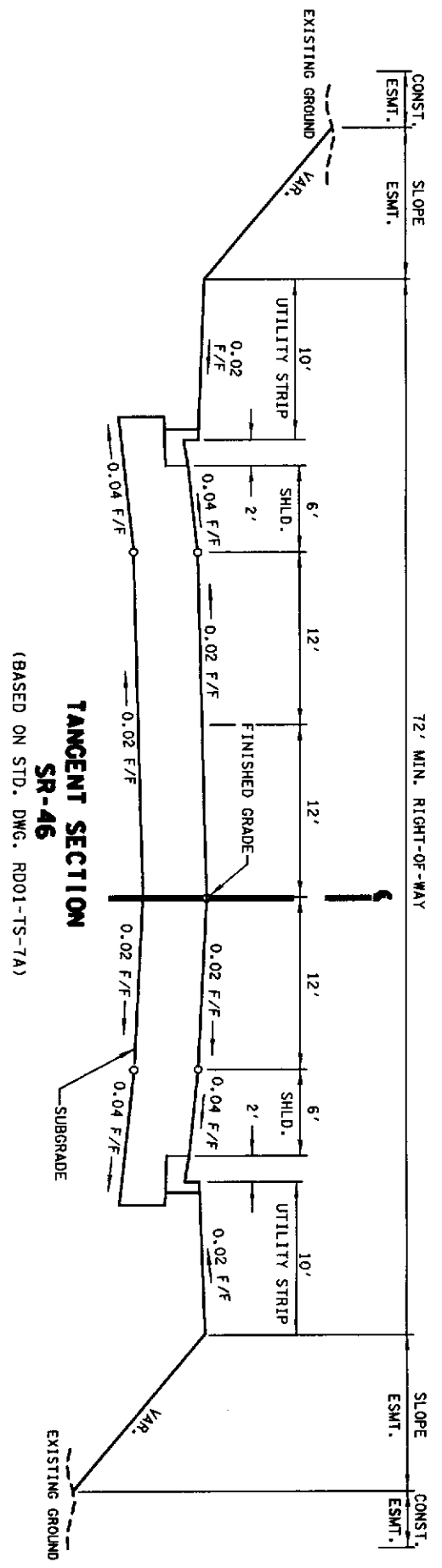
LOS E – Average control delay per vehicle is 55 to 80 seconds. The lower end is at the theoretical limit of capacity. Operations are severely restricted due to limited gaps in traffic stream. Drivers experience physical and psychological discomfort.

LOS F – Average control delay per vehicle is greater than 80 seconds. The volume of traffic entering exceeds the ability of the intersection to accommodate. Drivers experience physical and psychological discomfort.

Traffic volumes used for the analysis are shown in diagrams contained in Appendix A.



TYPE	YEAR	PROJECT NO.	SHEET NO.
	2007	99107-7086-04	



TYPE	YEAR	PROJECT NO.	SHEET NO.
	2007	99107-7086-04	

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION

TYPICAL  
SECTIONS  
SR-46  
FIGURE 4

A TDOT Check List of Determinants for Location Study is shown in Figure 5 and a TDOT Design Criteria for Location and Design Phase form is contained in Figure 6.

**No-Build Alternative**

The intersection of SR-106 and SR-46 is presently signal controlled with two-phase operation. SR-106 is a two-lane, north-south urban arterial with a posted speed limit of 45 miles per hour (mph) SR-46 is a two-lane north-south urban collector with a posted speed limit of 40 mph. The intersection is formed at an acute angle which causes operational problems for turning truck traffic.

Capacity analysis of the intersection indicates that the intersection presently operates at a LOS of D in the A.M. peak and a LOS of F in the P.M. peak. The LOS will continue to deteriorate with the expected increases in traffic at the intersection. Results of the capacity analysis for the No-Build Alternative are contained in Appendix B and are summarized in Table 1. Crash rates at the intersection should be expected to increase with the increased congestion.

An aerial view of the existing intersection is shown in Figure 7. No construction cost would be incurred for the No-Build Alternative.

**Table 1. Capacity Analysis Summary – No-Build Alternative**

	A.M.			P.M.		
	AVG. DELAY (SEC)	HCM LOS	HCM V/C	AVG. DELAY (SEC)	HCM LOS	HCM V/C
2006	46.1	D	1.00	94.6	F	1.23
2011	189.6	F	1.52	208.4	F	1.53
2031	276.3	F	1.67	565.9	F	2.11

**Traffic Operations Alternative**

Operational improvements, such as upgrading and improving the existing signal equipment and signal operations at the intersection were considered as an alternative. The existing signal is in conformance with the *Manual on Uniform Traffic Control Devices for Street and Highways*, (U.S. Department of Transportation Federal Highway Administration) and no additional signal phases were found to be reasonable due to the existing lane configuration. Installation of vehicle detection and improved signal timing could provide better operations, but will not provide a measurable improvement to the capacity of the intersection.

Moving the stop lines away from the intersection could provide some improvement for maneuvering of turning vehicles, but the necessary increase in vehicle clearance phases would have a negative impact on the capacity of the intersection.

The Traffic Operations Alternative was not deemed to be reasonable and prudent, and therefore this alternative was dropped from further consideration.



## CHECK LIST OF DETERMINANTS FOR LOCATION STUDY

(Build alternates A, B, and C)

If any of the following facilities or ESE categories are located within the project area or corridor, place an "X" in the blank opposite the item. Where more than one alternate is to be considered, place its letter designation in the blank.

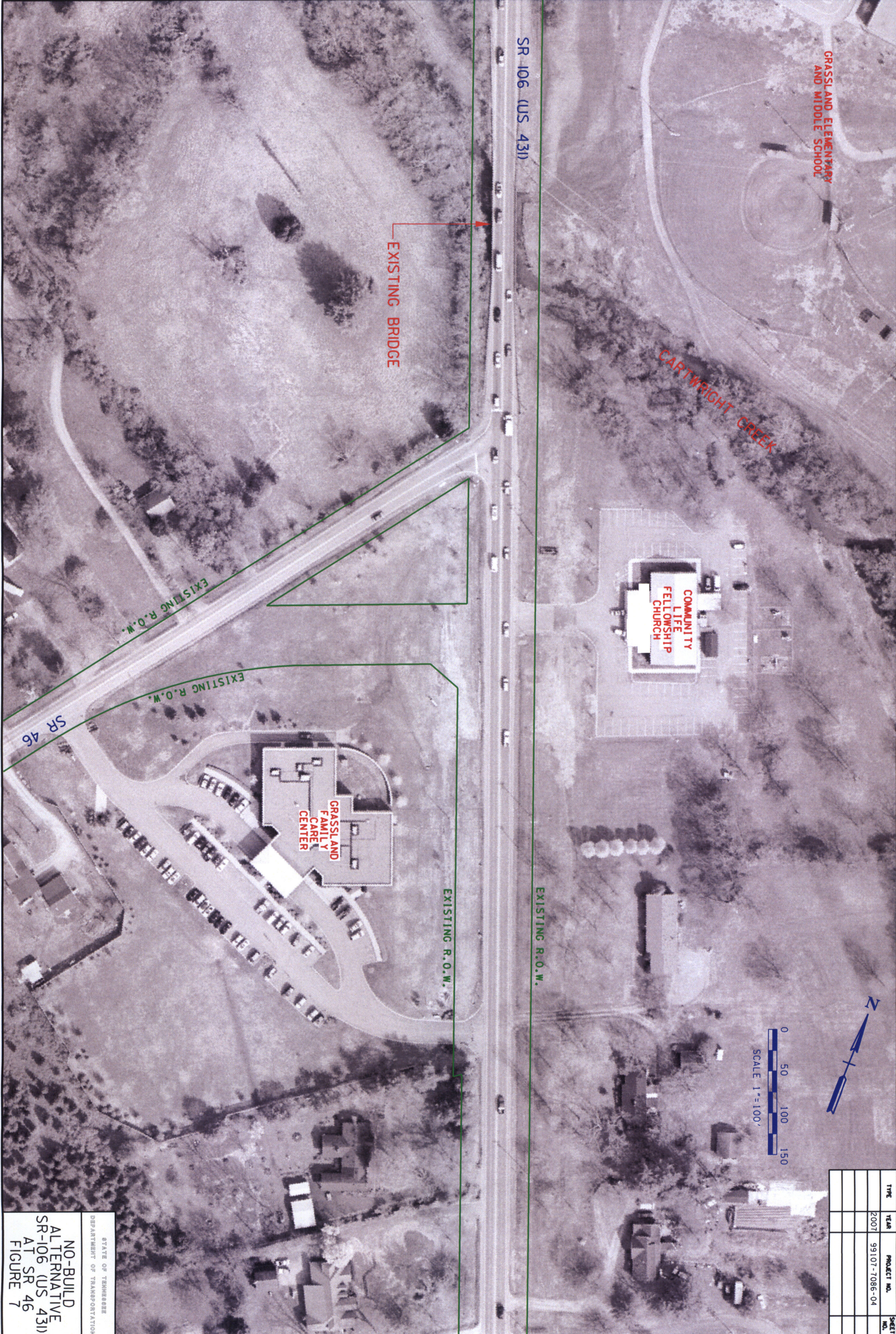
1.	Agricultural land usage	X
2.	Airport (existing or proposed)	
3.	Commercial area, shopping center	
4.	Floodplains	X
5.	Forested land	
6.	Historical, cultural, or natural landmark	
7.	Industrial park, factory	
8.	Institutional usages	
	a. School or other educational institution	X
	b. Church or other religious institution	X
	c. Hospital or other medical facility	X
	d. Public building, e.g., fire station	
	e. Defense installation	
9.	Recreation usages	
	a. Park or recreational area	
	b. Game preserve or wildlife area	
10.	Residential establishment	
11.	Urban area, town, city, or community	X
12.	Waterway, lake, pond, river, stream, spring	X
	(Permit required: Coast Guard	
	Section 404	
	TVA Section 26a review	
	NPDES	X
	Aquatic Resource Alteration	
13.	Other	
14.	Location coordinated with local officials	X
15.	Railroad crossings	
16.	Hazardous materials site	

Figure 5

## TDOT DESIGN CRITERIA FOR LOCATION AND DESIGN PHASE

<b>ROUTE</b>	<u>SR-106 / SR-46</u>	<b>CONCEPT:</b> <u>A, B, &amp; C</u>	
<b>REGION</b>	<u>III</u>	<b>COUNTY:</b> <u>WILLIAMSON</u>	
<b>LOCATION</b>	<u>INTERSECTION OF SR-106 / SR-46</u>		
	SR-106	SR-46	
PRESENT AADT (2006)	24,215	4,420	
FUTURE AADT (2011)	26,280	4,890	
FUTURE AADT (2031)	36,070	6,780	
DHV (2031)	3,968	746	
FUNCTIONAL CLASSIFICATION	URBAN ARTERIAL	URBAN COLLECTOR	
MINIMUM DESIGN SPEED	45	40	
ACCESS CONTROL	N/A	N/A	
MINIMUM RADIUS	660' (0.06 MAX S.E.)	510' (0.06 MAX S.E.)	
MAXIMUM GRADE	5	5	
MINIMUM STOPPING SIGHT DISTANCE	360'	305'	
SURFACE WIDTH	24' - 36'	24' - 36'	
NUMBER OF LANES	2 - 3	2 - 3	
USABLE SHOULDER WIDTH	6'	6'	
MEDIAN WIDTH	N/A	N/A	
MINIMUM RIGHT OF WAY	72'	72'	
SIGNALIZATION	New Signal		

FIGURE 6



TYPE	YEAR	PROJECT NO.	SHEET NO.
	2007	99107-1086-04	

STATE OF TENNESSEE  
 DEPARTMENT OF TRANSPORTATION

**NO-BUILD  
 ALTERNATIVE  
 SR-106 (US 431)  
 AT SR 46  
 FIGURE 7**

**Build Alternative A**

Build Alternative A includes reconstructing SR-46 on new alignment to provide an intersection skew of approximately ninety degrees, which will improve operation at the intersection. The new alignment would be located within right-of-way previously acquired by Williamson County and would traverse the existing storm water detention pond located adjacent to the existing intersection. It is recommended that the lost detention be replaced in the area of pavement removal with connecting piping installed under the realigned roadway. The new section of roadway would provide a 12-foot right turn lane, a 12-foot left turn lane, 6-foot paved shoulders, concrete curb and gutter, closed drainage system, and a 10-foot utility strip. Intersection signalization should be actuated with two phase operation.

Capacity analysis indicates that with improvements contained in Build Alternative A, the LOS at the intersection will remain essentially the same as the No-Build Alternative, however average delay at the intersection will be improved. Results of the capacity analysis for Build Alternative A are contained in Appendix C and are summarized in Table 2.

**Table 2. Capacity Analysis – Build Alternative A**

	A.M.				P.M.			
	AVG. DELAY	HCM LOS	HCM V/C	DECREASE IN AVG. DELAY*	AVG. DELAY	HCM LOS	HCM V/C	DECREASE IN AVG. DELAY*
2006	35.9	D	0.98	22.1%	88.4	F	1.21	6.6%
2011	162.7	F	1.46	14.2%	190.5	F	1.48	8.6%
2031	236.5	F	1.60	14.4%	504.1	F	2.03	10.9%

\* Percent decrease in average delay based on build alternative compared to no-build alternative.

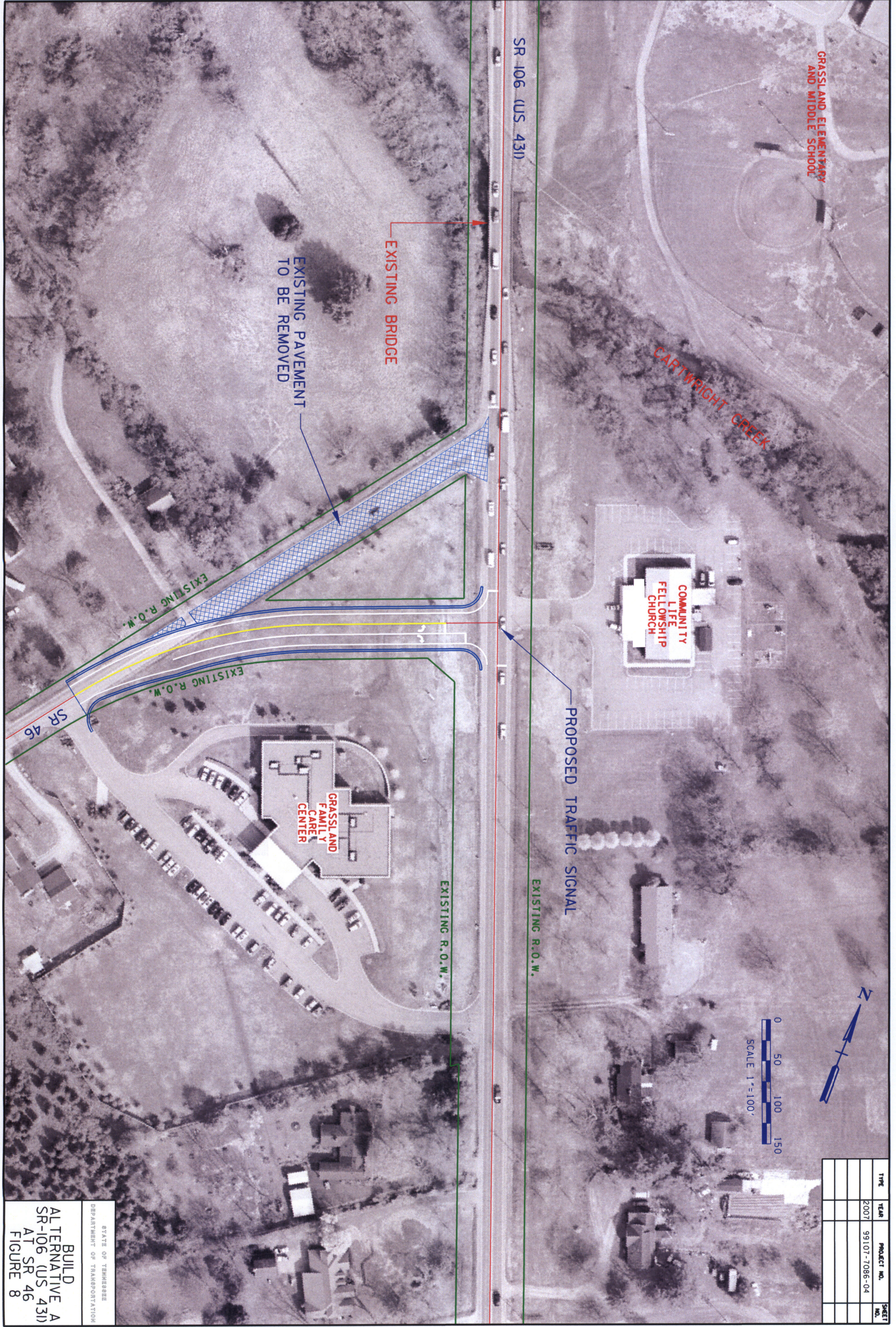
Conceptual layout of this alternative is shown in Figure 8. The estimated project cost for Build Alternative A is \$593,000. A Summary Data Table is shown on Figure 9, and a Cost Data Sheet summarizing the estimated cost is shown in Figure 10.

**Build Alternative B**

Build Alternative B provides all of the improvements described in Build Alternative A and includes widening the northbound approach of SR-106 to provide a left turn lane to SR-46. The new section of SR-106 would provide a 12-foot left turn lane, two 12-foot through lanes, 6-foot paved shoulders, concrete curb and gutter, closed drainage system, and a 10-foot utility strip. The additional left turn lane should provide better operations and safety at the intersection by providing storage out of the through traffic for the left turning vehicles northbound on SR-106. Intersection signalization should be actuated with two phase operation due to the relatively low volume of traffic turning to southbound SR-46.

Capacity analysis indicates that with improvements contained in Build Alternative B, an improvement to a LOS C will be achieved for the 2006 A.M. peak hour. All other levels of service remain essentially the same as the Build Alternative A, but average delay at the intersection will be

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TYPE	YEAR	PROJECT NO.	SHEET NO.
	2007	99107-7086-04	

STATE OF TENNESSEE  
 DEPARTMENT OF TRANSPORTATION  
 BUILD  
 ALTERNATIVE A  
 SR-106 (US 431)  
 AT SR 46  
 FIGURE 8

**SUMMARY DATA TABLE**

<u>ITEM</u>	<u>BUILD ALTERNATIVE A</u> <u>(SR-106 / SR-46)</u>
Functional Class	U. Art. / U. Coll.
System Class	STP
Length (Miles)	N/A
Cross Section (Feet)	24 - 36
Present AADT (2011)	26,280 / 4,890
Future AADT (2031)	36,070 / 6,780
DHV (2031)	3,968 / 746
% Trucks	4 / 6 (AADT) 3 / 4 (DHV)
Estimated Right-of-Way Acquisition (Acres)	0
Estimated Right-of-Way Tracts Affected	1
Estimated Family Displacements	0
Estimated Business Displacements	0
Estimated Non-Profit Displacements	0
Estimated Right-of-Way Cost	\$10,000
Estimated Utility Cost Reimbursable	\$0
Estimated Utility Cost Non-Reimbursable	\$10,000
Estimated Construction Cost	\$521,000
Estimated Preliminary Engineering Cost	\$52,000
<b>Total Estimated Project Cost</b>	<b>\$593,000</b>

FIGURE 9

## COST DATA SHEET

PROJECT S.R. 106 (U.S. 431) AT S.R. 46  
 LOCATION WILLIAMSON COUNTY  
 LENGTH  
 CROSS SECTION:

### RIGHT-OF-WAY

Land, Improvements & Damages	(# Acres	0)	
Incidentals	(# Tracts	1)	\$10,000
Relocation Payments	(Residences	0)	
	(Businesses	0)	
	(Non-Profits	0)	
<b>TOTAL RIGHT-OF-WAY COST</b>			<b>\$10,000</b>

### UTILITY RELOCATION

Reimbursable	
Non-Reimbursable	\$10,000
<b>TOTAL UTILITY ADJUSTMENT COST</b>	
<b>\$10,000</b>	

### CONSTRUCTIONS

Mobilization	\$10,000
Clear and Grubbing	\$5,000
Pavement Removal	\$10,000
Earthwork	\$20,000
Drainage (Erosion Control = \$15,000)	\$90,000
Structures (Preserv'n/Demol'n = \$0)	\$0
Concrete Curb and Gutter	\$26,000
Railroad Crossing	\$0
Paving	\$152,000
Retaining Walls	\$0
Maintenance of Traffic	\$15,000
Topsoil	\$10,000
Seeding	\$2,000
Sodding	\$13,000
Signing/Pavement Marking	\$2,000
Signalization	\$80,000
Fence	\$0
Rock Walls	\$0
Guardrail	\$0
Rip-rap or Slope Protection	\$2,000
Other Construction Items (8.5%)	\$37,000
10% Contingencies	\$47,000
<b>TOTAL CONSTRUCTION COST</b>	
<b>\$521,000</b>	
<b>Engineering Cost(10% of Constr.)</b>	
<b>\$52,000</b>	

**TOTAL ESTIMATED COST (Build Alternative A) \$593,000**

Figure 10

improved. Results of the capacity analysis for Alternative B are contained in Appendix D and are summarized in Table 3.

**Table 3. Capacity Analysis – Build Alternative B**

	A.M.				P.M.			
	AVG. DELAY	HCM LOS	HCM V/C	DECREASE IN AVG. DELAY*	AVG. DELAY	HCM LOS	HCM V/C	DECREASE IN AVG. DELAY*
2006	31.5	C	0.98	31.7%	87.5	F	1.21	7.5%
2011	81.2	F	1.16	57.2%	168.6	F	1.48	19.1%
2031	216.6	F	1.60	21.6%	362.3	F	2.03	36.0%

\* Percent decrease in average delay based on build alternative compared to no-build alternative.

Conceptual layout of this alternative is shown in Figure 11. The estimated project cost for Build B is \$1,051,000. A Summary Data Table is shown on Figure 12, and a Cost Data Sheet summarizing the estimated cost is shown in Figure 13.

**Build Alternative C**

Build Alternative C provides all of the improvements described in Build Alternative A and B, and includes widening the southbound approach of SR-106 to provide a right turn lane to SR-46. The new section of roadway would provide a 12-foot right turn lane (southbound), a 12-foot left turn lane (northbound), two 12-foot through lanes, 6-foot paved shoulders, concrete curb and gutter, closed drainage system, and a 10-foot utility strip. Intersection signalization should be actuated with two phase operation.

Capacity analysis indicates that with improvements contained in the Build Alternative C, a LOS D or better will be achieved for the 2006 peak hours and 2011 A.M. peak hour. The improvement will also provide significant reduction in delay at the intersection for all periods of analysis with greatly improved operations and safety. Results of the capacity analysis for Build Alternative C are contained in Appendix E and are summarized in Table 4.

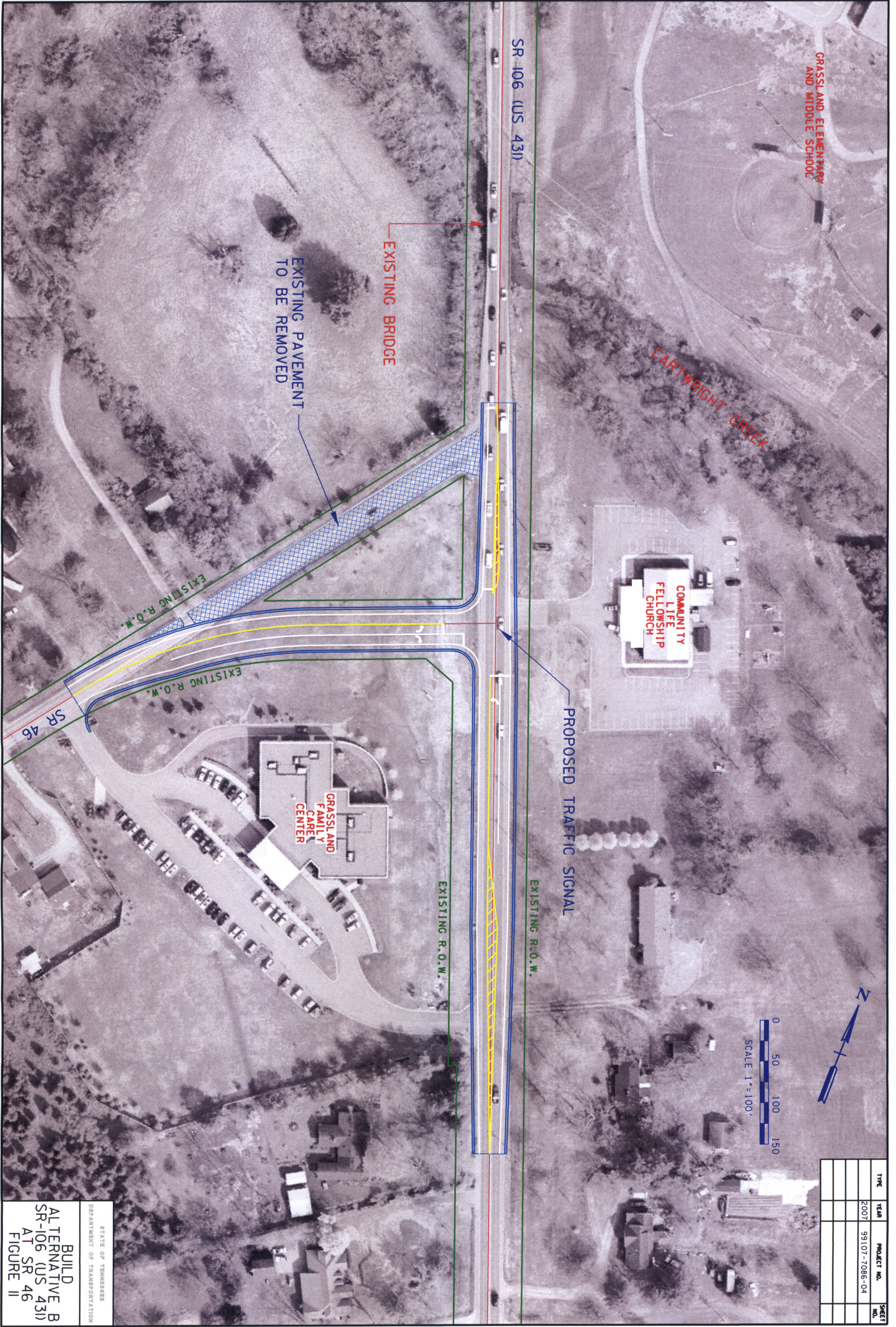
**Table 4. Capacity Analysis – Build Alternative C**

	A.M.				P.M.			
	AVG. DELAY	HCM LOS	HCM V/C	DECREASE IN AVG. DELAY*	AVG. DELAY	HCM LOS	HCM V/C	DECREASE IN AVG. DELAY*
2006	21.9	C	0.90	52.5%	51.2	D	1.10	45.9%
2011	52.3	D	1.07	72.4%	115.9	F	1.34	44.4%
2031	161.4	F	1.46	41.6%	276.7	F	1.84	51.1%

\* - Percent decrease in average delay based on build alternative compared to no-build alternative.



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TYPE	YEAR	PROJECT NO.	SHEET NO.
	2007	99107 - 7086 - 04	

STATE OF TENNESSEE  
 DEPARTMENT OF TRANSPORTATION  
 BUILD  
 ALTERNATIVE B  
 SR-106 (US 431)  
 AT SR 46  
 FIGURE II

**SUMMARY DATA TABLE**

<u>ITEM</u>	<u>BUILD ALTERNATIVE B</u> <u>(SR-106 / SR-46)</u>
Functional Class	U. Art. / U. Coll.
System Class	STP
Length (Miles)	N/A
Cross Section (Feet)	24 - 36
Present AADT (2011)	26,280 / 4,890
Future AADT (2031)	36,070 / 6,780
DHV (2031)	3,968 / 746
% Trucks	4 / 6 (AADT) 3 / 4 (DHV)
Estimated Right-of-Way Acquisition (Acres)	0
Estimated Right-of-Way Tracts Affected	3
Estimated Family Displacements	0
Estimated Business Displacements	0
Estimated Non-Profit Displacements	0
Estimated Right-of-Way Cost	\$20,000
Estimated Utility Cost Reimbursable	\$0
Estimated Utility Cost Non-Reimbursable	\$20,000
Estimated Construction Cost	\$919,000
Estimated Preliminary Engineering Cost	\$92,000
Total Estimated Project Cost	\$1,051,000

FIGURE 12

## COST DATA SHEET

PROJECT S.R. 106 (U.S. 431) AT S.R. 46  
 LOCATION WILLIAMSON COUNTY  
 LENGTH  
 CROSS SECTION:

### RIGHT-OF-WAY

Land, Improvements & Damages	(# Acres	0)	
Incidentals	(# Tracts	3)	\$20,000
Relocation Payments	(Residences	0)	
	(Businesses	0)	
	(Non-Profits	0)	
<b>TOTAL RIGHT-OF-WAY COST</b>			<b>\$20,000</b>

### UTILITY RELOCATION

Reimbursable	
Non-Reimbursable	\$20,000
<b>TOTAL UTILITY ADJUSTMENT COST</b>	
<b>\$20,000</b>	

### CONSTRUCTIONS

Mobilization	\$15,000
Clear and Grubbing	\$7,000
Pavement Removal	\$10,000
Earthwork	\$50,000
Drainage (Erosion Control = \$25,000)	\$233,000
Structures (Preserv'n/Demol'n = \$0)	\$0
Concrete Curb and Gutter	\$70,000
Railroad Crossing	\$0
Paving	\$224,000
Retaining Walls	\$0
Maintenance of Traffic	\$30,000
Topsoil	\$20,000
Seeding	\$3,000
Sodding	\$21,000
Signing/Pavement Marking	\$4,000
Signalization	\$80,000
Fence	\$0
Rock Walls	\$0
Guardrail	\$0
Rip-rap or Slope Protection	\$3,000
Other construction Items (8.5%)	\$65,000
10% Contingencies	\$84,000
<b>TOTAL CONSTRUCTION COST</b>	
<b>\$919,000</b>	
<b>Engineering Cost (10% of Constr.)</b>	
<b>\$92,000</b>	

**TOTAL ESTIMATED COST (Build Alternative B) \$1,051,000**

Conceptual layout of this alternative is shown in Figure 14. The estimated project cost for Build Alternative C is \$1,092,000. A Summary Data Table is shown on Figure 15, and a Cost Data Sheet summarizing the estimated cost is shown in Figure 16.

## **Disposition of Existing Route**

Build Alternatives A, B, and C require changes in the alignment of SR-46 but not for SR-106. The abandoned section of SR-46 should be removed and this area used as additional storm water detention volume.

## **Bicycle and Pedestrian Accommodation**

Representatives of Williamson County were consulted to determine the need and/or desirability of bicycle and pedestrian accommodations. Due to connectivity issues associated with the existing facilities and the limited length of construction of this project, Williamson County does not wish to include bicycle or pedestrian accommodations in this project. However, they do want a design that would not preclude the addition of these facilities when corridor improvements are made at a later date. The typical section includes 6-foot paved shoulders which can accommodate bicycle lanes and a 10-foot utility strip, which can accommodate sidewalks. There are no recommendations at this time to incorporate bicycle or pedestrian facilities with the intersection improvement project.

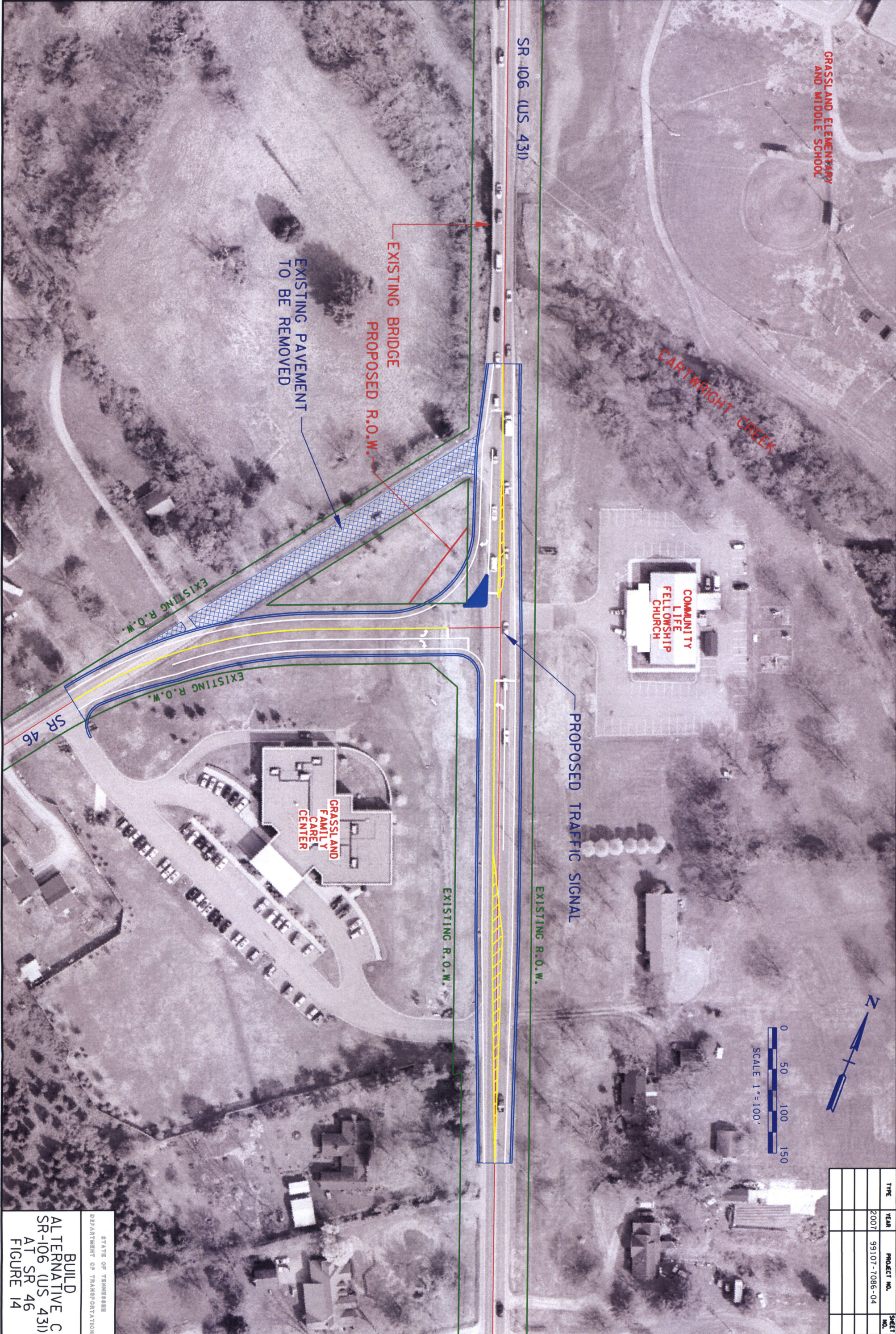
## **Environmental Review**

A preliminary review of floodplains, jurisdictional waters, wetlands, threatened and endangered species, historic properties, and hazardous materials located in and around the project site was performed to determine if any and what environmental impacts from the project might be expected. A map showing environmental areas of concern is shown on Figure 17. The following segments describe the methods used and the findings of this environmental review.

### **Flood Zone Review**

Executive Order No. 11988, *Floodplain Management* was enacted May 24, 1977, under President Jimmy Carter. Its purpose is “to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modifications of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.” The executive order requires each agency to investigate floodplain conditions for a proposed federally financed (or assisted) action to reduce the risk of flood loss, minimize the impact of floods on human safety, and to preserve the natural and beneficial values served by floodplains. ARCADIS performed a preliminary Flood Zone Review for proposed intersection improvements to SR-106 and SR-46 in Williamson County, Tennessee.

The Federal Emergency Management Authority (FEMA) Flood Insurance Rate Map (FIRM) for Williamson County, Tennessee, was reviewed to determine if the proposed intersection is located in the base flood zone (Map No. 47187C0070F, revised September 29, 2006). A copy of this map is provided in Appendix F. The base flood zone is defined as the area located in the 100-year floodplain. This area is subject to flooding by the 1 percent annual chance flood. The SR-106 and



TYPE	YEAR	PROJECT NO.	SHEET NO.
	2007	99107-7086-04	

STATE OF TENNESSEE  
 DEPARTMENT OF TRANSPORTATION  
 BUILD ALTERNATIVE C  
 SR-106 (US 431)  
 AT SR 46  
 FIGURE 14

### SUMMARY DATA TABLE

<u>ITEM</u>	<u>BUILD ALTERNATIVE C</u> (SR-106 / SR-46)
Functional Class	U. Art. / U. Coll.
System Class	STP
Length (Miles)	N/A
Cross Section (Feet)	24-36
Present AADT (2011)	26,280 / 4,890
Future AADT (2031)	36,070 / 6,780
DHV (2031)	3,968 / 746
% Trucks	4 / 6 (AADT) 3 / 4 (DHV)
Estimated Right-of-Way Acquisition (Acres)	0.07
Estimated Right-of-Way Tracts Affected	3
Estimated Family Displacements	0
Estimated Business Displacements	0
Estimated Non-Profit Displacements	0
Estimated Right-of-Way Cost	\$30,000
Estimated Utility Cost Reimbursable	\$0
Estimated Utility Cost Non-Reimbursable	\$20,000
Estimated Construction Cost	\$947,000
Estimated Preliminary Engineering Cost	\$95,000
<b>Total Estimated Project Cost</b>	<b>\$1,092,000</b>

FIGURE 15

## COST DATA SHEET

PROJECT S.R. 106 (U.S. 431) AT S.R. 46  
 LOCATION WILLIAMSON COUNTY  
 LENGTH  
 CROSS SECTION:

### RIGHT-OF-WAY

Land, Improvements & Damages	(# Acres	0.07)	\$10,000
Incidentals	(# Tracts	3)	\$20,000
Relocation Payments	(Residences	0)	
	(Businesses	0)	
	(Non-Profits	0)	

**TOTAL RIGHT-OF-WAY COST \$30,000**

### UTILITY RELOCATION

Reimbursable	
Non-Reimbursable	\$20,000

**TOTAL UTILITY ADJUSTMENT COST \$20,000**

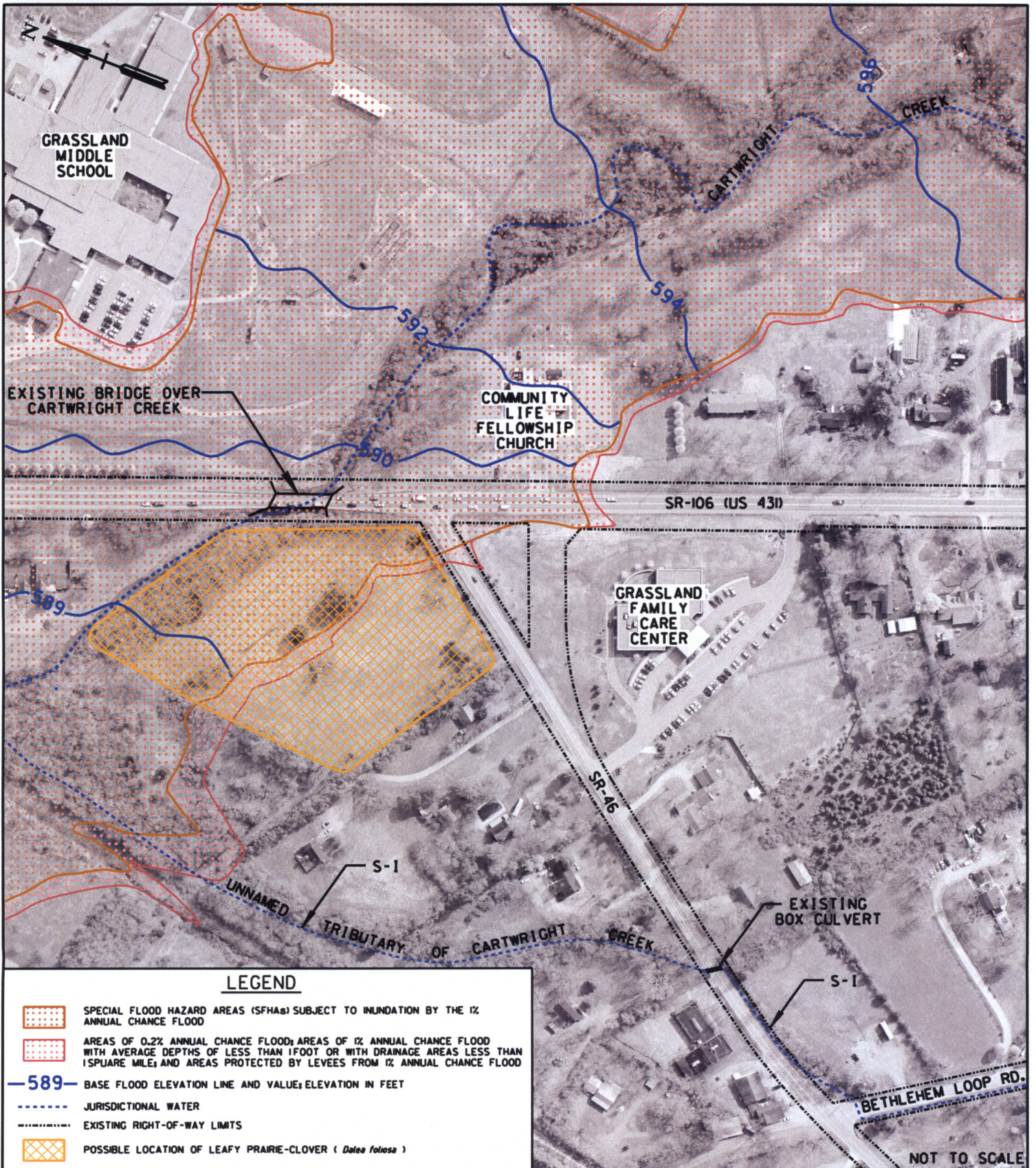
### CONSTRUCTIONS

Mobilization	\$15,000
Clear and Grubbing	\$7,000
Pavement Removal	\$10,000
Earthwork	\$50,000
Drainage (Erosion Control = \$25,000)	\$233,000
Structures (Preserv'n/Demol'n = \$0)	\$0
Concrete Curb and Gutter	\$73,000
Railroad Crossing	\$0
Paving	\$228,000
Retaining Walls	\$0
Maintenance of Traffic	\$30,000
Topsoil	\$20,000
Seeding	\$3,000
Sodding	\$22,000
Signing/Pavement Markings	\$4,000
Signalization	\$80,000
Fence	\$0
Rock Walls	\$0
Guardrail	\$16,000
Rip-rap or Slope Protection	\$3,000
Other construction Items (8.5%)	\$67,000
10% Contingencies	\$86,000







**TOTAL CONSTRUCTION COST \$947,000**

**Engineering Cost (10% of Constr.) \$95,000**

**TOTAL ESTIMATED COST (Build Alternative C) \$1,092,000**



**LEGEND**

-  SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
-  AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD
-  **589**— BASE FLOOD ELEVATION LINE AND VALUE; ELEVATION IN FEET
-  JURISDICTIONAL WATER
-  EXISTING RIGHT-OF-WAY LIMITS
-  POSSIBLE LOCATION OF LEAFY PRAIRIE-CLOVER (*Dalea foliosa*)



ENVIRONMENTAL AREAS OF CONCERN  
 INTERSECTION IMPROVEMENTS  
 SR-106 (US-431) AT SR-46  
 WILLIAMSON COUNTY

DRAWN BY: TJC		CHECKED BY: ARF	
PROJECT NO.		99107-7086-46	
FIGURE 17		DATE: 01-23-07	



SR-46 intersection is located in Zone AE of the FIRM maps, which is the 100-year flood zone. The base flood elevations for Zone AE have been determined and are denoted on the FIRM maps. The base flood elevations in the proposed project area are 589 feet, 590 feet, and 592 feet (NAVD 88 elevations). This flood zone area is created by Cartwright Creek, which exists adjacent to the proposed project. Flood zone information is shown in Figure 18.

The proposed project plan includes three possible build alternates: Build Alternative A, Build Alternative B, and Build Alternative C. Each alternate will encroach on the 100-year flood zone area. The encroachments are summarized as follows:

#### Build Alternative A

Build Alternative A proposes to realign SR-46 to intersect SR-106 at a 90 degree angle. This action will move the intersection approximately 200 feet south of the existing intersection. The proposed new alignment for Build Alternative A is not located in the 100-year flood zone area. However, this Alternative would require the existing roadway to be removed, which is located in the 100-year flood zone area. The disturbance of the floodplain would be minimal however, as only 100 feet of the existing roadway lies in the floodplain.

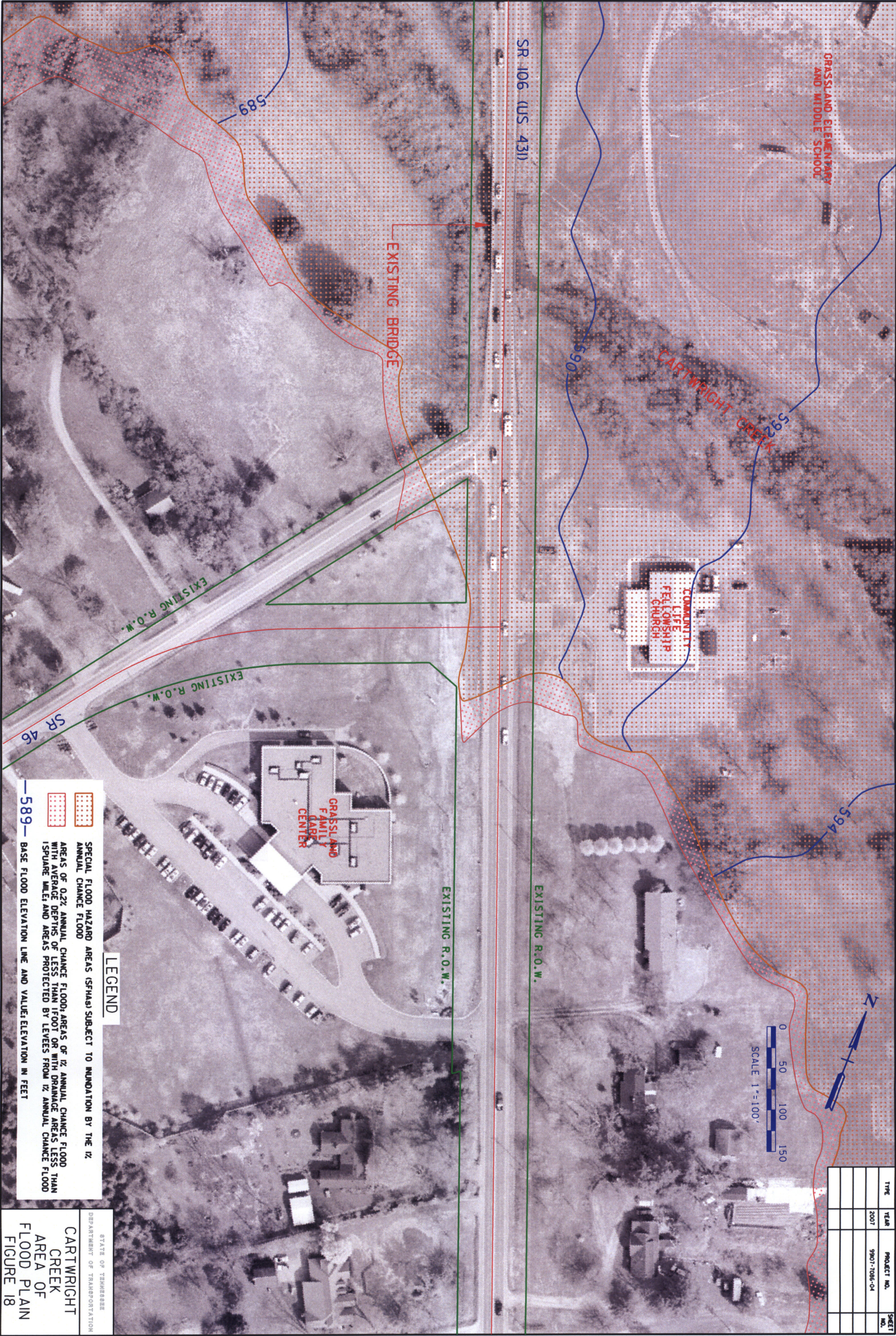
#### Build Alternative B

Build Alternative B proposes to realign SR-46 to intersect SR-106 at a 90 degree angle (identical to Build Alternative A) and also adds a left turn lane on SR-106 for vehicles traveling north. The encroachments on the 100-year floodplain would be the same as in Alternative A with the addition of a small encroachment for construction for the left turning lane on SR-106. Again, however, the construction would have a minimal encroachment on the 100-year floodplain zone.




#### Build Alternative C

Build Alternative C combines Alternates A and B and adds an additional right turn lane to SR-106 for vehicles traveling south to turn onto SR-46. The entire length of the proposed right turn lane is located in the 100-year flood zone. Build Alternative C has the largest encroachment to the 100-year flood zone, however, the impact to the floodplain is still anticipated to be minimal.

Based on the information provided in the FEMA FIRM maps described above, ARCADIS has determined that the proposed project is located in a 100-year flood zone area. While each alternative makes some encroachment into the 100-year flood zone, the impacts are expected to be minimal for all three alternates. The limits of the flood zones are shown in the environmental areas of concern map. Correspondence with local and state agencies, municipalities, and the U.S. Army Corps of Engineers should be conducted throughout the design phases to ensure any alteration or new construction would comply with applicable local, state, and federal regulations. The proposed design for the SR-106 and SR-46 intersection improvements should include a complete hydrologic and hydraulic analysis by a professional engineer. The analysis should evaluate the capacity of the floodplain to store or carry water based on proposed designs.



LEGEND

-  SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
-  AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1FOOT OR WITH DRAINAGE AREAS LESS THAN 1SPURF MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD
-  589- BASE FLOOD ELEVATION LINE AND VALUE; ELEVATION IN FEET

TYPE	YEAR	PROJECT NO.	SHEET NO.
	2007	9907-7086-04	

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION

**CARTWRIGHT CREEK AREA OF FLOOD PLAIN**  
FIGURE 18

According to Executive Order 11988, “the agency [TDOT] shall consider alternatives to avoid adverse effects and incompatible development in the floodplains.” In addition, the executive order states that if alternatives that do not adversely affect the floodplain are unavailable, “the agency [TDOT] shall, prior to taking action, design or modify its action in order to minimize potential harm to or within the floodplain” and “prepare and circulate a notice containing an explanation of why the action is proposed to be located in the floodplain.” In addition, it should be noted that executive order 11988 states that “each agency shall also provide the opportunity for early public review of any plans or proposals for actions in floodplains in accordance with Section 2(b) of Executive Order No. 11514,” *Protection and Enhancement of Environmental Quality*, where federal funding is involved.



Existing bridge over Cartwright Creek (Southbound SR-106)



Existing bridge over Cartwright Creek (Northbound SR-106)

### **Jurisdictional Waters and Wetlands Investigation**

Waters of the U.S. (jurisdictional waters), including wetlands, as defined by 33 CFR Part 328.3(b), are protected by Section 404 of the Federal Clean Water Act (33 USC 1344), and by the Tennessee Water Quality Control Act (T.C.A. 69-3-108(b)) within Tennessee. Impacts and alterations to jurisdictional waters in Tennessee are regulated by the U.S. Army Corps of Engineers (USACE) and the Tennessee Department of Environment and Conservation (TDEC). Verification of potential jurisdictional waters, if found during a site investigation, should therefore be performed by qualified representatives of the USACE and TDEC.

On Wednesday, December 13, 2006, an ARCADIS biologist performed a field investigation to determine the existence of potential jurisdictional waters and wetlands within the project limits and surrounding areas. Protocol utilized to determine the presence of jurisdictional wetlands was done in accordance with the methodology outlined in the 1987 USACE Wetlands Delineation Manual (Manual). According to the Manual, presence of all three wetlands indicators, including hydrophytic vegetation, hydric soils, and wetland hydrology, are required under normal circumstances to make a positive wetland determination. Available remote sensing data, including mapping and information obtained from the U.S. Geological Survey (USGS), U.S. Fish & Wildlife Service (USFWS) National Wetlands Inventory (NWI), Natural Resources Conservation Service (NRCS) and the Williamson County Soil Conservation District, were also referenced to determine potential presence of jurisdictional waters and wetlands on the project site.

Field reconnaissance began southwest of the project site, at the intersection of SR-46 and Bethlehem Loop Road. During review of the Bellevue, Tennessee USGS topographical quadrangle map, a “blue-line” (jurisdictional) stream was identified which terminates prematurely on the USGS topographic map (i.e. prior to entering a larger water body downstream and within the same watershed). The USGS topographic map depicts the terminus of the stream adjacent to SR-46 and south of the project site. Review of the area revealed that the stream, an unnamed tributary to Cartwright Creek (S-1), had been previously channelized in a roadside ditch adjacent to Bethlehem Loop Road. The stream is then conveyed beneath Bethlehem Loop Road by a reinforced concrete box culvert (RCBC) before paralleling the northbound lane of SR-46. The stream flows approximately 300 feet before crossing under SR-46 in a northwesterly direction via another RCBC. The stream eventually ties into Cartwright Creek and never enters the proposed project limits. See the environmental areas of concern map for the approximate location of Cartwright Creek and the unnamed tributary to Cartwright Creek.

The field review continued to the southwest corner of the project site, adjacent to SR-46. The proposed realignment of SR-46 in Build Alternative A, Build Alternative B, and Build Alternative C, begins near the parking lot entrance to Grassland Family Care Center (Center) from SR-46. Beyond the paved entrance, the proposed alignment continues in its entirety through lawn maintained by the Center. Additional vegetation within the proposed alignment consists solely of ornamental trees and shrubs. An existing roadside ditch located adjacent to SR-46 is also vegetated with maintained lawn and contained no standing or flowing water.

Prior to its proposed intersection with SR-106, the proposed alignment passes through a portion of an existing storm water detention basin. The basin is vegetated with a maintained lawn, is well drained, and contains no standing water (see photographs). Additionally, soil samples taken within the basin had a Munsell Soil Color Chart matrix chroma of 3 or greater with no mottles, which indicates aerobic (or non-wetland) conditions. Due to its intended and previously permitted purpose of storm water control, the area is not subject to jurisdiction by the USACE and TDEC.

The remaining portion of the proposed project site includes existing right-of-way located adjacent to the existing southbound lane of SR-106. Conditions observed in the area from the current intersection to the southeast corner of the Center’s property, include maintained lawn and a roadside ditch, which is also vegetated with maintained lawn. No standing or flowing water was observed in this ditch. A paved entrance to the Center’s parking lot from SR-106 is also located at the southeast corner of the Center’s property.

Storm water from the current property limits of the Grassland Family Care Center, including the existing roadside ditches and detention pond discharge into a roadside ditch located north of the intersection of SR-46 and SR-106. The ditch, which is adjacent to the southbound lane of SR-106, discharges to Cartwright Creek approximately 100 feet north of the intersection. Adjacent properties which also contribute storm water to this ditch contain single-family residential homes, maintained lawn, pasture, and wooded areas.

Conditions observed on the proposed project site did not exhibit characteristics of jurisdictional wetlands, as outlined in the 1987 USACE Wetland Delineation Manual. Additionally, no potential jurisdictional waters, as defined by 33 CFR Part 328.3(b), were observed within the proposed project limits. The USFWS NWI map along with the other reference sources cited above also reflect a lack of jurisdictional waters and wetlands on the project site. No streams are depicted within the project limits on the USGS quadrangle map (Bellevue, Tennessee) on which the site is located. However, it should be noted that storm water from the proposed project site eventually discharges into Cartwright Creek.

Two minor wetland areas, consisting of impounded and excavated ponds (PUBHh and PUBHx), are depicted off-site of the proposed project on the NWI Map (northeast of the SR-46 and SR-106 intersection and Cartwright Creek). However, comparison with additional map sources and aerial photography reveal that the Grassland Elementary and Middle School is now present in the location of these wetland areas. It is presumed that the ponds were filled during development and construction of the school site.

The soil types within the project area, as depicted on the NRCS Soil Survey for Williamson County, Tennessee, consist primarily of Armour Silt loam, 2 to 5 percent slopes (ArB) and Maury Silt Loam, 2 to 5 percent slopes, eroded (MbB2). Additional soil types include Armour Silt Loam, 2 to 5 percent slopes, eroded (ArB2) and Armour Silt Loam, 5 to 12 percent slopes, eroded (ArC2). All of these soil types are classified as well-drained, and none are included on the NRCS Hydric Soils List for Tennessee.

Based on the results of the field investigation in combination with available resource data, coordination with the USACE and TDEC for the obtainment of permits for impacts and/or alterations to jurisdictional waters and wetlands is not required for Build Alternative A, Build Alternative B, or Build Alternative C as presented in this report.



Detention area adjacent to Intersection of SR-106 and SR-46.



Roadside ditch along east side of northbound approach of SR-106



Roadside ditch along west side of northbound approach of SR-106

### **Threatened and Endangered Species Review**

The United States Department of the Interior, U.S. Fish and Wildlife Service, was consulted to determine if any threatened or endangered species or their habitats occur in the proposed project area. The department revealed that the leafy prairie-clover (*Dalea foliosa*) may exist in the project area. Before the U.S. Fish and Wildlife Service can confirm that the leafy prairie-clover does not exist they will require an additional investigation (beyond the scope of this study). They suggest recruiting a qualified biologist to study the area for this species. The findings of this study may then be submitted to their agency for a review and reevaluation. The open field directly adjacent to the proposed project intersection is the most likely location of the leafy prairie-clover (see the environmental areas of concern map). However, the biologist should investigate the entire project site for the presence of this species. A copy of the letter from the U.S. Fish and Wildlife Service is contained in Appendix G.



### Historic Properties Review

Members of the ARCADIS staff performed a reconnaissance in the project area to document and record adjacent buildings and structures near and around the SR-106 and SR-46 intersection. During the field investigation, it did not appear that any buildings or structures existed in the project area that would be eligible for listing on the National Register of Historic Places. In addition, an online search of records for Williamson County did not reveal any structures on or around the project site that were eligible for listing.

ARCADIS submitted a report with the conclusions of their investigation to the Tennessee Historical Commission and asked for their concurrence with the findings. The Commission responded and confirmed that “there are no national register of historic places listed or eligible properties affected by this undertaking.” In addition, The TDOT Environmental Division performed a records search at the Tennessee State Historic Preservation Office for eligible historic properties. The Historic Preservation Manager reported that they “identified no properties in the proposed project area listed on or eligible for listing.” Copies of the concurrence letters are contained in Appendix H.



Residential home located on SR-46 near intersection with SR-106.



Montpier historical information plaque adjacent to intersection.

### **Hazardous Materials**

On January 4, 2007, ARCADIS conducted a visual site inspection of the SR-106 and SR-46 intersection. The purpose of the inspection was to search for evidence of hazardous waste or hazardous waste handling in the proposed project area. The intersection is located in an area of predominantly un-improved land and residential properties in Williamson County, Tennessee. Site improvements on an adjacent property to the intersection include a brick building operated as the Grassland Family Care Center, a medical clinic. Groundcover on the periphery of the medical clinic property was noted to be grassy covered with no signs of stressed vegetation or stained soils. There were no visual signs indicating current or historical uses of underground storage tanks (USTs) or aboveground storage tanks (ASTs) in the proposed project area.

Federal and state regulatory agency databases were reviewed to evaluate the proposed project area and other sites in the vicinity of project that use, store, treat, generate, dispose, or otherwise handle hazardous materials. RCADIS subcontracted this task to Environmental Data Resources, Inc. (EDR). A copy of the report generated by EDR is located in Appendix I. The following federal and state databases were reviewed as part of this investigation. The date of most-recent update used for each database is included in the following:

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Site – 08/09/06: The CERCLIS database is USEPA’s comprehensive database and management system that inventories and tracks releases addressed, or needing to be addressed, by the Superfund program. The database includes “inactive releases” (those where a determination has been made, based on available information, that no further action is needed) and “active releases” (those that have not been assessed yet or where it has been determined that further action is necessary).

National Priorities List (NPL/Superfund) – 9/27/06: The NPL is USEPA’s list of uncontrolled hazardous substance facilities that need to be addressed under the Superfund program. A subset of the CERCLIS database, the NPL includes the sites determined most likely to pose an environmental risk.

Resource Conservation Recovery Information System (RCRIS) – 6/13/06: This USEPA database includes selective information on sites that generate, store, treat, and/or dispose of hazardous waste in small and large quantities as defined by Resource Conservation and Recovery Act (RCRA).

Emergency Response Notification System (ERNS) – 12/31/05: ERNS is a database shared by USEPA and the National Response Center of the U.S. Coast Guard storing information on reported releases of oil and hazardous substances.

RCRA Administration Action Tracking System (RAATS) - 04/17/95: RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by USEPA.

Registered Underground Storage Tanks – 03/04/05: USTs are regulated under RCRA and must be registered with the state department responsible for administering the UST program. The search radius for the UST database is 600 feet (subject property and adjoining properties).

Additional federal government records which were searched included: Biennial Reporting System (BRS), Delisted NPL, Superfund Consent Decrees (CONSENT), Corrective Action Report (CORRACTS), Facility Index System (FINDS), Hazardous Materials Information Reporting System (HMIRS), Material Licensing Tracking System (MLTS), Federal Superfund Liens (NPL Liens), PCB Activity Database System (PADS), Records of Decision (ROD), Toxic Chemical Release Inventory System (TRIS), and Toxic Substances Control Act (TSCA). Additional state government records that were searched include State Hazardous Waste Sites (SHWS), Tennessee LUST, Drycleaners, ASTs, and Solid Waste Facilities/Landfill Sites (SWF/LF).

The proposed project area was not identified on any of the databases searched by EDR.

A copy of the Warranty Deed was obtained from Sadie Wade, Register of Deeds, Williamson County for the Grassland Family Care Center and is included in Appendix J. Review of the deed did not indicate any handling of hazardous materials by previous owners or activity and use limitations associated with the medical center.

Information reviewed by ARCADIS as part of this assessment reveals no evidence of hazardous waste handling in connection with the proposed project site or the surrounding area. However, this investigation was not intended to meet the standard practices for Environmental Site Assessments as set forth in ASTM E 1527-5 for Phase I Environmental Site Assessment Process.



Looking northeast along SR-46 toward intersection.



Looking north along SR-106 toward intersection.



Looking southwest along SR-46 from intersection.

## Assessment of Options

The Tennessee Department of Transportation has adopted seven guiding principles against which all transportation projects are to be evaluated. These guiding principles address concerns for system management, mobility, economic growth, safety, community, environmental stewardship, and fiscal responsibility. These Guiding principles are discussed in the following paragraphs as they relate to the alternates for improving the intersection of SR-106 and SR-46.

### **Guiding Principle 1: Preserve and Manage the Existing Transportation System**

The intersection of SR-106 and SR-46 is currently approaching capacity during the peak hour traffic periods. As traffic volume increases in the corridor continue, this condition could extend into off peak traffic periods. While none of the Build Alternates will solve the capacity constraints at the intersection, Build Alternative A, B, and C, all of which involve construction of additional lanes at the intersection, will reduce the average vehicle delays and improve operations. Build Alternative C provides the greatest reduction in delay and the most improvement in operations but also will be the most costly of the alternatives also requiring some additional right-of-way. Realignment of the intersection contained in Build Alternatives A, B, and C will provide an improvement in safety by providing better sight distance and improved turning radii. None of the build alternatives have a significant impact on adjacent properties.

### **Guiding Principle 2: Move a Growing, Diverse, and Active Population**

Williamson County is amongst the fastest growing populations in Tennessee. With a 21.3 percent population growth from 2000-2005, the community continues to thrive with additions of neighborhoods, schools, and businesses. With population growth on the rise, so is the demand on the local infrastructure. Unfortunately, some local roadways do not have the capacity to effectively move the increased number of vehicles traveling in Williamson County each day. One example, SR-106, is a major north/south thoroughfare that has become increasingly congested due to the population increase.

Specific to the traffic congestion problem is the intersection of SR-106 and SR-46. Existing conditions at this intersection cause major delays in the morning and evening peak hour traffic, which function at a level of service D and F, respectively. The proposed project improvements will help move the traffic through this intersection more effectively in both morning and evening rush hours and although no off-peak calculations were performed, similar results would be expected in the off-peak periods. While Build Alternative A and Build Alternative B begin to address the safety and congestion issues at SR-106 and SR-46, Alternative C provides the most comprehensive solution to the problem. The addition of left and right turning lanes on SR-106 will prevent the interference of turning movements onto SR-46 by removing these vehicles from the through traffic stream. In addition, all build alternatives address the need to realign SR-46 with SR-106 at a safer angle of 90 degrees. The existing angle at which SR-46 is aligned is a safety hazard for all of the traveling population, especially those traveling in larger vehicles.

### **Guiding Principle 3: Support the State's Economy**

SR-106 serves as a north-south route for citizens traveling through Williamson County and the City of Franklin to surrounding counties and the Nashville metropolitan area. Approximately 46.5 percent of Williamson County residents work in other counties in Tennessee. A large percentage of those residents have a travel time of 30 minutes or more to work each day and 91.1 percent of those travel by car, truck, or van. Transportation projects such as the SR-106 and SR-46 intersection improvements help to support Tennessee's economy by providing improved traveling conditions for the work force in this area.

Not only are people traveling to work on SR-106, but they are traveling to nearby shopping areas, restaurants, and other retail industries in and around Nashville. Over half of the residents living in Williamson County earn more than \$75,000 each year. An improved infrastructure in this area will continue to encourage residents to live, work, and shop in Williamson County.

### **Guiding Principle 4: Maximize Safety and Security**

The intersection crash rate of 0.58 for SR-106 and SR-46 is lower than the statewide average crash rate of 0.75. However, 83 percent of the crashes during the study period were rear-end and possibly due to congestion at the intersection. All three Build Alternatives will reduce the congestion and improve operations at the intersection and should maximize safety until future corridor improvements can be made.

### **Guiding Principle 5: Build Partnerships for Livable Communities**

Part of TDOT's Long Range Transportation Plan is to promote projects that have public and community support. While no formal public involvement process has been implemented for the proposed project, there is no known opposition to the project at this time. Build Alternatives A, B, and C are anticipated to have very little (if any) negative impact to the surrounding community. While construction of the proposed project may cause temporary excess congestion, the overall product will benefit everyone in the community by improving safety conditions and relieving daily congestion on the roadway.

### **Guiding Principle 6: Promote Stewardship of the Environment**

This report includes results from an environmental review performed on the proposed project site and the surrounding area. The purpose of the review was to identify environmental concerns early in the project planning process and identify environmental agencies that will need to be involved throughout the life of the project. Environmental areas of review include a flood zone review, a jurisdictional waters and wetlands investigation, a threatened and endangered species investigation, a historical properties investigation, and a hazardous materials review.

The results of these studies indicated that the proposed project has two possible environmental issues to note. First, the project is located in a 100-year flood zone area and second, there is a possibility that the leafy prairie-clover (*Dalea foliosa*) a threatened and endangered species, may exist in the project area. While these areas are noted to require special attention, they are expected to have minimal (if any) negative impacts. Build Alternative C is anticipated to encroach on these areas more than Build Alternative A or Build Alternative B. Recommendations have been made in

this report on the appropriate action to proceed with environmental studies. An environmental area of concern map is also included to help demonstrate the locations of the possible environmental concerns. Table 5 is a comparison of each alternative.

**Table 5. Comparison of Environmental Considerations**

Option	Floodplains	Waters & Wetlands	Hazardous Materials	Threatened/Endangered Species	Historical Properties
No Build	x	x	x	x	x
Build Alt A	•	x	x	x	x
Build Alt B	•	x	x	x	x
Build Alt C	•	x	x	•	x

• Indicates a possible encroachment  
 x No encroachment or N/A

**Guiding Principle 7: Promote Financial Responsibility**

Project cost estimates were prepared for each considered alternative and are summarized in Table 6.

**Table 6. Construction Cost Comparisons**

Alternative	No. of New Lanes	Reduction in Avg. Veh. Delay - 2006 (Seconds)		Reduction in Avg. Veh. Delay - 2011 (Seconds)		Reduction in Avg. Veh. Delay - 2031 (Seconds)		Probable Project Cost
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	
No-Build	n/a	n/a	n/a	n/a	n/a	n/a	n/a	\$0.00
Build Alternative A	1	10.2	6.2	26.9	17.9	39.8	61.8	\$593,000.00
Build Alternative B	2	14.6	7.1	108.4	39.8	59.7	203.6	\$1,051,000.00
Build Alternative C	3	24.2	43.4	137.3	92.5	114.9	289.2	\$1,092,000.00

**Summary**

SR-106 in Williamson County is a major arterial (two-lane) roadway with an increasingly large number of peak hour commuters each day. SR-106 connects Williamson County and the City of Franklin to the Nashville metropolitan area via this existing north-south highway. Traffic volumes in Williamson County have increased dramatically over the past few years largely due to a documented 21.3 percent increase in population from 2000 to 2005. SR-46 intersects SR-106 just south of Cartwright Creek in Williamson County. SR-46 is two-lane collector roadway serving several residential areas in addition to some parcels of undeveloped land within the vicinity of its intersection with SR-106.

The traffic capacity analysis reveals that for 2006 peak hour traffic, the intersection of SR-106 and SR-46 operates at a LOS D in the A.M. and a LOS F in the P.M. Capacity analyses were also performed using forecasted traffic volumes for the future years, 2011 and 2031. The results of these analyses predict a LOS F for all peak hour traffic times. In addition to high traffic volumes, the



intersection of SR-106 and SR-46 is aligned at an acute angle causing difficulty with vehicular turning movements, especially for large trucks that pass through the intersection. Even with the abovementioned issues, the existing calculated crash rate for this intersection is presently less than the Tennessee statewide average crash rate.

Improvements to the intersection of SR-106 and SR-46 are needed to achieve the following criteria:

- Address the capacity, operational, and safety concerns at the intersection.
- Achieve an improved LOS (reduce the average delay) for both roadways.

Five options were considered in addressing the purpose and need of the project. The following is a summary and evaluation of these options:

#### **No Build Alternative**

- LOS of F in the A.M. peak and a LOS of F in the P.M. peak (2011 projected traffic counts).
- Provides no additional intersection capacity or improvements to operations or safety.
- Does not provide an improved LOS for either roadway.
- No additional right-of-way required.
- No environmental impact.

#### **Traffic Operations Alternative**

- Upgrade existing traffic signal equipment and signal operations at the intersection of SR-46 and SR-106 (install vehicle detection and improved signal timing).
- Provides very minimal improvements to intersection capacity.
- Does not provide improvements to safety.
- Provides slight measurable improvements to intersection operations.
- Does not provide an improved LOS for either roadway.
- Alternative was not given further consideration.

#### **Build Alternative A**

- Realign SR-46 to create perpendicular intersection with SR-106, including addition of left turn lane on SR-46.
- Reconfigure proposed traffic signal at new intersection.
- No roadway modifications to SR-106.
- LOS of F in the A.M. peak and a LOS of F in the P.M. peak (2011 projected traffic counts).
- Reduction in average delay by 26.9 seconds in the A.M. peak and an average delay reduction of 17.9 seconds in the P.M. peak (2011 projected traffic counts).
- Provides additional capacity to the intersection (left turn lane storage on SR-46).
- Improves intersection operations (new traffic signal along with better turning radii for vehicles and trucks).
- Increases safety (improves intersection sight distance and eliminates roadside ditches on SR-46).
- Provides improved LOS for SR-46, no improvements to SR-106.
- No additional right-of-way required.
- Minimal environmental impacts – floodplain.
- Estimate of project cost - \$593,000.

### **Build Alternative B**

- Realign SR-46 to create perpendicular intersection with SR-106, including the addition of left turn lanes on SR-46 and SR-106.
- Reconfigure proposed traffic signal at new intersection.
- LOS of F in the A.M. peak and a LOS of F in the P.M. peak (2011 projected traffic counts).
- Reduction in average delay by 108.4 seconds in the A.M. peak and an average delay reduction of 39.8 seconds in the P.M. peak (2011 projected traffic counts).
- Provides additional capacity to the intersection (left turn lane storage for both SR-46 and SR-106).
- Improves intersection operations (new traffic signal along with better turning radii for vehicles and trucks)
- Increases safety (improves intersection sight distance and eliminates roadside ditches on both SR-46 and SR-106).
- Provides improved LOS for both SR-46 and SR-106.
- No additional right-of-way required (possible need for slope easements).
- Minimal environmental impacts – floodplain.
- Estimate of project cost - \$1,051,000.

### **Build Alternative C**

- Realign SR-46 to create perpendicular intersection with SR-106, including the addition of left turn lanes on SR-46 and SR-106, and addition of right turn lane on SR-106.
- Reconfigure proposed traffic signal at new intersection.
- LOS of F in the A.M. peak and a LOS of F in the P.M. peak (2011 projected traffic counts).
- Reduction in average delay by 137.3 seconds in the A.M. peak and an average delay reduction of 92.5 seconds in the P.M. peak (2011 projected traffic counts).
- Provides additional capacity to the intersection (left turn lane storage for both SR-46 and SR-106 and right turn lane storage for SR-106).
- Improves intersection operations (new traffic signal along with better turning radii for vehicles and trucks)
- Increases safety (improves intersection sight distance and eliminates roadside ditches on both SR-46 and SR-106).
- Provides improved LOS for both SR-46 and SR-106.
- Moderate environmental impacts – floodplain and potential impact to threatened and endangered species (leafy prairie-clover).
- Requires additional right-of-way and slope easements.
- Estimate of project cost - \$1,092,000.

## Review Team

A field investigation of the site was made by the following individuals on December 6, 2006.

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