

*NHS-0000-00(691)*  
*I-16 Median Rest Area*  
*P.I. No. 0000691*  
Candler County, Georgia

## Value Engineering Study Report

March 2006



*Design Consultant*  
Clark-Patterson Associates





**Lewis & Zimmerman Associates, Inc.**

*Taking the Chance out of Change*

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April 3, 2006

Ms. Lisa L. Myers  
Design Review Engineer Manager  
State of Georgia Department of Transportation  
General Office  
No. 2 Capitol Square, Room 266  
Atlanta, Georgia 30334-1002

re: Project Number NHS-0000-00(691), P.I. No. 0000691  
I-16 Median Rest Area, Candler County, Georgia  
Value Engineering Study Report—Concept Development Stage

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc., is pleased to submit four hard copies and one electronic copy of the referenced report.

The focus of the VE study was to explore alternatives to reduce the high cost associated with the preferred design, which allows right-hand access to and from the rest area. The VE team felt that the safety concerns motivating this design are not entirely warranted, and the results of the study recommend using the left-hand access design to significantly reduce costs while maintaining functionality. The VE team developed other alternatives to the preferred design as well as alternatives that optimize the preferred design to create the greatest value for the project.

We thank the State of Georgia Department of Transportation and Clark Patterson Associates for providing the information necessary for the VE team to generate creative, alternative solutions for this project. We are available to answer any questions you have as you consider these alternatives and determine implementation.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

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

Attachment

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## **EXECUTIVE SUMMARY**

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### **INTRODUCTION**

This value engineering (VE) study report summarizes the events of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT) in Atlanta, Georgia. The subject of the study was the new U.S. Interstate 16 (I-16) Median Rest Area, Project NHS-0000-00(691), P. I. No. 0000691, Candler County, Georgia, which is being designed by Clark Patterson Associates (CPA). The workshop was conducted March 20–22, 2005 in GDOT’s Atlanta offices.

### **PROJECT DESCRIPTION**

The project constructs a rest area in the median of I-16 at milepost 97. The facility will be located seven miles west of the city of Metter and just west of the interchange of I-16 and State Route (SR) 57. The design includes the construction of two bridges over the mainline to permit access to and from the rest area from the right-hand side of the mainline. The rest area will include restroom facilities, parking area, picnic areas, lighting, landscaping, overflow parking for hurricane evacuation, and water and sewer systems. The purpose of the project is to provide a rest area facility for the traveling public between Savannah and Dublin and a facility that can be used as an information center, command center, or relief site during an evacuation of the Georgia Coastal areas.

The design includes six alternates, as follows:

- Alternate 1 proposes left-hand entrance and exit ramps connecting I-16 to the site.
- Alternate 2 proposes four fly-over bridges that will allow right-hand entrance and exit ramps connecting I-16 to the site.
- Alternate three proposes extended entrance ramps and one fly-over bridge.
- Alternate 4 proposes reconstructing each direction of the I-16 mainline for approximately two miles by raising its grade and constructing four mainline bridges over rest area entrances and exit ramps.
- Alternate 5 will “scissor,” (i.e., flip) the mainline eastbound and westbound directions so that access to and from the rest area site will be provided on the right-hand side of the mainline.
- Alternate 6 is to not build the median rest area.

The current cost of construction is \$30,141,259 based on the Preliminary Cost Estimate prepared by CPA, dated February 13, 2006.

### **CONCERNS AND OBJECTIVES**

The preferred design, Alternate 5, is a scissor rerouting of the I-16 mainline in order to provide right-hand access to and from the median rest area. The right-hand access has been designed to address safety concerns associated with traffic entering a high-speed (left-hand) lane. However, the complex design of

crossing bridges, ramps, and temporary mainline reroutes is estimated to be more than two times the cost of providing access to the rest area from the left-hand lanes.

Therefore, the objective of the VE study was to explore alternatives for reducing the cost of the project while meeting GDOT's goals of relieving drivers, accommodating evacuees, and informing the traveling public under normal and emergency conditions. Given the high cost of the flyover structures to accommodate the right-hand access to the rest area, the VE team focused its efforts on alternative solutions to that design. Since the right-hand access may be required, the VE team also sought to optimize that design approach as well as the overall facility design.

## **HIGHLIGHTS OF THE STUDY**

The VE team did not feel that left-hand access lanes present a significant safety concern. This is supported by the fact that many states, including Florida, Maryland, New York, New Jersey, Ohio, and North and South Carolina, have successfully used left-hand access to and from median-located rest areas. Furthermore, in the design year of 2027, the average annual daily traffic is anticipated to be only 28,000 vehicles, a relatively low number. Even during periods of high traffic volume, such as hurricane evacuations, the traveling speed would be unlikely to reach 70 mph, as demonstrated during the recent Gulf Coast evacuations. Taken together, these factors support simplifying the design and pursuing a less costly solution. The following alternatives directly address this high cost area:

- Design Alternate 1 proposes left-hand entrance and exit ramps to the rest area and provides all of the necessary functional elements at a substantially reduced cost. This design forms the basis of VE Alternative No. 9. Based on an updated cost estimate, implementation of Alternative No. 9 would result in initial cost savings of \$17,776,459. This alternative should be aggressively pursued.
- If concerns about left-hand access persist, VE Alternative Nos. 18A and 18B recommend constructing either one (18A) or two (18B) rest areas at the I-16/SR 57 interchange. These alternatives would take advantage of the existing interchange by incorporating the ramps into the solution, creating easy access between I-16 and the rest area(s). The calculated cost savings for VE Alternative Nos. 18A and 18B are approximately \$17,900,000 and \$15,400,000, respectively. An added benefit of implementing these alternatives is that construction of a rest area(s) at this site versus the widened median site would help meet the City of Metter's goal to commercially develop the corridor between the city and the rest area. The I-16/SR 57 interchange currently does not provide any amenities to the traveling public.
- Finally, if the median site with right-hand access must be used, VE Alternative No. 6 should be implemented. This revision of Design Alternate 4 provides only one entrance to the rest area with two bridges in lieu of four bridges. Cost savings associated with this alternative are approximately \$2,300,000, and it would simplify the design and construction while maintaining right-hand access to the rest area.

Based on the relatively low design-year traffic count indicated in the design documents, the plumbing fixture count for the restroom building can be reduced without impacting functionality. As shown in VE Alternative Nos. 25/26, reducing the fixture count reduces the overall size of the new building and results in initial cost savings exceeding \$500,000.

The current design provides for three-lane bridges to accommodate future expansion of I-16. However, given the low traffic volume on I-16, it does not appear that providing for future growth is a pressing need. VE Alternative No. 2 constructs a two-lane rather than three-lane bridge in order to avoid investing in a facility that will not reach capacity in the foreseeable future. Initial cost savings associated with this alternative are approximately \$680,000.

The Summary of Potential Cost Savings worksheet following this narrative outlines all of the alternatives and design suggestions that were developed by the VE team. Some of the alternatives are mutually exclusive or interrelated so that addition of all project cost savings does not equal total savings for the project. A listing of all of the ideas generated by the VE team can be found on the Creative Idea Listing worksheet in the Value Analysis & Conclusions section of this report.

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## **STUDY RESULTS**

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### **INTRODUCTION**

The results are the major feature of a VE study since they represent the benefits that can be realized on the project by the owner, users, and designer. The results will directly affect the project design and will require coordination among the designer and the owner to determine the ultimate acceptance of each alternative.

During the conduct of the study, many ideas for potential value enhance were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet the owner's project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that project comprises. For each alternative developed, the following information is provided:

- A summary of the original design;
- A description of the proposed change to the project;
- Sketches and design calculations, if appropriate;
- A capital cost comparison and life-cycle discounted present worth cost comparison of the alternative and original design (where appropriate);
- A descriptive evaluation of the advantages and disadvantages of selecting the alternative; and
- A brief narrative to compare the original design and the proposed change and provide a rationale for implementing the change into the project.

The capital cost comparisons used unit quantities contained in the project cost estimate prepared by the designers, whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means Company, or team member or owner databases were consulted.

Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) to track it through the value analysis process and facilitate referencing between the Creative Idea Listing and Evaluation worksheet, the Summary of Potential Cost Savings worksheet, and the alternatives.

### **RESULTS OF THE STUDY**

The VE team generated 32 ideas for change during the Function Analysis and Creative Idea phases of the VE Job Plan. The evaluation of these ideas was based upon 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, constructability, and soundness of the idea.

Of the 32 ideas generated, 13 of them were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 10 alternatives for change with an impact on project costs, and 3 design suggestions that will enhance the value of the project in terms of durability, reduced labor effort, improved constructability, and expansion of the work product. All of these alternatives and design suggestions are presented in detail following the Summary of Potential Cost Savings worksheet.

## **EVALUATION OF ALTERNATIVES**

It is important to consider each part of an individual alternative on its own merit. There is 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 estimate, where possible, is to be used as the pricing basis.

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



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **2**

DESCRIPTION: **REDUCE SPAN OF PROPOSED BRIDGES TO  
 ACCOMMODATE TWO LANES ONLY**

SHEET NO.: **1 of 4**

**ORIGINAL DESIGN:** (Sketch attached )

The current design proposes the construction of two new bridges that will “scissor” (i.e., flip) the mainline eastbound and westbound directions to allow right-hand access to and from the rest area. Although the proposed bridges are shown as two-lane facilities, they have been sized to three lanes to accommodate future expansion.

**ALTERNATIVE:**

Reduce the span of the proposed bridges to accommodate two lanes only.

**ADVANTAGES:**

- Shortens bridge spans
- Shortens MSE wall lengths
- Simplifies design and construction
- Reduces initial cost

**DISADVANTAGES:**

- If future demands call for a third lane (highly unlikely), bridges would have to be replaced

**DISCUSSION:**

The design documents provided indicate the Annual Average Daily Traffic (AADT) for this corridor of I-16 in the design year of 2027 will only be 28,000 vehicles. This relatively low traffic count does not warrant providing for potential future expansion of the facility.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 659,511	\$	\$ 659,511
ALTERNATIVE	\$ 0	\$	\$ 0
SAVINGS	\$ 659,511	\$	\$ 659,511

# SKETCHES



PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
Candler County, Georgia Department of Transportation  
Conceptual Design Stage

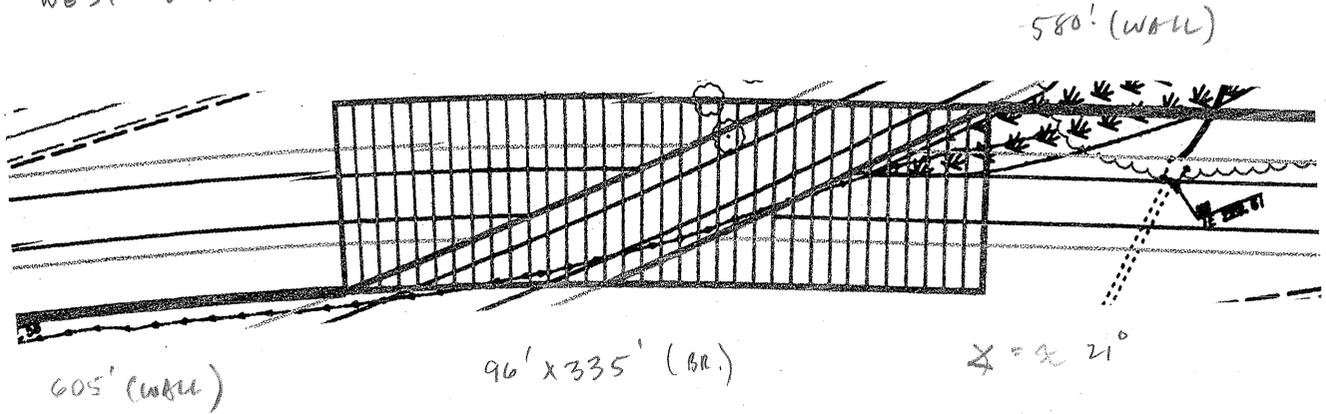
ALTERNATIVE NO.:

2

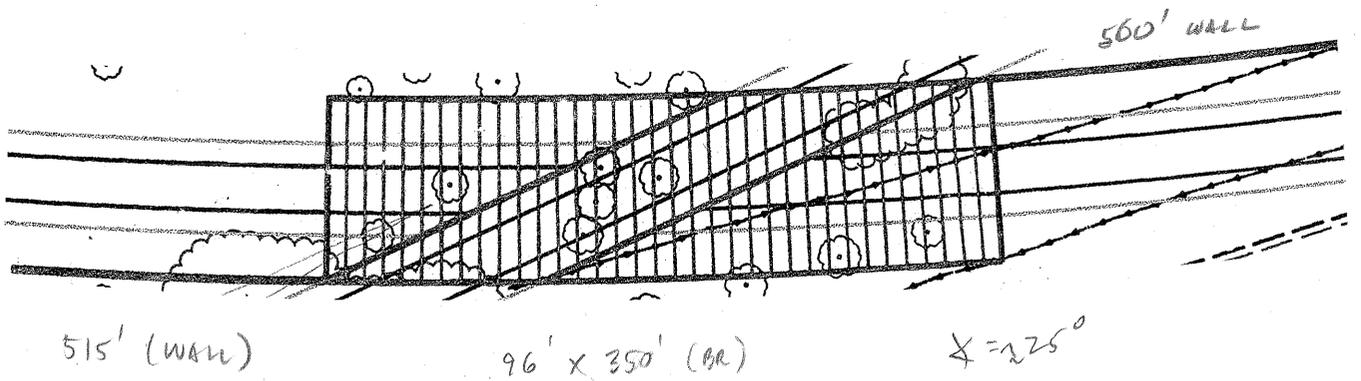
AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 4

WEST BRIDGE



EAST BRIDGE



# CALCULATIONS



PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
 Candler County, Georgia Department of Transportation  
 Conceptual Design Stage

ALTERNATIVE NO.:

2

DESCRIPTION:

SHEET NO.: 3 of 4

THE COST ESTIMATE OF THE BRIDGES AND MSE WALLS TOGETHER IS \$5,129,055. A UNIT COST OF \$60/SF FALLS WITHIN THE COST ESTIMATE. AVE. WALL HT. @ \$35/SF IS 15.23'

REDUCING THE SPAN LENGTH BY ONE LANE (12')

$$\text{AREA} = 12' (335' + 350') = 8,220 \text{ SF.}$$

$$\text{WALL LENGTH} = \frac{12'}{\tan 21^\circ} \times 2 + \frac{12'}{\tan 25^\circ} \times 2 = 114'$$

$$\text{WALL HEIGHT AT BRIDGE} = 17.5' (\text{CLR.}) + 2' = 19.5'$$

$$\text{WALL AREA} = 114' \times 19.5' = 2223 \text{ SF.}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **3**

DESCRIPTION: **PROVIDE TWO REST AREA BUILDINGS WITHIN THE  
 MEDIAN**

SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:** (Sketch attached)

The current design proposes the construction of two new bridges that will “scissor” (i.e., flip) the mainline eastbound and westbound directions to allow right-hand access to and from the rest area. A single restroom building/area is shared by westbound and eastbound traffic from I-16.

**ALTERNATIVE:** (Sketch attached)

Realign the I-16 mainline within the median and then exit on the existing alignment. This realignment creates “pockets” where there can be a restroom facility to serve each traffic direction and maintains a right-lane ingress/egress from the rest area.

**ADVANTAGES:**

- Eliminates bridges
- Eliminates MSE walls associated with bridges
- Simplifies design and construction
- Reduces initial cost
- Eliminates need to acquire new right-of-way
- Accommodates more users than a single building
- Requires no more wetlands mitigation than already anticipated

**DISADVANTAGES:**

- Increases O&M costs
- Places emergency parking farther away from facilities
- Access to emergency parking area would be from left lanes

**DISCUSSION:**

By realigning the mainline into the median, a dedicated restroom building can be constructed for each traffic direction, with right-lane ingresses/egresses to the overall rest area. This precludes building bridges and associated walls and eliminates the need for new right-of-way takes. The scenic beauty is maintained in both directions.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 20,436,444	\$	\$ 20,436,444
ALTERNATIVE	\$ 11,688,600	\$	\$ 11,688,600
SAVINGS	\$ 8,747,844	\$	\$ 8,747,844



PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
Candler County, Georgia Department of Transportation  
Conceptual Design Stage

ALTERNATIVE NO.:

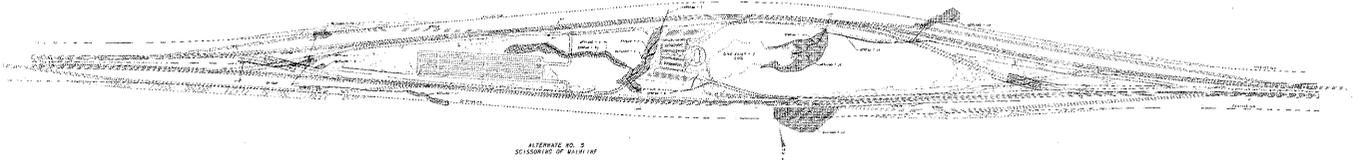
3

AS DESIGNED

ALTERNATIVE

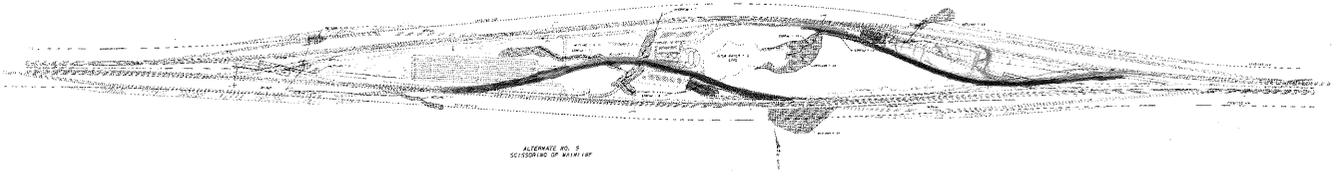
SHEET NO.: 2 of 3

AS DESIGNED:



ALTERNATE NO. 3  
SECTIONLINE OF MAIN PLAN

ALTERNATIVE:



ALTERNATE NO. 3  
SECTIONLINE OF MAIN PLAN

# COST WORKSHEET



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
**Candler County, Georgia Department of Transportation**  
*Conceptual Design Stage*

ALTERNATIVE NO:

3

SHEET NO.: 3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
BRIDGES & WALLS	LS			5,129,055			
MISCELLANEOUS	LS			1,708,600			
PAVING	LS			<u>10,200,116</u>			
SUBTOTAL				17,137,771			
M/U @ 15.5%				<u>2,656,353</u>			
TOTAL				<u>19,794,124</u>			
REST AREAS	LS				2	610,000 <sup>‡</sup>	1,240,000
MISCELLANEOUS	LS				2	990,000 <sup>*</sup>	1,980,000
PAVING	LS				1	6,900,000 <sup>**</sup>	<u>6,900,000</u>
SUBTOTAL							10,120,000
M/U @ 15.5%							<u>1,568,600</u>
TOTAL							<u>11,688,600</u>
R/W COSTS	LS			185,000			
M/U @ 247.20%				<u>457,320</u>			
TOTAL				<u>642,320</u>			
* ESTIMATED @ 50% OF ORIGINAL ESTIMATE							
** ESTIMATED @ 67% OF ORIGINAL ESTIMATE							
	Sub-total			20,436,444			11,688,600
Mark-up at	INCL			-			-
	TOTAL			20,436,444			11,688,600

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **4**

DESCRIPTION: **PROVIDE TWO REST AREA BUILDINGS OUTSIDE THE**  
**MEDIAN**

SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:** (Sketch attached )

The current design proposes the construction of two new bridges that will “scissor” (i.e., flip) the mainline eastbound and westbound directions to allow right-hand access to and from the rest area. A single restroom building/area is shared by westbound and eastbound traffic from I-16.

**ALTERNATIVE:** (Sketch attached )

Maintain the I-16 mainline alignment and provide new deceleration/acceleration ramps to accommodate right-lane ingress/egress outside the median. Restroom facilities can be dedicated to each traffic direction.

**ADVANTAGES:**

- Eliminates bridges
- Eliminates MSE walls associated with bridges
- Simplifies design and construction
- Reduces initial cost
- Accommodates more users
- Requires no additional wetlands mitigation

**DISADVANTAGES:**

- Increases O&M costs with two buildings in lieu of one
- Places emergency parking farther away from facilities
- Access to emergency parking area from left lanes
- Eliminates scenic overlook of existing median lake

**DISCUSSION:**

In order to accommodate right-lane ingress/egress, new rest areas can be constructed outside the mainline where the least impact to the environment can be realized. This alternative would intrinsically have the least impact on the current mainline alignment and drive expectations. The emergency parking lot access should be located along the westbound lanes of I-16. Although use of the existing median lake for scenic enhancements is lost, architectural embellishments of the two restroom buildings can still be achieved.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 20,436,444	\$	\$ 20,436,444
ALTERNATIVE	\$ 12,730,200	\$	\$ 12,730,200
SAVINGS	\$ 7,706,244	\$	\$ 7,706,244



PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
Candler County, Georgia Department of Transportation  
Conceptual Design Stage

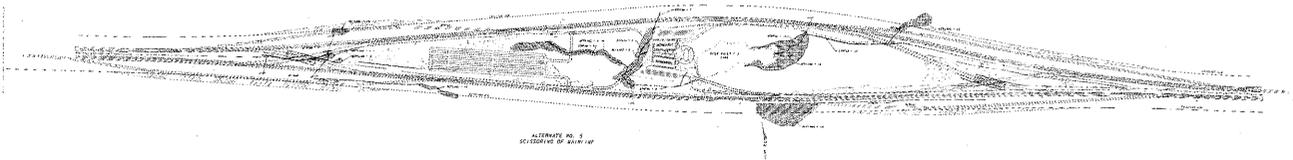
ALTERNATIVE NO.:

4

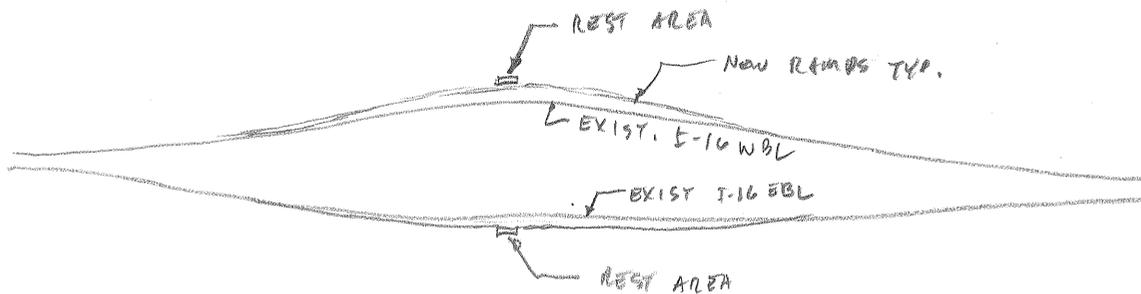
AS DESIGNED       ALTERNATIVE

SHEET NO.: 2 of 3

ALTERNATE #5



ALTERNATIVE :



NOTE: PARKING LOTS NOT SHOWN

# COST WORKSHEET



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
**Candler County, Georgia Department of Transportation**  
**Conceptual Design Stage**

ALTERNATIVE NO:

4

SHEET NO.: 3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
BRIDGES & WALLS	LS			5,129,055			
MISCELLANEOUS	LS			1,708,600			
PAVING	LS			10,800,116			
SUBTOTAL				17,137,771			
M/U @ 15.5%				2,656,353			
TOTAL				19,794,124			
REST AREAS	LS				2	620,000 <sup>*</sup>	1,240,000
MISCELLANEOUS	LS				2	990,000 <sup>*</sup>	1,980,000
PAVING	LS				1	6,900,000 <sup>**</sup>	6,900,000
SUBTOTAL							10,120,000
M/U @ 15.5%							1,568,600
TOTAL							11,688,600
R/W COSTS	LS			185,000	20 AC	15000	300,000
M/U @ 247.20%	AC			457,320			741,600
TOTAL				642,320			1,041,600
R/W COSTS							
* ESTIMATED @ 50% OF ORIGINAL ESTIMATE							
** ESTIMATED @ 67% OF ORIGINAL ESTIMATE							
	Sub-total			20,436,444			12,730,200
Mark-up at	INCL			-			
	TOTAL			20,436,444			12,730,200

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **5**

DESCRIPTION: **USE DESIGN ALTERNATE 4**

SHEET NO.: **1 of 1**

**ORIGINAL DESIGN:**

Alternate 5, the preferred design alternate, “scissors” (i.e., flips) the mainline eastbound and westbound directions so that access to and from the rest area site will be on the right-hand side of the mainline. West of the site, the eastbound mainline would bridge over the westbound mainline, and East of the site, the westbound mainline would bridge over the eastbound mainline. The mainline detours can be constructed on temporary easement, and no additional right-of-way will be required. Wetland and stream impacts are temporary in the locations of the proposed detours. Additional landscaping is proposed in the vicinity of the bridges.

**ALTERNATIVE:**

Design Alternate 4 reconstructs each direction of the I-16 mainline for approximately two miles by raising its grade and constructing four mainline bridges over the rest area entrance and exit ramps. Construction of an eastbound auxiliary lane is also required from the rest area to the SR 57 exit ramp. Right-of-way acquisition will be required for construction of the ramps and detours.

**ADVANTAGES:**

- Reduces impact on I-16 mainline
- Simplifies design and construction
- Reduces initial cost

**DISADVANTAGES:**

- Requires additional right-of-way takes
- Reduces rest area visibility

**DISCUSSION:**

Design Alternate 4 provides the same functionality as Design Alternate 5 at a reduced cost while maintaining the preferred right-hand access.

*Note: As the cost provided for Design Alternate 4 is from last year, it has been escalated at 5.00% and accounts for all necessary markups.*

See related VE Alternative No. 6.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 30,141,259	\$	\$ 30,141,259
ALTERNATIVE	\$ 27,899,550	\$	\$ 27,899,550
SAVINGS	\$ 2,241,709	\$	\$ 2,241,709

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **6**

DESCRIPTION: **USE DESIGN ALTERNATE 4 WITH ONLY ONE  
 ENTRANCE/EXIT PER DIRECTION OF TRAVEL TO  
 THE REST AREA AND TWO BRIDGES**

SHEET NO.: **1 of 4**

**ORIGINAL DESIGN:** (Sketch attached)

Design Alternate 4 reconstructs each direction of the I-16 mainline for approximately two miles by raising its grade and constructing four mainline bridges over the rest area entrance and exit ramps. Construction of an eastbound auxiliary lane is also required from the rest area to the SR 57 exit ramp. Right-of-way acquisition will be required for construction of the ramps and detours.

**ALTERNATIVE:** (Sketch attached)

Just west of the proposed rest area, provide only two bridges, one each for the eastbound and westbound entrances/exits with a shared connector to access the restroom building and the emergency parking area. Appropriate traffic controls are provided to preclude inadvertent travel direction changes or to use the rest area as a U-turn facility.

**ADVANTAGES:**

- Reduces impact on I-16 mainline
- Simplifies design and construction
- Reduces initial cost
- Takes advantage of detours by converting to permanent ramps

**DISADVANTAGES:**

- Requires stop condition on two ramps at entrance or exit to rest area
- Ingress and egress traffic will cross
- Raises mainline
- Increases permanent right-of-way take versus Design Alternate 5 (accounted for in overall costs)

**DISCUSSION:**

This alternative modifies Design Alternate 4 to reduce its impact on the mainline but still provide the same functionality at a reduced cost. Right-lane access to and from the rest area is also preserved. Placing the rest area traffic on one road simplifies movements and accommodates the anticipated low volume.

See related VE Alternative No. 5, as the cost savings are additive.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 2,495,038	\$	\$ 2,495,038
ALTERNATIVE	\$ 190,575	\$	\$ 190,575
SAVINGS	\$ 2,304,463	\$	\$ 2,304,463

# CALCULATIONS



PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
 Candler County, Georgia Department of Transportation  
 Conceptual Design Stage

ALTERNATIVE NO.:

6

DESCRIPTION:

SHEET NO.: 3 of 4

$$\text{bridges (2)} - 90' \times 60' \times \$60/\text{SF} = 324,000 \times 2 = \$648,000$$

$$\text{Detour} - 3400 \text{ LF} \times 30' / 9 = 11,333 \text{ SF}$$

$$\text{Base} = 8'' \times 110^{\#} / \text{in} \div 2000 = 0.44 \text{ ton/SF} \times 11,333 = 4,986 \text{ Tons}$$

$$\text{Surface} = 4'' = 0.22 = 2,493 \text{ Tons}$$

$$\text{Add'l Ramp} - 400 \text{ LF} + 500 \text{ LF} = 900 \text{ LF} \times 30' \div 9 = 3000 \text{ SF}$$

$$\text{Retaining walls} - 2600 \text{ LF} + 1600 \text{ LF} = 4200 \text{ LF} \times 8' = 33,600 \text{ SF}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **8**

DESCRIPTION: **BALANCE THE CUT AND FILL ON THE SITE**

SHEET NO.: **1 of 1**

**ORIGINAL DESIGN:**

The cost for earthwork for the preferred design solution is \$4,143,188 (after markup) with an unspecified quantity. During the design team's presentation, it was noted that the project will require borrow.

**ALTERNATIVE:**

Balance the cut and fill on the site to eliminate long hauls for borrow.

**ADVANTAGES:**

- Reduces borrow hauling costs
- Keeps all necessary work on site
- Uses a common practice
- Reduces initial cost

**DISADVANTAGES:**

- Risks additional impact on wetlands and environment
- Possibly results in additional defoliation of the site (although it could be restored with additional landscaping)

**DISCUSSION:**

There appears to be sufficient area within the median to excavate for the necessary fill requirements. The existing lake, a man-made feature created during the construction of I-16, could be further dredged/deepened to obtain the proposed fill needs. Other locations could be explored on the site.

Consideration should also be given to reducing the overall final elevation of the site. In the event of heavy rains or severe weather circumstances, the lake's dam would overflow at its designed spillway to the southwest, away from the proposed siting of the building and parking lots and into the creek/stream.

See related VE Alternative No. 31.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	<b>DESIGN SUGGESTION</b>		
SAVINGS			

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **9**

DESCRIPTION: **USE DESIGN ALTERNATE 1**

SHEET NO.: **1 of 1**

## ORIGINAL DESIGN:

Alternate 5, the preferred design alternate, “scissors” (i.e., flips) the mainline eastbound and westbound directions so that access to and from the rest area site will be on the right-hand side of the mainline. West of the site, the eastbound mainline would bridge over the westbound mainline, and East of the site, the westbound mainline would bridge over the eastbound mainline. The mainline detours can be constructed on temporary easement, and no additional right-of-way will be required. Wetland and stream impacts are temporary in the locations of the proposed detours. Additional landscaping is proposed in the vicinity of the bridges.

## ALTERNATIVE:

Use Design Alternate 1 with left entrances and exits to the rest area.

## ADVANTAGES:

- Creates a minimal impact on I-16 mainline
- Simplifies design and construction
- Reduces initial cost
- Speeds construction
- Requires no bridge construction
- Results in minimal right-of-way takes

## DISADVANTAGES:

- Creates a perceived safety problem
- Challenges a FHWA desire

## DISCUSSION:

Although driver expectations include right-hand access to and from controlled-access highways, the left-hand entrances and exits are not uncommon and do not present any additional confusion or create higher incidence of rear-end accidents. No data currently support an increased number of rear-end accidents over what is normally expected on an interstate highway due to left-lane weaving on and off of the highway. The inconsistency throughout the nation of typical on and off ramps to a controlled access highway from surface and arterial road systems further supports the argument. Additionally, the low volume of traffic, an average of 28,000 vehicles daily in the design year of 2027, further negates the need to have left-lane entries/exits

*Note: As the cost provided for Design Alternate 1 is from last year, it has been escalated at 5.00% and accounts for all necessary markups.*

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 30,141,259	\$	\$ 30,141,259
ALTERNATIVE	\$ 12,364,800	\$	\$ 12,364,800
SAVINGS	\$ 17,776,459	\$	\$ 17,776,459

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **12**

DESCRIPTION: **USE A SEPTIC TANK SEWER SYSTEM**

SHEET NO.: **1 of 2**

**ORIGINAL DESIGN:**

The preferred design alternate uses a self-contained, packaged sewer system for the rest area.

**ALTERNATIVE:**

Use a septic tank sewer system in lieu of the proposed self-contained unit.

**ADVANTAGES:**

- Eases construction
- Uses known technology
- Reduces initial cost
- Reduces operation and maintenance costs

**DISADVANTAGES:**

- Potentially reduces the area around the lake for walking/resting due to drain field location
- Creates potential for foul odors

**DISCUSSION:**

The ideal location for the drain field is near the emergency parking lot; however, the distance may be too great to effectively use the septic tank system. The primary location then becomes the area just northwest of the existing lake. The rural and unpopulated nature of the site and long distance to the city of Metter makes the use of a septic tank sewer system ideal. Pumping out the septic tank would be an infrequent occurrence compared to the routine maintenance of the self-contained system.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 775,582	\$	\$ 775,582
ALTERNATIVE	\$ 231,000	\$	\$ 231,000
SAVINGS	\$ 544,582	\$	\$ 544,582



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **18A**

DESCRIPTION: **DEVELOP ONE REST AREA AT THE I-16/SR 57 INTERCHANGE**

SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:**

Alternate 5, the preferred design alternate, “scissors” (i.e., flips) the mainline eastbound and westbound directions so that access to and from the rest area site will be on the right-hand side of the mainline. West of the site, the eastbound mainline would bridge over the westbound mainline, and East of the site, the westbound mainline would bridge over the eastbound mainline. The mainline detours can be constructed on temporary easement, and no additional right-of-way will be required. Wetland and stream impacts are temporary in the locations of the proposed detours. Additional landscaping is proposed in the vicinity of the bridges.

**ALTERNATIVE:** (Sketch attached)

Develop one rest area along with the emergency parking lot at the northwest corner of the I-16/SR 57 interchange with a reduced building footprint.

**ADVANTAGES:**

- Avoids all impacts on the I-16 mainline
- Simplifies design and construction
- Reduces initial cost
- Takes advantage of the existing ramp system at interchange
- Keeps mainline traffic constantly moving

**DISADVANTAGES:**

- Requires additional right-of-way takes
- Minimizes visibility of rest area
- Not as aesthetically pleasing as median with lake
- Disrupts traffic on SR 57

**DISCUSSION:**

The I-16/SR 57 interchange is an underutilized interchange with very low traffic volume. Since it is between the city of Metter and the widened median with the lake, the construction hauls are significantly reduced, precluding disruption to I-16 traffic in both directions. Although crossing traffic on SR 57 will have to be carefully controlled, it can be effectively handled with widening, lane markings, and signalization.

An added benefit is the potential to indirectly aid the city of Metter by promoting future growth in the corridor just west of the city, as it would be closer to the city and more accessible to prospective clients.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 30,141,259	\$	\$ 30,141,259
ALTERNATIVE	\$ 12,200,000	\$	\$ 12,200,000
SAVINGS	\$ 17,941,259	\$	\$ 17,941,259

# SKETCHES

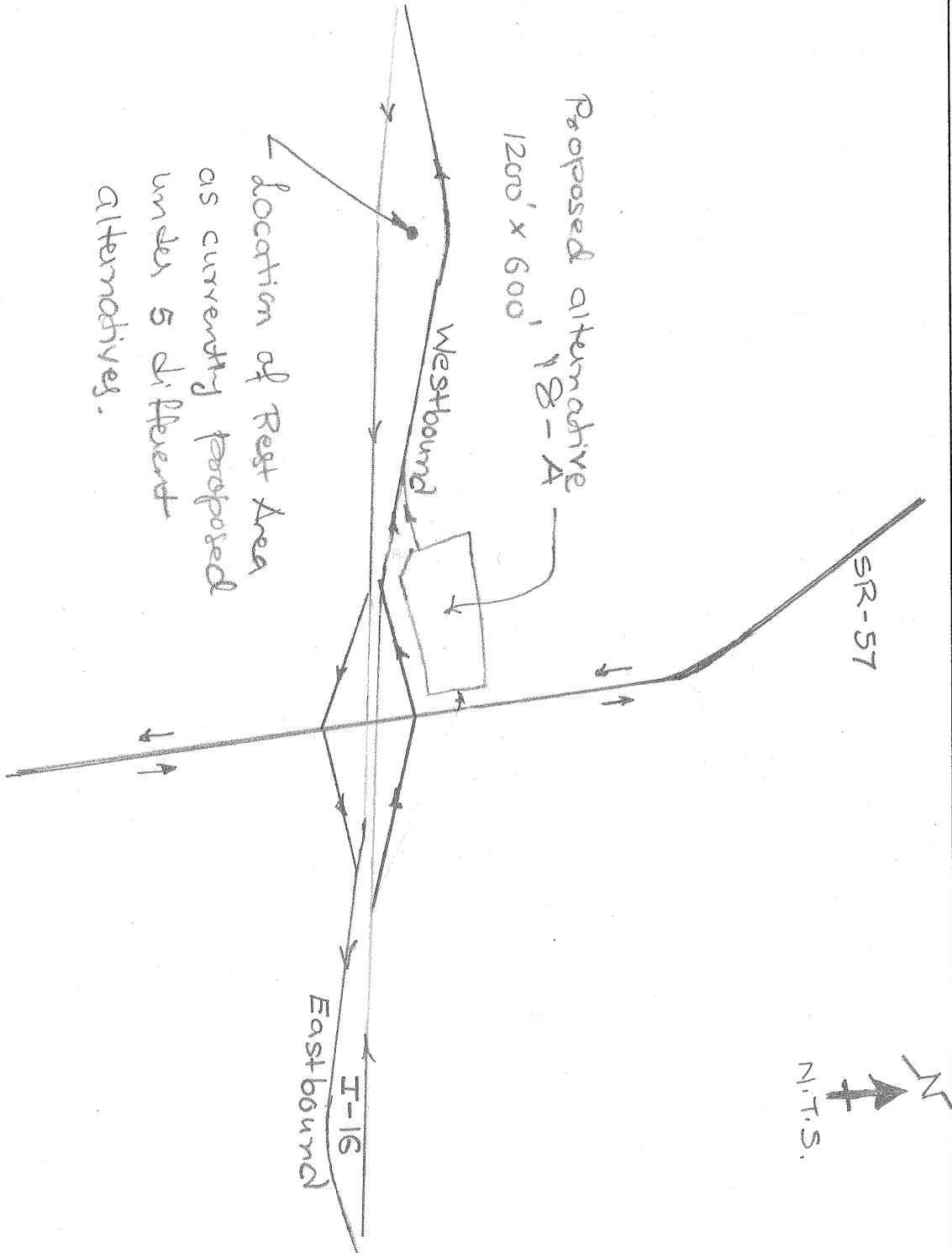


PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
Candler County, Georgia Department of Transportation  
Conceptual Design Stage

ALTERNATIVE NO.:  
18-A

AS DESIGNED     ALTERNATIVE

SHEET NO.: 2 of 3





# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **18B**

DESCRIPTION: **DEVELOP TWO REST AREAS AT THE I-16/SR 57 INTERCHANGE**

SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:**

Alternate 5, the preferred design alternate, “scissors” (i.e., flips) the mainline eastbound and westbound directions so that access to and from the rest area site will be on the right-hand side of the mainline. West of the site, the eastbound mainline would bridge over the westbound mainline, and East of the site, the westbound mainline would bridge over the eastbound mainline. The mainline detours can be constructed on temporary easement, and no additional right-of-way will be required. Wetland and stream impacts are temporary in the locations of the proposed detours. Additional landscaping is proposed in the vicinity of the bridges.

**ALTERNATIVE:** (Sketch attached )

Develop two rest areas along with the emergency parking lot at the I-16/SR 57 interchange; one at the northwest corner and the other at the southeast corner.

**ADVANTAGES:**

- Avoids all impacts on the I-16 mainline
- Simplifies design and construction
- Reduces initial cost
- Takes advantage of the existing ramp system at the interchange
- Keeps mainline traffic constantly moving

**DISADVANTAGES:**

- Requires additional right-of-way takes
- Reduces visibility of rest area
- Not as aesthetically pleasing as median with lake
- Disrupts traffic on SR 57

**DISCUSSION:**

The I-16/SR 57 interchange is an underutilized interchange with very low traffic volume. Since it is between the city of Metter and the widened median with the lake, the construction hauls are significantly reduced, precluding disruption to I-16 traffic in both directions. Crossing traffic on SR 57 is eliminated, and there is a restroom building for each traffic direction on I-16.

An added benefit is the potential to indirectly aid the city of Metter by promoting future growth in the corridor just west of the city, as it would be closer to the city and more accessible to prospective clients.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 30,141,259	\$	\$ 30,141,259
ALTERNATIVE	\$ 14,741,000	\$	\$ 14,741,000
SAVINGS	\$ 14,400,259	\$	\$ 14,400,259

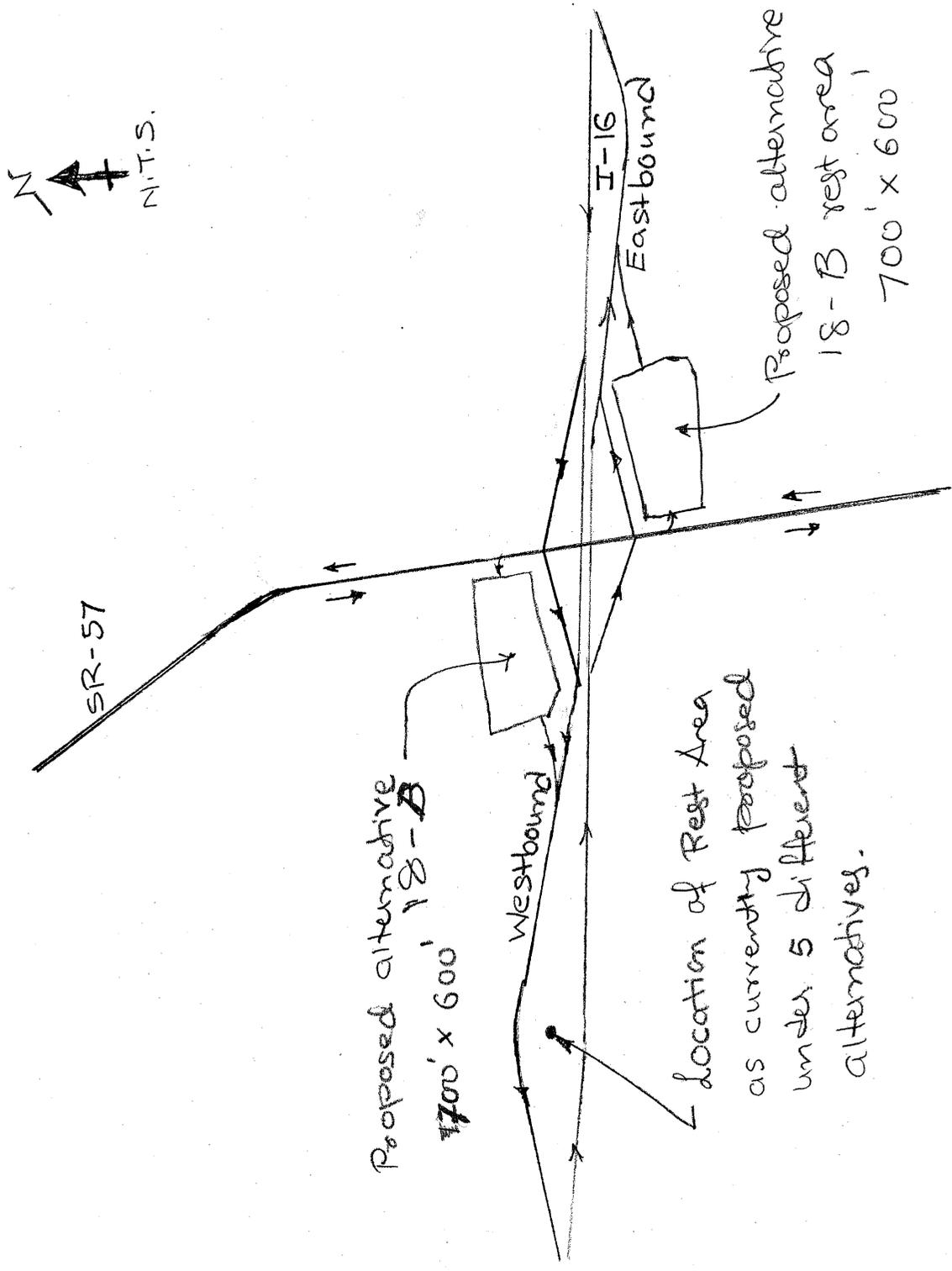
PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
Candler County, Georgia Department of Transportation  
Conceptual Design Stage

ALTERNATIVE NO.:

18-B

SHEET NO.: 2 of 3

AS DESIGNED     ALTERNATIVE



# COST WORKSHEET



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
**Candler County, Georgia Department of Transportation**  
*Conceptual Design Stage*

ALTERNATIVE NO:

18-B

SHEET NO.: 3 of 3

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
Building (S)				1,060,960			1,000,000
water System				1,737,800			1,500,000
sewer System				671,500			600,000
Traffic Control				400,000			150,000
Erosion Control				350,000			300,000
Grassing				230,000			250,000
Bridges & Walls				5,129,055			-
Earthwork				3,587,176			2,500,000
Longitudnal Pipe				200,000			250,000
Side Drain				165,000			200,000
Landscaping				600,000			600,000
clearing & Grubbing				300,000			300,000
Signing-Marking/Guard Rail				230,000			250,000
Lighting				220,000			250,000
Sidewalk & Boardwalk				200,000			200,000
Tables / Benches				82,600			100,000
Curb & Gutter				76,000			100,000
Concrete Pavement (2 ramps to I-16)				6,776,000			1,400,000
Aggregate Base for				1,884,800			400,000
Asphalt Paving Base				1,354,900			1,250,000
Asphalt Paving Surface				281,316			250,000
15.5 % mark up				+ 3,958,732			1,837,000
Sub-total				29,498,939			13,687,000
Acquire R/W				642,320	26	15,000	390,000
2(700 x 600) + 300,000					247	20 %	965,000
= 1140,000 sf = 26 acres					R/W	Total	1,055,000
Sub-total							
Mark-up at							
TOTAL				30,141,259			14,741,000

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **25/26**

DESCRIPTION: **REDUCE THE NUMBER OF PLUMBING FIXTURES AND  
 SIZE OF THE RESTROOM BUILDING**

SHEET NO.: **1 of 5**

**ORIGINAL DESIGN:** (Sketch attached)

The preferred design alternate provides 62 total plumbing fixtures for the new restroom building.

**ALTERNATIVE:** (Sketch attached)

Allow for 30 plumbing fixtures with the provision for temporary toilets in the event of an emergency situation.

**ADVANTAGES:**

- Simplifies design and construction
- Reduces initial cost
- Reduces operation and maintenance of excessive plumbing fixtures
- Creates potential for additional glass walls with views of the lake

**DISADVANTAGES:**

- Reduces number of plumbing fixtures
- Reduced building size may cramp its use as a command center during emergencies
- Requires additional temporary toilets in emergency situations

**DISCUSSION:**

The normal traffic counts do not justify the number of fixtures planned. The design team indicated that during emergencies and evacuations, temporary toilet facilities would be provided at the overflow/emergency parking lot. Additional temporary toilets could be used if needed.

The reduced number of plumbing fixtures helps minimize the use and potential waste of potable water.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 1,220,104	\$	\$ 1,220,104
ALTERNATIVE	\$ 712,753	\$	\$ 712,753
SAVINGS	\$ 507,351	\$	\$ 507,351

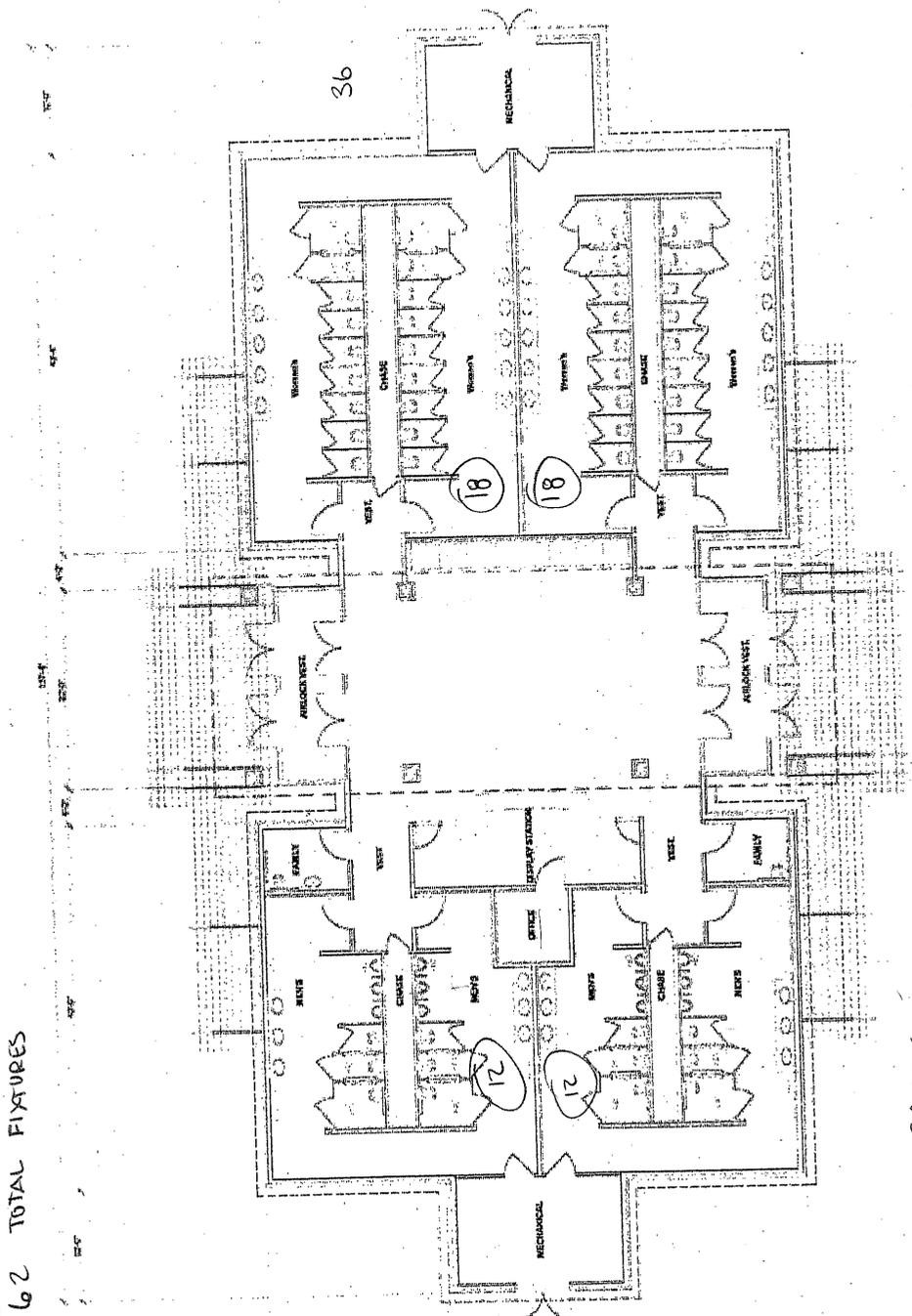
PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
 Candler County, Georgia Department of Transportation  
 Conceptual Design Stage

ALTERNATIVE NO.:

25/26

SHEET NO.: 2 of 5

AS DESIGNED     ALTERNATIVE



24 MEN  
 38 WOMEN  
 7 FAMILY  
 ---  
 62 TOTAL FIXTURES

24 MENS

**FLOOR PLAN**



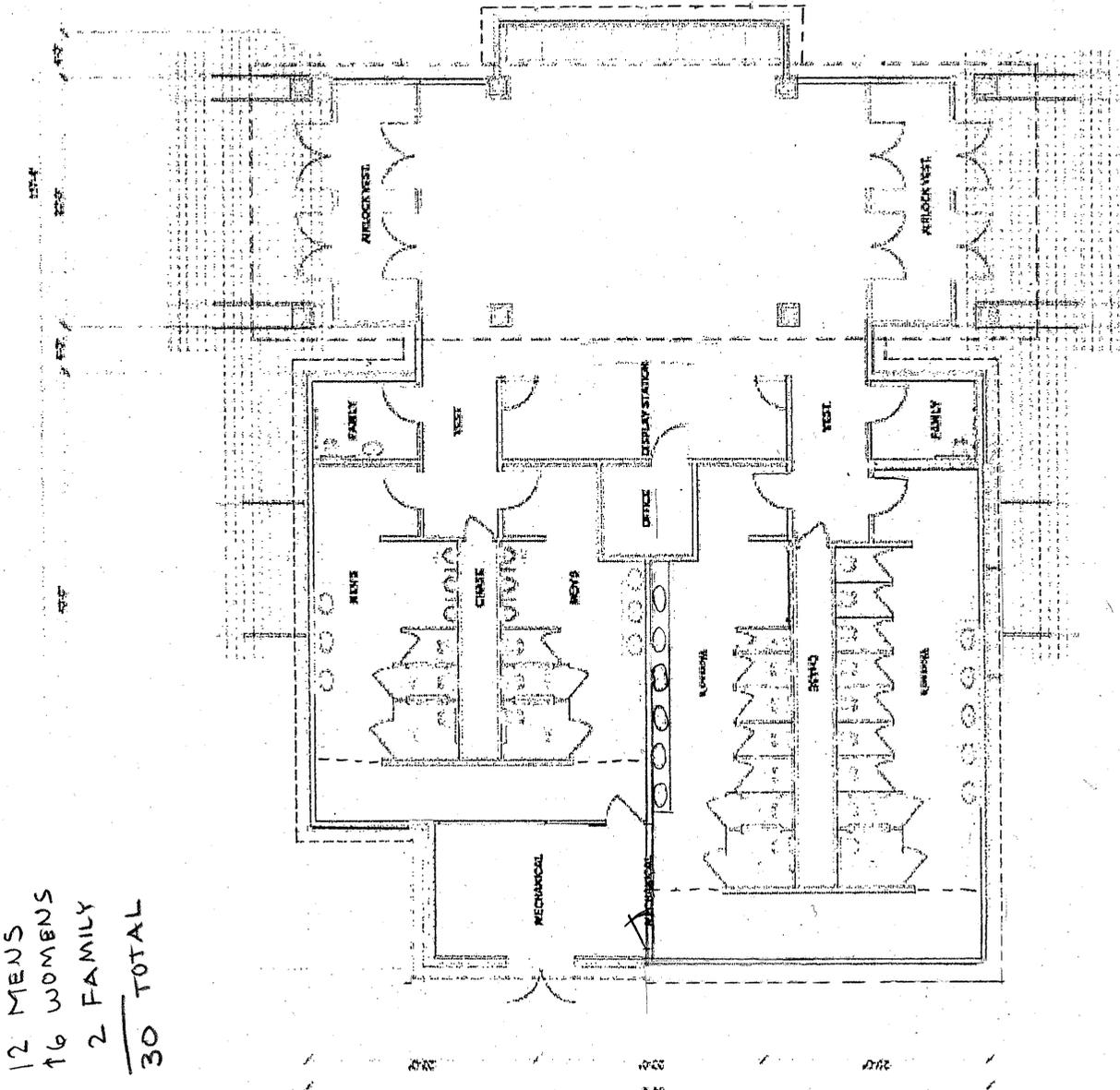
PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
Candler County, Georgia Department of Transportation  
Conceptual Design Stage

ALTERNATIVE NO.:

25/26

AS DESIGNED     ALTERNATIVE

SHEET NO.: 3 of 5



12 MENS  
 16 WOMENS  
 2 FAMILY  
 ---  
 30 TOTAL

**FLOOR PLAN**

# CALCULATIONS



PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
Candler County, Georgia Department of Transportation  
Conceptual Design Stage

ALTERNATIVE NO.:

25/26

DESCRIPTION:

SHEET NO.: 4 of 5

$$28,000 \text{ VEHICLES / DAY} \div 24 \text{ HRS / DAY} \approx 1200 \text{ VEHICLES / HOUR}$$

$$1200 \text{ VEHICLES / HOUR} \times 0.10 = 120 \text{ VEHICLES / HOUR AVERAGE}$$

ASSUME THAT DUE TO OTHER FACILITIES AVAILABLE AT EXITS  
ALONG THE ROUTE, 10% OF THE VEHICLES TRAVELING WILL STOP  
TO USE THE FACILITY AND THAT EACH VEHICLE AVERAGES 3 PEOPLE

$$120 \text{ VEHICLES / HOUR} \times 3 \text{ PEOPLE / VEHICLE} = 360 \text{ PEOPLE / HOUR} \approx 6 / \text{MIN.}$$



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **27**

DESCRIPTION: **USE LOCALLY AVAILABLE BUILDING MATERIALS**

SHEET NO.: **1 of 1**

**ORIGINAL DESIGN:**

The preferred design alternate indicates that the new restroom building will receive some type of stone, brick, and wood exterior finishes. The actual exterior and interior materials have not yet been selected.

**ALTERNATIVE:**

Use materials available and customary to the local area. If there are predominant types of brick and stone used on area buildings, then specify the same to minimize customization.

**ADVANTAGES:**

- Allows building to match nearby structures that could have historical significance
- Takes advantage of locally available materials
- Reduces long hauls/long lead items
- May provide business opportunities for local merchants, tradesmen, and craftsmen

**DISADVANTAGES:**

- Limits palette of materials

**DISCUSSION:**

Since the new restroom building and surrounding rest area is emphasizing an enhancement of the natural environment, the use of materials not commonly found in the area could be a distraction. Furthermore, the long distance to import customized materials could be costly.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	<b>DESIGN SUGGESTION</b>		
ALTERNATIVE			
SAVINGS			

# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **29**

DESCRIPTION: **USE POROUS PAVEMENT FOR THE EMERGENCY**  
**PARKING LOT**

SHEET NO.: **1 of 3**

**ORIGINAL DESIGN:**

The preferred design alternate uses a compacted subbase and natural grass for the emergency parking lot.

**ALTERNATIVE:** (Sketch attached)

Install a 12-in. thick layer of No. 57 stone over a geogrid material on top of the proposed compacted subbase as the paving for the emergency parking lot.

**ADVANTAGES:**

- Improves drainage of storm water
- Allows for a stronger pavement during inclement weather
- Not as susceptible to wear and tear as grass
- Common practice for minimally used parking areas
- Improves longevity of parking lot

**DISADVANTAGES:**

- Increases initial cost
- Not as aesthetically pleasing

**DISCUSSION:**

The as-designed solution, although certainly much more aesthetically pleasing, would quickly erode with the combination of heavy emergency traffic and severe inclement weather. The grass would become soggy and ultimately a quagmire, making vehicular traffic almost impossible. Additionally, periodic mowing will have to be undertaken for appearance, aesthetic, and vermin control purposes.

The gravel surface can overcome the aforementioned deficiencies of a “grassed pavement.” If a gravel pavement is considered unpleasant, then Grasspave™ ([www.invisiblestructures.com](http://www.invisiblestructures.com)) is a suitable alternate material, but the cost would be twice that of gravel pavement.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	\$ 486,216	\$	\$ 486,216
ALTERNATIVE	\$ 941,408	\$	\$ 941,408
SAVINGS	\$ (455,192)	\$	\$ (455,192)



PROJECT: NHS-0000-00(691), P.I. No. 0000691, I-16 MEDIAN REST AREA  
 Candler County, Georgia Department of Transportation  
 Conceptual Design Stage

ALTERNATIVE NO.:

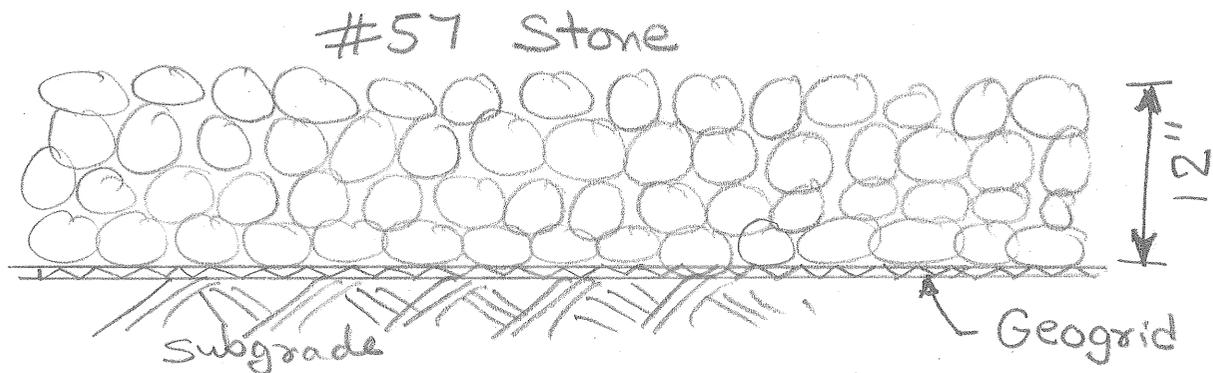
29

AS DESIGNED

ALTERNATIVE

SHEET NO.: 2 of 3

# Porous Pavement for Emergency Parking Lot



Clearing & Grubbing will need to occur after which you'll have to let grass grow naturally or install gravel-pave as shown above. Compaction of subgrade will also have to be performed in both cases.

The original design concept calls out for 6" Gravel base underneath grass-matting blanket that will help grass grow quickly.



# VALUE ENGINEERING ALTERNATIVE



PROJECT: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

ALTERNATIVE NO.: **31**

DESCRIPTION: **REDUCE THE BUILDING PAD ELEVATION/FILL REQUIREMENT**

SHEET NO.: **1 of 1**

**ORIGINAL DESIGN:**

The cost for earthwork for the preferred design solution is \$4,143,188 (after markup) with an unspecified quantity. The design team indicated that the project will be in need of borrow.

**ALTERNATIVE:**

Minimize the building pad elevation along with the adjacent parking lots to the maximum extent possible while assuring level pads for construction of the rest area's amenities.

**ADVANTAGES:**

- Could reduce borrow hauling costs
- Keeps all work on site
- Uses a common practice
- Reduces initial cost

**DISADVANTAGES:**

- The new building's elevation would be closer to that of the existing lake
- Must overcome additional ADA issues

**DISCUSSION:**

The proposed building has some very interesting roof lines. With the building sitting higher on the site, the roof lines will not be appreciated by the public.

It was also mentioned that this job would require borrow, and keeping the amenities at a lower elevation could minimize the amount of fill required and possibly eliminate the fill altogether.

See related VE Alternative No. 8.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	<b>DESIGN SUGGESTION</b>		
SAVINGS			

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## **PROJECT DESCRIPTION**

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### **NEED AND PURPOSE**

In recent years, Georgia coastal cities have been forced to evacuate their communities due to the threat of hurricanes. During evacuations, Interstate Highway 16 (I-16) becomes the major route of travel for thousands of people from these areas. As a result, GDOT has determined that there is a need for a rest area facility between Savannah and Dublin to be used as an information center, command center, or relief site for evacuating travelers.

There is also a need for this rest area to serve travelers under normal circumstances. The closest rest area to the proposed one is located approximately 117 miles away in Laurens County, and current American Association of State Highway and Transportation Officials (AASHTO) guidelines recommend spacing between rest areas of 30 to 60 miles.

### **DESCRIPTION OF THE PROPOSED PROJECT**

The project is to construct a rest area in the median of I-16 at milepost 97. The new facility will be located seven miles west of the city of Metter and just west of the interchange of I-16 and State Route (SR) 57. The project will include the construction of two new bridges that will “scissor,” (i.e., flip) the mainline eastbound and westbound directions to allow right-hand access to and from the rest for both travel directions. The rest area will include a conference center, restroom facilities, parking area, picnic areas, lighting, landscaping, overflow parking for hurricane evacuation, and water and sewer systems. The total length of the proposed project is 2.55 miles.

### **Design Features**

- Proposed typical sections:
  - Ramps - one 16-ft. lane with a paved shoulder, ditches, curb, and gutter, and one 20-ft. lane with curb and gutter
  - I-16 mainline - two 12-ft. lanes with paved shoulders in each direction and a variable width depressed median
  - I-16 mainline bridge - three 12-ft. lanes with shoulders
- Proposed design speed ramp - 70 mph
- Proposed design speed site - 15 mph
- Proposed maximum grade ramp - 4%
- Proposed maximum degree of curve ramp - 1.1
- Structures: New restroom building and two 240-ft. x 60-ft. bridges

### **WATER AND SEWER ALTERNATES CONSIDERED**

- Water and sewer provided by Candler County and city of Metter:
  - Approximately 7.5 miles of 8-in. water main; estimated construction cost (ECC) \$1,737,800

- Approximately 8.0 miles of 6-in. force main; ECC \$1,945,600
- Water provided by the city of Metter and sewer system on site (preferred alternative):
  - Approximately 7.5 miles of 8-in. water main; ECC \$1,737,800
  - On-site sewer treatment plan; ECC \$671,500
- Water and sewer systems on site:
  - On-site well water system; ECC \$190,000
  - On-site sewer treatment system; ECC \$671,500

## **DESIGN ALTERNATES CONSIDERED**

The following design alternates were considered by the design team and are paraphrased here from the Draft Project Concept Report, including the design team's comments and recommendations.

- Alternate 1 proposes left-hand entrance and exit ramps connecting I-16 to the site. Because drivers expect right-hand access to and from controlled-access highways, left-hand access has potential to confuse drivers. This confusion creates a higher incidence of rear-end accidents, particularly with slower moving trucks and recreational vehicles weaving into the left lane to access the site or I-16. This alternate is not recommended due to these safety concerns.
- Alternate 2 proposes constructing four fly-over bridges that will allow right-hand entrance and exit ramps connecting I-16 to the site. One ramp and fly-over bridge is proposed in each direction. Due to the location of the exit ramp for the SR 57 interchange, an auxiliary lane is required in the eastbound direction between the rest area/I-16 entrance ramp and the exit ramp for SR 57. The estimated construction cost, including wetland and stream mitigation, is roughly \$25,935,000. Additional right-of-way will be required for the construction of the ramps and detours. This alternate will have a tremendous and permanent impact on the wetlands and streams located in the vicinity of the proposed fly-over ramps. Also, the construction of the four bridges on each approach and exit from the site is less aesthetically pleasing.
- Alternate three proposes constructing extended entrance ramps and one fly-over bridge. The required length for a truck to accelerate to the posted speed of 70 mph before entering the I-16 mainline is 6,000 ft. for the westbound ramp and 8,000 ft. for the eastbound ramp. However, the extended eastbound ramp would conflict with the SR 57 exit ramp. To solve this problem, a fly-over bridge with an auxiliary lane to SR 57 is recommended. Exits from I-16 mainline to the rest area would be on the left-hand side. The estimated construction cost, including wetland and stream mitigation, is \$17,189,000. Additional right-of-way is required for ramp construction. For reasons stated above, the left-hand exits and entrances make this alternate a less desirable solution.
- Alternate 4 proposes reconstructing each direction of the I-16 mainline for approximately two miles by raising its grade and constructing four mainline bridges over rest area entrances and exit ramps. Construction of an eastbound auxiliary lane is also required from the rest area to the SR 57 exit ramp. The reconstruction of I-16 at a higher elevation than the rest area will require over 2,000 linear feet of retaining walls and will create less site visibility for the motoring public. The estimated construction cost, including wetland and stream mitigation, is \$26,571,000. Right-of-way acquisition will be required for construction of the ramps and detours. This alternate is less

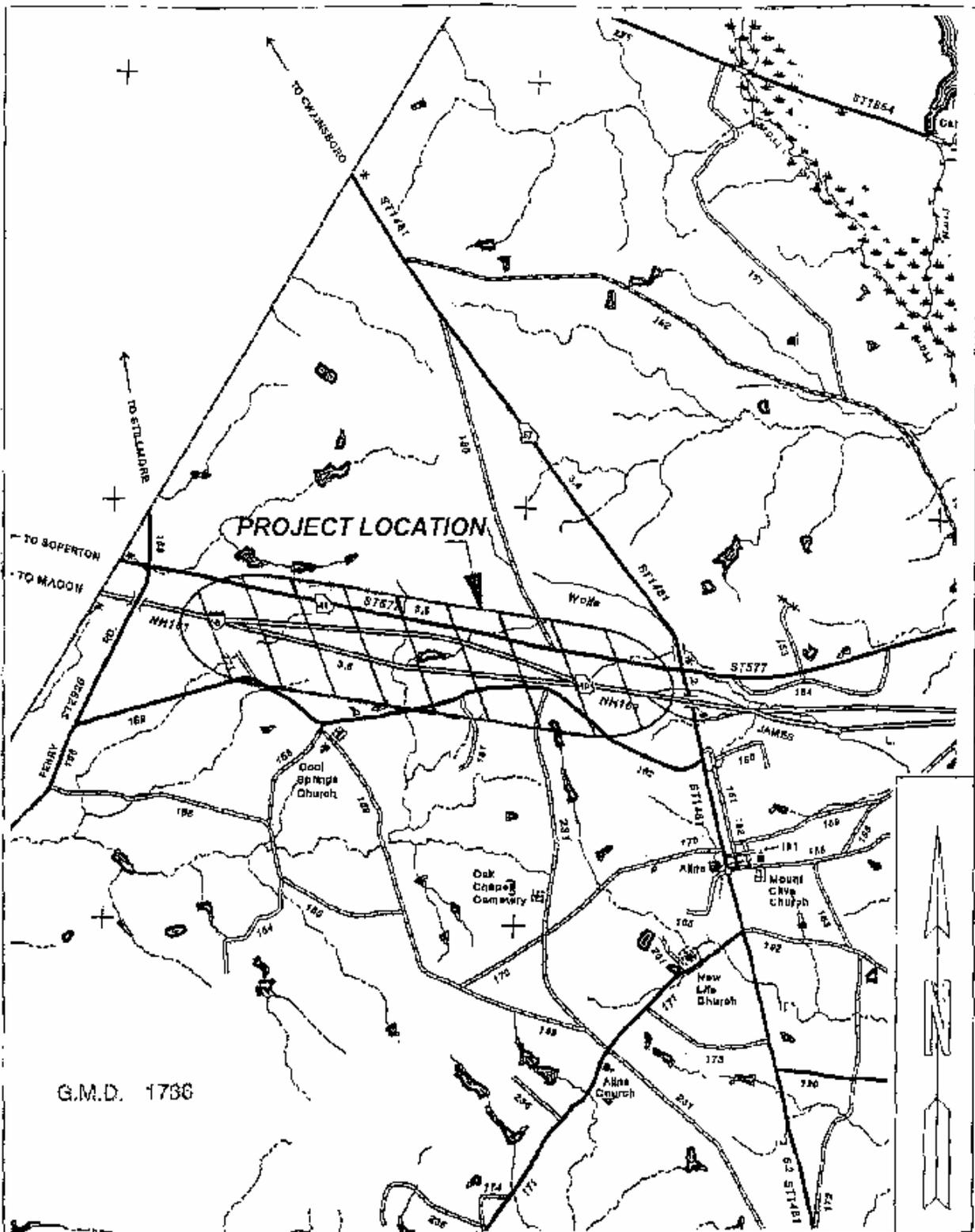
preferable due to limited motorist site visibility.

- Alternate 5 will “scissor,” (i.e., flip) the mainline eastbound and westbound directions so that access to and from the rest area site will be provided on the right-hand side of the mainline. The eastbound mainline would bridge over the westbound mainline west of the site, and the westbound mainline would bridge over the eastbound mainline west of the site. The mainline detours can be constructed on temporary easement, and no additional right-of-way will be required. Wetland and stream impacts are temporary in the locations of the proposed detours. Additional landscaping is proposed in the vicinity of the bridges. The estimated construction cost, including wetland and stream mitigation costs, is \$28,700,719. This preferred alternate creates safer right-hand site entrances and exits. Accordingly, the proposed grade of the site in relation to the I-16 mainline will create a beautiful rest area for the State of Georgia.
- A no-build alternate does not meet the operational needs of the project.

## **COST DATA**

The current probable cost of construction is \$30,141,259 per the Preliminary Cost Estimate prepared by Clark Patterson Associates, dated February 13, 2006.

The aforementioned cost includes construction cost at \$25,540,207 with \$2,554,021 for engineering and construction (at 10.00%), \$1,404,711 for inflation (at 5.00% per annum for one year [5.00%]), and right-of-way costs of \$642,320.



LOCATION SKETCH  
 PROJECT NO. NHS-0000-00 (691)  
 P. I. NO. 0000691  
 CANDLER COUNTY

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## VALUE ALTERNATIVES AND CONCLUSIONS

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### GENERAL

This section describes the value analysis procedure used during the VE study. It is followed by separate narratives and conclusions concerning the following:

- VE Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histogram
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

A systematic approach was used in the VE study, and the key procedures involved were organized into three distinct parts: (1) 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, 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-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 included five phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase

#### Information Phase

At the beginning of the study, the conditions and decisions that influenced the development of the project must be reviewed and understood. For this reason, the design development manager presented

information about the project to the VE team on the first day of the session. Following the presentation, the VE team discussed the project using the following documents:

- Draft Project Concept Report, prepared by CPA for GDOT, undated, containing the following:
  - Location Sketch
  - Preliminary Cost Estimate
  - Building Renderings and Floor Plan
  - Typical Roadway Sections
  - Copies of four Meeting Minutes
  - FHWA Correspondence
- Summary of Findings—Historic Resources, prepared by Edwards-Pitman Environmental, Inc., for CPA, dated October 20, 2005
- Summary of Findings—Ecology, prepared by Edwards-Pitman Environmental, Inc., for CPA, dated October 21, 2005
- CD with numerous drawings, prepared by CPA
- Aerial map of the I-16 median with Design Alternate 2 superimposed on the aerial map prepared by CPA (Conceptual Layout), undated
- Large size conceptual layouts of Design Alternate Nos. 1–5, prepared by CPA, undated

### **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.

### **Creative Phase**

This VE study phase involved the creation and listing of ideas. 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.

The GDOT and CPA representatives may wish to review the creative list since it may contain ideas that can be further evaluated for potential use in the design.

### **Evaluation Phase**

During this phase of the workshop, the VE team judged the ideas generated during the creative 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 by consensus, the team rated the ideas on a scale of zero to five, with the best ideas rated five. Only the 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 reevaluated 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 highly 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.

### **POST-WORKSHOP EFFORT**

The post-study portion of the VE study includes the preparation of this VE study report. Personnel from GDOT and CPA 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. LZA is available at your convenience as you review the alternatives.

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# VALUE ENGINEERING STUDY AGENDA

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Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour Value Engineering (VE) study on the **NHS-0000-00(691), P.I. No. 0000691, I-16 Median Rest Area** project located in Candler County, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) and the design team headed by CPA 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 March 20 – 23, 2006. The study will be conducted in Room 260, Bridge Conference Room in GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, who can be reached at 404-651-7468.

### Monday, March 20<sup>th</sup>

10:00 am – 10:15 am                    **General Introduction of all Parties and review of the VE Process**

10:15 am - 11:15 am                   **Owner's / Designer's Presentation**

GDOT is to present information concerning the project 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.

## **Tuesday, March 22<sup>nd</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**

## **Wednesday, March 23<sup>rd</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 and Commence Summary Worksheets**

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 work sheets form the basis of the informal oral presentation.

4:00 – 5:00 pm                        **Finalize Summary Worksheets**

The VE team will provide draft copies of the *Summary of Potential Cost Savings* worksheets to GDOT representatives and be available to clarify any points.

## **VALUE ENGINEERING WORKSHOP PARTICIPANTS**

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The VE team was organized to provide specific expertise on the unique project elements involved. The multidisciplinary group comprised professionals with a working knowledge of VE procedures and expertise as follows:

Dominic F. Saulino	Transportation Engineer	HNTB
Alex Pascual, PE	Structural/Bridge Engineer	HNTB
Paresh Parikh, PE	Construction Specialist	Delon Hampton and Associates
David L. Sablotny, RA	Architect	ARACDIS G&M
Luis M. Venegas, PE, CVS, LEED™ AP	Value Engineering Facilitator	Lewis & Zimmerman Associates, Inc.

### **OWNER'S/DESIGNER'S PRESENTATION**

The CPA design team presented an overview of the project on Monday, March 20, 2006. 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 did not conduct a final, oral presentation on Wednesday, March 22, 2006 to GDOT. However, copies of the draft Summary of Potential Cost Savings worksheets were provided for interim use by GDOT personnel.

A copy of the meeting participants is attached for reference.

# VALUE ENGINEERING ATTENDEES

## MEETING PARTICIPANTS



PROJECT: <b>NHS-0000-00(691), I-16 MEDIAN REST AREA</b> <i>Conceptual Design Stage</i>		Date: <b>March 20–22, 2006</b>
NAME & E-MAIL (PLEASE PRINT)	ORGANIZATION/TITLE	PHONE/FAX
Clay C. Bastian em: clay.bastian@dot.state.ga.us	State of Georgia Department of Transportation (GDOT) Office of Road and Airport Design Project Manager/Design Engineer	ph: 404-655-5400 fx: 404-657-0653
Steve Gaston, PE em: steve.gaston@dot.state.ga.us	GDOT, Office of Bridge Design Bridge Engineer	ph: 404-656-5197 fx: 404-651-7076
Claude R. (CR) Jackson em: calude.jackson@dot.state.ga.us	GDOT, Jesup District – District 5 Area Engineer	ph: 912-871-1108 fx: 912-681-0278
William (Will) R. Murphy, Jr. em: will.murphy@dot.state.ga.us	GDOT, Jesup District – District 5 Assistant District Construction Engineer	ph: 912-427-5733 fx: 912-427-5763
Lisa L. Myers em: lisa.myers@dot.state.ga.us	GDOT, General Office Design Review Engineer Manager, Value Engineering Coordinator	ph: 404-651-7468 fx: 404-463-6131
Amber Perkins em: a.perkins@dot.state.ga.us	GDOT, Office of Environment and Location National Environmental Protection Act Planner	ph: 404-699-4373 fx: 404-699-4440
Floyd Moore em: floyd.moore@fhwa.dot.gov	U.S. Department of Transportation, Federal Highway Administration, Georgia Division Transportation Engineer	ph: 404-562-3654 fx: 404-562-3703
Joseph (Joe) M. Garland em: jgarland@clarkpatterson.com	Clark Patterson Associates Senior Engineer	ph: 770-831-9000 fx: 770-831-9243
Adolfo A. Guzman, PE em: aguzman@clarkpatterson.com	Clark Patterson Associates Senior Engineer	ph: 770-831-9000 fx: 770-831-9243
David L. Sablotny, RA em: dsablotny@arcadis-us.com	ARCADIS G&M of Ohio A&E, LLC Project Architect	ph: 216-781-6177 fx: 216-781-6243
Paresh Parikh, PE em: pparikh@delonhampton.com	Delon Hampton & Associates, Chartered Manager, Engineering Services	ph: 404-524-8030 fx: 404-524-2575



## ECONOMIC DATA

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The VE team developed economic criteria used for evaluation with information gathered from GDOT and the CPA design team. To express costs in a meaningful manner, the VE team 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:	<b>2006</b>
Construction Startup:	<b>2008</b>
Construction Duration:	<b>±24 Months (2010)</b>
Economic Planning Life:	<b>35 years for pavement 50 years for bridges</b>
Discount Rate/Interest:	<b>2.50%</b> (Latest United States Office of Management and Budget Circular A-94)
Inflation/Escalation Rate:	<b>5.00%</b> (per GDOT)
Uniform Present Worth (UPW) Factor:	<b>23.1452</b> for 35 years <b>28.3623</b> for 50 years
Cost of Power (assumed):	<b>\$0.07/kWhr</b> (kilowatt hour)
Operation and Maintenance Costs (industry norms):	
Equipment - With Many Moving Parts	<b>5.00%-5.50%+ of Capital Cost</b>
Equipment - With Minimal Moving Parts	<b>3.50%-4.00% of Capital Cost</b>
Equipment - Electronic	<b>3.00% of Capital Cost</b>
Structural	<b>1.00%-2.00% (or less) of Capital Cost</b>
Composite Markup (Construction): <i>(Composed of inflation [based on 5.00% per annum for one year] at 5.00% and engineering and onstruction at 10.00 %)</i>	<b>15.50%</b>
Composite Markup (Right-of-Way): <i>(Composed of scheduling contingency at 55.00%, administration/court costs at 60.00%, and inflation factor at 40.00 %)</i>	<b>247.20%</b>

## **COST ESTIMATE SUMMARY AND COST HISTOGRAM**

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The VE team prepared several cost models for the project that are included following this page. The cost models are arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and are based on the Preliminary Cost Estimate prepared by CPA, dated February 13, 2006. As can be expected, judgments at this stage of the study are based on experience and intuition rather than facts, which are not uncovered until the analysis of function. Based on these preliminary judgments, there appears to be a potential for initial cost savings in the following areas:

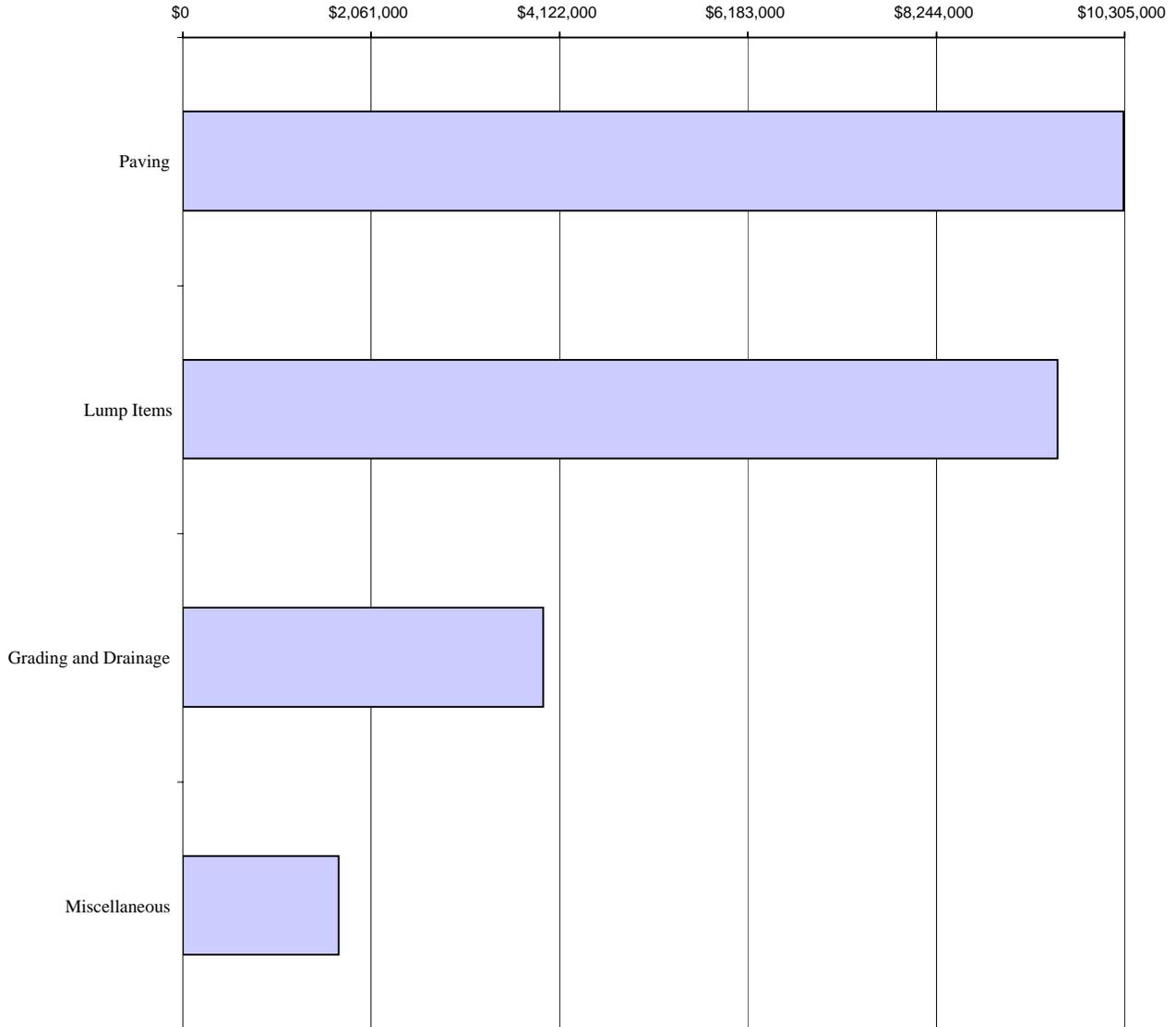
- Paving
  - Concrete Pavement
  - Aggregate Base
  - Asphalt Paving
- Lump items
  - Bridges and Walls
  - Water System
  - Restroom Building
- Grading and Drainage
  - Earthwork
  - Drainage
- Miscellaneous
  - Landscaping
  - Clearing and Grubbing

# COST HISTOGRAM



Project: **NHS-0000-00(691), I-16 MEDIAN REST AREA**  
*Conceptual Design Stage*

TOTAL PROJECT	COST	PERCENT	CUM. PERCENT
Paving	10,300,116	40.33%	40.33%
Lump Items	9,579,315	37.51%	77.84%
Grading and Drainage	3,952,176	15.47%	93.31%
Miscellaneous	1,708,600	6.69%	100.00%
<b>Construction Subtotal</b>	<b>\$ 25,540,207</b>	<b>100.00%</b>	
Engineering and Construction @ 10.00%	\$ 2,554,021		
Inflation Based on 5.00% per annum for One Year 5.00%	\$ 1,404,711		
<b>Construction Total</b>	<b>\$ 29,498,939</b>		<b>Construction</b> Comp Markup: 15.50%
Net Right-of-Way	\$ 185,000		
Right-of-Way Scheduling Contingency 55.00%	\$ 101,750		
Right-of-Way Administration / Court Costs 60.00%	\$ 172,050		
Right-of-Way Inflation Factor 40.00%	\$ 183,520		
<b>Total Right-of-Way</b>	<b>\$ 642,320</b>		<b>Right-of-Way</b> Comp Markup: 247.20%
<b>GRAND TOTAL</b>	<b>\$ 30,141,259</b>		



Costs in graph are not marked up.

## **FUNCTION ANALYSIS**

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A function analysis was performed to (1) define the requirements for each project element and (2) to ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. The Random Function Analysis worksheet indicating the functions provided by the project is attached. This part of the 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.



## **CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS**

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During the creative phase, numerous ideas were generated using conventional brainstorming techniques as recorded on the following page. These ideas were then discussed and the advantages/disadvantages of each considered. The VE team compared each of the ideas with the concept solution to determine whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were then ranked on a scale of one to five on how well the VE design team believed the idea met necessary criteria and program needs. The higher rated ideas were then developed into formal alternatives and included in the VE workshop. Some ideas were judged to have minimal cost impact on the project but provided enhancements in the form of improved operations, efficiency, constructability, or potential to save unknown or hidden costs. These were given the designation “DS,” which indicates a design suggestion. 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 four or above are included in the study report. If a highly rated idea was not incorporated, it may have been combined with another idea, or it may have been discarded as a result of additional research that indicated it was not cost effective or technically feasible.

All readers are encouraged to review the Creative Idea Listing and Evaluation worksheets since they may suggest additional ideas that can be applied to the design.



