NH-002-7(23)

Cleveland West Bypass

P.I. No. ~~612390~~

White County, Georgia

Value Engineering Study Report

Concept Development Stage

October 2005

Design Consultant

Georgia Department of Transportation, District 1

Value Engineering Consultant

Lewis & Zimmerman Associates, Inc.

Lewis & Zimmerman Associates, Inc.
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October 7, 2005

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 NH-002-7(23), P.I. No. 162390
Cleveland West Bypass, White County, Georgia
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the referenced report. The alternatives and design suggestions developed during this VE effort identify opportunities to improve the value of the project in terms of relieving congestion, reducing travel time, improving safety, and potentially reducing capital cost.

We thank you for assisting the VE team in generating creative alternative solutions for this project. We look forward to working with you on future assignments and stand ready to provide additional value engineering services.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

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

Attachment

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EXECUTIVE SUMMARY

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), Atlanta, Georgia. The subject of the study was the Cleveland West Bypass known as Project NH-002-7(23), P. I. No. 162390, White County, Georgia, being designed by District 1. The VE workshop was conducted in GDOT offices September 26 – 28, 2005.

PROJECT DESCRIPTION

The project provides a bypass west of Cleveland beginning near the Intersection of State Route (SR) 11/United States Route (US) 129 with Hope Road south of Cleveland and tying into US 129/SR 11/SR 75 Alternate (ALT). After crossing SR 75 ALT the project continues along County Route (CR) 68/Hulsey Road to SR 75, the north terminus.

The current probable cost of construction is $34,409,454 as noted on the NH-002-7(23) – P.I. No. 162390 Cost Estimate, White County, prepared by District 1, Georgia Department of Transportation, and dated July 2005.

CONCERNS AND OBJECTIVES

The project is a straightforward design of a rural-type, limited-access roadway combined with a five-lane section at its northern terminus to accommodate light industry and potential future growth. Further, the preliminary estimate indicates a construction cost that is within acceptable parameters for a facility that includes traversing mountainous terrain.

However, the VE team noted several areas of concern in the design:

1. Maintaining a 55-mile-per-hour speed limit. Beyond either end of the project, the speed limit is 45 mph or lower due to the terrain and/or congested traffic within Cleveland.
2. The width of the median and the associated right-of-way takes.
3. The roadway alignment curves and resulting length of the project and the proximity to an historical area to the west.

The team also identified some concerns with the estimate.

Therefore, the objective of the effort was to identify opportunities that would address the concerns and improve the value of the project in terms of relieving congestion, reducing travel time, improving safety, and reducing capital cost.

HIGHLIGHTS OF THE STUDY

Several ideas were developed to help ameliorate the concerns noted above by reducing the speed limits, reducing the overall facility's length, and minimizing unnecessary crossing traffic. Listed below are some of the more salient ideas developed.

Since the posted speed limits before and after Cleveland are in the range of 35 to 45 miles per hour (mph), the need to have a 3.44-mile section of the new facility (approximately 75%) at 55 mph does not appear to be warranted. Therefore, Alternative 1 recommends a five-lane section for the entire facility, improving safety by reducing the speed to 45 mph while allowing for future development along those areas of the facility that are developable. However, the additional paved area for the fifth lane will increase the project cost by about $450,000.

The current design calls for the southern terminus to permit turning movements from the bypass onto US 129. However, since only 50 vehicles per day are anticipated to make this movement in the design year, the need to accommodate this movement is not warranted. Alternative 5 recommends eliminating the turning movement and saving nearly $230,000.

Alternatives 7 and 17 attempt to straighten the alignment of the new bypass between SR 115 and US 129/SR 115/SR 75 ATL and between CR 115/Jess Hunt Road/Claud Sims Road and US 129/SR 115/SR 75 ATL. Both resulted in substantial increases to the project's cost (+$4M for Alternative 7 and almost $14M for Alternative 17), but these approaches should be analyzed to see if improvements of this nature are feasible with new geotechnical and geometric data. They have potential to further improve the safety of the design.

The VE team also reviewed the cost estimate and identified two potential problems:

1. Apparently the costs associated with *Aggregate Base* are doubled, adding an additional ±$2M in construction costs; and
2. There is inconsistency between the construction cost noted on the *Preliminary Cost Estimate* dated July 2005 and the right-of-way costs delineated in the *Detailed Cost Estimate Summary Sheet* dated August 5, 2005. This results in an additional ±$10M added to the bottom line.

The *Summary of Potential Cost Savings* worksheet follows this narrative outlining the six alternatives 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 full listing of all of the ideas considered by the VE team can be found on the *Creative Idea Listing* worksheets in the Value Analysis and Conclusions section of this report.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **NH–002–7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALT. NO.		ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
1	Construct a five-lane section of roadway throughout the project	$1,550,701	$1,999,725	($449,024)		($449,024)
2	Use a four-lane section with guardrail at 55 miles per hour	$1,860,796	$1,768,111	$92,685		$92,685
5	Eliminate southbound access to US 129 from the bypass	$225,636	$0	$225,636		$225,636
6	Realign depressed median section between the area of the Environmental Justice community and SR 115	DESIGN SUGGESTION				
7	Realign the bypass between SR 115 and US 129/SR 115/SR 75 ALT	$6,117,288	$10,239,996	($4,122,708)		($4,122,708)
17	Realign the bypass between CR 115/Jess Hunt Road/Claud Sims Road and US 129/SR 115/SR 75 ALT	$9,645,859	$23,597,280	($13,951,421)		($13,951,421)

STUDY RESULTS

INTRODUCTION

The results are the major feature of a value engineering (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, user and owner to determine the ultimate acceptance of each alternative.

The creative ideas are organized according to the order in which they were originally generated by the VE team during their function analysis creative sessions.

RESULTS OF THE STUDY

The VE team generated 24 ideas for change during the Function Analysis and Creative Ideas 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, constructibility and soundness of the idea.

Of the 24 ideas generated, seven of them were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded five alternatives for change with an impact on project costs and one design suggestion that will enhance the value of the project in terms of durability, reduced labor effort/improved constructibility, and expansion of the work product. All of these alternatives and design suggestions are presented in detail following this narrative and on the *Summary of Potential Cost Savings* worksheets.

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, should be used as the pricing basis. Where appropriate, the impact of energy costs, replacement costs, and effect on operations and maintenance should be shown within each alternative.

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.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **NH–002–7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALT. NO.		ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
1	Construct a five-lane section of roadway throughout the project	$1,550,701	$1,999,725	($449,024)		($449,024)
2	Use a four-lane section with guardrail at 55 miles per hour	$1,860,796	$1,768,111	$92,685		$92,685
5	Eliminate southbound access to US 129 from the bypass	$225,636	$0	$225,636		$225,636
6	Realign depressed median section between the area of the Environmental Justice community and SR 115	DESIGN SUGGESTION				
7	Realign the bypass between SR 115 and US 129/SR 115/SR 75 ALT	$6,117,288	$10,239,996	($4,122,708)		($4,122,708)
17	Realign the bypass between CR 115/Jess Hunt Road/Claud Sims Road and US 129/SR 115/SR 75 ALT	$9,645,859	$23,597,280	($13,951,421)		($13,951,421)

VALUE ENGINEERING ALTERNATIVE

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: **1**

DESCRIPTION: **CONSTRUCT A FIVE-LANE SECTION OF ROADWAY THROUGHOUT THE PROJECT**

SHEET NO.: 1 of 3

ORIGINAL DESIGN:

The original design of this project includes a four-lane section with a depressed 44-ft. median from Station 130+50 to Station 275+72. After that, a five-lane section runs to the termination point of the project.

ALTERNATIVE:

Eliminate the depressed median section and construct the five-lane section throughout. The objective is to decrease the right-of-way impact and cost. It is assumed that the horizontal and vertical alignment will remain unchanged.

ADVANTAGES:

- Provides a uniform cross section
- May be able to tighten some of the curves (horizontal) and shorten the alignment
- Promotes future growth
- Increases accessibility

DISADVANTAGES:

- Speed drops to 45 mph
- Increases asphalt pavement
- Increases cost
- Makes future widening more difficult

DISCUSSION:

This alternative was conceived based on the idea that it would save cost because of the decrease in right-of-way width. However, it turns out that there is actually an associated cost increase due to the low cost of land and the relatively high cost of asphalt pavement.

Based on the cost increase, the VE team does recommend implementation of this alternative.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,550,701	—	$ 1,550,701
ALTERNATIVE	$ 1,999,725	—	$ 1,999,725
SAVINGS	$ (449,026)	—	$ (449,026)

CALCULATIONS

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 1

DESCRIPTION:

SHEET NO.: 2 of 3

Quantity effect due to proposed change:

① Additional 14ft of asphalt pavement from station 130+50 to Sta. 275+72.

② In general the decrease in ROW is the difference between 112ft shoulder to shoulder width on the depressed median section and 82 ft shoulder to shoulder width on the five lane section.

③ Median drainage will be eliminated.

④ Twin span bridges at three location will turn into single structures.

① $14ft \cdot [27572ft - 13050ft + (28021.5 - 27572)] = 209{,}601\ ft^2 \cdot \frac{1SY}{9ft^2} = \underline{23{,}289\ SY}$ Add'l Asphalt

② $112ft - 82ft = 30ft$ decrease in ROW Width

Length $= (28021.5 - 27572) + (27572 - 13050) = 14{,}972\ ft$

Area $= 30ft \cdot 14{,}972ft = 449{,}160\ ft^2 \cdot \frac{1\ Acre}{43{,}560\ ft^2}$

Decreased Area = 10.3 Acre

③ \$207,970 /mi for minor drainage

- 4.7mi total length

- Miles of 44ft median & associated drainage $= 14{,}972ft \cdot \frac{1\ mi}{5280\ ft} = 2.8mi$

Decrease in drainage = 2.8 mi

④ Twin Span Bridges (\$61.60/SF)

$2[(38ft \cdot 300ft) + (38ft \cdot 380ft) + (38ft \cdot 350ft)] = 78{,}280\ ft^2$

Single Bridge

$48ft + 14ft + 20ft + 6.5ft = 88.5ft$ Wide

$88.5ft(300ft \cdot 380ft \cdot 350ft) = 91{,}155\ ft^2$

Increase Bridge Area $= 91{,}155ft^2 - 78{,}280ft^2 = \underline{12{,}875\ ft^2}$

COST WORKSHEET

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO: 1

DESCRIPTION

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
Construction Items							
Additional Pavement - 5th Lane	SY				23,289	37.50	873,338
Decreased Drainage	MI	2.80	207,970	582,316			
Increase bridge Area	SF				12,875	61.60	793,100
Subtotal				582,316			1,666,438
Markup at 20.00%				116,463			333,288
Subtotal Construction				**698,779**			**1,999,725**
Right-of-Way Costs							
Land	AC	10.30	49,486	509,706			
Subtotal				509,706			
Markup at 67.14%				342,216			
Subtotal Right-of-Way				**851,922**			
Sub-total				1,550,701			1,999,725
Mark-up at				Incl			Incl
TOTAL				1,550,701			1,999,725

VALUE ENGINEERING ALTERNATIVE

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: **2**

DESCRIPTION: **USE A FOUR-LANE SECTION WITH GUARDRAIL AT 55 MPH**

SHEET NO.: 1 of 3

ORIGINAL DESIGN:

The current design calls for a 44-ft. depressed median for the bypass US 129/SR 11 to tie into Hulsey Road.

ALTERNATIVE:

Reduce the median width to 4-ft. inside shoulders and provide a double-faced steel W beam installed on strong posts.

ADVANTAGES:

- Reduces earthwork
- Reduces right-of-way
- Minimizes first cost

DISADVANTAGES:

- Adds paving costs for median
- Prohibits widening to the inside if needed

DISCUSSION:

Construct the bypass, maintaining a 55 mph design speed and using a 4-ft. inside shoulder and a double steel W-beam on strong posts. This will reduce the total width of the roadway by 34 ft.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,860,796	—	$ 1,860,796
ALTERNATIVE	$ 1,768,111	—	$ 1,768,111
SAVINGS	$ 92,685	—	$ 92,685

CALCULATIONS

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 2

DESCRIPTION:

SHEET NO.: 2 of 3

Asphalt Paving - 18,148 LF × 10' ÷ 9 = 20,164 SY × $37.50 = $756,167

R/W Area - 112' - 78' = 34' decrease in R/W width
34' × 18,148 LF ÷ 43,560 FT²/AC = 14.2 AC

Drainage - $207,970/mi for minor drainage in median

18,148 LF ÷ 5280 LF × $207,970 = ($714,818)

Double Beam Guardrail on Strong Posts - 18,148 LF - 210 LF (3 Median Openings) =

17,938 LF × $23.00/LF = $412,574

Bridge - Original - 2[(38' × 300') + (38' × 380') + (38' × 350')] = 78,280 FT²

Proposed - Single Bridge - 84.5' Wide

84.5(300 + 380 + 350) = 87,035 FT² - 78,280 = 8,755 FT²

8,755 × $61.60/SF = $593,308

COST WORKSHEET

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO: 2

DESCRIPTION

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
Construction Items							
Additional Pavement - 5th Lane	SY				16,133	37.50	604,988
Decreased Media Drainage	MI	2.75	207,970	571,918			
Double Beam Guardrail	LF				14,310	23.00	329,130
Additional Bridge Width	SF				8,755	61.60	539,308
Subtotal				571,918			1,473,426
Markup at 20.00%				114,384			294,685
Subtotal Construction				**686,301**			**1,768,111**
Right-of-Way Costs							
Land	AC	14.20	49,486	702,701			
Subtotal				702,701			
Markup at 67.14%				471,794			
Subtotal Right-of-Way				**1,174,495**			
	Sub-total			1,860,796			1,768,111
Mark-up at				Incl			Incl
	TOTAL			1,860,796			1,768,111

VALUE ENGINEERING ALTERNATIVE

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: **5**

DESCRIPTION: **ELIMINATE SOUTHBOUND ACCESS TO US 129 FROM THE BYPASS**

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (Sketch attached)

The current plans show a right-turn lane from the northbound (NB) bypass to access existing US 129 approximately 800 ft. after the proposed US 129/SR 11 NB ramp. There is also a left-turn lane from the southbound (SB) bypass to access US 129/SR 11.

ALTERNATIVE: (Sketch attached)

Provide access to US 129/SR 11 NB from the proposed ramp. Eliminate left-turn lane from SB bypass to US 129/SR 11 and provide access from SR 115 for the estimated 50 vehicles per day (VFD) based on the proposed traffic. Access from the existing US 129/SR 11 to the bypass will be maintained as will the proposed signal at this location.

ADVANTAGES:

- Right-turn lane not warranted from NB and left turn not warranted from bypass to US 129/SR 11
- Simplifies design and construction
- Improves traffic flow
- Improves safety

DISADVANTAGES:

- Forces traffic on SB to use SR 115 to access US 129/SR 11 (55 VPD)

DISCUSSION:

The ramp allows both ingress and egress from the bypass to US 129/SR 11. The proposed traffic calls for 50 VPD to enter from the bypass which also has a ramp connection from the NB bypass to US 129/SR 11. Access from US 129/SR 11 to the bypass must be maintained, including the signal.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 225,636	—	$ 225,636
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 225,636	—	$ 225,636

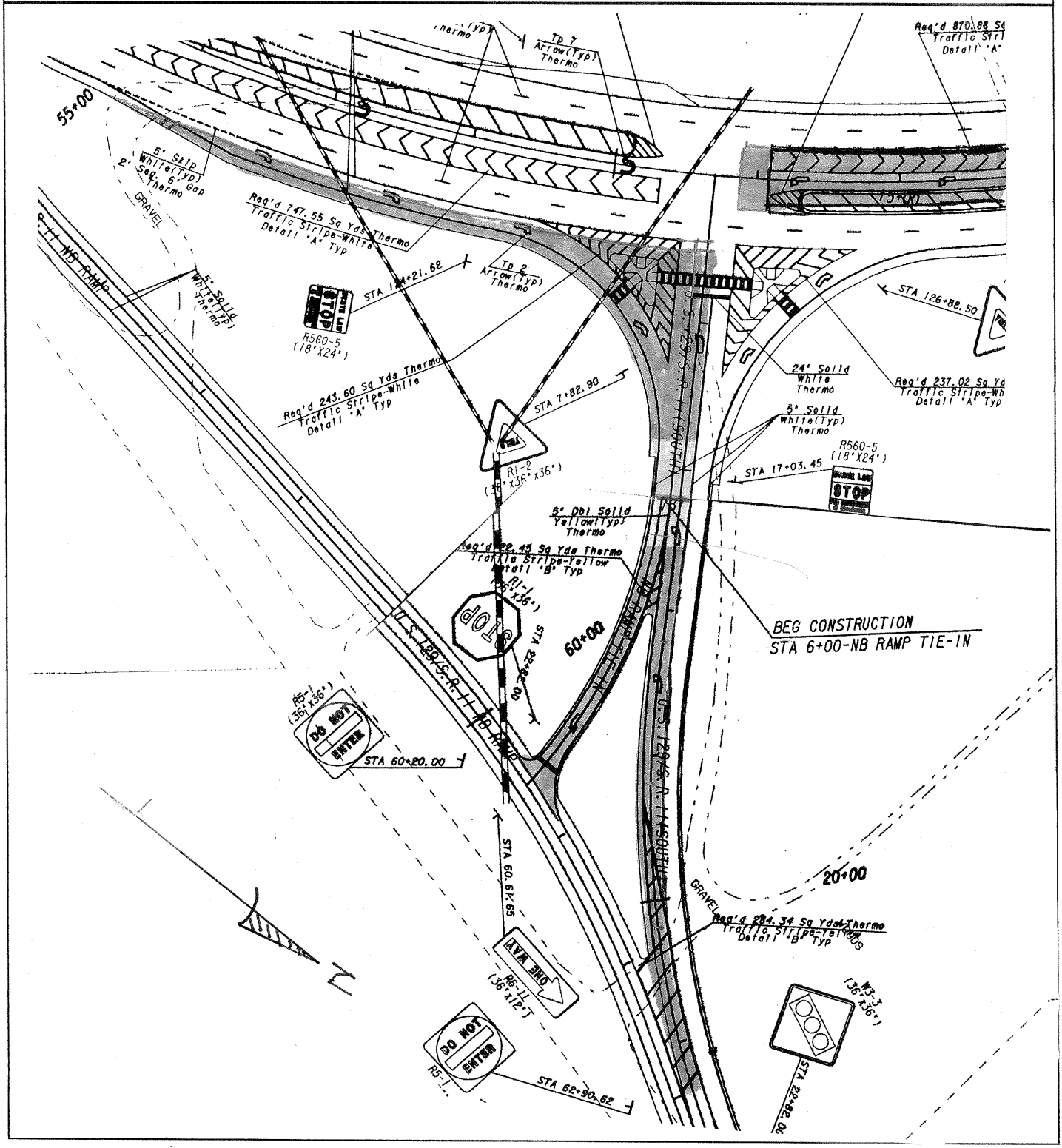
SKETCHES

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 5

☐ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 4



CALCULATIONS

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 5

DESCRIPTION:

SHEET NO.: 3 of 4

NB Paving - 340 LF × 12 ÷ 9 = 453 SY × $37.50/SY = $ 17,000

SB Paving - 450 LF × 44 ÷ 9 = 2200 SY
350 LF × 22 ÷ 2 ÷ 9 = 428 SY

2628 SY × $37.50/SY = $98,550

Bypass to US 129 Connection -
130' × 160' × .4 ÷ 9 = 924 SY - 72 SY (Island) = 852 SY
220 × 16 ÷ 9 = 391 SY
420 × 12 ÷ 9 = 560 SY

1803 SY × $37.50/SY = $67,613

Conc Island - 72 SY × $40/SY = $2,880

Signing & Marking - LS - $2,000

72

COST WORKSHEET

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO: 5

DESCRIPTION

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Asphalt Paving	SY	4,884	37.50	183,150			
Concrete Island	SY	72	40.00	2,880			
Signing and Marking	LS	1	2,000	2,000			
	Sub-total			188,030			
Mark-up at	20.00%			37,606			
	TOTAL			225,636			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: **6**

DESCRIPTION: **REALIGN DEPRESSED MEDIAN SECTION BETWEEN THE AREA OF THE ENVIRONMENTAL JUSTICE COMMUNITY AND SR 115**

SHEET NO.: 1 of 1

ORIGINAL DESIGN:

Currently, the alignment in this area has been shifted to the east in order to preserve an historic well and its associated property. This causes the alignment to go into an "S" curve in order to tie into the proposed alignment north of SR 115. In general, the alignment of the depressed median section of this project is forced to snake between mountainous terrain, Environmental Justice communities, historic properties, and environmentally-sensitive areas.

ALTERNATIVE:

Modify the alignment between the area of the Environmental Justice community and SR 115 can be modified by reducing the radius of the curve that begins near the Environmental Justice community so that it will tie in more closely to the short piece of tangent alignment (near the historic well/spring box) before crossing SR 115. This change in alignment will add one residential/farm take. However, it eliminates one of the original alignments right-of-way takes.

ADVANTAGES:

- Reduces length
- Provides a better driving experience
- Improves safety

DISADVANTAGES:

- Retains "S" curve

DISCUSSION:

Minimizing the "S" curve in this portion of the alignment will definitely benefit the project. However, any commitments made to the two landowners in the area will need to be renegotiated. We do not anticipate any significant cost reduction due to this minor shortening of the alignment.

With the information available at this time, it is not possible to determine the exact amount of alignment length reduction.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE	DESIGN SUGGESTION		
SAVINGS			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: **7**

DESCRIPTION: **REALIGN THE BYPASS BETWEEN SR 115 AND US 129/SR 113/SR 75 ALT**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The alignment between SR 115 and US 129 is a series of three curves with a reversed middle curve to offset the roadway from an historical area immediately west of it.

ALTERNATIVE: (Sketch attached)

Realign between the termini to the east of Cox River with a straighter alignment.

ADVANTAGES:

- Shortens alignment
- Clears the historic area on the west side
- Reduces impact to established homes

DISADVANTAGES:

- Impacts the creek longitudinally
- Advanced acquisition right-of-way will not be used
- Requires extensive rock excavation

DISCUSSION:

Realignment of the Cleveland Bypass between SR 115 and US 129 will shorten the bypass by approximately a quarter of a mile. However, the alternate will have to be located between the creek and the sharp mountain slopes in the east. In the absence of related information, it is conceived that a vertical alignment can be fitted on the slopes with the secondary objective of lowering the alignment enough to use culverts over the creek tributaries in lieu of bridges. The bridge over Claud Sims Road will have to remain to maintain the limited access of the bypass. The right-of-way acquired through the advanced acquisition between Claud Sims Road and Shepard Drive will not be put to use in the alignment.

While seeming to add significant cost, this alternative may warrant additional investigation.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 6,117,288	—	$ 6,117,288
ALTERNATIVE	$ 10,239,996	—	$ 10,239,996
SAVINGS	$ (4,122,708)	—	$ (4,122,708)

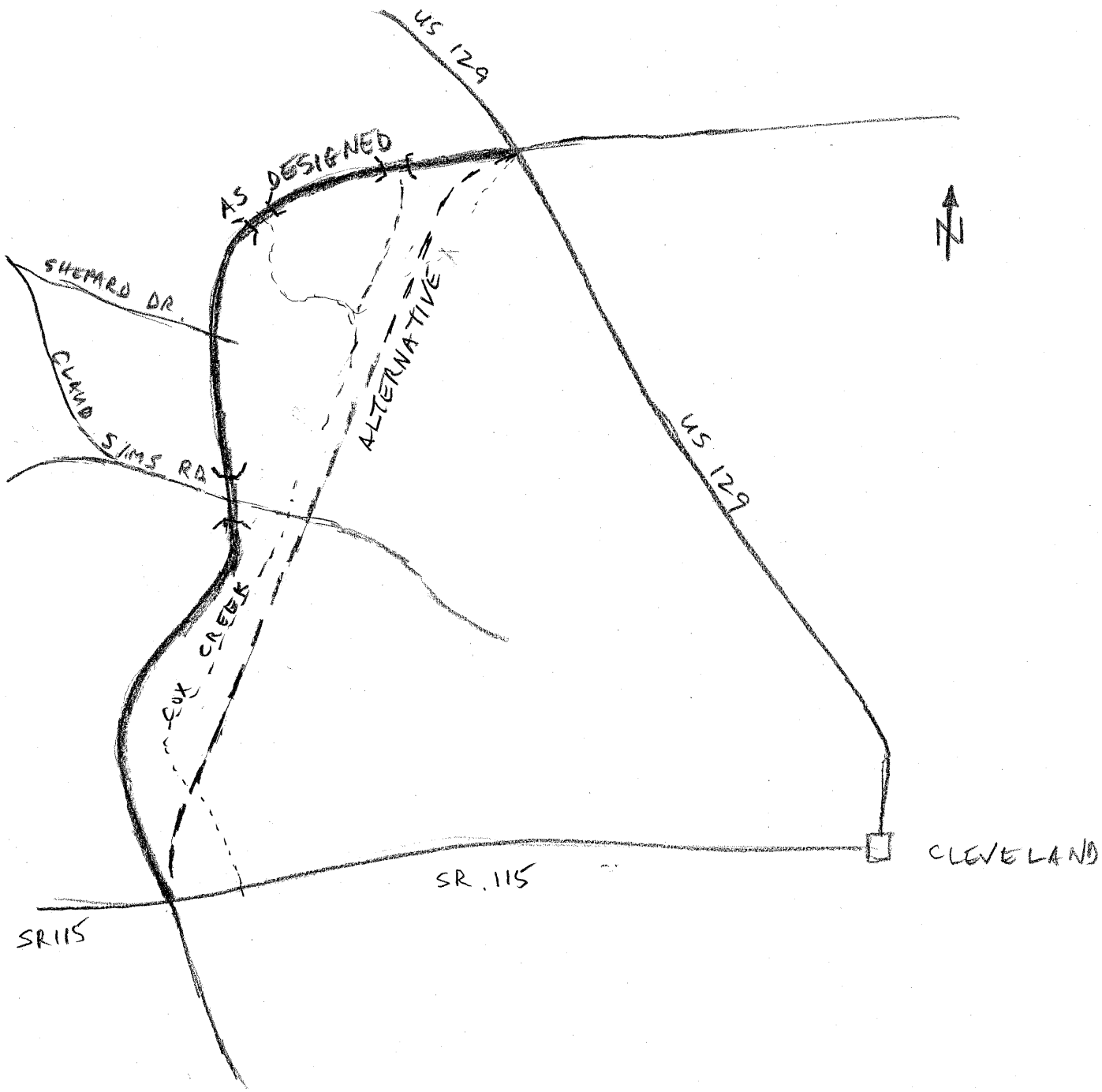
SKETCHES

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 7

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 5

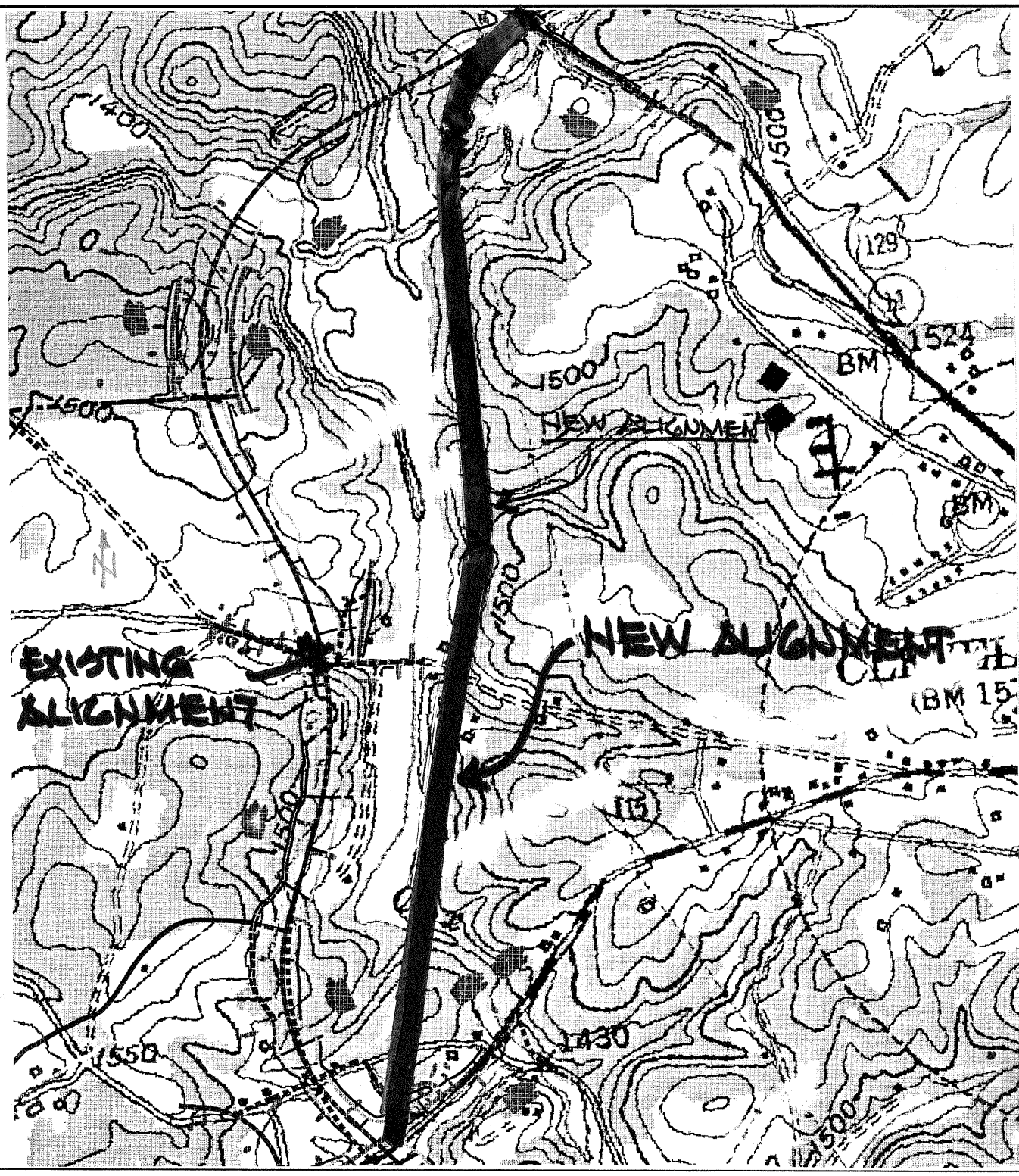


PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 7

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 5



PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 7

DESCRIPTION:

SHEET NO.: 4 of 5

LENGTH OF SEGMENT AS ORIGINALLY DESIGNED

STA. @ US 129 281+88.35
STA @ SR 115 196+47.02
8541.33'

CONSTRUCTION COST = $ 18,751,012 (W/O BRIDGES)
LENGTH = 24,112 FT. (W/O BRIDGES)
PRORATED CONSTR. COST = $778/LFT.

APPROXIMATE LENGTH OF ALTERNATE = 7200'
DIFFERENCE = (8541.33' - 7200') = 1341.33'

ROCK EXCAVATION:
$0.5 \times (80')^2 \times 7200' / 27 = 853,333$ CY.

R.O.W. = $10,343,176 / 160AC = $64,644.85/AC.
ALTERNATE = 1341.33' x 300' / 43,560SF/AC = 9.24 ACRES

COST WORKSHEET

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO: 7

DESCRIPTION

SHEET NO.: 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Construction Items							
Construction	LF	1,341	778.00	1,043,298			
Rock Excavation	CY				853,333	10.00	8,533,330
Bridges - 2 @ 300' x 38'	SF	22,800	78.03	1,779,008			
Bridges - 2 @ 350' x 38'	SF	26,600	63.29	1,638,560			
Subtotal				4,460,866			8,533,330
Markup at 20.00%				892,173			1,706,666
Subtotal Construction				**5,353,039**			**10,239,996**
Right-of-Way Costs							
Land	AC	9.24	49,486	457,251			
Subtotal				457,251			
Markup at 67.14%				306,998			
Subtotal Right-of-Way				**764,249**			
	Sub-total			6,117,288			10,239,996
Mark-up at				Incl			Incl
	TOTAL			6,117,288			10,239,996

VALUE ENGINEERING ALTERNATIVE

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: **17**

DESCRIPTION: **REALIGN BYPASS BETWEEN CLAUD SIMS ROAD AND US 129/SR 115/SR 75 ALT**

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (Sketch attached)

The current alignment between Claud Sims Road and US 129 is a big curve running along the acquired right-of-way between Claud Sims Road and Shepard Drive.

ALTERNATIVE: (Sketch attached)

Realign between the termini and viaduct.

ADVANTAGES:

- Shortens alignment

DISADVANTAGES:

- Lengthens bridge
- Advanced acquisition right-of-way will not be used
- Impacts Cox Creek

DISCUSSION:

The alternative will shorten the distance by approximately 1,000 ft. However, the alignment crosses over the creek and the flood plain so the substructure has to be designed to reduce the impact to the creek, significantly increasing the cost.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 9,645,859	—	$ 9,645,859
ALTERNATIVE	$ 23,597,280	—	$ 23,597,280
SAVINGS	$ (13,951,421)	—	$ (13,951,421)

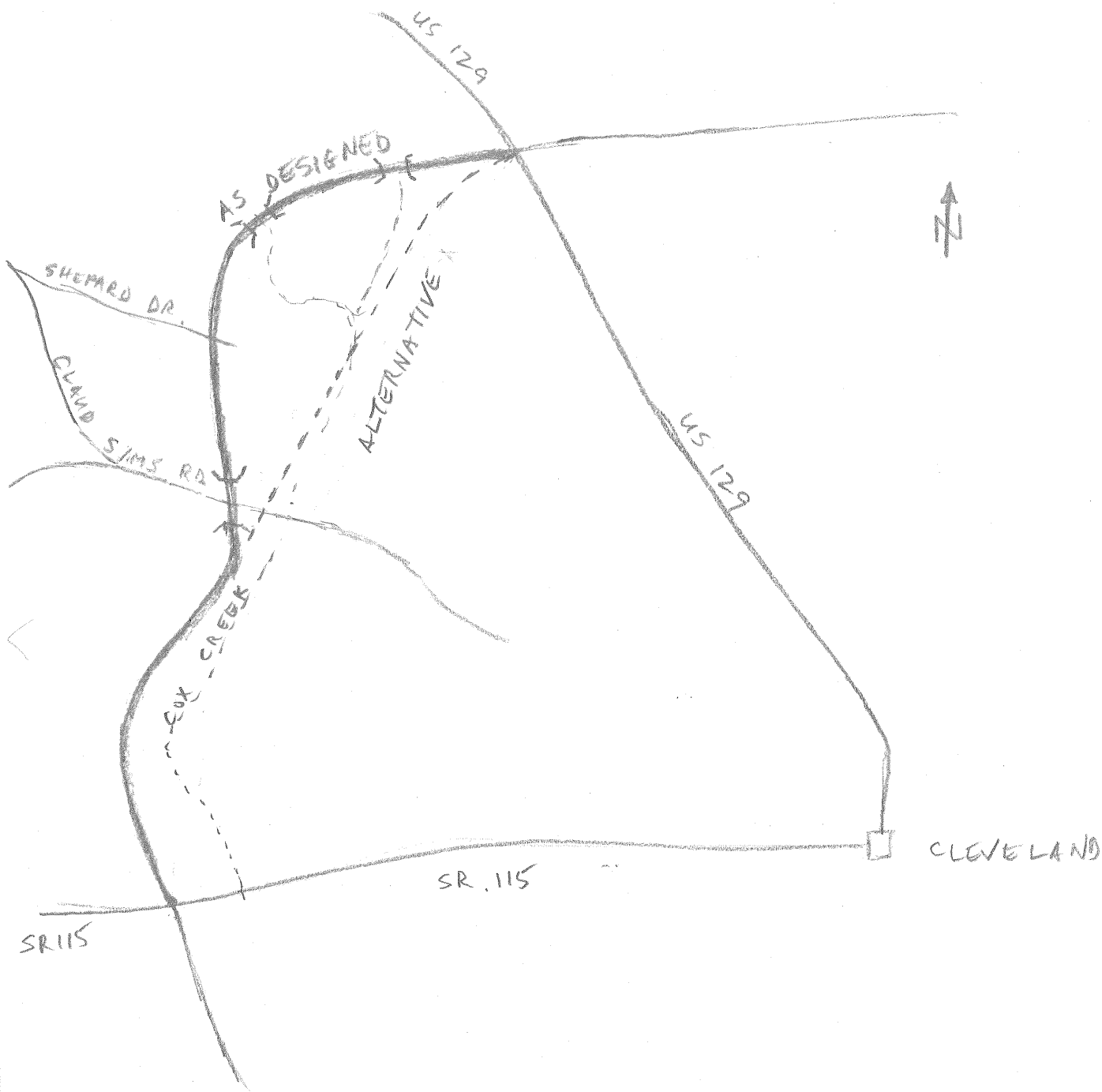
SKETCHES

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 17

☑ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO.: 17

DESCRIPTION:

SHEET NO.: 3 of 4

LENGTH OF SEGMENT AS ORIGINALLY DESIGNED

STA. @ US 129	281+88.35
STA. @ SR 115	229+08.15
	5280.20'

CONSTRUCTION COST = $18,751,012 (W/O BRIDGES)

LENGTH = 24,112 FT. (W/O BRIDGES)

PRORATED CONSTR. COST = $778 / LFT.

APPROXIMATE LENGTH OF ALTERNATE = 4200'

DIFFERENCE = (5280.20' - 4200') = 1080'

R.O.W. = $10,343,176 / 160 AC. = $64,644.85 / AC.

ALTERNATE = 1080' x 300' / 43,560 SF/AC = 7.44 ACRES.

BRIDGE COST = $1,779,008 / 380' = $4,681.60 / LF

COST WORKSHEET

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

ALTERNATIVE NO: 17

DESCRIPTION

SHEET NO.: 4 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Construction Items							
Construction	LF	5,280	778.00	4,107,840			
Viaduct	LF				4,200	4,682	19,664,400
Bridges - 2 @ 300' x 38'	SF	22,800	78.03	1,779,008			
Bridges - 2 @ 350' x 38'	SF	26,600	63.29	1,638,560			
Subtotal				7,525,408			19,664,400
Markup at 20.00%				1,505,082			3,932,880
Subtotal Construction				**9,030,490**			**23,597,280**
Right-of-Way Costs							
Land	AC	7.44	49,486	368,176			
Subtotal				368,176			
Markup at 67.14%				247,193			
Subtotal Right-of-Way				**615,369**			
	Sub-total			9,645,859			23,597,280
Mark-up at				Incl			Incl
	TOTAL			9,645,859			23,597,280

PROJECT DESCRIPTION

NEED AND PURPOSE

The City of Cleveland is a gateway to the tourist destinations located in North Central Georgia. Three state routes (SR) that serve central north Georgia intersect in the City of Cleveland: SR 11, SR 75 and SR 115. These roadways all have two lanes. The common section of SR 11 and SR 75 is also a two-lane roadway traveling north/south through the central business district. Due to growth in the north Georgia area, capacity has been exceeded along these two-lane roadways. SR 11 alone now carries over 20,000 average annual daily traffic (AADT). Due to the historical nature of the area, any improvements would adversely impact the downtown area. There is no feasible and prudent means to increase the capacity of the existing roadways to meet current and future demand.

In order to increase the capacity of the state highway system through the City of Cleveland, the Department has proposed a bypass west of the City. Project traffic volumes for the bypass are 16,000 vehicles per day in the 2022 design year. The distribution of through traffic movements away from the downtown area will reduce the need to increase the capacity of State Routes 11, 75, and 115 in the central business district. The proposed bypass will provide sufficient capacity to handle long-term transportation needs for central north Georgia.

PROJECT LOCATION AND DESCRIPTION

Project NH 002-7(23) in White County is proposed as a west bypass of Cleveland. It begins near the Intersection of SR 11/United State Route (US) 129 with Hope Road south of Cleveland and tie into project STP 007-2(21). It proceeds onto the new location to the west of Cleveland until crossing US 129/SR 11/SR 75 Alternate (ALT).

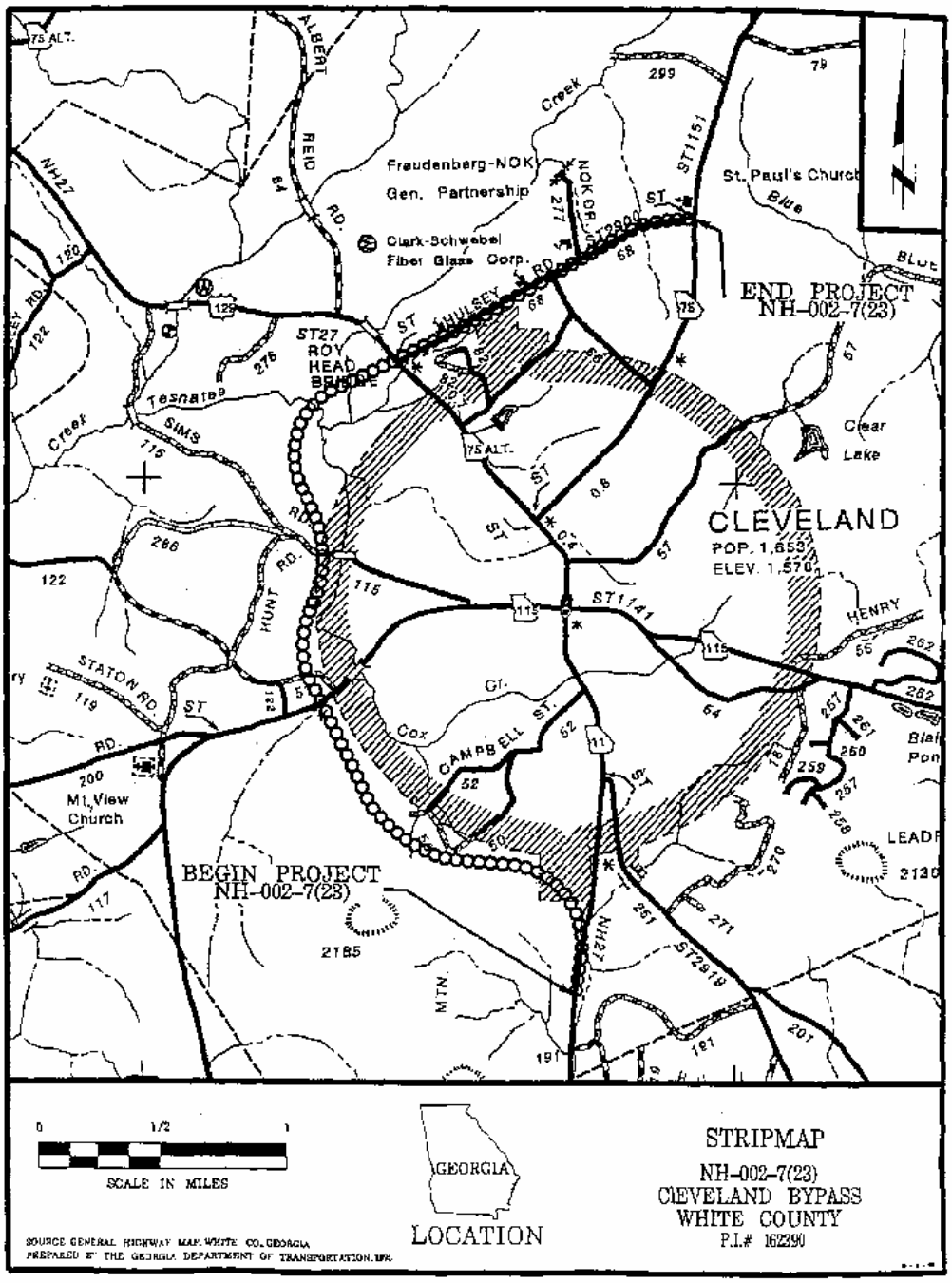
After crossing SR 75 ALT the project continues along County Route (CR) 68/Hulsey Road to SR 75 and end tying into project STP 002-1(7), just north of Cleveland. The roadway is proposed to contain two lanes in each direction with a 44-ft. grassed median or 20-ft. raised median. Along CR 68/Hulsey Road, the roadway is proposed to be widened to four lanes with a 20-ft. raised median. The proposed right-of-way varies from 150 ft. to 600 ft. Traffic volumes are projected to vary from 6,500 to 9,000 average daily traffic (ADT) in the year 2002 and 11,500 to 16,000 ADT in the design year 2022. There are nine residents, four mobile homes, and one business displaced by the project. It crosses 10 U.S. bodies of water. The total length of the project is 4.6 miles.

The alignment begins at SR 11 at Hope Road and proceeds on to the new location, transitioning from a 20-ft. raised median to a 44-ft. grassed median. It continues in a west to northwest direction, crossing SR 115 and CR 51/Hunt Road. There is an at-grade intersection at SR 115. The alignment turns in a northern direction, bridging CR 115/Jess Hunt Road. It then turns in a northwest direction and intersect Shepard Drive at grade. The alignment then turns in a northeast direction and transitions to a 20-ft. raised median 1,500 ft. southwest SR 75 ALT/US 129/SR 11. It bridges Tesnatee Creek with two, 38-ft. x 319-ft. bridges and again with one, 92-ft. x 310-ft. bridge. The alignment continues intersecting SR 75 ALT at grade and follows along CR 68/Hulsey Road widening to the left side. Widening to the left side lessens the impact to the stream paralleling Hulsey Road. It lands into SR 75, just north of Cleveland, where the project ends. Traffic is maintained on the existing network of roads during construction.

COST DATA

The current probable cost of construction is $34,409,454 as noted on the NH-002-7(23) – PI No. 162390 Cost Estimate, White County, as noted in the Preliminary Cost Estimate Prepared by District 1, Georgia Department of Transportation, dated July 2005.

The cost includes Construction Cost at $21,912,878, $4,382,576 for Inflation (at 5.00% per annum for two years (10.00%)), Engineering and Construction (at 10.00%), Right-of-Way Costs of $7,134,000, and Utilities at $1,080,000.



VALUE ANALYSIS AND CONCLUSIONS

GENERAL

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

- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histograms
- 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 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-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
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase *(Not conducted)*

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

Value Engineering Study Task Flow Diagram

Preparation Effort

Coordinate Project
- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Establish Performance and Acceptance Requirements
- Conduct Coordination Meeting
- Identify Project Constraints

→

Prepare for Workshop
- Collect Project Data
- Distribute Data to Team Members
- Team Members Become Familiar with Project
- Visit Project Site

→

Construct Cost, LCC, Energy Models
- Construct Models
- Identify High Cost and Consumption Areas

Workshop Effort

Information Phase
- VETL Opens Workshop
- Designer Gives Project Description/Presentation
- Discuss Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)
- Finalize Cost, LCC, Energy Models

→

Function Identification and Analysis Phase
- Perform Function Analysis
- Calculate Cost/Worth Ratios

List Ideas Generated During Function Analysis

→

Creative Phase
- VETL Introduces Creative Thinking
- Prepare Creative Idea Listing. Seek:
  - Quantity of Ideas
  - Association of Ideas
- Brainstorm
- Do Creative Thinking
  - Group Thinking
  - Individual Thinking

→

Evaluation Phase
- Eliminate Impractical Alternatives
- Rank Ideas with Advantages/Disadvantages
- Evaluate Alternatives (Include Non-Economic considerations: Safety, Reliability, Environment, Aesthetics, O & M, etc.)
- Select Best Ideas for Implementation

→

Development Phase
- Develop Proposed Alternatives
- Prepare Alternative Sketches
- Estimate Costs
- Perform Life Cycle Comparison
  - Initial Cost
  - Redesign Cost
  - O & M Cost
  - LCC Cost

→

Presentation Phase
- Summarize Findings
- Present VE Ideas to Owner/User/Designer
- Prepare VE Report

Post-Workshop Effort

Implementation Phase
- Develop Implementation Plan
- Designer Prepares Responses to VE Report
- Participate in Implementation Meeting with Owner/User/ Designer/VE Team, as needed
- Owner Evaluates and Selects Preferred Alternatives

→

Final Acceptance
- Redesign by Designer

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:

- ***Interdepartmental Correspondence*** from the office of the Chief Engineer regarding Design Guidance for Lane Widths, Raised/Depressed/Flush Medians, and Roadside, dated January 7, 2003;
- ***Chief Engineer's Policy for Establishing Access Control (4A-3)*** noted on Georgia Department of Transportation's Transportation Online Policy & Procedure System (TOPPS), dated December 14, 2004, revised January 27, 2005 and September 23, 2005;
- ***Chief Engineer's Policy for Granting Breaks in Access Control (4A-4)*** noted on Georgia Department of Transportation's Transportation Online Policy & Procedure System (TOPPS), dated December 14, 2004 and revised January 27, 2005;
- ***Geometric Design of Highways and Streets***; prepared by the American Association of State Highway and Transportation Officials, dated 2004;
- ***Half Size Drawings*** *(three bundles)* entitled Department of Transportation, State of Georgia, Plan and Profile of Proposed **Cleveland West Bypass**, Federal Aid Project NH-002-7(23), White County, Federal Route No. 129, State Route No. 963, P.I. No. 162390, prepared by District 1, Department of Transportation, State of Georgia, dated August 8, 2005;
- ***Preliminary Cost Estimate*** for Project No. NH-002-7(23); prepared by District 1, Department of Transportation, State of Georgia, dated July, 2005;
- ***Project Concept Report*** for NH-002-7(23), P.I. No. 162390; prepared by District 1, Department of Transportation, State of Georgia, dated February 2, 2000;
- ***Right of Way Program Estimate*** for Project NH-002-7(23), White County; prepared by the Department of Transportation, State of Georgia, dated August 5, 2005;
- ***General Highway Map, White County, Georgia***; prepared by the Department of Transportation, Division of Planning and programming, Planning Data Services in cooperation with U.S. Department of Transportation, Federal highway Administration, dated 1983; and
- ***Georgia Road Map***; prepared by the Department of Transportation, Official Highway and Transportation Map, Georgia Department of Transportation, dated 2002 – 2003.

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 to 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/or Function Analysis Systems Technique (F.A.S.T.) diagram.

Creative Phase

This VE study 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 free association of ideas.

The Georgia Department of Transportation (GDOT) 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 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 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 section entitled *Study Results*.

Presentation Phase

The last phase of the VE study usually presents the findings of the study. However, GDOT now conducts the presentation internally upon receipt of the report. The VE alternatives were screened by the VE team before draft copies of the *Summary of Potential Cost Savings* worksheets were provided to GDOT representatives. 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 will analyze each alternative and prepare a short response, recommending incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. Lewis & Zimmerman Associates, Inc. is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour Value Engineering (VE) study on the **NH-002-7(23), P.I. No. 162390, Cleveland Bypass** project located in White, County, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) 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 26 – 28, 2005. The study will be conducted in Rooms 344 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, September 26th

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

9:15 am - 11:00 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.

11:00 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, September 27th

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, September 28th

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

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

Dominic F. Saulino	Transportation Engineering,	HNTB
Alex Pascual, PE	Structural/Bridge Engineer	HNTB
Jeffrey Dingle, PE	Construction Specialist	Delon Hampton and Associates
Luis M. Venegas, PE, CVS, LEED™ AP	Value Engineering Facilitator	Lewis & Zimmerman Associates, Inc.

OWNER'S/DESIGNER'S PRESENTATION

Representatives from the State of Georgia Department of Transportation (GDOT) District 1 presented an overview of the project on Monday, September 26, 2005. 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, September 28, 2005, 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: NH–002–7(23), PI No. 162390, CLEVELAND WEST BYPASS White County, Georgia Department of Transportation, District 1 *Design Development*		Date: **September 26 - 28, 2005**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Kim Coley em: kim.coley@dot.state.ga.us	Georgia Department of Transportation (GDOT), District 1 District Environmentalist	ph: 770-532-5582 fx: 770-532-5581
Mike Dover em: mike.dover@dot.state.ga.us	GDOT, District 1 District Construction Engineer	ph: 770-718-5508 fx: 770-532-5581
Jeffrey Nix em: jeffrey.nix@dot.state.ga.us	GDOT, District 1 Design Squad Leader	ph: 770-718-5012 fx: 770-532-5542
Jonathan Cox em: jonathan.cox@dot.state.ga.us	GDOT, Office of Environmental Location (OEL) National Environmental Protection Act (NEPA) Section Chief	ph: 404-699-3475 fx: 404-699-4480
Randall (Randy) Hart, PE em: randall.hart@dot.state.ga.us	GDOT, Construction Constriction Liaison	ph: 404-656-5306 fx: 404-657-0783
Jennifer Mathis em: jennifer.mathis@dot.state.ga.us	GDOT, OEL Transportation Environmental Planner Associate	ph: 404-699-6882 fx: 404-699-4440
Jerry Milligan em: jerry.milligan@dot.state.ga.us	GDOT, Right-Of-Way Office Right-of-Way	ph: 770-986-1541 fx: 770-896-1558
Lisa L. Myers em: lisa.myers@dot.state.ga.us	GDOT, General Office Design Review Engineer Manager	ph: 404-651-7468 fx: 404-463-6131
Vince Wilson em: vince.wilson@dot.state.ga.us	GDOT, General Office, Bridge Design Assistant Group Leader	ph: 404-656-532 fx: 404-651-7076
Jeffery G. Dingle, PE em: jdingle@delonhampton.com	Delon Hampton & Associates, Chartered Vice President, Southern Regional Office	ph: 404-524-8030 fx: 404-524-2575
Alex Pascual, PE em: apascual@hntb.com	HNTB Structural Engineering/Bridge Engineer	ph: 404-946-5700 fx: 404-841-2820

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT: **NH–002–7(23), PI No. 162390, CLEVELAND WEST BYPASS** **White County, Georgia Department of Transportation, District 1** ***Design Development***		Date: **September 26 - 28, 2005**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Dominic (Dom) F. Saulino em: dsaulino@hntb.com	HNTB Director of Transportation	ph: 404-946-5700 fx: 404-841-2820
Luis M. Venegas, PE, CVS-Life, LEED™ AP em: lvenegas@lza.com	Lewis & Zimmerman Associates, Inc. VE Facilitator	ph: 770-992-3032 fx: 770-435-2666
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ECONOMIC DATA

The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation. 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:	2005
Construction Start-Up:	2008
Construction Duration:	±24 Months (2010)
Economic Planning Life:	35 years for Pavement
Economic Planning Life:	50 years for Bridges
Discount Rate/Interest:	2.10% (Latest United States Office of Management and Budget Circular A-94)
Inflation/Escalation Rate:	5.00% (Per GDOT, District 1)
Uniform Present Worth (UPW) Factor:	24.6110 for 35 years 30.7732 for 50 years
Cost of Power:	$0.07/kWHr (kilowatt hour) (assumed)
Operation and Maintenance Costs *(Industry Norms)*:	
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
Composite Mark-Up: *(Composed of: Inflation [based on 5.00% per annum for two years] at 10.00%; and Engineering and Construction at 10.00 %.)*	20.00% (1.2000)

COST ESTIMATE SUMMARY AND COST HISTOGRAMS

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 *NH-002-7(23) Preliminary Cost Estimate* prepared by the Georgia Department of Transportation, the designing agency. 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 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:

- Grading and Drainage
  - Unclassified Excavation
  - Minor Drainage
  - Rock Excavation

- Base and Paving
  - Aggregate Base
  - Base – Superpave
  - Binder – Superpave

- Major Structures
  - Bridges

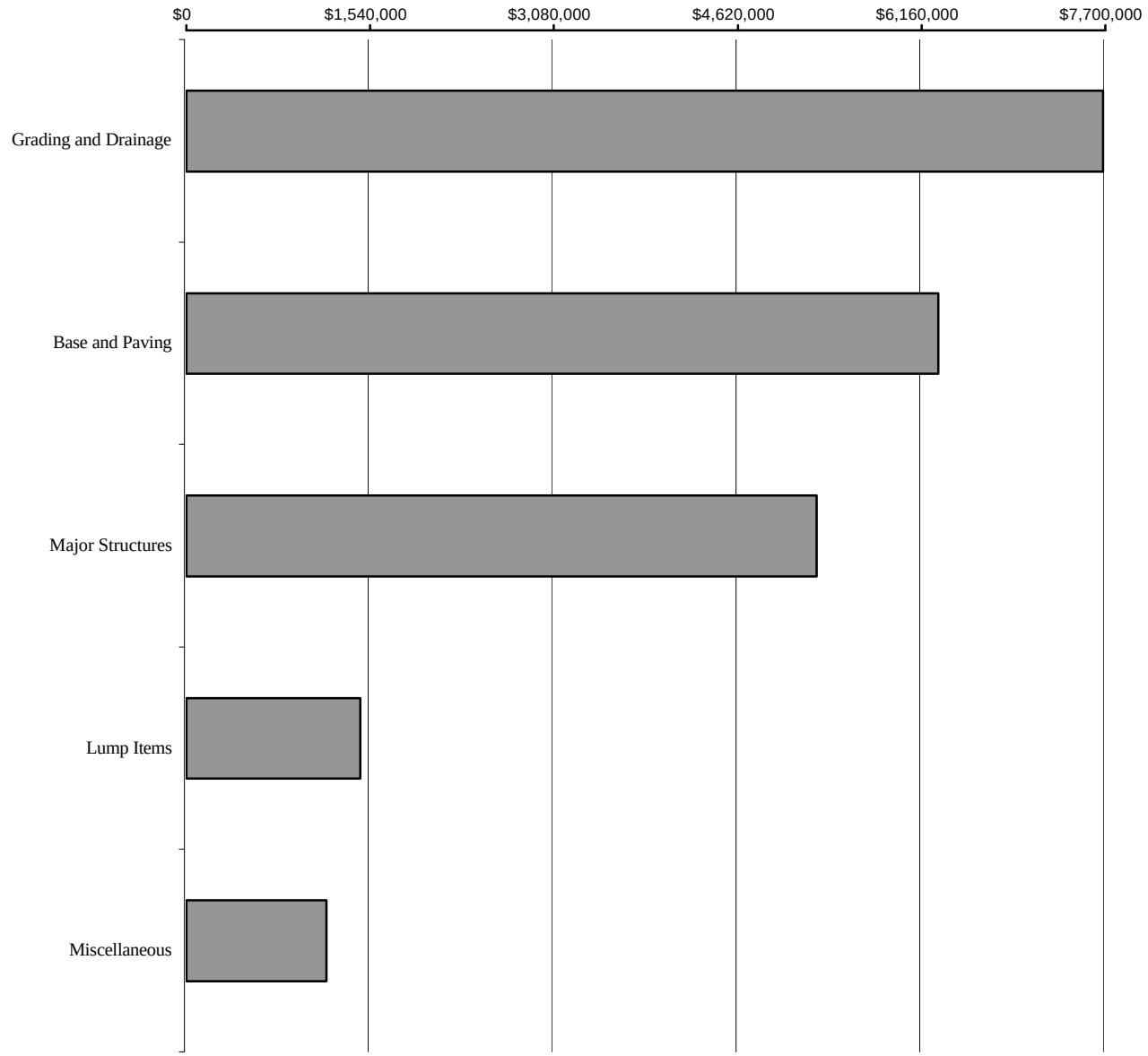
DESIGNER'S COST ESTIMATE

The cost estimate, as described above, did contain sufficiently detailed information to perform a VE evaluation. However, the cost associated with Base and Paving contained a double account for Aggregate Base at $2,122,183, resulting in a subtotal of $8,427,083 that should have been $6,304,900.

COST HISTOGRAM

Project: NH-002-7(23), PI No. 162390, CLEVELAND BYPASS
White County, Georgia
Design Development

TOTAL PROJECT	COST	PERCENT	CUM. PERCENT
Grading and Drainage	7,685,189	35.07%	35.07%
Base and Paving	6,304,901	28.77%	63.84%
Major Structures	5,284,048	24.11%	87.96%
Lump Items	1,461,700	6.67%	94.63%
Miscellaneous	1,177,040	5.37%	100.00%
Construction Subtotal	**$ 21,912,878**	**100.00%**	
Inflation - Based on 5.00% per annum for 2 years@ 10.00%	$ 2,191,288		
Engineering and Construction @ 10.00%	$ 2,191,288		
Construction Total	**$ 26,295,454**		
Right-Of-Way	$ 7,134,000		
Utilities	$ 1,080,000		
GRAND TOTAL	**$ 34,509,454**	Comp Mark-Up:	57.48%

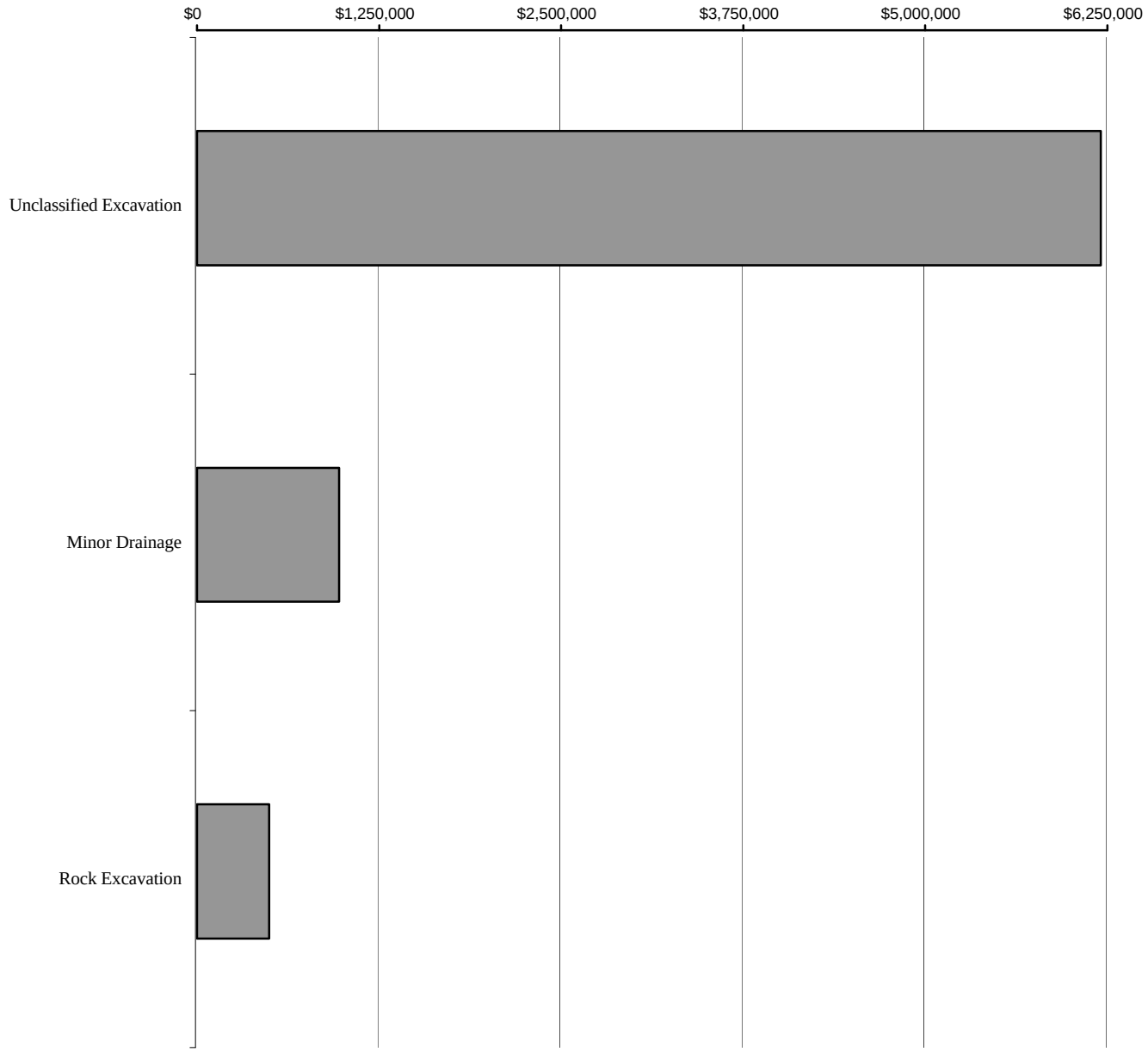


Costs in graph are not marked-up.

COST HISTOGRAM

Project: NH-002-7(23), PI No. 162390, CLEVELAND BYPASS
White County, Georgia
Design Development

GRADING AND DRAINAGE	COST	PERCENT	CUM. PERCENT
Unclassified Excavation	6,207,728	80.78%	80.78%
Minor Drainage	977,461	12.72%	93.49%
Rock Excavation	500,000	6.51%	100.00%
Construction Subtotal	**$ 7,685,189**	**100.00%**	
Inflation - Based on 5.00% per annum for 2 years@ 10.00%	$ 768,519		
Engineering and Construction @ 10.00%	$ 768,519		
GRAND TOTAL	**$ 9,222,227**	Comp Mark-Up:	20.00%

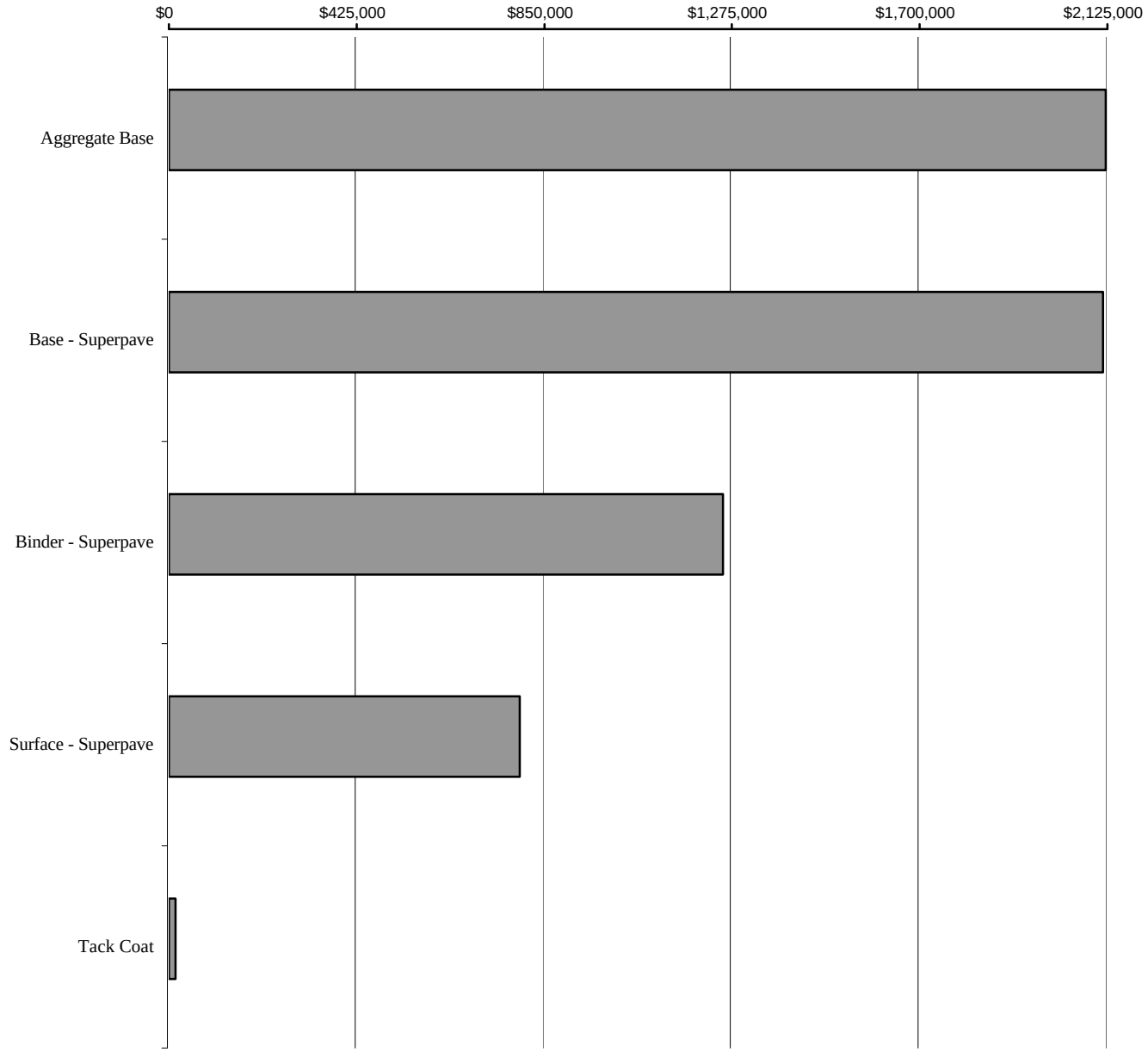


Costs in graph are not marked-up.

COST HISTOGRAM

Project: NH-002-7(23), PI No. 162390, CLEVELAND BYPASS
White County, Georgia
Design Development

BASE AND PAVING	COST	PERCENT	CUM. PERCENT
Aggregate Base	2,122,183	33.66%	33.66%
Base - Superpave	2,115,843	33.56%	67.22%
Binder - Superpave	1,255,554	19.91%	87.13%
Surface - Superpave	795,452	12.62%	99.75%
Tack Coat	15,869	0.25%	100.00%
Construction Subtotal	**$ 6,304,901**	**100.00%**	
Inflation - Based on 5.00% per annum for 2 years@ 10.00%	$ 630,490		
Engineering and Construction @ 10.00%	$ 630,490		
GRAND TOTAL	**$ 7,565,881**	Comp Mark-Up:	20.00%

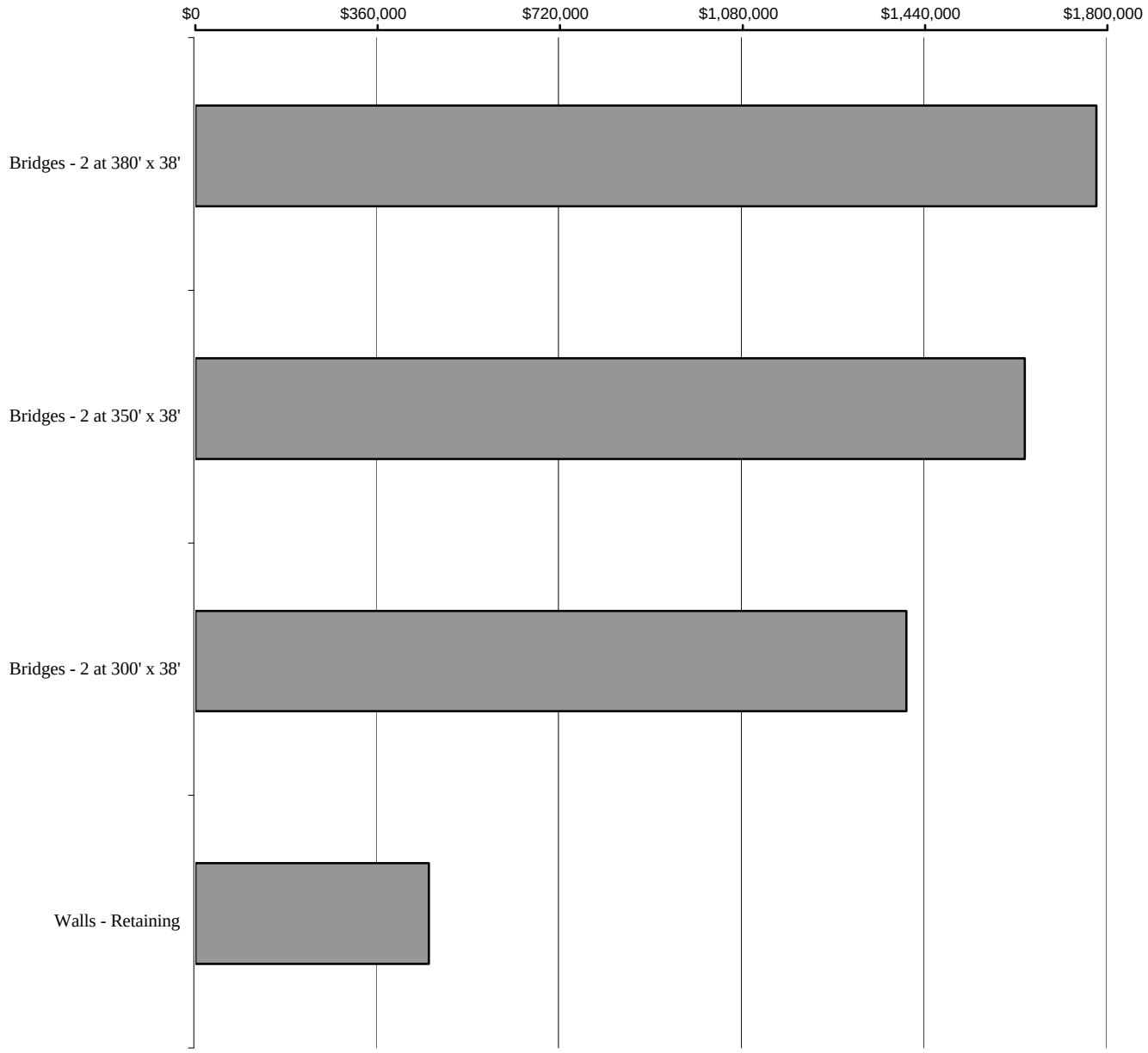


Costs in graph are not marked-up.

COST HISTOGRAM

Project: NH-002-7(23), PI No. 162390, CLEVELAND BYPASS
White County, Georgia
Design Development

MAJOR STRUCTURES	COST	PERCENT	CUM. PERCENT
Bridges - 2 at 380' x 38'	1,779,008	33.67%	33.67%
Bridges - 2 at 350' x 38'	1,638,560	31.01%	64.68%
Bridges - 2 at 300' x 38'	1,404,480	26.58%	91.26%
Walls - Retaining	462,000	8.74%	100.00%
Construction Subtotal	**$ 5,284,048**	**100.00%**	
Inflation - Based on 5.00% per annum for 2 years@ 10.00%	$ 528,405		
Engineering and Construction @ 10.00%	$ 528,405		
GRAND TOTAL	**$ 6,340,858**	Comp Mark-Up:	20.00%



Costs in graph are not marked-up.

FUNCTION ANALYSIS

A function analysis was performed to: (1) define the requirements for each project element and (2) 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 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.

In addition to the random function analysis, the VE Facilitator 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. It helps to confirm the project is addressing those issues that have been voiced by the owner as important. The diagrams are 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 continues 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 project's basic function is: Relieve/Congestion by Adding/Capacity and Bypassing/Cleveland and thereby improving/safety, saving/travel time, and reducing/city truck traffic. The F.A.S.T. diagram is included at the end of this section of the report.

RANDOM FUNCTION ANALYSIS

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

SHEET NO.: 1 of 1

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
CLEVELAND BYPASS	**Relieve**	**Congestion (Downtown Cleveland)**	**B**
	Reduce	**Travel Time**	**B**
	Improve	**Safety**	**B**
	Promote	Development	HO
	Satisfy	Locals	HO
	Preserve	History	S
	Minimize	Right-of-Way Takes	G/O
	Maintain	55 Miles per Hour	O
	Maintain	Access (Local Businesses)	RS
	Limit	Access	RS
	Minimize	Earthwork	G
	Avoid	Environmental Justice (EJ)	S
	Bypass	**Cleveland**	**B**

Function defined as: Action Verb, Measurable Noun

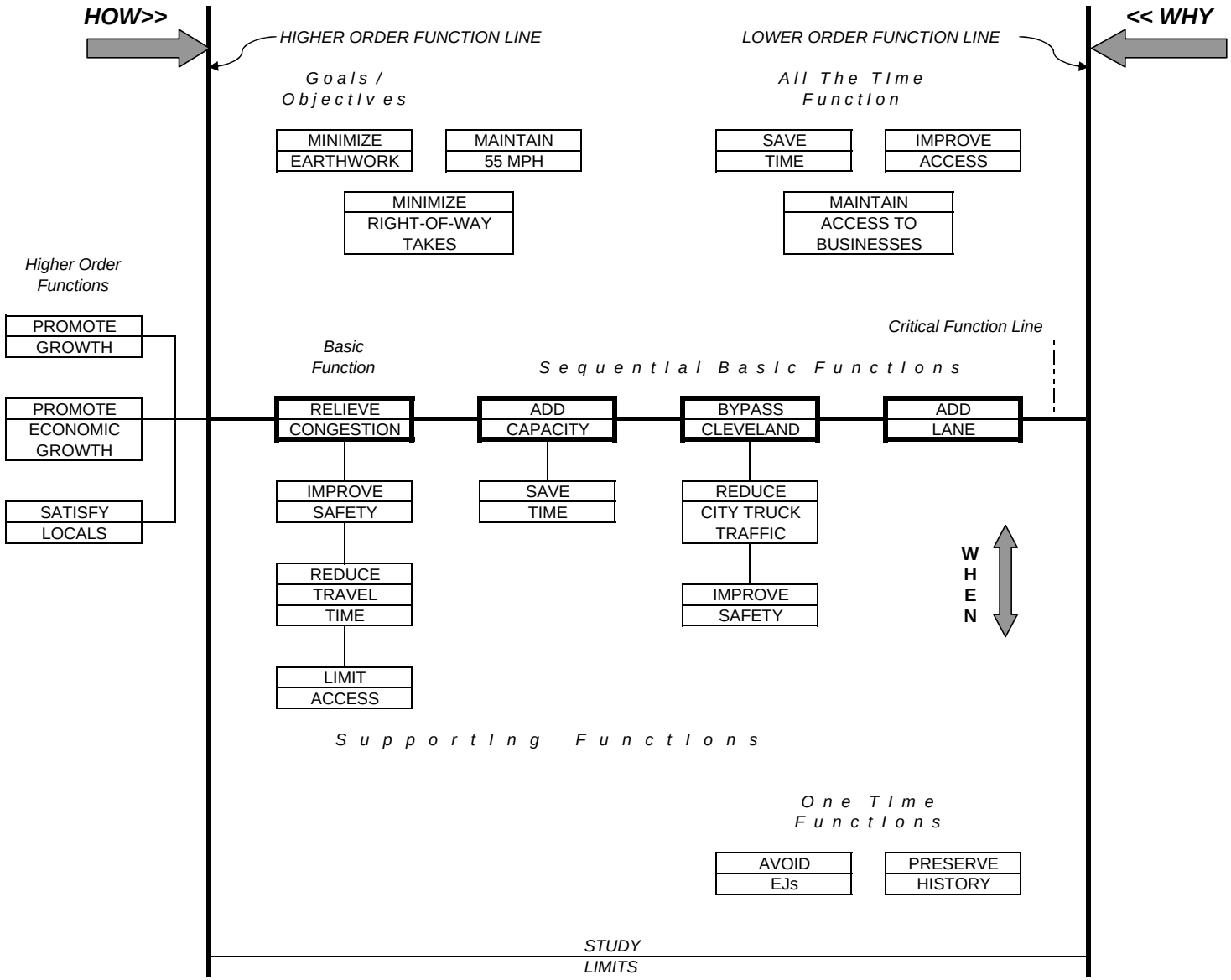
Kind: B = Basic; S = Secondary; RS = Required Secondary; HO = Higher Order; LO = Lower Order; O = Objective; G = Goal; U = Unwanted

FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F. A. S. T.)

CLEVELAND BYPASS, NH-002-7(23), PI No. 162390

Georgia Department of Transportation, District 1

White County, Cleveland , Georgia



CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

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

These ideas were then discussed and the advantages/disadvantages of each listed. The VE design 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 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 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 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. 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.

The reader is encouraged to review the *Creative Idea Listing and Evaluation* worksheets since they may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING

PROJECT: **NH-002-7(23), PI No. 162390, CLEVELAND WEST BYPASS**
White County, Georgia Department of Transportation, District 1
Design Development

SHEET NO.: 1 of 1

NO.	IDEA DESCIRPTION	RATING
1	Five-lane the new bypass	4
2	Use a four-lane section and maintain 55 miles per hour (mph)	4
3	Use a divided four-lane section throughout	2
4	Use a one-way pair	1
5	Eliminate southbound access to US 129 from the bypass	4
6	Realign the bypass between Environmental Justice (EJ) communities and SR 115	3
7	Realign bypass between CR 115 (Jess Hunt Road/Claud Sims Road) to the US 129/SR 11/SR 75 Alt intersection (Combine with No. 17)	4
8	Appeal south portion of historic property west of the bypass (where convergence of Jess Hunt Road/Claud Sims Road/Virginia Hunt Road occurs) to eliminate bridge over CR 115 (Jess Hunt Road)	1
9	Connect the two bridges over the creeks	1
10	Tunnel/bore through south end of bypass mountain/hill	1
11	Do nothing	1
12	Eliminate southwest portion of bypass by diverting US 129 to SR 115 south of Cleveland	1
13	Use a four-lane section without median and reduce to 45 mph	4
14	Bypass on east side of Cleveland and keep current alignment for SR 75 to SR 115	1
15	Realign bypass east of EJ community in lieu of west side	2
16	Grade separate up to the US 129/SR 11/SR 75 Alt intersection	1
17	Viaduct/bridge between US 129/SR 11/SR 75 Alt intersection and CR 115 (Jess Hunt Road/Claud Sims Road) (Combine with No. 7)	4
18	Lower profile	3
19	Increase allowable slope	3
20	In lieu of bridges over streams, use box culverts	1
21	Continue SR 75 to SR 115 at northwest corner of Cleveland	1
22	Use a two-lane section bypass	1
23	Viaduct through downtown	1
24	Use a one-way pair with viaduct downtown northbound	1

Function defined as: Action Verb / Measurable Noun

Kind: B = Basic; S = Secondary; RS = Required Secondary; HO = Higher Order; LO = Lower Order; O = Objective; G = Goal; U = Unwanted