



# US 27/SR 1 WIDENING AND RECONSTRUCTION

EDS00-0027-00(159)(160)(174) and  
BRN-0027-03(018)  
Early, Clay, and Randolph Counties  
P.I. Nos.: 422230, 422220, 422235, 431531

Value Engineering Study Report  
90% Design Stage

September 2008

*Design Consultant*

**MA** Moreland Altobelli Associates, Inc.

*Value Engineering Consultant*



**Lewis & Zimmerman Associates, Inc.**



**Lewis & Zimmerman Associates, Inc.**

*Taking the Chance out of Change*

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September 25, 2008

Ms. Lisa L. Myers  
Design Review Engineer Manager  
Georgia Department of Transportation  
One Georgia Center  
600 West Peachtree Street, NW, 5<sup>th</sup> Floor  
Atlanta, Georgia 30308

re: Project Numbers EDS00-0027-00(159)(160)(174) and BRN-0027-03(018)  
P.I. Nos. 422230, 422220, 422235, and 431531  
US 27/SR 1 Widening and Reconstruction, Early, Clay and Randolph Counties  
Value Engineering Study Report

Dear Ms. Myers:

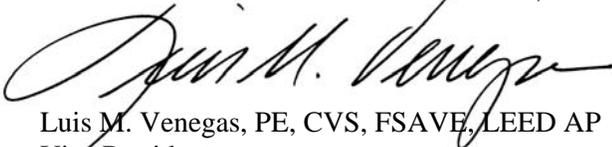
Lewis & Zimmerman Associates, Inc. (LZA) is pleased to submit this value engineering (VE) study report on the widening and reconstruction of US 27/SR 1. The goal of the project is to promote economic development in this corridor through an improved transportation network.

Although the majority of the corridor follows the existing alignment, EDS00-0027-00(159) departs from the current alignment on a new location to bypass the Environmentally Sensitive Area (ESA) historic area between Station 10+00 and Station 95+00, increasing the cost of the facility for minimal preservation of the ESA. As such, the objective of the VE study was to identify opportunities to reduce costs and improve the value of the project in terms of fulfilling the basic functions of increasing capacity and improving safety.

We thank you for your assistance during the course of the VE team's work. Please do not hesitate to call upon us if you or any of the reviewers have any questions regarding the information presented in this report.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



Luis M. Venegas, PE, CVS, FSAVE, LEED AP  
Vice President

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## EXECUTIVE SUMMARY

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### INTRODUCTION

This value engineering (VE) study report summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT). The subject of the study is the design of the US 27/SR 1 Widening and Reconstruction project, which comprises the following: EDS00-0027-00(159), P.I. No. 422230; EDS00-0027-00(160), P.I. No. 422220; EDS00-0027-00(174), P.I. No. 422235; and BRN-0027-03(018), P.I. No. 431531. The project is located in Early, Clay and Randolph Counties. The 90% Design Stage documents, developed by Moreland Altobelli Associates, Inc., were the basis of the VE study.

The VE workshop was held September 9 – 12, 2008 at GDOT Headquarters and comprised a multidisciplinary team of highway planning, design and construction specialists. The team used the following six-phased VE Job Plan to guide its deliberations:

- Information Gathering Phase
- Function Identification and Analysis Phase
- Speculation Phase
- Evaluation/Judgment Phase
- Alternative Development Phase
- Presentation of Alternatives Phase

### PROJECT DESCRIPTION

The following projects were the subject of the VE study:

- Project EDS00-0027-00(159), P.I. No. 422230: This project involves the widening of the existing two-lane US 27/SR 1 to a four-lane roadway with a 44-ft.-wide depressed grassed median. The roadway will be on a new location to the west, from south of CR 19 to approximately 4,000 ft. north of the intersection of US 27 and SR 37/Hartford Road. The Preliminary Field Plan Review (PFPR) was held on February 9, 2005. This project is currently scheduled for July 2009. The concept was approved January 31, 1995 and revised on June 7, 2002. Final roadway plans are 80% complete.
- Project EDS00-0027-00(160), P.I. No. 422220: This project consists of four 12-ft.-wide travel lanes (two in each direction) separated by a 44-ft.-wide depressed grassed median with 10-ft.-wide rural shoulders. The PFPR was held on May 9, 2006. This project is currently scheduled for March 2009. The concept was approved January 20, 1995 and final roadway plans are 95% complete.
- Project EDS00-0027-00(174), P.I. No. 422235: This project involves the widening of the existing two-lane US 27/SR 1 to a four-lane roadway with a 44-ft.-wide depressed grassed median. The existing bridge over the Georgia Southwestern Railroad will be replaced under twin project BRN00-0027-03(018), P.I. No. 431531 and a new parallel bridge will be constructed under EDS00-0027-00(174). The PFPR was held on March 3, 2005. This project is currently scheduled

for July 2009. The concept was approved January 31, 1995 and revised on June 7, 2002. Final roadway plans are 90% complete and final bridge plans are under review by GDOT's Office of Bridge Design.

The anticipated costs of construction are as follows:

	Construction Cost*	Right of Way Costs**	Reimbursable Utilities**
EDS00-0027-00(159)	\$ 27,003,754	\$ 5,769,000	\$ 421,685
EDS00-0027-00(160)	31,475,757	2,451,000	197,622
EDS00-0027-00(174)	28,219,317	3,350,000	319,061
BRN00-0027-03(018)	925,749	-	-
Subtotals	87,624,577	\$ 11,570,000	\$ 938,368
Grand Total	\$ 100,132,945		

\*No markups or contingency factors have been added to construction costs.

\*\* These figures are taken directly from the latest TPro documents.

## CONCERNS AND OBJECTIVES

Although the majority of the corridor follows the existing alignment, EDS00-0027-00(159) departs from the current alignment on a new location to bypass the Environmentally Sensitive Area (ESA) historic area between Station 10+00 and Station 95+00, which increases the cost of the facility for minimal preservation of the ESA.

Also, the traffic count does not warrant the use of 44-ft.-wide depressed grassed medians or 12-ft.-wide travel lanes.

The objective of the VE effort was to identify opportunities that would improve the value of the project in terms of fulfilling the basic functions of continuing the GRIP along this corridor, increasing capacity, improving safety, and where logical, reducing capital cost.

## HIGHLIGHTS OF THE STUDY

Highlighted below are some of the more promising ideas developed by the VE team.

### EDS00-0027-00(174)/BRN00-0027-03(018):

- Alternative Number (Alt. No.) 174-5 reduces the depressed grassed median to 32 ft. wide, reducing costs by about \$689,000.
- Alt. No. 174-6 reduces the width of the median to 20 ft., employs a cable barrier system, and minimizes the number of median openings, reducing costs by \$790,000.
- If 5-ft.-wide paved shoulders are used, as suggested in Alt. No. 174-7, savings of about \$460,000 are possible.
- If the inside travel lanes are reduced to a width of 11 ft., while maintaining the proposed 12-ft.-wide outside travel lanes, savings of about \$444,000 are possible, as shown in Alt. 174-16.
- Alt. No. 174-12 reduces the road profile by 3 ft., reducing costs by about \$723,000.

**EDS00-0027-00(159):**

- Alt. No. 159-2 reduces the depressed grassed median to 32 ft. wide, reducing costs by about \$940,000.
- Alt. No. 159-3 reduces the width of the median to 20 ft., employs a cable barrier system, and minimizes the number of median openings, reducing costs by \$1,363,000.
- If 5-ft.-wide paved shoulders are used, as noted in Alt. No. 159-4, savings of close to \$397,000 are possible.
- If the inside travel lanes are reduced to a width of 11 ft., while maintaining the proposed 12-ft.-wide outside travel lanes, savings of about \$393,000 are possible, as indicated in Alt. No. 159-11.
- Alt. No. 159-8 provides a unique solution to the concerns associated with the ESA historic area by providing a one-way pair along the proposed new location for southbound traffic and along the existing location for northbound traffic. Savings approaching \$3,124,000 are feasible with the added value of improving the existing location's two travel lanes.

**EDS00-0027-00(160):**

- Alt. No. 160-2 reduces the depressed grassed median to 32 ft. wide, reducing costs by about \$535,000.
- Alt. No. 160-3 reduces the width of the median to 20 ft., employs a cable barrier system, and minimizes the number of median openings, reducing costs by \$500,000.
- If 5-ft. paved shoulders are used, as noted in Alt. No. 160-4, savings of close to \$340,000 are possible.
- If the inside travel lanes are reduced to a width of 11 ft., while maintaining the proposed 12-ft.-wide outside travel lanes, savings of about \$376,000 are possible, as noted in Alt. No. 160-7.
- Alternative No. 160-5 reduces the road profile by about 3 ft., reducing costs by about \$1,018.
- Although a commitment was made to a property owner to provide a cattle crossing at Station 452+00, Alt. No. 160-13 eliminates the cattle crossing, reducing costs by \$2,795,000.
- Should a real need arise for a cattle crossing on an intermittent basis, a gated system similar to a railroad crossing could be employed across the at-grade roadway, as noted in Alt. No. 160-14, reducing costs by \$2,296,000.

The Summary of VE Alternatives following this narrative outlines all of the alternatives and the design suggestions developed by the VE team. A full listing of all of the ideas considered by the VE team can be found on the Creative Idea Listing in the Value Analysis and Conclusions section of the report.



# SUMMARY OF VE ALTERNATIVES

PROJECT: EDS00-0027-00(159)(160)(174), PIs 422230, 422220, 422235; and BRN00-0027-03(018), PI 431531

US 27/SR 2 WIDENING AND RECONSTRUCTION US 27/SR 1

Early, Clay, and Randolph Counties  
Design Development Stage

PRESENT WORTH OF COST SAVINGS

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST	RECURRING COST	TOTAL PW LCC
	<b>EDS00-0027-00(174)</b>					
174-1	Use the existing road to the Cuthbert-Randolph Airport	\$ 208,513	\$ 17,439	\$ 191,074		\$ 191,074
174-5	Reduce the median width to 32 ft.	\$ 688,600	\$ -	\$ 688,600		\$ 688,600
174-6	Reduce the median width to 20 ft. with a cable barrier and reduce the number of median openings	\$ 1,425,475	\$ 635,652	\$ 789,823		\$ 789,823
174-7	Use 5-ft.-wide paved shoulder	\$ 458,371	\$ 3,007	\$ 455,364		\$ 455,364
174-8	Minimize the number of beams on the bridges	\$ 31,922	\$ 16,814	\$ 15,108		\$ 15,108
174-10	Replace the box culvert with a precast system at Carter Creek - Stream #12	\$ 507,446	\$ 501,884	\$ 5,562		\$ 5,562
174-11	Replace the box culvert with a precast system for Stream #11	\$ 387,591	\$ 479,065	\$ (91,474)		\$ (91,474)
174-12	Evaluate the profile to reduce the quantity of required borrow	\$ 723,125	\$ -	\$ 723,125		\$ 723,125
174-16	Reduce the inside travel lanes to 11 ft. and retain 12-ft.-wide outside travel lanes	\$ 444,025	\$ -	\$ 444,025		\$ 444,025
	<b>EDS00-0027-00(159)</b>					
159-2	Reduce the median width to 32 ft.	\$ 940,224	\$ -	\$ 940,224		\$ 940,224
159-3	Reduce the median width to 20 ft. with a cable barrier and reduce the number of median openings	\$ 1,953,279	\$ 589,940	\$ 1,363,339		\$ 1,363,339
159-4	Use 5-ft.-wide paved shoulder	\$ 399,347	\$ 2,725	\$ 396,622		\$ 396,622
159-8	Reconfigure the alignment to create one-way pairs with the existing northbound roadway	\$ 3,123,542	\$ -	\$ 3,123,542		\$ 3,123,542
159-11	Reduce the inside travel lanes to 11 ft. and retain 12-ft.-wide outside travel lanes	\$ 393,887	\$ -	\$ 393,887		\$ 393,887



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## **STUDY RESULTS**

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### **INTRODUCTION**

The results of the value engineering study performed on the US 27/SR 1 Widening and Reconstruction project portray the benefits that can be realized on the project by GDOT, the design team and the users. The results will directly affect the project design and require coordination among the stakeholders to determine the ultimate acceptance of each alternative.

### **RESULTS OF THE STUDY**

The VE team generated 44 ideas for improvements to the project during the VE workshop. The evaluation of these ideas was based on their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally accepted standards and procedures, life cycle cost efficiency, safety, maintainability, constructibility and soundness of the idea.

Of the ideas generated, 32 were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 24 alternatives for change with an impact on project costs. These alternatives are presented in detail following this narrative and on the attached Summary of VE Alternatives table.

### **EVALUATION OF ALTERNATIVES**

It is important to consider each part of an individual alternative on its own merit. There may be a tendency to disregard an alternative because of concern about one portion of it. Separate consideration should be given to each of the areas within an alternative that are acceptable and those parts should be considered in the final design, even if the entire alternative is not implemented.

Cost is the primary basis of comparison for alternative designs. To ensure that costs are comparable within the alternatives proposed by the VE team, the designer's cost estimates, where possible, were used as the pricing basis. Where appropriate, the impact of energy costs, replacement costs, and effect on operations and maintenance are shown within each alternative.

Some of the alternatives are interrelated, so acceptance of one may preclude the acceptance of another. The reviewer should evaluate those alternatives carefully to select the ideas with the greatest beneficial impact to the project.



# SUMMARY OF VE ALTERNATIVES

PROJECT: EDS00-0027-00(159)(160)(174), PIs 422230, 422220, 422235; and BRN00-0027-03(018), PI 431531  
 US 27/SR 2 WIDENING AND RECONSTRUCTION US 27/SR 1  
 Early, Clay, and Randolph Counties  
 Design Development Stage

ALT. NO.	DESCRIPTION	PRESENT WORTH OF COST SAVINGS					TOTAL PW LCC
		ORIGINAL COST	ALTERNATIVE COST	INITIAL COST	RECURRING G COST		
	<b>EDS00-0027-00(174)</b>						
174-1	Use the existing road to the Cuthbert-Randolph Airport	\$ 208,513	\$ 17,439	\$ 191,074		\$ 191,074	
174-5	Reduce the median width to 32 ft.	\$ 688,600	\$ -	\$ 688,600		\$ 688,600	
174-6	Reduce the median width to 20 ft. with a cable barrier and reduce the number of median openings	\$ 1,425,475	\$ 635,652	\$ 789,823		\$ 789,823	
174-7	Use 5-ft.-wide paved shoulder	\$ 458,371	\$ 3,007	\$ 455,364		\$ 455,364	
174-8	Minimize the number of beams on the bridges	\$ 31,922	\$ 16,814	\$ 15,108		\$ 15,108	
174-10	Replace the box culvert with a precast system at Carter Creek – Stream #12	\$ 507,446	\$ 501,884	\$ 5,562		\$ 5,562	
174-11	Replace the box culvert with a precast system for Stream #11	\$ 387,591	\$ 479,065	\$ (91,474)		\$ (91,474)	
174-12	Evaluate the profile to reduce the quantity of required borrow	\$ 723,125	\$ -	\$ 723,125		\$ 723,125	
174-16	Reduce the inside travel lanes to 11 ft. and retain 12-ft.-wide outside travel lanes	\$ 444,025	\$ -	\$ 444,025		\$ 444,025	
	<b>EDS00-0027-00(159)</b>						
159-2	Reduce the median width to 32 ft.	\$ 940,224	\$ -	\$ 940,224		\$ 940,224	
159-3	Reduce the median width to 20 ft. with a cable barrier and reduce the number of median openings	\$ 1,953,279	\$ 589,940	\$ 1,363,339		\$ 1,363,339	
159-4	Use 5-ft.-wide paved shoulder	\$ 399,347	\$ 2,725	\$ 396,622		\$ 396,622	
159-8	Reconfigure the alignment to create one-way pairs with the existing northbound roadway	\$ 3,123,542	\$ -	\$ 3,123,542		\$ 3,123,542	
159-11	Reduce the inside travel lanes to 11 ft. and retain 12-ft.-wide outside travel lanes	\$ 393,887	\$ -	\$ 393,887		\$ 393,887	

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-1**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **USE EXISTING ROAD TO THE CUTHBERT-RANDOLPH** SHEET NO.: **1 of 4**  
**AIRPORT**

**ORIGINAL DESIGN:** (Sketch attached)

The design provides a new road for access to the Cuthbert-Randolph Airport and abandons the existing airport access road.

**ALTERNATIVE:** (Sketch attached)

Eliminate the new airport access road and retain the existing access road.

**ADVANTAGES:**

- Reduces construction cost
- Reduces right-of-way cost
- Not warranted

**DISADVANTAGES:**

- Eliminates an amenity

**DISCUSSION:**

Traffic count in the design year is extremely low and does not warrant a new roadway to the airport. If the airport is to expand in the future, a new access road could be considered at that time when firm plans are developed for the expansion. Currently, expansion of the airport is in the planning stages with no firm commitments as to the direction or amount of expansion.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 208,513	—	\$ 208,513
ALTERNATIVE	\$ 17,439	—	\$ 17,439
SAVINGS (Original minus Alternative)	\$ 191,074	—	\$ 191,074



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-1

SHEET NO.: 3 of 4

As Designed - Proposed New Airport Drive  
 Length = 1050' width = 24'

Full Pavement Depth same as US 25 according  
 to Roadway plans typical section:  
 See (Alt. 174-16, sheet 3) = \$42.60/sy

$$\text{Proposed Airport DR.} = \frac{(24' \times 1050')}{9 \text{ sf/sy}} = 2,800 \text{ s.y.}$$

Earthwork average:

$$(1050' \times 3' \times 60') = 7,000 \text{ c.y.}$$

Average / 27  $\frac{\text{sf}}{\text{cy}}$

Alternate Cost: if existing Airport Drive  
 Retained then cost to patch and overlay.

$$\frac{(20' \times 1100')}{9 \text{ sf/sy}} = 2,445 \text{ sy}$$

use: 135 lbs/sy  $\times \frac{1}{2000 \text{ lbs}} \times \$81.00 = \$5.47/\text{sy}$   
 (for overlay)

use: \$5.00/sy for Patching pavement

$$\text{use } 2,440 \text{ s.y.} \times 33\% = 813 \text{ sy}$$

(.33)



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-5**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE MEDIAN WIDTH FROM 44 FT. TO 32 FT.** SHEET NO.: **1 of 5**

**ORIGINAL DESIGN:** (Sketch attached)

The typical sections call for a 44-ft.-wide depressed grassed median.

**ALTERNATIVE:**

Reduce the depressed grassed median width to 32 ft.

**ADVANTAGES:**

- Reduces pavement costs
- Reduces right-of-way costs

**DISADVANTAGES:**

- Perceived loss of required clear zone
- Not a Department standard – but not excluded

**DISCUSSION:**

The use of a 32-ft.-wide depressed grassed median meets AASHTO design criteria for a four-lane, 65 mph rural highway.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 688,600	—	\$ 688,600
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 688,600	—	\$ 688,600

PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

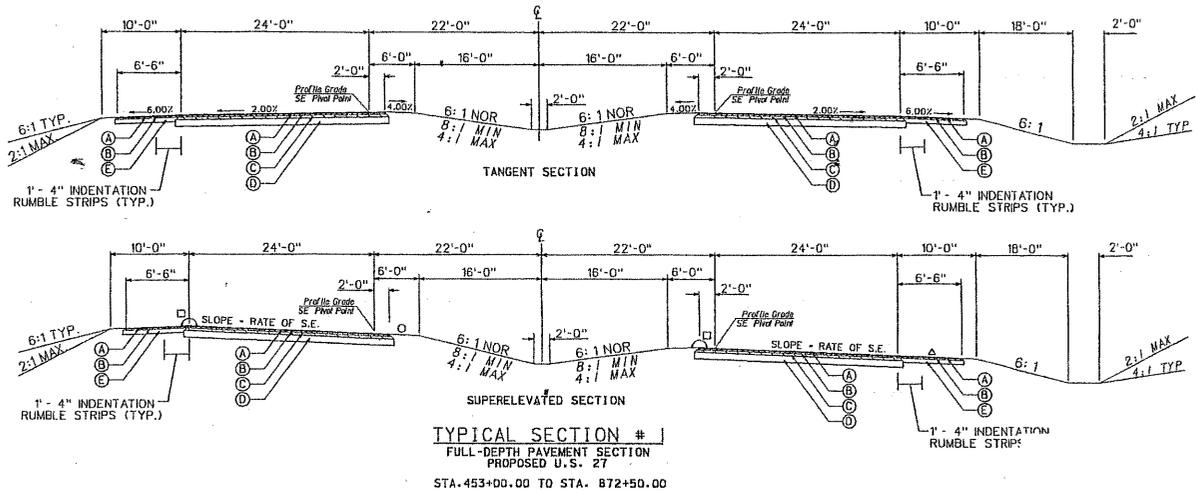
ALTERNATIVE NO.:

174-5

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 5

## TYPICAL SECTIONS



- SLOPE 4% OR RATE
- △ SLOPE 6.00% OR RA
- ALGEBRAIC DIFFERENTIAL SLOPES NOT TO EXC

**PAVEMENT**

- D ASPH CONC 9.5 mm SUPERPAVE. GP 2 ONLY. INCL BITUM MATL & H LIME 135 LBS/SY
- D ASPH CONC 19 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 220 LBS/SY
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 330 LBS/SY
- BASE CRS. 10". INCL MATL (ALT. #1)
- ED SOIL-CEM STAB BASE CRS. 8". INCL MATL AND HAUL (ALT. #2)
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 550 LBS/SY (ALT. #3)
- BASE CRS. 6". INCL MATL (ALT. #1)
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 330 LBS/SY (ALT. #2)
- IC CONCRETE LEVELING. AS DIRECTED BY THE ENGINEER

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-5

SHEET NO.: 3 of 5

R/W - Sta. 453+00 to Sta. 874+98 = 42,198 LF x 24' (12' reduction ea side)

$$1,012,752 \text{ SF} \div 43,560 \text{ SF/AC} =$$

$$23.2 \text{ AC.}$$

Pav't Reduction at Median Openings - Each Opening - 120 LF x 12 FT ÷ 9 SF/SF

$$160 \text{ SF Ea}$$

$$- 13 \text{ Median Openings} \times 160 \text{ SF} = 2080 \text{ SF}$$

Grass - 42,198 LF - 1,560 LF (Med Open) = 40,638 LF x 12 FT = 487,656 SF

$$= 487,656 \text{ SF} \div 43,560 \text{ SF/AC} = 11.2 \text{ AC}$$

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage

ALTERNATIVE NO.:

174-5

SHEET NO.: 4 of 5

## R/W Costs

EDS00-0027-00(159):

- R/W Required from R/W Project Status Report - 144.74 Ac
- R/W Cost = \$ 5,769,000
- Cost per Ac = \$ 39,858/Ac

EDS00-0027-00(160):

- R/W Required - 117.18 Ac
- R/W Cost = \$ 2,451,000
- Cost per Ac = \$ 20,917/Ac

EDS00-0027-00(174):

- R/W Required - 131.85 Ac
- R/W Cost = \$ 3,350,000
- Cost per Ac = \$ 25,408/Ac



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and ALTERNATIVE NO.: 174-6**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE MEDIAN WIDTH FROM 44 FT. TO 20 FT., SHEET NO.: 1 of 3**  
**USE A CABLE BARRIER, AND REDUCE THE NUMBER OF**  
**MEDIAN OPENINGS**

**ORIGINAL DESIGN:**

The typical sections call for a 44-ft.-wide depressed grassed median.

**ALTERNATIVE:**

Reduce the depressed grassed median width to 20 ft. and use a cable barrier. Reduce the number of median openings to maintain the 2,000 LF distance for a cable barrier system to be effective.

**ADVANTAGES:**

- Reduces pavement costs
- Reduces right-of-way costs
- Simplifies maintenance after an impact
- Implements a common practice in other States

**DISADVANTAGES:**

- Perceived loss of safety
- Not a Department standard – but not excluded
- Affects aesthetics

**DISCUSSION:**

Using a cable barrier system with a narrower depressed grassed median has become standard practice in many southern states due to the simplicity and ease of repair after a collision. Crossover collisions are precluded with this type of barrier without being obtrusive as concrete or guardrail type barriers.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,425,475	—	\$ 1,425,475
ALTERNATIVE	\$ 635,652	—	\$ 635,652
SAVINGS (Original minus Alternative)	\$ 788,823	—	\$ 788,823

# CALCULATIONS



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

ALTERNATIVE NO.:

174-6

SHEET NO.: 2 of 3

R/w - Sta. 453+00 to Sta. 874+98 = 42,198 LF x 48 Ft (24 Ft reduction ea side)

$$2,025,504 \text{ SF} \div 43,560 \text{ SF/Ac} =$$

$$\underline{46.5 \text{ Ac.}}$$

Pav't reduction at Median Openings - Each Opening - 120 LF x 24 Ft  $\div$  9 SF/SY

$$320 \text{ SY Ea}$$

$$9 \text{ Med Openings} \times 320 \text{ SY} = \underline{2880 \text{ SY}}$$

Grassing - 42,198 LF - 1,080 (Med. Open) = 41,118 LF x 24 Ft = 986,832 SF

$$= 986,832 \text{ SF} \div 43,560 \text{ SF/Ac} = \underline{22.7 \text{ Ac.}}$$

Eliminate Median Openings at Sta. 475+00, 527+00, 630+00 + 729+00.

$$4 \times 120 \text{ LF} \times 44 \text{ Ft} \div 9 \text{ SF/SY} = 2347 \text{ SY}$$

$$+ 2880 \text{ SY}$$

$$\underline{5,227 \text{ SY}} \text{ Pavement Total}$$

Cable Barrier - 42,198 LF - 1,080 LF = 41,118 LF

Anchors - 2 x 9 (Med Openings) + Beg + End = 20 Ea



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-7**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **USE 5-FT. PAVED SHOULDERS**

SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:**

The original shoulder design is 6.5 ft. of pavement and 3.5 ft. of grass.

**ALTERNATIVE:**

The minimum amount of paved shoulder is considered to be 5 ft. Therefore, use 5-ft. pavement shoulders with a 5-ft. grassed area beyond. Retain the same clear zone as the as-designed shoulder section.

**ADVANTAGES:**

- Reduces pavement costs
- Maintains safe clear zones

**DISADVANTAGES:**

- Perceived loss of safety
- May increase mowing costs (minimally)

**DISCUSSION:**

A reduction in the amount of paved shoulders with the same safety clear zones would reduce initial costs with a minimal loss of effectiveness in the project's rural environment.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 458,371	—	\$ 458,371
ALTERNATIVE	\$ 3,007	—	\$ 3,007
SAVINGS (Original minus Alternative)	\$ 455,364	—	\$ 455,364

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-7

SHEET NO.: 2 of 3

Shoulder Pavement (Eliminate 1.5 ft)

$$Q = (\text{Sta } 889+30 - \text{Sta } 410+48) \cdot 1.5 \text{ ft} \cdot \frac{2}{9}$$

$$= 15961 \text{ SY}$$

Grassing (Add 1.5 ft)

$$Q = (\text{Sta } 889+30 - \text{Sta } 410+48) \cdot 1.5 \cdot \frac{2}{9} \cdot 43,560$$

$$= 3.2 \text{ Acre}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-8**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **MINIMIZE THE NUMBER OF BEAMS ON THE BRIDGES** SHEET NO.: **1 of 5**

**ORIGINAL DESIGN:** (Sketch attached)

The original bridge design indicates that Spans 1 through 3 have a beam spacing of 7 ft. on center.

**ALTERNATIVE:** (Sketch attached)

For bridge Spans 1 and 2, increase the beam spacing to 8'-9" on center using a concrete compressive strength of 7 ksi.

**ADVANTAGES:**

- Reduces initial costs
- Reduces beams

**DISADVANTAGES:**

- Uses different beam spacing between Spans 1 and 2 and Span 3

**DISCUSSION:**

Although showing a minimal savings, the bridges can be erected faster with a reduction in components.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 31,922	—	\$ 31,922
ALTERNATIVE	\$ 16,814	—	\$ 16,814
SAVINGS (Original minus Alternative)	\$ 15,108	—	\$ 15,108

PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

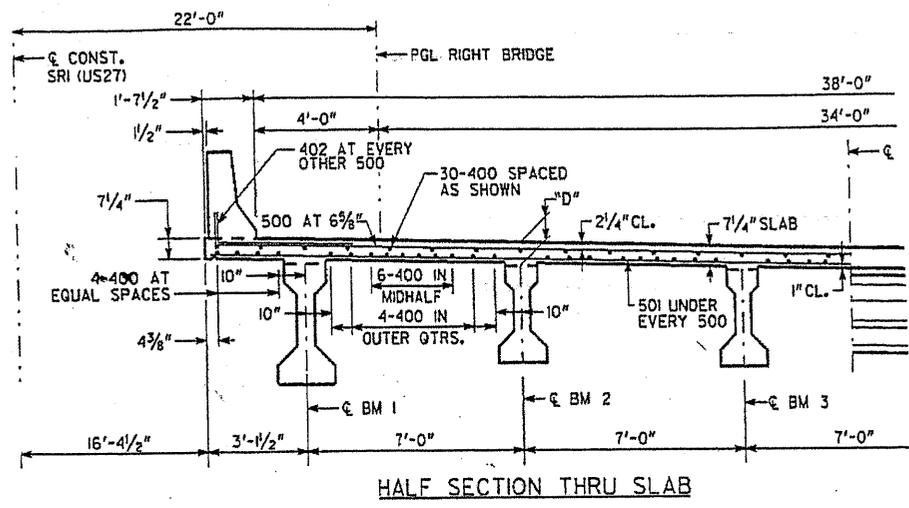
ALTERNATIVE NO.:

174-8

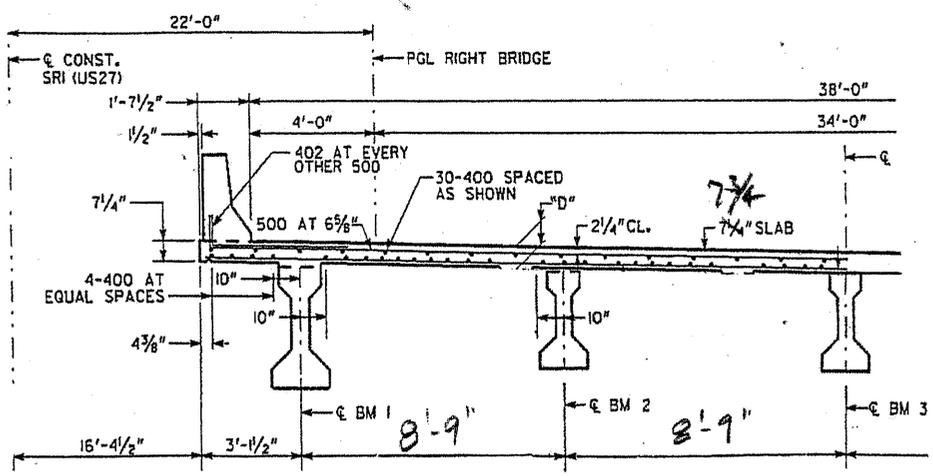
AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 3

SPAN 1



AS-DESIGNED



\* SEE GDOT BRIDGE MANUAL FIG. 3.12.2.10c

ALTERNATE

PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
*Design Development Stage*

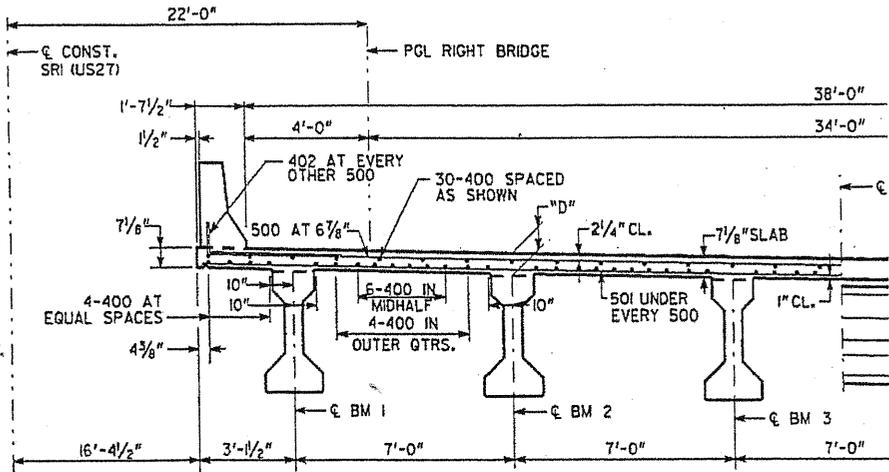
ALTERNATIVE NO.:

174-8

AS DESIGNED     ALTERNATIVE

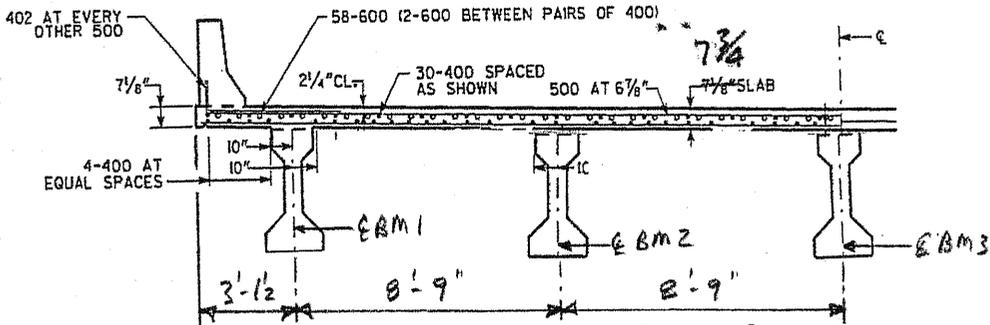
SHEET NO.: 3 of 5

**SPAN 2**



HALF SECTION THRU SLAB

AS-DESIGNED



\* SEE GDOT BRIDGE MANUAL FIG. 3.12.2.10d

ALTERNATE

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-0

SHEET NO.: 4 of 5

## SPAN-1:

TYPE II BEAM:  $L = 50.38' @ \$123.08/lf = <\$6,201 >$

INCREASED SLAB:  $7.75" - 7.25" = 0.5"$   
 (AA)  $(10.5"/12) \times 52' \times 41.25' (1/27) = 3.31 cy$   
 $3.31 @ \$830.96/cy = \$2,751$

REBAR:  $3.31 cy \times \left(\frac{17972\#}{66.5cy}\right) = 895\# @ 0.89 = \underline{\$796}$

TOTAL (174) =  $<\$2,654 >$

PARALLEL BRIDGE TOTAL (1B) =  $<\$2,654 >$

$\Sigma = \boxed{\$5,308}$

## SPAN-2

TYPE III:  $L = 68.94' @ \$142.31/lf = <\$9,811 >$

INCREASED SLAB: 1.25" INCR.

$(0.5"/12) \times 70' \times 41.25' (1/27) = 4.46 cy \times 830.96 = 3,703$

$4.46 cy \times \left(\frac{21,473\#}{73.0}\right) = 1,300\# \times 0.89 = \underline{\$1,157}$

TOTAL (174) =  $<\$4,951 >$

PARALLEL BRIDGE TOTAL (1B) =  $<\$4,951 >$

$\Sigma = \boxed{\$9,902}$

$\boxed{\text{TOTAL DEDUCT} = <\$15,210 >}$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-10**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REPLACE THE BOX CULVERT WITH A PRECAST** SHEET NO.: **1 of 4**  
**SYSTEM AT CARTER CREEK – STREAM NO. 12**

**ORIGINAL DESIGN:** (Sketch attached)

The design calls for a cast-in-place, double 9-ft. x 9-ft. concrete culvert to cross Carter Creek at Station 854+33.

**ALTERNATIVE:** (Sketch attached)

Replace the double concrete culvert with a precast arched single-span structure.

**ADVANTAGES:**

- Reduces initial costs
- Expedites construction
- Implements a common practice
- Simplifies design and construction

**DISADVANTAGES:**

- Still requires cast-in-place footings and knee walls
- Not a preferred Department solution

**DISCUSSION:**

This alternative is a comparison of the barrels of the two structural systems. The wing walls and apron would be similar as part of each system so those costs are negligible.

The costs savings associated with the schedule reduction of approximately one month for each phase was not calculated.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 507,446	—	\$ 507,446
ALTERNATIVE	\$ 501,884	—	\$ 501,884
SAVINGS (Original minus Alternative)	\$ 5,562	—	\$ 5,562

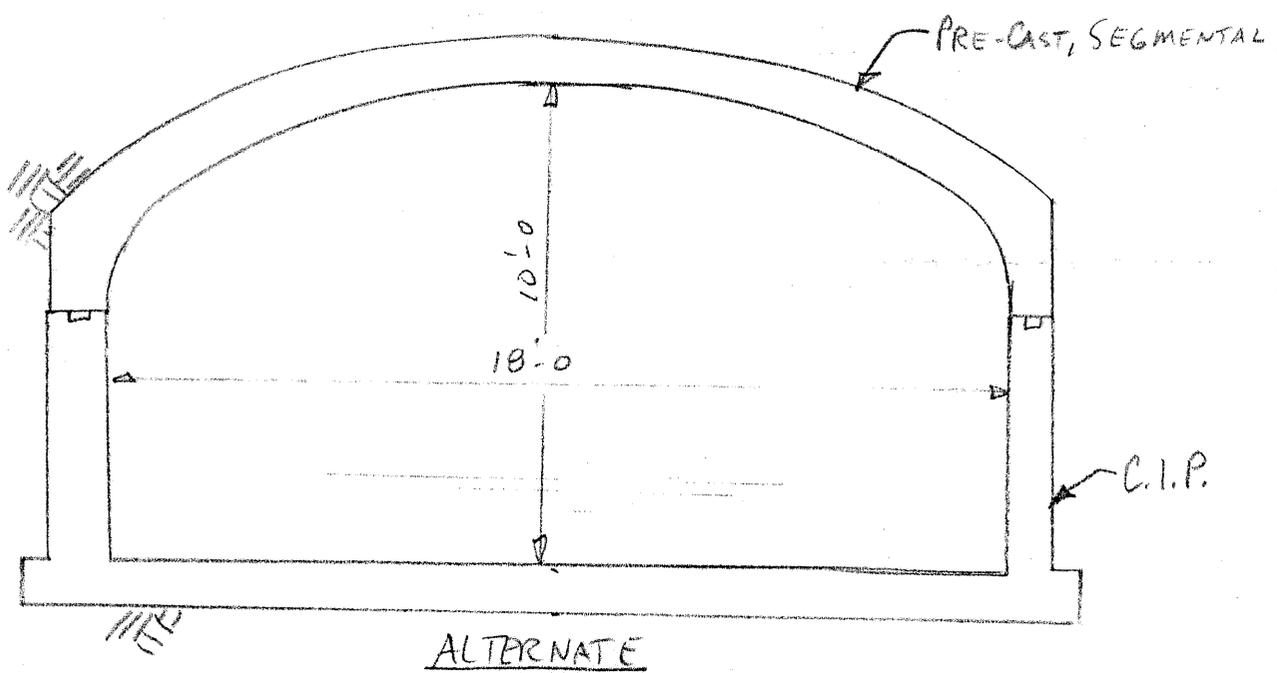
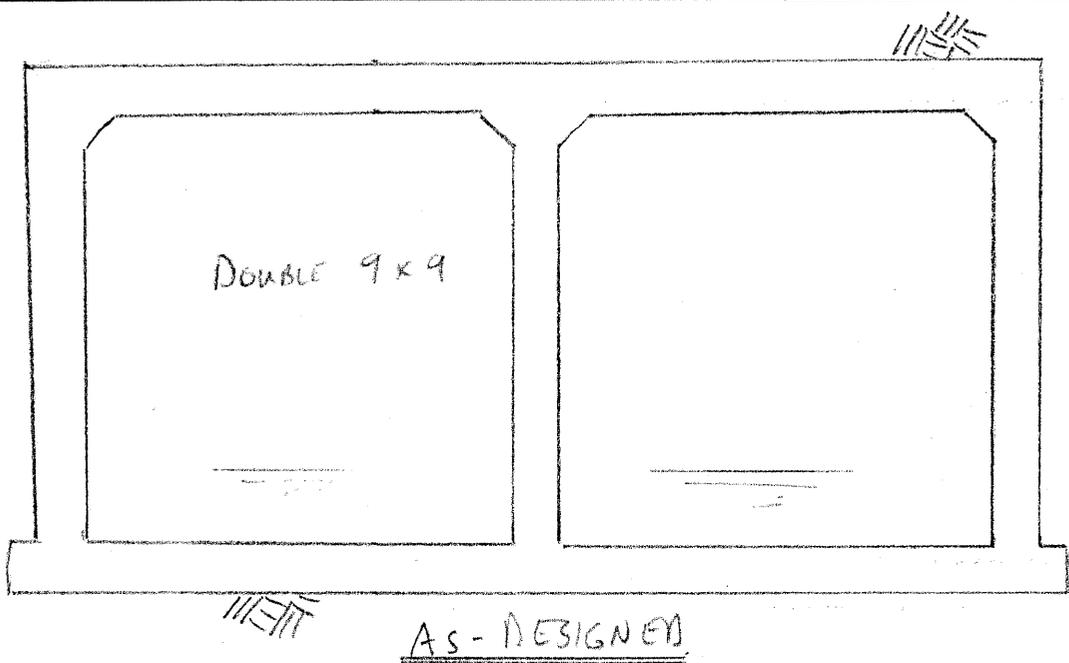
PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

ALTERNATIVE NO.:

174-10

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 4



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-10

SHEET NO.: 3 of 4

DOUBLE 9x9 [CULVERT QUANTITIES TABLE, SH. 6-06]  
 (AS-DESIGNED)

CLASS A CONC = 1,106 CY @ \$377.57 CY = ~~\$417,592~~

BAR REINF. = 104,481 # @ \$0.86 # = < 89,854 >

\$507,446

18' SPAN PRE-CAST ARCH  
 (ALTERNATE)

18' SPAN x 279' (LS COST PC ONLY) = \$350,000

FOOTING AND KNEE-WALLS C.I.P. =

$279' \times [(5' \times 1') \times 2 + (18' + 2' + 2') \times 1'] \times \frac{1}{2} = 331 \text{ CY}$   
 @ \$377.57 CY = 9124,850

BAR REINF. =  $\frac{104,481 \#}{1106 \text{ CY}} \times 331 \text{ CY} = 31,289 \#$   
 @ \$0.86 # = 26,891

\$501,741

ASSUMING END TREATMENTS ARE SIMILAR, NO COST DIFF.

TOTAL = < \$5,705 >



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-11**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REPLACE THE BOX CULVERT WITH A PRECAST** SHEET NO.: **1 of 4**  
**SYSTEM AT STREAM NO. 11**

**ORIGINAL DESIGN:** (Sketch attached)

The design uses a cast-in-place, double 10-ft. x 10-ft. concrete culvert to cross Stream No. 11 at Station 803+10.

**ALTERNATIVE:** (Sketch attached)

Replace the double concrete culvert with a precast attached single-span structure.

**ADVANTAGES:**

- Expedites construction
- Implements a common practice
- Simplifies design and construction

**DISADVANTAGES:**

- Still requires cast-in-place footings and knee walls
- Not a preferred Department solution
- Increases initial costs

**DISCUSSION:**

This alternative is a comparison of the barrels of the two structural systems. The wing walls and apron would be similar as part of each system so those costs are negligible.

The costs savings associated with the schedule reduction of approximately one month for each phase was not calculated.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 387,591	—	\$ 387,591
ALTERNATIVE	\$ 479,065	—	\$ 479,065
SAVINGS (Original minus Alternative)	\$ (91,474)	—	\$ (91,474)

# SKETCHES



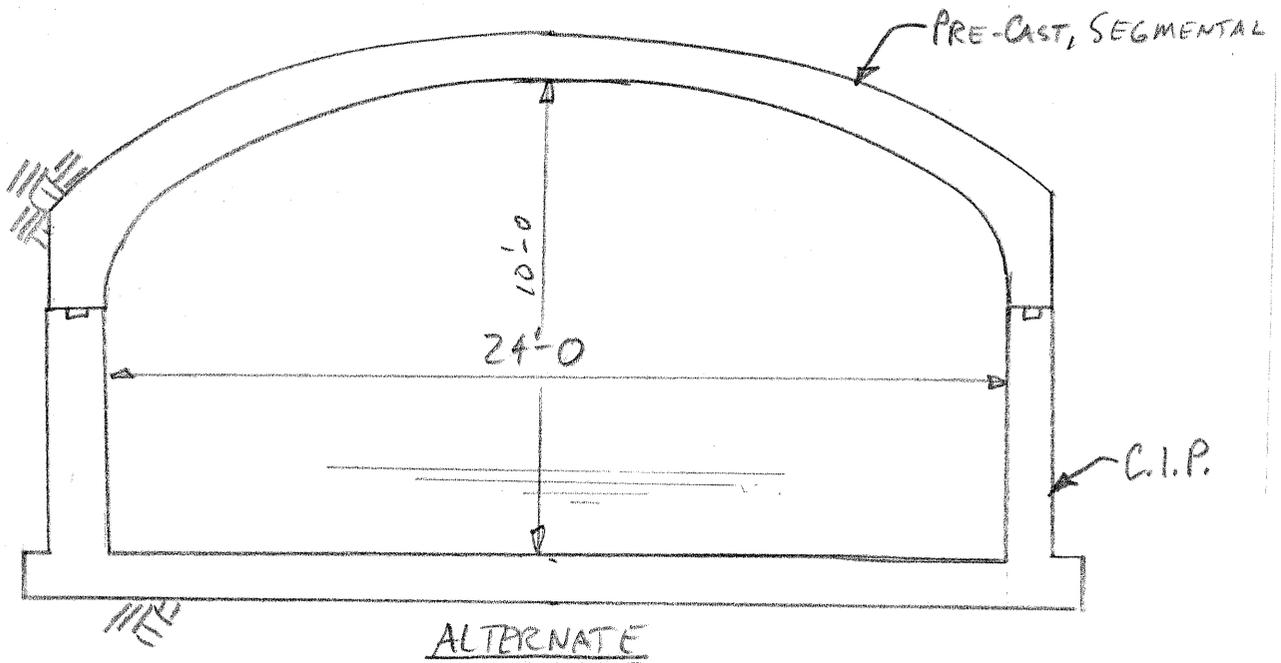
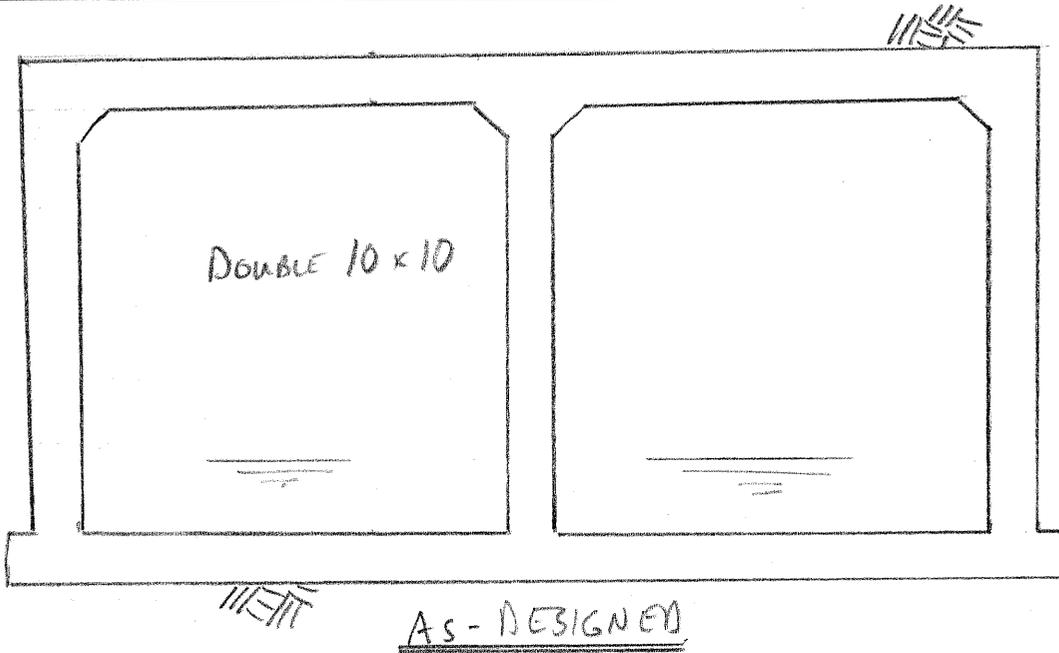
PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage

ALTERNATIVE NO.:

174-11

AS DESIGNED       ALTERNATIVE

SHEET NO.: 2 of 4



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-11

SHEET NO.: 2 of 4

DOUBLE 10x10 [CULVERT QUANTITIES TABLE SHIT 6-06]  
 AS DESIGNED

CLASS A CONC = 793 CY @ 377.57/cy = \$ 299,413  
 BAR REINF. = 102,533 LB @ 0.86\$/LB = \$ 88,178

$\Sigma = \$ 387,591$

24' SPAN PRE-CAST ARCH:

ALTERNATE

24' SPAN x 217' (LS COST PCONCY) = \$ 330,000

FOOTING + KNEE WALL C.I.P. =

$217' \times [(5' \times 1') \times 2 + (24' + 2' + 2') \times 1'] \times 1.27 = \frac{305 \text{ CY} @ 377.57}{= \$ 115,159}$

BAR REINF. =  $\frac{102,533 \#}{793 \text{ CY}} \times 305 \text{ CY} = 39,436 \text{ LB} @ 0.86 \$/\# = \underline{\underline{\$ 33,915}}$

$\Sigma = \$ 479,074$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-12**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **EVALUATE THE PROFILE TO REDUCE THE AMOUNT OF** SHEET NO.: **1 of 3**  
**REQUIRED BORROW**

**ORIGINAL DESIGN:**

The present design has an earthwork balance which requires 365,000 cubic yards of borrow.

**ALTERNATIVE:**

Adjust the profile to reduce the amount of required fill embankment in an effort to reduce the necessary borrow. This reduction could be as high as 1/3 of the noted volume.

**ADVANTAGES:**

- Expedites construction
- Implements a common practice
- Reduces initial cost

**DISADVANTAGES:**

- Requires a redesign of the profile
- Requires a revision to the construction plans

**DISCUSSION:**

By adjusting the profile an average of 3 ft. in the noted location of the attached calculation sheet, the need for fill embankment is greatly reduced, thereby reducing construction and hauling costs and expediting construction.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 723,125	—	\$ 723,125
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 723,125	—	\$ 723,125

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-12

SHEET NO.: 2 of 3

$$\frac{(2200' \times 2' \times 150')}{27} = 22,450 \text{ C.Y.} \leftarrow$$

$$\frac{1000' \times 3' \times 150'}{27 \text{ cf}} = 10,700 \text{ C.Y.} \leftarrow$$

(Lower profile 3')  
 ↑ tie to  
 PVI at 568+40

$$\frac{(2250' \times 3' \times 150')}{27} \approx 18,750 \text{ C.Y.} \leftarrow$$

(Lower 0' to 3')

$$\frac{(2400' \times 4' \times 150')}{27} = 53,350 \text{ C.Y.} \leftarrow$$

(Lower 4')

Total (Net Quantity) 111,250 C.Y.  $\leftarrow$

Savings in Borrow Quantity



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **174-16**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE INSIDE TRAVEL LANE WIDTH TO 11 FT.** SHEET NO.: **1 of 6**  
**AND RETAIN the 12-FT. OUTSIDE TRAVEL LANES**

**ORIGINAL DESIGN:** (Sketch attached)

The present design uses four 12-ft.-wide travel lanes throughout the project length.

**ALTERNATIVE:** (Sketch attached)

Reduce the width of the two inside travel lanes to 11 ft. and retain the width of the proposed two outside travel lanes at 12 ft.

**ADVANTAGES:**

- Expedites construction
- Implements a common practice
- Reduces initial cost

**DISADVANTAGES:**

- Narrows the inside travel lanes
- Not a common practice – although more and more an acceptable solution

**DISCUSSION:**

The alternative design saves 2 ft. of full-depth pavement (1 ft. on each inside travel lane) and reduces the project construction cost considerably. Since there is a larger volume of trucks on a 65 mph facility, the outside lanes would remain at the proposed 12-ft. widths. It should be noted there is a 2-ft. paved shoulder (full depth) which provides extra “space” adjacent to the inside lanes.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 444,025	—	\$ 444,025
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 444,025	—	\$ 444,025

PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

ALTERNATIVE NO.:

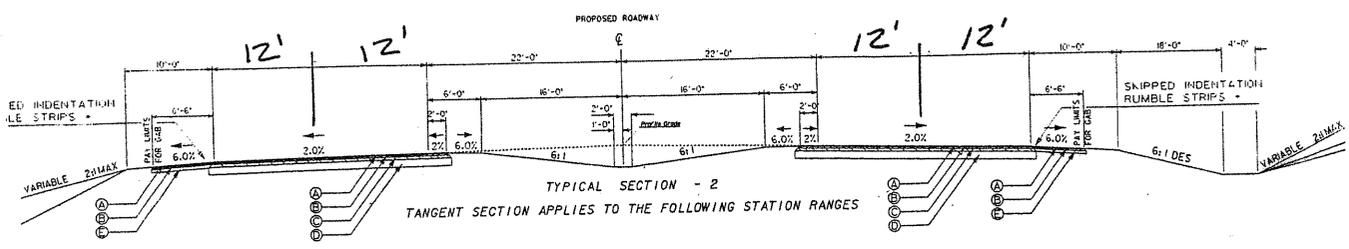
174-16

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 6

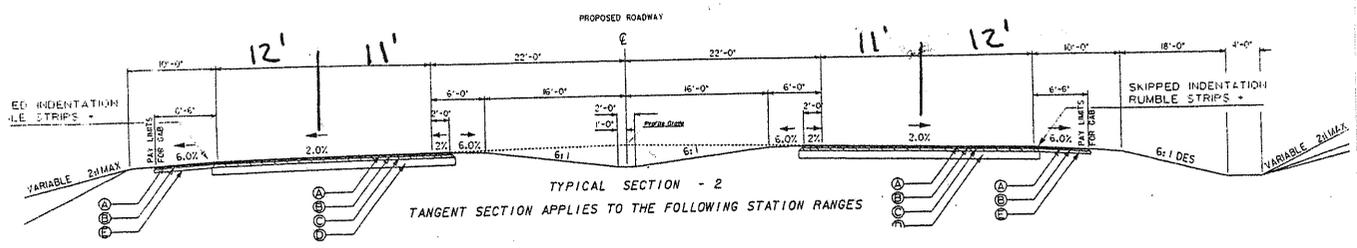
As Designed

US 27 / SR 1



ALTERNATE

US 27 / SR 1



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-16

SHEET NO.: 3 of 6

EDS-27 (159) (Full depth Pavement)

$$(9.5\text{mm})_{\text{mix}}: \frac{135\text{lbs}}{\text{sy}} \times \frac{T}{2000\text{lbs}} \times \frac{\$81.00}{\text{sy}} = \$5.48/\text{sy}$$

$$(19\text{mm}): \frac{220\text{lbs}}{\text{sy}} \times \frac{T}{2000\text{lbs}} \times \frac{\$75.00}{\text{sy}} = \$8.25/\text{sy}$$

$$(25\text{mm}): \frac{330\text{lbs}}{\text{sy}} \times \frac{T}{2000} \times \frac{\$75.00}{\text{sy}} = \$11.88/\text{sy}$$

$$\text{GAB: } 10'' = \underline{\$17.00/\text{sy}}$$

$$\text{Total Cost} = \$42.61/\text{sy}$$

shldr: \$5.48/sy (9.5mm)  
 \$8.25/sy (19mm)  
 \$15.00/sy (6" GAB)

$$\text{shldr} = \underline{\$28.73/\text{sy}}$$

EDS-27 (160)

$$(12.5\text{mm}): \frac{165\text{lbs}}{\text{sy}} \times \frac{T}{2000\text{lbs}} \times \frac{\$61.98}{\text{sy}} = \$5.12/\text{sy}$$

$$(19\text{mm}): \frac{220\text{lbs}}{\text{sy}} \times \frac{T}{2000\text{lbs}} \times \frac{\$65.02}{\text{sy}} = \$7.15/\text{sy}$$

$$(25\text{mm}): \frac{440\text{lbs}}{\text{sy}} \times \frac{T}{2000\text{lbs}} \times \frac{\$63.59}{\text{sy}} = \$13.99/\text{sy}$$

$$\text{G.A.B, } 10'' = \underline{\$17.00/\text{sy}}$$

$$\text{Total Cost} = \underline{\$43.26/\text{sy}}$$

shldr: \$5.12 (12.5mm)  
 \$7.15 (19mm)  
 \$13.97 (6" GAB)

$$\text{shldr} = \underline{\$26.24}$$



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

174-16

SHEET NO.: 5 of 6

Cost in \$Y of mainline Pavement  
 mainline full depth pavement \$ 46.56/sy

$$\left(8.373 \text{ mix } \frac{5,280'}{\text{mi}} \times (1+1)\right) / \frac{9 \text{ SF}}{\text{SY}} = 9,825 \text{ sy}$$

Bridge Savings:

$$182' \text{ LF} \times (1+1) = 364 \text{ sf}$$

(includes 1' for each Bridge)

unit cost: \$ 70/sf



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **159-2**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE MEDIAN WIDTH FROM 44 FT. TO 32 FT.** SHEET NO.: **1 of 4**

**ORIGINAL DESIGN:** (Sketch attached)

The typical sections call for a 44-ft.-wide depressed grassed median.

**ALTERNATIVE:**

Reduce the median width to 32 ft.

**ADVANTAGES:**

- Reduces pavement costs
- Reduces right-of-way costs

**DISADVANTAGES:**

- Perceived loss of required clear zone
- Not a Department standard – but not excluded

**DISCUSSION:**

A 32-ft.-wide depressed grassed median meets AASHTO design criteria for a four-lane, 65 mph rural highway.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 940,224	—	\$ 940,224
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 940,224	—	\$ 940,224



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
**Design Development Stage**

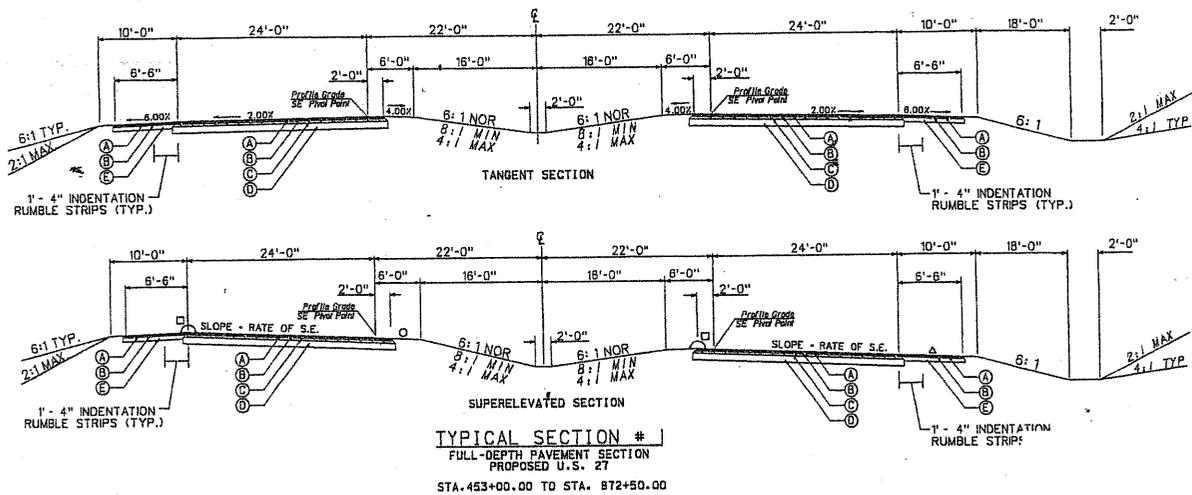
ALTERNATIVE NO.:

159-2

AS DESIGNED     ALTERNATIVE

SHEET NO. 2 of 4

## TYPICAL SECTIONS



- SLOPE 4% OR RATE
- △ SLOPE 6.00% OR RA
- ALGEBRAIC DIFFERE SLOPES NOT TO EXC

### PAVEMENT

- D ASPH CONC 9.5 mm SUPERPAVE. GP 2 ONLY. INCL BITUM MATL & H LIME 135 LBS/SY
- D ASPH CONC 19 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 220 LBS/SY
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 330 LBS/SY
- BASE CRS. 10". INCL MATL (ALT. #1)
- EO SOIL-CEM STAB BASE CRS. 8". INCL MATL AND HAUL (ALT. #2)
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 550 LBS/SY (ALT. #3)
- BASE CRS. 6". INCL MATL (ALT. #1)
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2. INCL BITUM MATL & H LIME 330 LBS/SY (ALT. #2)
- IC CONCRETE LEVELING. AS DIRECTED BY THE ENGINEER

# CALCULATIONS



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

ALTERNATIVE NO.:

15A-2

SHEET NO.: 3 of 4

R/W - Sta. 22+50 to Sta. 418+00 = 39,550 LF x 24' (12' reduction ea side)

$$949,200 \text{ SF} \div 43,560 \text{ SF/AC} =$$

21.8 AC.

Pav't Reduction at Median Openings - Each Opening - 120 LF x 12 FT ÷ 9 SF/SY

160 SY Ea

$$- 9 \text{ Median Openings} \times 160 \text{ SY} = 1,440 \text{ SY}$$

Gross - 39,550 LF - 1,080 LF (Med Open) = 38,470 LF x 12 FT = 461,640 SF

$$= 461,640 \text{ SF} \div 43,560 \text{ SF/AC} = 10.6 \text{ AC}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **159-3**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE MEDIAN WIDTH FROM 44 FT. TO 20 FT.,** SHEET NO.: **1 of 3**  
**USE A CABLE BARRIER, AND REDUCE THE NUMBER OF**  
**MEDIAN OPENINGS**

**ORIGINAL DESIGN:**

The typical sections call for a 44-ft.-wide depressed grassed median.

**ALTERNATIVE:**

Reduce the depressed grassed median width to 20 ft. and use a cable barrier. Reduce the number of median openings to maintain the 2,000 LF distance for a cable barrier system to be effective.

**ADVANTAGES:**

- Reduces pavement costs
- Reduces right-of-way costs
- Simplifies maintenance after an impact
- Implements a common practice in other States

**DISADVANTAGES:**

- Perceived loss of safety
- Not a Department standard – but not excluded
- Affects aesthetics

**DISCUSSION:**

Using a cable barrier system with a narrower depressed grassed median has become standard practice in many southern states due to the simplicity and ease of repair after a collision. Crossover collisions are precluded with this type of barrier without being obtrusive as concrete or guardrail type barriers.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,953,279	—	\$ 1,953,279
ALTERNATIVE	\$ 589,940	—	\$ 589,940
SAVINGS (Original minus Alternative)	\$ 1,363,339	—	\$ 1,363,339

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

159-3

SHEET NO.: 2 of 3

R/W - Sta. 22+50 to Sta. 418+00 = 39,550 LF x 48 Ft (24 Ft reduction ea side)

$$1,898,400 \text{ SF} \div 43,560 \text{ SF/Ac} =$$

43.6 Ac.

Pav't reduction at Median Openings - Each Opening - 120 LF x 24 Ft  $\div$  9 SF/SY

$$320 \text{ SY Ea}$$

$$7 \text{ Med Openings} \times 320 \text{ SY} = \underline{2240 \text{ SY}}$$

Grassing - 39,550 LF - 840 (Med. Open) = 38,710 LF x 24 Ft = 929,040 SF

$$= 929,040 \text{ SF} \div 43,560 \text{ SF/Ac} = \underline{21.3 \text{ Ac.}}$$

Eliminate Median Openings at Sta. 67+00, 169+00, 312+00, 324+00

$$4 \times 120 \text{ LF} \times 44 \text{ Ft} \div 9 \text{ SF/SY} = 2347 \text{ SY}$$

$$+ 2240 \text{ SY}$$

$$\underline{4,587 \text{ SY}} \text{ Pavement Total}$$

Cable Barrier - 39,550 LF - 840 LF = 38,710 LF

Barrier Anchor - 2 x 7 (Med Open) + (Beg + End) = 16 Ea



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **159-4**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **USE 5-FT. PAVED SHOULDERS** SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:**

The original shoulder design calls for 6.5 ft. of pavement and 3.5 ft. of grass.

**ALTERNATIVE:**

The minimum amount of paved shoulder is considered to be 5 ft. Therefore, use 5-ft. pavement shoulders with a 5-ft. grassed area beyond. Retain the same clear zone as with the as-designed shoulder section.

**ADVANTAGES:**

- Reduces pavement costs
- Maintains safe clear zones

**DISADVANTAGES:**

- Perceived loss of safety
- May increase mowing costs (minimally)

**DISCUSSION:**

A reduction in the amount of paved shoulders with the same safety clear zones would save initial costs with minimal loss of effectiveness in this rural environment.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 399,347	—	\$ 399,347
ALTERNATIVE	\$ 2,725	—	\$ 2,725
SAVINGS (Original minus Alternative)	\$ 396,622	—	\$ 396,622

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage

ALTERNATIVE NO.:

159-4

SHEET NO.: 2 of 3

Shoulder Pavement (Eliminate 1.5 ft)

$$Q = (\text{Sta } 437+00 - \text{Sta } 20+00) \cdot 1.5 \text{ ft} \cdot \frac{2}{9} \\ = 13,900 \text{ sy}$$

Grassing (Add 1.5 ft)

$$Q = (\text{Sta } 437+00 - \text{Sta } 20+00) \cdot 1.5 \cdot \frac{2}{43,560} \\ = 2.9 \text{ Acre}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **159-8**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **RECONFIGURE THE ALIGNMENT TO CREATE ONE-** SHEET NO.: **1 of 7**  
**WAY PAIRS WITH THE EXISTING NORTHBOUND**  
**ROADWAY**

**ORIGINAL DESIGN:** (Sketch attached)

The proposed alignment is a western bypass around the historic properties running from Station (STA) 180+00 to STA 310+00. The proposed realignment includes four lanes with a 44-ft.-wide depressed grassed median. The original design includes an overlay of the existing roadway between STA 10+00 and STA 95+00.

**ALTERNATIVE:** (Sketch attached)

Use the existing two-lane roadbed for northbound traffic and carry southbound traffic on a new two-lane roadway constructed on the same new alignment as the original design. Maintain the intersections at CR 19/Chulee Road and at SR 37/Hartford Road on the southbound roadway. Retain the overlay of the existing roadbed from STA 10+00 to STA 95+00.

**ADVANTAGES:**

- Reduces initial cost
- No impact on historic properties
- Eliminates “bypass” economic effect
- Implements a common practice, albeit, not with as much separation between directions

**DISADVANTAGES:**

- Alters local access
- Deviates from what has been depicted to-date

**DISCUSSION:**

Maintaining the existing roadbed and using it for the northbound traffic maintains the concept of not impacting historic properties. Constructing only the southbound roadway in the bypass alignment saves over \$3 million.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 3,123,542	—	\$ 3,123,542
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 3,123,542	—	\$ 3,123,542

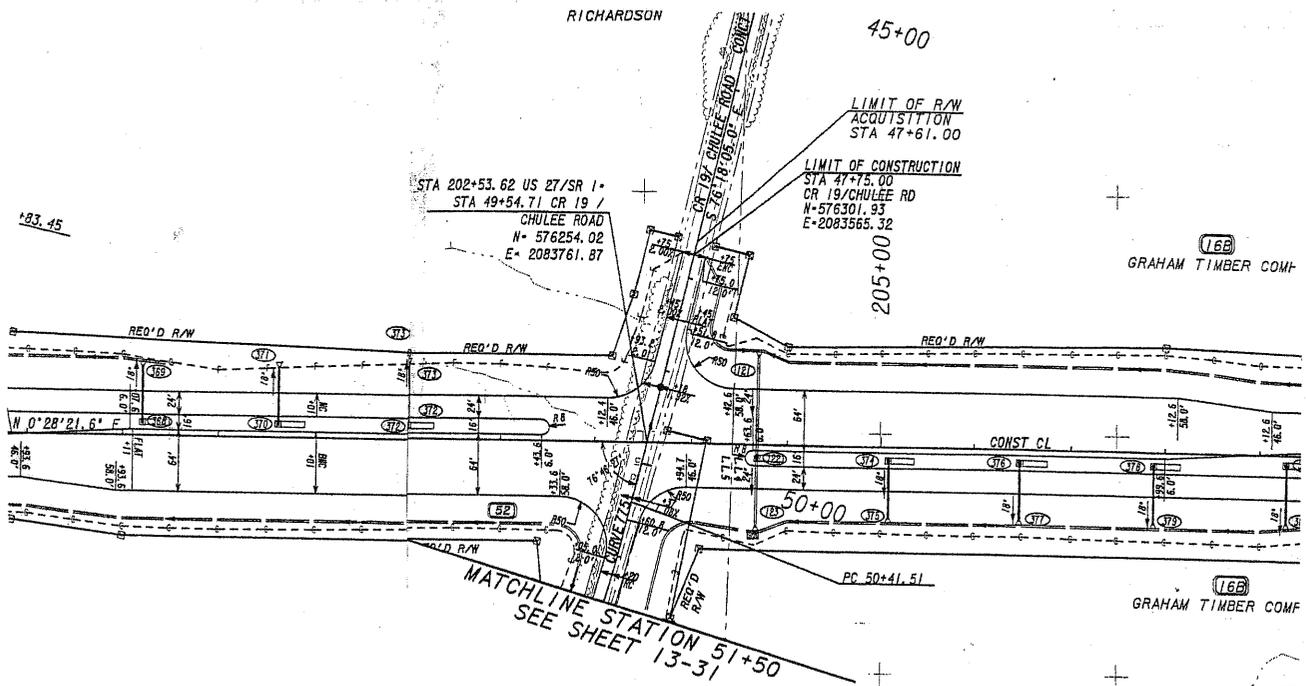
PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
*Design Development Stage*

ALTERNATIVE NO.:

159-8

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 7



Original Design At CR 19/Chulee Road  
 (Same Configuration Change at Hartford Rd/SR37)

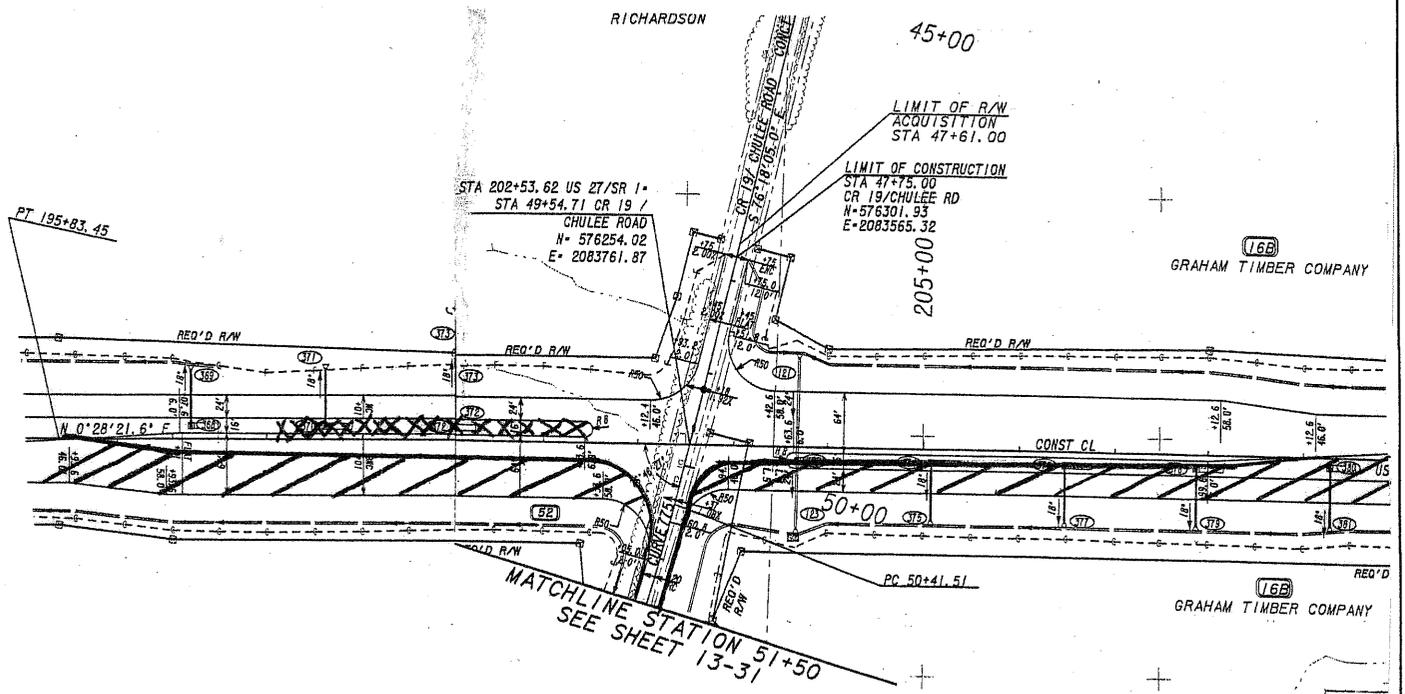
PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
*Design Development Stage*

ALTERNATIVE NO.:

159-8

AS DESIGNED       ALTERNATIVE

SHEET NO. 3 of 7



Proposed Design At CR19/Chulee Road (Same Configuration  
Change at Hartford Rd/SR 37)

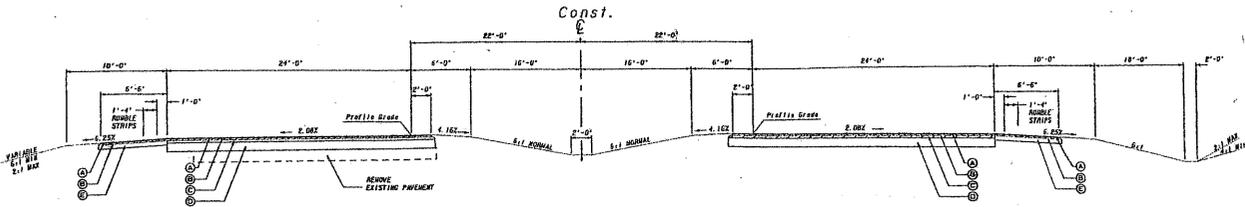
PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
*Design Development Stage*

ALTERNATIVE NO.:

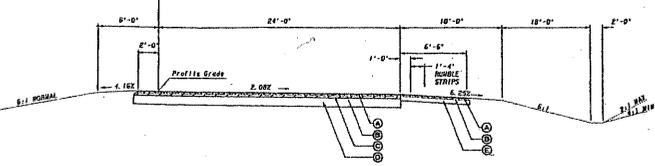
159-8

AS DESIGNED       ALTERNATIVE

SHEET NO.: 4 of 7



*Proposed Design Typical Section*



*Alternative Design Southbound Roadbed*

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

FA-8

SHEET NO.: 5 of 7

## Items Eliminated:

- New Northbound Road bed
- Right of way (44ft Median, 24ft Roadway, 12ft Shoulder)
- 56ft of all transverse pipe
- 18" Drains on original design northbound roadbed (18ft)

## NB Roadbed

Pvmt \$42.61/SY

Shoulder \$28.73/SY

Pvmt:

$$Q = 24\text{ft} \cdot (310+00 - 180+00) = 312,000\text{ft}^2 \cdot \frac{1\text{SY}}{9\text{ft}^2} = 34,667\text{SY}$$

Shoulder:

$$Q = 12\text{ft} (310+00 - 180+00) = 156,000\text{ft}^2 \cdot \frac{1\text{SY}}{9\text{ft}^2} = 17,333\text{SY}$$

Right of way:

$$Q = (44\text{ft} + 24\text{ft} + 12\text{ft}) \cdot (310+00 - 180+00) = 1,040,000\text{ft}^2 \cdot \frac{\text{Acres}}{43,560\text{ft}^2} = 23.9\text{Acres}$$

## Transverse Pipe (56ft)

(119) DBL 48in RCP

(123) 24in RCP

(124) 24in RCP

(130B) 18in RCP

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District4  
 Design Development Stage

ALTERNATIVE NO.:

159-0

SHEET NO.: 6 of 7

18" RCP

- (375) Q = 57 ft
- (377) Q = 57 ft
- (379) Q = 57 ft
- (381) Q = 61 ft
- (387) Q = 93 ft
- (389) Q = 77 ft
- (391) Q = 77 ft
- (393) Q = 77 ft
- (395) Q = 77 ft
- (397) Q = 77 ft
- (399) Q = 77 ft
- (401) Q = 77 ft
- (403) Q = 98 ft
- (405) Q = 108 ft
- (33) Q = 57 ft
- (400A) Q = 48 ft
- (411A) Q = 61 ft
- (412A) Q = 78 ft
- (413A) Q = 78 ft
- (415A) Q = 82 ft
- (416A) Q = 49 ft
- (417A) Q = 67 ft
- (418A) Q = 76 ft
- (419A) Q = 59 ft
- (461) Q = 84 ft

Q = 1809 ft

Overlay of Existing

$$(95+00 - 10+00) \cdot 44 \text{ ft} / 9 = 41,555 \text{ SY}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **159-11**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE INSIDE TRAVEL LANES TO 11 FT. AND** SHEET NO.: **1 of 4**  
**RETAIN 12-FT. OUTSIDE TRAVEL LANES**

**ORIGINAL DESIGN:** (Sketch attached)

The present design uses four 12-ft.-wide travel lanes throughout the project length.

**ALTERNATIVE:** (Sketch attached)

Reduce the width of the two inside travel lanes to 11 ft. and retain the width of the proposed two outside travel lanes at 12 ft.

**ADVANTAGES:**

- Expedites construction
- Implements a common practice in other states
- Reduces initial cost

**DISADVANTAGES:**

- Narrows the inside travel lanes
- Not a common practice – although more and more an acceptable solution

**DISCUSSION:**

The alternative design saves 2 ft. of full-depth pavement (1 ft. on each inside travel lane) and reduces the project construction cost considerably. Since there is a larger volume of truck traffic on a 65 mph facility, the outside lanes would remain at the proposed 12-ft. widths. It should be noted there is a 2-ft. paved shoulder (full-depth) which provides extra “space” adjacent to the inside lanes.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 393,887	—	\$ 393,887
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 393,887	—	\$ 393,887

PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
**Design Development Stage**

ALTERNATIVE NO.:

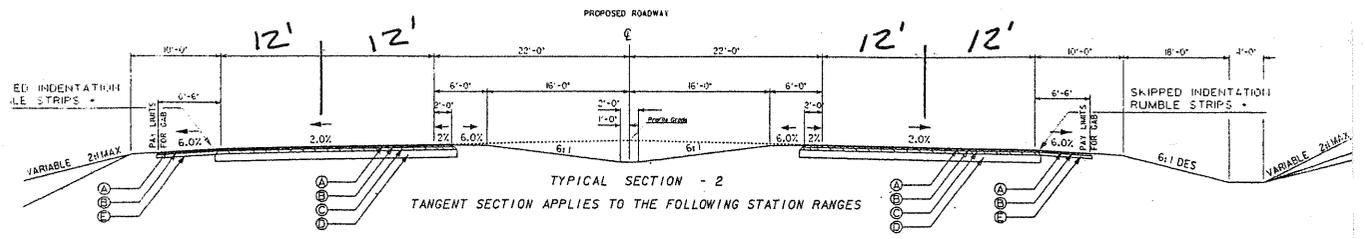
159-11

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 4

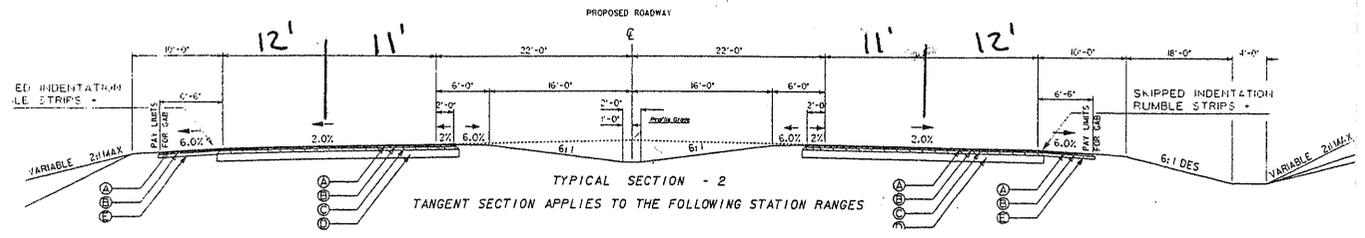
As Designed

US 27 / SR 1



Alternate

US 27 / SR 1



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage

ALTERNATIVE NO.:

159-11

SHEET NO.: 3 of 4

see (Alt. 174-16) calculations / sheet 3

EDS-27(159)

Full Depth Pavement = \$ 42.61/sy

Roadway (S.Y.)

$$\left( 7.878 \text{ miles} \times \frac{5,280'}{\text{mi}} \times (1' + 1') \right) = 9,244 \text{ S.Y.}$$

9sf/sy





# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **160-2**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE MEDIAN WIDTH FROM 44 FT. TO 32 FT.** SHEET NO.: **1 of 4**

**ORIGINAL DESIGN:** (Sketch attached)

The typical sections call for a 44-ft.-wide depressed grassed median.

**ALTERNATIVE:**

Reduce the depressed grassed median width to 32 ft.

**ADVANTAGES:**

- Reduces pavement costs
- Reduces right-of-way costs

**DISADVANTAGES:**

- Perceived loss of required clear zone
- Not a Department standard – but not excluded

**DISCUSSION:**

The use of a 32-ft.-wide depressed grassed median meets AASHTO design criteria for a four-lane, 65 mph rural highway.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 535,144	—	\$ 535,144
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 535,144	—	\$ 535,144

PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
**Design Development Stage**

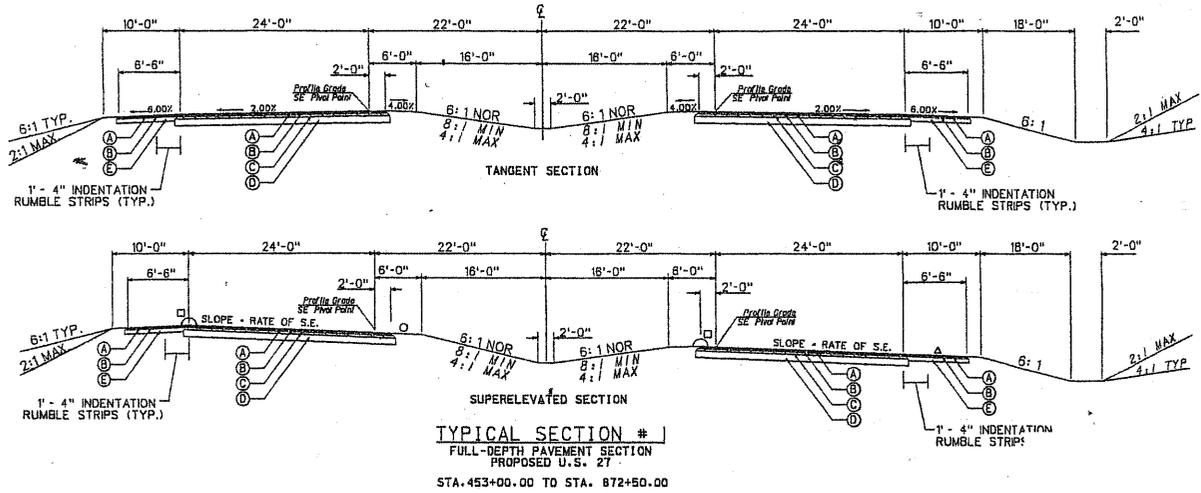
ALTERNATIVE NO.:

160-2

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 4

## TYPICAL SECTIONS



**PAVEMENT**

- D ASPH CONC 9.5 mm SUPERPAVE. GP 2 ONLY, INCL BITUM MATL 8 H LIME 135 LBS/SY
- D ASPH CONC 19 mm SUPERPAVE. GP 1 OR 2, INCL BITUM MATL 8 H LIME 220 LBS/SY
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2, INCL BITUM MATL 8 H LIME 330 LBS/SY
- BASE CRS. 10", INCL MATL (ALT. #1)
- ED SOIL-CEM STAB BASE CRS. 8", INCL MATL AND HAUL (ALT. #2)
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2, INCL BITUM MATL 8 H LIME 550 LBS/SY (ALT. #3)
- BASE CRS. 6", INCL MATL (ALT. #1)
- D ASPH CONC 25 mm SUPERPAVE. GP 1 OR 2, INCL BITUM MATL 8 H LIME 330 LBS/SY (ALT. #2)
- IC CONCRETE LEVELING, AS DIRECTED BY THE ENGINEER

- SLOPE 4% OR RATE
- ▲ SLOPE 6.00% OR RA
- ALGEBRAIC DIFFERE SLOPES NOT TO EXC

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

160-2

SHEET NO.: 3 of 4

$$\begin{aligned} \text{R/W - Sta. } 102+00 \text{ to Sta. } 491+60 &= 38,960 \text{ LF} \times 24' \text{ (12' reduction ea side)} \\ &= 935,040 \text{ SF} \div 43,560 \text{ SF/Ac} = \\ &= 21.5 \text{ Ac.} \end{aligned}$$

$$\begin{aligned} \text{Pav't Reduction at Median Openings - Each Opening - } 120 \text{ LF} \times 12 \text{ FT} &\div 9 \text{ SF/SF} \\ &= 160 \text{ SF Ea} \end{aligned}$$

$$= 11 \text{ Median Openings} \times 160 \text{ SF} = 1,760 \text{ SF}$$

$$\begin{aligned} \text{Gross - } 38,960 \text{ LF} - 1,320 \text{ LF (Med Open)} &= 37,640 \text{ LF} \times 12 \text{ FT} = 451,680 \text{ SF} \\ &= 451,680 \text{ SF} \div 43,560 \text{ SF/Ac} = 10.4 \text{ Ac} \end{aligned}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT:	<b>EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and BRN00-0027-03(018), PI 431531 US 27/SR 1 WIDENING AND RECONSTRUCTION Early, Clay, and Randolph Counties</b>	ALTERNATIVE NO.:	<b>160-3</b>
DESCRIPTION:	<b>REDUCE THE MEDIAN WIDTH FROM 44 FT. TO 20 FT., USE A CABLE BARRIER, AND REDUCE THE NUMBER OF MEDIAN OPENINGS</b>	SHEET NO.:	<b>1 of 3</b>

**ORIGINAL DESIGN:**

The typical sections call for a 44-ft.-wide depressed grassed median.

**ALTERNATIVE:**

Reduce the depressed grassed median width to 20 ft. and use a cable barrier. Reduce the number of median openings to maintain the 2,000 LF distance for a cable barrier system to be effective.

**ADVANTAGES:**

- Reduces pavement costs
- Reduces right-of-way costs
- Simplifies maintenance after an impact
- Implements a common practice in other States

**DISADVANTAGES:**

- Perceived loss of safety
- Not a Department standard – but not excluded
- Affects aesthetics

**DISCUSSION:**

Using a cable barrier system with a narrower depressed grassed median has become standard practice in many southern states due to the simplicity and ease of repair after a collision. Crossover collisions are precluded with this type of barrier without being obtrusive as concrete or guardrail type barriers.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,091,342	—	\$ 1,091,342
ALTERNATIVE	\$ 590,320	—	\$ 590,320
SAVINGS (Original minus Alternative)	\$ 501,022	—	\$ 501,022

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

160-3

SHEET NO.: 2 of 3

R/W - Sta. 102+00 to Sta. 491+60 = 38,960 LF x 48 Ft (24 Ft reduction ea. side)

$$1,870,080 \text{ SF} \div 43,560 \text{ SF/Ac} =$$

42.9 Ac.

Pav't reduction at Median Openings - Each Opening - 120 LF x 24 Ft  $\div$  9 SF/SF

$$320 \text{ SF Ea}$$

$$9 \text{ Med Openings} \times 320 \text{ SF} = \underline{2880 \text{ SF}}$$

Grassing - 38,960 LF - 1080 (Med. Open) = 37,880 LF x 24 Ft = 909,120 SF

$$= 909,120 \text{ SF} \div 43,560 \text{ SF/Ac} = \underline{20.9 \text{ Ac.}}$$

Eliminate Median Openings at Sta. 135+00 + 345+00

$$2 \times 120 \text{ LF} \times 44 \text{ Ft} \div 9 \text{ SF/SF} = 1173 \text{ SF}$$

$$+ 2880 \text{ SF}$$

$$\underline{4053 \text{ SF Pavement Total}}$$

Cable Barrier - 38,960 LF - 1080 LF = 37,880 LF

Barrier Anchors - 20 Ea.



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **160-4**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **USE 5-FT. PAVED SHOULDERS**

SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:**

The original shoulder design is 6.5 ft. of pavement and 3.5 ft. of grass.

**ALTERNATIVE:**

The minimum amount of paved shoulder is considered to be 5 ft. Therefore, use 5-ft. pavement shoulders with a 5-ft. grassed area beyond. Retain the same clear zone as the as-designed shoulder section.

**ADVANTAGES:**

- Reduces pavement costs
- Maintains safe clear zones

**DISADVANTAGES:**

- Perceived loss of safety
- May increase mowing costs (minimally)

**DISCUSSION:**

A reduction in the amount of paved shoulders with the same safety clear zones would reduce initial costs with a minimal loss of effectiveness in the project's rural environment.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 342,537	—	\$ 342,537
ALTERNATIVE	\$ 2,412	—	\$ 2,412
SAVINGS (Original minus Alternative)	\$ 340,125	—	\$ 340,125

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage

ALTERNATIVE NO.:

160-4

SHEET NO.: 2 of 3

Shoulder Pavement (Eliminate 1.5 ft)

$$Q = (\text{Sta } 491+60 - \text{Sta } 100+00) \cdot 1.5 \text{ ft} \cdot \frac{2}{9}$$
$$= 13,054$$

Grassing (Add 1.5 ft)

$$Q = (\text{Sta } 491+60 - \text{Sta } 100+00) \cdot 1.5 \text{ ft} \cdot \frac{2}{9} \cdot 43,560$$
$$= 2.7 \text{ Acre}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **160-5**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **EVALUATE THE PROFILE TO REDUCE THE AMOUNT OF** SHEET NO.: **1 of 3**  
**REQUIRED BORROW**

**ORIGINAL DESIGN:**

The present design has an earthwork balance which requires 800,000 cubic yards of borrow.

**ALTERNATIVE:**

Adjust the profile to reduce the amount of required fill embankment in an effort to reduce the necessary borrow. This reduction could be as high as 18% of the noted volume.

**ADVANTAGES:**

- Expedites construction
- Implements a common practice
- Reduces initial cost

**DISADVANTAGES:**

- Requires a redesign of the profile
- Requires a revision of the construction plans

**DISCUSSION:**

By adjusting the profile an average of 3 ft. in the noted location of the attached calculation sheet, the need for fill embankment is greatly reduced, thereby reducing construction and hauling costs and expediting construction.

It is important to mention this alternative does not include the savings in borrow material required to raise the US 27/SR 1 profile for the cattle crossing. If this alternative is implemented with Alt. No. 160-13 or Alt. No. 160-14 (to eliminate the cattle crossing or provide a railroad type signal to stop traffic on US 27/SR 1, respectively), more than 500,000 CY of borrow would be saved.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,018,160	—	\$ 1,018,160
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 1,018,160	—	\$ 1,018,160

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

160-5

SHEET NO.: 2 of 3

$$\text{STA. 145+00 to STA. 160+00 (Lower 3')} \\ \frac{1600' \times 3' \times 150'}{27 \text{ cf/cy}} = 26,670 \text{ c.y.}$$

$$\text{STA. 183+00 to STA. 200+00 (Lower 3')} \\ \frac{1700' \times 3' \times 150'}{27 \text{ cf/cy}} = 28,330 \text{ c.y.}$$

$$\text{STA. 228+00 to STA. 262+00 (Lower 2')} \\ \frac{2100' \times 2' \times 150'}{27 \text{ cf/cy}} = 23,000 \text{ c.y.}$$

$$\text{STA. 275+00 to STA. 287+00 (Lower 2.5')} \\ \frac{1200' \times 2.5' \times 150'}{27 \text{ cf/cy}} = 16,670 \text{ c.y.}$$

$$\text{STA. 334+00 to STA. 363+00 (Lower 3')} \\ \frac{2900' \times 3' \times 150'}{27 \text{ cf/cy}} = 48,330 \text{ c.y.}$$

(Net Quantities) Total  $\approx$  143,000 c.y.



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **160-7**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **REDUCE THE INSIDE TRAVEL LANE WIDTH TO 11 FT.** SHEET NO.: **1 of 4**  
**AND RETAIN THE 12-FT.-WIDE OUTSIDE TRAVEL LANES**

**ORIGINAL DESIGN:** (Sketch attached)

The present design uses four 12-ft.-wide travel lanes throughout the project length.

**ALTERNATIVE:** (Sketch attached)

Reduce the width of the two inside travel lanes to 11 ft. and retain the width of the proposed two outside travel lanes at 12 ft.

**ADVANTAGES:**

- Expedites construction
- Implements a common practice in other states
- Reduces initial cost

**DISADVANTAGES:**

- Narrows the inside travel lanes
- Not a common practice – although more and more an acceptable solution

**DISCUSSION:**

The alternative design saves 2 ft. of full-depth pavement (1 ft. on each inside travel lane) and reduces the project construction cost considerably. Since there is a larger volume of truck traffic on a 65 mph facility, the outside lanes would remain at the proposed 12-ft. widths. It should be noted there is a 2-ft. paved shoulder (full-depth) which provides extra “space” adjacent to the inside lanes.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 376,492	—	\$ 376,492
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 376,492	—	\$ 376,492

PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

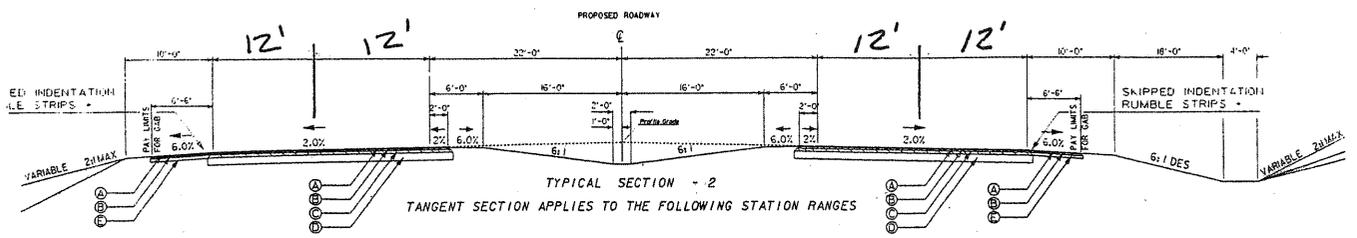
160-7

AS DESIGNED       ALTERNATIVE

SHEET NO.: 2 of 4

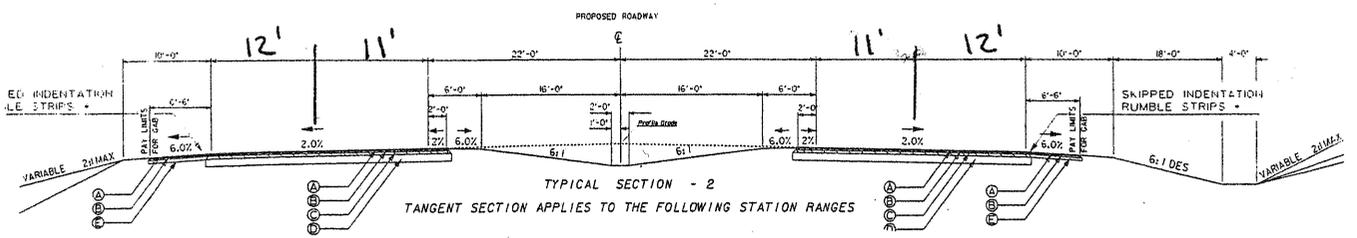
As Designed

US 27 / SR 1



Alternate

US 27 / SR 1



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

160-7

SHEET NO.: 3 of 4

EDS-27(160) see (Alt. 174-16) for full Depth  
 Pavement Calculations.  
 = \$43.26/sy

Roadway (SY)  

$$\left( 7.417 \text{ miles} \times \frac{5,280'}{\text{mi}} \times (1' + 1') \right) \div \frac{9 \text{ sf}}{\text{sy}} = 8,703 \text{ s.y.}$$
 for Savings or Additional Cost for Original



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and ALTERNATIVE NO.: 160-13**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **ELIMINATE THE CATTLE CROSSING SYSTEM** SHEET NO.: **1 of 4**

**ORIGINAL DESIGN:**

The mainline is raised to go over a new 10-ft. x 10-ft. concrete culvert, providing a “tunnel” to permit cattle to cross in either an east or west direction without impeding traffic; and honors a commitment made to a property owner.

**ALTERNATIVE:**

Eliminate raising the mainline to accommodate the concrete culvert and proposed cattle crossing.

**ADVANTAGES:**

- Reduces initial cost
- Reduces fill requirements
- Eliminates a large culvert that may not function as intended
- Enhances aesthetics
- Eliminates O&M costs of the culverts

**DISADVANTAGES:**

- Challenges a previous Department commitment to a property owner

**DISCUSSION:**

It is not known how often cattle must cross the highway. It was stated that cattle can graze on either side of the new roadway on an as-needed basis when the grazing fields are rotated. It is doubtful that cattle cross on such a frequent basis that elimination of the crossing would not have an adverse effect on the rancher.

Alt. No. 160-14 offers a similar suggestion.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,795,604	—	\$ 2,795,604
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 2,795,604	—	\$ 2,795,604

# CALCULATIONS

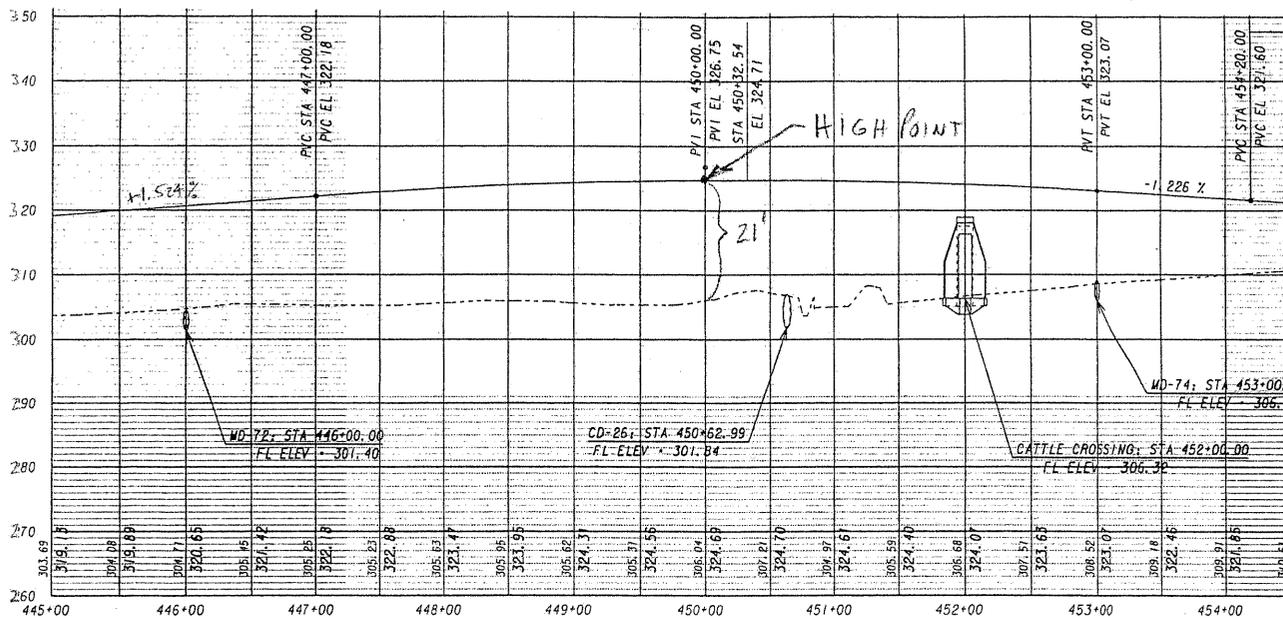


PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District4  
Design Development Stage**

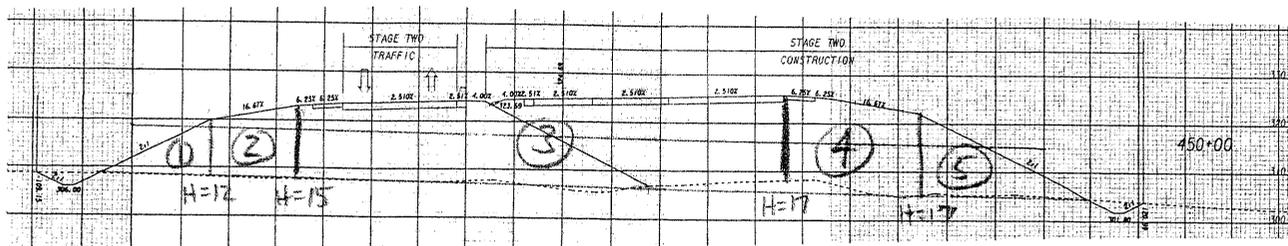
ALTERNATIVE NO.:

160-13

SHEET NO.: 2 of 4



PROFILE @ CATTLE CROSSING



TYP. CROSS SECTION

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

160-13

SHEET NO. 3 of 4

THE HIGH POINT IS AT STA 450+00.  
 THE SOUTH LOW POINT IS TAKEN AT STA 415+00 AS 0.  
 THE NORTH LOW POINT IS TAKEN AT STA 483+00 AS 0.

AREA @ HIGH POINT:

- ①  $\Rightarrow \left(\frac{12'}{2}\right) \times 22' = 132 \text{ SF}$
- ②  $\Rightarrow \left(\frac{12'+15'}{2}\right) \times 18' = 243$
- ③  $\Rightarrow \left(\frac{15'+17'}{2}\right) \times 102' = 1,632$
- ④  $\Rightarrow 17' \times 28' = 476$
- ⑤  $\Rightarrow \left(\frac{17'}{2}\right) \times 34' = 289 \rightarrow \Sigma = 2,772 \text{ SF}$

AVERAGE END AREA

	<u>L</u>	<u>A</u>	
415+00	> 3,500'	0	> 1386 (1/27) = 179,667 CY
450+00		2772	
483+00	> 3,300'	0	> 1386 (1/27) = 169,400 CY
10x10 CULVERT			
			$\Sigma = 349,067 \text{ CY}$

CLASS A CONC  $\Rightarrow$  318cy + 87cy + 18cy = 423cy  
BARREL WW/PAPR APRIN

BAR REINF  $\Rightarrow$  56,011 + 7,016 + 1,170 = 64,197 LB



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **160-14**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **PROVIDE AN AT-GRADE CATTLE CROSSING SYSTEM** SHEET NO.: **1 of 2**

**ORIGINAL DESIGN:**

The mainline is raised to go over a new 10-ft. x 10-ft. concrete culvert, providing a “tunnel” to permit cattle to cross in either an east or west direction without impeding traffic; and honors a commitment made to a property owner.

**ALTERNATIVE:**

Eliminate raising the mainline to accommodate the concrete culvert and provide a gated cattle crossing system similar to a railroad crossing system across the roadway at grade.

**ADVANTAGES:**

- Honors commitment to property owners
- Reduces initial cost
- Reduces fill requirements
- Eliminates a large culvert that may not function as intended

**DISADVANTAGES:**

- Impedes flow of traffic when cattle are required to cross the highway
- Slightly increases operation and maintenance costs
- May require GDOT personnel to operate if not remotely activated
- Affects aesthetics

**DISCUSSION:**

It is not known how often cattle cross the highway. It was stated that cattle can graze on either side of the new roadway on an as-needed basis when the grazing fields are rotated. It is doubtful that cattle cross on such a frequent basis that elimination of the crossing would not have an adverse effect on the rancher.

See Alt. no. 160-13 for the cost of the concrete culvert and associated fill requirements.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,795,604	—	\$ 2,795,604
ALTERNATIVE	\$ 500,000	—	\$ 500,000
SAVINGS (Original minus Alternative)	\$ 2,295,604	—	\$ 2,295,604



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and ALTERNATIVE NO.: 160-15**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **MAINTAIN THE EXISTING ALIGNMENT AT STATION SHEET NO.: 1 of 3**  
**335+00 TO STATION 370+00 AT OBLITERATED**  
**PAVEMENT**

**ORIGINAL DESIGN:**

The original design shifts the alignment to the east approximately 150 ft. at Station 360+00 and approximately 130 ft. west at alignment at Station 426+00.

**ALTERNATIVE:**

Hold the existing alignment to reduce the purchase of right-of-way. Once the profile grade at Station 426+00 is evaluated, it seems that due to the raising of the profile of approximately 6 ft., the alignment was shifted to avoid homes. Therefore, the shift in alignment at Station 360+00 is the only one in question.

**ADVANTAGES:**

- Reduces right-of-way costs
- Minimally reduces construction costs (not calculated)

**DISADVANTAGES:**

- Unexplained reason for the shift in alignment at the point in question

**DISCUSSION:**

There appears to be no reason for the shift in alignment of the mainline at approximate Station 369+00. If no reason emerges, then the calculated right-of-way and minor construction costs can be realized.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 27,192	—	\$ 27,192
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 27,192	—	\$ 27,192

# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage

ALTERNATIVE NO.:

160-15

SHEET NO.: 2 of 3

Basic shape of additional right of way near  
Sta 360+00:



$$Q = 3700\text{ft} \cdot 30\text{ft} \cdot \frac{1}{2} / 43560$$
$$= 1.3 \text{ Acre}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **160-16**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **USE A GUARDRAIL WITH 2:1 SLOPES TO REDUCE FILL** SHEET NO.: **1 of 5**

**ORIGINAL DESIGN:** (Sketch attached)

The present design uses a “barn roof” typical section (6:1 slope to clear zone and 2:1 beyond) for fill sections.

**ALTERNATIVE:** (Sketch attached)

Use guardrails and a 2:1 slope to reduce the amount of fill embankment.

**ADVANTAGES:**

- Reduces fill quantities
- Implements a common practice

**DISADVANTAGES:**

- Slightly increases initial cost
- Guardrail is considered an obstacle

**DISCUSSION:**

The “barn roof” typical section for fill sections is sometimes used to provide the necessary clear zone distance in lieu of a wider shoulder and guardrail. Since the project requires 365,000 CY of borrow, it may be beneficial to use 2:1 slopes with guardrails to reduce the amount of required fill. It is noted that since borrow on this project is 365,000 CY, the average height of fill needs to be 15 ft. or more to save costs.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 156,640	—	\$ 156,640
ALTERNATIVE	\$ 169,553	—	\$ 169,553
SAVINGS (Original minus Alternative)	\$ (12,913)	—	\$ (12,913)

PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

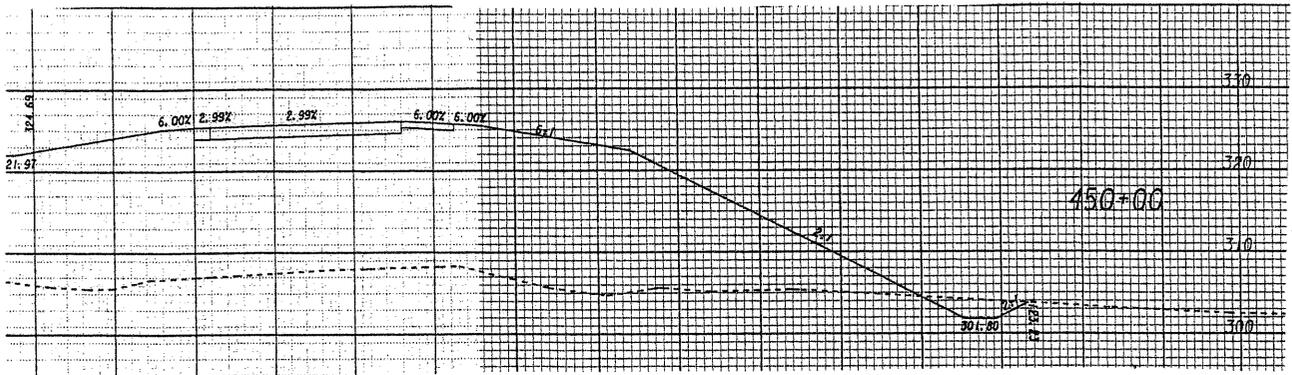
ALTERNATIVE NO.:

160-16

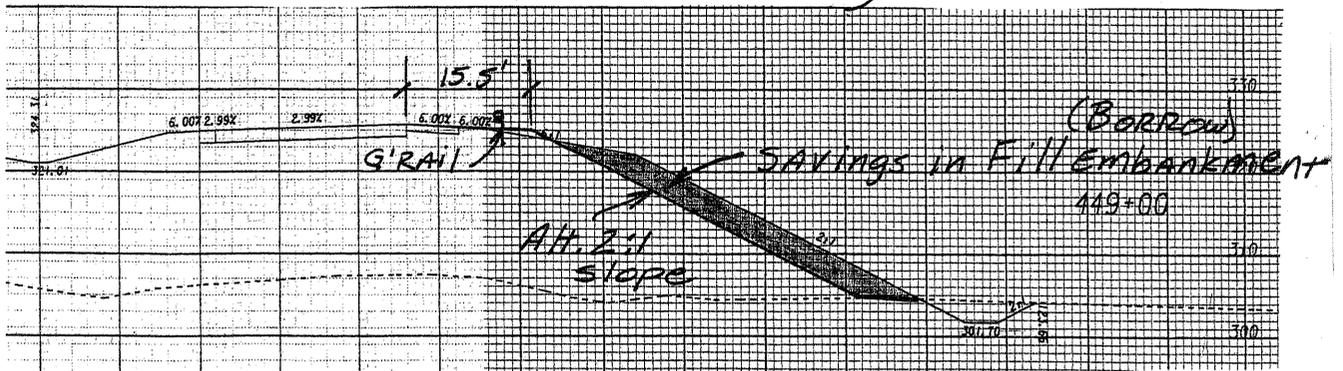
AS DESIGNED       ALTERNATIVE

SHEET NO.: 2 of 5

As Designed



Alternate Design



# CALCULATIONS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
 BRN00-0027-03(018), PI 431530  
 WIDENING AND RECONSTRUCTION US 27 / SR 1  
 Early, Clay and Randolph Counties, Georgia DOT, District 4  
 Design Development Stage

ALTERNATIVE NO.:

160-16

SHEET NO. 3 of 5

Savings in Required Fill embankment which  
 results in saving "BORROW" on this project.  
 By using Guard Rail & 2:1 fill slopes.

$$\text{STA. 136+00 to STA 139+00: } \frac{300' \times 3' \times 10'}{27 \frac{\text{cf}}{\text{cy}}} = 330 \text{ c.y.}$$

$$\text{STA. 144+00 to STA 154+00: } \frac{1000' \times 3' \times 16'}{27} = 1,800 \text{ c.y.}$$

$$\text{STA 195+00 to STA 198+00: } \frac{300' \times 3' \times 22'}{27} = 730 \text{ c.y.}$$

$$\text{STA 248+00 to 259+00: } \frac{1100' \times 3' \times 18'}{27} = 2,200 \text{ c.y.}$$

$$\text{STA 424+00 to STA 454+00: } \frac{3000' \times 3' \times 30'}{27} = 10,000 \text{ c.y.}$$

$$\text{STA 425+00 to STA 453+00: } \frac{2800' \times 3' \times 20'}{27} = 6,240 \text{ c.y.}$$

21060

total "Fill" Savings: 21,300 c.y.  
 say 22,000 c.y.

# CALCULATIONS



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

ALTERNATIVE NO.:

160-16

SHEET NO.: 4 of 5

Require G'rail for Alt. design  
(10" Beam): 8,400 L.F.  
Ty. 12 Anch. = 5 ea.                      Ty 1 Anch. = 5 ea.

Paving to G'rail  $\frac{8400' \times 5.5'}{9} = 5,130 \text{ S.Y.}$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and** ALTERNATIVE NO.: **160-17**  
**BRN00-0027-03(018), PI 431531**  
**US 27/SR 1 WIDENING AND RECONSTRUCTION**  
**Early, Clay, and Randolph Counties**

DESCRIPTION: **SHORTEN THE EAST-WEST IMPROVEMENTS TO CR-** SHEET NO.: **1 of 5**  
**267/COLOMOKEE CHURCH/ROCKMINE ROADS**

**ORIGINAL DESIGN:** (Sketch attached)

The original design includes 607 ft. of reconstruction along County Road 267; 357 ft. along Colomokee Church Road; and 250 ft. along Rockmine Road.

**ALTERNATIVE:** (Sketch attached)

Limit the reconstruction on CR-267 as much as possible. Based on the given profiles, it seems that approximately 120 ft. of reconstruction can be eliminated.

**ADVANTAGES:**

- Reduces construction cost
- Minimizes construction impacts

**DISADVANTAGES:**

- May not provide as smooth a transition for US 27/SR 1 to side roads

**DISCUSSION:**

Limiting side road reconstruction reduces costs but would be required on numerous side roads to make a major impact. Due to the raising of the mainline profile grade on this project, many side roads end up needing vertical reconstruction. As such, this alternative may not have a significant impact on the project.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 13,843	—	\$ 13,843
ALTERNATIVE	\$ 0	—	\$ 0
SAVINGS (Original minus Alternative)	\$ 13,843	—	\$ 13,843

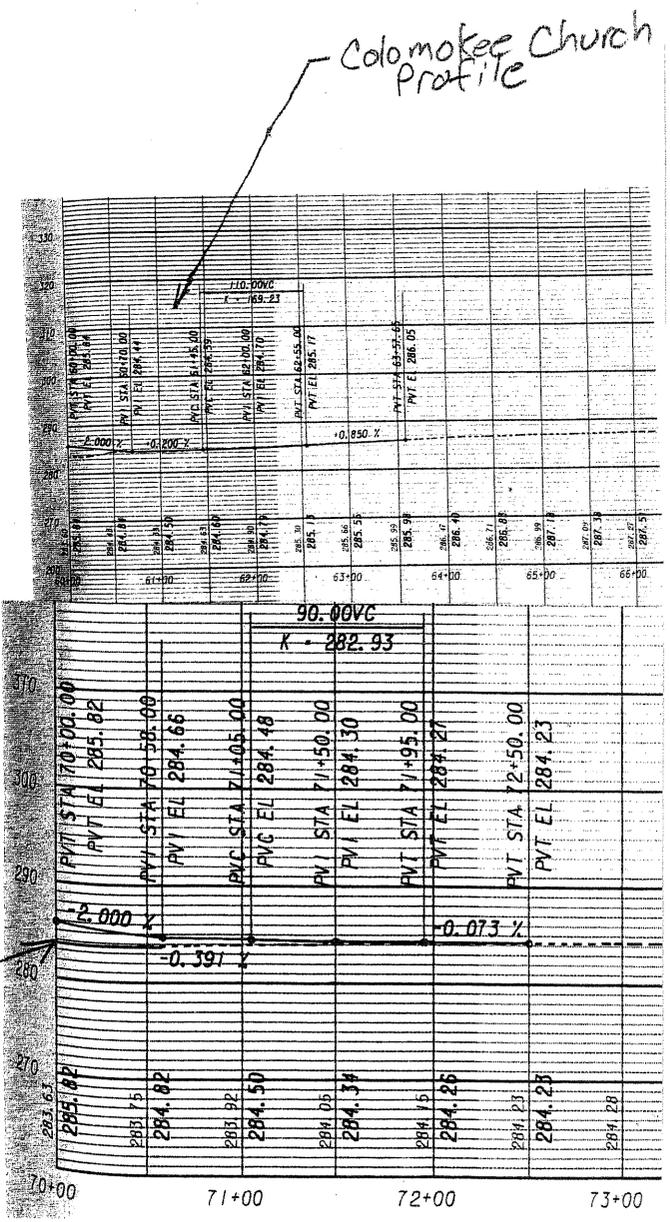
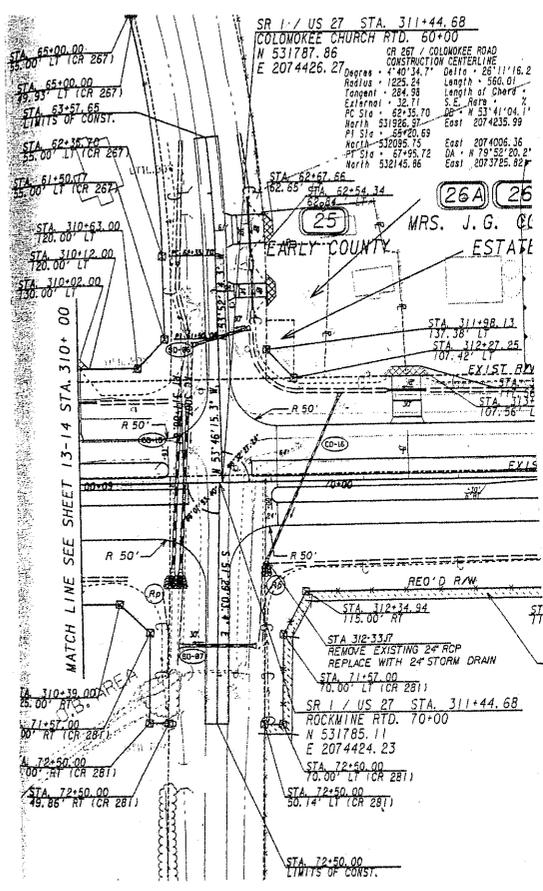
PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District 4  
Design Development Stage**

ALTERNATIVE NO.:

160-17

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 5



Rockmine Profile

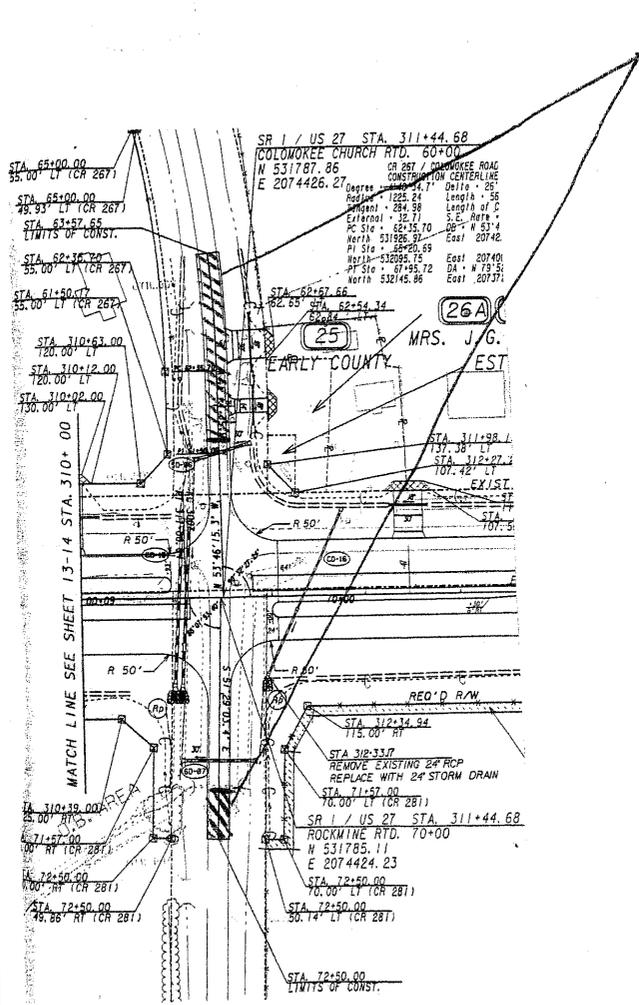
PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27 / SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District4  
Design Development Stage**

ALTERNATIVE NO.:

160-17

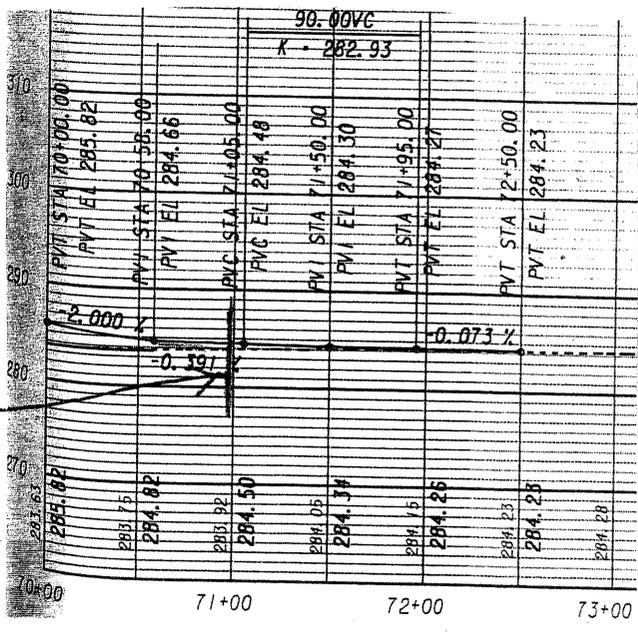
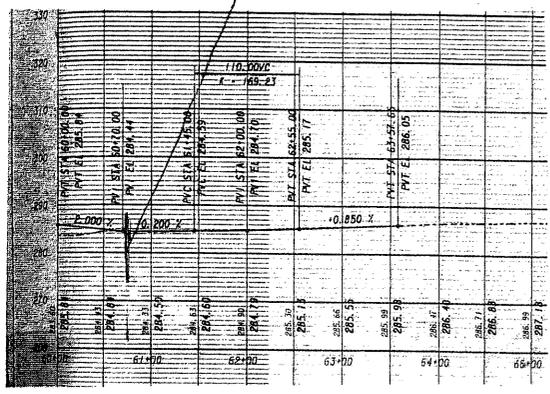
AS DESIGNED  ALTERNATIVE

SHEET NO.: 3 of 5



*Eliminate 120ft  
of Reconstruction*

*End reconstruction  
of Colomokee  
here (75ft from Q)*



*End Reconstruction  
of Rockmine  
here (100ft from Q)*

# CALCULATIONS



PROJECT: **EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and**  
**BRN00-0027-03(018), PI 431530**  
**WIDENING AND RECONSTRUCTION US 27 / SR 1**  
**Early, Clay and Randolph Counties, Georgia DOT, District 4**  
*Design Development Stage*

ALTERNATIVE NO.:

160-17

SHEET NO.: 4 of 5

Pavement Quantity:

$$Q = 24\text{ft} \cdot 120\text{ft} / 9 = 320 \text{ SY}$$



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## PROJECT DESCRIPTION

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### INTRODUCTION

The widening and reconstruction of US 27/SR 1 is part of the Governor's Road Improvement Program (GRIP) and involves the multi-laning of this primary north-south corridor in west Georgia, serving as a catalyst for the development of this region. The improvements will aid in the economic development of sparsely populated rural areas and small towns along this route. Traffic carrying capacity will be increased, and safety and operational characteristics along this segment will be improved.

The GRIP is a system of proposed economic developmental highways in Georgia that was originally adopted in 1989 by the Georgia General Assembly. Georgia law defines the following corridors as the GRIP:

- Appalachian Developmental Highway
- South Georgia Parkway/US 82
- US 319
- Golden Isles Parkway
- Fall Line Freeway
- SR 72
- Savannah River Parkway
- US 19
- US 1/SR 17
- **US 27**
- US 441
- US 84
- Sunbelt Parkway/SR 133
- Power Alley/US 280
- East-West Highway
- SR 40
- SR 32
- SR 125
- SR 15

GRIP originally consisted of 14 corridors with 2,690 miles of roadway, including 113 miles of truck access routes. During the 2001 and 2005 Legislative sessions, the General Assembly added new routes, including three truck access routes. The current length of the GRIP system has grown to 3,314 miles. The total length will continue to vary as alignments, including bypasses and shifts, are determined through the engineering process.

### Purpose

Economic development highways traditionally receive strong support in Georgia. The purpose of the GRIP system explains why:

- Provide connectivity in Rural Georgia: GRIP will connect 95% of Georgia cities with a population of 2,500 or more to the Interstate System and ensure that 98% of all areas in the state will be within 20 miles of a four-lane road.
- Provide opportunities for growth: Several studies have provided evidence that GRIP fosters economic development.
- Provide effective and efficient transportation for the growing statewide population.
- Improve safe travel in rural areas: Accidents occur three times more often on two-lane highways than on multi-lane divided highways, especially on corridors with higher travel volumes.

## **US 27/SR 1 Corridor Facts**

- The US 27/SR 1 corridor traverses the entire western length of the state beginning in Chattanooga at the Tennessee State Line and continuing south through Rome, Carrollton, Columbus and Bainbridge at the Florida State Line.
- Completed projects provide four lanes of roadway, usually divided with a 44-ft.-wide grass median.
- The US 27 corridor is approximately 352 miles long.
- Approximately 304 miles (87%) of the corridor is open to traffic or under construction.
- The current estimated cost to complete the four-lane construction of the US 27 corridor is \$466,382,000.

## **PROJECT LOCATION**

Project EDS00-0027-00(159), P.I. No. 422230, is located in Clay and Randolph Counties and proposes to improve US 27/SR 1 from Bluffton Bypass in Clay County to 2,225 ft. north of CR 153/Carnegie Vilulah Road in Randolph County. The total length of this project is 7.33 miles.

Project EDS00-0027-00(174), P.I. No. 422235, is in Randolph County and proposes to improve US 27/SR 1 from CR 153/Carnegie Vilulah Road northward to the Cuthbert Bypass. The total length of this project is 8.36 miles.

Project EDS00-0027-00(160), P.I. No. 422220, is in Early and Clay Counties and widens US 27/SR 1 from the Blakely Bypass to the Bluffton Bypass. This project begins at CR 156/W. J. Davis Road, north of Blakely, at the end of the Bluffton Bypass. The project extends northeastward 7.15 miles to the Clay County Line.

Figure 1 shows the location of the projects.



- Project EDS00-0027-00(174), P.I. No. 422235: This project involves the widening of the existing two-lane US 27/SR 1 to a four-lane roadway with a 44-ft. depressed grassed median. The existing bridge over the Georgia Southwestern Railroad will be replaced under twin project BRN00-0027-03(018), P.I. No. 431531 and a new parallel bridge will be constructed under EDS00-0027-00(174). The PFPR was held on March 3, 2005. This project is currently scheduled for July 2009. The concept was approved January 31, 1995 and revised on June 7, 2002. Final roadway plans are 90% complete and final bridge plans are under review by GDOT's Office of Bridge Design.

The anticipated costs of construction are as follows:

	Construction Cost*	Right of Way Costs**	Reimbursable Utilities**
EDS00-0027-00(159)	\$ 27,003,754	\$ 5,769,000	\$ 421,685
EDS00-0027-00(160)	31,475,757	2,451,000	197,622
EDS00-0027-00(174)	28,219,317	3,350,000	319,061
BRN00-0027-03(018)	925,749	-	-
Subtotals	87,624,577	\$ 11,570,000	\$ 938,368
Grand Total	\$ 100,132,945		

\*No markups or contingency factors have been added to construction costs.

\*\* These figures are taken directly from the latest TPro documents.

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## VALUE ANALYSIS AND CONCLUSIONS

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### INTRODUCTION

This section describes the procedures used during the value engineering study on the US 27/SR 1 widening and reconstruction project. It is followed by separate narratives and conclusions concerning:

- Workshop agenda
- Workshop participants
- Economic data
- Cost model
- Function analysis
- Creative idea listing and evaluation

A systematic approach was used in the VE study and the key procedures involved were organized into three distinct parts: 1) pre-study preparation; 2) VE workshop; and 3) post-study. A task flow diagram that outlines each of the procedures included in the VE study is attached for reference.

### PREPARATION EFFORT

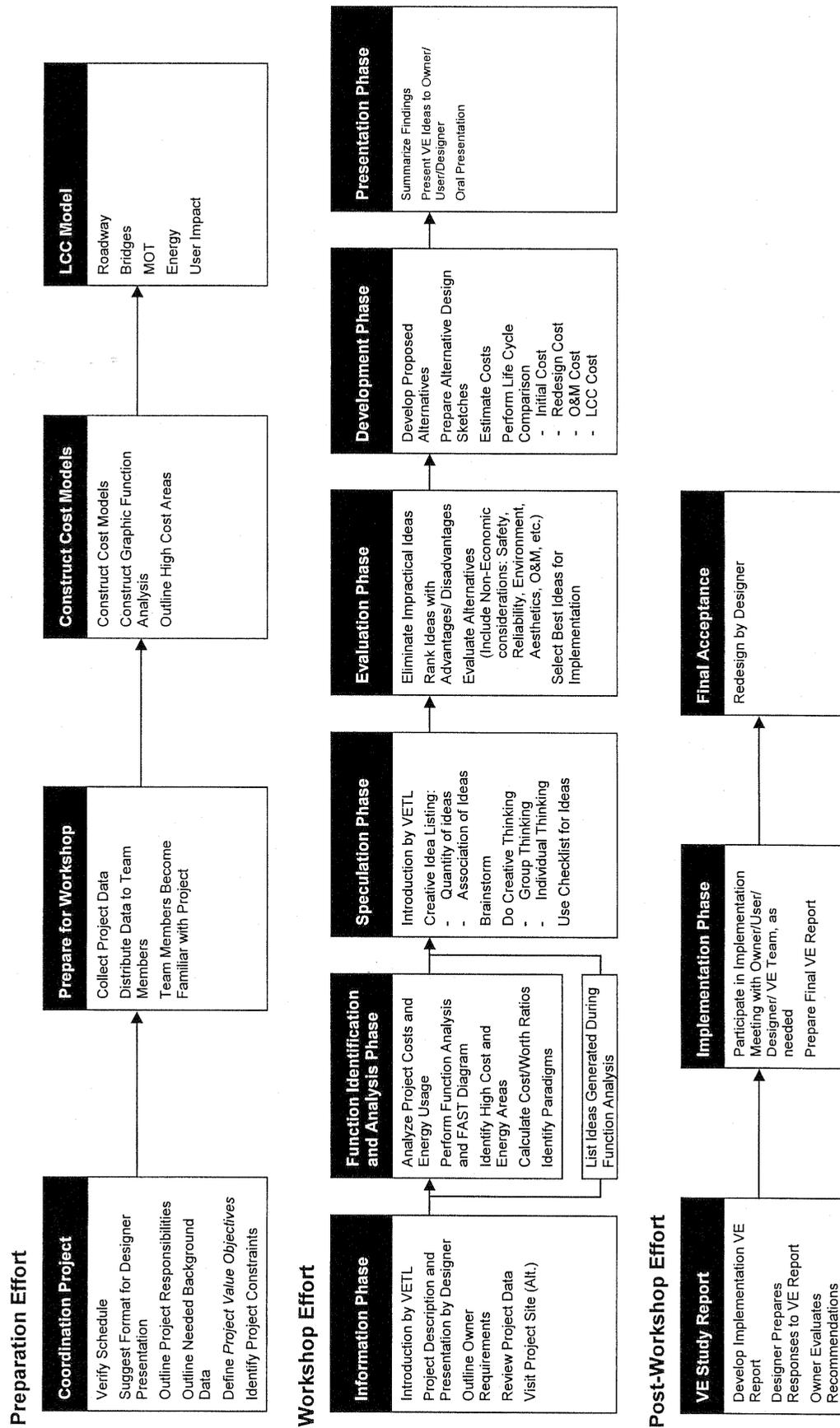
Pre-study preparation for the VE effort consisted of scheduling study participants and tasks, gathering necessary background information on the facility, and compiling project data into a cost model and graphic cost histogram. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning operating needs, systems evaluations, basis of cost, soil conditions, and construction of the facility was also a part of the analysis.

### VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three and a half-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Speculation Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

# Value Engineering Study Task Flow Diagram



## Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the development manager presented information about the project to the VE team on first day of the session. Following the presentation, the VE team discussed the project using the following documents:

- GDOT GRIP Fact Sheet, updated May 2006;
- Revised Project Concept Report, Department of Transportation, State of Georgia, Office of Preconstruction for EDS00-0027-00(159), Clay and Randolph Counties, P.I. No. 422230, dated June 7, 2002;
- Estimate Report for File “EDS-27 (159)” for Project EDS00-0027-00(159), P.I. No. 422230, prepared by the Gresham Smith and Partners (GSP) and Moreland Altobelli Associates, Inc. (MA), dated June 25, 2008;
- Project Concept Report, Department of Transportation, State of Georgia, Office of Preconstruction for EDS00-0027-00(159), Clay and Randolph Counties, P.I. No. 422230, dated March 9, 1995;
- Half-size Construction Plans entitled Plan and Profile of Proposed U.S. 27/S.R. 1, State Aid Project EDS00-0027-00(159), Clay and Randolph Counties, Federal Route 27, State Route 1, P.I. No. 422230, prepared by Gresham Smith and Partners (GSP) and Moreland Altobelli Associates, Inc., for the State of Georgia Department of Transportation, run date August 4, 2008;
- Design Files CD for Projects EDS00-0027-00(159) P.I. No. 422230 and EDS00-0027-00(174), P. I. No. 422235, provided by GDOT, undated;
- Revised Project Concept Report, Department of Transportation, State of Georgia, Office of Preconstruction for EDS00-0027-00(160), Early and Clay Counties, P.I. No. 422220, dated February 23, 2000;
- Estimate Report for File “EDS-27 (160) PI 422220” for Project EDS00-0027-00(160), P.I. No. 422220, prepared by the State of Georgia Department of Transportation; dated August 25, 2008;
- Project Concept Report, Department of Transportation, State of Georgia, Office of Preconstruction for EDS00-0027-00(160), Early and Clay Counties, P.I. No. 422220, dated February 7, 1995;
- Half-size Construction Plans entitled Plan and Profile of Proposed Widening and Reconstruction of US-27/S.R. 1, from Blakely Bypass to Bluffton Bypass, State Aid Project EDS00-0027-00(160), Early and Clay Counties, Federal Route #U.S. 27, State Route #S.R. 1, P.I. No. 422220, prepared by the State of Georgia Department of Transportation, run date August 25, 2008;
- Revised Project Concept Report, Department of Transportation, State of Georgia, Office of Environmental/Location for EDS00-0027-00(174), Randolph County, P. I. No. 422235, dated May 28, 2002;
- Estimate Report for File “EDS-0027-00(174)-Aug2708” for Project EDS00-0027-00(174), P.I. No. 422235, prepared by Moreland Altobelli Associates, Inc., Brindley Pieters & Associates, Inc. and Development Planning & Engineering, Inc., dated August 27, 2008;
- Estimate Report for File “BRN-027-3(18) Randolph” for Project BRN00-0027-03(018), P.I. No. 431530, prepared by Moreland Altobelli Associates, Inc., Brindley Pieters & Associates, Inc. and Development Planning & Engineering, Inc., dated August 27, 2008;
- Half-size Construction Plans entitled Plan and Profile of Proposed Widening and Reconstruction of US 27/SR 1, Randolph County, Federal Aid Project EDS-0027-00(174), EDS00-0027-00(174), P.I. No. 422235 and BRN00-0027-3(018), P. I. No. 431530; Federal Route 27, State

- Route No. 1, prepared Moreland Altobelli Associates, Inc., Brindley Pieters & Associates, Inc., and Development Planning & Engineering, Inc., dated August 27, 2008;
- Early, Clay, and Randolph Counties Accident Rate Calculations for Years 1999 through 2007, prepared by the Department of Transportation, State of Georgia, undated;
  - Statewide Mileage, Travel and Accident Data for Years 1999 through 2006, prepared by the Department of Transportation, State of Georgia, undated;
  - Email with District 4 Recommendations for VE Study from Joe Cowan, District Four District Construction Engineer, dated September 8, 2008;
  - Overview Location Map of EDS00-0027-00(160)(159)(174) and BRN00-0027-03(018), Early, Clay, and Randolph Counties, P.I. Nos. 422220, 422230, 422235 and 431530, undated;
  - Email with ROW Project Status Reports, TPro Data for VE Study from Karyn Matthews, Design Group Manager, dated September 9, 2008;
  - Standards and Construction Details Binder; prepared by the Department of Transportation, State of Georgia, undated;
  - Standard Specifications Construction of Transportation Systems, prepared by the Department of Transportation, State of Georgia, 2001 Edition;
  - Design Policy Manual, A Georgia Department of Transportation Publication, Version 2.0, revised June 1, 2007;
  - A Policy on Geometric Design of Highway and Streets, prepared by the American Association of State Highway and Transportation Officials, dated 2004;
  - General Highway Map of Early County, Georgia, prepared by the Department of Transportation, Division of Planning and Programming, Planning Data Services in cooperation with the U.S. Department of Transportation, Federal Highway Administration, dated 1982;
  - General Highway Map of Clay County, Georgia, prepared by the Department of Transportation, Division of Planning and Programming, Office of Information Services in cooperation with the U.S. Department of Transportation, Federal Highway Administration, dated 1994;
  - General Highway Map of Randolph County, Georgia, prepared by the Department of Transportation, Division of Planning and Programming, Office of Information Services in cooperation with the U.S. Department of Transportation, Federal Highway Administration, dated 1995; and
  - Official Highway and Transportation Map of Georgia, dated 2007 – 2008.

### **Function Identification and Analysis Phase**

Based on historical and background data, a cost model and graphic function analysis were developed for this project by major construction elements. They were used to distribute costs by project element, serve as a basis for alternative functional categorization, and assign worth to the categories, where worth is the least cost to provide the required function, as determined by the VE team. The VE team identified the functions of the various project elements and subsystems by using random function generation techniques resulting in the attached Random Function Analysis worksheet and Function Analysis Systems Technique (F.A.S.T.) diagram.

### **Speculation Phase**

This phase involved the creation and listing of ideas. Creative idea worksheets were organized by project element. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the

project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and association of ideas.

### **Evaluation Phase**

During this phase of the workshop, the VE team judged the ideas generated during the Speculation Phase. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were then developed further.

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts, in terms of how well it met the design intent. Advantages and disadvantages were discussed, and each team member rated the ideas on a scale of zero to five, with the best ideas rated five. Total scores were summed for each idea and only highly-rated ideas were developed into alternatives. In cases where there was little cost impact, but an improvement to the project was anticipated, the designation DS, for design suggestion, was used. The design team should review this listing for possible incorporation of ideas into the project.

The creative listing was re-evaluated frequently during the process of developing alternatives. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single alternative. For these reasons, some of the originally high-rated items may not have been developed into alternatives.

### **Development Phase**

During the Development Phase, each highly rated idea was expanded into a workable solution. The development consisted of a description of the alternative, life cycle cost comparisons, where applicable, and a descriptive evaluation of the advantages and disadvantages of the proposed alternatives. Each alternative was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the Study Results section of the report.

### **Presentation Phase**

The last phase of the VE study was the presentation of the findings. The VE alternatives were screened by the VE team before draft copies of the Summary of VE Alternatives table was provided to GDOT and the design team during an informal presentation on the last day of the study. The VE alternatives were arranged in the same order as the idea listing sheets to facilitate cross-referencing.

### **POST-WORKSHOP EFFORT**

The post-study portion of the VE study includes the preparation of this Value Engineering Study Report. Personnel from GDOT and the design team will analyze each alternative and prepare a short response, recommending either incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection.

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# VALUE ENGINEERING STUDY AGENDA

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Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 36-hour Value Engineering (VE) study on the following projects: **EDS00-0027-00(159)(160)(174), P.I. Nos. 422230, 422220, and 422235** respectively, and **BRN00-0027-03(018), PI No. 421530, WIDENING AND RECONSTRUCTION OF U.S. ROUTE 27 (US 27) / STATE ROUTE 1 (SR 1)**. The projects are located in Early, Clay and Randolph Counties, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) and the following design consultants: Gresham Smith and Partners (GSP) / Moreland Altobelli Associates, Inc. (MA) [for EDS00-0027-00(159)]; GDOT [for EDS00-0027-00(160)]; and Moreland Altobelli Associates, Inc. (MA) / Brindley Pieters & Associates (BPA) / Development Planning & Engineering, Inc. (DPE) [for EDS00-0027-00(174) and BRN00-0027-03(018)], will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

## VE Study Agenda

The VE study will follow the outline described below and be conducted September 9 - 12, 2008, in the Engineering Services' Conference Room on the 5<sup>th</sup> Floor, Room 5CR1L2, at GDOT's General Office located at One Georgia Center, 600 West Peachtree Street, N.W., Atlanta, Georgia 30308. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager / Value Engineering Coordinator, who can be reached at 404-631-1770.

### Tuesday, September 9<sup>th</sup>

9:00 am – 9:15 am                      **General Introduction of all Parties and review of the VE Process**

9:15 am - 11:15 am                    **Owner's / Designer's Presentation**

GDOT and the design consultants are to present information concerning the projects including, but not necessarily limited to: rationale for design, criteria for specific areas of study, project constraints, and the reasons for design decisions.

11:15 am - 12:00 noon                **Commence Function Analysis Phase**

The VE team will continue their familiarization with the cost models and project data for each area of study. The cost model(s) will be refined, as necessary; define the function of each project element or system in the cost model, select the primary or basic functions, and determine the worth, or least cost, to provide the function. Cost / worth or value index ratios will be calculated, and high cost / low worth areas for study identified. In addition, the VE team will continue defining the function of each element / system to gain a thorough understanding of the project's needs and requirements.

12:00 noon - 1:00 pm                **Lunch**

1:00 pm - 5:00 pm                    **Conclude the Function Analysis Phase and Commence the Creative Phase**

The VE team will conduct a brainstorming session and list as many ideas as possible for consideration. The aim is to obtain a large quantity of ideas through free association, by eliminating roadblocks to creativity and deferring judgment.

### **Wednesday, September 10<sup>th</sup>**

8:30 am - 10:00 am                      **Conclude Creative Phase and Complete Evaluation / Analytical Phase**

The VE team will analyze the ideas listed in the creative phase and select the best ideas for further development.

10:00 am - 12:00 noon                **Development Phase**

VE team will develop creative ideas into alternate design solutions. Initial and life cycle cost estimates comparing original and proposed alternatives will be prepared. Selected alternatives for change will be developed and supported with sketches, calculations and written substantiation.

12:00 noon - 1:00 pm                **Lunch**

1:00 pm - 5:00 pm                    **Continue Development Phase**

### **Thursday, September 11<sup>th</sup>**

8:30 am - 12:00 am                    **Continue Development Phase**

12:00 noon - 1:00 pm                **Lunch**

1:00 pm - 4:00 pm                    **Conclude Development Phase**

4:00 pm – 5:00 pm                    **Commence Summary Worksheets for Information oral Presentation**

Upon completion of the Development Phase, the VE facilitator will commence preparation of the summary worksheets based on the alternatives developed by the VE team. The summary worksheets will form the basis of the informal oral presentation.

### **Friday, September 12<sup>th</sup>**

8:00 am - 9:00 am                    **Finalize Summary Worksheets**

9:00 am – 11:00 am                  **Informal Oral Presentation**

The VE team presents its alternatives to the owner and design team representatives and is available to clarify any points. The process for accepting / rejecting VE alternatives is described and a target schedule for meeting to finalize implementation decisions is established.

## VALUE ENGINEERING WORKSHOP PARTICIPANTS

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The VE team was organized to provide specific expertise on the project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of VE procedures:

<b>Name</b>	<b>Discipline</b>	<b>Organization</b>
Joseph A. Leoni, PE	Roadway Engineer	ARCADIS U.S., Inc.
Jeffery G. Dingle, PE	Construction Engineer	Delon Hampton and Associates
Lawrence D. Prescott, Jr., PE	Bridge Engineer	HNTB
Dominic F. Saulino	Roadway Engineer	HNTB
Luis M. Venegas, PE, CVS, FSAVE, LEED AP	Facilitator	Lewis & Zimmerman Associates

### OWNER'S/DESIGNER'S PRESENTATION

Representatives from GDOT, Moreland Altobelli Associates, Inc., Brindley Pieters & Associates, Inc., Development Planning & Engineering, Inc., and Gresham Smith and Partners presented an overview of the projects on Tuesday, September 9, 2008. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE Study, was to bring the VE team up-to-speed regarding the overall project. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention.

### VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team conducted an informal presentation of its findings on Friday, September 12, 2008. Copies of the draft Summary of VE Alternatives table was provided to GDOT and the design team for interim use.

A copy of the meeting participants is attached for reference.

# VALUE ENGINEERING ATTENDEES

## MEETING PARTICIPANTS



PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and BRN00-0027-03(018), PI 431531 WIDENING AND RECONSTRUCTION US 27/SR 1 Early, Clay and Randolph Counties, Georgia DOT, District4 <i>Design Development Stage</i>		Date: <b>September 9 - 12, 2008</b>
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Name: Carlos Baker em: cabaker@dot.ga.gov	GDOT, Office of Road Design Transportation Engineer Associate	ph: 404-635-8149 cell: 404-604-0009 fx: 404-635-8116
Name: C. Andy Casey, PE em: acasey@dot.ga.gov	GDOT, Office of Road Design Transportation Engineer	ph: 404-631-9757 cell: fx: 404-631-1946
Name: Joe Cowan, PE em: jcowan@dot.ga.gov	GDOT, District 4, Office of Construction District Construction Engineer	ph: 229-386-3304 cell: 229-309-9756 fx: 229-386-3612
Name: Dot Downie em: d.downie@dot.ga.gov	GDOT, District 4, Office of Construction Area Engineer	ph: 229-386-3066 cell: 229-309-9897 fx: 229-732-4032
Name: Joe King em: joking@dot.ga.gov	GDOT, Office of Bridge Design Assistant Group Leader Bridge Design	ph: 404-631-1913 cell: fx: 404-631-1954
Name: James Magnus, CPESC em: jmagnus@dot.ga.gov	GDOT, Office of Construction Assistant State Construction Engineer	ph: 404-631-1971 cell: fx: 404-631-1941
Name: Karyn M. Matthews, PE em: kmatthews@dot.ga.gov	GDOT, Office of Consultant Design/Program Delivery Design Group Manager	ph: 404-631-1584 cell: fx: 404-631-1588
Name: Tim Matthews, PE em: tmatthews@dot.ga.gov	GDOT, Office of Road Design Assistant Design Group Manager	ph: 404-631-1584 cell: fx: 404-631-1949
Name: Gerald A. Milligan em: jmilligan@dot.ga.gov	GDOT, Office of Right of Way Supervisor Appraisal Estimator	ph: 770-986-1541 cell: fx: 770-986-1558
Name: Lisa L. Myers em: lmyers@dot.ga.gov	GDOT, Engineering Services Design Review Engineer Manager, Value Engineering Coordinator	ph: 404-631-1770 cell: fx: 404-631-1956

# VALUE ENGINEERING ATTENDEES

## MEETING PARTICIPANTS



<b>PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and BRN00-0027-03(018), PI 431530 WIDENING AND RECONSTRUCTION US 27/SR 1 Early, Clay and Randolph Counties, Georgia DOT, District4 Design Development Stage</b>		Date: <b>September 9 - 12, 2008</b>
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Name: Amber Leigh Phillips em: aPhillips@dot.ga.gov	GDOT, Office of Environmental/Location NEPA/Contract Specialist	ph: 404-699-4408 cell: fx: 404-699-4440
Name: Chris Rudd em: crudd@dot.ga.gov	GDOT, Office of Road Design Design Engineer	ph: 404-631-1551 cell: fx: 404-631-1949
Name: Ken Werho em: kwerho@dot.state.ga.com	GDOT, Office of Traffic Safety and Design Design Review Engineer	ph: 404-635-8144 cell: fx: 404-635-8116
Name: Darryl D. Lowe em: dlowe@bpa-engineers.com	Brindley Pieters & Associates, Inc. Senior Transportation Engineer	ph: 404-224-9260 cell: 678-923-1360 fx: 404-224-9268
Name: Edgardo E. Aponte, PE em: eaponte@dpengr.com	Development Planning & Engineering, Inc. Senior Transportation Engineer	ph: 678-730-1873 cell: 678-361-1056 fx: 770-271-0779
Name: Jody Braswell em: jody_braswell@gspnet.com	Gresham Smith and Partners	ph: 678-518-4655 cell: 678-836-9864 fx:
Name: Gunter H. Hirschler em: ghirschler@moreland-altobelli.com	Moreland Altobelli Associates, Inc. Associate, Project Manager	ph: 770-263-5945 cell: 404-216-4621 fx: 770-263-0166
Name: Joseph A. Leoni, PE, PE em: joe.leoni@arcadis-us.com	ARCADIS U.S., Inc. Roadway QA/QC Manager	ph: 770-431-8666 cell: 770-294-9970 fx: 770-435-2666
Name: Jeffery G. Dingle, PE em: jdingle@delonhampton.com	Delon Hampton & Associates, Chartered Vice President, Corporate Marketing Director	ph: 404-524-8030 cell: 404-427-0155 fx: 404-524-2575
Name: Lawrence D. Prescott, Jr., PE em: lprescott@hntb.com	HNTB Corporation Director of Structural Engineering	ph: 404-946-5943 cell: 404-558-9627 fx: 404-841-2820

# VALUE ENGINEERING ATTENDEES

## MEETING PARTICIPANTS



<b>PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and                  BRN00-0027-03(018), PI 431530                  WIDENING AND RECONSTRUCTION US 27/SR 1                  Early, Clay and Randolph Counties, Georgia DOT, District4                  Design Development Stage</b>		Date: <b>September                  9 - 12, 2008</b>
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Name: Dominic (Dom) F. Saulino  em: dsaulino@hntb.com	HNTB Corporation  Associate Vice President, Director of Transportation	ph: 404-946-5745 cell: 678-206-9205  fx: 404-841-2820
Name: Luis M. Venegas, PE, CVS, FSAVE, LEED AP  em: lvenegas@lza.com	Lewis & Zimmerman Associates, Inc.  Value Engineering Facilitator	ph: 770-992-3032 cell: 678-488-4287  fx: 770-435-2666
Name:  em:		ph: cell:  fx:

## ECONOMIC DATA

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The VE team developed economic criteria to evaluate the information gathered from GDOT and the design team. To express costs in a meaningful manner, the VE team's alternatives are presented on the basis of discounted present worth. Criteria for planning project period interest rates are based on the following parameters:

Year of Analysis:	2008
Construction Start Up:	September 2009 (EDS00-0027-00(159)(174)) May 2009 (EDS00-0027-00(160))
Construction Duration:	±36 Months (All three project – average)
Economic Planning Life:	35 years for Pavement
Economic Planning Life:	50 years for Bridges
Discount Rate/Interest:	2.50% (extrapolated from latest United States Office of Management and Budget Circular A-94, Appendix C – January 2008)
Inflation/Escalation Rate:	N/A
Uniform Present Worth (UPW) Factor:	23.1452 for 35 years 28.3623 for 50 years
Cost of Power:	\$0.07/kWHr (assumed)
Operation and Maintenance Costs ( <i>Industry Norms</i> ):	
Equipment - With Many Moving Parts	5.00%-5.50%+ of Capital Cost
Equipment - With Minimal Moving Parts	3.50%-4.00% of Capital Cost
Equipment - Electronic	3.00% of Capital Cost
Structural	1.00%-2.00% (or less) of Capital Cost

## COST ESTIMATE SUMMARY AND COST HISTOGRAMS

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The VE team prepared the attached cost models for the project. The models are arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and are based on the following: (1) Estimate Report for File EDS-27 (159), for Project EDS00-0027-00(159), P.I. No. 422230, (2) Estimate Report for File EDS-27 (160) PI 422220, for Project EDS00-0027-00(160), P.I. No. 422220, (3) Estimate Report for File EDS-0027-00(174)-Aug2708, for Project EDS00-0027-00(174), P.I. No. 422235, and (4) Estimate Report for File BRN-027-3(18) Randolph for Project BRN00-0027-03(018), P.I. No. 431530.

As can be expected, judgment at this stage of the study is based on experience and intuition rather than fact, which are is uncovered until well along in the analysis of function. As a result of these qualified hypotheses, there appears to be a potential for initial savings in the following areas:

- Roadway reduction due to alignment/realignment/lowering profile
- Median width reduction
- Minimize median openings
- Right-of-way reductions

### DESIGNER'S COST ESTIMATE

The cost estimates did not have any markup costs or contingencies after the initial cost for construction. Right-of-way costs were taken from the latest TPro data sheets and used as-is.

In order to facilitate the cost developments of the selected ideas, the VE team generated numerous unit prices for specific roadway costs that are noted below:

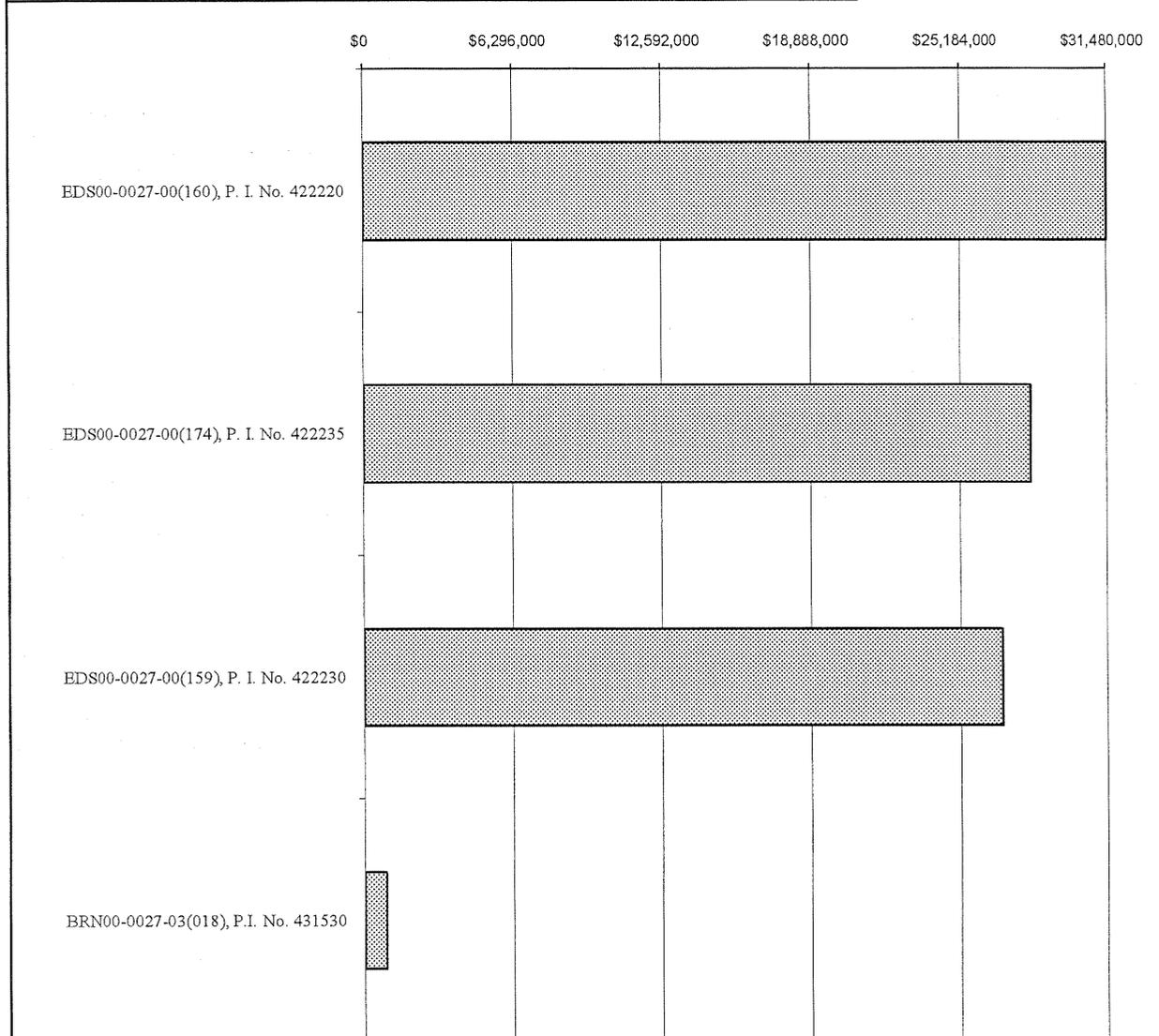
	Pavement Unit Cost/SY	Shoulder Unit Cost/SY	ROW/Acre
<b>EDS00-0027-00(159)</b>	\$ 42.61	\$ 28.73	\$ 39,858
<b>EDS00-0027-00(160)</b>	\$ 43.26	\$ 26.24	\$ 20,917
<b>EDS00-0027-00(174)</b>	\$ 42.60	\$ 28.72	\$ 25,408

# COST HISTOGRAM



Project: **EDS00-0027-00(159)(160)(174) and BRN00-0027-03(018)**  
**WIDENING AND RECONSTRUCTION OF US 27/SR 1**  
 Early, Clay and Randolph Counties, Georgia Department of Transportation, District 4  
*Design Development Stage*

TOTAL PROJECT	COST	PERCENT	CUM. PERCENT
EDS00-0027-00(160), P. I. No. 422220	31,475,757	35.92%	35.92%
EDS00-0027-00(174), P. I. No. 422235	28,219,317	32.20%	68.13%
EDS00-0027-00(159), P. I. No. 422230	27,003,754	30.82%	98.94%
BRN00-0027-03(018), P.I. No. 431530	925,749	1.06%	100.00%
<b>Construction Subtotal</b>	<b>\$ 87,624,577</b>	<b>100.00%</b>	
Right-of-Way Costs; EDS00-0027-00(160), P. I. No. 422220	\$ 2,451,000		
Right-of-Way Costs; EDS00-0027-00(174), P. I. No. 422235	\$ 3,350,000		
Right-of-Way Costs; EDS00-0027-00(159), P. I. No. 422230	\$ 5,769,000		
<b>Right-of-Way Subtotal</b>	<b>\$ 11,570,000</b>		
Reimbursable Utilities Costs; EDS00-0027-00(160), P. I. No. 422220	\$ 197,622		
Reimbursable Utilities Costs; EDS00-0027-00(174), P. I. No. 422235	\$ 319,061		
Reimbursable Utilities Costs; EDS00-0027-00(159), P. I. No. 422230	\$ 421,685		
<b>Reimbursable Utilities Subtotal</b>	<b>\$ 938,368</b>		
<b>GRAND TOTAL</b>	<b>\$ 100,132,945</b>		



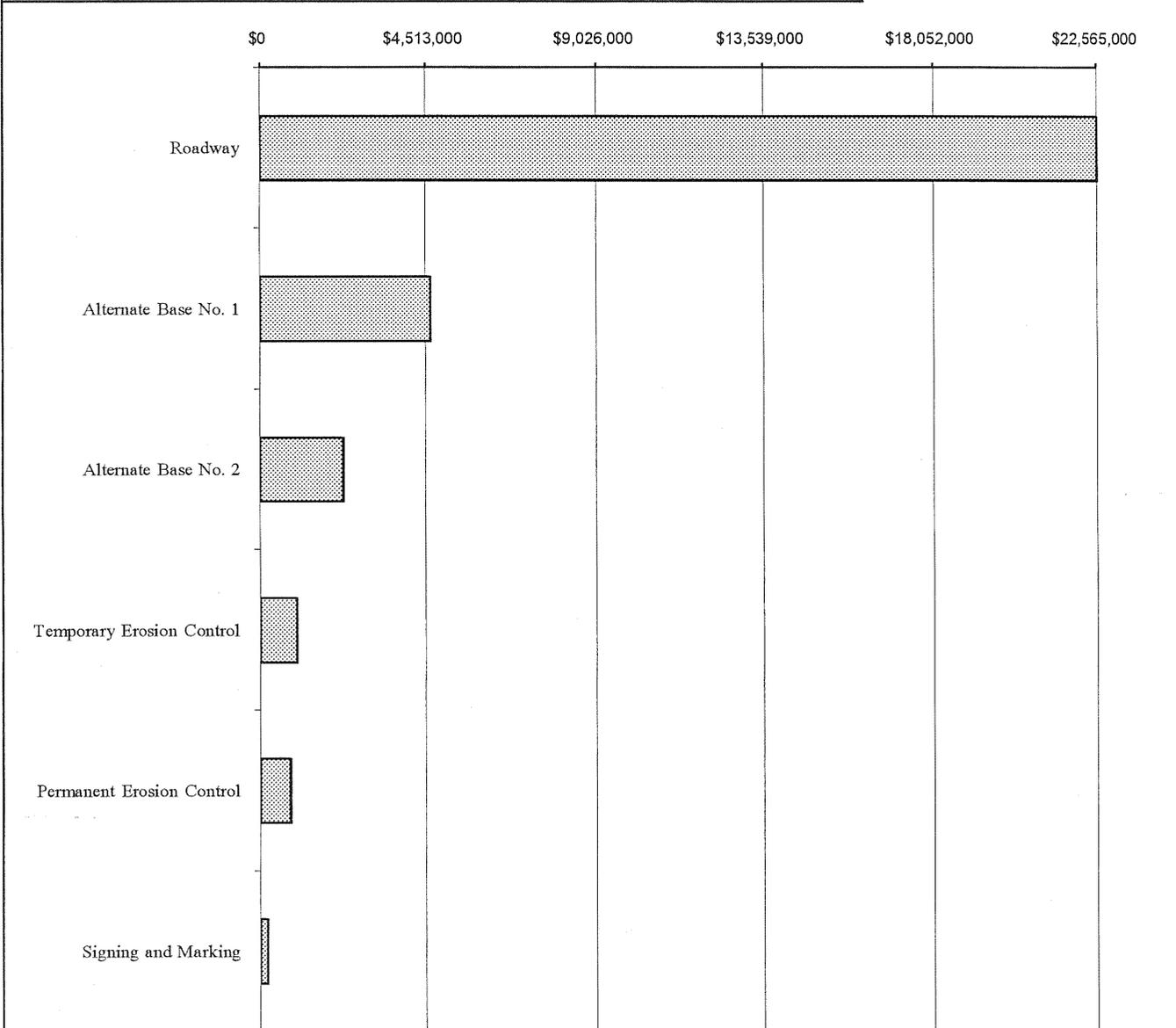
*Costs in graph are not marked-up.*

# COST HISTOGRAM



Project: **EDS00-0027-00(159)(160)(174) and BRN00-0027-03(018)**  
**WIDENING AND RECONSTRUCTION OF US 27/SR 1**  
 Early, Clay and Randolph Counties, Georgia Department of Transportation, District 4  
*Design Development Stage*

EDS00-0027-00(160), P. I. No. 422220	COST	PERCENT	CUM. PERCENT
Roadway	22,564,840	71.69%	71.69%
Alternate Base No. 1	4,635,472	14.73%	86.42%
Alternate Base No. 2	2,274,278	7.23%	93.64%
Temporary Erosion Control	994,543	3.16%	96.80%
Permanent Erosion Control	813,883	2.59%	99.39%
Signing and Marking	192,740	0.61%	100.00%
<b>Construction Subtotal</b>	<b>\$ 31,475,756</b>	<b>100.00%</b>	
Right-of-Way Costs; EDS00-0027-00(160), P. I. No. 422220	\$ 2,451,000		
Reimbursable Utilities Costs; EDS00-0027-00(160), P. I. No. 422220	\$ 197,622		
<b>GRAND TOTAL</b>	<b>\$ 34,124,378</b>		



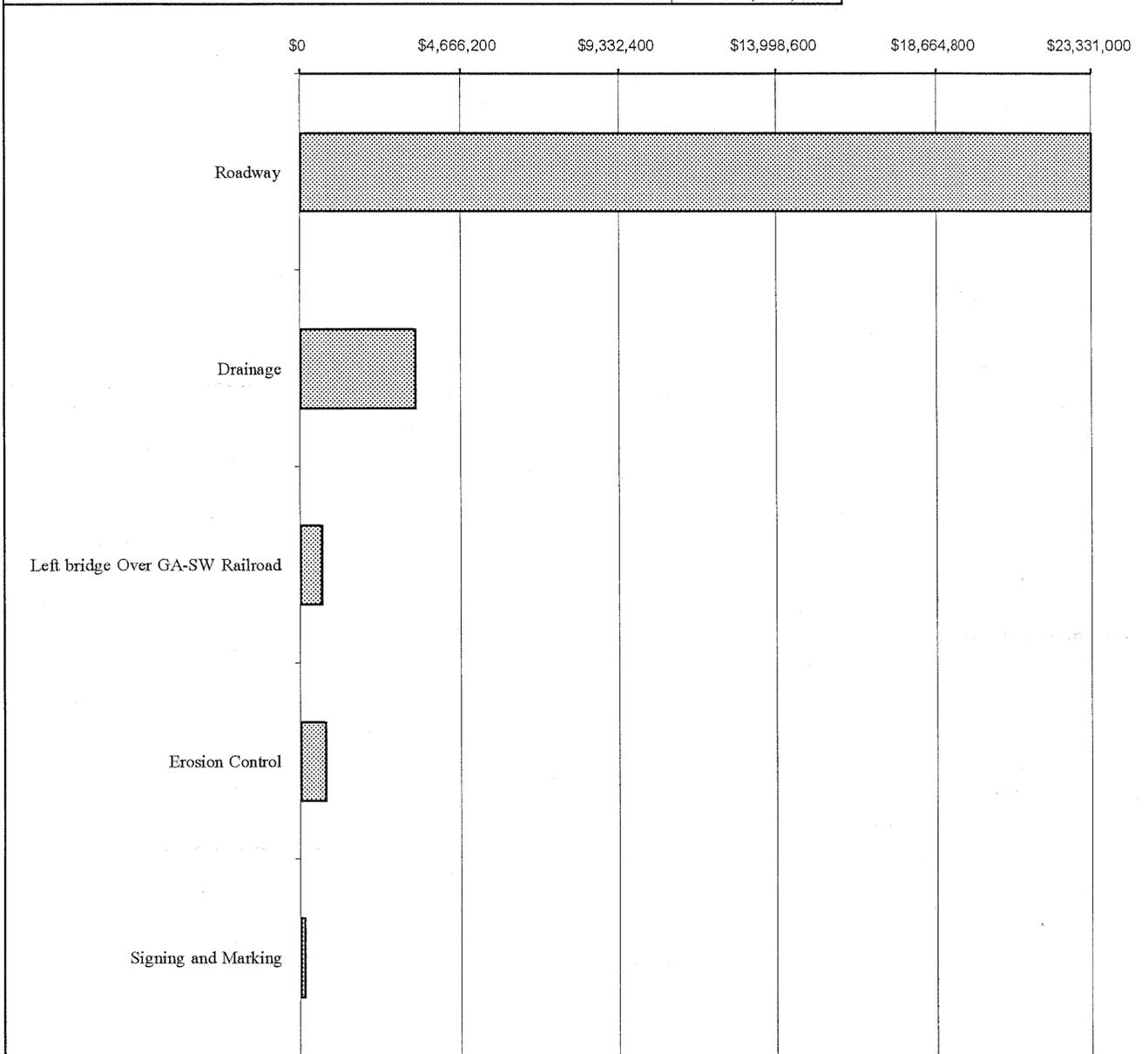
*Costs in graph are not marked-up.*

# COST HISTOGRAM



Project: **EDS00-0027-00(159)(160)(174) and BRN00-0027-03(018)**  
**WIDENING AND RECONSTRUCTION OF US 27/SR 1**  
 Early, Clay and Randolph Counties, Georgia Department of Transportation, District 4  
*Design Development Stage*

EDS00-0027-00(174), P. I. No. 422235	COST	PERCENT	CUM. PERCENT
Roadway	23,330,917	82.68%	82.68%
Drainage	3,376,871	11.97%	94.64%
Left bridge Over GA-SW Railroad	638,476	2.26%	96.91%
Erosion Control	740,536	2.62%	99.53%
Signing and Marking	132,518	0.47%	100.00%
<b>Construction Subtotal</b>	<b>\$ 28,219,318</b>	<b>100.00%</b>	
Right-of-Way Costs; EDS00-0027-00(174), P. I. No. 422235	\$ 3,350,000		
Reimbursable Utilities Costs; EDS00-0027-00(174), P. I. No. 422235	\$ 319,061		
<b>GRAND TOTAL</b>	<b>\$ 31,888,379</b>		



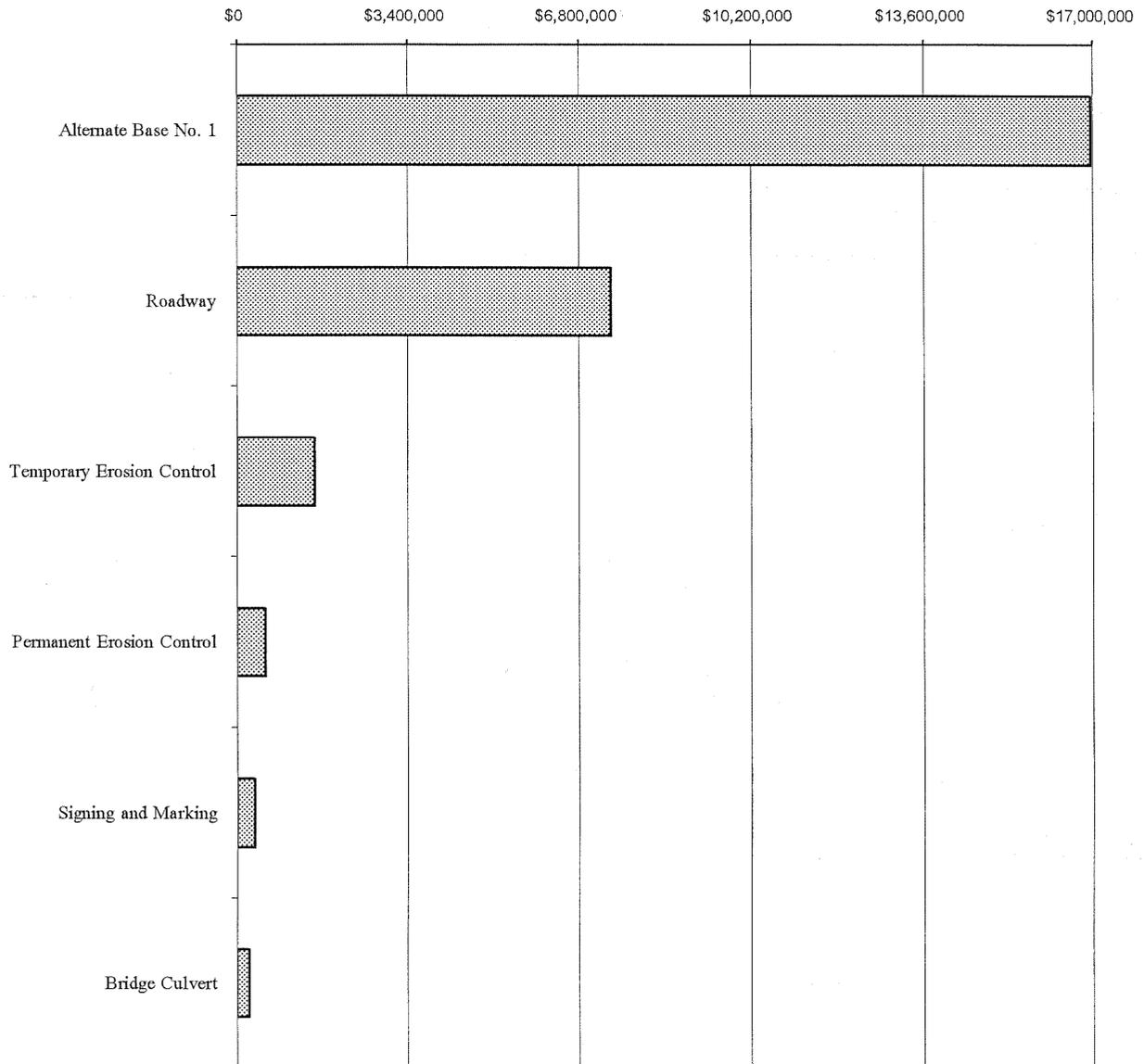
Costs in graph are not marked-up.

# COST HISTOGRAM



Project: EDS00-0027-00(159)(160)(174) and BRN00-0027-03(018)  
**WIDENING AND RECONSTRUCTION OF US 27/SR 1**  
 Early, Clay and Randolph Counties, Georgia Department of Transportation, District 4  
*Design Development Stage*

EDS00-0027-00(159), P. I. No. 422230	COST	PERCENT	CUM. PERCENT
Alternate Base No. 1	16,949,760	62.77%	62.77%
Roadway	7,407,098	27.43%	90.20%
Temporary Erosion Control	1,522,314	5.64%	95.84%
Permanent Erosion Control	547,582	2.03%	97.86%
Signing and Marking	338,267	1.25%	99.12%
Bridge Culvert	238,733	0.88%	100.00%
<b>Construction Subtotal</b>	<b>\$ 27,003,754</b>	<b>100.00%</b>	
Right-of-Way Costs; EDS00-0027-00(159), P. I. No. 422230	\$ 5,769,000		
Reimbursable Utilities Costs; EDS00-0027-00(159), P. I. No. 422230	\$ 421,685		
<b>GRAND TOTAL</b>	<b>\$ 33,194,439</b>		



*Costs in graph are not marked-up.*

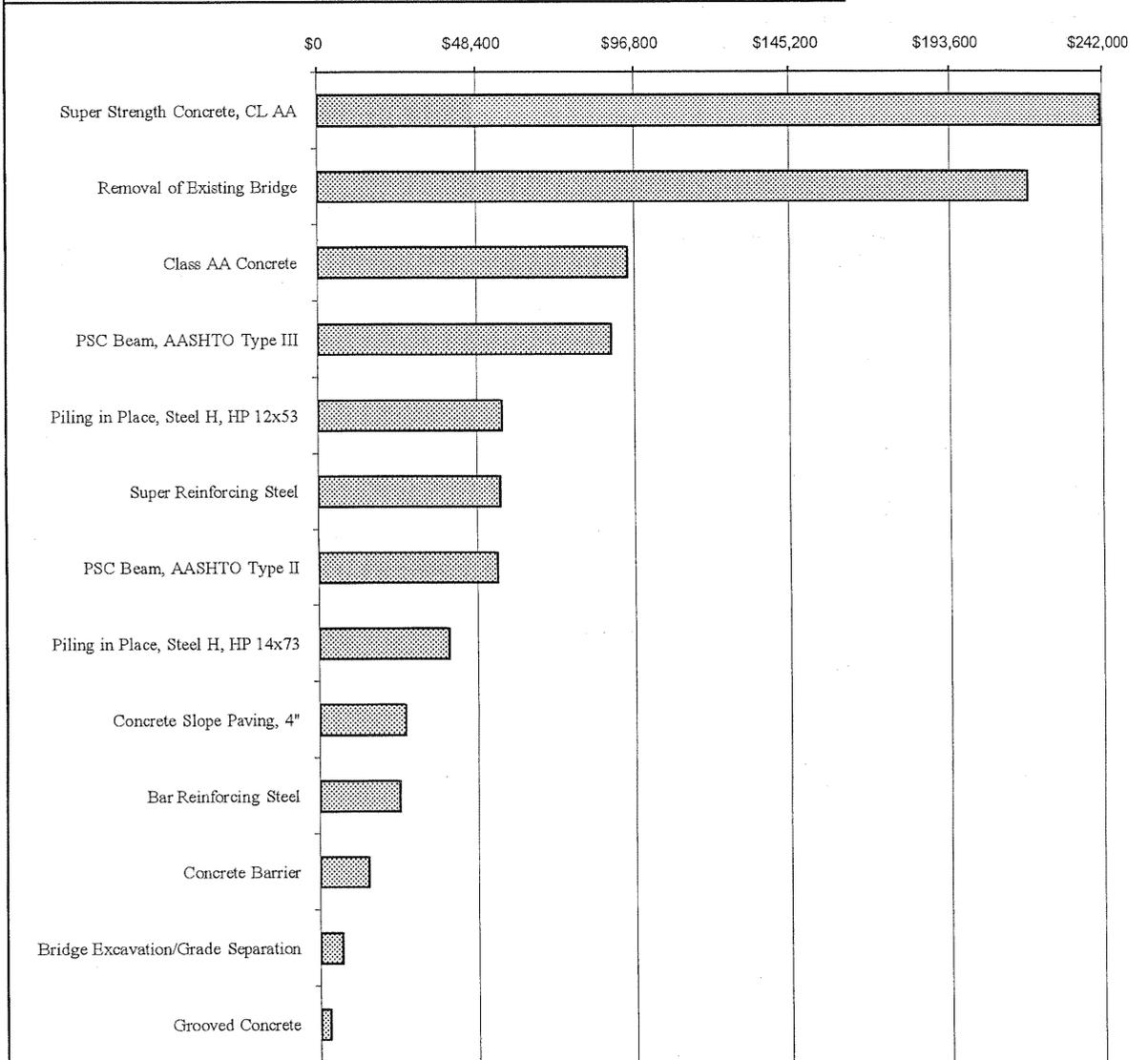
# COST HISTOGRAM



Project: EDS00-0027-00(159)(160)(174) and BRN00-0027-03(018)  
**WIDENING AND RECONSTRUCTION OF US 27/SR 1**  
 Early, Clay and Randolph Counties, Georgia Department of Transportation, District 4  
*Design Development Stage*

<b>BRN00-0027-03(018)</b>	COST	PERCENT	CUM. PERCENT
Super Strength Concrete, CL AA	241,371	26.07%	26.07%
Removal of Existing Bridge	218,209	23.57%	49.64%
Class AA Concrete	94,754	10.24%	59.88%
PSC Beam, AASHTO Type III	89,533	9.67%	69.55%
Piling in Place, Steel H, HP 12x53	55,886	6.04%	75.59%
Super Reinforcing Steel	55,415	5.99%	81.57%
PSC Beam, AASHTO Type II	54,449	5.88%	87.46%
Piling in Place, Steel H, HP 14x73	39,674	4.29%	91.74%
Concrete Slope Paving, 4"	26,525	2.87%	94.61%
Bar Reinforcing Steel	24,646	2.66%	97.27%
Concrete Barrier	15,251	1.65%	98.92%
Bridge Excavation/Grade Separation	7,064	0.76%	99.68%
Grooved Concrete	2,970	0.32%	100.00%
<b>Construction Subtotal</b>	<b>\$ 925,747</b>	<b>100.00%</b>	

**GRAND TOTAL \$ 925,747**



*Costs in graph are not marked-up.*

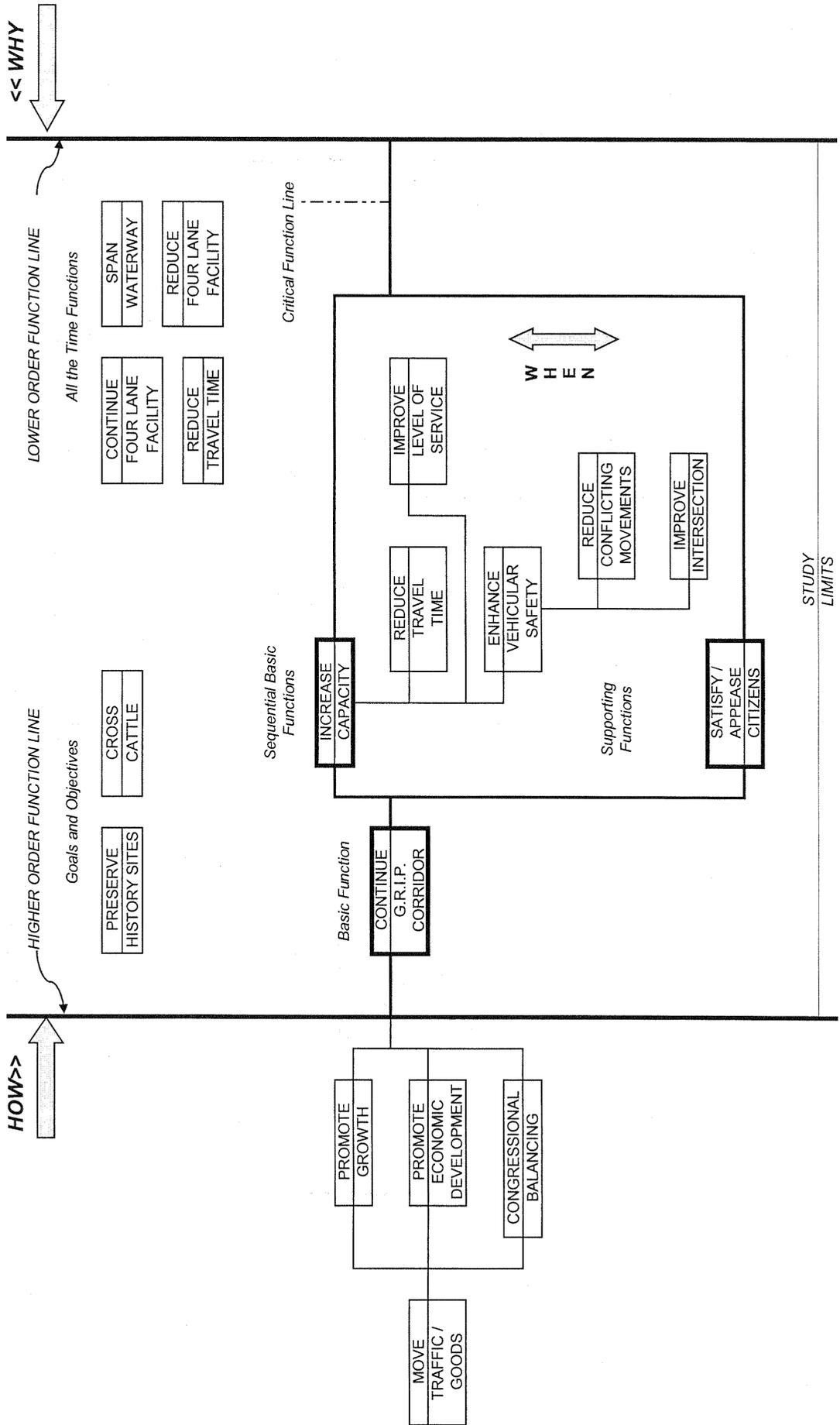


FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F. A. S. T.)  
**Widening and Reconstruction of US 27/SR 1**

EDS00-0027-00(159)(160)(174) and BRN00-0027-03(018)

P. I. Nos. 422230, 422220, 422235, and 431530

Georgia Department of Transportation, District 4  
 Early, Clay, and Randolph Counties, Georgia



## FUNCTION ANALYSIS

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Function analysis of the project was performed to define the requirements for each project element and ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. A Random Function Analysis worksheet for the project is attached. This part of function analysis stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

Function analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These elements add cost to the final product, but have a relatively low worth to the basic function.

In addition to the random function analysis, the VE team leader worked with members of the study team to develop a Function Analysis System Technique (F.A.S.T.) diagram for each phase. The F.A.S.T. diagrams were used to show the flow of function within the phases and help confirm the project is addressing those issues that have been voiced by the owner as being important. The diagrams were generated by asking the key question: "What is the most important function to be accomplished by this phase?" The answer is characterized by a verb/noun pair. In turn, another question is asked: "Why?" The answer is again listed in a verb/noun pair, and the process continued from left to right. If the result is a true F.A.S.T. diagram, the flow of functions from right to left will answer the question "Why?" No F.A.S.T. diagram is ever completed. The readers of this report may wish to challenge themselves to see how far they can carry the construction of the F.A.S.T. diagram.

This F.A.S.T. diagram notes the critical function paths and identifies the projects' basic functions as **CONTINUING/G.R.I.P.** by **Increasing/Capacity** and **Satisfying/Citizens**. The F.A.S.T. diagram is included at the end of this section of the report.



## CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

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During the Speculation Phase, numerous ideas, alternative proposals and/or recommendations were generated using conventional brainstorming techniques as recorded on the following pages.

These ideas were discussed and the advantages/disadvantages of each listed. The VE team compared each of the ideas with the concept solution determining whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were ranked on a scale of 1 to 5 on how well the VE team believed the idea met necessary criteria and program needs. The higher rated ideas were developed into formal alternatives. Some ideas were judged to have minimal cost impacts on the project but provided enhancements in the form of improved operations, efficiency, constructibility or potential to save unknown or hidden costs. These were given the designation "DS" which indicates a design suggestions. This designation is also used when an idea is difficult to price but improves the functionality of the project or system, and is deemed to be of significant value to the owner, user, operator or designer.

Typically, all ideas rated 4 or 5 are developed and included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research that indicated the concept as not being cost-effective or technically feasible.

# CREATIVE IDEA LISTING



PROJECT:	<b>EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and                  BRN00-0027-03(018), PI 431530                  WIDENING AND RECONSTRUCTION US 27/SR 1                  Early, Clay and Randolph Counties, Georgia DOT, District4                  Design Development Stage</b>	SHEET NO.: <b>1 of 2</b>
NO.	IDEA DESCRIPTION	RATING
	<b>EDS00-0027-00(174)</b>	
174-1	Use existing road to the Cuthbert-Randolph Airport	4
174-2	Do not realign CR-17/Mitchell Grove Road	4
174-3	Minimize improvements/relocation of CR-70/Mount Hebron Road	4
174-4	Use 11-ft. lanes throughout	3
174-5	Use a 32-ft. median	4
174-6	Use minimal median width with cable barrier and reduce the number of openings	4
174-7	Use a narrower paved shoulder	4
174-8	Minimize the number of beams on the new bridges	4
174-9	Use a steel bridge in lieu of a concrete bridge	2
174-10	Replace box culvert with precast system for Carter Creek – Stream #12	4
174-11	Replace box culvert with precast system for Stream #11	4
174-12	Evaluate profile to reduce quantity of borrow	4
174-13	Reduce design speed to 55 mph	3
174-14	Use MSE walls at bridge approaches in lieu of embankment	4
174-15	Upgrade existing alignments	3
174-16	Use a 12-ft. outside travel lane and an 11-ft. inside travel lane	4
	<b>EDS00-0027-00(159)</b>	
159-1	Use 11-ft. lanes throughout	3
159-2	Use a 32-ft. median	4
159-3	Use minimal median width with cable barrier and reduce the number of openings	4
159-4	Use a narrower paved shoulder	4
159-5	Evaluate profile to reduce quantity of borrow	4
159-6	Reduce design speed to 55 mph	3
159-7	Move alignment further east between Stations ±185+00 and ±300+00	2
159-8	Use one-way pairs between Stations ±185+00 and ±300+00	4****
Rating: 1 → 2 = Not to be Developed;      3 – 4 = Varying Degree of Development Potential;      5 = Most Likely to be Developed; DS = Design Suggestion;      ABD = Already Being Done;      N/A = Not Applicable		

# CREATIVE IDEA LISTING



**PROJECT: EDS00-0027-00(159)(160)(174), PI 422230, 422220, 422235; and  
BRN00-0027-03(018), PI 431530  
WIDENING AND RECONSTRUCTION US 27/SR 1  
Early, Clay and Randolph Counties, Georgia DOT, District4  
Design Development Stage**

**SHEET NO.:**  
**2 of 2**

NO.	IDEA DESCRIPTION	RATING
	<b>EDS00-0027-00(159)</b> (continued)	
159-9	Replace two box culverts with precast system for the stream at Station ±346+00	4
159-10	Upgrade existing alignments	3
159-11	Use a 12-ft. outside travel lane and an 11-ft. inside travel lane	4
	<b>EDS00-0027-00(160)</b>	
160-1	Use 11-ft. lanes throughout	3
160-2	Use a 32-ft. median	4
160-3	Use minimal median width with cable barrier and reduce the number of openings	4
160-4	Use a narrower paved shoulder	4
160-5	Evaluate profile to reduce quantity of borrow	4
160-6	Reduce design speed to 55 mph	3
160-7	Use a 12-ft. outside travel lane and an 11-ft. inside travel lane	4
160-8	Upgrade existing alignments	3
160-9	Shorten east side road connection with CR 156/W. J. Davis Road	4
160-10	Maintain existing alignment for CR 155/Walnut Fork Road	4
160-11	Maintain existing alignment for CR 157/Evelyn Gee Road	4
160-12	Maintain existing alignment for CR 340/Schoolhouse Road	4
160-13	Eliminate cattle crossing	4
160-14	Use a cattle crossing ala railroad crossing	4
160-15	Maintain existing alignment at obliterated pavement	4
160-16	Use guardrail with 2:1 slope beyond and reduce fill	4
160-17	Shorten east-west improvements to CR-267/Colomokee Church Road	4

Rating: 1 → 2 = Not to be Developed;      3 – 4 = Varying Degree of Development Potential;      5 = Most Likely to be Developed;  
DS = Design Suggestion;      ABD = Already Being Done;      N/A = Not Applicable