Georgia Department of Transportation

Widening of SR 135
From SR 31/US 441 East to SR 32,
Coffee County, GA

Project Number STP00-0079-01(042)
P.I. No. 431830

Value Engineering Study Report

July 2009

Designer

Columbia Engineering

Value Engineering Consultant

Lewis & Zimmerman Associates

an ARCADIS company

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Ms. Lisa L. Myers
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GA DOT - Engineering Services
One Georgia Center – 5th Floor
Atlanta, Georgia 30308

Re: Project No.STP00-0079-01(042), P.I. No.: 431830
Widening of SR 135 from SR 31/US 441 East to SR 32
Value Engineering Study Report

Date:
July 31, 2009

Contact:
Stephen Havens

Phone:
608-438-8227

Email:
shavens@lza.com

Our ref:
LZ083347.0000

Dear Ms. Myers:

Lewis & Zimmerman Associates is pleased to submit two hard copies and one electronic copy of the referenced value engineering (VE) study report documenting the study that took place July 20 - 23, 2009. The objective of the VE effort was to identify opportunities to reduce costs and enhance the value of the project.

The VE team developed 21 ideas that will yield significant project cost savings. Of particular interest are alternatives to reduce the median width, reduce lane widths, use striping to mark islands, reduce sidewalk, and use HDPE piping for longitudinal storm drain piping. The team also suggested several alternatives to reduce or eliminate the 55 degree skew between Old Bell Lake Road and SR 135 and reduce impacts to wetlands.

We would like to thank Ms. Helen Hawkins from Columbia Engineering for her assistance during the course of the VE team's work. Please do not hesitate to call upon us if you or any reviewers have questions regarding the information presented in this report.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES
an ARCADIS company

Stephen G. Havens

Stephen G. Havens, PE, CVS
Senior Project Manager

Attachment

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EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report documents the events and results of the VE study conducted by Lewis & Zimmerman Associates (LZA) for the Georgia Department of Transportation (GDOT). The subject of the study is Project STP00-0079-01(042), P.I. No. 431830, Widening of SR 135 from SR 31/US 441 East to SR 32, in Coffee County, Georgia. The project is being planned for GDOT District 4 by the design team led by Columbia Engineering.

The VE workshop was conducted July 20 - 23, 2009 at GDOT's Atlanta Headquarters, One Georgia Center and followed the six-phase VE Job Plan:

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

PROJECT DESCRIPTION

The entire project is located within the City of Douglas, GA. The project begins at Mile Post 8.10+/-, at SR 31/US 441/US 221/Peterson Avenue, where the existing SR 135 rural 5-lane section ends. It extends approximately 2.72 miles to Mile Post 10.82+/- at SR 32/US 221/Westgreen Rd.

The approved concept includes widening of SR 135 from a two-lane and three-lane section to a four-lane divided highway and a five-lane section with a flush median. The first typical section is an urban four-lane section with a 20-ft-wide raised median, 16-ft shoulders, curb and gutter, and 5 ft sidewalks beginning just west of the intersection with SR 31/US 441/US 221/Peterson Avenue and extending to the intersection with McDonald/Old Axson Road. The second typical section includes an urban five-lane section with a 14-ft-wide flush median, 16-ft shoulders, curb and gutter, and 5 ft sidewalks with provisions for a future 20-ft-wide raised median. The second section extends from McDonald/Old Axson Road to the intersection with SR 158/East Baker Highway, and then moves onto a new location to the east of the existing roadway with a new 300 ft by 94.5 ft +/- bridge over the CSX Railroad. The second section continues along the new location and ties back into SR 135 just before the intersection with SR 32/Ward Street. It ends at the intersection with SR 32/Westgreen Road.

The following roadway improvements are also included as part of the approved concept:

- Old Bell Lake Road is being realigned with SR 135 to eliminate a 55 degree skewed intersection.

- A new frontage road is being added just to the east of the new bridge to provide access to existing property owners including a large veterinarian facility located just north of the railroad tracks.
- Curb and gutter and sidewalks are being added to SR 31/US 441/US 221/Peterson Avenue.
- Curb and gutter is being added to McDonald/Old Axson Road, and SR 158/East Baker Highway to improve drainage.
- Raised islands are being added at several intersections to improve traffic flow and enhance pedestrian safety.

The following box culverts are included as part of the approved concept:

- Two double 6 ft by 6 ft box culverts between Sta. 120+50 and Sta. 124+00 for creek realignment.
- A new quadruple 10 ft by 7 ft bridge box culvert along realigned Old Bell Lake Road East.
- Extensions to existing double box culverts at Sta. 161+00, Sta. 162+00, and Sta. 192+35.

The estimated total cost of construction is $22,364,706, including right-of-way. The estimated right-of-way cost is $6,521,150 and the estimated non-reimbursable utilities cost is $5,873,608, as of the start of the VE workshop.

CONCERNS AND OBJECTIVES

Concerns

- A new frontage road is being added just to the west of the new bridge to provide access to existing property owners including a large veterinarian facility located just north of the railroad tracks. Access for existing businesses must be maintained.
- The CSX Railroad averages 23 trains per day on the track through the City of Douglas. A second track is being considered and must be included in the new bridge design. New bridge design and construction must be carefully coordinated with the CSX Railroad.
- The City of Douglas is very interested in the creek realignment between Sta. 120+50 and Sta. 124+00. Two double 6 ft by 6 ft box culverts are included in the current creek realignment plan.
- The new bridge design includes provisions to widen the median from 14-ft-wide to 20-ft-wide in the future since the design year (2033) average daily traffic is expected to reach 24,950 vehicles per day (VPD). New bridge median width options must be carefully considered since the design year traffic is just over the minimum traffic demand (24,000 VPD) which would create the need for a future 20-ft-wide median.
- Old Bell Lake Road West and Old Bell Lake Road East require realignment to eliminate a 55 degree skew with SR 135/Perimeter Road. Wetlands located near Old Bell Lake Road East will require careful coordination to minimize disturbance.

Objectives

The VE team was tasked with the following objectives:

- Recommend cost reduction ideas
- Recommend ideas to add value by improving roadway design

To meet these objectives, the VE team focused on the key functions associated with the project, paying particular attention to roadway design including typical sections, median requirements, shoulder requirements, Old Bell Lake Road realignment, culvert requirements, sidewalk requirements, and drainage requirements.

RESULTS

This VE report is a formalization of the draft materials provided to the project team during the out-briefing discussion which occurred on July 23, 2009. Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 19 VE alternatives and two design suggestions for consideration by the project team. The Summary of Potential Cost Savings worksheets following this narrative contain all of the alternatives and the design suggestion 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 in Section Four.

If the following list of recommended VE alternatives is accepted for implementation, a total cost savings of approximately $4.3 million could be realized.

- Save six feet of section width by not providing for the future 20-ft-wide median from Sta. 158+25 to Sta. 245+51 to save $1,124,000 (Alt. No. T-1).
- Plan for an 18-ft-wide median in lieu of a 20-ft-wide median the entire length of SR 135 within the project limits to save two feet of section width and save $319,000 (Alt. No. T-2).
- Use 11-ft-wide through lanes in lieu of 12-ft-wide through lanes on SR 135 to save $565,000 (Alt. No. T-4).
- Use 12-ft-wide shoulders in lieu of 16-ft-wide shoulders throughout the project to save $1,267,000 (Alt. No. T-6).
- Use HDPE pipe in lieu of rigid concrete pipe for longitudinal storm drain piping to save $116,000 (Alt. No. D-1).
- Use 24-in-wide curb and gutter in lieu of 30-in-wide curb and gutter to save $68,000 (Alt. No. CG-1).
- Eliminate curb and gutter, sidewalk, and associated drainage from Baker Highway to save $48,000 (Alt. No. CG-3).
- Eliminate sidewalks from the east side of SR 135 between Gaskin Avenue (Sta. 123+25) and the end of the project (Sta. 245+50) to save $218,000 (Alt. No. S-1).
- Use striping to mark all islands at intersections in lieu of providing raised concrete islands to save $112,000 (Alt. No. G-1).
- Tie in Old Bell Lake Road East and West at the existing intersection in lieu of providing the proposed new alignment to eliminate the need for a new quadruple barrel box culvert to save $673,000 (Alt. No. G-7).

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**

Coffee County, Georgia

ALT. NO.	DESCRIPTION	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
	TYPICAL SECTIONS (T)					
T-1	Save six feet of section width by not providing for the future 20-ft-wide median from Sta. 158+25 to Sta. 245+51.	$1,124,000	$0	$1,124,000		$1,124,000
T-2	Plan for an 18-ft-wide median in lieu of a 20-ft-wide median the entire length of SR 135 within the project limits to save 2 feet of section width.	$319,679	$0	$319,679		$319,679
T-3	Use a rural section in lieu of an urban section from Sta. 158+25 to Sta. 237+00.	$969,236	$444,739	$524,497		$524,497
T-4	Use 11-ft-wide through lanes in lieu of 12-ft-wide through lanes on SR 135.	$613,592	$0	$613,592		$613,592
T-5	Use 11-ft-wide inside through lanes in lieu of 12-ft-wide inside through lanes on SR 135.	$306,800	$0	$306,800		$306,800
T-6	Use 12-ft-wide shoulders in lieu of 16-ft-wide shoulders throughout the project.	$1,267,049	$0	$1,267,049		$1,267,049

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

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	BRIDGE (B)					
B-1	Save 12 ft of bridge width by providing an 8-ft-wide median on the new bridge in lieu of providing for a future 20-ft-wide median.	$411,539	$0	$411,539		$411,539
B-2	Save 6 ft of bridge width by providing a 14-ft-wide median on the new bridge in lieu of providing for a future 20-ft-wide median.	$193,619	$0	$193,619		$193,619
B-3	Coordinate a construction window with CSX Railroad for girder placement during new bridge construction.	DESIGN SUGGESTION				
B-4	Construct a bridge for realigned Old Bell Lake Road East in lieu of providing a quadruple 10-ft by 7-ft bridge box culvert.	$318,440	$331,200	($12,760)		($12,760)

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

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	DRAINAGE (D)					
D-1	Use HDPE pipe in lieu of rigid concrete pipe for longitudinal storm drain piping.	$685,222	$568,467	$116,755		$116,755
	CURB AND GUTTER (CG)					
CG-1	Use 24-in-wide curb and gutter in lieu of 30-in-wide curb and gutter.	$684,810	$616,440	$68,370		$68,370
CG-2	Eliminate curb and gutter from McDonald Road and Old Axson Road.	$9,384	$0	$9,384		$9,384
CG-3	Eliminate curb and gutter, sidewalk, and associated drainage from Baker Highway.	$48,448	$0	$48,448		$48,448
	SIDEWALKS (S)					
S-1	Eliminate sidewalks from the east side of SR 135 between Gaskin Avenue (Sta. 123+25) and the end of the project (Sta. 245+50).	$218,159	$0	$218,159		$218,159
S-2	Reduce the shoulder width from 16-ft-wide to 12-ft-wide and eliminate sidewalk on the east side of SR 135 from Gaskin Avenue (Sta. 123+50) to the end of the project (Sta. 145+50).	$779,667	$0	$779,667		$779,667

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**

Coffee County, Georgia

ALT. NO.	DESCRIPTION	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
	GENERAL (G)					
G-1	Use striping to mark all islands at intersections in lieu of providing raised concrete islands.	$118,029	$5,939	$112,090		$112,090
G-2	Cul-de-sac Old Bell Lake Road West and provide Parcel #40 a driveway access at Sta. 169+90.	$273,197	$55,666	$217,531		$217,531
G-3	Make W. Forest Drive a right-in/right-out with a traffic island to improve traffic flow.	DESIGN SUGGESTION				
G-6	Realign Old Bell Lake Road East to eliminate the need for a bridge box culvert.	$591,870	$103,390	$488,480		$488,480
G-7	Tie in Old Bell Lake Road East and West at the existing intersection in lieu of providing the proposed new alignment.	$750,652	$77,307	$673,345		$673,345

STUDY RESULTS

INTRODUCTION

The results of this value engineering study portray the benefits that can be realized by GDOT, Columbia Engineering, and the highway users. The results will directly affect the project's design and require coordination between the project team members from GDOT and Columbia Engineering to determine the disposition of each alternative.

During the course of the study, many ideas for potential value enhancement were conceived and evaluated by the team for technical feasibility, applicability to the project, 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 comprise the project. These may be in the form of VE alternatives (accompanied by cost estimates) or design suggestions (without cost estimates). For each alternative developed the following information has been 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, if 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 for each alternative use unit quantities from the Estimate Report for file "431830-prelim-20090508", prepared by District 4, State of Georgia Department of Transportation, dated 5/9/2009. If unit quantities were not available, GDOT databases were consulted.

Each design suggestion contains the same information as the VE alternatives, except that no cost information is included. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons may include improve circulation, reduce maintenance, improve constructability, improve safety, and reduce project risk. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.

Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) that can be tracked through the value analysis process and facilitate referencing between the Creative

Idea Listing and Evaluation worksheets, the alternatives, and the Summary of Potential Cost Savings table. The Alt. No. includes a prefix that refers to one of the major project elements:

PROJECT ELEMENT	PREFIX
Typical Sections	T
Bridge	B
Drainage	D
Curb and Gutter	CG
Sidewalk	S
General	G

Summaries of the alternatives are provided on the Summary of Potential Cost Savings table. The table is divided into project elements for the reviewer's convenience and is used to divide the results section. The complete documentation of the developed alternatives and design suggestions follows the Summary of Potential Cost Savings tables.

KEY ISSUES

The project team summarized the following key design issues during the design overview on July 20, 2009:

- Truck traffic along SR 135/Perimeter Road averages approximately 18% of all traffic.
- A new frontage road is being added just to the west of the new bridge to provide access to existing property owners including a large veterinarian facility located just north of the railroad tracks. Access for existing businesses must be maintained.
- The CSX Railroad averages 23 trains per day on the track through the City of Douglas. A second track is being considered and must be included in the new bridge design.
- The City of Douglas is very interested in realignment of the creek between Sta. 120+50 and Sta. 124+00. Two double 6 ft by 6 ft box culverts are included in the current plan for the creek realignment.
- The new bridge design includes a provision to widen the median from 14-ft-wide to 20-ft-wide in the future since the design year (2033) average daily vehicle count is expected to reach 24,950 VPD.
- Old Bell Lake Road West and Old Bell Lake Road East require realignment to eliminate a 55 degree skew with SR 135/Perimeter Road. The current plan includes a button hook curve on Old Bell Lake Road West and a quadruple 10 ft by 7 ft bridge box culvert on Old Bell Lake Road East. Access for a future BBQ restaurant to be built along Old Bell Lake Road West must be provided. Wetlands located near Old Bell Lake Road East will require careful coordination to minimize disturbance.

STUDY OBJECTIVES

The VE team was tasked with the following key objectives:

- Recommend cost reduction ideas
- Recommend ideas to add value by improving roadway design

To meet these objectives, the VE team focused on the key functions associated with the project, paying particular attention to roadway design, including typical sections, median requirements, shoulder requirements, Old Bell Lake Road realignment, culvert requirements, sidewalk requirements, and drainage requirements.

RESULTS OF THE STUDY

Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 19 VE alternatives and two design suggestions for consideration by the project team. Several of the design suggestions have cost savings potential which should be easy to quantify as the project development effort progresses. The greatest opportunity for cost reduction and added value centered on median widths, lane widths, shoulder design, curb and gutter width, and the realignment of Old Bell Lake Road.

Each of the alternatives should be given careful consideration for the potential cost savings and/or value improvement that they offer compared to the tradeoffs.

EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS

When reviewing the study results, the project team should consider each part of an alternative or design suggestion on its own merit. There may be a tendency to disregard an alternative because of a concern about one part of it. Each area within an alternative or design suggestion that is acceptable should be considered for use in the final design, even if the entire alternative or design suggestion is not implemented. Variations of these alternatives and design suggestions by the owner or designer are encouraged.

All alternatives and design suggestions were developed independently of each other to provide a broad range of options to consider for implementation. Therefore, some of them are "mutually exclusive," so acceptance of one may preclude the acceptance of another. In addition, some of the alternatives may be interrelated, so acceptance of one or more may not yield the total of the cost savings shown for each alternative. Design suggestions could also be interrelated thus precluding a part of one or more suggestions from being implemented if another design suggestion is also implemented.

Columbia Engineering and GDOT should evaluate all alternatives carefully in order to select the combination of ideas with the greatest beneficial impact on the project. Once this has been accomplished, the total cost savings resulting from the VE study can be calculated based on implementing a revised, all-inclusive design solution.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALT. NO.	DESCRIPTION	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
	TYPICAL SECTIONS (T)					
T-1	Save six feet of section width by not providing for the future 20-ft-wide median from Sta. 158+25 to Sta. 245+51.	$1,124,000	$0	$1,124,000		$1,124,000
T-2	Plan for an 18-ft-wide median in lieu of a 20-ft-wide median the entire length of SR 135 within the project limits to save 2 feet of section width.	$319,679	$0	$319,679		$319,679
T-3	Use a rural section in lieu of an urban section from Sta. 158+25 to Sta. 237+00.	$969,236	$444,739	$524,497		$524,497
T-4	Use 11-ft-wide through lanes in lieu of 12-ft-wide through lanes on SR 135.	$613,592	$0	$613,592		$613,592
T-5	Use 11-ft-wide inside through lanes in lieu of 12-ft-wide inside through lanes on SR 135.	$306,800	$0	$306,800		$306,800
T-6	Use 12-ft-wide shoulders in lieu of 16-ft-wide shoulders throughout the project.	$1,267,049	$0	$1,267,049		$1,267,049

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-1**

DESCRIPTION: **SAVE SIX FEET OF SECTION WIDTH BY NOT PROVIDING FOR THE FUTURE 20-FT-WIDE MEDIAN FROM STA. 158+25 TO STA. 245+51**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (See attached sketch)

The original design includes a 14-ft-wide flush median plus an extra six feet of section width (striped out) to accommodate a future 20-ft-wide median from Sta. 158+25 to Sta. 245+51.

ALTERNATIVE: (See attached sketch)

Save six feet of section width by only providing for the required 14-ft-wide flush median from Sta. 158+25 to Sta.2 45+51.

ADVANTAGES:

- Reduces right-of-way requirement
- Reduces construction cost

DISADVANTAGES:

- Does not provide for a future 20-ft-wide median

DISCUSSION:

Since the design year traffic (2033) is only slightly greater than 24,000 VPD, it would not be necessary to provide for a future 20-ft-wide median. Additionally, the clear zone is not an issue since all the slopes are flat due to the level terrain. The only exception to this is at the new bridge where the guard rail is already being included in the design.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,124,000	—	$ 1,124,000
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 1,124,000	—	$ 1,124,000

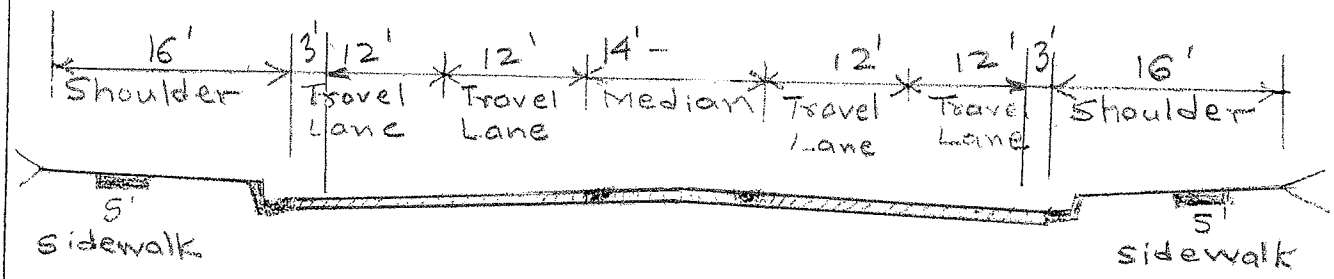
SKETCH

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

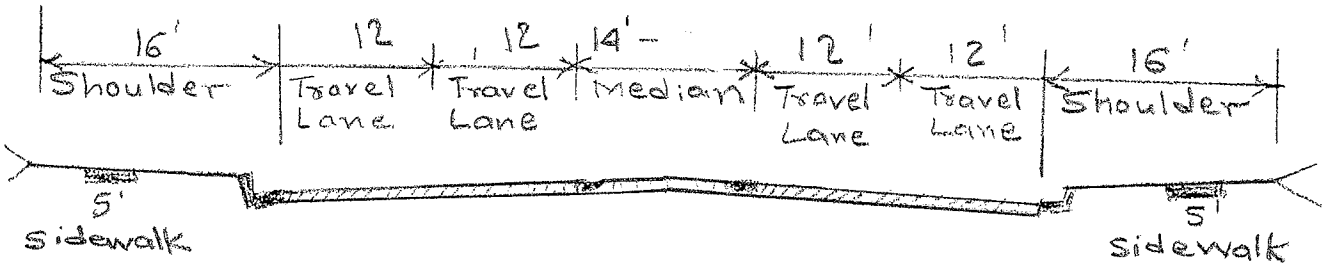
ALTERNATIVE NO.: T-1

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☑

SHEET NO.: 2 of 5



Original Design



Alternate Design

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: T-1

SHEET NO.: 3 of 5

Steepen Profile grades to 6% (per AASHTO) ILO of 5% grade.

(12.5 mm) $\frac{165 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$67.20}{TN} = \$5.44/SY$

(19 mm) $\frac{220 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$80.00}{TN} = \$8.80/SY$

(25 mm) $\frac{440 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$85.00}{TN} = \$18.70/SY$

12" GAB = $\$22.88/SY$

$\$55.82/SY$

(Based on GDOT estimate prices)

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
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ALTERNATIVE NO.: T-1

SHEET NO.: 4 of 5

Original Cost Saved.
20'-14'=6' of full-Depth pavement

$$\frac{6' \times 2.714 mi \times 5{,}280'/mi}{9 sf/sy} = 9{,}553 sy \text{ (Pavement)}$$

Bridge Savings:

$252' \times 6' = 1512 sf$

Earth work

$$\frac{6' \times 3'_{Avg.} \times 2.714 mi \times 5{,}280'/mi}{27 cf/cy} \approx 9{,}600 cy$$

R/W Saved: $1.66/sf (Avg. from GDOT)

$6' \times 2.7 mi \times 5{,}280'/mi = 85{,}536 sf$

Clearing & Grubbing:

$$\frac{85{,}536 sf}{43{,}560 sf/Ac} = 2 Ac \text{ est.}$$

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-1**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Full Depth Pavement	SY	9,553	55.82	533,248			
Bridge Area Cost	SF	1,512	120.00	181,440			
Earthwork - Fill	CY	9,600	5.00	48,000			
Clearing & Grubbing	AC	2	5,000.00	10,000			
Right-of-Way	SF	85,336	1.66	141,658			
Right-of-Way Markup (148%)	LS	1	209,654	209,654			
Subtotal				1,124,000			
Markup (%) at							
TOTAL				1,124,000			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-2**

DESCRIPTION: **PLAN FOR AN 18-FT-WIDE MEDIAN IN LIEU OF A 20-FT-WIDE MEDIAN FOR THE ENTIRE LENGTH OF SR 135 WITHIN THE PROJECT LIMITS TO SAVE TWO FT OF SECTION WIDTH**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (See attached sketch)

The original design includes a planned 20-ft-wide median for all of SR 135 within the project limits

ALTERNATIVE: (See attached sketch)

Provide an 18-ft-wide median for SR 135 within the project limits.

ADVANTAGES:

- Reduces right-of-way requirements
- Reduces material costs

DISADVANTAGES:

- None apparent

DISCUSSION:

Reducing the median width from 20-ft-wide to 18-ft-wide would reduce right-of-way and materials costs. It would also result in a 6-ft-wide "nose" median using 12-ft-wide left turn lanes; however this should not present a problem.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 319,679	—	$ 319,679
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 319,679	—	$ 319,679

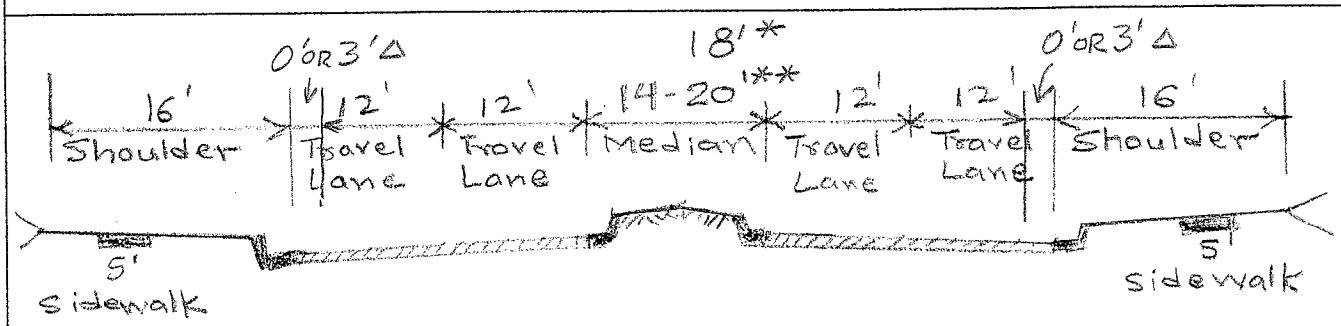
SKETCH

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: T-2

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: 2 of 4



* 18' wide Median - Alternate Design

** 14-20' wide Median - Original Design

Δ - 0' for the 20' median & 3' for the 14' median under the Original Design

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: T-2

SHEET NO.: 3 of 4

Original Costs Saved:

Earthwork: $\frac{2' \times 5'_{Avg.} \times 2.714 mi \times 5{,}280' / mi}{27 cf/cy} =$

→ Earthwork: 5,310 cy

→ R/W = $2' \times 5{,}280' / mi \times 2.714 mi = 28{,}660 sf$

→ Clearing & Grubbing: $\frac{28{,}660 sf}{43{,}560 sf / Ac} = 0.66 Ac$

Pavement Saved through intersections from Sta. 107+53 to Sta. 155+25.

$\left(\frac{6 \text{ intersections} \times 100' \times 2'}{9 sf/sy}\right) = 134 sy$ ← 1,995 s.y.

Bridge = $2' \times 252' = 504 sf$ (Saved) ←

(Use $55.82/sy (from Alt. T-1) for full-depth Pavement)

2' of Full depth Pavement saved in the 20' Retrofit Section (14' median & 6' extra pavement) from Sta. 158+25 to Sta. 242+00.00 (8375')

Full depth pavement saved: $\frac{8375' \times 2'}{9 sf/sy} = 1{,}861 sy$ ←

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-2**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Full Depth Pavement	SY	1,995	55.82	111,361			
Bridge Area Cost	SF	504	120.00	60,480			
Earthwork - Fill	CY	5,310	5.00	26,550			
Clearing & Grubbing	AC	0.66	5,000.00	3,300			
Right-of-Way	SF	28,660	1.66	47,576			
Right-of-Way Markup (148%)	LS	1	70,412	70,412			
Subtotal				319,679			
Markup (%) at							
TOTAL				319,679			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-3**

DESCRIPTION: **USE A RURAL SECTION IN LIEU OF AN URBAN SECTION FROM STA. 158+25 TO STA. 237+00**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (See attached sketch)

The original design includes an urban section with curb and gutter throughout the length of the project.

ALTERNATIVE: (See attached sketch)

Use a rural section (with no curb and gutter) from Sta. 158+25 to Sta. 237+00.

ADVANTAGES:

- Reduced construction cost

DISADVANTAGES:

- A rural typical section does not control runoff as efficiently as an urban drainage system

DISCUSSION:

Since the original design proposes a ditch behind the urban section at numerous locations throughout the project limits, curb and gutter offers no functional advantage from Sta. 158+25 to Sta. 237+00. Additionally, the original design proposes sufficient right-of-way or permanent easement to develop ditches in this area. The alternative design retains several drop inlets to handle the ditch drainage at certain locations.

The alternative design retains the urban section (including curb and gutter plus sidewalks) on SR 135 in the commercial areas from the beginning of the project to the McDonald Road intersection and from the Ward Street intersection to the end of the project.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 969,236	—	$ 969,236
ALTERNATIVE	$ 444,739	—	$ 444,739
SAVINGS	$ 524,497	—	$ 524,497

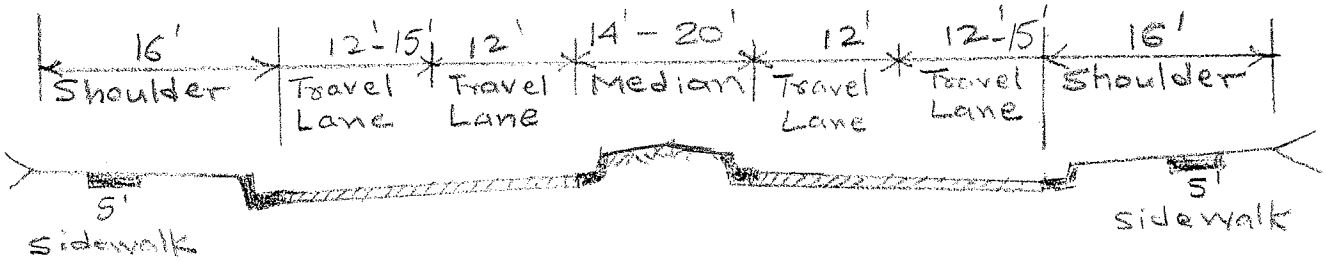
SKETCH

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

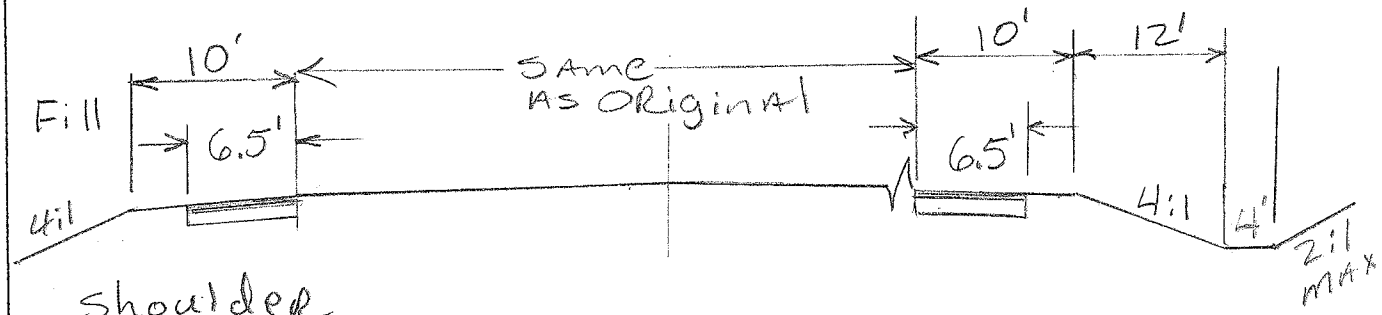
ALTERNATIVE NO.: T-3

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: 2 of 5



Original



Shoulder
As per plans:

165# / SY (12.5mm Mix)

220# / SY (19mm Mix)

6" GAB

Alternate shoulder Design

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: T-3

SHEET NO.: 3 of 5

Original Cost Saved:
(158+25 → 237+00) = 7875'

Curb & gutter saved: 7,875' x 2 sides = 15,750' ←

Catch Basins saved: 76 EA. ←

Drop Inlets saved: 8 EA. ←

Pipe saved"

18" R.C.P. = 4,500 L.F. ←

24" R.C.P. = 1,130 L.F. ←

30" R.C.P. = 700 L.F. ←

Flared End Sections: ←

18" - 5 Each

24" - 1 Each

(Pipe, Structures, and Flared End section was left out of the Swings to accommodate X-drains, drive side drains and ditch drop Inlets)

Sidewalk Saved: $\frac{7475' \times 5' \times 2 \text{ sides}}{9 \text{ sf/sy}}$ = 8,305 sy ←

Earthwork would be the same for both designs, since there would Add'l excavation for ditches, however there would also be less "Fill" since the Rural shoulder would be narrower (10' vs. 16').

Additional Cost for Alternate Paved Slides
(6.5' x 2 sides x 7475')/9 sf/sy = 10,798 sy ←

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: T-3

SHEET NO.: 4 of 5

Alternate Add'l Cost for Ditch protection:

Plain conc Ditch Paving (4") = 3,300 sy ±

Perm. Soil Reinf. Mats = 3,300 sy ±

Unit Price for Shoulder Pavement Section:

(12.5mm) 165 Lbs/sy (from T-1) = $5.44/sy

(19mm) 220 Lbs/sy (from T-1) = $8.80/sy

6" GAB (from GDOT Prices) = $13.76/sy

$28.00 s/y

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-3**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Original Design:							
6-in by 30-in Curb & Gutter, Tp2	LF	15,750	12.63	198,923			
Catch Basins, GP1 and GP2	EA	76	2,650.00	201,400			
Drop Inlets, GP1 and GP2	EA	8	2,600.00	20,800			
18-inch Rigid Concrete Pipe	LF	4,500	37.73	169,785			
24-inch Rigid Concrete Pipe	LF	1,130	43.32	48,952			
30-inch Rigid Concrete Pipe	LF	700	54.77	38,339			
Flared End Section - 18-inch	EA	5	616.24	3,081			
Flared End Section - 24-inch	EA	1	699	699			
Sidewalk, 4-inch thick	SY	8,305	32.12	266,757			
Strucutre Additional Depth	LF	100	205.00	20,500			
Alternative Design:							
Paved Shoulder	SY				10,798	28.00	302,344
4-inch Plain Concrete Ditch	SY				3,300	38.47	126,951
Permanent Soil Reinforcement Mats	SY				3,300	4.68	15,444
Subtotal				969,236			444,739
Markup (%) at							
TOTAL				969,236			444,739

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-4**

DESCRIPTION: **USE 11-FT-WIDE THROUGH LANES IN LIEU OF 12-FT-WIDE THROUGH LANES ON SR 135**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (See attached sketch)

The original design includes all 12-ft-wide through lanes on SR 135 within the project limits.

ALTERNATIVE: (See attached sketch)

Use all 11-ft-wide through lanes on SR 135.

ADVANTAGES:

- Reduces material cost
- Reduces construction cost

DISADVANTAGES:

- None apparent

DISCUSSION:

Downtown Atlanta has 11-ft-wide lanes on its freeways without any significant problems. Constructing 11-ft-wide lanes on SR 135 from SR 31-US 441 East to SR 32 will save material and construction costs without sacrificing the quality of traffic movement. If 30-in-wide curb and gutter is used, the effective travel width will be 13 ft. Where there is no curb and gutter, there is ample shoulder and pavement width on each side.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 613,592	—	$ 613,592
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 613,592	—	$ 613,592

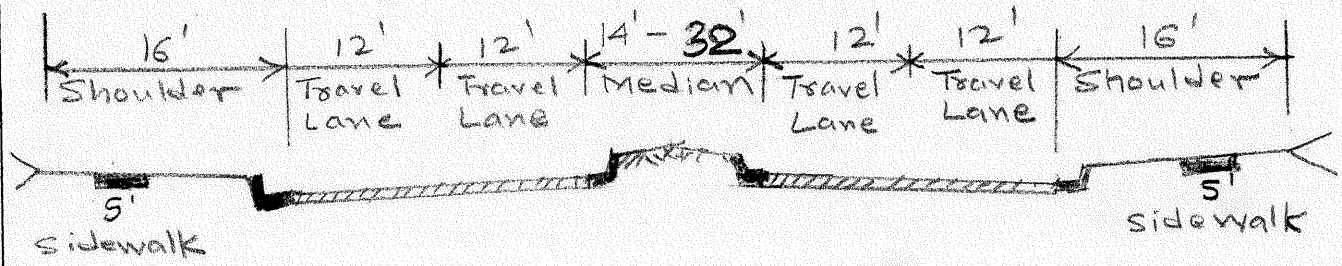
SKETCH

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

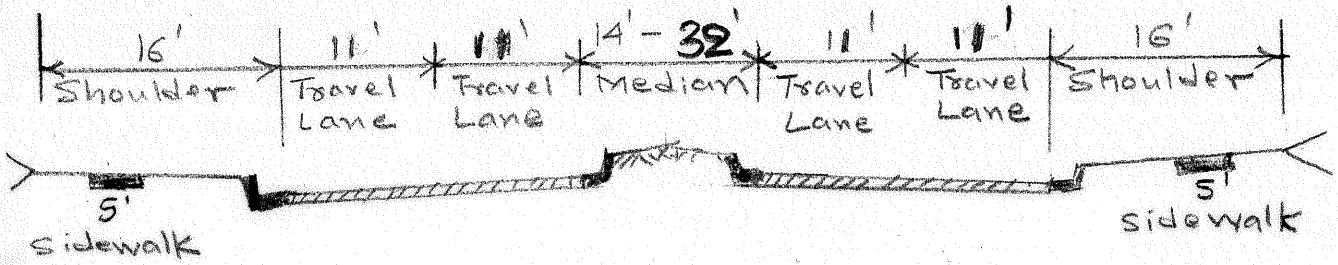
ALTERNATIVE NO.: T-4

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☑

SHEET NO.: 2 of 4



Original Design



Alternate Design

CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32** ALTERNATIVE NO.: T-4
Coffee County, Georgia

SHEET NO.: 3 of 4

Total length of 12' auxiliary lanes:

STA. 295+11 − STA. 108+11 = 13,700 feet

Total width of pavement saved: 1' + 1' + 1' + 1' = 4'

Area of pavement saved: $\frac{13{,}700' \times 4'}{9}$ = 6,089 SY

R/W Saved: 13,700 × (2' + 2') = 54,800 SF

EARTHWORK = 13700 × 4' × 3' AVG × $\frac{1}{27}$ = 6089 CY

(12.5 mm) $\frac{165 \text{ Lbs}}{\text{SY}} \times \frac{\text{T}}{2000 \text{ T}} \times \frac{\$67.20}{\text{TN}}$ = $5.44/SY

(19 mm) $\frac{220 \text{ Lbs}}{\text{SY}} \times \frac{\text{T}}{2000 \text{ T}} \times \frac{\$80.00}{\text{TN}}$ = $8.80/SY

(25 mm) $\frac{440 \text{ Lbs}}{\text{SY}} \times \frac{\text{T}}{2000 \text{ T}} \times \frac{\$85.00}{\text{TN}}$ = $18.70/SY

12" GAB = $22.88/SY

$55.82/SY

(Based on GDOT estimate prices)

Ave. R/W cost: $\frac{1{,}593{,}666}{489{,}265 + 241{,}238 + 162{,}075 + 69{,}879}$ = $1.66/SF

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-4**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Full Depth Pavement	SY	6,089	55.82	339,888			
Earthwork - Fill	CY	6,089	7.90	48,103			
Right-of-Way	SF	54,800	1.66	90,968			
Right-of-Way Markup (148%)	LS	1	134,633	134,633			
Subtotal				613,592			
Markup (%) at							
TOTAL				613,592			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-5**

DESCRIPTION: **USE 11-FT-WIDE INSIDE THROUGH LANES IN LIEU OF 12-FT-WIDE INSIDE THROUGH LANES ON SR 135**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (See attached sketch)

The original design includes all 12-ft-wide through lanes on SR 135 within the project limits.

ALTERNATIVE: (See attached sketch)

Use 11-ft-wide inside through lanes on SR 135.

ADVANTAGES:

- Reduces material cost
- Reduces construction cost

DISADVANTAGES:

- None apparent

DISCUSSION:

Downtown Atlanta has 11-ft-wide lanes on its freeways without any significant problems. Constructing 11-ft-wide inside lanes on SR 135 from SR 31-US 441 East to SR 32 will save material and construction costs without sacrificing the quality of traffic movement. If 30-in-wide curb and gutter is used, the effective travel width will be 13 ft. Where there is no curb and gutter, there is ample shoulder and pavement width.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 306,800	—	$ 306,800
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 306,800	—	$ 306,800

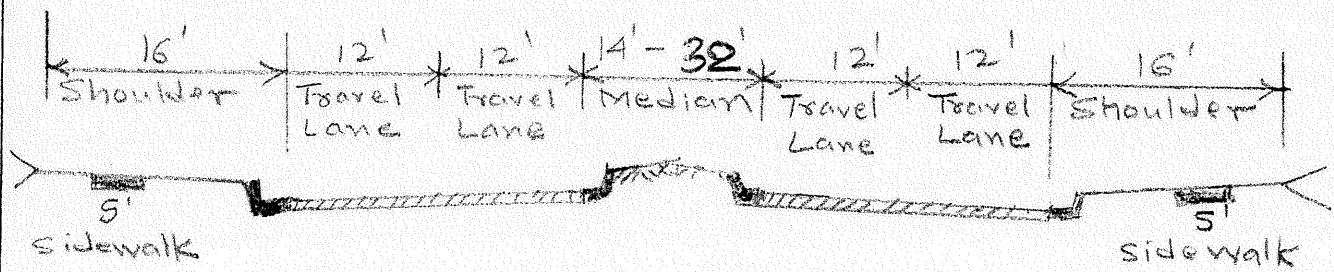
SKETCH

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

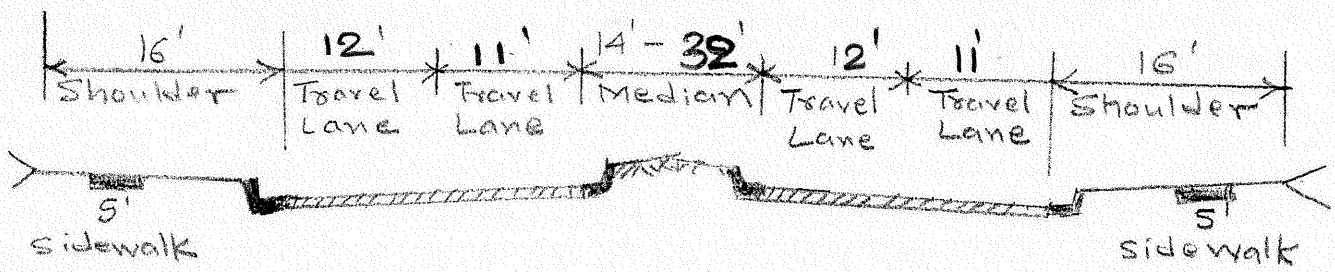
ALTERNATIVE NO.: T-5

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☑

SHEET NO.: 2 of 4



Original Design



Alternate Design

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: T-5

SHEET NO.: 3 of 4

Total length of 12' wide thru lanes:

STA. 245+11 − STA. 108+11 = 13,700 feet

Total width of pavement saved: 1' + 1' = 2'

Area of pavement saved: $\frac{13{,}700' \times 2'}{9}$ = 3,044.4 sy

R/W saved: 13,700 × (1' + 1') = 27,400 sf

EARTHWORK 13700 × 2' × 3' AVG × $\frac{1}{27}$ = 3045 CY

(12.5mm) $\frac{165 Lbs}{SY} \times \frac{T}{2000T} \times \frac{\$67.20}{TN}$ = $5.44/sy

(19mm) $\frac{220 Lbs}{SY} \times \frac{T}{2000T} \times \frac{\$80.00}{TN}$ = $8.80/sy

(25mm) $\frac{440 Lbs}{SY} \times \frac{T}{2000T} \times \frac{\$85.00}{TN}$ = $18.70/sy

12" GAB = $22.88/sy

$55.82/sy

(Based on GDOT estimate prices)

Ave. R/W Cost: $\frac{1{,}593{,}666}{489{,}265 + 241{,}238 + 162{,}075 + 69{,}879}$ = $1.66/sf

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-5**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Full Depth Pavement	SY	3,045	55.82	169,944			
Earthwork - Fill	CY	3,045	7.90	24,056			
Right-of-Way	SF	27,400	1.66	45,484			
Right-of-Way Markup (148%)	LS	1	67,316	67,316			
Subtotal				306,800			
Markup (%) at							
TOTAL				306,800			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-6**

DESCRIPTION: **USE 12-FT-WIDE SHOULDERS IN LIEU OF 16-FT-WIDE SHOULDERS THROUGHOUT THE PROJECT**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (See attached sketch)

The original design includes 16-ft-wide shoulders from the edge of travel-way with guardrail at the new bridge approaches.

ALTERNATIVE: (See attached sketch)

Use 12-ft-wide shoulders from edge of travel-way with guardrail at the new bridge approaches

ADVANTAGES:

- Reduces right-of-way requirement
- Reduces material cost
- Reduces earthwork requirement

DISADVANTAGES:

- Sidewalk width is limited to 5 ft
- No future expansion opportunity for the multi-use trail

DISCUSSION:

Per AASHTO Roadside Design Guide Table 3.1, 18 ft of clear zone is required. Since the project area is relatively flat and all slope lengths exceed 10 ft, the shoulder width could be reduced to as little as 8 ft and still meet the clear zone requirement.

The combined sidewalk width, curb width and mow strip width requires a 12-ft-wide shoulder; however, there is no future expansion opportunity for a multi-use trail.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,267,049	—	$ 1,267,049
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 1,267,049	—	$ 1,267,049

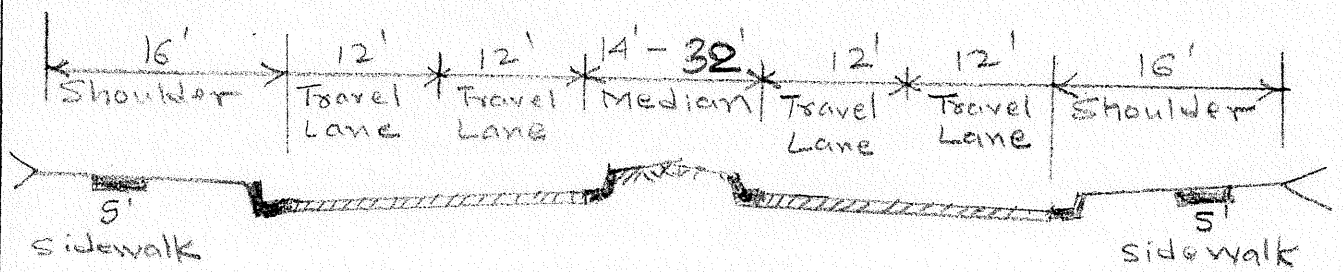
SKETCH

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

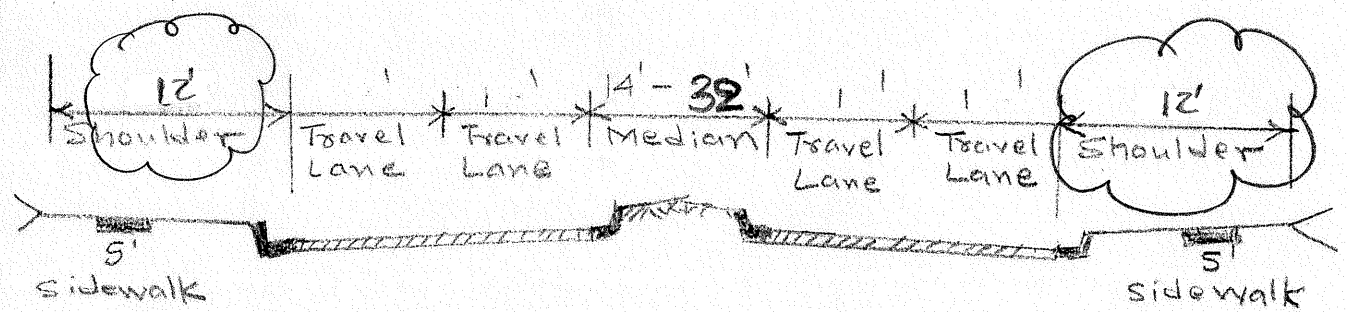
ALTERNATIVE NO.: T-6

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☑

SHEET NO.: 2 of 4



Original Design



Alternate Design

CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: T-6

SHEET NO.: 3 of 4

AVG FILL LENGTH

$$\text{FILL} = (16'-12')(25' \times 2 \text{ SIDES})(24550' - 10750')\left(\frac{1}{27}\right)$$

$$= \boxed{402,222 \text{ CY}}$$

$$\text{R/W} = (16'-12')(24550'-10750')\times 2 = \boxed{110,400 \text{ SF}}$$

SOME MINOR DRAINAGE PIPE LENGTH REDUCTION

$\boxed{\sim \$5000}$

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **T-6**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Drainage Pipe	LS	1	5,000.00	5,000			
Earthwork - Fill	CY	102,222	7.90	807,554			
Right-of-Way	SF	110,400	1.66	183,264			
Right-of-Way Markup (148%)	LS	1	271,231	271,231			
Subtotal				1,267,049			
Markup (%) at							
TOTAL				1,267,049			

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALT. NO.	DESCRIPTION	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
	BRIDGE (B)					
B-1	Save 12 ft of bridge width by providing an 8-ft-wide median on the new bridge in lieu of providing for a future 20-ft-wide median.	$411,539	$0	$411,539		$411,539
B-2	Save 6 ft of bridge width by providing a 14-ft-wide median on the new bridge in lieu of providing for a future 20-ft-wide median.	$193,619	$0	$193,619		$193,619
B-3	Coordinate a construction window with CSX Railroad for girder placement during new bridge construction.	DESIGN SUGGESTION				
B-4	Construct a bridge for realigned Old Bell Lake Road East in lieu of providing a quadruple 10-ft by 7-ft bridge box culvert.	$318,440	$331,200	($12,760)		($12,760)

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **B-1**

DESCRIPTION: **SAVE 12 FT OF BRIDGE WIDTH BY PROVIDING AN 8-FT-WIDE MEDIAN ON THE NEW BRIDGE IN LIEU OF PROVIDING FOR A FUTURE 20-FT-WIDE MEDIAN**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (See attached sketch)

The original new bridge design includes a provision for a future 20-ft-wide raised median to match the approaching roadway width.

ALTERNATIVE: (See attached sketch)

Taper the approaching roadway and provide an 8-ft-wide median across the entire length of the new bridge.

ADVANTAGES:

- Requires fewer girders over the operational railroad
- Reduces material requirements

DISADVANTAGES:

- No room for future expansion
- Reduces left-turn queuing capacity

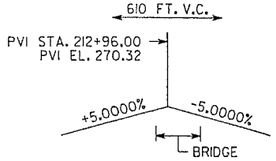
DISCUSSION:

The traffic flow patterns do not warrant future turn lanes across the new bridge.

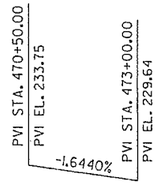
It has been common practice throughout Georgia to use narrower medians as an effective means to reduce bridge construction costs.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 411,539	—	$ 411,539
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 411,539	—	$ 411,539

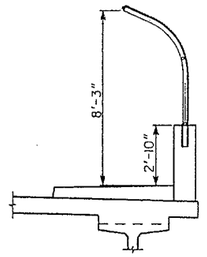
B-1
EXISTING.
PAGE 2 OF 6



BENCHMARK D-210
STA. 212+43.96
OFFSET 67.07 LT.
ELEV. 231.73
N 546961.30726
E 450229.58434
DESCRIPTION: ¾" REBAR

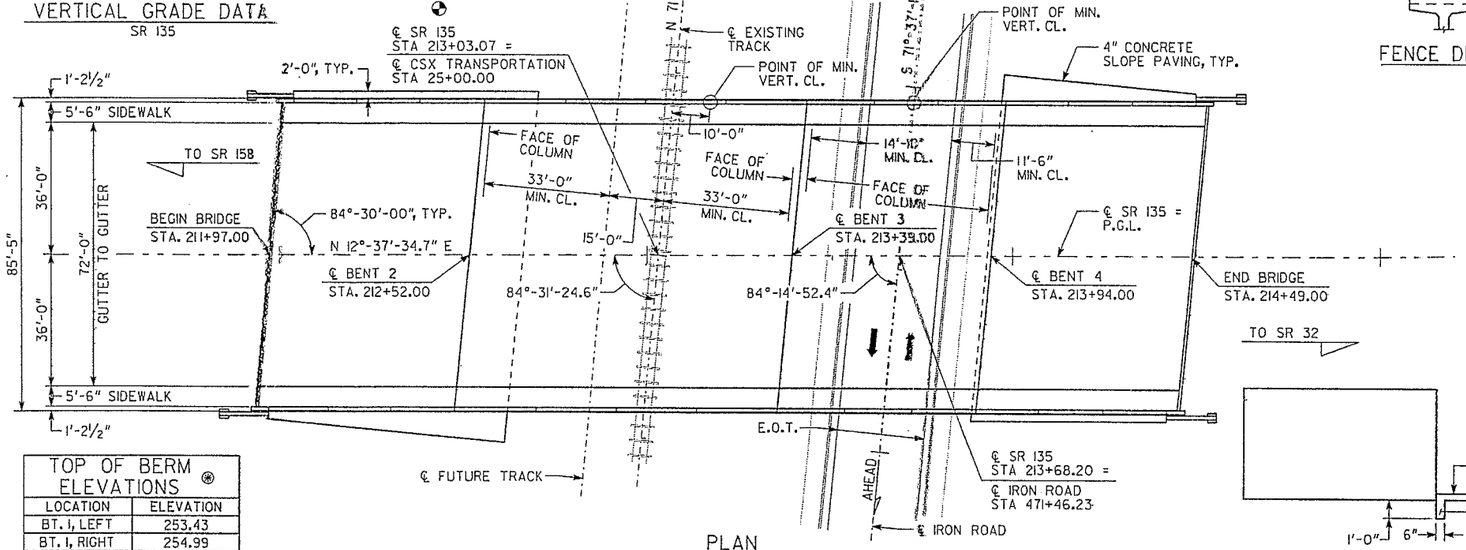


VERTICAL GRADE DATA
IRON ROAD

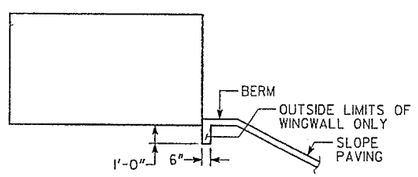


FENCE DETAIL

VERTICAL GRADE DATA
SR 135



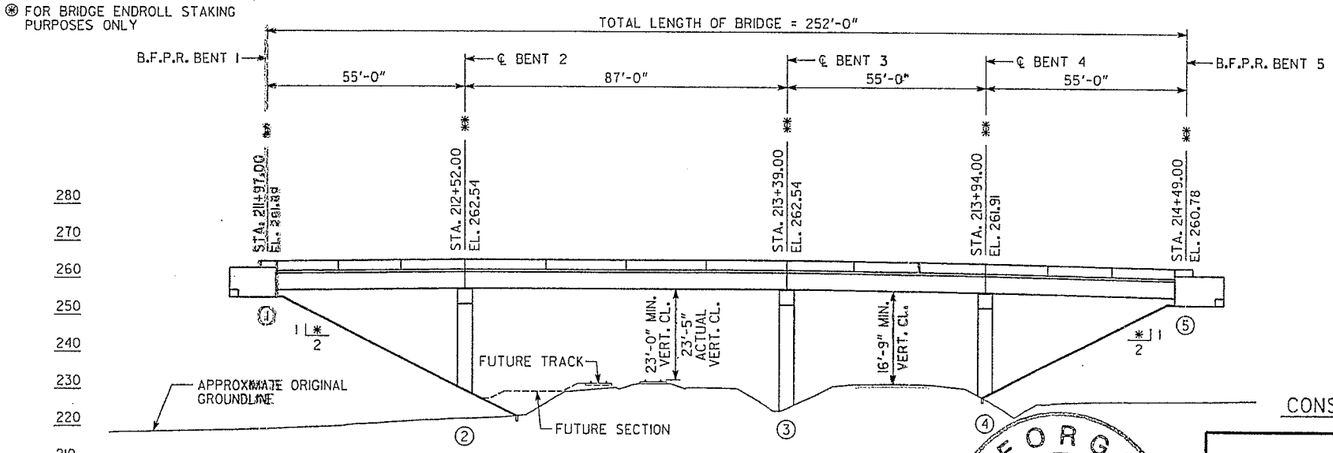
PLAN
SCALE: 1" = 20'-0"



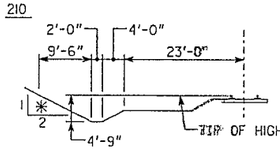
SLOPE PAVING DETAIL AT WINGS

TOP OF BERM ELEVATIONS ⊛	
LOCATION	ELEVATION
BT. 1, LEFT	253.43
BT. 1, RIGHT	254.99
BT. 5, LEFT	252.09
BT. 5, RIGHT	254.03

⊛ FOR BRIDGE ENDROLL STAKING PURPOSES ONLY

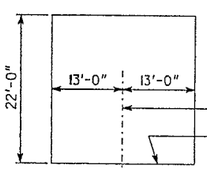


ELEVATION
SCALE: 1" = 20'-0"

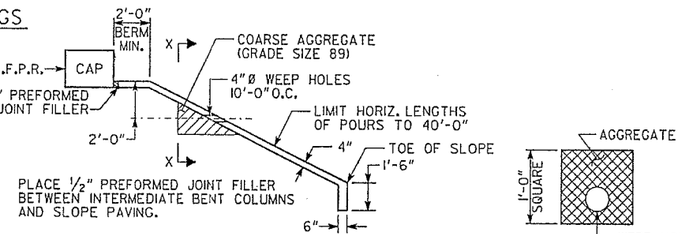


ENDFILL CONTROL DIAGRAM

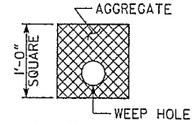
TOP OF RAIL	
STATION	ELEVATION
24+15.78	231.74
25+00.00	232.42
25+43.41	232.85



CONSTRUCTION CLEARANCE DIAGRAM



SLOPE PAVING DETAIL



SECTION X-X

BRIDGE CONSISTS (

3 - 55'-0" TYPE II PSC BEAM SPANS WITH 54 IN BULB TEE FASCIA -- SPECIAL DESIGN
1 - 87'-0" BULB TEE, 54 IN, PSC BEAM SPAN ---------- SPECIAL DESIGN
2 - PILE END BENTS ---------- SPECIAL DESIGN
3 - CONCRETE INTERMEDIATE BENTS ---------- SPECIAL DESIGN

DESIGN DATA

SPECIFICATIONS ---------- AASHTO 17TH EDITION, 2002 (DESIGNED FOR SEISMIC PERFORMANCE CATEGORY A)
TYPICAL HS20-44 AND/OR MILITARY LOADING---------- IMPACT ALLOWED
FUTURE PAVING ALLOWANCE ---------- 30 LBS PER SQ FT

TRAFFIC DATA

TRAFFIC ---------- ADT = 18,300 (2013)
ADT = 24,950 (2033)
DESIGN SPEED ---------- 45 MPH
TRUCKS ---------- 14.6%
24 HOUR TRUCKS ---------- 18%
DIRECTIONAL DIST. ---------- 49%

UTILITIES

NONE

NOTES:

1. ** STATIONS AND ELEVATIONS ARE ALONG PROFILE GRADE LINE AT THE INTERSECTION OF PROFILE GRADE LINE AND B.F.P.R. OR ℄ BENTS.
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GEORGIA REGISTERED No. 29316 PROFESSIONAL ENGINEER LISA S. WOODS 7/17/09

NOT RELEASED FOR CONSTRUCTION

PROJECT P.I. NO. 431830
BRIDGE NO. 1

GEORGIA
DEPARTMENT OF TRANSPORTATION
PRECONSTRUCTION DIVISION-OFFICE OF BRIDGE DESIGN

PRELIMINARY LAYOUT
SR 135 OVER CSX TRANSPORTATION AND IRON ROAD
COFFEE COUNTY STP00-0079-01(042)

SCALE: NONE, UNO JULY 2009

JOB NO.	BRIDGE SHEET
7089.005	1 OF 1

DESIGNED LSW | CHECKED AS | REVIEWED WEI/WMD
DRAWN RAR | DESIGN GROUP | APPROVED PVL

DATE | REVISIONS | BY

.../dgn/bridge/prelim/c43830p1.dgn 7/17/2009 9:20:24 AM $FILES 7/17/2009 9:20:24 AM

B-1
Proposed
Page 3 of 6

TOTAL SHEETS

610 FT. V.C.

PVI STA. 212+96.00
PVI EL. 270.32

+5.0000% -5.0000%

BRIDGE

BENCHMARK D-210

STA. 212+43.96
OFFSET 67.07 LT.
ELEV. 231.73
N 546961.30726
E 450229.58434
DESCRIPTION: ¾" REBAR

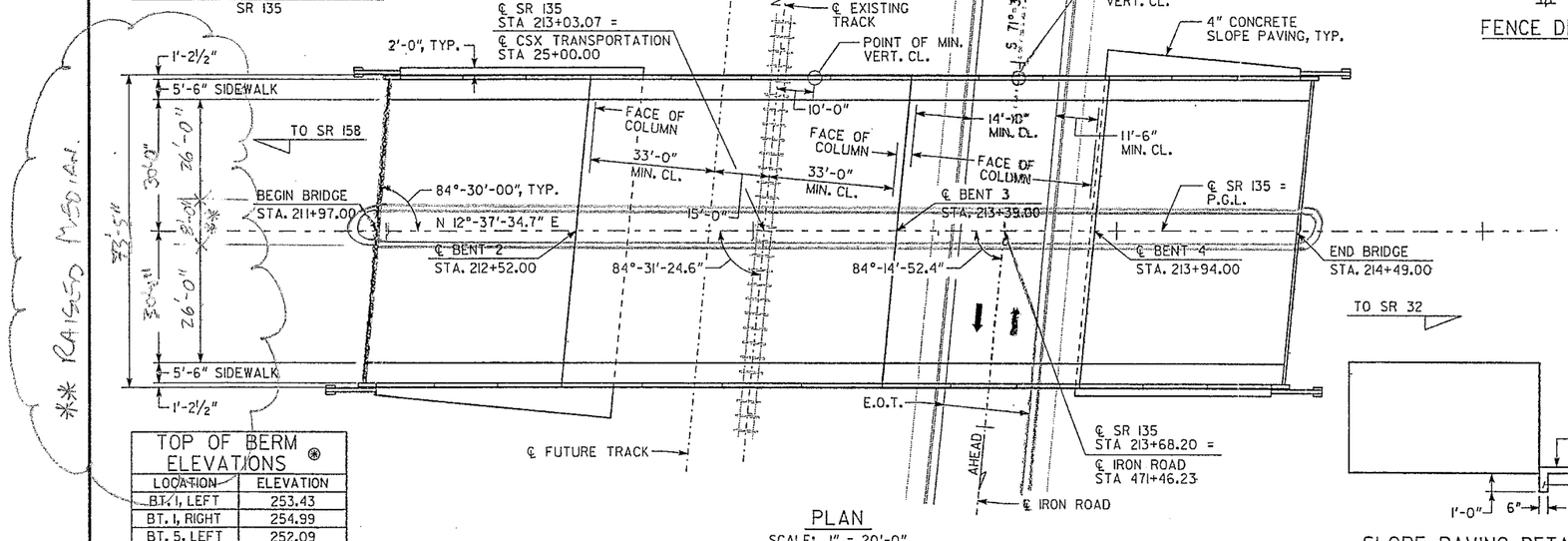
PVI STA. 470+50.00
PVI EL. 233.75

-1.6440%

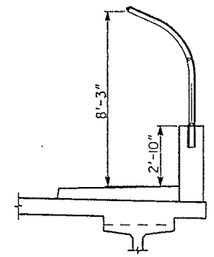
PVI STA. 473+00.00
PVI EL. 229.64

VERTICAL GRADE DATA
IRON ROAD

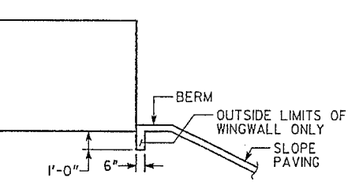
VERTICAL GRADE DATA
SR 135



PLAN
SCALE: 1" = 20'-0"



FENCE DETAIL



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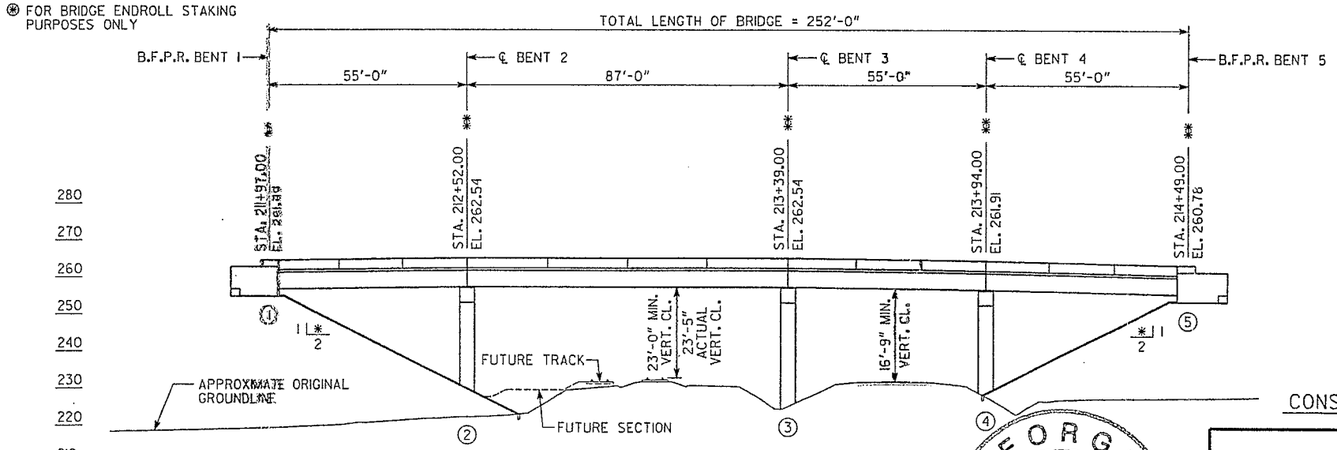

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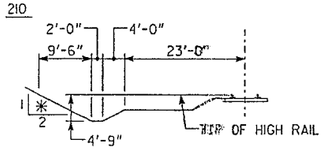

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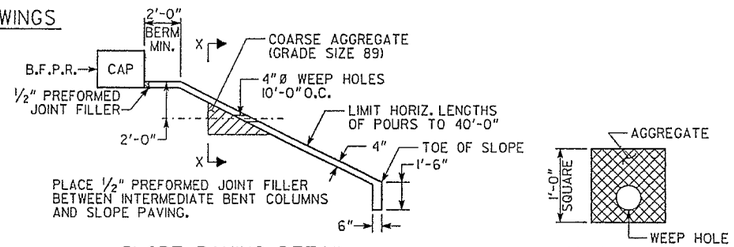
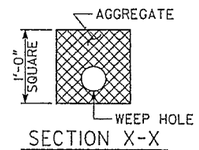
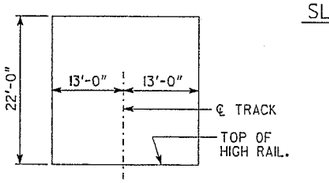


SLOPE PAVING DETAIL



SECTION X-X



CONSTRUCTION CLEARANCE DIAGRAM

BRIDGE CONSISTS OF

3 - 55'-0" TYPE II PSC BEAM SPANS WITH 54 IN BULB TEE FASCIA -- SPECIAL DESIGN
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NONE

NOTES:

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GEORGIA REGISTERED No. 29316 PROFESSIONAL ENGINEER 7/17/09 LISA S. WOODS

PROJECT P.I. NO. 431830

BRIDGE NO. 1

GEORGIA
DEPARTMENT OF TRANSPORTATION
PRECONSTRUCTION DIVISION-OFFICE OF BRIDGE DESIGN

PRELIMINARY LAYOUT
SR 135 OVER CSX TRANSPORTATION AND IRON ROAD
COFFEE COUNTY STP00-0079-01(042)

NOT RELEASED FOR CONSTRUCTION

DATE / REVISIONS / BY

SCALE: NONE, UNO JULY 2009

JOB NO. 7089.005 | BRIDGE SHEET 1 OF 1

DESIGNED LSW | CHECKED AS | REVIEWED WEI/WMD
DRAWN RAR | DESIGN GROUP | APPROVED PVL

.../dgn/bridge/prelim/o43830p1.dgn 7/17/2009 9:20:24 AM

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CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32** ALTERNATIVE NO.: B-1
Coffee County, Georgia

SHEET NO.: 4 of 6

EXISTING BRIDGE AREA ≅ 85.4' × 252' = 21,521 □'

UNIT COST ASSUMED ≅ 2,550,000 ÷ 21,521 ≅ $120/□'

PROPOSED BRIDGE AREA = 73.4' × 252' = 18,497 □'

Δ AREA = 21,521 − 18,497 = **3,024 □'**

TAPER LENGTH = (45 mph)$\left(\frac{12'}{2}\right)$ = 270' ASSUME 300'

≈ 25' OF FILL ALONGSIDE VOLUME = 4(25')$\left(\frac{6'}{2}\right)$(300')

= 90,000 ft³

= **3333 yd³**

AREA = 4$\left(\frac{6'}{2}\right)$(300') = 3600 ft²

= **400 yd²**

NO CHANGE TO OTHER ITEMS.

CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: B-1

Steeper profile grades to 6% (per AASHTO) ILO of 5% grade.

SHEET NO.: 5 of 6

(12.5 mm) $\frac{165 \text{ Lbs}}{\text{SY}} \times \frac{\text{T}}{2000 \text{ T}} \times \frac{\$67.20}{\text{TN}} = \$5.44/\text{SY}$

(19 mm) $\frac{220 \text{ Lbs}}{\text{SY}} \times \frac{\text{T}}{2000 \text{ T}} \times \frac{\$80.00}{\text{TN}} = \$8.80/\text{SY}$

(25 mm) $\frac{440 \text{ Lbs}}{\text{SY}} \times \frac{\text{T}}{2000 \text{ T}} \times \frac{\$85.00}{\text{TN}} = \$18.70/\text{SY}$

12" GAB = $22.88/SY

$55.82/SY

(Based on GDOT estimate prices)

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **B-1**

SHEET NO.: **6 of 6**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge Area Cost	SF	3,024	120.00	362,880			
Earthwork - Fill	CY	3,333	7.90	26,331			
Pavement	SY	400	55.82	22,328			
Subtotal				411,539			
Markup (%) at							
TOTAL				411,539			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **B-2**

DESCRIPTION: **SAVE 6 FT OF BRIDGE WIDTH BY PROVIDING A 14-FT-WIDE MEDIAN ON THE NEW BRIDGE IN LIEU OF PROVIDING FOR A FUTURE 20-FT-WIDE MEDIAN**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (See attached sketch)

The original new bridge design includes a provision for a future 20-ft-wide raised median to match the approaching roadway width.

ALTERNATIVE: (See attached sketch)

Taper the approaching roadway and provide a 14-ft-wide flush median across the entire length of the new bridge.

ADVANTAGES:

- Requires fewer girders over the operational railroad
- Reduces material requirements

DISADVANTAGES:

- No room for future expansion
- Reduces left-turn queuing capacity

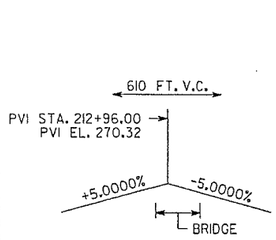
DISCUSSION:

The traffic flow patterns do not warrant future turn lanes across the proposed new bridge.

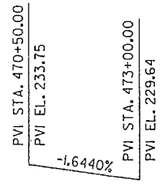
It has been common practice throughout Georgia to use narrower medians as an effective means to reduce bridge construction costs.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 193,619	—	$ 193,619
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 193,619	—	$ 193,619

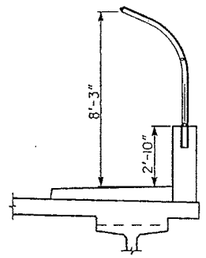
B-2
EXISTING
Page 2 of 6



BENCHMARK D-210
STA. 212+43.96
OFFSET 67.07 LT.
ELEV. 231.73
N 546961.30726
E 450229.58434
DESCRIPTION: ¾" REBAR

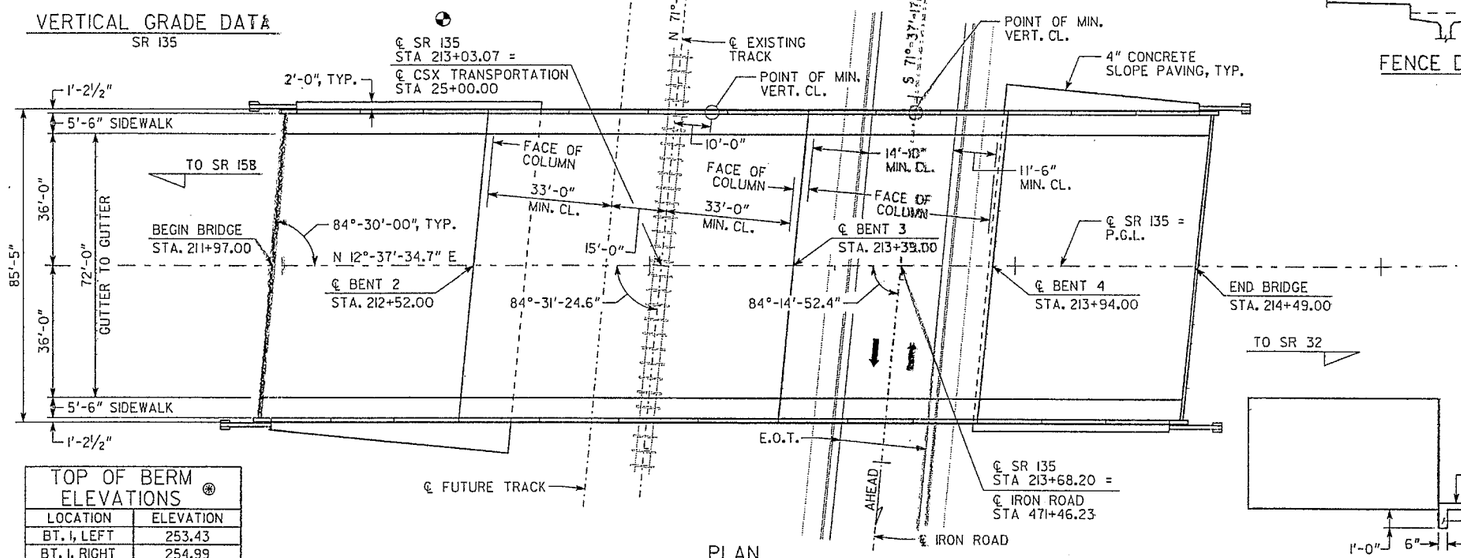


VERTICAL GRADE DATA
IRON ROAD

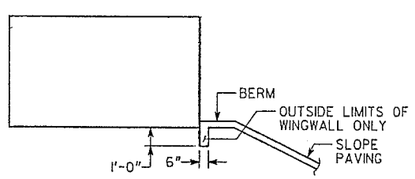


FENCE DETAIL

VERTICAL GRADE DATA
SR 135



PLAN
SCALE: 1" = 20'-0"



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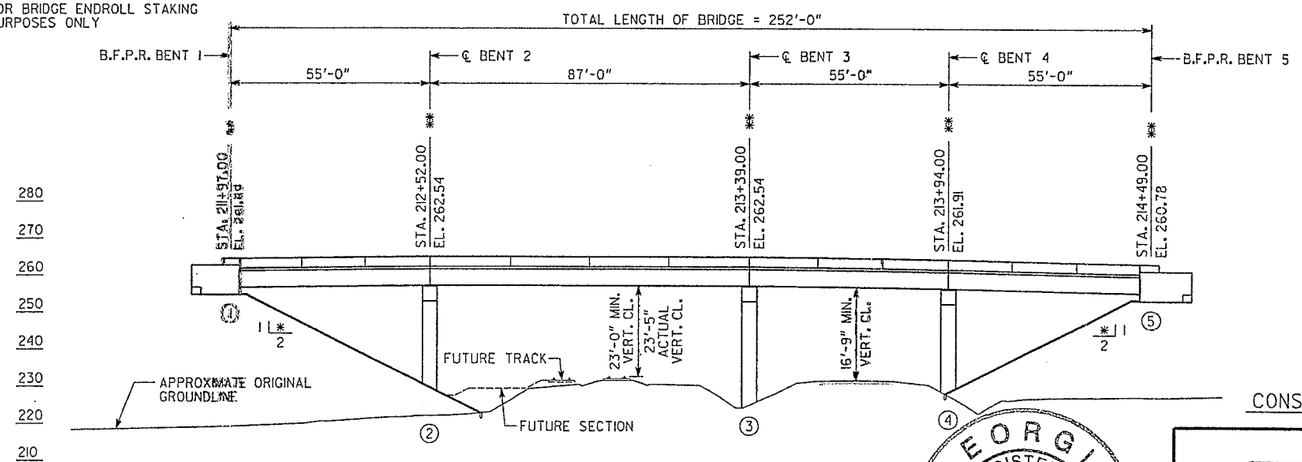

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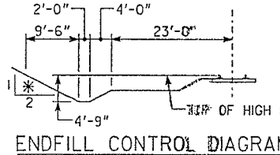

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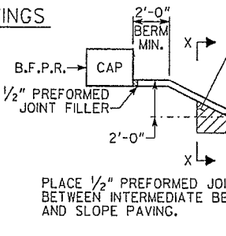

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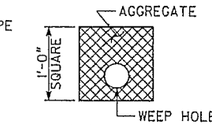
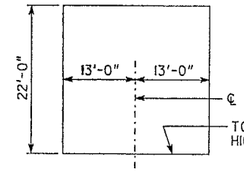


SECTION X-X



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PROJECT P.I. NO. 431830

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DEPARTMENT OF TRANSPORTATION
PRECONSTRUCTION DIVISION-OFFICE OF BRIDGE DESIGN

PRELIMINARY LAYOUT
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SCALE: NONE, UNO JULY 2009

NOT RELEASED FOR CONSTRUCTION

DATE	REVISIONS	BY

JOB NO. 7089.005 | BRIDGE SHEET 1 OF 1

DESIGNED LSW | DRAWN RAR | CHECKED AS | DESIGN GROUP | REVIEWED WEI/WMD | APPROVED PVL

.../dgn/bridge/prelim/c43830p1.dgn 7/17/2009 9:20:24 AM

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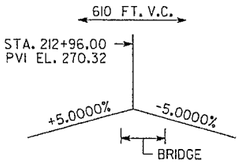
B-2 Proposed Page 3 of 6



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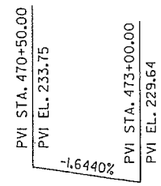

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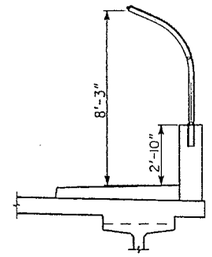

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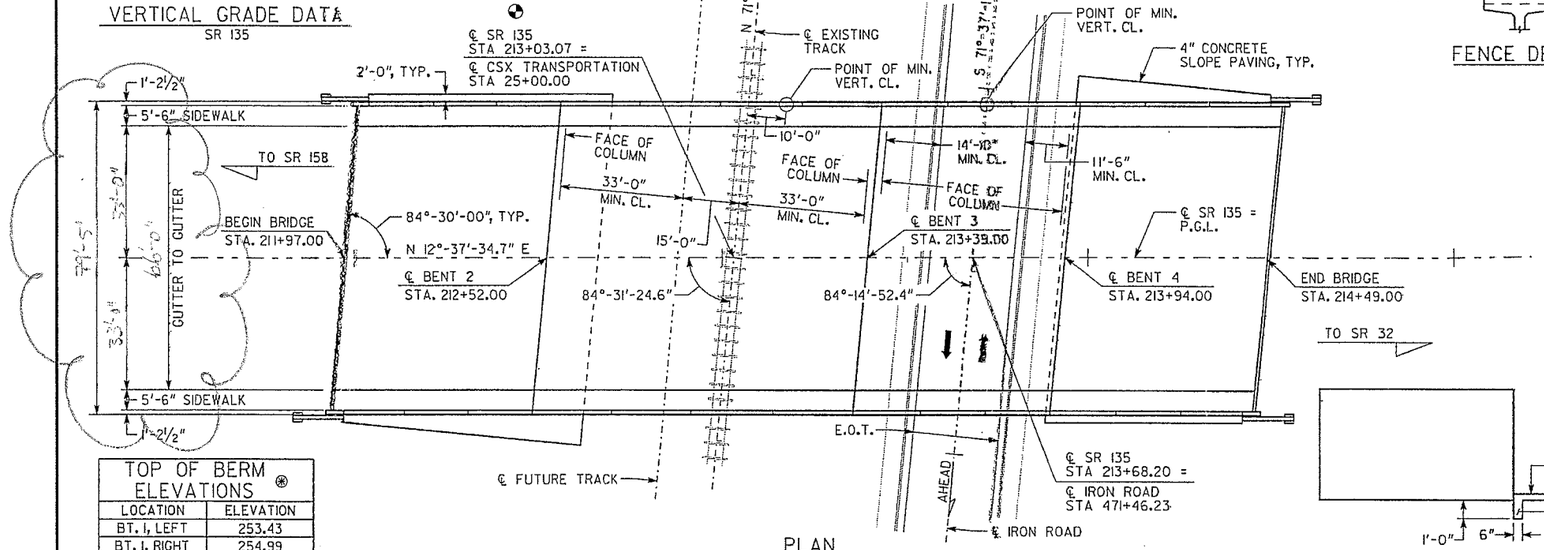
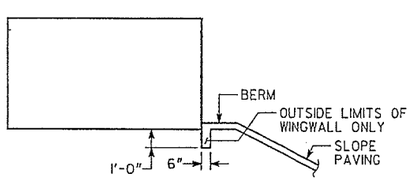


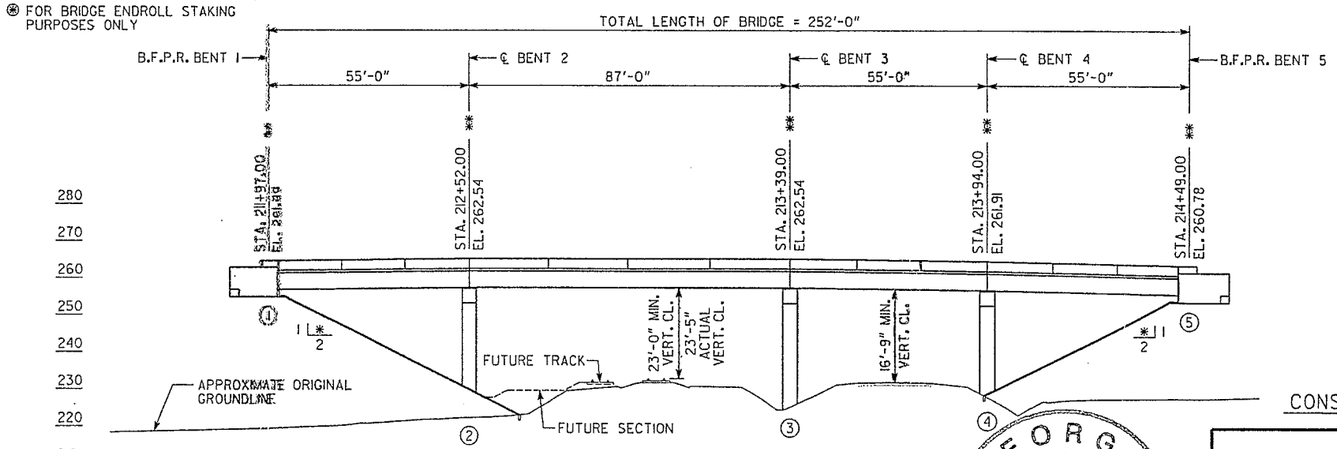
PLAN
SCALE: 1" = 20'-0"



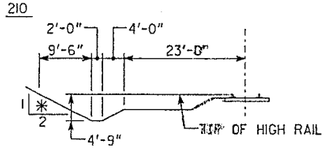
SLOPE PAVING DETAIL AT WINGS

TOP OF BERM ⊛ ELEVATIONS	
LOCATION	ELEVATION
BT. 1, LEFT	253.43
BT. 1, RIGHT	254.99
BT. 5, LEFT	252.09
BT. 5, RIGHT	254.03

⊛ FOR BRIDGE ENDROLL STAKING PURPOSES ONLY

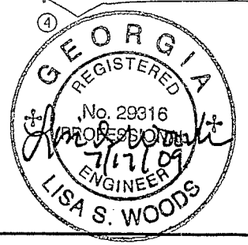


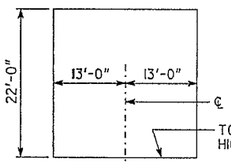
ELEVATION
SCALE: 1" = 20'-0"



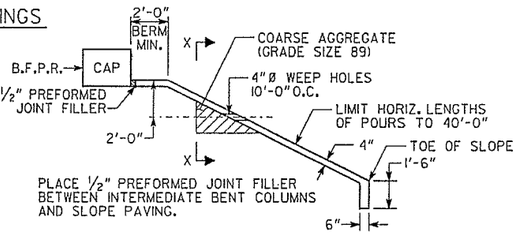
ENDFILL CONTROL DIAGRAM

TOP OF RAIL	
STATION	ELEVATION
24+15.78	231.74
25+00.00	232.42
25+43.41	232.85

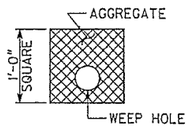




CONSTRUCTION CLEARANCE DIAGRAM



SLOPE PAVING DETAIL



SECTION X-X

BRIDGE CONSISTS (

3 - 55'-0" TYPE II PSC BEAM SPANS WITH 54 IN BULB TEE FASCIA -- SPECIAL DESIGN
1 - 87'-0" BULB TEE, 54 IN, PSC BEAM SPAN ---------- SPECIAL DESIGN
2 - PILE END BENTS ---------- SPECIAL DESIGN
3 - CONCRETE INTERMEDIATE BENTS ---------- SPECIAL DESIGN

DESIGN DATA

SPECIFICATIONS ---------- AASHTO 17TH EDITION, 2002 (DESIGNED FOR SEISMIC PERFORMANCE CATEGORY A)
TYPICAL HS20-44 AND/OR MILITARY LOADING---------- IMPACT ALLOWED
FUTURE PAVING ALLOWANCE ---------- 30 LBS PER SQ FT

TRAFFIC DATA

TRAFFIC ---------- ADT = 18,300 (2013)
ADT = 24,950 (2033)
DESIGN SPEED ---------- 45 MPH
TRUCKS ---------- 14.6%
24 HOUR TRUCKS ---------- 18%
DIRECTIONAL DIST. ---------- 49%

UTILITIES

NONE

NOTES:

1. ** STATIONS AND ELEVATIONS ARE ALONG PROFILE GRADE LINE AT THE INTERSECTION OF PROFILE GRADE LINE AND B.F.P.R. OR ℄ BENTS.
2. * NORMAL TO END BENT.
3. ALL BENTS ARE PARALLEL.
4. P.G.L. = PROFILE GRADE LINE, E.O.T. = EDGE OF TRAVELWAY
5. THE PROPOSED BRIDGE DECK IS TO BE BUILT ON A CONSTANT CROSS SLOPE OF 2% SLOPING DOWN TO THE LEFT.

PROJECT P.I. NO. 431830

BRIDGE NO. 1

GEORGIA
DEPARTMENT OF TRANSPORTATION
PRECONSTRUCTION DIVISION-OFFICE OF BRIDGE DESIGN

PRELIMINARY LAYOUT
SR 135 OVER CSX TRANSPORTATION AND IRON ROAD
COFFEE COUNTY STP00-0079-01(042)

NOT RELEASED FOR CONSTRUCTION

SCALE: NONE, UNO JULY 2009

JOB NO. 7089.005 | BRIDGE SHEET 1 OF 1

DESIGNED LSW | DRAWN RAR | CHECKED AS | DESIGN GROUP | REVIEWED WEI/WMD | APPROVED PVL

REVISIONS | DATE | BY

.../dgn/bridge/prelim/o43830p1.dgn 7/17/2009 9:20:24 AM

7/17/2009 9:20:24 AM $FILES

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: B-2.

SHEET NO.: 4 of 6

EXISTING BRIDGE AREA ≅ 85.4' × 252' = 21,521 □'

UNIT COST ASSUMED ≅ 2,550,000 ÷ 21,521 ≅ $120/□'

PROPOSED BRIDGE AREA = 79.4' × 252' = 20,009 □'

Δ_{AREA} = 1512 □'

TAPER LENGTH = (45 MPH)($\frac{6'}{2}$) = 135' USE 150'

~25' OF FILL AVERAGE VOLUME = 4(25')($\frac{3'}{2}$)(150')

= 22,500 ft³

= 835 yd³

AREA = 4($\frac{3'}{2}$)(150') = 900 ft²

= 100 yd²

NO CHANGE TO OTHER ITEMS.

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: B-2

Steeper profile grades to 6% (per AASHTO) ILO of 5% grade.

SHEET NO.: 5 of 6

(12.5 mm) $\frac{165 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$67.20}{TN} = \$5.44/SY$

(19 mm) $\frac{220 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$80.00}{TN} = \$8.80/SY$

(25 mm) $\frac{440 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$85.00}{TN} = \$18.70/SY$

12" GAB = $22.88/SY

$55.82/SY

(Based on GDOT estimate prices)

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **B-2**

SHEET NO.: **6 of 6**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge Area Cost	SF	1,512	120.00	181,440			
Earthwork - Fill	CY	835	7.90	6,597			
Pavement	SY	100	55.82	5,582			
Subtotal				193,619			
Markup (%) at							
TOTAL				193,619			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **B-3**

DESCRIPTION: **COORDINATE A CONSTRUCTION WINDOW WITH CSX RAILROAD FOR GIRDER PLACEMENT DURING NEW BRIDGE CONSTRUCTION**

SHEET NO.: **1 of 1**

ORIGINAL DESIGN: (See attached sketch)

The original design does not consider the limited bridge installation opportunities over the existing railroad.

The track is currently carrying 23 trains per day with a maximum allowable capacity of 24 trains per day or approximately one train per hour on average; though there may be a period of 3 - 4 hours during which no train movement is occurring.

ALTERNATIVE: (See attached sketch)

Negotiate a signed memorandum of understanding with CSX Railroad concerning construction of the new bridge over this heavily used railroad corridor.

ADVANTAGES:

- Formalized agreement with the railroad
- Provides a clear outline for hours of operation for construction per Traffic Control Special Provision 150.
- Reduces potential scheduling issues

DISADVANTAGES:

- None apparent

DISCUSSION:

A signed memorandum of understanding with CSX Railroad will ensure that the new bridge design can be constructed given all the limiting factors.

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

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **B-4**

DESCRIPTION: **CONSTRUCT A BRIDGE FOR REALIGNED OLD BELL LAKE ROAD EAST IN LIEU OF PROVIDING A QUADRUPLE 10 FT BY 7 FT BRIDGE BOX CULVERT**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (See attached sketch)

The original design includes a quadruple 10-ft by 7-ft bridge box culvert for realigned Old Bell Lake Road between Sta. 406+90 and Sta. 407+70.

ALTERNATIVE: (See attached sketch)

Construct a bridge (approximately 80-ft-long by 34.5 ft-wide) for realigned Old Bell Lake Road between Sta. 406+90 and Sta. 407+70.

ADVANTAGES:

- Reduces impact to wetlands
- Possible benefit for negotiation of Individual Permit

DISADVANTAGES:

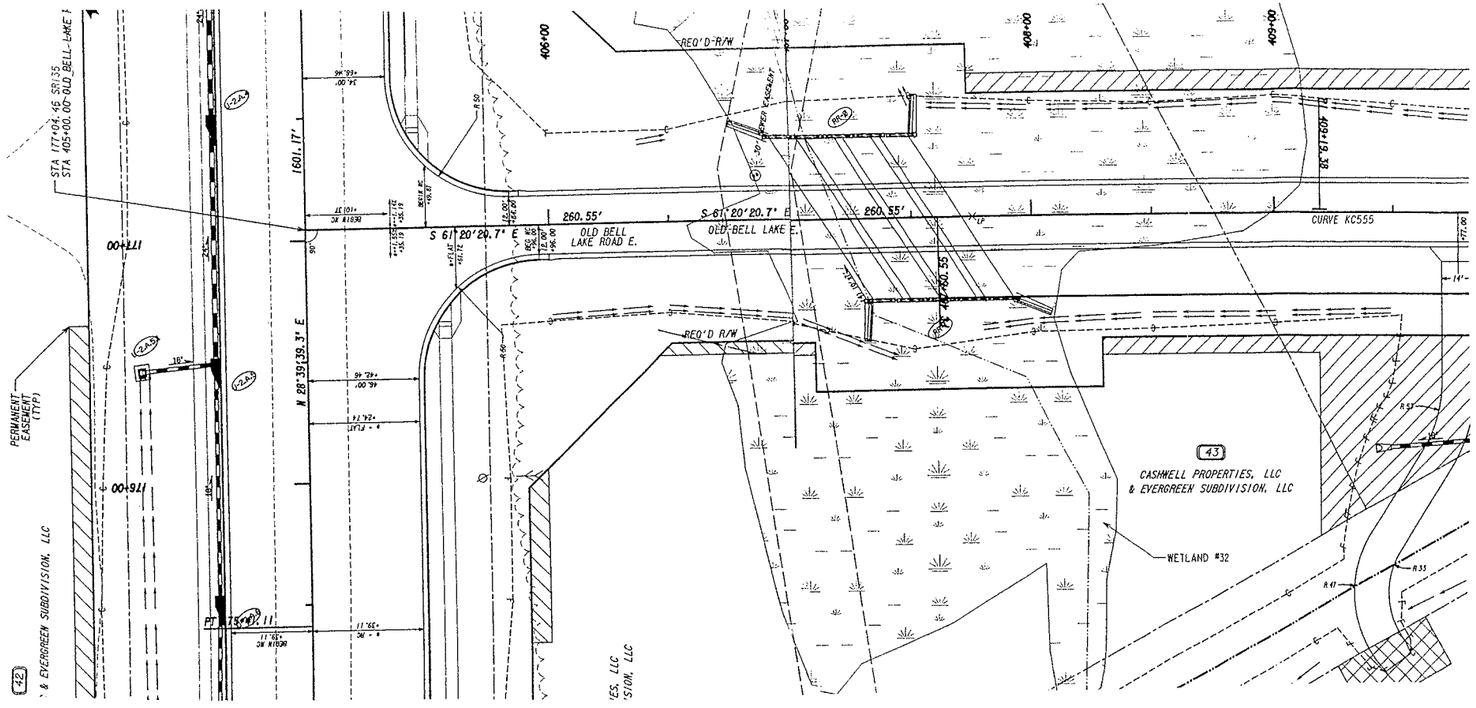
- Adds minor construction cost

DISCUSSION:

Drainage requirements at the southwest end of the project may have exceeded the allowable environmental impact limits and require an Individual Permit.

Application for an Individual Permit requires demonstration of minimization of all environmental impacts within the project limits. The additional cost of a bridge for Old Bell Road as compared to the original box culvert design may be justified in helping to minimize environmental impacts to the overall design.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 318,440	—	$ 318,440
ALTERNATIVE	$ 331,200	—	$ 331,200
SAVINGS	$ (12,760)	—	$ (12,760)

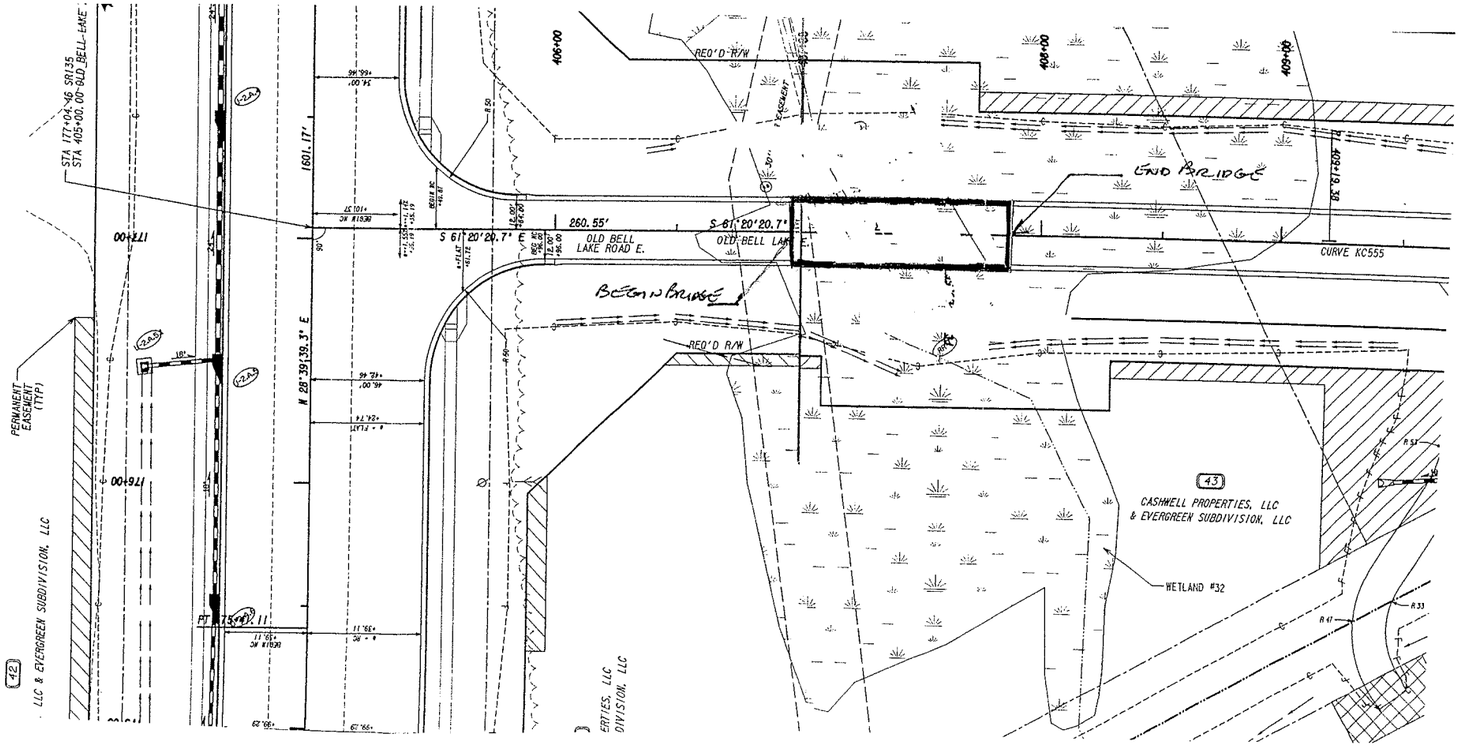


EXISTING ↑

BRIDGE LENGTH ≅ 80'-0"

BRIDGE WIDTH ≅ 34'-6"

↓ PROPOSED.



CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.:

SHEET NO.: 3 of 5

BRIDGE = (80')(34.5') = 2760 ft².

Box_{CONC} = (4.8715 $\frac{CY}{ft}$)(~75') + (52.74 CY) = 418 CY
BARRELS PARAPET.

Box_{REBAR} = (515)(~75) + (7077 lbs) = 45,702 lbs.
BARRELS PARAPET

Type II BACKFILL = (1')(75')(60')$\frac{1}{27}$ = 165 CY

Fill = (2')($\frac{75'+36'}{2}$)(60')($\frac{1}{27}$) = 246 CY

CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.:

Steeper profile grades to 6% (per AASHTO) ILO of 5% grade.

SHEET NO.: 4 of 5

(12.5mm) $\frac{165 Lbs}{SY} \times \frac{T}{2000T} \times \frac{\$67.20}{TN} = \$5.44/SY$

(19mm) $\frac{220 Lbs}{SY} \times \frac{T}{2000T} \times \frac{\$80.00}{TN} = \$8.80/SY$

(25mm) $\frac{440 Lbs}{SY} \times \frac{T}{2000T} \times \frac{\$85.00}{TN} = \$18.70/SY$

12" GAB = $22.88/SY

$55.82/SY

(Based on GDOT estimate prices)

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **B-4**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Pavement	SY	306	55.82	17,081			
Class "A" Concrete	CY	418	587.75	245,680			
Rebar	LB	45,702	0.96	43,874			
Type II Backfill	CY	165	59.77	9,862			
Earthwork - Fill	CY	246	7.90	1,943			
Bridge Area Cost	SF				2,760	120.00	331,200
Subtotal				318,440			331,200
Markup (%) at							
TOTAL				318,440			331,200

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALT. NO.	DESCRIPTION	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
	DRAINAGE (D)					
D-1	Use HDPE pipe in lieu of rigid concrete pipe for longitudinal storm drain piping.	$685,222	$568,467	$116,755		$116,755
	CURB AND GUTTER (CG)					
CG-1	Use 24-in-wide curb and gutter in lieu of 30-in-wide curb and gutter.	$684,810	$616,440	$68,370		$68,370
CG-2	Eliminate curb and gutter from McDonald Road and Old Axson Road.	$9,384	$0	$9,384		$9,384
CG-3	Eliminate curb and gutter, sidewalk, and associated drainage from Baker Highway.	$48,448	$0	$48,448		$48,448
	SIDEWALKS (S)					
S-1	Eliminate sidewalks from the east side of SR 135 between Gaskin Avenue (Sta. 123+25) and the end of the project (Sta. 245+50).	$218,159	$0	$218,159		$218,159
S-2	Reduce the shoulder width from 16-ft-wide to 12-ft-wide and eliminate sidewalk on the east side of SR 135 from Gaskin Avenue (Sta. 123+50) to the end of the project (Sta. 145+50).	$779,667	$0	$779,667		$779,667

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **D-1**

DESCRIPTION: **USE HDPE PIPE IN LIEU OF CONCRETE PIPE FOR LONGITUDINAL STORM DRAIN PIPING**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (See attached sketch)

The current design proposes reinforced concrete storm drain pipe (RCP) for all storm drain piping.

ALTERNATIVE: (See attached sketch)

Use High Density Polyethylene (HDPE) pipe for the longitudinal storm drainage piping only.

ADVANTAGES:

- Reduces material cost
- Reduces installation cost
- Reduces construction time due to easier installation requirements

DISADVANTAGES:

- None apparent

DISCUSSION:

HDPE pipe comes in 20 ft sections, is lightweight, and much easier and faster to install than the conventional concrete storm drain pipe with a similar life span. A 6 in Type II backfill material is required for a foundation with HDPE pipe.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 685,222	—	$ 685,222
ALTERNATIVE	$ 568,467	—	$ 568,467
SAVINGS	$ 116,755	—	$ 116,755

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: D-1

SHEET NO.: 2 of 3

Quantities for Pipe to be used for HDPE pipe consideration

18" - 11,900 L.F.

24" - 3,300 L.F.

30" - 1,700 L.F.

Alternate Design Add'l Cost for 6" Found. Backfill Material, Tp II

$$\frac{.5' \times 1.5' \times 11{,}400'}{27 cf/cy} = 317 cy$$

$$\frac{.5' \times 2' \times 3{,}100'}{27 cf/cy} = 115 cy$$

$$\frac{.5' \times 2.5' \times 1{,}600'}{27 cf/cy} = 74 cy$$

Total = 506 cy

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **D-1**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Original Design:							
Longitudinal Pipe:							
18-inch RCP	LF	11,900	37.74	449,106			
24-inch RCP	LF	3,300	43.32	142,956			
30-inch RCP	LF	1,700	54.80	93,160			
Alternative D-1:							
18-inch HDPE pipe					11,400	30.00	342,000
24-inch HDPE pipe					3,100	39.00	120,900
30-inch HDPE pipe					1,600	49.00	78,400
Foundation Material, Backfill Tp2	CY				506	53.69	27,167
Subtotal				685,222			568,467
Markup (%) at							
TOTAL				685,222			568,467

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **CG-1**

DESCRIPTION: **USE 24-IN-WIDE CURB AND GUTTER IN LIEU OF 30-IN-WIDE CURB AND GUTTER**

SHEET NO.: **1 of 2**

ORIGINAL DESIGN:

The original design proposes 30-in-wide curb and gutter throughout the project.

ALTERNATIVE:

Use 24-in-wide curb and gutter throughout the project.

ADVANTAGES:

- Reduces material cost

DISADVANTAGES:

- Increases gutter spread which may result in increased drainage cost

DISCUSSION:

The cost savings from 24-in-wide curb and gutter do not include the right-of-way cost savings resulting from 6 in less width on both sides of the road. The median would remain 20-ft-wide.

The potential right-of-way cost savings might be offset by a possible increase in the cost of additional catch basins that could be required due to increased gutter spread.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 684,810	—	$ 684,810
ALTERNATIVE	$ 616,440	—	$ 616,440
SAVINGS	$ 68,370	—	$ 68,370

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **CG-1**

SHEET NO.: **2 of 2**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
30-in-wide Curb & Gutter, Type 2	LF	37,000	12.63	467,310			
30-in-wide Curb & Gutter, Type 7	CY	12,500	17.40	217,500			
30-in-wide Curb & Gutter, Type 2	LF				37,000	11.37	420,690
30-in-wide Curb & Gutter, Type 7	CY				12,500	15.66	195,750
Subtotal				684,810			616,440
Markup (%) at							
TOTAL				684,810			616,440

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **CG-2**

DESCRIPTION: **ELIMINATE CURB AND GUTTER FROM MCDONALD ROAD AND OLD AXSON ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (See attached sketch)

The original design includes new curb and gutter on McDonald Road and Old Axson Road to the limits of construction.

ALTERNATIVE: (See attached sketch)

From SR 135, turning toward either McDonald Road or Old Axson Road, provide curb and gutter to the curb returns. On both sides of McDonald Road and Old Axson Road, eliminate curb and gutter from the curb returns to the limit of construction.

ADVANTAGES:

- Reduces material cost
- Reduces construction time

DISADVANTAGES:

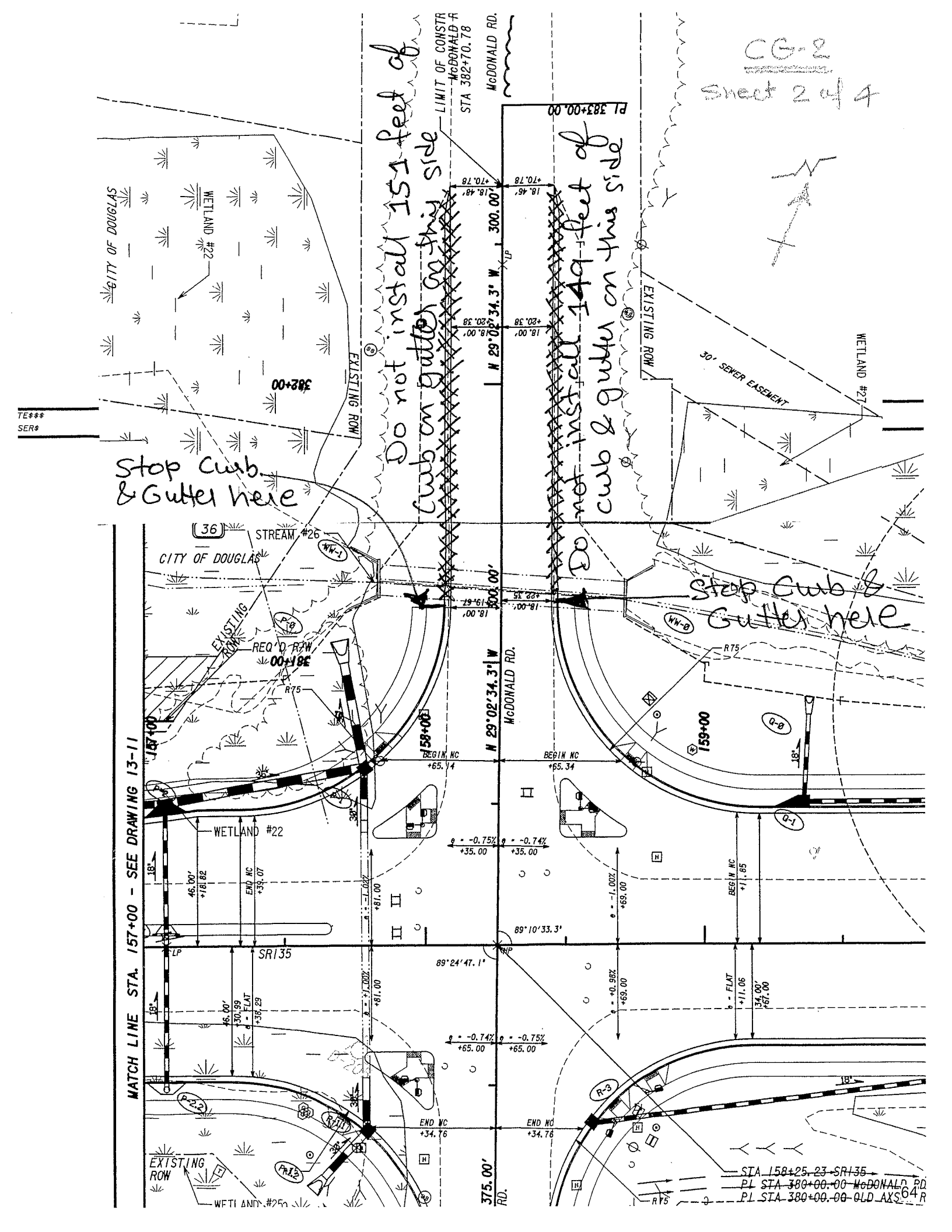
- None apparent

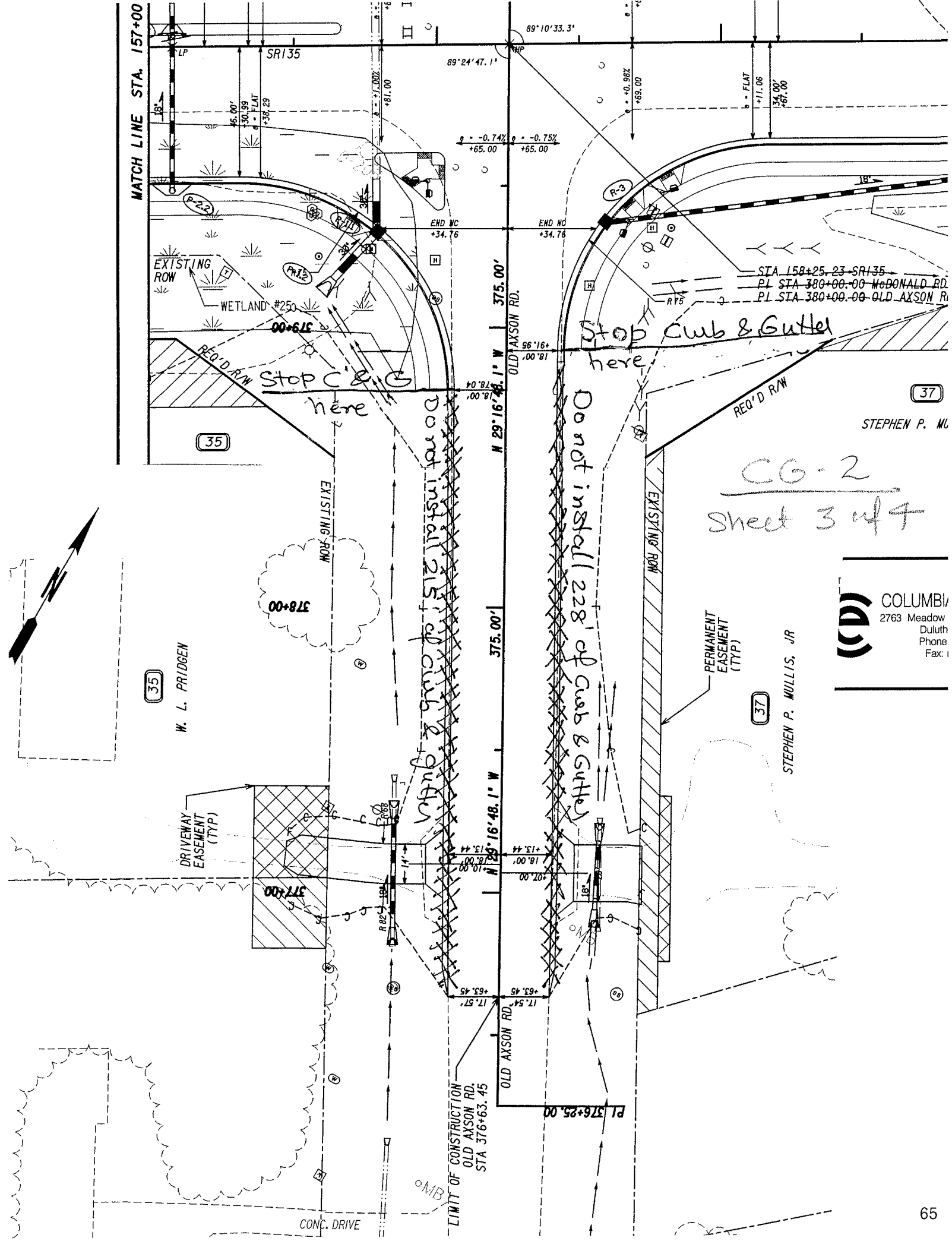
DISCUSSION:

Currently there is no curb and gutter on McDonald Road or Old Axson Road. Storm water sheet flows from the roadway to adjoining properties and wetlands.

There is no significant advantage in constructing approximately 150 additional ft of curb and gutter on both sides of McDonald Road and 220 additional ft of curb and gutter on both sides of Old Axson Road.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 9,384	—	$ 9,384
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 9,384	—	$ 9,384


CG-2
Sheet 2 of 4
Do not install 151 feet of curb on gutter on this side
Do not install 149 feet of curb & gutter on this side
Stop Curb & Gutter here
Stop Curb & Gutter here
LIMIT OF CONSTR
McDONALD RD.
STA 382+70.78
PI 383+00.00
CITY OF DOUGLAS
WETLAND #22
WETLAND #27
WETLAND #25
EXISTING ROW
30' SEWER EASEMENT
STREAM #26
REQ'D R/W
N 29°02'34.3" W
300.00'
375.00'
158+00
159+00
157+00
MATCH LINE STA. 157+00 - SEE DRAWING 13-11
SR135
89°10'33.3"
89°24'47.1"
STA 158+25.23 SR135
PI STA 380+00.00 McDONALD RD
PI STA 380+00.00 OLD AXS
64


MATCH LINE STA. 157+00
SR135
89°10'33.3"
89°24'47.1"
EXISTING ROW
WETLAND #25
379+00
REQ'D R/W
Stop C & G here
Do not install 215' of Curb & Gutter
Do not install 228' of Curb & Gutter
Stop Curb & Gutter here
STA 158+25.23 SR135
PI STA 380+00.00 McDONALD RD.
PI STA 380+00.00 OLD AXSON RD.
OLD AXSON RD.
N 29°16'48.1" W
375.00'
378+00
377+00
W. L. PRIDGEN
STEPHEN P. MULLIS, JR
PERMANENT EASEMENT (TYP)
DRIVEWAY EASEMENT (TYP)
LIMIT OF CONSTRUCTION OLD AXSON RD. STA 376+63.45
PI 376+25.00
CONC. DRIVE
CG-2
Sheet 3 of 4
COLUMBI
2763 Meadow
Duluth
Phone
Fax:

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **CG-2**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
30-in-wide Curb & Gutter, Type 2 (McDonald Road)	LF	300	12.63	3,789			
30-in-wide Curb & Gutter, Type 2 (Old Axson Road)	LF	443	12.63	5,595			
Subtotal				9,384			
Markup (%) at							
TOTAL				9,384			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **CG-3**

DESCRIPTION: **ELIMINATE CURB AND GUTTER, SIDEWALK, AND ASSOCIATED DRAINAGE FROM BAKER HIGHWAY**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (See attached sketch)

The original design includes new curb and gutter and associated drainage on Baker Highway to the limits of construction.

ALTERNATIVE: (See attached sketch)

From SR 135, turning toward Baker Highway, provide curb and gutter to the curb returns. On both sides of Baker Highway, eliminate curb and gutter from the curb returns to the limit of construction. Keep the existing drainage piping.

ADVANTAGES:

- Reduces material cost
- Reduces construction time

DISADVANTAGES:

- None apparent

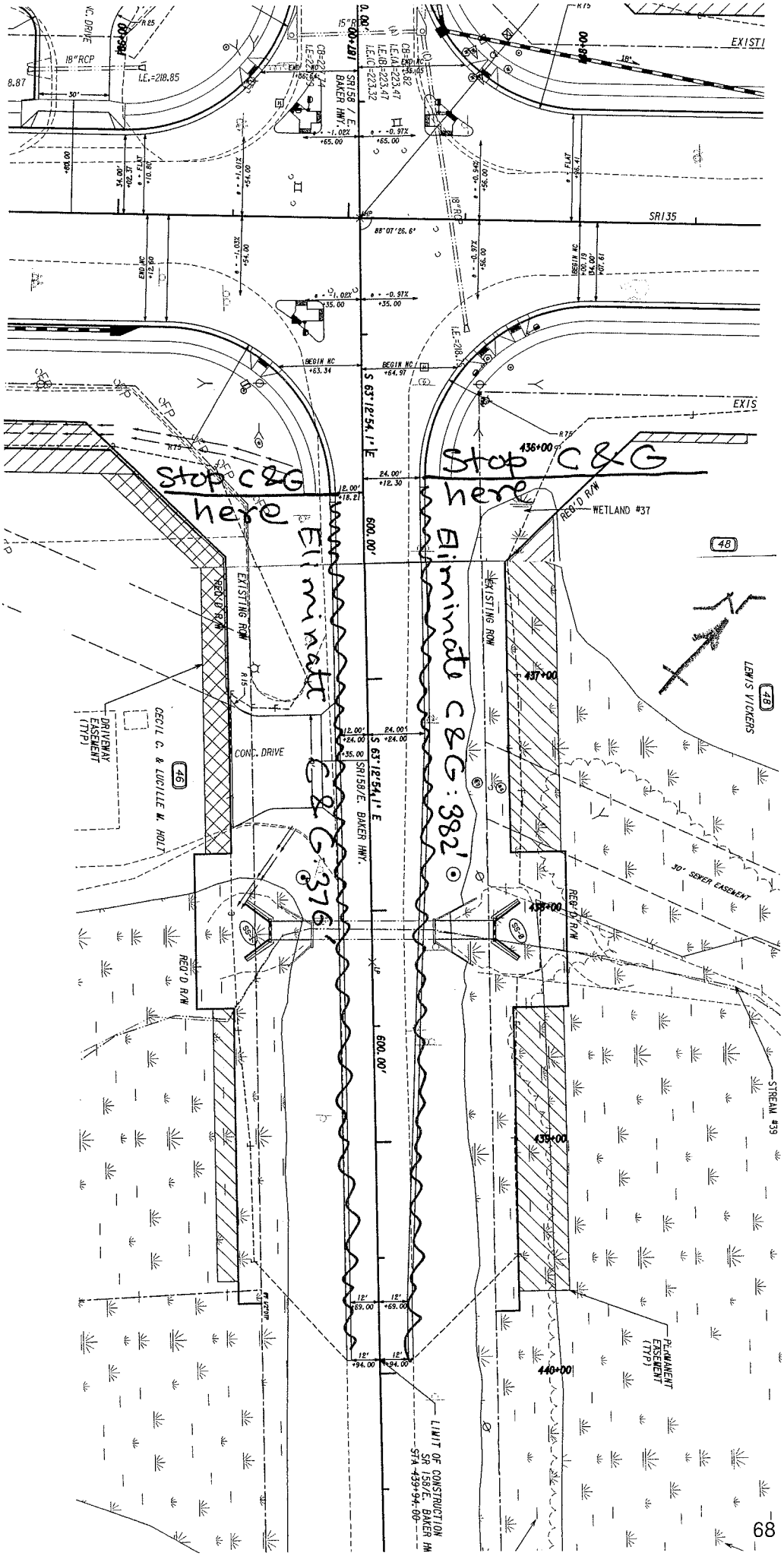
DISCUSSION:

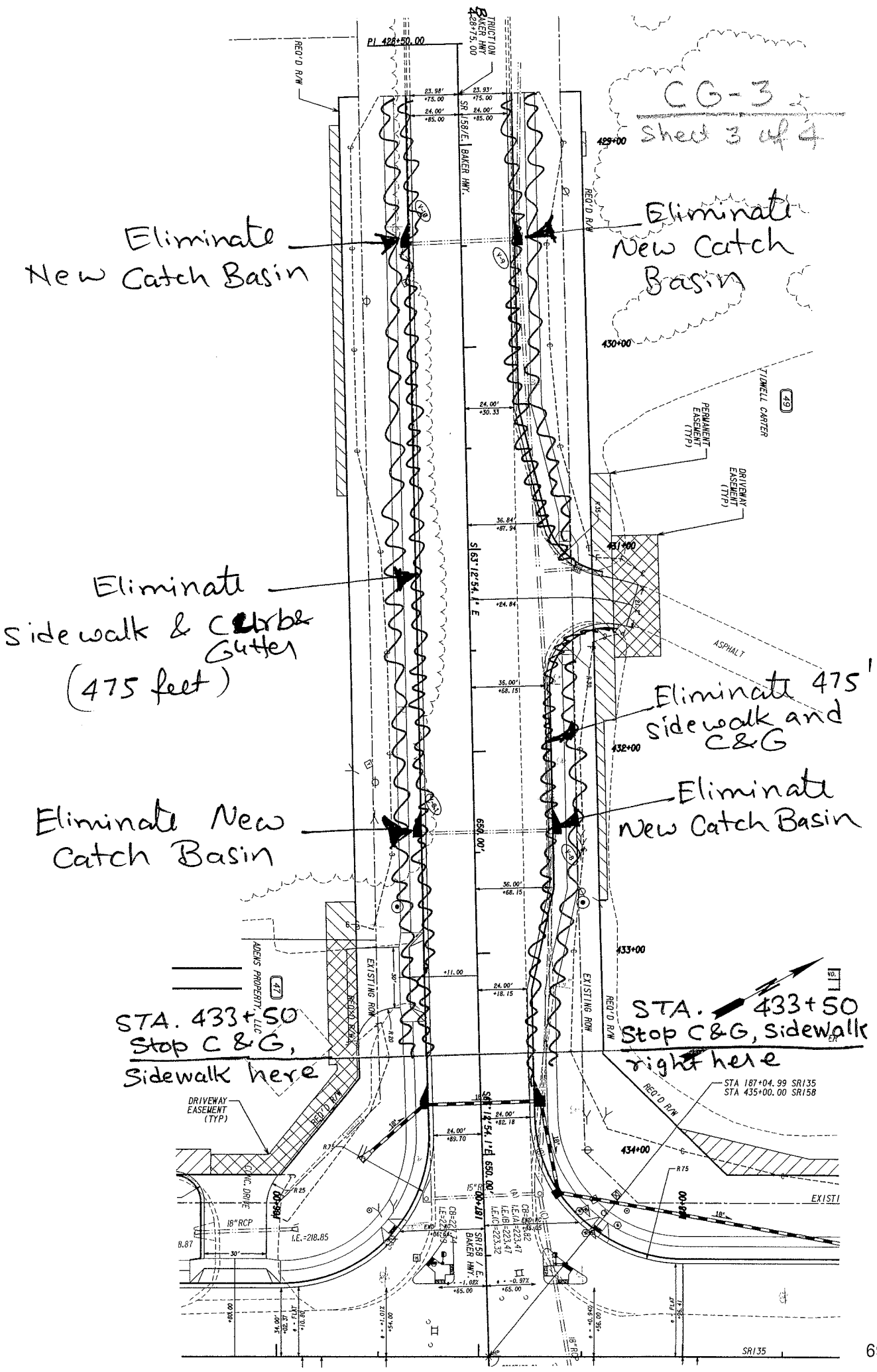
Currently there is no curb and gutter on Baker Highway. Storm water is transported via earthen ditches.

The installation of curb and gutter on Baker Highway involves construction of ditches on both sides and thus does not serve the purpose of channeling storm water.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 48,448	—	$ 48,448
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 48,448	—	$ 48,448

CG-3
Sheet 2 of 4




CG-3
Sheet 3 of 4
Eliminate New Catch Basin
Eliminate New Catch Basin
Eliminate Sidewalk & Curb & Gutter (475 feet)
Eliminate 475' Sidewalk and C&G
Eliminate New Catch Basin
Eliminate New Catch Basin
STA. 433+50 Stop C&G, Sidewalk here
STA. 433+50 Stop C&G, Sidewalk right here
PI 428+50.00
TRUCTION 428+75.00
SR 158/E. BAKER HWY.
REQ'D R/W
EXISTING R/W
PERMANENT EASEMENT (TYP)
DRIVEWAY EASEMENT (TYP)
TIMWELL CARTER
ASPHALT
ADEKS PROPERTY, LLC
DRIVEWAY EASEMENT (TYP)
CONC. DRIVE
18" RCP
I.E.=218.85
SR158 / E. BAKER HWY.
SR135
STA 187+04.99 SR135
STA 435+00.00 SR158
429+00
430+00
431+00
432+00
433+00
434+00
S63°12'54.1"E
650.00'

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **CG-3**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
30-in-wide Curb & Gutter, Type 2 (Baker Hwy)	LF	1,708	12.63	21,572			
4-in thick Concrete Sidewalk	SY	527.7	32.12	16,950			
Catch Basin	EA	4	2,481.45	9,926			
Subtotal				48,448			
Markup (%) at							
TOTAL				48,448			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **S-1**

DESCRIPTION: **ELIMINATE SIDEWALK FROM THE EAST SIDE OF SR 135 BETWEEN GASKIN AVENUE (STA. 123+25) AND THE END OF THE PROJECT (STA. 245+50)**

SHEET NO.: **1 of 2**

ORIGINAL DESIGN:

The original design has a 5-ft-wide concrete sidewalk on both sides of SR 135 throughout the project.

ALTERNATIVE:

Eliminate the 5-ft-wide concrete sidewalk from the east side of SR 135 from Sta. 123+25 to Sta. 245+50 for a total length of 13,275 feet while continuing to maintain the 16-ft-wide shoulder.

ADVANTAGES:

- Reduces material cost
- Reduces construction time

DISADVANTAGES:

- Pedestrians would be required to cross to the west side of the road to use the sidewalk

DISCUSSION:

Since there is very little development on the east side of SR 135 from Gaskin Avenue (Sta. 123+25) to Sta. 245+50, pedestrian movements are not expected. Sidewalk could be installed in the future at the developer's cost as development occurs.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 218,159	—	$ 218,159
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 218,159	—	$ 218,159

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **S-1**

SHEET NO.: **2 of 2**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
5-ft-wide Concrete sidewalk	SY	6,792	32.12	218,159			
Subtotal				218,159			
Markup (%) at							
TOTAL				218,159			

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **S-2**

DESCRIPTION: **REDUCE THE SHOULDER WIDTH FROM 16-FT-WIDE TO 12-FT-WIDE AND ELIMINATE THE SIDEWALK ON THE EAST SIDE OF SR 135 FROM GASKIN AVENUE (STA. 123+50) TO THE END OF THE PROJECT (STA. 145+50)**

ORIGINAL DESIGN:

The original design includes 16-ft wide shoulders and 5-ft-wide sidewalk on both sides of SR 135 for the entire length of the project.

ALTERNATIVE:

Remove the sidewalk and reduce the shoulder width from 16-ft-wide to 12-ft wide on the east side of SR 135 from Gaskin Avenue (Sta. 123+25) to the end of the project (Sta. 145+50). The guardrail is already provided along the new bridge approaches.

ADVANTAGES:

- Reduces material cost
- Sidewalk can be placed in the future on a 12-ft-wide shoulder
- Less right-of-way required

DISADVANTAGES:

- Pedestrians would be required to cross to the west side of the road to use the sidewalk in this area

DISCUSSION:

Since there is very little development on the east side of SR 135 from Gaskin Avenue (Sta. 123+25) to Sta. 245+50, pedestrian movements are not expected. A sidewalk could be installed in the future at the developer's cost as development occurs.

12-ft-wide shoulders reduce material and right-of-way costs while allowing for future sidewalks that can be placed by developers as needed.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 779,667	—	$ 779,667
ALTERNATIVE	$ 0	—	$ 0
SAVINGS	$ 779,667	—	$ 779,667

CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: S-2

SHEET NO.: 2 of 3

$$\text{Fill} = (16'-12')(25')(24550' - 12325')\left(\frac{1}{27}\right)$$

$$= \boxed{45,278 \text{ CY}}$$

$$R/W = (16'-12')(24550 - 12325) = \boxed{48,900 \text{ SF}}$$

SOME MINOR DRAINAGE PIPE LENGTH REDUCTION = $\boxed{\sim 2500}$

$$\text{SIDEWALK REMOVAL} = (24550 - 12325)(5)\left(\frac{1}{9}\right)$$

$$= \boxed{6792 \text{ SY}}$$

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **S-2**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Drainage Pipe	LS	1	2,500.00	2,500			
Earthwork - Fill	CY	45,278	7.90	357,696			
4" Thick Sidewalk	SY	6,792	32.12	218,159			
Right-of-Way	SF	48,900	1.66	81,174			
Right-of-Way Markup	LS	1	120,138	120,138			
Subtotal				779,667			
Markup (%) at							
TOTAL				779,667			

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALT. NO.	DESCRIPTION	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
	GENERAL (G)					
G-1	Use striping to mark all islands at intersections in lieu of providing raised concrete islands.	$118,029	$5,939	$112,090		$112,090
G-2	Cul-de-sac Old Bell Lake Road West and provide Parcel #40 a driveway access at Sta. 169+90.	$273,197	$55,666	$217,531		$217,531
G-3	Make W. Forest Drive a right-in/right-out with a traffic island to improve traffic flow.	DESIGN SUGGESTION				
G-6	Realign Old Bell Lake Road East to eliminate the need for a bridge box culvert.	$591,870	$103,390	$488,480		$488,480
G-7	Tie in Old Bell Lake Road East and West at the existing intersection in lieu of providing the proposed new alignment.	$750,652	$77,307	$673,345		$673,345

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-1**

DESCRIPTION: **USE STRIPING TO MARK ISLANDS AT INTERSECTIONS IN LIEU OF PROVIDING RAISED CONCRETE ISLANDS**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The original design uses raised concrete islands to channelize traffic making right turns at intersections.

ALTERNATIVE:

Use striping to mark islands and channelize traffic making right turns at intersections as is the current practice on this section of roadway.

ADVANTAGES:

- Reduces material cost
- Reduces construction time
- Improves storm water drainage

DISADVANTAGES:

- Pedestrians would not have access to a raised median while waiting for the signal to change at intersections

DISCUSSION:

Striping islands will provide channelized traffic flow while reducing material cost and construction time and improving storm water drainage.

Striping is currently being used for channelized traffic flow on this section of SR 135 with no record of related safety problems.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 118,029	—	$ 118,029
ALTERNATIVE	$ 5,939	—	$ 5,939
SAVINGS	$ 112,090	—	$ 112,090

CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: G-1

SHEET NO.: 2 of 3

Islands at SR 135 / SR 31 intersection:
$\frac{1}{2}(35 \times 35) \times 4 = 2{,}450$ sf

Islands at SR 135 / Walmart Entrance intersection:
$\frac{1}{2}(20 \times 20) \times 4 = 800$ sf

Islands at SR 135 / Gayton Avenue:
$\frac{1}{2}(25 \times 25) \times 4 = 1{,}250$ sf

Islands at SR 135 / Boundary Blvd:
$\frac{1}{2}(25 \times 22) + \frac{1}{2}(18 \times 15) = 410$ sf

Islands at SR 135 / MYA Drive: $\frac{1}{2}(23 \times 20) \times 2 = 460$ sf

Islands at SR 135 / Old Axson Rd: $\frac{1}{2}(25 \times 20) \times 3 = 750$ sf

Islands at SR 135 / SR 158: $\frac{1}{2} \times 20 \times 25 + \frac{1}{2}(15 \times 20) \times 2 = 550$ sf

Island at SR 135 / New Frontage Road: $\frac{1}{2} \times 20 \times 15 = 150$ sf

Islands at SR 135 / Ward Street:

$$\left[\frac{25+85}{2} \times \frac{95+85}{2}\right] + \left[\frac{25+105}{2} \times \frac{110+120}{2}\right] = 12{,}425 \text{ sf}$$

Total area of concrete islands which will be priced at the rate of concrete median ($54.06/SY):

$[2{,}450 + 800 + 1{,}250 + 410 + 460 + 750 + 550 + 150 + 12{,}425] / 9 =$

$2{,}183.\dot{3}$ SY

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-1**

SHEET NO.: **3 of 3**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Concrete Islands	SY	2,183	54.06	118,029			
Thermoplastic White Traffic Striping	SY				2,183	2.72	5,939
Subtotal				118,029			5,939
Markup (%) at							
TOTAL				118,029			5,939

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-2**

DESCRIPTION: **CUL-DE-SAC OLD BELL LAKE ROAD WEST AND PROVIDE PARCEL #40 A DRIVEWAY ACCESS AT STA. 169+90**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN:

The original design relocates a portion of Old Bell Lake Road to the west of SR 135 to eliminate the 55 degree skewed intersection.

ALTERNATIVE:

Eliminate the 55 degree skewed intersection by providing a cul-de-sac at the end of Old Bell Lake Road just to the west of SR 135. Additionally, provide direct driveway access to the proposed business at Parcel #40 near Sta. 169+90, if needed.

ADVANTAGES:

- Eliminates one 55 degree skewed intersection
- Reduces construction cost

DISADVANTAGES:

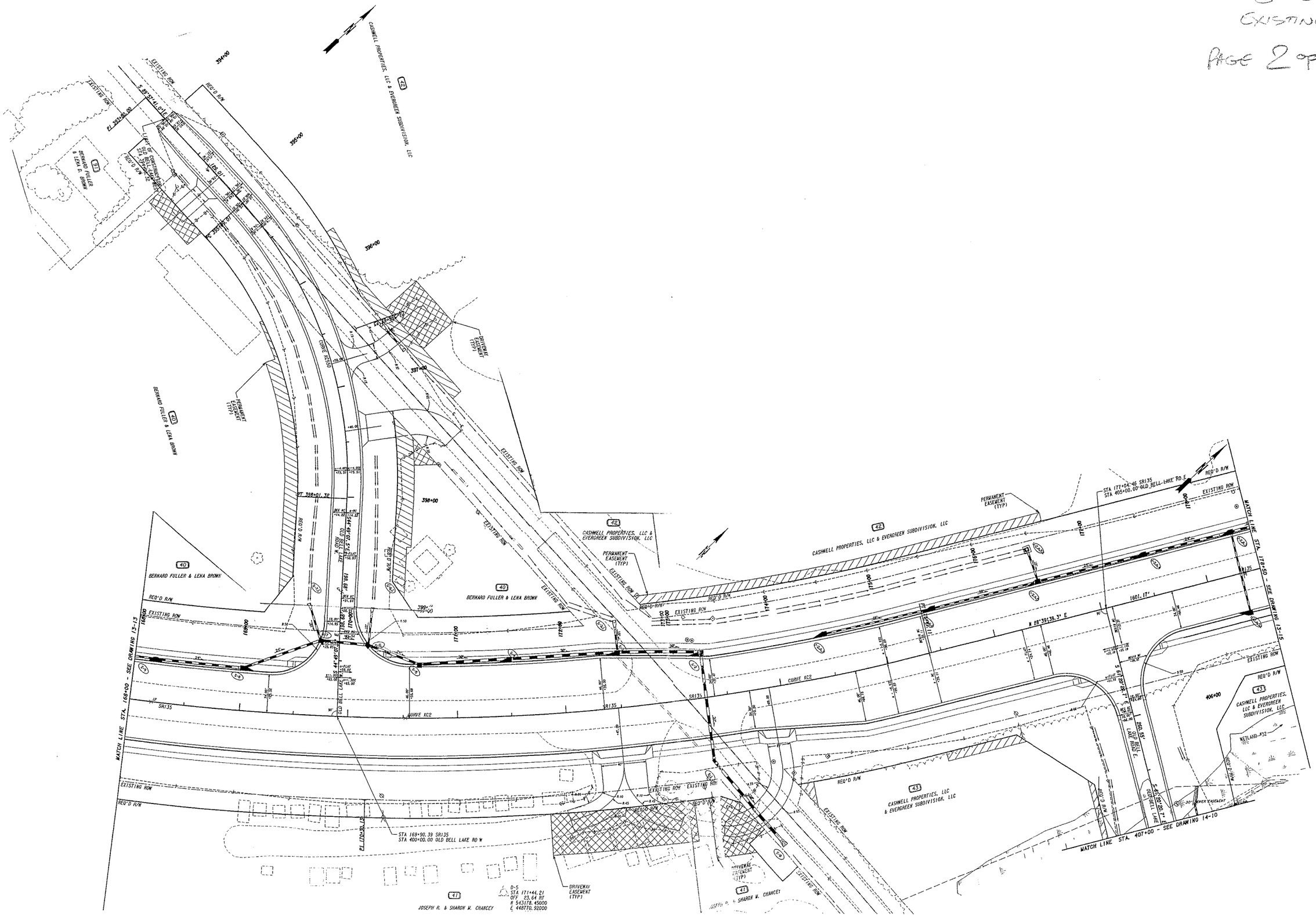
- Eliminates through access along Old Bell Lake Road across SR 135

DISCUSSION:

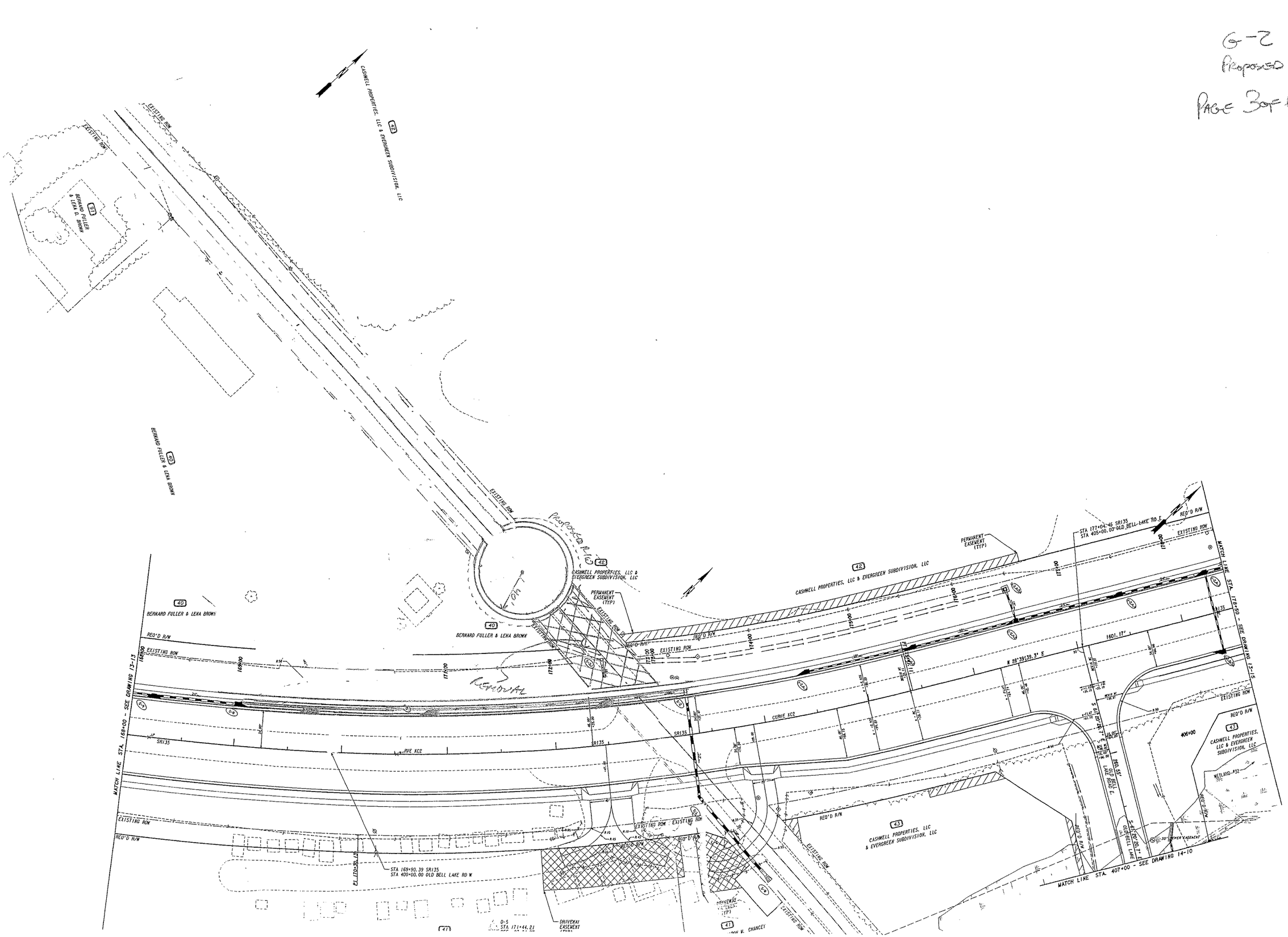
Adding a cul-de-sac to Old Bell Lake Road to the west of SR 135 will enhance safety by eliminating the 55 degree skewed intersection and reducing construction cost as compared with the original design. The two existing property owners will be required to access SR 135 via McDonald Road.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 273,197	—	$ 273,197
ALTERNATIVE	$ 55,666	—	$ 55,666
SAVINGS	$ 217,531	—	$ 217,531

G-2
EXISTING.
PAGE 2 OF 6



G-2
Proposed
Page 3 of 6



CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: G-2

SHEET NO.: 4 of 6

NEW PAVEMENT ADDED BY EXISTING = $[(24')(550') + (12')(250')](\frac{1}{9})$ (Road, Rt Turn)

$\cong$ 1800 SY

CUL-DE-SAC PAVEMENT = $\pi(40')^2(\frac{1}{9}) \cong$ 560 SY

REDUCE 2 DRAINAGE INLETS.

REDUCE 2 FES 18" ϕ

REDUCE 2 x 30'; 18" @ 10' MAX FILL

R/W EXISTING = $(100')(300')$ = 30,000 SF

R/W PROPOSED = $(80')(30')(2)$ = 4,800 SF

ASSUME SAME # OF DRIVEWAYS NEED REPAIR/REDO.

C&G EXISTING = 550' x 2 = 1100'

C&G PROPOSED = $\pi(80')$ = 251'

CHANGES TO EROSION CONTROL UNKNOWN.

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: G-2

SHEET NO.: 5 of 6

(12.5 mm) $\frac{165 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$67.20}{TN} = \$5.44/SY$

(19 mm) $\frac{220 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$80.00}{TN} = \$8.80/SY$

(25 mm) $\frac{440 Lbs}{SY} \times \frac{T}{2000 T} \times \frac{\$85.00}{TN} = \$18.70/SY$

12" GAB = $22.88/SY

$55.82/SY

(Based on GDOT estimate prices)

EARTHWORK Δ: FROM CROSS SECTION = 3700 CY

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-2**

SHEET NO.: **6 of 6**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Full Depth Pavement	SY	1,800	55.82	100,476	560	55.82	31,259
30-in-wide Curb & Gutter, Tp2	LF	1,100	18.51	20,361	251	18.51	4,646
Catch Basin	EA	2	2,285.00	4,570			
Flared End Section, 18-inch	EA	2	754.00	1,508			
18-inch @ 10-ft-length Fill Max. Pipe	LF	60	35.54	2,132			
Earthwork - Cut	CY	3,700	5.58	20,646			
Right-of-way	SF	30,000	1.66	49,800	4,800	1.66	7,968
Right-of-way Markup (148%)	LS	1	73,704	73,704	1	11,793	11,793
Subtotal				273,197			55,666
Markup (%) at							
TOTAL				273,197			55,666

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-3**

DESCRIPTION: **MAKE W. FOREST DRIVE A RIGHT-IN/RIGHT-OUT WITH A TRAFFIC ISLAND TO IMPROVE TRAFFIC FLOW**

SHEET NO.: **1 of 2**

ORIGINAL DESIGN: (See attached sketch)

The original design includes all direction access to SR 135 from W. Forest Drive.

ALTERNATIVE: (See attached sketch)

Limit W. Forest Drive to right-in/right-out access by installing a traffic island.

ADVANTAGES:

- Improves traffic flow
- Enhances safety

DISADVANTAGES:

- Limits access to SR 135

DISCUSSION:

The proximity of W. Forest Drive to Ward Street creates a potential safety and traffic flow concern. Limiting turning movements by installing a traffic island will reduce the potential for traffic accidents in the future.

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

G-3

Proposed

Page 2 of 2

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-6**

DESCRIPTION: **REALIGN OLD BELL LAKE ROAD EAST TO ELIMINATE THE NEED FOR A BRIDGE BOX CULVERT**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (See attached sketch)

The original design includes a four-barrel, 10 ft by 7 ft bridge box culvert for the realignment of Old Bell Lake Road East.

ALTERNATIVE: (See attached sketch)

Realign Old Bell Lake Road East with a short realignment to eliminate the need for a new bridge box culvert.

ADVANTAGES:

- Reduces material cost
- Reduces construction time
- Reduces right-of-way cost
- Reduces environmental impact
- Avoids disturbance to wetlands

DISADVANTAGES:

- None apparent

DISCUSSION:

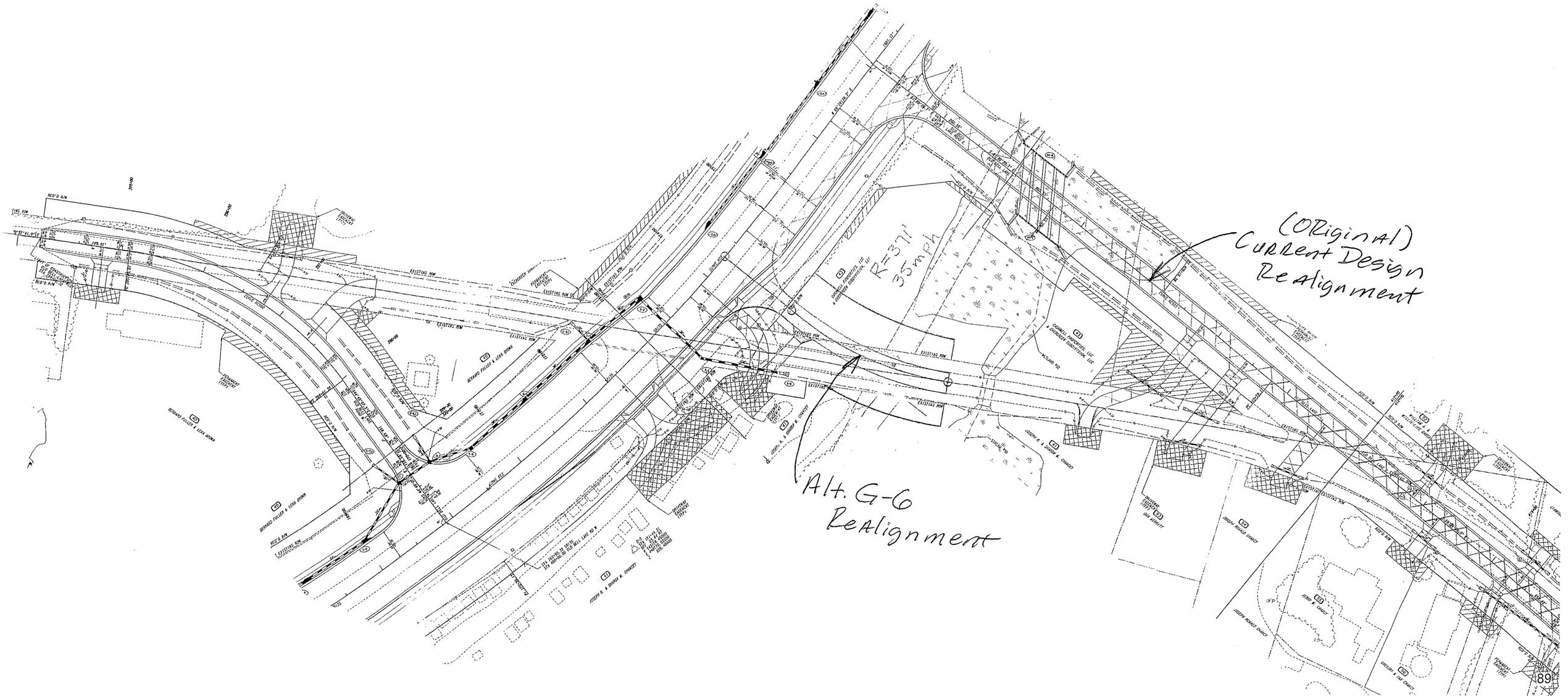
The alternative realignment would improve the skew angle from 55 degrees to 90 degrees and eliminate construction of a bridge box culvert and disturbance to local wetlands. It is important to note that application for an Individual Permit requires demonstration of minimization of all environmental impacts within the project limits.

Additionally, the distance between the intersections of Old Bell Lake Road East and Old Bell Lake Road West is not critical since the left turns from SR 135 are not opposing or "overlapping."

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 591,870	—	$ 591,870
ALTERNATIVE	$ 103,390	—	$ 103,390
SAVINGS	$ 488,480	—	$ 488,480

Sketch Alt. G-6

2/5



PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: G-6

SHEET NO.: 3 of 5

Original Costs for Relocation of Old Bell Lake Road East

Full-Depth Pavement Section

$$\frac{\left[(2'+12'+12'+2') \times 870\right] + \left(130' \times 12'\right) + \left(\frac{100' \times 12'}{2}\right)}{9 \text{ sf/sy}} = 3080 \text{ sy} \leftarrow$$

Overlay Exist. Old Bell Rd East (w/ 165 #/sy)

$$\frac{150' \times 22'}{9 \text{ sf/sy}} = 367 \text{ sy} \leftarrow \quad (\text{use \$ } 5.44/\text{sy from T-1})$$

$$\text{Earthwork} = \frac{870' \times 3'_{\text{Avg.}} \times 50'_{\text{Avg}}}{27 \text{ cf/cy}} \approx 4,840 \text{ cy} \leftarrow$$

$$\text{R/W} = \left[(600' \times 100') + (50' \times 200')\right] = 70,000 \text{ sf} \leftarrow$$

Extended Drives: $(14' \times 330')/9 \text{ sf/sy} = 514 \text{ sy} \leftarrow$ (2 for 6 drives)

(Drives: 165 #/sy ℄ (9.5mm); 220 #/sy (19mm); 6" GAB)

Use $28/sy for Pavement Section:

Clearing & Grubbing: $(900' \times 100') = \frac{90,000 \text{ SF}}{43,560 \text{ SF/AC}} =$

$= 2.1 \text{ ACRES} \leftarrow$

CALCULATIONS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: G-6

SHEET NO.: 4 of 5

4- BARREL - 10'x7' Box Culvert

$$Box_{CONC} = \overset{\text{BARRELS}}{\left(4.8715 \frac{CY}{ft}\right)(\sim 75')} + \overset{\text{PARPET.}}{(52.74\ CY)} = 418\ CY$$

$$Box_{REBAR} = \overset{\text{BARRELS}}{(515)(\sim 75)} + \overset{\text{PARPET}}{(7077\ lbs)} = 45{,}702\ lbs.$$

$$\text{Type II BACKFILL} = (1')(75')(60')\frac{1}{27} = 165\ CY$$

$$Fill = \left(2'\right)\left(\frac{75'+36'}{2}\right)(60')\left(\frac{1}{27}\right) = 246\ CY$$

Alternate Costs for Relocated Old Bell E. Rd

Full depth pavement =

$$\frac{(12' \times 290') + \left(\frac{100' \times 12'}{2}\right) + \left[(280' \times (24'+2'+2')\right]}{9sf/sy} = 1{,}325\ sy \leftarrow$$

$$R/W = \left(\frac{150' \times 25'}{2}\right) + (210 \times 45') = 11{,}325\ SF \leftarrow$$

$$\text{Earthwork} \frac{(3'_{Avg.} \times 50'_{Avg} \times 300')}{27cf/cy} = 1{,}700\ cy \leftarrow$$

$$\text{clearing \& grubbing} \frac{(300' \times 100')}{43{,}560sf/AC} = 0.69\ AC \leftarrow$$

$$\text{Drive:} \frac{(20' \times 100')}{9sf/sy} = 223\ sy$$

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-6**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Original Design:							
Full Depth Pavement	SY	3,080	55.82	171,926			
Asphalt Overlay	SY	367	5.44	1,996			
Earthwork	CY	4,840	5.00	24,200			
Driveway Pavement	SY	514	28.00	14,392			
Clearing and Grubbing	AC	2.1	5,000.00	10,500			
Culvert - Class "A" Concrete	CY	418	587.75	245,680			
Culvert - Bar Inforced Steel	LB	45,702	0.96	43,874			
Type II Foundation Backfill	CY	165	59.77	9,862			
Right-of-Way (Res)	SF	70,000	0.40	28,000			
Right-of-Way Markup (148%)	LS	1	41,440.00	41,440			
Alternative Design:							
Full Depth Pavement	SY				1,325	55.82	73,962
Earthwork	CY				1,700	5.00	8,500
Driveway Pavement	SY				223	28.00	6,244
Clearing and Grubbing	AC				0.69	5,000.00	3,450
Right-of-Way	SF				11,325	0.40	4,530
Right-of-Way Markup	LS				1	6,704.40	6,704
Subtotal				591,870			103,390
Markup (%) at							
TOTAL				591,870			103,390

VALUE ENGINEERING ALTERNATIVE

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-7**

DESCRIPTION: **TIE IN OLD BELL LAKE ROAD EAST AND WEST AT THE EXISTING INTERSECTION IN LIEU OF PROVIDING THE PROPOSED NEW ALIGNMENT**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (See attached sketch)

The original design includes realignment of Old Bell Lake Road on both the east and west approaches.

ALTERNATIVE: (See attached sketch)

Tie in Old Bell Lake Road to SR 135 using the existing alignment and 55 degree skew.

ADVANTAGES:

- Reduces material cost
- Reduces construction time
- Reduces right-of-way cost
- Reduces environmental impact by avoiding disturbance to wetlands

DISADVANTAGES:

- Requires a design variance for a 55 degree skew

DISCUSSION:

A more cost-effective alternative would be to request a design variance to maintain the current 55 degree skew angle at the intersection of Old Bell Lake Road and SR 135. Traffic volumes along Old Bell Lake Road are very low, making it extremely difficult to justify the cost to realign Old Bell Lake Road on both approaches as is currently being proposed by the original design.

It is important to note that turning traffic can be redirected to approximately 90 degrees before turning since the traffic control condition is stopped on the side roads.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 750,652	—	$ 750,652
ALTERNATIVE	$ 77,307	—	$ 77,307
SAVINGS	$ 673,345	—	$ 673,345

Sketch

Alt. G-7 2/

Alternate Design

Tie-in to Existing

Old Bell Lake Road.

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: G-7

SHEET NO.: 3 of 5

Original Cost for Realignment of Old Bell Rd West:

Full-Depth Pavement:

$$\frac{[(24'+2'+2') \times 425'] + (300' \times 12')}{9 sf/sy} = 1,723 sy \leftarrow$$

Overlay existing Rdwy $= \frac{125' \times 28'}{9 sf/sy} = 389 sy \leftarrow$

Earthwork $\frac{(550' \times 50' \text{ avg.} \times 3' \text{ avg.})}{27 cf/cy} = 3,056 cy \leftarrow$

clearing & grubbing: $\frac{(550' \times 100')}{43,560 \frac{sf}{AC}} = 1.26 \text{ AC.} \leftarrow$

R/W (original): $(200' \times 100') + (40' \times 200') + (75' \times 45') =$
$= 31,375 sf \leftarrow$

Drives: $\frac{(14' \times 50') + (75' \times 24')}{9 sf/sy} = 278 sy$ (Pavement) ← (use $25/sy)

Alternate costs to tie in existing Old Bell Lake Rd

Pavement: $\frac{[2 \text{ returns} \times (12' \times 250')] + (50' \times 50')}{9 sf/sy} = 945 sy \leftarrow$

Overlay $= \frac{(200' \times 24')}{9} = 534 sy \leftarrow$

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: G-7

SHEET NO.: 4 of 5

Alternate Costs Continued

Earthwork $\frac{(30' \times 450' \times 3' \times 2 \text{ sid Rds})}{27 \text{ cf/cy}} =$

$= 3{,}000 \text{ cy} \leftarrow$

RIW = (2sides × 12' × 250') = 6000 s.f. ←

Clearing & Grubbing (extra) $= \frac{6000 \text{ sf}}{43{,}560 \frac{\text{sf}}{\text{AC}}} = 0.14 \text{ AC} \leftarrow$

See Alt. G-6 Calculations for Quantities for "Original" Design on the realignment of Old Bell Lake Rd East.

COST WORKSHEET

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441E TO SR 32**
Coffee County, Georgia

ALTERNATIVE NO.: **G-7**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Realign Old Bell Lake Rd. East:							
Full Depth Pavement	SY	3,080	55.82	171,926			
Asphalt Overlay	SY	367	5.44	1,996			
Earthwork	CY	4,840	5.00	24,200			
Driveway Pavement	SY	514	28.00	14,392			
Clearing and Grubbing	AC	2.1	5,000.00	10,500			
Culvert - Class "A" Concrete	CY	418	587.75	245,680			
Culvert - Bar Inforced Steel	LB	45,702	0.96	43,874			
Type II Foundation Backfill	CY	165	59.77	9,862			
Right-of-Way	SF	70,000	0.40	28,000			
Right-of-Way Markup (148%)	LS	1	41,440.00	41,440			
Realign Old Bell Lake Rd. West:							
Full Depth Pavement	SY	1,723	55.82	96,178			
Asphalt Overlay	SY	389	5.44	2,116			
Earthwork	CY	3,056	5.00	15,280			
Driveway Pavement	SY	278	28.00	7,784			
Clearing and Grubbing	AC	1.26	5,000.00	6,300			
Right-of-Way	SF	31,375	0.40	12,550			
Right-of-Way Markup (148%)	LS	1	18,574.00	18,574			
Alternative Design:							
Full Depth Pavement	SY				945	55.82	52,750
Asphalt Overlay	CY				534	5.44	2,905
Earthwork	SY				3,000	5.00	15,000
Clearing and Grubbing	AC				0.14	5,000.00	700
Right-of-Way	SF				6,000	0.40	2,400
Right-of-Way Markup	LS				1	3,552.00	3,552
Subtotal				750,652			77,307
Markup (%) at							
TOTAL				750,652			77,307

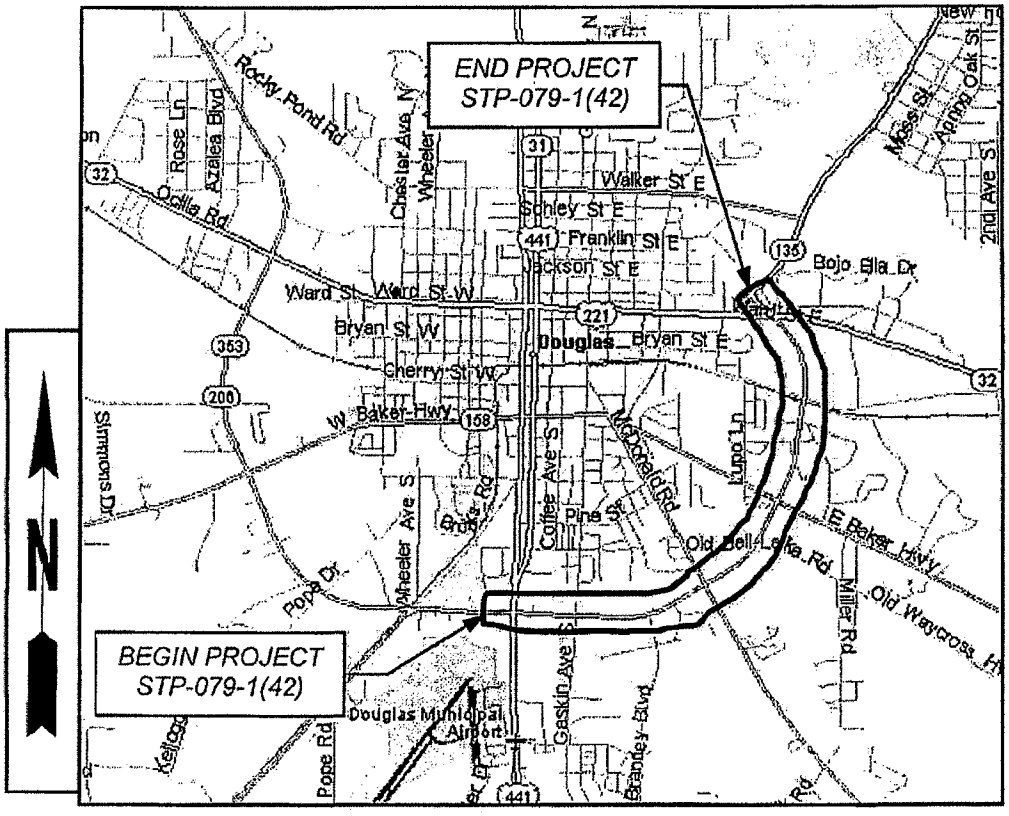
PROJECT DESCRIPTION

Project STP00-0079-01(042), P.I. No. 431830, Widening of SR 135 from SR 31/US441 East to SR 32, proposes to widen the SR 135/Perimeter Road corridor around the City of Douglas in Coffee County from a two-lane and three-lane section to a four-lane divided highway and a five-lane section with a flush median including a new bridge over the CSX Railroad for a total length of 2.72 miles. The project is being designed by Columbia Engineering in concert with GDOT District 4.

Existing Conditions

The existing roadway is a two-lane section with turn lanes at intersections and no sidewalks. The typical section varies from rural to urban. The urban/commercial areas include two 12-ft-wide lanes with 10-ft-wide urban shoulders including 30 in curb and gutter. The rural areas vary between either two 12-ft-wide lanes with 8-ft-wide rural shoulders or two 12-ft-wide lanes with 10-ft-wide rural shoulders. Right-of-way widths vary between 150 ft and 200 ft. Major structures include a double 6 ft by 5 ft box culvert at Sta. 161+00 and a double 5 ft by 5 ft box culvert at Sta. 192+35. Major intersections along the SR 135 project limits include SR 31/US 441/US 221/Peterson Avenue, Gaskin Avenue, McDonald/Old Axson Road, SR 158/East Baker Highway, CSX Railroad Crossing, SR 32/Ward Street, and SR 32/US 221/Westgreen Road. The base year (2013) traffic is 18,300 VPD and the design year (2033) traffic is 24,950 VPD. Truck traffic along the SR 135/Perimeter Road corridor averages 18%. The posted speed varies from 35 mph to 55 mph.

Figure 1: Project Location Sketch



Need and Purpose

This project is needed to address current and future traffic congestion, which will also improve the Level of Service (LOS). The new bridge over the CSX Railroad is needed to accommodate safe travel for school buses during daily trips as well as improve the travel time and operational flow for trucks using SR 135/Perimeter Road.

The purpose of this project is to enhance safety and improve operations and traffic flow along the SR 135/Perimeter Road corridor by providing a railroad overpass and additional through lanes for regional traffic, including cars and trucks traveling on the SR 32 GRIP corridor between I-95 and I-75 and needing to bypass the City of Douglas. In addition, this project will tie into the existing southwestern portion of SR 135/Perimeter Road, which is already a rural five-lane section with a flush median.

Project Location

The entire project is located within the limits of the City of Douglas. This project will begin at Mile Post 8.10+/-, at SR 31/US 441/US 221/Peterson Avenue, where the existing SR 135 rural five-lane section ends and extend approximately 2.72 miles to Mile Post 10.82+/- at SR 32/US 221/Westgreen Road.

Description of the Approved Concept

The approved concept includes widening of SR 135 from a two-lane and three-lane section to a four-lane divided highway and a five-lane section with a flush median. The first typical section is an urban four-lane section with a 20-ft-wide raised median, 16 ft shoulders, curb and gutter, and 5 ft sidewalks beginning just west of the intersection with SR 31/US 441/US 221/Peterson Avenue and extending to the intersection with McDonald/Old Axson Road. The second typical section has an urban five-lane section with a 14-ft-wide flush median, 16-ft shoulders, curb and gutter, and 5 ft sidewalks with provisions for a future 20-ft-wide raised median. The second section extends from McDonald/Old Axson Road to the intersection with SR 158/East Baker Highway, and then moves onto a new location to the east of the existing roadway with a new 300 ft by 94.5 ft +/- bridge over the CSX Railroad. The second section continues along the new location and ties back into SR 135 just before the intersection with SR 32/Ward Street, and then ends at the intersection with SR 32/Westgreen Road.

The following roadway improvements are also included as part of the approved concept:

- Old Bell Lake Road is being realigned with SR 135 to eliminate a 55 degree skewed intersection.
- A new frontage road is being added just to the east of the new bridge to provide access to existing property owners, including a large veterinarian facility located just north of the railroad tracks.
- Curb and gutter and sidewalks are being added to SR 31/US 441/US 221/Peterson Avenue.
- Curb and gutter is being added to McDonald/Old Axson Road, and SR 158/East Baker Highway to improve drainage.
- Raised islands are being added at several intersections to improve traffic flow and enhance pedestrian safety.

The following box culverts are included as part of the approved concept:

- Two double 6 ft by 6 ft box culverts between Sta. 120+50 and Sta. 124+00 for creek realignment
- A new quadruple 10 ft by 7 ft bridge box culvert along realigned Old Bell Lake Road East
- Extensions to existing double box culverts at Sta. 161+00, Sta. 162+00, and Sta. 192+35

Design variances include the following:

- A median opening spacing of less than 1,000 ft from the intersection of SR 31/US 441/US 221/Peterson Avenue to the Wal-Mart main driveway
- A median opening spacing of less than 1,000 ft from the Wal-Mart main driveway to Gaskin Avenue

The estimated total cost of construction is $22,364,706, including right-of-way, based upon the Estimate Report for file "431830-prelim-20090508", not dated. The estimated right-of-way cost is $6,521,150 and the estimated non-reimbursable utilities cost is $5,873,608, as of the start of the VE workshop.

VALUE ANALYSIS AND CONCLUSIONS

INTRODUCTION

This section describes the procedures used during the VE study. It is followed by separate narratives and conclusions including:

- Value Engineering Study Agenda
- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Model
- Function Analysis
- Creative Idea Listing and Evaluation 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.

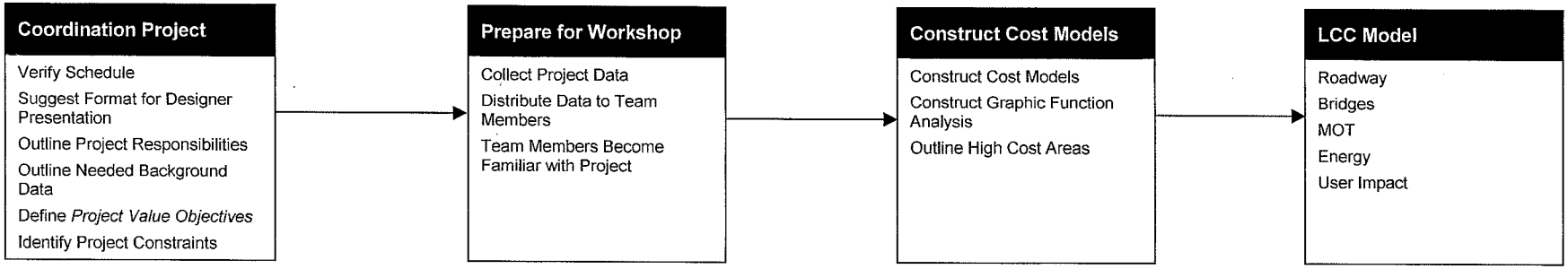
VALUE ENGINEERING WORKSHOP EFFORT

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

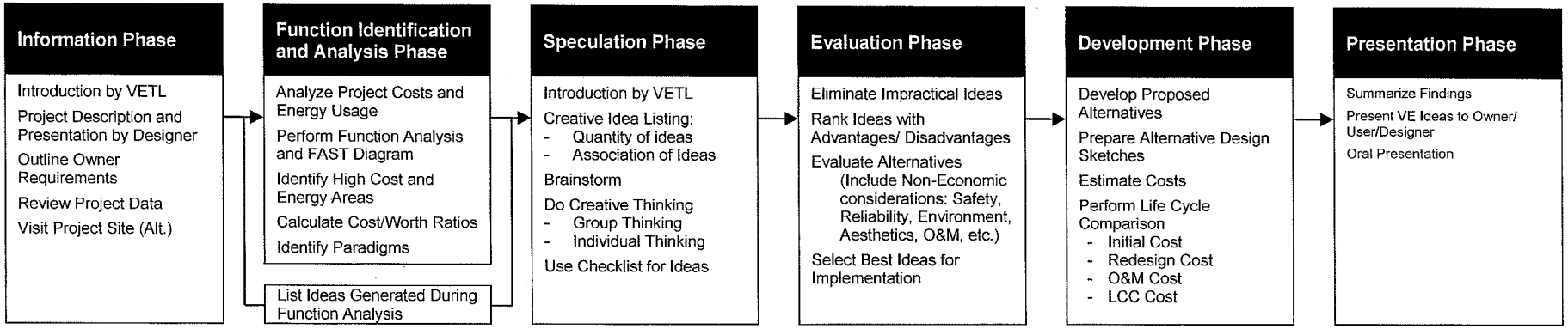
- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

Value Engineering Study Task Flow Diagram

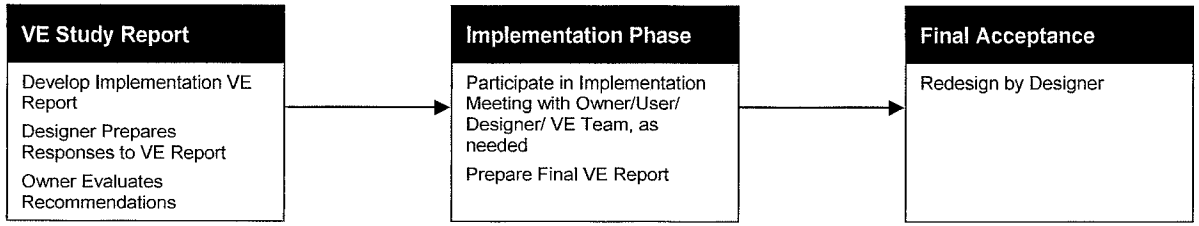
Preparation Effort



Workshop Effort



Post-Workshop Effort



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 design team 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:

- Plan and Profile of Proposed Widening of SR 135 from SR 31/US 441 East to SR 32, Including Railroad Separation, Project STP00-0079-01(042), Coffee County, Georgia, P.I. No. 431830, prepared by Columbia Engineering, dated 6/16/2009;
- Project Concept Report (Approved), Department of Transportation, State of Georgia, Project STP00-0079-01(042), Coffee County, Georgia, P.I. No. 431830, Widening of SR 135 from SR 31/US 441 East to SR 32, Including Railroad Separation, not dated;
- Estimate Report for file "431830-prelim-20090508", prepared by District 4, State of Georgia Department of Transportation, dated 5/8/2009;
- Item Mean Summary for 01/2009 to 12/2008 compiled by the State of Georgia Department of Transportation, dated January 20, 2009;
- Soil Survey for Proposed Widening of SR 135 from SR 31/US 441 East to SR 32, Including Railroad Separation, Project STP-079-1(42), Coffee County, Georgia, P.I. No. 431830, prepared by United Consulting, dated 6/16/2009;
- Standards and Construction Details Binder; prepared by the Department of Transportation, State of Georgia, undated;
- Standard Specifications Construction of Transportation Systems; prepared by the Department of Transportation, State of Georgia, 2001 Edition;
- Design Policy Manual; A Georgia Department of Transportation Publication; Version 2.0, revised May 21, 2007; and
- A Policy on Geometric Design of Highway and Streets; prepared by the American Association of State Highway and Transportation Officials, dated 2004.

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. Creative idea worksheets were organized by project element. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and association of ideas.

Columbia Engineering and GDOT District 4 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.

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 4 or 5. Only those ideas rated 4 or 5 were developed into alternatives. In cases where there was little cost impact but an improvement to the project was anticipated, the designation DS, for design suggestion, was used. The design team should review this listing for possible incorporation of ideas into the project.

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

Development Phase

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

Presentation Phase

The last phase of the VE study was the presentation of the findings. The VE alternatives were screened by the VE team before draft copies of the Summary of Potential Cost Savings worksheets were provided to Columbia Engineering and GDOT District 4 and representatives during an informal presentation on the last day of the workshop. 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 report. It is recommended that personnel from Columbia Engineering and GDOT District 4 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.

VALUE ENGINEERING WORKSHOP AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 3-1/2 day Value Engineering (VE) workshop on Project Number STP-079-1(42), P.I. No. 431830, Widening of SR 135 from SR 31-US 441 East to SR 32, Including Railroad Separation. The project is located in Coffee County, Georgia. The workshop will be held July 20-23, 2009 at the following location:

Georgia Department of Transportation
One Georgia Center (OGC)
5th Floor Conference Room
600 West Peachtree Street
Atlanta, Georgia 30308

The point of contact is Ms. Lisa L. Myers, Transportation Engineer Assistant Administrator, and Value Engineering Coordinator, who can be reached at 404-631-1770.

The design consultants from Columbia Engineering will provide an overview of the project at the beginning of the workshop and be available to answer questions during the VE study effort.

AGENDA

Monday, July 20, 2009

8:30 am - 9:00 am **VE Team Gathers for Introductions**

9:00 am - 9:15 am **Introduction to the Workshop**

- Welcome and opening remarks by GDOT
- Team member introductions
- VE process, workshop organization and agenda
- Objectives of the workshop

9:15 am - 11:00 am **Designer's Overview**

Representatives from Columbia Engineering will provide an overview of the project. After the overview, the design team will answer VE team questions.

11:00 am - 12:00 pm **Function Analysis Phase**

The VE team will perform function analysis by defining the function of each project element or system in the cost model, selecting the primary or basic functions, and determining the worth, or least cost, to provide the function. The goal is to identify those functions or project elements which offer the greatest opportunity for cost reduction or value improvement.

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

1:00 pm - 2:00 pm **Conclude Function Analysis Phase**

2:00 pm – 5:00 pm **Creative Phase**

The 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. The VE Team Leader will be responsible for developing an idea listing for the team.

Tuesday, July 21, 2009

8:00 am – 10:00 am **Conclude Creative Phase**

10:00 am - 11:00 am **Evaluation Phase**

The VE team will analyze the ideas listed in the creative phase and select the best ideas based on project criteria obtained during the design overview and a discussion of the ideas advantages and disadvantages. This will be accomplished by assigning each idea a *Gut Feel Index* rating between 1 and 5, with 5 being the best, based on the team's consensus of how well the idea meets the noted criteria.

The team selects the highly rated ideas for research and development.

11:00 am - 12:00 pm **Development Phase**

The VE team will develop creative ideas into alternate designs. Initial and life cycle cost estimates comparing original and proposed alternatives will be prepared. Selected alternatives will be developed and supported with sketches, calculations and substantiation for change. Suppliers of materials and equipment will be contacted and specialists consulted.

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

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

Wednesday, July 22, 2009

8:00 am - 8:30 am **Review Status and Progress of the Team**

The VE team will assess its status and plan for completion of the alternatives development.

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

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

1:00 pm - 3:00 pm **Continue Development Phase**

3:00 pm - 5:00 pm **Completion of Development Phase**

The VE team will wrap up and complete the development effort. The VE Team Leader will be responsible for reviewing each developed idea for completion and preparing a summary of the VE alternatives in preparation for the out-briefing presentation.

Thursday, July 23, 2009

8:00 am - 9:00 am **Preparation for Presentation Phase**

The VE team will finalize a summary of the VE alternatives with descriptions and initial and life cycle costs for a verbal presentation to interested parties. Summary of Potential Cost Saving worksheets will be copied for distribution to VE presentation attendees.

9:00 am – 10:15 am **Presentation Phase**

The VE team will present its alternatives to GDOT and Columbia Engineering and is available to clarify any points. The process for accepting/rejecting VE alternatives is described and a target schedule for meeting to finalize implementation decisions is established.

10:15 am – 10:30 am **Workshop "Post Mortem" and Closing Remarks**

10:30 am **Adjourn**

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:

Joseph A. Leoni, PE	Roadway QA/QC Manager	ARCADIS-US, Inc.
J. Daniel Hood, PE	Structural Engineer	HNTB
Paresh J. Parikh, PE	Construction/Civil Engineer	Delon Hampton & Associates
Stephen G. Havens, PE, CVS	VE Team Leader	Lewis & Zimmerman Associates

OWNER/DESIGNER PRESENTATION

Representatives from GDOT and Columbia Engineering presented an overview of the project on Monday, July 20, 2009. 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 PRESENTATION

The VE team conducted an informal presentation on Thursday, July 23, 2009 to GDOT and Columbia Engineering. Copies of the draft Summary of Potential Cost Savings worksheets were provided for interim use.

A copy of the meeting participants is attached for reference.

VE STUDY SIGN-IN SHEET

Project No.: STP00-0079-01(042) County: Coffee PI No.: 431830 Date: July 20-23, 2009

NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS	In-briefing 7/20/09	Out-briefing 7/23/09
Lisa L. Myers	00244168	Engineering Services	404-631-1770	lmyers@dot.ga.gov	x	x
Ken Werho	00258268	Traffic Operations	404-635-8144	kwerho@dot.ga.gov	x	
Joe Leoni		ARCADIS-US	770-431-8666	joe.leoni@arcadis-us.com	x	x
Steve Havens		Lewis & Zimmerman	608-438-8227	shavens@lza.com	x	x
Paresh J. Parikh		Delon Hampton & Assoc.	404-419-8434	pparikh@delonhampton.com	x	x
Dan Hood		HNTB	404-946-5734	jhood@hntb.com	x	x
Sam Fleming		Columbia Engineering	770-925-0357	sfleming@columbia-engineering.com	x	
Helen Hawkins		Columbia Engineering	770-925-0357	hhawkins@columbia-engineering.com	x	x
Paul Cook		Columbia Engineering	770-925-0357	pcook@columbia-engineering.com	x	x
Richard W. Mielke		Columbia Engineering	770-925-0357	rmielke@columbia-engineering.com	x	x
Judy Meisner	00326591	GDOT Bridge	404-631-1899	jmeisner@dot.ga.gov	x	
Jeremy Busby	00814098	GDOT-OPD	404-631-1154	jbusby@dot.ga.gov	x	x
Philip P. Alimia	00910548	GDOT-OEL	404-699-4448	palimia@dot.ga.gov	x	

ECONOMIC DATA

The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation, Columbia Engineering, and District 4. 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:	2009
Economic Planning Life:	30 years for Pavement
Economic Planning Life:	50 years for Bridges
Discount Rate/Interest:	0% (Per GDOT)
Inflation/Escalation Rate:	5.00% Rural/10% Urban (Per GDOT)
Engineering and Inspection:	5.00% (Per GDOT)
Construction Contingency:	6.00% (Per GDOT)

COST ESTIMATE SUMMARY AND COST MODEL

The VE team prepared the attached cost model for the project prior to the workshop. The cost model is arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas. 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:

- Typical Sections
    - Lane widths
    - Median widths
    - Shoulder widths
- Bridge
    - Median width
    - Box Culvert vs. Single-Span Bridge
- Drainage
    - Curb and Gutter
    - Drainage Piping Material
- Curb and Gutter
    - Curb and Gutter widths
    - Requirements at Intersections
- Sidewalks
    - Sidewalk Requirements
- General
    - Old Bell Lake Road Alignment

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

Asphaltic Concrete (12.5 mm Mix) Per Square Yard	Asphaltic Concrete (19 mm Mix) Per Square Yard	Asphaltic Concrete (25 mm Mix) Per Square Yard	Graded Aggregate Base (12") Per Square Yard	Total Cost of Full Depth Pavement Section Per Square Yard
$5.44*	$8.80*	$18.70*	$22.88*	$55.82*

Bridge over CSX Railroad = $120/Square Foot**

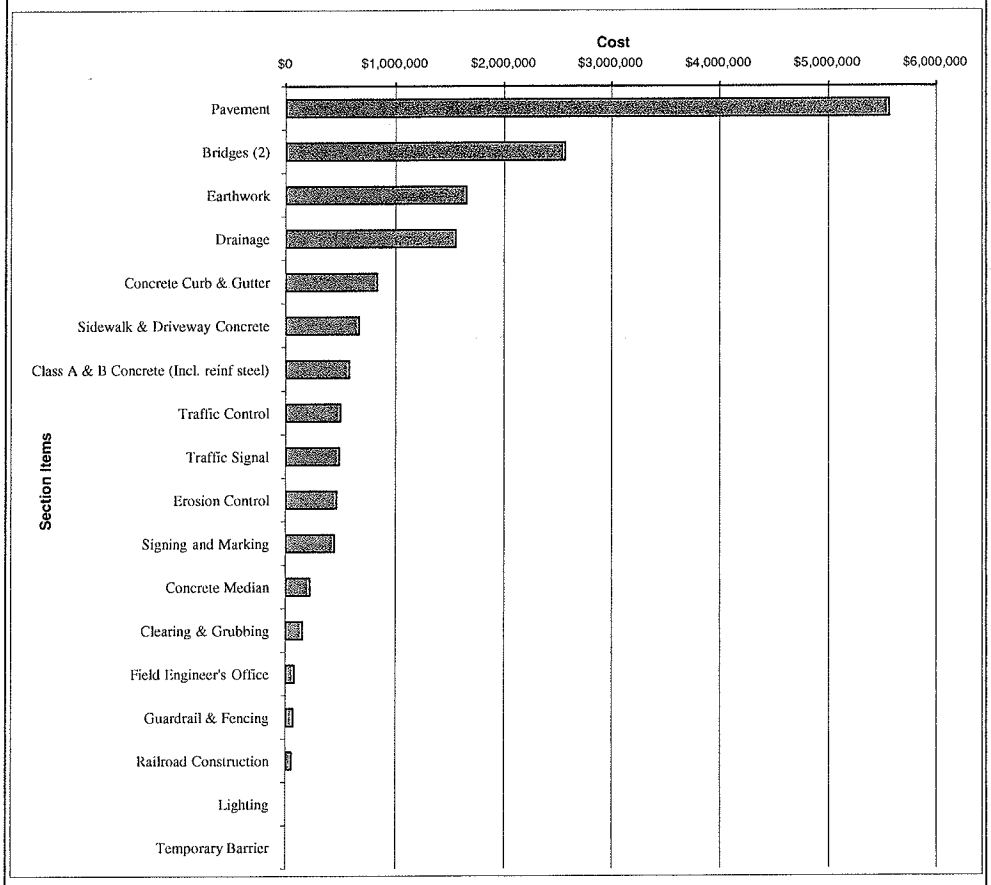
*Reference Value Engineering Alternative T-1 for Pavement unit pricing calculations.
**Reference Value Engineering Alternative B-1 for Bridge Area unit pricing calculations.

COST HISTOGRAM

Project: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia
Design Development Stage

Project No. STP00-0079-01(042) P.I. Number 431830	COST	PERCENT	CUM. PERCENT
Pavement	5,553,986	35.06%	35.06%
Bridges (2)	2,563,044	16.18%	51.23%
Earthwork	1,642,182	10.36%	61.60%
Drainage	1,548,802	9.78%	71.37%
Concrete Curb & Gutter	835,129	5.27%	76.64%
Sidewalk & Driveway Concrete	664,668	4.20%	80.84%
Class A & B Concrete (Incl. reinf steel)	576,310	3.64%	84.48%
Traffic Control	500,000	3.16%	87.63%
Traffic Signal	488,340	3.08%	90.71%
Erosion Control	463,915	2.93%	93.64%
Signing and Marking	444,340	2.80%	96.45%
Concrete Median	218,943	1.38%	97.83%
Clearing & Grubbing	150,000	0.95%	98.78%
Field Engineer's Office	77,628	0.49%	99.27%
Guardrail & Fencing	66,272	0.42%	99.68%
Railroad Construction	50,000	0.32%	100.00%
Lighting	0	0.00%	100.00%
Temporary Barrier	0	0.00%	100.00%
Walls	0	0.00%	100.00%

Construction Total		**$**	**15,843,557**	**100.00%**
Right-of-Way: Land		$	1,912,000	
Right-of-Way: Improvements		$	200,000	
Right-of Way: Relocation		$	105,000	
Right-of-Way: Damage		$	412,500	
Right-of-Way Subtotal		$	2,629,500	
Scheduling Contingency	55.00%	$	1,446,225	
Administration / Court Costs	60.00%	$	2,445,435	
Inflation Factor	0.00%	$	-	**ROW**
Right-of-Way Total		**$**	**6,521,150**	Mark-Up: 148.00%
Reimbursable Utilities Costs		$	-	
Reimbursable Utilities Subtotal		**$**	**-**	
GRAND TOTAL		**$**	**22,364,707**	



Costs in graph are not marked-up.

FUNCTION ANALYSIS

A random function analysis was performed to (1) understand the project purpose and need, (2) define the requirements for each project element, (3) ensure a complete and thorough understanding by the VE team of the basic functions needed to attain the given project purpose and need, (4) identify other goals, and (5) identify secondary functions that should be addressed by the VE team. The Random Function Analysis worksheet completed by the team for the project in its entirety and the various elements follow.

The key opportunity areas for potential cost reduction and value improvement established during the function analysis session (including input from the design team during the design overview) includes the following:

- Typical Sections
  - Increase Space
  - Add Lanes
  - Increase Right-of-Way
- Bridge
  - Accommodate Future Expansion
  - Accommodate Median
  - Accommodate Pedestrians
- Drainage
  - Transfer Stormwater
  - Control Runoff
- Sidewalks
  - Accommodate Pedestrians
- General
  - Improve Alignments
  - Channelize Traffic Flow
  - Enhance Safety

RANDOM FUNCTION ANALYSIS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

SHEET NO.: **1 of 3**

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
Project Purpose and Need Functions	Increase	Capacity	B
	Improve	Access	RS
	Enhance	Safety	B
	Improve	Level of Service	HO
	Accommodate	Pedestrians	S
	Accommodate	Future Traffic	B
	Accommodate	Commercial Development	RS
	Accommodate	Drainage Requirements	RS
	Sustain	Environment	HO
	Eliminate	RR Crossing	B
	Support	Growth	HO
	Improve	Aesthetics	S
	Accommodate	Truck Traffic	B
	Accommodate	Future 2nd RR Track	HO
Right-of-Way Functions **$6.5M**	Increase	Space	RS
	Acquire	Land	RS
Typical Section Functions **$5.6M**	Support	Loads	B
	Increase	Space	B
	Use	Existing Pavement	S
	Add	Lanes	RS
	Support	Future Expansion	S

Function defined as: Action Verb, Measurable Noun

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

RANDOM FUNCTION ANALYSIS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32** SHEET NO.: **2 of 3**
Coffee County, Georgia

DESCRIPTION		FUNCTION		
		VERB	NOUN	KIND
Typical Section Functions (Continued)		Accommodate	Cross Roads	RS
		Accommodate	45 mph Speed Limit	RS
		Accommodate	Driveways	RS
Bridge Functions	**$2.6M**	Span	Railroad Tracks	B
		Support	Load	RS
		Accommodate	2nd Rail	HO
		Accommodate	Median	RS
		Accommodate	Pedestrian Traffic	S
		Accommodate	Turn Lanes	RS
Earthwork Functions	**$1.6M**	Accommodate	Grade Separation	RS
		Accommodate	Additional Lanes	B
		Achieve	Required Profile	RS
		Accommodate	MOT	RS
		Move	Earth	RS
Drainage Functions	**$1.5M**	Control	Runoff	B
		Control	Erosion	B
		Transfer	Stormwater	RS
		Relocate	Creek	RS

Function defined as: Action Verb, Measurable Noun

Kind: B = Basic, S = Secondary, RS = Required Secondary, HO = Higher Order, LO = Lower Order, G = Goal

RANDOM FUNCTION ANALYSIS

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32** SHEET NO.: **3 of 3**
Coffee County, Georgia

DESCRIPTION		FUNCTION		
		VERB	NOUN	KIND
Curb & Gutter Functions	**$0.8M**	Transfer	Storm Water	RS
		Improve	Aesthetics	S
		Prevent	Erosion	RS
Sidewalk Functions	**$0.7M**	Accommodate	Pedestrians	S
Culvert Functions (Concrete)	**$0.6M**	Transfer	Storm Water	B
		Support	Load	RS

Function defined as: Action Verb, Measurable Noun

Kind: B = Basic, S = Secondary, RS = Required Secondary, HO = Higher Order, LO = Lower Order, G = Goal

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the Creativity Phase, numerous ideas were generated using conventional brainstorming techniques. These ideas were recorded and are shown with their corresponding ranking on the attached Creative Idea Listing Worksheets. For the convenience of tracking an idea through the VA process, the ideas were grouped according to the following categories and numbered in the order in which they were conceived. The following letter prefixes were used to identify the categories.

PROJECT ELEMENT	PREFIX
Typical Sections	T
Bridge	B
Drainage	D
Curb and Gutter	CG
Sidewalk	S
General	G

Creative Idea Evaluation

After discussing each idea, the team evaluated the ideas by consensus. This effort produced 19 ideas rated 4 or 5 to research and develop into formal VE alternatives and two ideas to develop as a design suggestion to be included in Section Two. Ideas that were not developed further may have been combined with another related idea or discarded as a result of additional research indicating the concept as not being cost effective or technically feasible. The project team is encouraged to review the Creative Idea Listing since it may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING

PROJECT: **WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32**
Coffee County, Georgia

SHEET NO.: **1 of 2**

NO.	IDEA DESCRIPTION	RATING
	TYPICAL SECTIONS (T)	
T-1	Use a 14-ft-wide flush median in lieu of a 20-ft-wide raised median from Sta. 158+25 to Sta. 45+51.	4
T-2	Use a 18-ft-wide raised median in lieu of a 20-ft-wide raised median from Sta. 107+53 to Sta. 158+25.	4
T-3	Use rural typical sections in lieu of urban typical sections from Sta. 158+25 to Sta. 45+51.	4
T-4	Use 11-ft-wide through lanes in lieu of 12-ft-wide through lanes.	4
T-5	Use 11-ft-wide outside through lanes in lieu of 12-ft-wide outside through lanes.	4
T-6	Use 12-ft-wide shoulders in lieu of 16-ft-wide shoulders throughout the project.	4
T-7	Use 11-ft-wide lanes for all side roads in lieu of 12-ft-wide lanes.	2
	BRIDGES (B)	
B-1	Use an 8-ft-wide raised median on the new bridge in lieu of providing for a future 20-ft-wide raised median.	4
B-2	Use a 14-ft-wide flush median on the new bridge in lieu of providing for a future 20-ft-wide raised median.	4
B-3	Coordinate a construction window with CSX Transportation for girder placement during new bridge construction.	DS
B-4	Construct a bridge over realigned Old Bell Road in lieu of providing four, 10 ft by 7 ft box culverts.	4
	EARTHWORK (E)	
E-1	Use a six percent +/- grade in lieu of a five percent grade for new bridge approaches.	3
	DRAINAGE (D)	
D-1	Use HDPE pipe in lieu of rigid concrete pipe for longitudinal storm drain piping.	5
	CURB AND GUTTER (CG)	
CG-1	Use 24-in-wide curb and gutter in lieu of 30-in-wide curb and gutter.	4
CG-2	Eliminate curb and gutter and associated drainage on select side roads.	4

Rating: 1→2 = Not to be developed 3→4 = Varying degrees of development potential 5 = Most likely to be developed
DS = Design suggestion ABD = Already being done

CREATIVE IDEA LISTING

PROJECT:	**WIDENING OF SR 135 FROM SR 31-US 441 EAST TO SR 32** *Coffee County, Georgia*	SHEET NO.:	**2 of 2**

NO.	IDEA DESCRIPTION	RATING
	SIDEWALKS (S)	
S-1	Eliminate sidewalks from the east side of the new roadway between Gaskin Avenue and the end of the project.	4
S-2	Eliminate sidewalks from the east side of the new roadway between Gaskin Avenue and the end of the project and reduce the shoulders from 16-ft-wide to 14-ft-wide.	4
	GENERAL (G)	
G-1	Use striping to mark all islands in lieu of providing raised concrete islands.	4
G-2	Cul-de-sac Old Bell Road east of SR 135 by providing Parcel #40 with driveway access and eliminate the intersection at Sta. 169+90.	4
G-3	Make W. Forest Drive a right-in/right-out with a traffic island to improve traffic flow.	DS
G-4	Cul-de-sac W. Forest Drive in lieu of providing direct access to SR 135.	2
G-5	Eliminate the right-in/right-out at Parcel #40 to improve traffic flow.	3
G-6	Realign Old Bell Road to eliminate the need for a box culvert.	4
G-7	Maintain Old Bell Road in the existing alignment in lieu of providing the proposed new alignment.	4

Rating: 1→2 = Not to be developed 3→4 = Varying degrees of development potential 5 = Most likely to be developed
DS = Design suggestion ABD = Already being done