



SR 38/US 84 WIDENING
EDS-84(23) and BHN-007-3(25), Clinch/Ware Counties
P.I. Nos. 422120, 422125

Value Engineering Study Report
Preliminary Design Stage

July 2007

Design Consultant



Value Engineering Consultant



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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August 2, 2007

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

re: Project Numbers EDS-84(23) and BHN-007-3(25), US 84/SR 38 Widening and Reconstruction,
Clinch and Ware Counties
Value Engineering Study Report

Dear Ms. Myers:

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

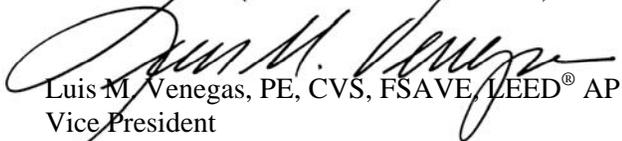
Although the project basically follows the existing alignment of US 84/SR 38 by widening the facility to the north, it bypasses the community of Argyle due to potential conflicts with historical properties. The VE team, in reviewing the approved Environmental Assessment, noted that only one property in Argyle qualifies for historic preservation: Hall-Palmer House. This property is sited a considerable distance from the current US 84/SR 38 alignment. Therefore, the VE team recommends that the facility can be widened without impacting this property and without bypassing Argyle. This also addresses a concern voiced by Argyle residents who fear a bypass would detrimentally impact the community.

Additionally, considering the relatively low traffic count in the design year of 2032 and the fact the specific area between Homerville and Manor has not shown a significant demographic growth, the VE team recommends considering narrower rural medians.

We thank you for your hospitality and for providing the information necessary for the VE team to generate creative, alternative solutions for this project. We look forward to working with you on future assignments and stand ready to provide additional value engineering services.

Sincerely,

LEWIS & ZIMMERMAN ASSOCIATES, INC.


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

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

| | |
|-----------------------------------|---|
| Introduction | 2 |
| Project Description | 2 |
| Construction Costs | 2 |
| Concerns and Objectives | 3 |
| Highlights of the Study | 3 |
| Summary of Potential Cost Savings | 5 |

STUDY RESULTS

| | |
|--------------------------------|----|
| Introduction | 8 |
| Results of the Study | 8 |
| Evaluation of Alternatives | 8 |
| Value Engineering Alternatives | 10 |

PROJECT DESCRIPTION

| | |
|---------------------------------|-----|
| Background/Proposed Revisions | 104 |
| Need and Purpose | 104 |
| Project Location | 104 |
| Description of Approved Concept | 104 |
| Approved Revisions | 105 |
| Construction Costs | 105 |

VALUE ANALYSIS AND CONCLUSIONS

| | |
|---|-----|
| Introduction | 108 |
| Preparation Effort | 108 |
| Value Engineering Workshop Effort | 108 |
| Post-Workshop Effort | 112 |
| Value Engineering Study Agenda | 113 |
| Value Engineering Workshop Participants | 115 |
| Economic Data | 118 |
| Cost Estimate Summary and Cost Histograms | 119 |
| Function Analysis | 124 |
| Creative Idea Listing and Judgment of Ideas | 127 |

EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report summarizes the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT). The subject of the study was US 84/SR 38 Widening and Reconstruction, EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125 in Clinch and Ware Counties, Georgia. The project is being designed by Heath & Lineback Engineers, Inc. (H&L). The workshop was conducted in GDOT offices July 23-26, 2007.

PROJECT DESCRIPTION

The project is located along United States Route (US) 84/State Route (SR) 38 beginning at mile post 15.6 in Clinch County and ending at mile post 3.9 in Ware County. The total length of the project is approximately 11.4 miles. Project EDS-84(23) is located within Clinch and Ware Counties and project BHN-007-3(25) is located in Ware County. The project completes one of the Governor's Road Improvement Program (G.R.I.P.) corridors for this region of southern Georgia.

It commences just west of Woodyard Creek by tying to project EDS-84(20) and widens US 84/SR 38 on the north side by adding a 14-foot flush median urban section and two 12-foot lanes. The alignment avoids the existing CSX railroad and continues to a point east of the Woodyard Creek Overflow Bridge where the urban section changes to a rural road section. At this point, the median tapers to a 32-foot, depressed grassed median, and the alignment continues eastward (widening to the north) until reaching Peters Branch where it shifts north on a new alignment to bypass the town of Argyle. After crossing the existing power easement, the alignment parallels the easement to about County Road (CR) 128 where the alignment returns southward (widening on the north side) just past Polly Branch. The 32-foot depressed median section continues to west of existing CR 27 in Ware County. The median then tapers to a 14-foot flush median with urban shoulders, widening US 84/SR 38 symmetrically. The urban section corresponds to the existing urban section through Manor. The alignment continues through Manor to east of CR 26/Mills Road where the median again tapers to a 32-foot, depressed grassed median. The alignment continues to a point just west of Greasy Branch Creek, east of Manor, where the project ends.

CONSTRUCTION COSTS

The probable cost of construction is \$47,005,784, based on H&L's cost estimate dated June 21, 2007. This comprises construction at \$41,560,784 and right-of-way at \$5,445,000.

During the designer's VE presentation, a new right-of-way cost of \$8,226,109 was provided. Furthermore, the original cost estimate did not take into account the quantity or cost of borrow material. H&L provided the quantities of both borrow and excavation and the VE team calculated

the cost of the borrow material at \$5,437,945 prior to mark-ups. For additional information, please see the Value Analysis & Conclusions section of the report.

Therefore, the final probable cost of construction is \$55,768,733, comprising construction at \$47,542,524 and right-of-way at \$8,226,209.

CONCERNS AND OBJECTIVES

Although the project basically follows the existing alignment of US 84/SR 38 by widening the facility to the north, it bypasses the community of Argyle due to potential conflicts with historical properties. This became a concern as the approved Environmental Assessment indicated that only one property in Argyle qualifies for historic preservation, Hall-Palmer House, and this property is sited a considerable distance from the current US 84/SR 38 alignment. The relocation away from the community is also a concern of Argyle residents who fear a bypass would detrimentally impact the community.

Another concern is that the relatively low traffic count predicted in the design year 2032 coupled with the lack of significant demographic growth in the area between Homerville and Manor does not seem to justify the width of the rural medians. Finally, there is a minor concern for the discrepancy between the drawings and the cost estimate for the thickness of the sidewalks and curb and gutter.

The objective of the VE effort was to identify opportunities that would improve the value of the project while meeting the basic functions. These functions include completing a G.R.I.P. corridor, increasing capacity to foster economic development, and improving safety.

HIGHLIGHTS OF THE STUDY

Listed below are some of the more salient ideas developed as part of the study. The Summary of Potential Cost Savings table follows this narrative and outlines all of the alternatives and design suggestion developed. 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.

The VE team investigated options to improve the seven twin bridges along the widened corridor of US 84/SR 38 in lieu of replacing them. However, only four of the alternatives reduced the cost of the work to be performed. The VE team also sought to reduce the number of bent piles/structures in the waterway to minimize the environmental impact and follow sustainable design philosophies.

Alternatives 4, 9, and 13 replace the three span bridges with three Con/Span[®] culverts, corresponding to Bridge No. 2 over Woodyard Creek Overflow, Bridge No. 4 over Peters Creek, and Bridge No. 6 over Little Suwanee Creek. Savings for these alternatives is in the \$375,000 to \$450,000 range. Alternative No. 12 eliminates one intermediate bent from each of the bridges at Bridge No. 5 over Box Creek and could yield minor savings.

The remaining bridge alternatives describe the potential to eliminate two intermediate bents from each of the twin bridges at Bridge No. 1 over Woodyard Creek/Darby Creek, Bridge No. 7 over Suwanee Creek, and Bridge No. 3 over Cane Creek. Unfortunately, due to an increase in

superstructure work, these alternatives will add money to the project. However, the reduced ecological impact and potential hydraulic improvements may justify further investigation.

With respect to the relatively low volume of traffic anticipated in the design year 2032, Alternative No. 3A eliminates the proposed 14-foot, full-depth pavement median at the beginning of the project as it leaves Homerville in an easterly direction. This narrower roadway section could save over \$2.5 million. In a similar manner, Alternative 3B removes the full-depth pavement of the 14-foot median and substitutes permanent grassing. This could also save about \$2.5 million.

Since the approved Environmental Assessment noted that only one property in Argyle qualifies for historic preservation and this property is sited a considerable distance from the current 38 alignment, the proposed alignment does not need to bypass Argyle. This addresses a concern voiced by Argyle's residents who fear a bypass would be detrimental to the community's survival, and it could also save almost \$8 million (Alternative No. 11). In a like manner, Alternative No. 8 provides a one-way traffic pair wherein the eastbound traffic would continue along the present alignment and the westbound traffic would follow the proposed new alignment along the north side of Argyle paralleling the existing power line easement. Savings for this alternative could reach \$2.8 million.

Since this project has been designated as a bicycle route by the Southeast Regional Development Center Plan, the current design calls for 4-foot bicycle lanes and 5-foot sidewalks on each side of the mainline in the urban areas. Alternative No. 23 provides a 10-foot asphalt, multiuse path on one side of the mainline in the urban areas of the project. This concept could save as much as \$3 million, and since known bicycle usage and pedestrian travel is quite limited, a single multiuse path will provide the necessary functions. If this alternative can not be implemented, a multiuse path on one side of the mainline and a sidewalk on the opposite side is another option that will still save significant money (Alternative No. 25).



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84/SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

| ALT. NO. | DESCRIPTION | PRESENT WORTH OF COST SAVINGS | | | | |
|----------|--|-------------------------------|------------------|----------------------|------------------------|----------------------|
| | | ORIGINAL COST | ALTERNATIVE COST | INITIAL COST SAVINGS | RECURRING COST SAVINGS | TOTAL PW LCC SAVINGS |
| 2 | Eliminate two intermediate bents at Bridge No. 1 - US 84/SR 38 over Woodyard Creek/Darby Creek | \$ 1,439,363 | \$ 1,663,222 | \$ (223,859) | | \$ (223,859) |
| 3A | Eliminate the flush median in its entirety at the beginning of the project | \$ 2,672,443 | \$ - | \$ 2,672,443 | | \$ 2,672,443 |
| 3B | Eliminate the flush median at the beginning of the project and grass the area | \$ 2,662,235 | \$ 253 | \$ 2,661,982 | | \$ 2,661,982 |
| 4 | Replace the existing three-span bridges with three Con/Span@ culverts at Bridge No. 2 over Woodyard Creek Overflow | \$ 700,304 | \$ 247,500 | \$ 452,804 | | \$ 452,804 |
| 8 | Use a one-way pair traffic system around and through Argyle | \$ 7,683,211 | \$ 4,842,218 | \$ 2,840,993 | | \$ 2,840,993 |
| 9 | Replace the existing three-span bridges with three Con/Span@ culverts at Bridge No. 4 over Peters Branch | \$ 653,400 | \$ 279,079 | \$ 374,321 | | \$ 374,321 |
| 10 | Relocate the beginning of the Argyle west bypass | \$ 1,144,507 | \$ 385,032 | \$ 759,475 | | \$ 759,475 |
| 11 | Do not bypass Argyle | \$ 8,654,609 | \$ 730,856 | \$ 7,923,753 | | \$ 7,923,753 |
| 12 | Eliminate one intermediate bent from each bridge at Bridge No. 5 - US 84/SR 38 over Box Creek | \$ 19,305 | \$ - | \$ 19,305 | | \$ 19,305 |
| 13 | Replace the existing three-span bridges with three Con/Span@ culverts at Bridge No. 6 over Little Suwanee Creek | \$ 653,400 | \$ 279,079 | \$ 374,321 | | \$ 374,321 |
| 14 | Eliminate two intermediate bents from each bridge at Bridge No. 7 - US 84/SR 38 over Suwanee Creek | \$ 1,562,676 | \$ 1,810,463 | \$ (247,787) | | \$ (247,787) |
| 15 | Use 14-ft. flush urban median prior to County Road 9/Flagler Crossing | \$ 425,717 | \$ 237,494 | \$ 188,223 | | \$ 188,223 |
| 16 | Continue 55 mph zone and 14-ft. flush median to Greasy Branch Creek | \$ 59,237 | \$ 153,136 | \$ (93,899) | | \$ (93,899) |

STUDY RESULTS

INTRODUCTION

The results of a value engineering (VE) study represent the benefits that can be realized on the project by the owner, users and designer. The results will directly affect the project design and require coordination between the designer, the user and the owner to determine the ultimate acceptance of each alternative.

RESULTS OF THE STUDY

The VE team generated 31 ideas for improvement during the Function Analysis and Speculation Phases of the VE Job Plan. The evaluation of these ideas was based upon their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally accepted standards and procedures, life cycle cost efficiency, safety, maintainability, constructibility and soundness of the idea.

Of the ideas generated, 25 were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded 21 alternatives with an impact on project costs and four design suggestions. These alternatives and design suggestions are presented in detail following this narrative and on the Summary of Potential Cost Savings worksheets. The creative ideas are organized according to the order in which they were originally generated by the VE team during their function analysis and creative sessions.

EVALUATION OF ALTERNATIVES

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

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

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



SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84/SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

| ALT. NO. | DESCRIPTION | PRESENT WORTH OF COST SAVINGS | | | | |
|----------|--|-------------------------------|------------------|----------------------|------------------------|----------------------|
| | | ORIGINAL COST | ALTERNATIVE COST | INITIAL COST SAVINGS | RECURRING COST SAVINGS | TOTAL PW LCC SAVINGS |
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| 3A | Eliminate the flush median in its entirety at the beginning of the project | \$ 2,672,443 | \$ - | \$ 2,672,443 | | \$ 2,672,443 |
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| 11 | Do not bypass Argyle | \$ 8,654,609 | \$ 730,856 | \$ 7,923,753 | | \$ 7,923,753 |
| 12 | Eliminate one intermediate bent from each bridge at Bridge No. 5 - US 84/SR 38 over Box Creek | \$ 19,305 | \$ - | \$ 19,305 | | \$ 19,305 |
| 13 | Replace the existing three-span bridges with three Con/Span@ culverts at Bridge No. 6 over Little Suwanee Creek | \$ 653,400 | \$ 279,079 | \$ 374,321 | | \$ 374,321 |
| 14 | Eliminate two intermediate bents from each bridge at Bridge No. 7 - US 84/SR 38 over Suwanee Creek | \$ 1,562,676 | \$ 1,810,463 | \$ (247,787) | | \$ (247,787) |
| 15 | Use 14-ft. flush urban median prior to County Road 9/Flagler Crossing | \$ 425,717 | \$ 237,494 | \$ 188,223 | | \$ 188,223 |
| 16 | Continue 55 mph zone and 14-ft. flush median to Greasy Branch Creek | \$ 59,237 | \$ 153,136 | \$ (93,899) | | \$ (93,899) |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: **2**

DESCRIPTION: **ELIMINATE TWO INTERMEDIATE BENTS AT BRIDGE**
NO. 1 – US 84/SR 38 OVER WOODYARD CREEK/DARBY
CREEK

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (Sketch attached)

The current design indicates Bridge No. 1 over the Woodyard Creek/Darby Creek as a six-span (30-ft. each) bridge with concrete T-beams and pile bents.

ALTERNATIVE: (Sketch attached)

Use a four-span (45-ft. each) bridge with prestressed concrete (PSC) beams (Type I modified) and pile bents.

ADVANTAGES:

- Fewer intermediate pile bents
- May improve bridge hydraulics
- Reduces construction time
- Simpler to construct
- Complies with contractor preference for rural bridge structures

DISADVANTAGES:

- Superstructure depth will increase
- Clearance between bottom of beam and 100-year high water elevation may be less than required

DISCUSSION:

Even though it will increase the initial cost to implement this alternative, the duration of construction will be reduced, and past records have shown that contractors prefer Type I modified PSC beams vs. T-beams.

The difference in clearance for a 100-year flood event is less than 6 in. (1.67 ft. [original] – 1.23 ft. [alternative] = 0.44 ft. = 5.28 in.). If this is an issue, the bridge profile can be increased to accommodate the new elevation; albeit for additional cost.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,439,363 | — | \$ 1,439,363 |
| ALTERNATIVE | \$ 1,663,222 | — | \$ 1,663,222 |
| SAVINGS | \$ (223,859) | — | \$ (223,859) |



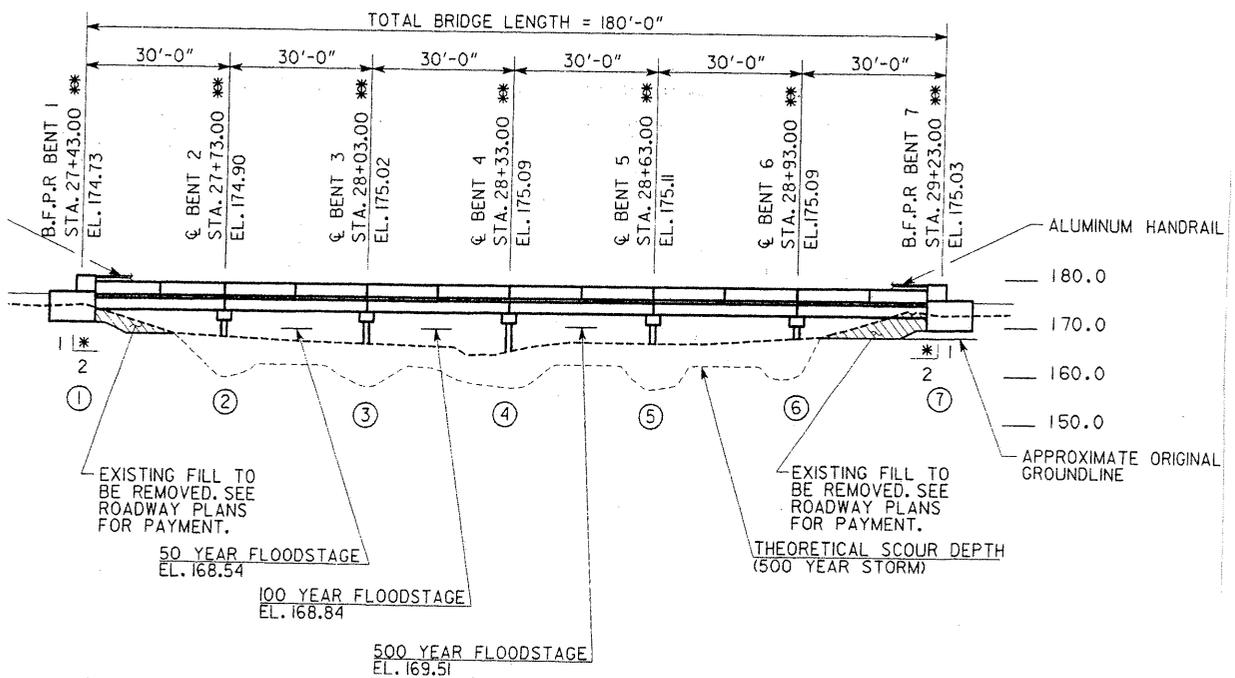
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US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

2

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 6



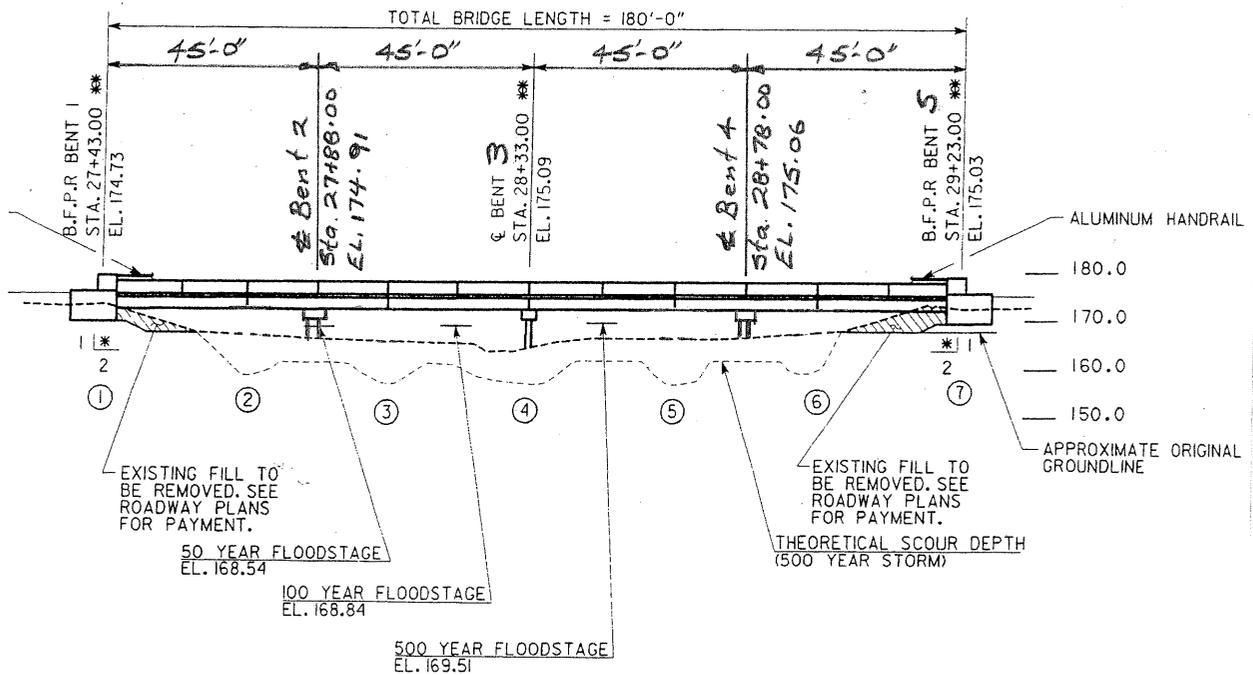
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US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

2

AS DESIGNED ALTERNATIVE

SHEET NO.: 3 of 6



CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

2

SHEET NO.: 4 of 6

Clearance Calculations:

As Designed:

PGL = 174.73'
 Dist. to edge bm. = 40.0'
 Cross slope = 2.0%
 Correction = $40 \times 2\%$
 = 0.8'
 Deck thickness = 2.75'
 Edge bm. elev.
 (Bottom) = $174.73 - 2.75 - 0.8'$
 = 171.18'

500yr HW = 169.51'
 Clearance = $171.18' - 169.51'$
 " = 1.67'
 100yr HW = 168.84
 Clearance = $171.18' - 168.84'$
 " = 2.34'

Alternative:

PGL = 174.73'
 Dist. to edge bm. = 40.0'
 Cross slope = 2.0%
 Correction = 0.8'
 Slab thickness = $0.69' + 0.17'$
 Beam depth = 2.33'
 Tot. deck thick. = 3.19
 Edge bm. elev. = $174.73' - 3.19' - 0.8'$
 = 170.74'

500yr HW = 169.51'
 Clearance = $170.74' - 169.51'$
 " = 1.23'
 100yr HW = 168.84
 Clearance = $170.74' - 168.84'$
 " = 1.90'

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

2

SHEET NO.: 5 of 6

As Designed

$$\begin{aligned} \text{Deck Area} &= 88.42' \times 180' \\ &= 15915.6 \text{ sf} \end{aligned}$$

Alternative

- Class A Concrete:

$$\text{Pile Cap} = 3.25' \times 2.0' \times 84' \times \frac{1}{27} \times 2 \text{ ea.}$$

$$\text{Pile Cap} = 40.44 \text{ cu. yd.}$$

- 16" sq. piles:

$$\text{Length} = 9 \text{ ea} \times 2 \text{ bents} \times 20'$$

$$\text{Length} = 360'$$

- Deck Area = 15915.6 sf.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: **3A**

DESCRIPTION: **ELIMINATE FLUSH MEDIAN IN ITS ENTIRETY AT THE**
BEGINNING OF THE PROJECT

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The present design provides a 14-ft. paved median between the end of Bridge No. 1 over Woodyard Creek/Darby Creek at Station (STA) 29+23.00 to the beginning of Bridge No. 2 over Woodyard Creek Overflow at STA 72+56.00.

ALTERNATIVE: (Sketch attached)

Eliminate the 14-ft. flush, paved median between STA 29+23.00 and 72+56.00. All else to remain the same.

ADVANTAGES:

- Reduces right-of-way costs
- Reduces construction cost
- Simplifies construction
- Reduces construction time

DISADVANTAGES:

- Slight loss in safety – reduced width between opposing traffic
- Providing turning lanes in the future (if ever needed) would be expensive

DISCUSSION:

This roadway segment has limited population that would likely use the center lane. Elimination of the paved median will not hamper the basic functions of the project to increase capacity and complete a G.R.I.P. corridor.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 2,672,443 | — | \$ 2,672,443 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 2,672,443 | — | \$ 2,672,443 |

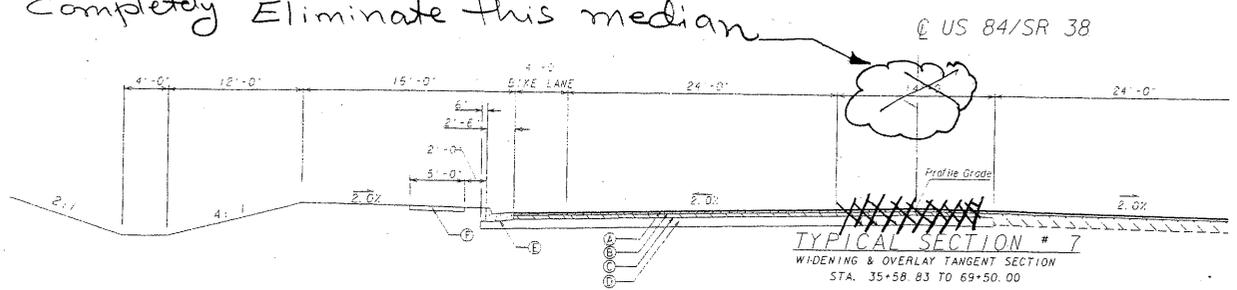
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Final Design Stage

ALTERNATIVE NO.:
3A

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 4

From STA. 29+23.00 to STA. 72+56.00,
 Completely Eliminate this median



REQUIRED PAVEMENT

- (A) RECYCLED ASPH CONC 12.5 MM SUPERPAVE, GP 2 ONLY, INCL BITUM MATL & H LIME (65 LBS/SY) (MIX DES LEVEL B)
- (B) RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1OR 2, INCL BITUM MATL & H LIME (220 LBS/SY) (MIX DES LEVEL B)
- (C) RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1OR 2, INCL BITUM MATL & H LIME (330 LBS/SY) (MIX DES LEVEL A)
- (D) GR ADGR BASE CRS, 8 INCH, INCL MATL
- (E) CONC CURB & GUTTER, 6 IN X 30 IN, TP 2
- (F) 4' CONCRETE SIDEWALK

CALCULATIONS



PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

3A

SHEET NO.: 3 of 4

The project is stated as 11.62 miles of widening of US 84/SR 38 from two to four lanes. However, the project cost includes improvements on minor connecting roads. So lets say that the project cost is for 12 miles of road.

From 29+23.00 to 72+56.00, the length of the segment under consideration is: 4,333' or 0.827 mi or 7% of the total 12 miles.

Total cost of pavement: \$21,739,218

Cost of pavement per mile: $21,739,218 \div 12 = 1,811,601.50$

Total cost of Roadway: \$7,952,822

Cost of roadway per mile: $7,952,822 \div 12 = 662,735$

Total Cost of R/W: \$369,300

Cost of R/W per acre: $369,300 \div 176 = 2,100$

[By reducing R/W width by 14', you will still not be able to save a couple of residences & sheds. Therefore, the cost of improvements, relocation & damages is excluded from the cost]

The R/W acreage saved is: $14 \times 4,333 = 60,662$ or 1.4 acres

Project Const. Cost per mile is: $(37,782,531 + 5,437,945) / 12 = 3,601,706$
 (Earthwork)

VALUE ENGINEERING ALTERNATIVE



PROJECT: EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 3B

DESCRIPTION: ELIMINATE PAVEMENT FROM FLUSH MEDIAN AT THE
BEGINNING OF THE PROJECT AND GRASS THE AREA

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (Sketch attached)

The present design provides a 14-ft. paved median between the end of Bridge No. 1 over Woodyard Creek/Darby Creek at Station (STA) 29+23.00 to the beginning of Bridge No. 2 over Woodyard Creek Overflow at STA 72+56.00.

ALTERNATIVE: (Sketch attached)

Eliminate the pavement from the median between STA 29+23.00 and 72+56.00 and provide grassing in this area.

ADVANTAGES:

- Reduces construction cost
- Reduces construction time
- Provides a more sustainable design

DISADVANTAGES:

- Increases cost to provide turning lanes in the future (if ever needed)

DISCUSSION:

Since this segment of US 84/SR 38 hardly has any turning lane users, eliminating the pavement in the median will not affect the basic functions of the project to increase capacity and complete a G.R.I.P. corridor.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 2,662,235 | — | \$ 2,662,235 |
| ALTERNATIVE | \$ 253 | — | \$ 253 |
| SAVINGS | \$ 2,661,982 | — | \$ 2,661,982 |



PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

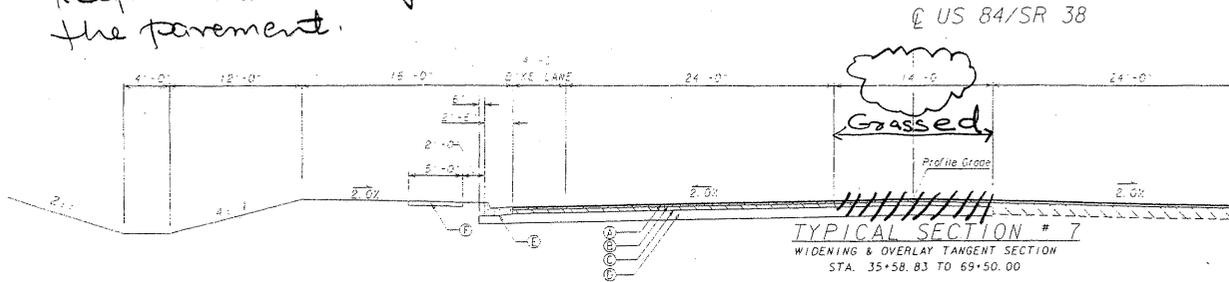
3B

AS DESIGNED

ALTERNATIVE

SHEET NO.: 2 of 4

From STA. 29+23.00 to STA. 72+56.09
 Keep the median grassed, but eliminate
 the pavement.



REQUIRED PAVEMENT

- (A) RECYCLED ASPH CONC 12.5 MM SUPERPAVE, GP 2 ONLY, INCL BITUM MATL & H LIME (165 LBS/SY) (MIX DES LEVEL B)
- (B) RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME (220 LBS/SY) (MIX DES LEVEL B)
- (C) RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME (330 LBS/SY) (MIX DES LEVEL A)
- (D) GR AGGR BASE CRS, 8 INCH, INCL MATL
- (E) CONC CURB & GUTTER, 6 IN X 30 IN, TP 2
- (F) 4' CONCRETE SIDEWALK

CALCULATIONS



PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:
3B

SHEET NO.: 3 of 4

| NO | LOCATION | FILE (YD) | CUT (YD) |
|-------------------------------|--------------|---------------|--------------|
| 1 | US1/SR4 | 662171 | 89222 |
| 2 | CR 128 | 3730 | 2952 |
| 3 | CR 194 | 121 | 298 |
| 4 | CR 136 | 149 | 263 |
| 5 | CR 141 | 92 | 135 |
| 6 | CR 134 | 11630 | 3645 |
| 7 | CR 143 | 154 | 44 |
| 8 | CR 518 | 1005 | 609 |
| 9 | CR 9 | 57 | 394 |
| 10 | CR 27 | 2737 | 1212 |
| 11 | CR 24 | 21 | 194 |
| 12 | CR 472 SOUTH | 1035 | 29 |
| 13 | CR 472 NORTH | 29 | 68 |
| 14 | CR 26 NORTH | 12 | 182 |
| 15 | CR 26 SOUTH | 405 | 251 |
| 16 | CR 517 | 39 | 235 |
| TOTAL (YD³) | | 683387 | 99733 |

$$- 84,773 \quad (.85) \quad 84,773$$

$$598,614$$

Multiply by: (1.15) = **688,917 (BORROW)**

$$\times 7.90 (\$/cy)$$

$$\underline{\$ 5,437,945}$$

$$\div 12 \text{ miles}$$

$$\underline{\$ 453,162 \text{ per mile}}$$

See sheet 3 of 3A alternative for other
 detail roadway & pavement cost per mile.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 4

DESCRIPTION: **REPLACE THE EXISTING THREE SPAN BRIDGES WITH**
THREE CON/SPAN® CULVERTS AT BRIDGE NO. 2 –OVER
WOODYARD CREEK OVERFLOW

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The current design indicates Bridge No. 2 over the Woodyard Creek Overflow as a three-span (30-ft. each) bridge with concrete T-beams and pile bents.

ALTERNATIVE: (Sketch attached)

Use a three-span (32-ft. x 10-ft.) Con/Span® culvert for Bridge No. 2.

ADVANTAGES:

- Reduces construction time
- Simplifies construction
- Reduces initial cost

DISADVANTAGES:

- May not satisfy the hydraulic requirements

DISCUSSION:

The typical cost of a Con/Span® foundation could not be determined as the Bridge Foundation Investigation Report (BFI) was not available. Although not included, it appears that with the inclusion of the foundation, the Con/Span® will be more economical to construct than the three-span twin bridges.

Although Con/Span® is addressed with this alternative, other manufacturers are available that can provide similar products.

The lump sum numbers in the cost estimate for Con/Span® and its installation were obtained from Contech's representative Steve Poole at 678-662-9331.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 700,304 | — | \$ 700,304 |
| ALTERNATIVE | \$ 247,500 | — | \$ 247,500 |
| SAVINGS | \$ 452,804 | — | \$ 452,804 |



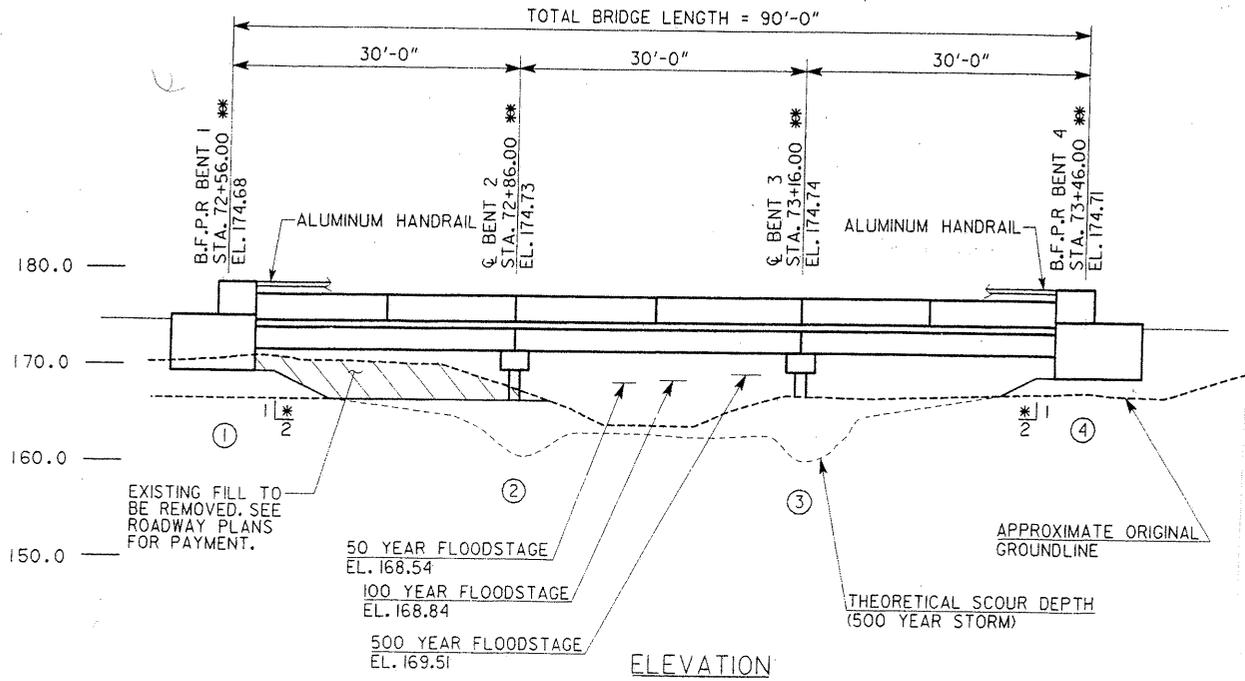
PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

4

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 5



SKETCHES

PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

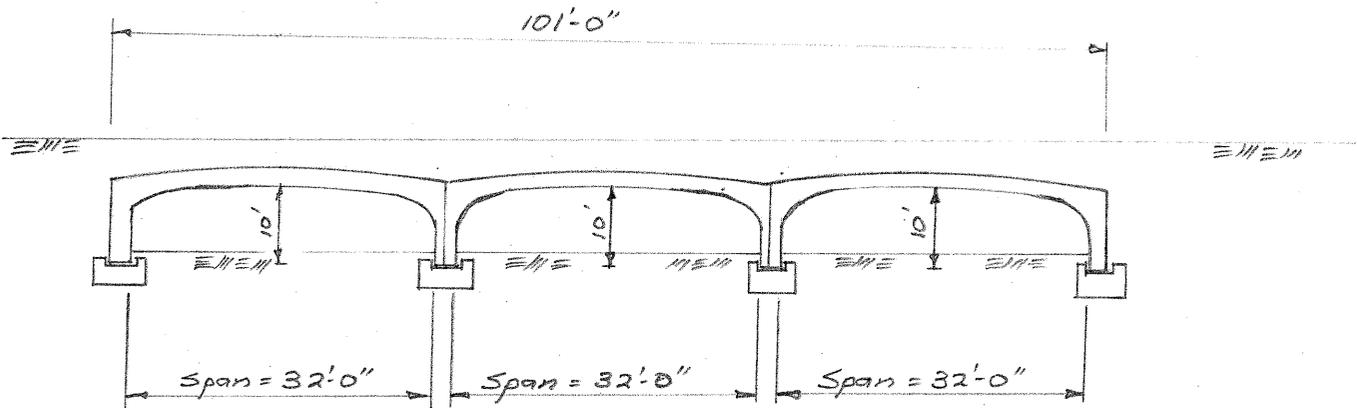
ALTERNATIVE NO.:

4

AS DESIGNED

ALTERNATIVE

SHEET NO.: 3 of 5



CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

4

SHEET NO.: 4 of 5

As Designed:

$$\begin{aligned} \text{Deck Area} &= 88.42' \times 90' \\ &= 7,958 \text{ sf} \end{aligned}$$

Alternative:

$$\begin{aligned} \text{Conspan Cost} &= \$195,000 \\ \text{2 day labor cost} &= \$30,000 \\ \text{Foundation cost} &= \text{Not included.} \end{aligned}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: **8**

DESCRIPTION: **USE A ONE-WAY PAIR TRAFFIC SYSTEM AROUND AND THROUGH ARGYLE**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN:

The present design calls for bypassing the community of Argyle on the north side with all four new lanes of traffic paralleling the existing high-voltage power line.

ALTERNATIVE:

Provide a one-way pair traffic system through and around the community of Argyle. The eastbound traffic would use the existing roadway through Argyle and the westbound traffic would be on the proposed new location/alignment on the north side of town.

ADVANTAGES:

- Reduces right-of-way costs
- Retains existing pavement
- Reduces construction cost
- Helps satisfy local opposition
- Improves safety by segregating opposing traffic
- Eliminates conflicting traffic to left turns

DISADVANTAGES:

- None apparent

DISCUSSION:

The one-way pair system would most likely have local support because it would bring some traffic through Argyle.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 7,683,211 | — | \$ 7,683,211 |
| ALTERNATIVE | \$ 4,842,218 | — | \$ 4,842,218 |
| SAVINGS | \$ 2,840,993 | — | \$ 2,840,993 |

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

8

SHEET NO.: 2 of 3

Original: Cost for BYPASS

\$3,601,706 / (includes BORROW Adjustment)
 mile

$$\text{STA } 255+00 \text{ to STA } 355+75 = \frac{10,075}{5280} = 1.908 \text{ miles}$$

$$1.908 \text{ miles} \times \$3,601,706 = \$6,872,570 \leftarrow$$

Alternative:

West bound Lanes on New location approximately same proposed Bypass Alignment to could move closer to downtown Argyle, just south of the GA Power Easement.

$$\text{Westbound cost } \$3,601,706 / 2 = \$1,800,853$$

$$1.908 \text{ miles} \times \$1,800,853 = \$3,436,030 \leftarrow$$

Eastbound Lanes

Eastbound lanes are along exist Rday thru town overlay (9.5mm) $((24' + 2' + 6.5')) \times (9,530') \times .125' \times .076 \frac{T}{CF} = 29,431 \text{ tons}$

$$\text{Asph Leveling: } 1,309,725 \frac{SF}{CF} \times .167' \times .076 \frac{T}{CF} = 3,931 \text{ tons}$$

EARTHWORK: to build adequate shoulders approaching & leaving ARGYLE. $(85' \times 4' \times 6800') / 27 \approx 9,000 \text{ C.Y.} \leftarrow$

$$\text{Clearing \& Grubbing } (80' \times 7000') / 43560 \frac{SF}{AC} = 14.5 \text{ ac} \leftarrow$$

$$\text{Erosion \& Grassing} = 14.5 \text{ ac} \leftarrow$$

$$\text{Sign \& Marking} = \$293,816 / 11.42 \frac{\text{mi}}{2 \text{ (one-way)}} = \$12,860 / \text{mi} \leftarrow$$

$$\text{Drainage: } \$1,235,370 / 11.42 \text{ mi} / 2 \text{ one way} = \$54,000 / \text{mi} \leftarrow$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 9

DESCRIPTION: **REPLACE THE EXISTING THREE-SPAN BRIDGES WITH**
THREE CONSPAN[®] CULVERTS AT BRIDGE NO. 4 OVER
PETERS BRANCH

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The current design indicates Bridge No. 4 over Peters Branch as a three-span (30-ft. each) bridge with concrete T-beams and pile bents.

ALTERNATIVE: (Sketch attached)

Use three (32-ft. x 10-ft.) Con/Span[®] culverts for Bridge No. 4.

ADVANTAGES:

- Reduces construction time
- Simplifies construction
- Reduces initial cost

DISADVANTAGES:

- May not satisfy the hydraulic requirements

DISCUSSION:

The typical cost of a Con/Span[®] foundation could not be determined as the Bridge Foundation Investigation Report (BFI) was not available. Although not included, it appears that with the inclusion of the foundation, the Con/Span[®] will be more economical to construct than the three-span twin bridges.

Although Con/Span[®] is addressed with this alternative, other manufacturers are available that can provide similar products.

The lump sum numbers in the cost estimate for Con/Span[®] and its installation were obtained from Contech's representative Steve Poole at 678-662-9331.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 653,400 | — | \$ 653,400 |
| ALTERNATIVE | \$ 279,079 | — | \$ 279,079 |
| SAVINGS | \$ 374,321 | — | \$ 374,321 |

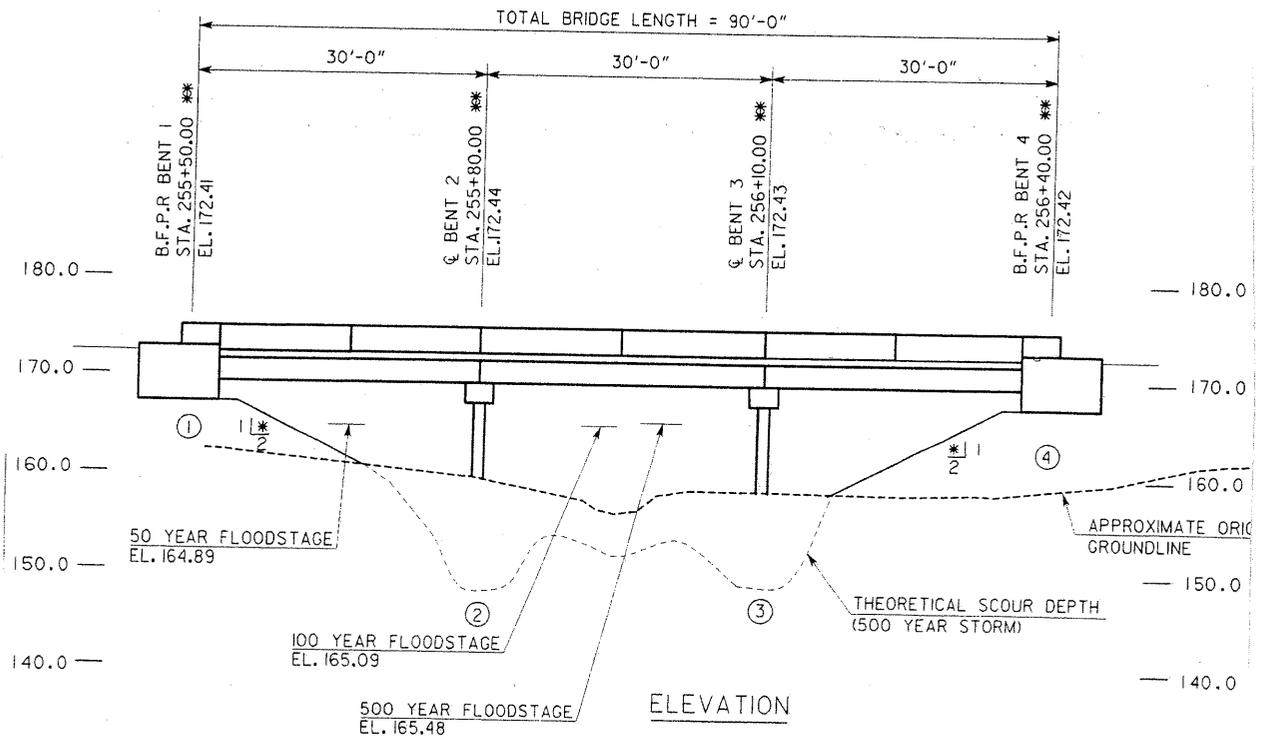
PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

9

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 5



SKETCHES

PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

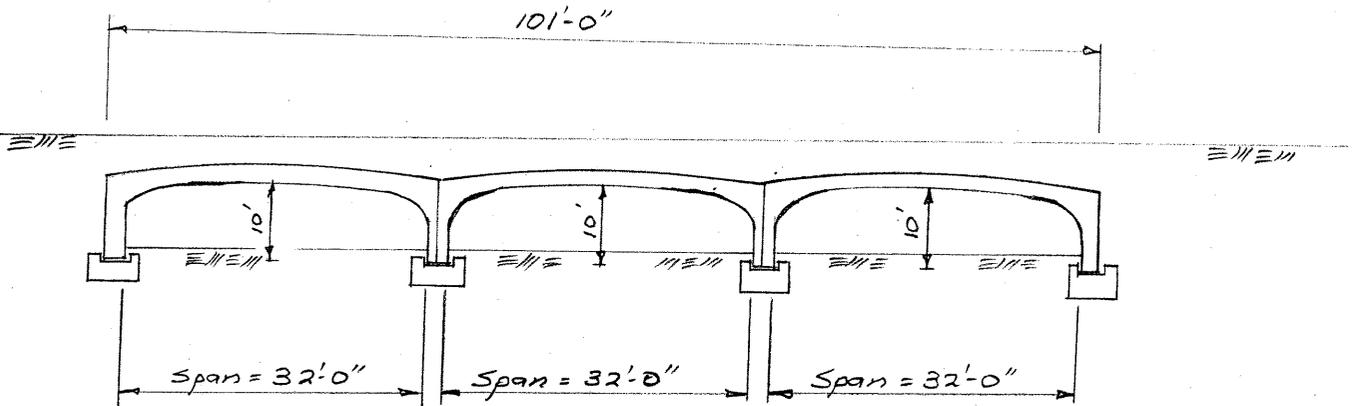
ALTERNATIVE NO.:

9

AS DESIGNED

ALTERNATIVE

SHEET NO.: 3 of 5



CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

9

SHEET NO.: 4 of 5

As Designed:

$$\begin{aligned} \text{Deck Area} &= 2 \text{ ea.} * 41.25' * 90' \\ &= 7,425 \text{ sf.} \end{aligned}$$

Alternative:

$$\begin{aligned} \text{Conspan Cost} &= \$195,000 * \frac{103.25'}{90'} \\ &= \$223,708 \end{aligned}$$

$$\text{2 day labor cost} = \$30,000$$

Foundation cost = Not included.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 10

DESCRIPTION: **RELOCATE THE BEGINNING OF THE ARGYLE WEST**
BYPASS

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The present design begins with an Argyle bypass in the vicinity of Peters Creek.

ALTERNATIVE: (Sketch attached)

Commence the Argyle bypass closer to the community of Argyle in the vicinity of County Road 134/
 Richard James Road.

ADVANTAGES:

- Reduces right-of-way costs
- Retains existing pavement
- Reduces construction cost
- Uses existing pavement

DISADVANTAGES:

- Could result in impacting more wetlands – dependent on final alignment
- Could cause more right-of-way impacts – dependent on final alignment

DISCUSSION:

This alternative would shorten the bypass around Argyle and result in a shorter project alignment and reduced construction cost. However, it could result in greater wetlands impact.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,144,507 | — | \$ 1,144,507 |
| ALTERNATIVE | \$ 385,032 | — | \$ 385,032 |
| SAVINGS | \$ 759,475 | — | \$ 759,475 |

AUT 10
2/15

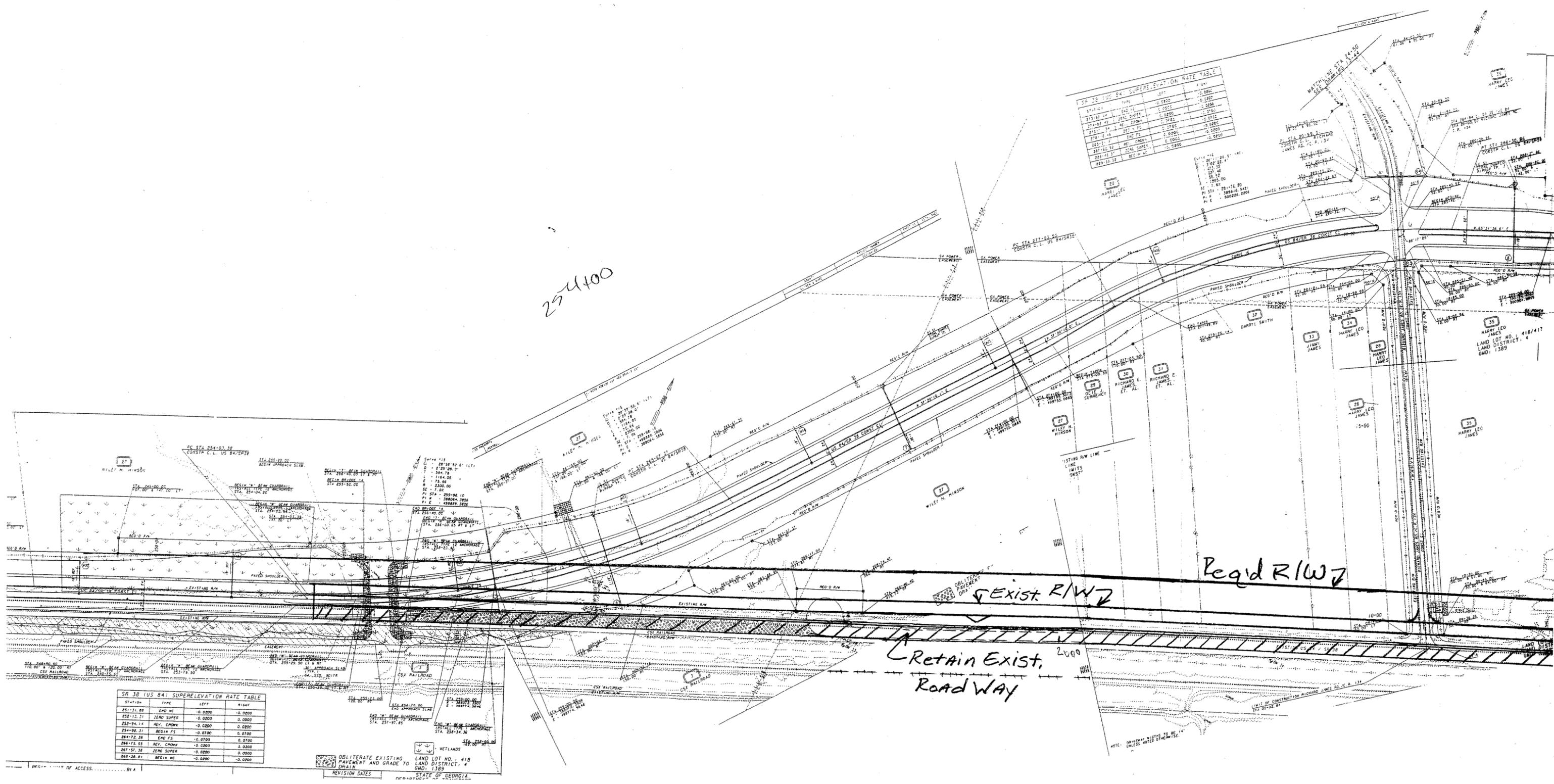
254400

SR 16 (US 84) SUPERELEVATION RATE TABLE

| STATION | TYPE | LEFT | RIGHT |
|-----------|-------------|--------|--------|
| 251+00.00 | END AC | 0.0200 | 0.0200 |
| 251+12.31 | 1/2ND SUPER | 0.0200 | 0.0200 |
| 251+24.62 | REV. CROWN | 0.0200 | 0.0200 |
| 251+36.93 | BEGIN FS | 0.0700 | 0.0700 |
| 251+49.24 | END FS | 0.0700 | 0.0700 |
| 251+61.55 | REV. CROWN | 0.0200 | 0.0200 |
| 251+73.86 | 1/2ND SUPER | 0.0200 | 0.0200 |
| 251+86.17 | BEGIN AC | 0.0200 | 0.0200 |

SR 38 (US 84) SUPERELEVATION RATE TABLE

| STATION | TYPE | LEFT | RIGHT |
|-----------|-------------|--------|--------|
| 251+31.88 | END AC | 0.0200 | 0.0200 |
| 251+44.19 | 1/2ND SUPER | 0.0200 | 0.0200 |
| 251+56.50 | REV. CROWN | 0.0200 | 0.0200 |
| 251+68.81 | BEGIN FS | 0.0700 | 0.0700 |
| 251+81.12 | END FS | 0.0700 | 0.0700 |
| 251+93.43 | REV. CROWN | 0.0200 | 0.0200 |
| 252+05.74 | 1/2ND SUPER | 0.0200 | 0.0200 |
| 252+18.05 | BEGIN AC | 0.0200 | 0.0200 |



OBLITERATE EXISTING PAVEMENT AND GRADE TO DRAIN
STATE OF GEORGIA
LAND LOT NO. 418
LAND DISTRICT: 4
GMD: 1389

Exist Pavement. (Grubbing) *Grubbing/Earth*
 SAVE 19mm
 25mm
 GAB 8"

CALCULATIONS

PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125, US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.: 10
 SHEET NO.: 4 of 5

Both Original & Alternative Routes for this proposed idea would be approximately the same length.

Exist Pavement to be Retained & overlaid
 (24' x 4000') = 96,000 S.F.

Savings Retaining Exist. Pavement for 4000'
 2" (19mm) $96,000 \times .167' \times .076 T/CF = 1,219 \text{ tons}$
 3" (25mm) $96,000 \times .25' \times .076 T/CF = 1,824 \text{ tons}$
 GAB (8") $96,000 / 9 SF/SY = 10,667 \text{ s.y.}$

(Save) Clearing & Grubbing = $\frac{96,000 SF}{43,560 SF/Ac} = 2.21 \text{ Ac}$

Cost/unit = \$ 1,300,000 / 260 Ac = \$ 5,000 / Ac

Earthwork saved following existing alignment for 4,000'. Assumed Earthwork saved for only the section that follows the existing route. (All Borrow that is saved - see x-sections)
 (6' Aug. height x 70' Aug. width x 4000') / 27 SF/SY = 62,230 C.Y.

for only Westbound; eastbound would still require earthwork.

Asph. Leveling: $(.167' \times 4000' \times 24') \times .076 = 1,219 \text{ tons}$

COST WORKSHEET



**PROJECT: EDS-84(23), P.I. No. 422120 & BHN-007-3(25), P.I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage**

**ALTERNATIVE NO:
10**

SHEET NO.: 5 of 5

| CONSTRUCTION ITEM | | ORIGINAL ESTIMATE | | | PROPOSED ESTIMATE | | |
|---|-------|-------------------|------------|-----------|-------------------|------------|---------|
| ITEM | UNITS | NO. OF UNITS | COST/ UNIT | TOTAL | NO. OF UNITS | COST/ UNIT | TOTAL |
| 19 mm (2") Superpave | TN | 1,219 | 80.00 | 97,520 | | | |
| 25 mm (3") Superpave | TN | 1,824 | 91.00 | 165,984 | | | |
| GAB 8" | SY | 10,667 | 19.50 | 208,007 | | | |
| Clearing and Grubbing | AC | 2.21 | 5,000 | 11,050 | | | |
| Borrow Including Material | CY | 62,230 | 7.90 | 491,617 | | | |
| Construction Subtotal | | | | 974,178 | | | |
| Construction Markup at 10.00% | | | | 97,418 | | | |
| Total Construction | | | | 1,071,595 | | | |
| Right of Way (32' vs. 14') | AC | 10.00 | 2,100.00 | 21,000 | | | |
| ROW Markup at 247.20% | | | | 51,912 | | | |
| Total ROW | | | | 72,912 | | | |
| Asphalt Leveling to Level Existing Pavement | TN | | | | 1,219 | 80.00 | 97,520 |
| Construction Subtotal | | | | | | | 97,520 |
| Construction Markup at 10.00% | | | | | | | 9,752 |
| Total Construction | | | | | | | 107,272 |
| Right of Way One Parcel [Harry James] Damaged (average cost from ROW cost estimate) | LS | | | | 1 | 80,000 | 80,000 |
| ROW Markup at 247.20% | | | | | | | 197,760 |
| Total ROW | | | | | | | 277,760 |
| Sub-total | | | | 1,144,507 | | | 385,032 |
| Mark-up at | | | | INCL | | | INCL |
| TOTAL | | | | 1,144,507 | | | 385,032 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 11

DESCRIPTION: **DO NOT BYPASS ARGYLE**

SHEET NO.: 1 of 6

ORIGINAL DESIGN:

The present design bypasses the community of Argyle on the north side with all four new lanes of traffic paralleling the existing high voltage power line.

ALTERNATIVE:

Widen the existing alignment of US 84/SR 38 through the town of Argyle on the north side of the alignment, thereby minimizing property acquisitions. The only property of historical significance is kept intact; i.e., the Hall-Parlor House.

ADVANTAGES:

- Reduces right-of-way costs
- Retains existing pavement
- Reduces construction cost
- Helps satisfy local opposition
- Takes advantage of an existing asset

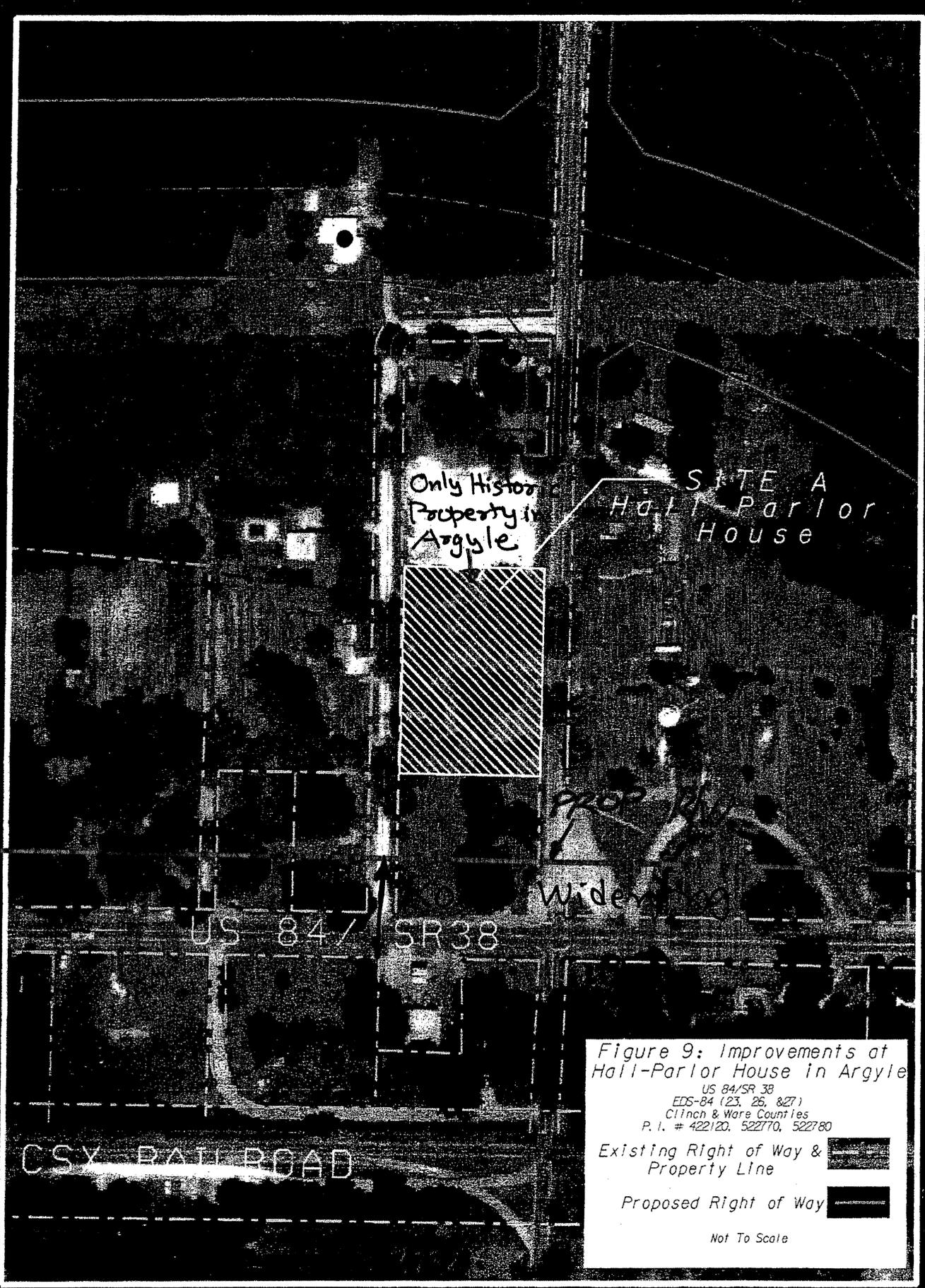
DISADVANTAGES:

- Additional demolition of existing structures
- More disruptive to the local community

DISCUSSION:

At least five additional residential/commercial properties will need to be relocated elsewhere on US 84/SR 38 in Argyle. This may not be a problem, however, since the town residents are known to favor the road widening through their town.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 8,654,609 | — | \$ 8,654,609 |
| ALTERNATIVE | \$ 730,856 | — | \$ 730,856 |
| SAVINGS | \$ 7,923,753 | — | \$ 7,923,753 |



Proposed Alternate Road Widening

Only Historic Property in Argyle

SITE A
Hall-Parlor House

US 84 / SR 38

CSX RAILROAD

PROP RW
Widening

Figure 9: Improvements at Hall-Parlor House in Argyle

US 84/SR 38
EDS-84 (23, 26, & 27)
Clinch & Wata Counties
P.I. # 422120, 522770, 522780

Existing Right of Way & Property Line

Proposed Right of Way

Not To Scale

Alt. # 11
Sheet 3 of 6

Project EDS-84 (23) (26) & HPPN-EDS-84(27)
Clinch and Ware Counties, Georgia
P.I. Numbers: 422120, 522770 & 522780

The proposed project would widen US 84/ SR 38 from Homerville northeastward to the intersection with SR 38C and US 82/SR 50 in Waycross in southern Georgia. The existing two-lane highway would be reconstructed to a four-lane, divided facility with a center median. The approximate length of the proposed project would be 24 miles.

ENVIRONMENTAL ASSESSMENT

U.S. Department of Transportation
Federal Highway Administration

and

Georgia Department of Transportation
In Cooperation With
United States Army Corps of Engineers

Submitted pursuant to 42 U.S.C. 4321 et. seq.

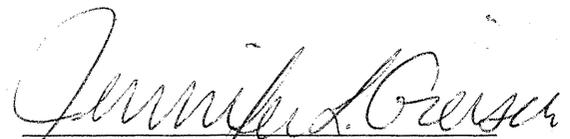
Approval for Advancement to Availability/Public Hearing Phase

12-29-06

Date

Approval of Environmental Assessment

Date



For: Robert M. Callan, P.E.
Division Administrator
Federal Highway Administration

For: Robert M. Callan, P.E.
Division Administrator
Federal Highway Administration

The eligible boundary, comprising approximately 0.23 of an acre, contains all National Register qualifying characteristics and features of the property and includes the house and the property's domestic setting.

CSX Railroad Bed - is located to the southeast of US 84/SR 38 throughout the study corridor (*Historic Resources*, Figure 7). The rail bed dates from the railroad boom of the 1880s and connects Homerville, Georgia, to Waycross, Georgia. Originally part of the Georgia Railroad, the line has been owned by the Atlantic Coast Railroad and the Seaboard Air Line Railroad before coming under ownership of CSX in the 1980s.

The property was evaluated for eligibility for listing in the National Register under Criterion A. The property possesses a local level of significance in the area of transportation for its association with the railroad boom in the 1880s in this part of Georgia.

The eligible National Register boundary of the property corresponds to the legal property boundary that follows the railroad right-of-way for the length of the project corridor. All significant and character defining features of the property are included within the legal boundary.

✓ Hall-Parlor House in Argyle - is a ca. 1915-1925 Hall-Parlor, with no apparent academic style, that is located in Argyle on the southwest side of CR 128, approximately 250 feet west of the intersection of CR 128 and US 84/SR 38 (refer to *Existing/Proposed Right-of-Way at the Hall-Parlor House in Argyle*, Figure 9). The property retains its original materials and features including brick pier foundation, exposed rafter tails, six-over-six double-hung windows, and a gable end chimney. Alterations to the property include a ca. 1935-1945 rear gabled addition and nonhistoric wood siding dating to ca. 1955-1965. A small, one-bay garage from ca. 1940-1950 is also located on the property.

The property was evaluated for eligibility for listing in the National Register under Criterion C. The property possesses a local level of significance in the area of architecture as an example of a Hall-Parlor house type. This house represents a house type that is identified in *Georgia's Living Places: Historic Houses in Their Landscaped Settings* that is significant in Georgia's architectural history. The house has experienced few alterations since its construction ca. 1915-1925 and retains many character-defining features.

Because the historic boundary is no longer intact and because there are no other significant or character defining features within the legal boundary that contribute to the architectural significance of the property, the eligible National Register boundary consists of a visual boundary. The eligible boundary, comprising approximately 3.13 acres, contains all National Register qualifying characteristics and features of the property and includes the house, garage, and the property's domestic setting.

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

11

SHEET NO.: 5 of 6

Bypass begins at STA. 254+03.32 and ends at STA. 355+15.61 for a total length of 10,172' or 1.94 miles of brand new pavement including 1,500' or 0.28 mile of recycling of existing pavement (CR 134). Since CR 134 is a minor 2-lane road with minimal improvements, it is assumed that by removing bypass, we will save not 1.94 but 2 miles of new pavement that does not include bridge at the beginning of the bypass.

$$\text{Total acreage saved} = \frac{2 \times 5240 \times 250}{43,560} = 60 \text{ acres}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: **12**

DESCRIPTION: **ELIMINATE ONE INTERMEDIATE BENT FROM EACH**
BRIDGE AT BRIDGE NO. 5 – US 84/SR 38 OVER BOX CREEK

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design indicates Bridge No. 5 over Box Creek as a five-span (30-ft. each) twin bridge with concrete T-beams and pile bents.

ALTERNATIVE: (Sketch attached)

Use four-span (37.5-ft. each) twin bridge with concrete T-beams and pile bents.

ADVANTAGES:

- Requires fewer intermediate pile bents
- May improve bridge hydraulics
- Reduces construction time
- Simplifies construction

DISADVANTAGES:

- Superstructure depth will increase

DISCUSSION:

Although this alternative results in minimal cost savings, fewer bent piles in the waterway is more environmentally friendly and follows sustainable design philosophies.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 19,035 | — | \$ 19,035 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS | \$ 19,035 | — | \$ 19,035 |



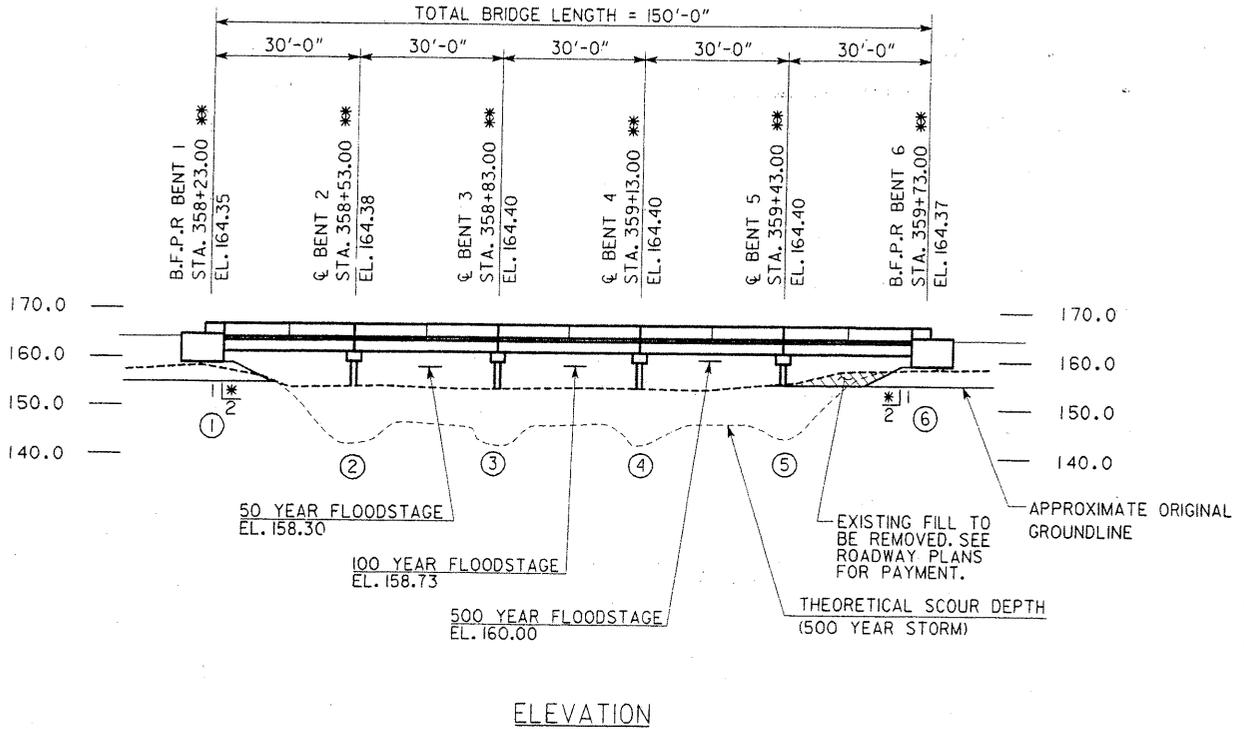
PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

12

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 5



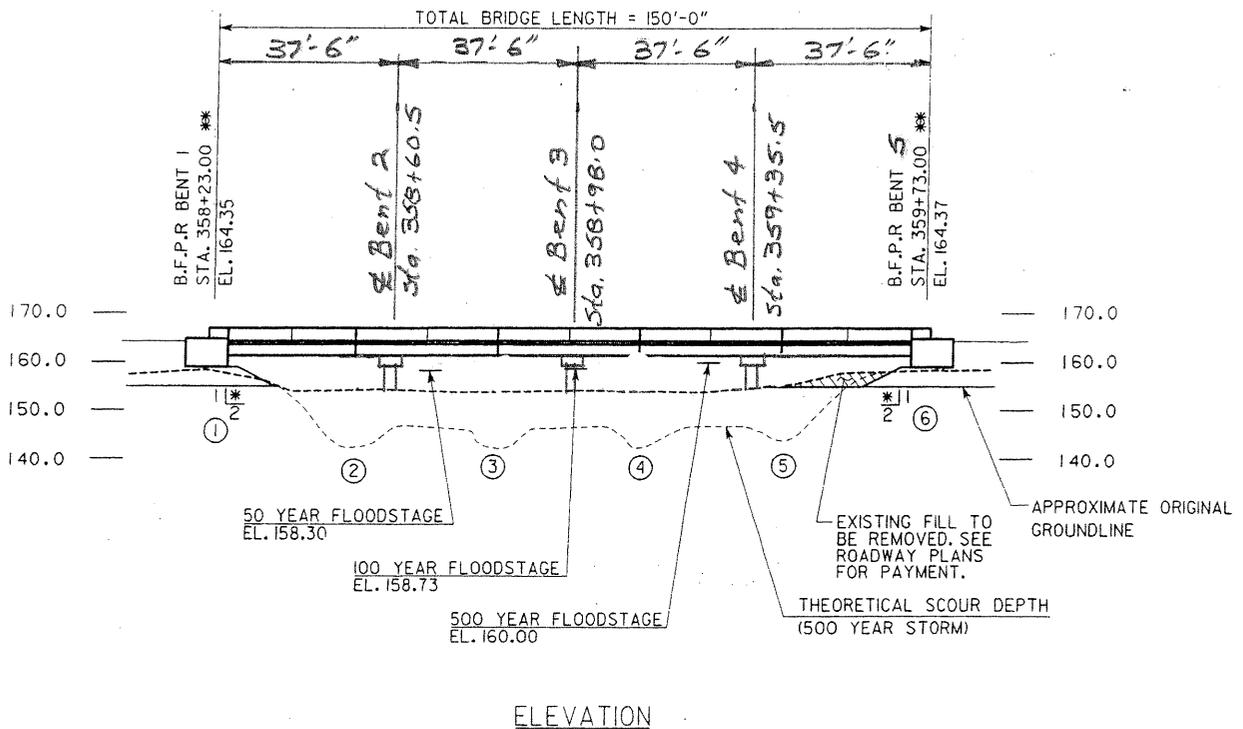
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US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

12

AS DESIGNED ALTERNATIVE

SHEET NO.: 3 of 5



CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

SHEET NO.: 4 of 5

Alternative:

- Class A Concrete:

$$\text{Pile Cap} = 2 \text{ ea.} \times 3.25' \times 2.0' \times 37' \times 1/27$$

$$\text{" " } = 17.81 \text{ cy.}$$

- 16" sq. Piles = 2 ea. x Spiles x 20'
= 200'

VALUE ENGINEERING ALTERNATIVE



PROJECT: EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,
 US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 13

DESCRIPTION: REPLACE THE EXISTING THREE-SPAN BRIDGES WITH
 THREE CONSPAN[®] CULVERTS AT BRIDGE NO. 6 OVER
 LITTLE SUWANEE CREEK

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The current design indicates Bridge No. 6 over the Little Suwanee Creek as a three-span (30-ft. each) bridge with concrete T-beams and pile bents.

ALTERNATIVE: (Sketch attached)

Use three (32-ft. x 10-ft.) Con/Span[®] culverts for Bridge No. 6.

ADVANTAGES:

- Reduces construction time
- Simplifies construction
- Reduces initial cost

DISADVANTAGES:

- May not satisfy the hydraulic requirements

DISCUSSION:

The typical cost of a Con/Span[®] foundation could not be determined as the Bridge Foundation Investigation Report (BFI) was not available. Although not included, it appears that with the inclusion of the foundation, the Con/Span[®] will be more economical to construct than the three-span twin bridges.

Although Con/Span[®] is addressed with this alternative, other manufacturers are available that can provide similar products.

The lump sum numbers in the cost estimate for Con/Span[®] and its installation were obtained from Contech's representative Steve Poole at 678-662-9331.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 653,400 | — | \$ 653,400 |
| ALTERNATIVE | \$ 279,079 | — | \$ 279,079 |
| SAVINGS | \$ 374,321 | — | \$ 374,321 |

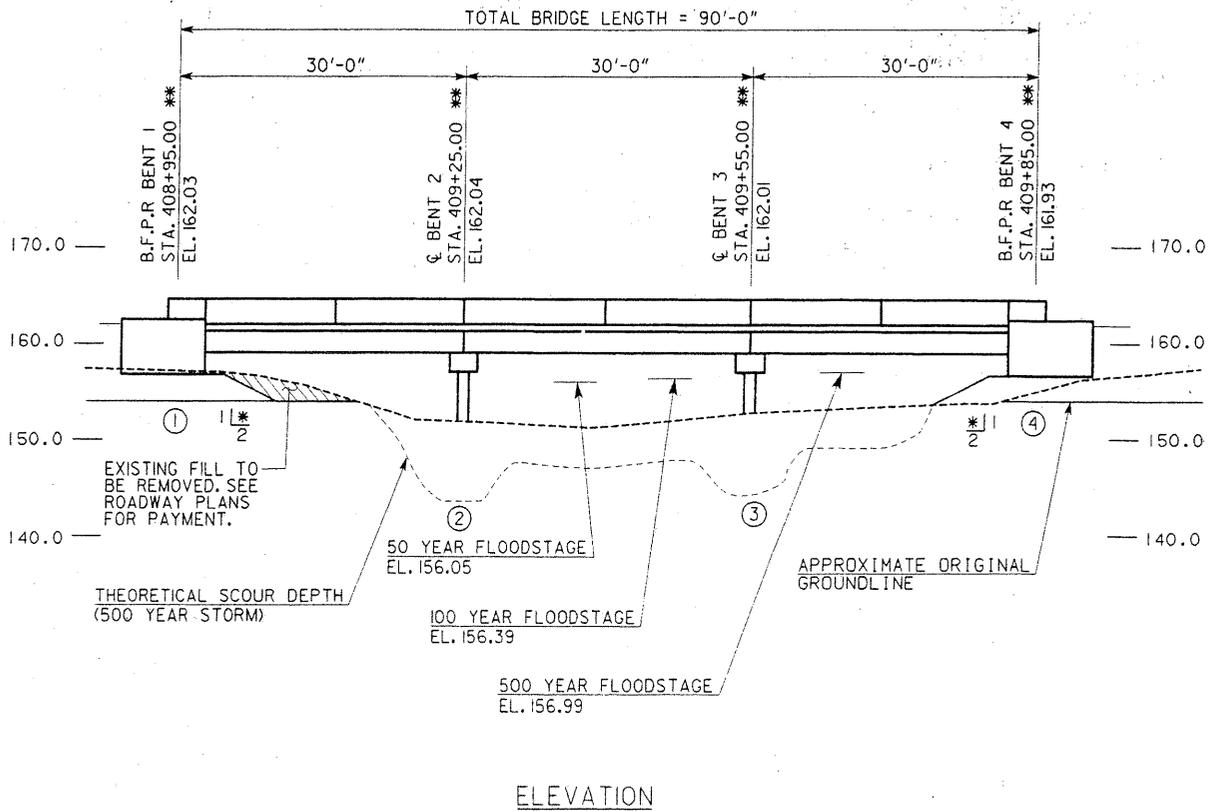
**PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage**

ALTERNATIVE NO.:

13

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 5



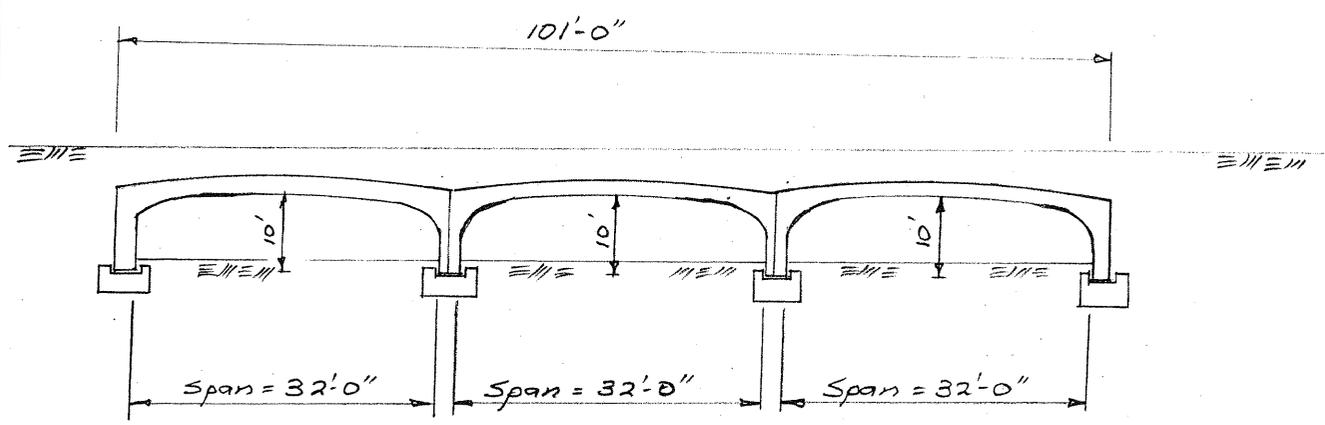
SKETCHES

PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:
13

AS DESIGNED ALTERNATIVE

SHEET NO.: **3** of **5**



CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

13

SHEET NO.: 4 of 5

As Designed:

$$\begin{aligned} \text{Deck Area} &= 2 \text{ ea.} \times 41.25' \times 90' \\ &= 7,425 \text{ sf.} \end{aligned}$$

Alternative:

$$\begin{aligned} \text{Cospan Cost} &= \$195,000 \times \frac{103.25'}{90'} \\ &= \$223,708 \end{aligned}$$

$$\text{2 day Labor cost} = \$30,000$$

Foundation cost = Not included.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 14

DESCRIPTION: **ELIMINATE TWO INTERMEDIATE BENTS FROM EACH**
BRIDGE AT BRIDGE NO. 7 – US 84/SR 38 OVER SUWANEE
CREEK

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The current design indicates Bridge No. 7 over Suwanee Creek as a seven-span (30-ft. each) twin bridge with concrete T-beams and pile bents.

ALTERNATIVE: (Sketch attached)

Use five-span (42-ft. each) twin bridge with PSC beams (Type I modified) and pile bents.

ADVANTAGES:

- Requires fewer intermediate pile bents
- May improve bridge hydraulics
- Reduces construction time
- Simplifies construction
- Complies with contractor preference for rural bridge structures

DISADVANTAGES:

- Superstructure depth will increase
- Clearance between bottom of beam and 100 year high water elevation may be less than required

DISCUSSION:

Even though it will increase the initial cost to implement this alternative, the duration of construction will be reduced and past records have shown that contractors prefer Type I modified PSC beams vs. T-beams.

The difference in clearance for a 100-year flood event is less than 6 in. (1.99 ft. [original] – 1.55 ft. [alternative] = 0.43 ft. = 5.16 in.). If this is an issue, the bridge profile can be increased to accommodate the new elevation, albeit for an additional cost.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,562,676 | — | \$ 1,562,676 |
| ALTERNATIVE | \$ 1,810,463 | — | \$ 1,810,463 |
| SAVINGS | \$ (247,787) | — | \$ (247,787) |

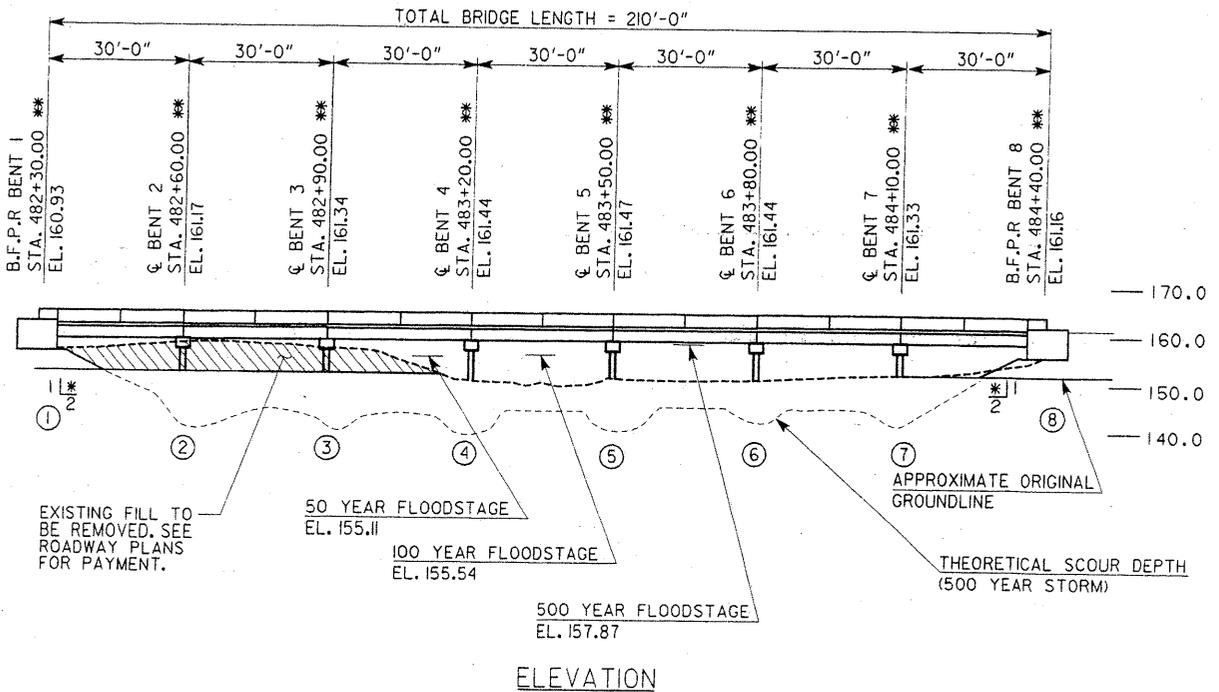
PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

14

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 5



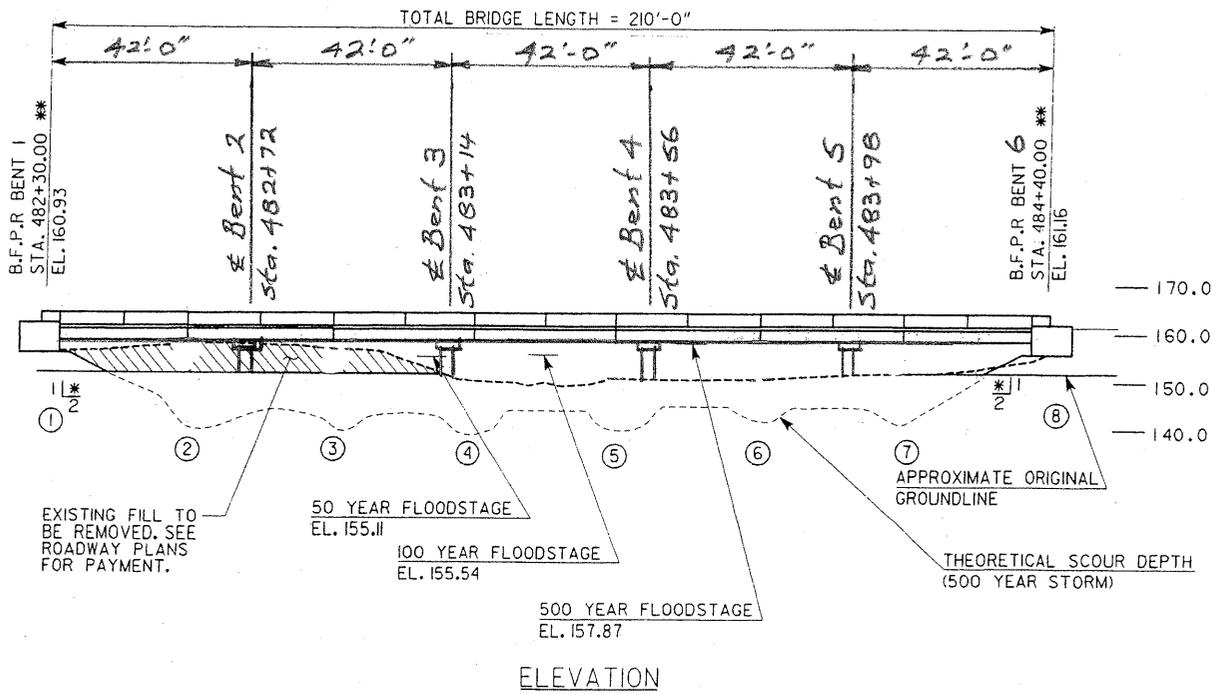
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US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

14

AS DESIGNED ALTERNATIVE

SHEET NO.: 3 of 5



CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

14

SHEET NO.: 4 of 5

Clearance Calculations

As Designed:

$$PGL = 160.93$$

$$\text{Dist. to bm.} = 33'$$

$$\text{Cross Slope} = 2\%$$

$$\begin{aligned} \text{Correction} &= 33' \times 2\% \\ &= 0.66' \end{aligned}$$

$$\text{Deck thick.} = 2.75'$$

$$\begin{aligned} \text{Beam Elev.} &= 160.93' - 2.75' - 0.66' \\ &= 157.52' \end{aligned}$$

$$100\text{yr HW} = 155.54'$$

$$\begin{aligned} \text{Clearance} &= 157.52' - 155.54' \\ &= 1.98' \end{aligned}$$

$$\text{Deck Area} = 2\text{ea.} \times 41.25' \times 210'$$

$$\text{" " " " } = 17,325\text{sf.}$$

Alternative:

$$PGL = 160.93$$

$$\text{Dist. to beam} = 33'$$

$$\text{Cross Slope} = 2\%$$

$$\begin{aligned} \text{Correction} &= 33' \times 2\% \\ &= 0.66' \end{aligned}$$

$$\text{Slab thickness} = 0.85'$$

$$\text{Beam depth} = 2.33'$$

$$\text{Tot. deck thick.} = 3.18'$$

$$\begin{aligned} \text{Beam Elev.} &= 160.93' - 3.18' - 0.66' \\ &= 157.09' \end{aligned}$$

$$100\text{yr HW} = 155.54'$$

$$\begin{aligned} \text{Clearance} &= 157.09' - 155.54' \\ &= 1.55' \end{aligned}$$

$$\text{Deck Area} = 17,325\text{sf.}$$

Class A concrete:

$$\text{Pile cap} = 4\text{ea.} \times 3.25' \times 2' \times 37' \times \frac{1}{27}$$

$$\text{" " " " } = 35.63\text{cy.}$$

$$\begin{aligned} 16''\text{ sq. Piles} &= 4\text{ea.} \times 5\text{piles} \times 20' \\ &= 400' \end{aligned}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: **15**

DESCRIPTION: **USE 14-FT. FLUSH URBAN MEDIAN PRIOR TO COUNTY**
ROAD 9/FLAGLER CROSSING

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The present design begins with a flush median at Station (STA) 572+82 approaching the town of Manor.

ALTERNATIVE: (Sketch attached)

Commence the 14-ft. flush median earlier, i.e., before County Road (CR) 9/Flagler Crossing at STA 546+00.

ADVANTAGES:

- Reduces right-of-way costs
- Improves traffic operations
- Reduces construction cost
- Simplifies construction

DISADVANTAGES:

- Slight loss in safety – reduced width between opposing traffic

DISCUSSION:

This alternative would use a 14-ft.-wide flush median versus the 32-ft.-wide depressed median, thus saving 18-ft. of additional/required right-of-way. Construction costs are actually less costly for a 14-ft. median for this section of the roadway since the 32-ft. median has two Type B median openings with tapers and 16-ft. of full depth pavement.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 425,717 | — | \$ 425,717 |
| ALTERNATIVE | \$ 237,494 | — | \$ 237,494 |
| SAVINGS | \$ 188,223 | — | \$ 188,223 |

PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

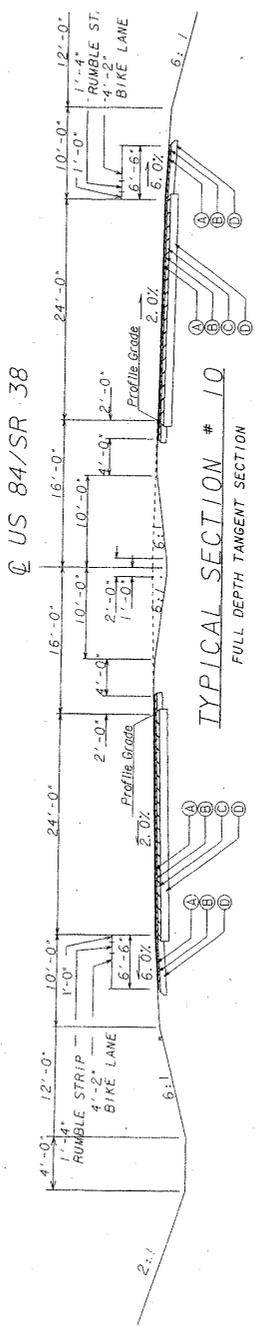
ALTERNATIVE NO.:

15

AS DESIGNED ALTERNATIVE

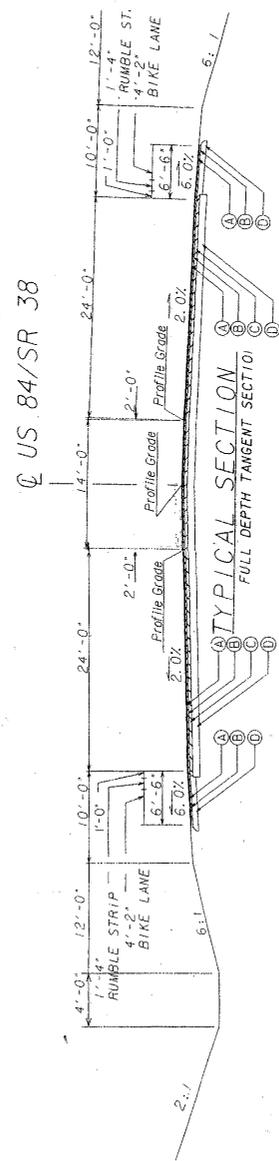
SHEET NO.: 2 of 4

AS DESIGN



32' median - Rural

ALTERNATIVE



14' median - Rural outside
Shoulders

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:
 15

SHEET NO.: 3 of 4

Alternate^{proposed} - Pavement - STA. 546+00 to STA. 572+82
 → 2,682' ←

(9.5mm) $(14' \times 2,682) \times .125' \times .076 \frac{T}{CF} = 357 \text{ tons}$
 $\uparrow 37,548 \text{ S.F.}$

(19mm) $37,548 \text{ S.F.} \times .167' \times .076 \frac{T}{CF} = 477 \text{ tons}$

(25mm) $37,548 \text{ S.F.} \times .25' \times .076 \frac{T}{CF} = 714 \text{ tons}$

(GAB) $37,548 \text{ S.F.} / 9 \text{ SF/sy} = 4,172 \text{ sy}$

Original R/W (Add'l R/W: 32' - 14' = 18')

$(18' \times 2,682') / 43,560 \frac{SF}{AC} = 1.10 \text{ ac}$ (Add'l R/W 32' med. vs 14' med.)

Original - Pavement in Median (Turn Lanes)

(9.5mm) $[(1200' + 1000') \times 16'] \times .125' \times .076 \frac{T}{CF} = 335 \text{ tons}$

(19mm) $35,200 \text{ S.F.} \times .167' \times .076 \frac{T}{CF} = 447 \text{ tons}$

(25mm) $35,200 \text{ S.F.} \times .25' \times .076 \frac{T}{CF} = 667 \text{ tons}$

(8") (GAB) $35,200 \text{ S.F.} / 9 \text{ SF/sy} = 3,911 \text{ sy}$

2' shoulders = 4' total

(9.5mm) $(4' \times (2,682 - 300')) \times .125' \times .076 \frac{T}{CF} = 91 \text{ tons} + 335 = 426 \text{ tons}$
 (Med. openings already incl. above)

(19mm) $9,528 \text{ S.F.} \times .167' \times .076 \frac{T}{CF} = 121 \text{ tons} + 447 = 568 \text{ tons}$

(8") (GAB) $9,528 \text{ S.F.} / 9 \text{ SF/sy} = 1,059 \text{ sy} + 3,911 = 4,970$

GRASSING/EROSION = \$6,000/AC ± based on Project Eros. Control.

$\$1,853,060 / 310 \text{ ac} \approx \$6,000/\text{ac}$

GRASSING AREA = $(16' \times (500' + 650' + 300')) + ((32' + 14') \times 600') / 43,560 = 0.85 \text{ ac.}$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 16

DESCRIPTION: **CONTINUE 55 MILE-PER-HOUR ZONE AND 14-FT. FLUSH**
MEDIAN TO GREASY BRANCH CREEK

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (Sketch attached)

The present design ends the flush median at Station (STA) 613+73 departing the town of Manor.

ALTERNATIVE: (Sketch attached)

Extend the flush median to what would be Bridge 8 on project EDS-84(26), or to the end of this project at STA 631+03 for comparison sake.

ADVANTAGES:

- Reduces right-of-way costs
- Simplifies construction
- Provides more accessibility

DISADVANTAGES:

- Slight loss in safety – reduced width between opposing traffic
- Slight increase in initial cost

DISCUSSION:

This alternative would continue the 14-ft. paved flush median versus using a 32-ft. depressed grassed median, saving 18 ft. of additional right-of-way costs. The 14-ft. median would provide more accessibility to local residents.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 59,237 | — | \$ 59,237 |
| ALTERNATIVE | \$ 153,136 | — | \$ 153,136 |
| SAVINGS | \$ (93,899) | — | \$ (93,899) |



PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

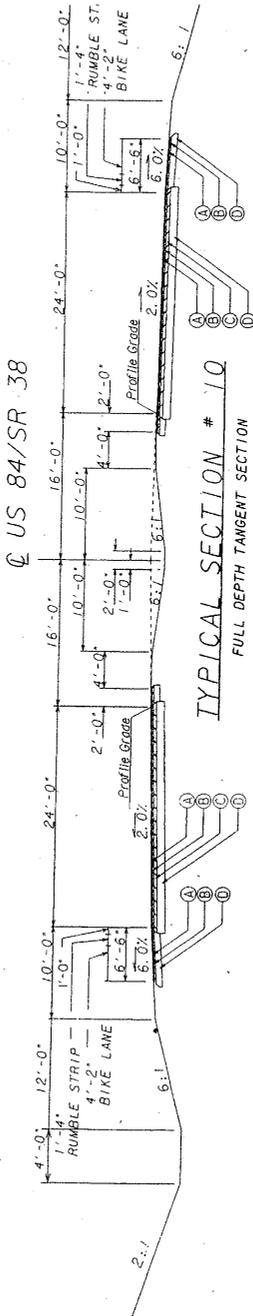
16

AS DESIGNED

ALTERNATIVE

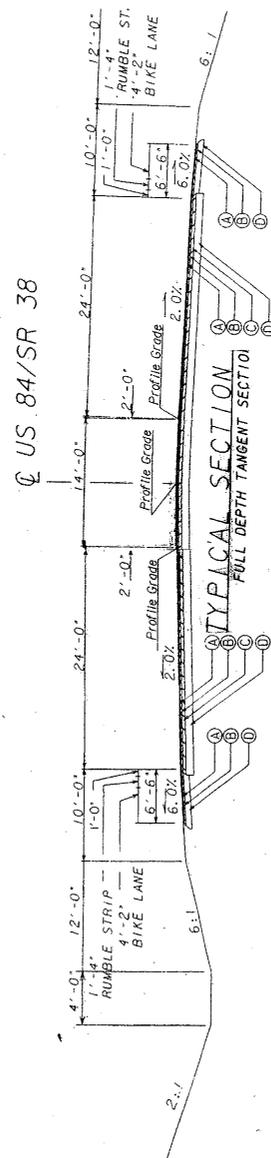
SHEET NO.: 2 of 4

AS DESIGN



32' median - Rural

ALTERNATIVE



14' median - Rural outside shoulders

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

16

SHEET NO.: 3 of 4

Length STA 613+73 → STA 631+03 = 1,730'

Alternative Construction Quantities/Pavement
 (14' flush median)

$$9.5\text{mm } (14' \times 1,730') \times .125' \times .076 \frac{\text{T}}{\text{CF}} = 230 \text{ tons}$$

$$19\text{mm } (24,220 \text{ SF}) \times .167' \times .076 \frac{\text{T}}{\text{CF}} = 308 \text{ tons}$$

$$25\text{mm } (24,220 \text{ SF}) \times .25' \times .076 \frac{\text{T}}{\text{CF}} = 460 \text{ tons}$$

$$\text{GAB (8") } 24,220 \text{ SF} / 9 \text{ SF/sy} = 2,691 \text{ sy}$$

Original R/W (Add'l R/W : 32'-14')

$$(18' \times 1,730') / 43,560 \frac{\text{SF}}{\text{AC}} = 0.715 \text{ AC}$$

Original Pavement in Median (2' shoulders = 4' total)

$$9.5\text{mm } (4' \times 1,730') \times .125' \times .076 \frac{\text{T}}{\text{CF}} = 66 \text{ tons}$$

$$19\text{mm } (6,920 \text{ SF}) \times .167' \times .076 \frac{\text{T}}{\text{CF}} = 88 \text{ tons}$$

$$\text{GAB (8") } 6,920 \text{ SF} / 9 \text{ SF/sy} = 769 \text{ sy}$$

$$\text{Grassing/Erosion Control} = \left(\frac{32'+14'}{2} \times 1,730' \right) / 43,560 \frac{\text{SF}}{\text{AC}}$$

$$= 0.91 \text{ AC}$$

COST WORKSHEET



**PROJECT: EDS-84(23), P.I. No. 422120 & BHN-007-3(25), P.I. No. 422125,
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage**

ALTERNATIVE NO:

16

SHEET NO.: 4 of 4

| CONSTRUCTION ITEM | | ORIGINAL ESTIMATE | | | PROPOSED ESTIMATE | | |
|--------------------------------|-------|-------------------|-----------|--------|-------------------|-----------|---------|
| ITEM | UNITS | NO. OF UNITS | COST/UNIT | TOTAL | NO. OF UNITS | COST/UNIT | TOTAL |
| 9.5 mm (1½") 2-foot Shoulders | TN | 66 | 88.00 | 5,808 | | | |
| 19 mm (2") 2-foot Shoulders | TN | 88 | 80.00 | 7,040 | | | |
| GAB 8" | SY | 769 | 19.50 | 14,996 | | | |
| Grassing / Erosion Control | AC | 0.91 | 6,000 | 5,460 | | | |
| Drop Inlets | EA | 2 | 4,240 | 8,480 | | | |
| Flared End Section | EA | 2 | 453 | 906 | | | |
| 18" Storm Drain Pipe | LF | 150 | 42.82 | 6,423 | | | |
| Construction Subtotal | | | | 49,113 | | | |
| Construction Markup at 10.00% | | | | 4,911 | | | |
| Total Construction | | | | 54,024 | | | |
| | | | | | | | |
| Right of Way for 32' Median | AC | 0.72 | 2,100.00 | 1,502 | | | |
| ROW Markup at 247.20% | | | | 3,712 | | | |
| Total ROW | | | | 5,213 | | | |
| | | | | | | | |
| 9.5 mm (1½") 14-foot Shoulders | TN | | | | 230 | 88.00 | 20,240 |
| 19 mm (2") 14-foot Shoulders | TN | | | | 308 | 80.00 | 24,640 |
| 25 mm (3") 14-foot Shoulders | TN | | | | 460 | 91.00 | 41,860 |
| GAB 8" | SY | | | | 2,691 | 19.50 | 52,475 |
| Construction Subtotal | | | | | | | 139,215 |
| Construction Markup at 10.00% | | | | | | | 13,921 |
| Total Construction | | | | | | | 153,136 |
| | | | | | | | |
| Sub-total | | | | 59,237 | | | 153,136 |
| Mark-up at | | | | INCL | | | INCL |
| TOTAL | | | | 59,237 | | | 153,136 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,** ALTERNATIVE NO.: **17/18/**
US 84/SR 38 WIDENING AND RECONSTRUCTION **19**
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

DESCRIPTION: **ELIMINATE THE INTERSECTIONS AT CR 24/CHERRY ROAD,** SHEET NO.: **1 of 2**
CR 26/MILLS STREET AND CR 517/HOKE STREET

ORIGINAL DESIGN: (Sketch attached)

The current design indicates numerous intersections to be maintained through the town of Manor, in particular those at Country Road (CR) 24/Cherry Road, CR 26/Mills Street and CR 517/Hoke Street.

ALTERNATIVE: (Sketch attached)

Close the aforementioned intersections through Manor and continue the proposed curb and gutter and sidewalks along the US 84/SR 38 route.

ADVANTAGES:

- Improves safety – less left turning traffic
- Maintains driveways
- Improves traffic flow
- Simplifies construction
- Improves traffic operations

DISADVANTAGES:

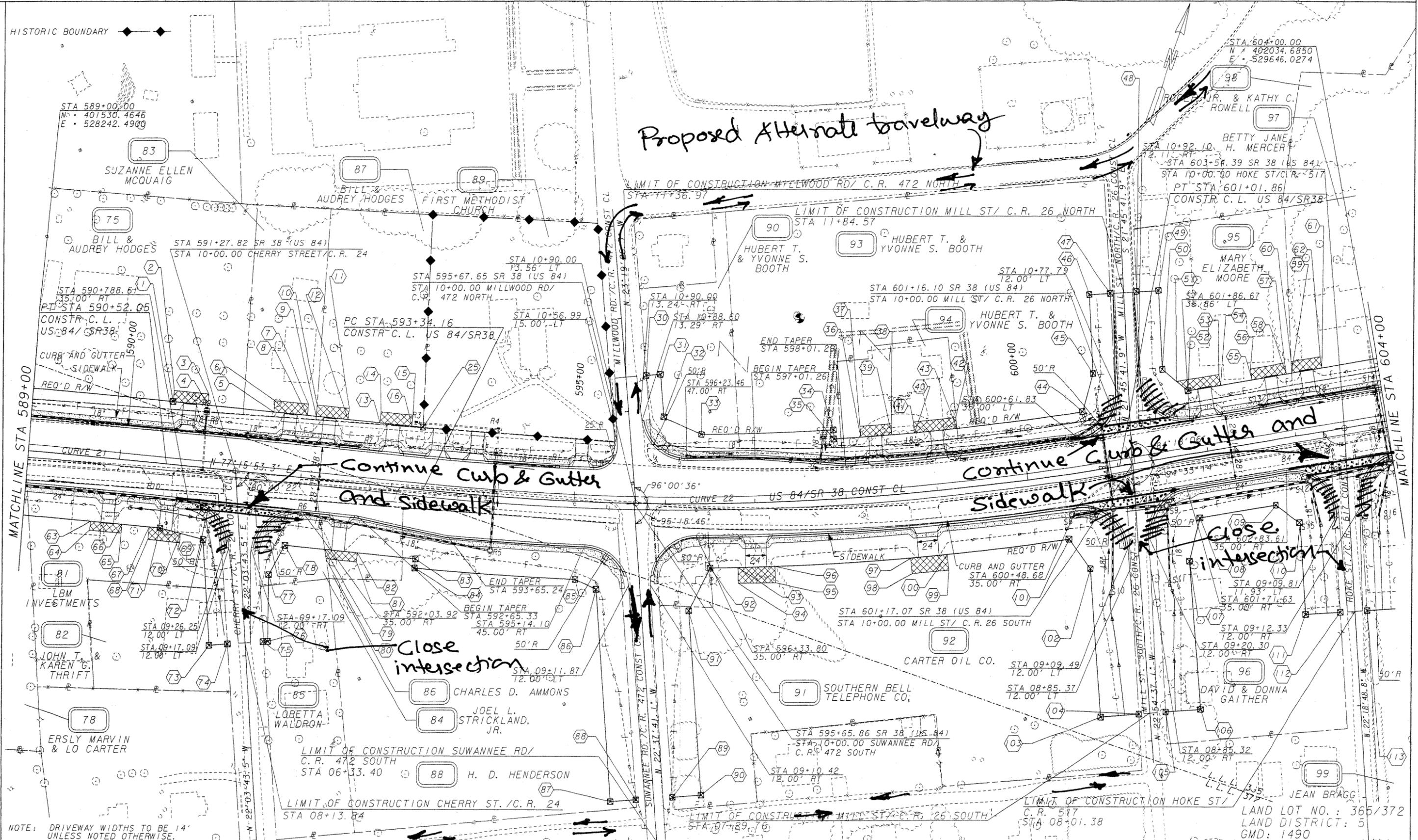
- Increases usage of the inside travelway will increase creating some minor inconveniences
- Increases initial cost
- Eliminates known crossings
- Increases use of existing local street network

DISCUSSION:

As sufficient local streets are available to traverse US 84/SR 38 within Manor, the need for so many intersections may not be warranted. Although acknowledging the loss of known crossings by local residents, the improvement in traffic operations can offset this loss until locals learn and become comfortable with the new routings.

On the north side of the mainline, a suggested route from the CR 26/Mills Street intersection would be CR 408/Sob Nob Road. On the south side, the three aforementioned intersections could be diverted to CR 407/Pond Avenue.

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



NOTE: DRIVEWAY WIDTHS TO BE 14' UNLESS NOTED OTHERWISE.

| | |
|---|---|
| PROPERTY AND EXISTING R/W LINE | — |
| REQUIRED R/W LINE | — |
| CONSTRUCTION LIMITS | — |
| EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES | ▨ |

| | |
|-------------------------|----------|
| BEGIN LIMIT OF ACCESS |BLA |
| END LIMIT OF ACCESS |ELA |
| LIMIT OF ACCESS | — |
| R/W AND LIMIT OF ACCESS | — |
| EXISTING R/W LINE | — |

HL Heath & Lineback Engineers INCORPORATED
2390 CANTON ROAD, BUILDING 200
MARIETTA, GEORGIA 30066-5393

SCALE IN FEET

| REVISION DATES |
|----------------|
| |
| |
| |

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: **MAINLINE PLAN**

LAND LOT NO.: 365/372
LAND DISTRICT: 5
GMD: 1490

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,** ALTERNATIVE NO.: **21**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

DESCRIPTION: **PROVIDE SIDEWALKS ON ONE SIDE OF MAINLINE ONLY** SHEET NO.: **1 of 2**
IN URBAN SECTIONS

ORIGINAL DESIGN:

The current design provides sidewalks on both sides of the mainline in the beginning of the project and through the town of Manor.

ALTERNATIVE:

Provide sidewalks on only the north side of the mainline where there are proportionately more property residents who use the sidewalks.

ADVANTAGES:

- Reduces construction time
- Simplifies construction
- Reduces initial cost

DISADVANTAGES:

- Slight loss of safety and convenience as pedestrians would have to cross the mainline to access the sidewalk

DISCUSSION:

Since the current population in the region is not very large and is not expected to growth significantly in the near future, the use of sidewalks on both sides of the mainline in the urban sections may not be warranted. Pedestrian “destinations” are limited, and a sidewalk on one side may be more prudent.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 398,246 | — | \$ 398,246 |
| ALTERNATIVE | \$ 199,123 | — | \$ 199,123 |
| SAVINGS | \$ 199,123 | — | \$ 199,123 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 23

DESCRIPTION: **PROVIDE A MULTI-USE PATH ON ONLY ONE SIDE OF
 MAINLINE THROUGHOUT THE PROJECT LIMIT IN THE
 URBAN AREAS**

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (Sketch attached)

The current design indicates the use of 4-ft. bicycle lanes and 5-ft. sidewalks on each side of the mainline in the urban areas of the project.

ALTERNATIVE: (Sketch attached)

Use a single 10-ft.-wide asphalt multi-use path in lieu of the sidewalks and bicycle lanes.

ADVANTAGES:

- Reduces initial cost
- Reduces construction time
- Simplifies construction
- Allows for pedestrian and bicycle usage

DISADVANTAGES:

- Inconvenient for users on one side only
- Slight reduction in safety as users will have cross the mainline to access multi-use path

DISCUSSION:

The project is predicting an average daily traffic count of only 13,000 in the year 2032. Accommodating full depth pavement for two bicycle lanes and two sets of sidewalks is very expensive and may not be warranted. Known bicycle usage and pedestrian travel is quite limited, and a single multi-use path will provide the necessary functions at a reduced cost.

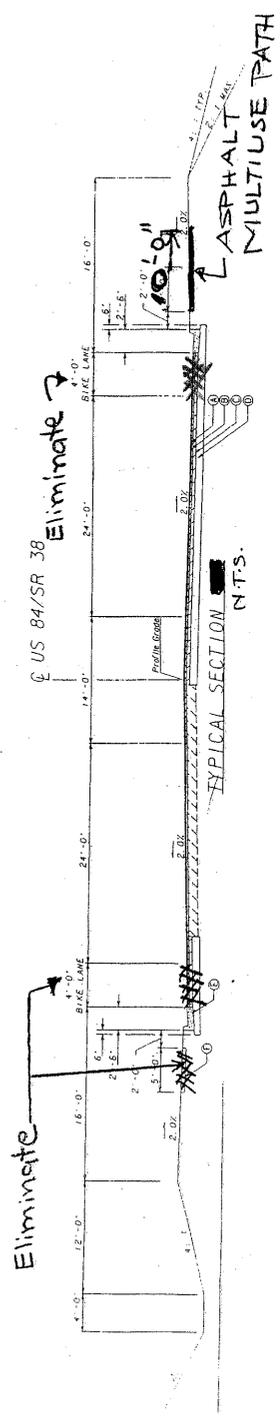
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 4,994,486 | — | \$ 4,994,486 |
| ALTERNATIVE | \$ 1,960,134 | — | \$ 1,960,134 |
| SAVINGS | \$ 3,034,352 | — | \$ 3,034,352 |

PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

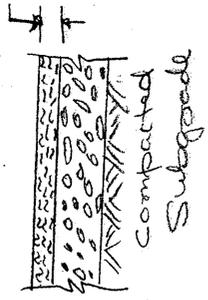
ALTERNATIVE NO.:
23

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 4



19 MM Superfave (220 lbs/sy)



6" Graded Aggregate Base

MULTI-USE PATH
 N.T.S.

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

23

SHEET NO.: 3 of 4

Multi-Use Path: (10' wide)

Total roadway length (excluding bridges): 11.42 miles
 $\Rightarrow 59,841$ feet

$$\text{Area} = (59,841 \times 10) / 9 = 66,490 \text{ SY}$$

At 220 lbs/sy, the asphalt tonnage used is

$$(66,490 \times 220) / 2000 = 7,314 \text{ tons}$$

Total construction Cost - Bridge Costs \Rightarrow

$$43,220,476 - 6,659,480 = \$36,560,996$$

Total pavement width = 4 + 24 + 14 + 24 + 4 = 70'

$$\text{Costs per foot width} = 36,560,996 \div 70 = \$522,300$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 24

DESCRIPTION: USE 6-IN. X 24 IN. CURB AND GUTTER IN LIEU OF
 6-IN. X 30 IN. UNITS

SHEET NO.: 1 of 1

ORIGINAL DESIGN:

The present design denotes the use of 6-in. x 30-in. Type 2 concrete curb and gutters; however, the design cost estimate prices 6-in. x 24-in. Type 2 curb and gutters.

ALTERNATIVE:

Since the 6-in. x 30-in. curb and gutter units would be more expensive, use 6-in. x 24-in. Type 2 concrete curb and gutters.

ADVANTAGES:

- Eases installation
- Reduces initial cost

DISADVANTAGES:

- Loss of 6-in. of storm water conveyance

DISCUSSION:

Both concrete curb and gutter systems would suffice for this project; however, the recommended system will reduce overall costs.

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

VALUE ENGINEERING ALTERNATIVE



| | | |
|--------------|--|----------------------------|
| PROJECT: | EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125, US 84/SR 38 WIDENING AND RECONSTRUCTION <i>Clinch and Ware Counties, Districts 4 and 5, Final Design Stage</i> | ALTERNATIVE NO.: 25 |
| DESCRIPTION: | PROVIDE A MULTI-USE PATH ON ONE SIDE OF THE MAINLINE AND SIDEWALKS ON THE OTHER SIDE IN THE URBAN AREA | SHEET NO.: 1 of 3 |

ORIGINAL DESIGN: (Sketch attached)

The current design indicates the use of 4-ft. bicycle lanes and 5-ft. sidewalks on each side of the mainline in the urban areas of the project.

ALTERNATIVE: (Sketch attached)

Use a single 10-ft.-wide asphalt multi-use path in lieu of the sidewalks and bicycle lanes on one side of the facility and retain the sidewalk on the opposite side of the multi-use path.

ADVANTAGES:

- Reduces initial cost
- Reduces construction time
- Simplifies construction
- Allows for pedestrian and bicycle usage

DISADVANTAGES:

- Slight reduction in safety as users will have cross the mainline to access multi-use path

DISCUSSION:

The project is predicting an average daily traffic count of only 13,000 in the year 2032. Accommodating full depth pavement for two bicycle lanes and two sets of sidewalks is very expensive and may not be warranted. Known bicycle usage and pedestrian travel is quite limited, and a single multi-use path will provide the necessary functions at a reduced cost.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 4,994,486 | — | \$ 4,994,486 |
| ALTERNATIVE | \$ 2,159,257 | — | \$ 2,159,257 |
| SAVINGS | \$ 2,835,229 | — | \$ 2,835,229 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 26

DESCRIPTION: **PREPARE SHOULDERS FOR SIDEWALKS BUT DO NOT**
PLACE THE CONCRETE

SHEET NO.: 1 of 2

ORIGINAL DESIGN:

The current design provides sidewalks on both sides of the mainline in the beginning of the project and through the town of Manor.

ALTERNATIVE:

Prepare the shoulders to potentially receive sidewalk pavement in the future; however, do not place the sidewalk concrete at this time.

ADVANTAGES:

- Reduces construction time
- Simplifies construction
- Reduces initial cost

DISADVANTAGES:

- Grass sidewalks are not as easy to walk on as rigid or flexible pavement
- Loss of an existing amenity in Manor
- Increases maintenance cost (mowing, watering, etc.)

DISCUSSION:

Since the current population in the region is not very large, nor is expected to grow significantly in the near future, paving of proposed sidewalks may not be warranted. As the population grows and the need for paving is demonstrated, pave the prepared shoulders.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 398,246 | — | \$ 398,246 |
| ALTERNATIVE | \$ 11,486 | — | \$ 11,486 |
| SAVINGS | \$ 386,760 | — | \$ 386,760 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 27

DESCRIPTION: **USE 14-FT. FLUSH MEDIAN THROUGHOUT**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The design uses a 32-ft. median in the rural portion of the project and a 14-ft. paved flush median in the “urban” portions.

ALTERNATIVE: (Sketch attached)

Use a 14-ft. paved flush median throughout the whole project.

ADVANTAGES:

- Reduces right-of-way takes
- Simplifies construction
- Provides more accessibility

DISADVANTAGES:

- Top speed would be limited to 60 mph with a rural shoulder
- Slight loss in safety – reduced width between opposing traffic
- Increases cost

DISCUSSION:

Shoulders would still be used in the rural sections so the design speed can meet 60 miles per hour in those areas. (Note: This alternative includes Alt. Nos. 6 and 7.)

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|----------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 4,070,461 | — | \$ 4,070,461 |
| ALTERNATIVE | \$ 5,336,870 | — | \$ 5,336,870 |
| SAVINGS | \$ (1,266,409) | — | \$ (1,266,409) |

PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

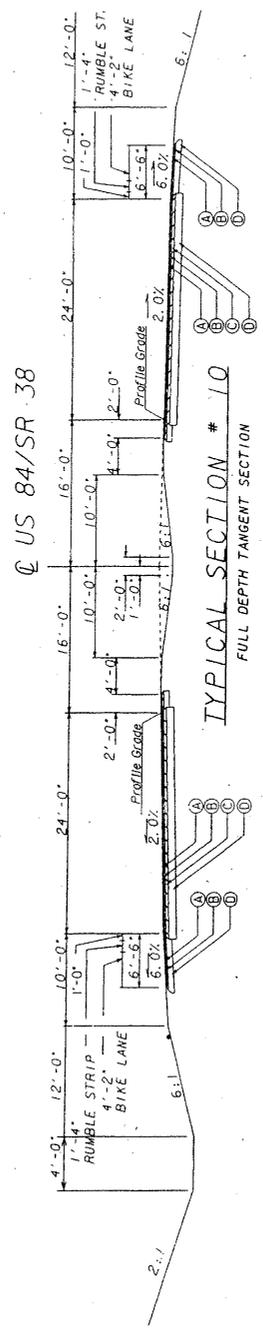
ALTERNATIVE NO.:

27

AS DESIGNED ALTERNATIVE

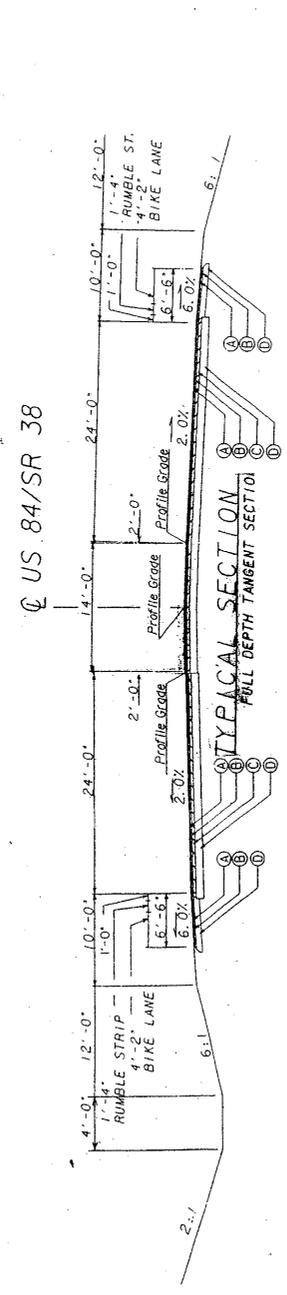
SHEET NO.: 2 of 5

AS DESIGN



32' median - Rural

ALTERNATIVE



14' median - Rural outside
Shoulders

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

27

SHEET NO.: 3 of 5

Alternative / Proposed 14' paved flush median
 Roadway Length = 11.421 mi x 5,280' / mi = 60,300'

(9.5mm) (14' x 60,300') x .125' x .076 T / CF = 8,020 tons

(19mm) (844,200 S.F.) x .167' x .076 T / CF = 10,715 tons

(25mm) (844,200 S.F.) x .25' x .076 T / CF = 16,040 tons

GAB(8") 844,200 S.F. / 9 SF/SY = 93,800 SY

Original :- Median throughout the project.

$$60,300' - \left[\begin{matrix} \text{median openings} \\ 13EA. \times 120' \\ 2AVG. \end{matrix} \right] - \left(\begin{matrix} \text{EXIST. 14' med.} \\ 4,960' + 4,263' \end{matrix} \right) = 49,517'$$

(length of Project with 2' slides) (49,517' x 2' x 2EA) = 198,068 SF.

(2' slides) (9.5mm) (198,068 SF x .125' x .076 T / CF) = 1,882 tons

(19mm) (198,068 SF x .167' x .076 T / CF) = 2,514 tons

GAB(8") 198,068 SF / 9 SF/SY = 22,008 SY.

Median openings Pavement

(13EA. x 120' x 32') = 49,920 SF

(9.5mm) 49,920 SF x .125' x .076 T / CF = 474 tons

(19mm) 49,920 SF x .167' x .076 T / CF = 634 tons

(25mm) 49,920 SF x .25' x .076 T / CF = 949 tons

GAB(8") 49,920 SF / 9 SF/SY = 5,547 SY.

CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

27

SHEET NO.: 4 of 5

Cont. - Original

Pavement for Lt. Turn / Decel Lanes in Median

$$16' \times [(1,570' \times 10 \text{ EA}) + (1,460') + (1,130') + (620')] = 302,560 \text{ SF}$$

$$(9.5 \text{ mm}) (302,560 \text{ SF} \times .125' \times .076 \text{ T/CF}) = 2,875 \text{ tons}$$

$$(19 \text{ mm}) 302,560 \text{ SF} \times .167' \times .076 \text{ T/CF} = 3,840 \text{ tons}$$

$$(25 \text{ mm}) 302,560 \text{ SF} \times .25' \times .076 \text{ T/CF} = 5,749 \text{ tons}$$

$$\text{GAB}(8'') 302,560 \text{ SF} / 9 \text{ sy/sy} = 33,618 \text{ sy.}$$

Grass/Erosion Control in 32' median section:

$$(32' - (2' \times 2 \text{ EA}))_{\text{ch'drs}} = 28' \text{ grassed area}$$

$$(28' \times (49,517' - 18,910')) / 43,560 \frac{\text{SF}}{\text{AC}} = 19.7 \text{ AC}$$

$$(16' \times 18,910') / 43,560 \frac{\text{SF}}{\text{AC}} = 6.95 \text{ AC}$$

$$(\text{median grassed area}) = 26.65 \text{ AC}$$

$$\text{Add'l R/W for 32' med: } [(32' - 14') \times (60,300' - 4,960' - 4263')] = 919,386 \frac{\text{SF}}{43,560 \frac{\text{SF}}{\text{AC}}} = 21.1 \text{ AC (Add'l R/W)}$$

Median Drainage

Drop Inlets: 75 EA

18" St. Dr. Pipe: 5300 LF

Flared End. Sections: 75 EA.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 28

DESCRIPTION: **MINIMIZE RIGHT-OF-WAY WIDTH**

SHEET NO.: 1 of 2

ORIGINAL DESIGN:

The current design acquires the right-of-way a few ft. beyond the cut and fill lines.

ALTERNATIVE:

Only acquire the right-of-way that is actually needed for the project. For the cut and fill areas, acquire permanent easements only.

ADVANTAGES:

- Reduces initial cost
- Purchases what is essential

DISADVANTAGES:

- Future road expansion (if ever needed) necessitates addition of a right-of-way at a higher cost than today

DISCUSSION:

Where a property is to be demolished, acquiring the right-of-way makes sense. Where an area is needed to extend the cut and fill, that area can be acquired as temporary or permanent easements.

The savings noted below include only land costs. Costs for relocation, improvements, etc. are not indicated.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 1,245,786 | — | \$ 1,245,786 |
| ALTERNATIVE | \$ 728,530 | — | \$ 728,530 |
| SAVINGS | \$ 517,256 | — | \$ 517,256 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: **30**

DESCRIPTION: **ELIMINATE TWO INTERMEDIATE BENTS FROM EACH**
BRIDGE AT BRIDGE NO. 3 – US 84/SR 38 OVER CANE CREEK

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design indicates Bridge No. 3 over Cane Creek as an eight-span (30-ft. each) twin bridge with concrete T-beams and pile bents.

ALTERNATIVE: (Sketch attached)

Use six-span (40-ft. each) twin bridge with PSC beams (Type I modified) and pile bents.

ADVANTAGES:

- Requires fewer intermediate pile bents
- May improve bridge hydraulics
- Reduces construction time
- Simplifies construction
- Complies with contractor preference for rural bridge structures

DISADVANTAGES:

- Superstructure depth will increase
- Clearance between bottom of beam and 100-year high water elevation may be less than required

DISCUSSION:

Even though it will increase the initial cost to implement this alternative, the duration of construction will be reduced, and past records have shown that contractors prefer Type I modified PSC beams vs. T-beams.

The difference in clearance for a 100-year flood event is less than 6-in. (2.18 ft. [original] – 1.75 ft. [alternative] = 0.43 ft. = 5.16 in.). If this is an issue, the bridge profile can be increased to accommodate the new elevation, albeit for an additional cost.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,780,476 | — | \$ 1,780,476 |
| ALTERNATIVE | \$ 2,069,100 | — | \$ 2,069,100 |
| SAVINGS | \$ (288,624) | — | \$ (288,624) |

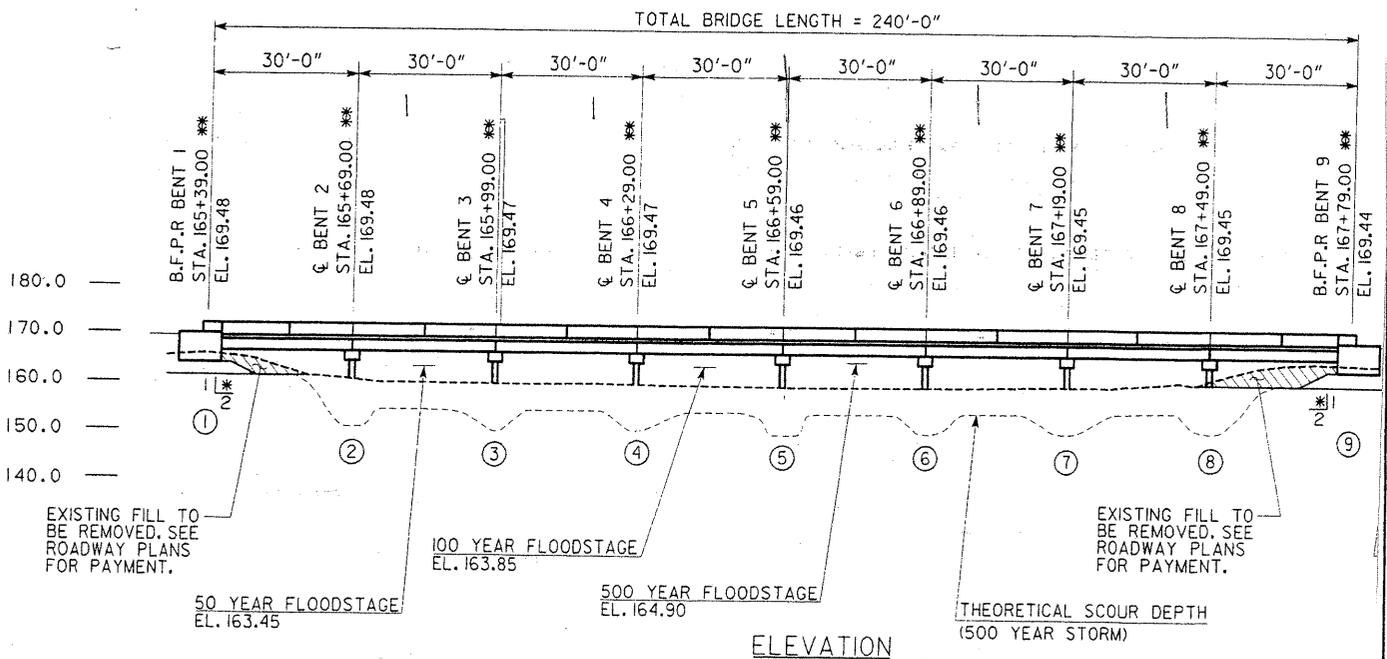
PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

30

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 5



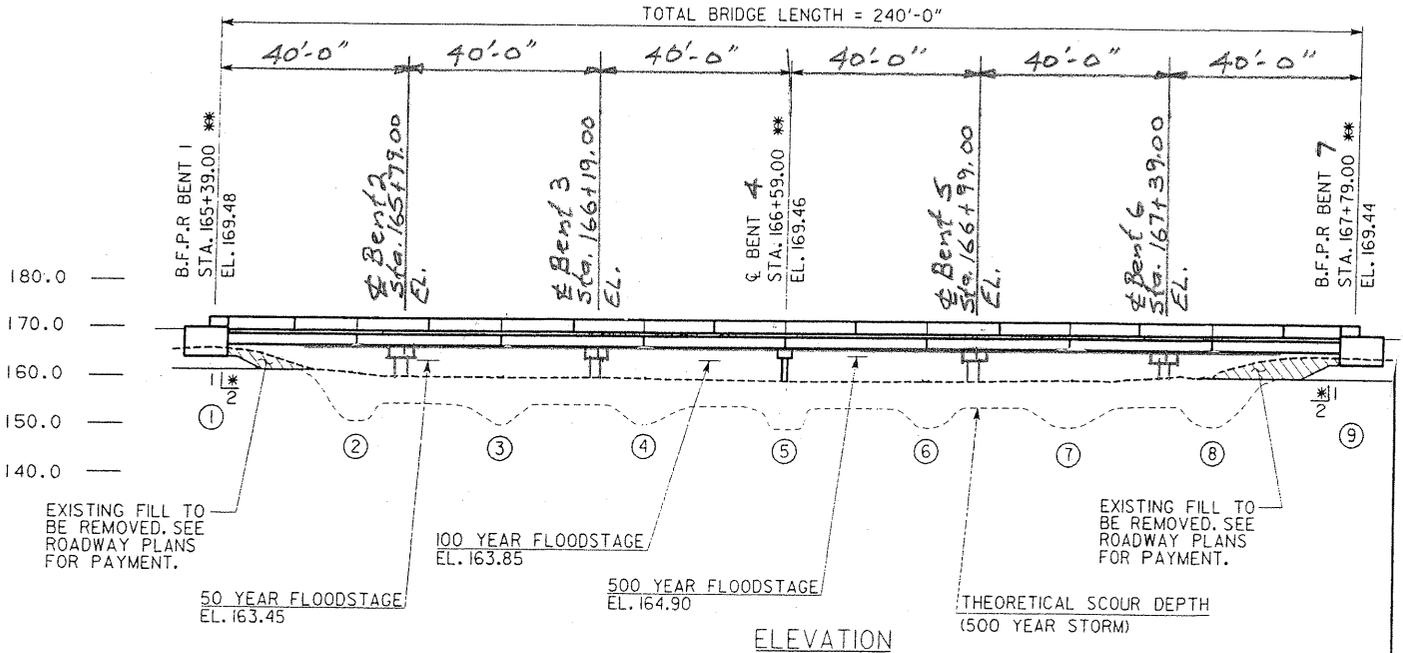
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Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

30

AS DESIGNED ALTERNATIVE

SHEET NO.: 3 of 5



CALCULATIONS



PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,
 US 84 / SR 38 Widening and Reconstruction
 Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
 Final Design Stage

ALTERNATIVE NO.:

30

SHEET NO.: 4 of 5

Clearance Calculations:

As Designed:

$$PGL = 169.44$$

$$\text{Dist. to b.m.} = 33'$$

$$\text{Cross Slope} = 2\%$$

$$\begin{aligned} \text{Correction} &= 33' \times 2\% \\ &= 0.66 \end{aligned}$$

$$\text{Deck thick.} = 2.75$$

$$\begin{aligned} \text{Edge b.m. elev.} &= 169.44 - 2.75 - 0.66 \\ &= 166.03' \end{aligned}$$

$$100\text{yr HW} = 163.85$$

$$\begin{aligned} \text{Clearance} &= 166.03 - 163.85 \\ &= 2.18' \end{aligned}$$

$$\begin{aligned} \text{Deck Area} &= 2 \text{ ea.} \times 41.25' \times 240' \\ &= 19,800 \text{ sf.} \end{aligned}$$

Alternative:

$$PGL = 169.44$$

$$\text{Dist. to b.m.} = 33'$$

$$\text{Cross Slope} = 2\%$$

$$\begin{aligned} \text{Correction} &= 33' \times 2\% \\ &= 0.66' \end{aligned}$$

$$\text{Slab thickness} = 0.85$$

$$\text{Beam depth} = 2.33$$

$$\text{Tot. Deck thick.} = 3.18'$$

$$\begin{aligned} \text{Edge b.m. Elev.} &= 169.44 - 3.18 - 0.66' \\ &= 165.60 \end{aligned}$$

$$100\text{yr HW} = 163.85$$

$$\begin{aligned} \text{Clearance} &= 165.60 - 163.85 \\ &= 1.75' \end{aligned}$$

$$\text{Deck Area} = 19,800 \text{ sf}$$

Class A concrete:

$$\begin{aligned} \text{Pile cap} &= 4 \text{ ea.} \times 3.25' \times 2.0' \times 37' / 27 \\ &= 35.63 \text{ cy.} \end{aligned}$$

$$\begin{aligned} 16'' \text{ sq. Piles} &= 4 \text{ ea.} \times 5 \text{ piles} \times 20' \\ &= 400' \end{aligned}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **EDS-84(23) AND BHN-007-3(25), P. I. NOS. 422120 & 422125,**
US 84/SR 38 WIDENING AND RECONSTRUCTION
Clinch and Ware Counties, Districts 4 and 5, Final Design Stage

ALTERNATIVE NO.: 31

DESCRIPTION: **USE 4-IN.-THICK SIDEWALKS THROUGHOUT**

SHEET NO.: 1 of 5

ORIGINAL DESIGN: (Sketch attached)

The current cost estimate lists and prices the concrete sidewalk for a 6-in.-thick cross section. The drawing sections indicate the use of 4-in.-thick sidewalks.

ALTERNATIVE: (Sketch attached)

Use 4-in.-thick sidewalks throughout the project.

ADVANTAGES:

- Conforms to Department standards
- Eases installation
- Reduces initial cost

DISADVANTAGES:

- None apparent

DISCUSSION:

Since there does not appear to be undue heavy traffic crossing of the proposed sidewalk locations, the cost estimate should reflect the drawings, thereby reducing capital cost.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|-----------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 398,246 | — | \$ 398,246 |
| ALTERNATIVE | \$ 286,434 | — | \$ 286,434 |
| SAVINGS | \$ 111,812 | — | \$ 111,812 |



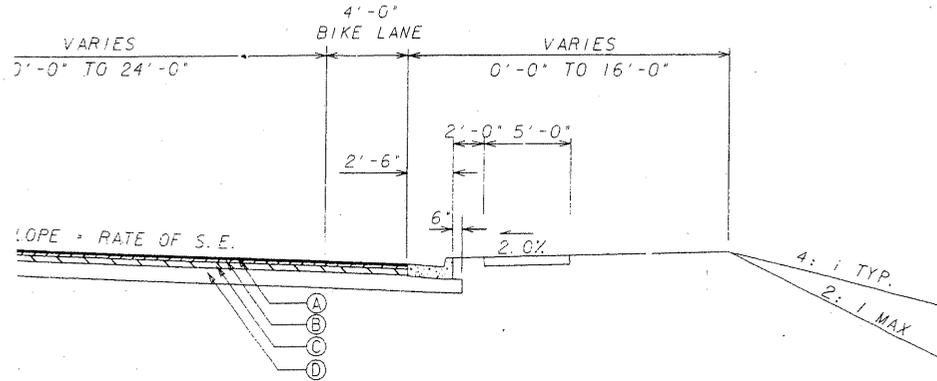
PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

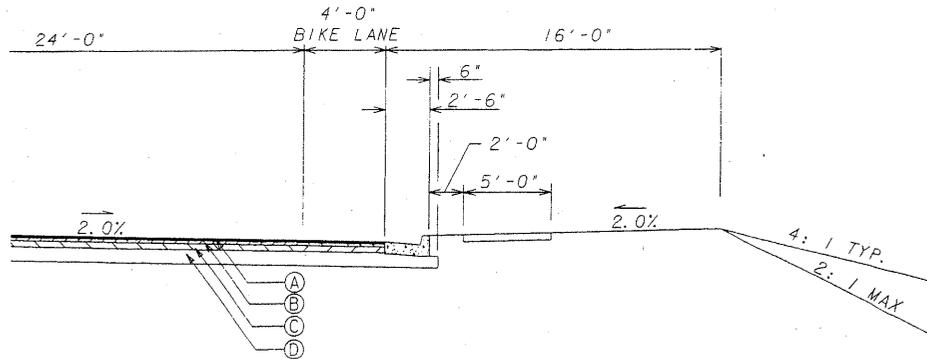
31

AS DESIGNED ALTERNATIVE

SHEET NO.: 2 of 5



8



REQUIRED PAVEMENT

- (A) RECYCLED ASPH CONC 12.5 MM SUPERPAVE, GP 2 ONLY, INCL BITUM MATL & H LIME (165 LBS/SY) (MIX DES LEVEL B)
- (B) RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME (220 LBS/SY) (MIX DES LEVEL B)
- (C) RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM MATL & H LIME (330 LBS/SY) (MIX DES LEVEL A)
- (D) GR AGGR BASE CRS, 8 INCH, INCL MATL
- (E) CONC CURB & GUTTER, 6 IN X 30 IN, TP 2
- (F) 4' CONCRETE SIDEWALK





PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

31

AS DESIGNED

ALTERNATIVE

SHEET NO.: 3 of 5

Estimate Report for file "EDS-84(23) P.I. NO. 422120_2007-06-19"

| Section Roadway | | | | | | |
|---------------------------|----------|-------|------------|--|-----------------------|--|
| Item Number | Quantity | Units | Unit Price | Item Description | Cost | |
| 150-1000 | 1 | LS | 900000.00 | TRAFFIC CONTROL - | 900000.00 | |
| 150-5010 | 4 | EA | 12228.36 | TRAFFIC CONTROL, PORTABLE IMPACT ATTENUATOR | 48913.44 | |
| 201-1500 | 1 | LS | 1300000.00 | CLEARING & GRUBBING - | 1300000.00 | |
| 205-0001 | 54000 | CY | 5.21 | UNCLASS EXCAV | 2813400.00 | |
| 318-3000 | 12000 | TN | 19.38 | AGGR SURF CRS | 232560.00 | |
| 433-1000 | 3900 | SY | 131.73 | REINF CONC APPROACH S | 513747.00 | |
| 441-0106 | 9438 | SY | 38.36 | CONC SIDEWALK, 6 IN | 362041.68 | |
| 441-6012 | 16987 | LF | 31.17 | CONC CURB & GUTTER, 6 IN X 24 IN, TP 2 | 529484.79 | |
| 446-1002 | 64100 | LF | 2.63 | PVMT REINF FABRIC STRIPS, TP 2, INCL BITUM BINDER | 168583.00 | |
| 456-2015 | 20 | GLM | 812.29 | INDENTATION RUMBLE STRIPS - GROUND-IN-PLACE (SKIP) | 16245.80 | |
| 634-1200 | 600 | EA | 105.44 | RIGHT OF WAY MARKERS | 63264.00 | |
| 641-1100 | 1400 | LF | 54.82 | GUARDRAIL, TP T | 76748.00 | |
| 641-1200 | 7100 | LF | 18.05 | GUARDRAIL, TP W | 128155.00 | |
| 641-5001 | 12 | EA | 653.72 | GUARDRAIL ANCHORAGE, TP 1 | 7844.64 | |
| 641-5012 | 38 | EA | 1811.86 | GUARDRAIL ANCHORAGE, TP 12 | 68850.68 | |
| Section Sub Total: | | | | | \$7,229,838.03 | |



PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84 / SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

ALTERNATIVE NO.:

31

SHEET NO.: 4 of 5

DETERMINE COST OF 4" THICK SIDEWALK VERSUS 6" THICK SIDEWALK GIVEN THE COST OF THE 6" THICK SIDEWALK

Per current design cost estimate: \$38.36 / SY for 6" thick sidewalk:

$$\$38.37 / \text{SY} \div 9 \text{ SF} / \text{SY} = \$4.26 / \text{SF}$$

Per 2007 RS Means, Heavy Construction Cost Data for 6" thick sidewalk:

$$\$4.28 / \text{SF}$$

Per 2007 RS Means, Heavy Construction Cost Data for 4" thick sidewalk:

$$\$3.08 / \text{SF}$$

Use ratios to determine what the cost of the 4" thick sidewalk would be in the design estimate if it had been included.

$$\text{Design Estimate 6"} = \$4.26 / \text{SF}$$

$$\text{2007 RS Means 6"} = \$4.28 / \text{SF}$$

$$\text{Design Estimate 4"} = \$ X / \text{SF}$$

$$\text{2007 RS Means 4"} = \$3.08 / \text{SF}$$

$$\$4.26 / \$4.28 :: X / \$3.08 \quad \therefore \quad X = \$3.07 / \text{SF}$$

$$\therefore \quad \$3.07 / \text{SF} \times 9 \text{ SF} / \text{SY} = \mathbf{\$27.59 / \text{SY}}$$

PROJECT DESCRIPTION

BACKGROUND/PROPOSED REVISION

In order to meet current GDOT guidelines for the Governor's Road Improvement Program (G.R.I.P.) projects, the urban typical section for project PDS-84(23) is proposed to be revised to include 4-ft. bicycle lanes at the outside edges of the travelway and wider shoulders on each side of the mainline to accommodate the requirements of the Americans with Disabilities Act. This revision complies with the Southeast Regional Development Center Plan's (SRDCP) designation of the entire stretch of United States Route (US) 84 beginning in Clinch County, through Ware County, and into Pierce County as a bicycle route.

The proposed alignment would shift further north just east of Homerville, requiring additional right-of-way to avoid impacts to the CSX railroad. The rural sections would use GDOT standard G.R.I.P. bicycle accommodating shoulders.

In addition, as none of the existing seven bridges within this project meet HS-20 design criteria, they are to be replaced in accordance with the Transportation Online Policy and Procedure System (TOPPS), Policy 2405-1.

The revised concept submitted for approval has EDS 84(23) listed in the current State Transportation Improvement Program (STIP), but not BHN-007-3(25). Both projects are included in GDOT's Construction Work Program (CWP).

NEED AND PURPOSE

The US 84/State Route (SR 38) improvements involve the multi-laning of this primary east-west corridor in South Georgia, serving as a catalyst for the development of the region. The improvements will aid in the economic development of sparsely populated rural areas and small towns along this route. Traffic carrying capacity will be increased, and safety and operational characteristics along this segment will be improved.

Project Location: The project is located along SR 38 beginning at mile post 15.6 in Clinch County and ending at mile post 3.9 in Ware County. The total length of the project is approximately 11.4 miles. Project EDS-84(23) is located within Clinch and Ware Counties, and project BHN-007-3(25) is located in Ware County.

Description of Approved Concept: The project begins just west of Woodyard Creek by tying to EDS-84(20) and widens US 84/SR 38 on the north side by adding a 14-ft. flush median urban section and two 12-ft. lanes. The alignment then widens to the north side of the existing alignment in order to stay off the CSX railroad and continues to a point approximately 500 ft. east of the Woodyard Creek Overflow Bridge where the urban section changes to a rural road section. At this point, the median tapers to a 32-ft. grassed median and continues eastward, while widening to the north side until reaching Peters Branch where the alignment shifts further north on a new location bypassing the

town of Argyle on the north side. After crossing the existing power easement, the alignment parallels the easement on its north side until approximately County Road (CR) 128 where the alignment returns southward to continue widening the north side of the existing alignment beginning just past Polly Branch. The 32-ft. depressed median section continues to approximately 500 ft. west of existing CR 27 in Ware County. From there, the median tapers to a 14-ft. flush median with urban shoulders while widening US 84/SR 38 symmetrically. The urban section corresponds to the existing urban section through Manor. It then continues through Manor to approximately 200 ft. east of CR 26/Mills Road where it tapers to a 32-ft. grassed median and continues to a point just west of Greasy Branch Creek, east of Manor, where the project ends.

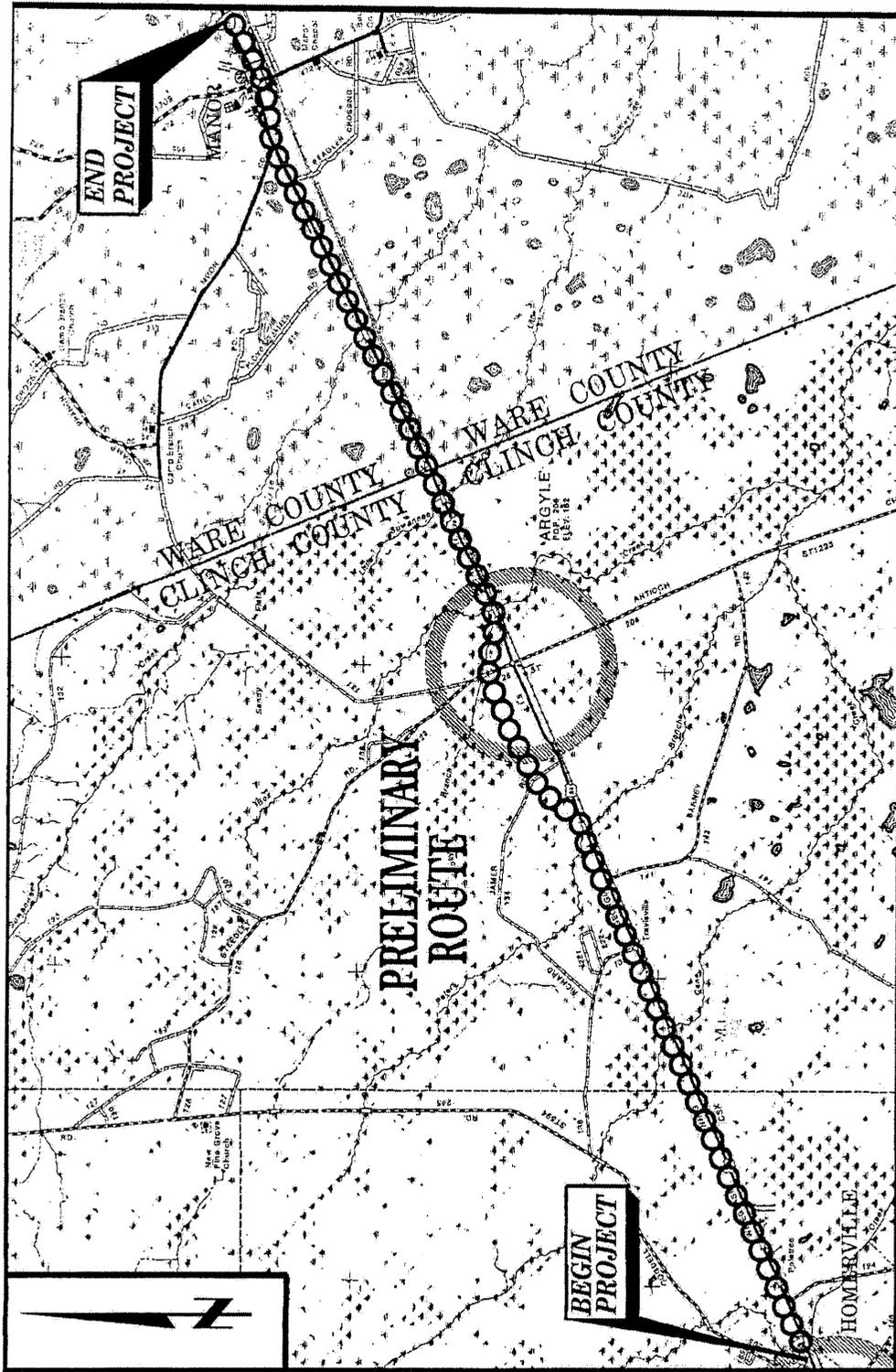
Approved Revisions: The urban typical section is revised to have a shoulder width of 16-ft. where needed in accordance with the SRDCP's designation of the entire stretch of US 84 beginning in Clinch County into Pierce County as a bicycle route. To accommodate this designation, an additional four ft. of pavement along the outside edges of the travelway have been added for bicycle accommodations; a total addition of eight ft. of pavement width. The urban sections are from the beginning of the project to approximately 500 ft. east of Woodyard Creek Overflow Bridge and from 500 ft. west of existing CR 27 through Manor in Ware County to approximately 1,000 ft. east of CR 57.

CONSTRUCTION COSTS

The probable cost of construction on H&L's cost estimate, dated June 21, 2007, of \$47,005,784. This figure is comprised of a construction subtotal of \$41,560,784 and right-of-way costs of \$5,445,000.

During the designer's presentation, a new right-of-way cost was provided in the amount of \$8,226,109. Furthermore, the original cost estimate did not take into account the quantity or cost of borrow material. H&L provide the VE team with the quantities of both borrow and excavation. Once these quantities were made available, the VE team was able to compute the cost of the borrow material to be an additional \$5,437,945 prior to mark-ups. For additional information, please see the Cost Estimate Summary and Cost Histograms section of the report.

As a consequence, the final probable cost of construction was determined to be \$55,768,733, broken down as a construction subtotal of \$47,542,524 and right-of-way costs of \$8,226,209.



END PROJECT

BEGIN PROJECT

PRELIMINARY ROUTE

WARE COUNTY
CLINCH COUNTY

STRIP MAP
EDS-84(23)
US 84/SR 38 IMPROVEMENTS
CLINCH/WARE COUNTIES
P.I.# 422120



LOCATION



SCALE IN MILES

SOURCE: GENERAL HIGHWAY MAP CLINCH & WARE CO. GEORGIA
PREPARED BY THE GEORGIA DEPARTMENT OF TRANSPORTATION, 1969

06/21/2004

VALUE ANALYSIS AND CONCLUSIONS

INTRODUCTION

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

- Value Engineering Study Agenda
- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histograms
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

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

PREPARATION EFFORT

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

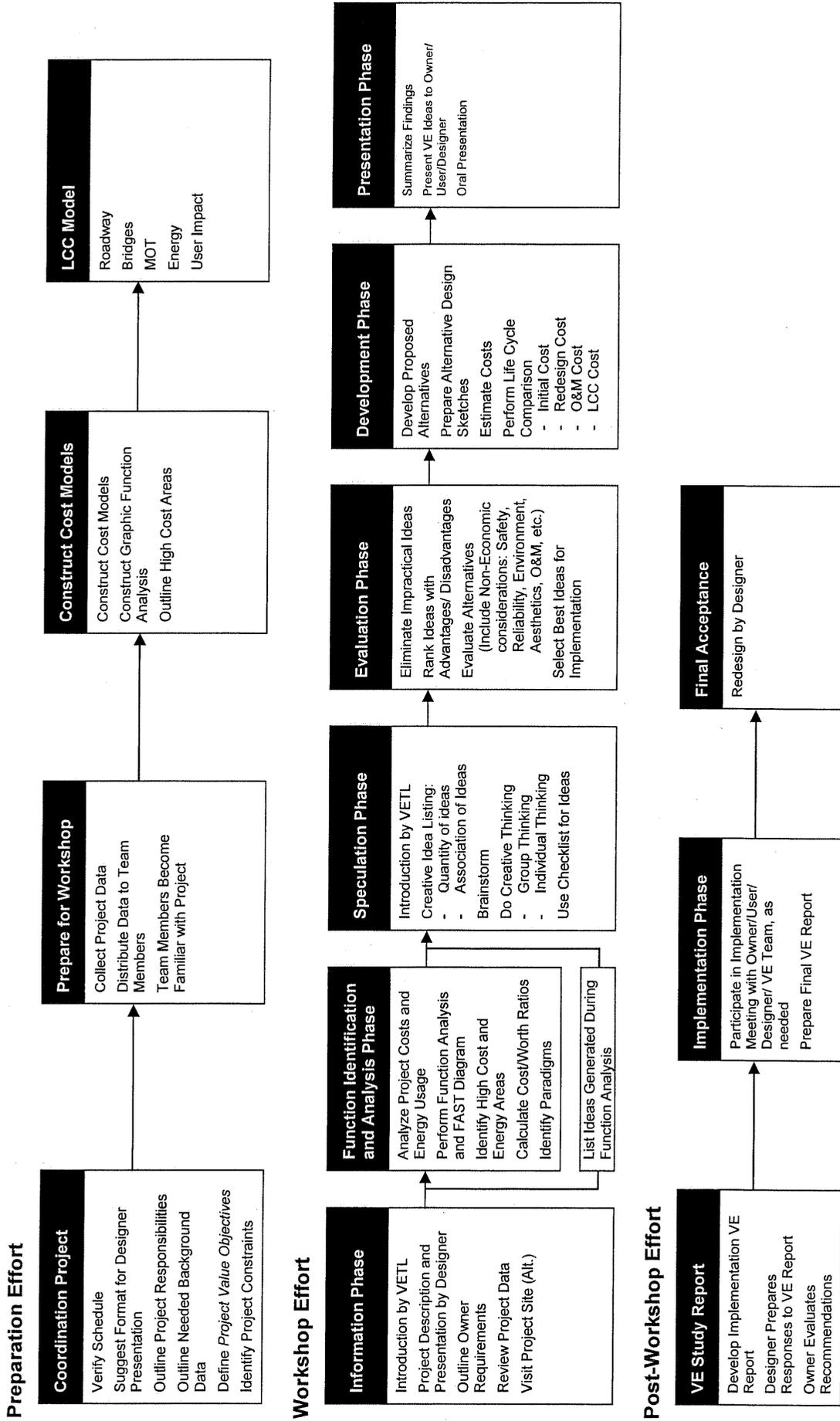
VALUE ENGINEERING WORKSHOP EFFORT

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

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



Value Engineering Study Task Flow Diagram



Information Phase

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

- Approved Revised Project Concept Report, Department of Transportation, State of Georgia, Interdepartment Correspondence, Office of Preconstruction for P. I. Nos. 422120/422125, Clinch/Ware Counties, EDS-84(23)/BHN-007-3(25), US 84/SR 38 Improvements; dated November 20, 2006 ;
- Half Size Drawings entitled Plan and Profile of Proposed Reconstruction of SR 38 (US 84); Clinch and Ware Counties; EDS-84(23) & BHN-007-3(25); P. I. Nos. 422120 & 422125; prepared by Heath & Lineback Engineers, Inc. for the State of Georgia Department of Transportation; undated;
- CD entitled Georgia, Department of Transportation, SR 38 (US 84), VE Study Packages, project nos. 422120 & 422125, Ware & Clinch Counties; prepared by Heath & Lineback Engineers, Inc.; undated;
- Earthwork Quantities for Project EDS-84(23); prepared by Heath & Lineback Engineers, Inc.; undated;
- Environmental Assessment; Approved for Advancement to Availability/Public Hearing Phase for Project EDS-84 (23) (26) & HPPN-EDS-84(27), Clinch and Ware Counties, Georgia; P. I. Nos. 422120, 522770 & 522780; U.S. Department of Transportation, Federal Highway Administration and Georgia Department of Transportation in cooperation with the United States Army Corps of Engineers, Submitted pursuant of 42 U.S.C. 4321 et. seq.; dated December 29, 2006;
- Flexible Pavement Design Analysis for EDS-84(23), P. I. No. 422120, SR 38 (US 84), County: Clinch and Ware; prepared by Heath & Lineback Engineers, Inc.; dated July 19, 2007;
- Preliminary Right of Way Cost Estimate for project EDS-84(23), Clinch/Ware, P. I. No. 422120; prepared by the State of Georgia Department of Transportation office of Right of Way; dated July 2, 2007;
- Accident Report for SR 38 (US 84) from west of Woodyard Creek in Clinch County to 0.06 miles east of Hoke Street (CR 517) in Ware County; prepared by Heath & Lineback Engineers, Inc.; undated;
- Traffic Count for EDS-84(23); P. I. No. 422120, Clinch/Ware Counties; prepared by Heath & Lineback Engineers, Inc. for the State of Georgia Department of Transportation, Office of Environmental/Location; dated May 2007;
- Copies of Existing Bridge Drawings for Bridge No. 1 over Wood Yard Creek/Darby Creek (March 1955), Bridge No. 2 over Creek/Wood Yard Overflow (March 1955), Bridge No. 3 over Cane Creek (April 1955), Bridge No. 4 over Peters Creek (April 1955), Bridge No. 5 over Box Creek (April 1955), Bridge No. 6 over Cypress Creek (April 1955), Bridge No. 7 over Suwanee Creek (June 1955), Substructure Details for Bridges 1, 2, 3, 4, 5, & 6, Clinch County (April 1955), and Superstructure Details for Bridges 1, 2, 3, 4, 5, & 6, Clinch County;
- General Highway Map, Clinch County, Georgia, prepared by the Department of Transportation, Division of Planning and Programming, Planning Data Services in cooperation with the U.S. Department of Transportation, Federal Highway Administration, dated 1982;
- General Highway Map, Ware County, Georgia, prepared by the Department of Transportation, Division of Planning and Programming, Planning Data Services in cooperation with the U.S. Department of Transportation, Federal Highway Administration, dated 1982;

- Standard Specifications Construction of Transportation Systems, GDOT, State of Georgia, 2001 Edition;
- GDOT English Construction Standards and Construction Details, GDOT, State of Georgia, dated August 19, 2004 and November 19, 2003, respectively;
- Geometric Design of Highways and Streets, A Policy on, American Association of State Highway and Transportation Officials, 2004;
- Guide for the Planning, Design, and Operation of Pedestrian Facilities, American Association of State Highway and Transportation Officials, July 2004;
- Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials, 1999;
- Item Mean Summary for 01/2006 to 12/2006 prepared the Georgia Department of Transportation; dated January 8, 2007;
- GDOT Design Policy Manual, a Georgia Department of Transportation Publication, Version 2.0; revised June 1, 2007; and
- GDOT Bridges and Structures Design Policy Manual, Office of Bridge and Structural Design; dated October 2005, revised April 2007.

Function Identification and Analysis Phase

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

Speculation Phase

This 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.

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

Evaluation Phase

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

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts, in terms of how well it met the design intent. Advantages and disadvantages were discussed, and each team member rated the ideas on a scale of 1-5, with the best ideas rated 5. Total scores were summed for each idea and only highly-rated ideas were developed into alternatives. In cases where there was little cost impact, but an improvement to the project was anticipated, the designation DS, for design suggestion, was used. The design team should review this listing for possible incorporation of ideas into the project.

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

Development Phase

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

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 GDOT and H&L 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 Value Engineering Study Report. Personnel from GDOT and H&L will analyze each alternative and prepare a short response, recommending either incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. Lewis & Zimmerman Associates, Inc. is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 28-hour Value Engineering (VE) study on the following projects: **EDS-84(23) P. I. No. 422120** and **BHN-007-3(25), P. I. No. 422125, United States Route (US) 84 / State Route (SR) 38 Widening and Reconstruction**. The projects are located in the Clinch and Ware Counties, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) and the design consultant, Health and Lineback Engineers, Inc. (H&L), will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

VE Study Agenda

The VE study will follow the outline described below and be conducted July 23 - 26, 2007. The study will be conducted in the Road Design's Conference Room, Room 444 of GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, and Value Engineering Coordinator, who can be reached at 404-651-7468.

Monday, Jul 23rd

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

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

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

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

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

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

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

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

Tuesday, July 24th

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

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

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

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

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

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

Wednesday, July 25th

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

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

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

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

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

Thursday, July 26th

8:00 am - 9:00 am **Finalize Summary Worksheets and Prepare for Oral Presentation Strategies**

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

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

11:00 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 | Highway Engineer | ARCADIS |
| Paresh J. Parikh, PE | Construction Specialist | Delon Hampton and Associates |
| | Transportation Engineer | |
| Molapo R. M. Kgabo, PE | Bridge/Structural Engineer | HNTB Corporation |
| Luis M. Venegas, PE, CVS, LEED® AP | Value Engineering Facilitator Team Leader | Lewis & Zimmerman Associates |

OWNER'S/DESIGNER'S PRESENTATION

GDOT, the owner, and Heath & Lineback Engineers, Inc., the designer, presented an overview of the projects on Monday, July 23, 2007. This meeting was an integral part of the Information Gathering Phase of the VE Study, and familiarized the VE team with the overall project. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention.

VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team conducted an informal presentation on Friday, July 26, 2007 to GDOT and H&L representatives. Copies of the draft Summary of Potential Cost Savings worksheets were provided for interim use by GDOT and H&L personnel.

A copy of the meeting participants is attached for reference.

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS



| PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125, US 84/SR 38 Widening and Reconstruction Clinch and Ware Counties, Georgia DOT, Districts 4 and 5 Final Design Stage | | DATE: July 23 – 26, 2007 |
|---|--|--|
| NAME & E-MAIL (PLEASE PRINT) | ORGANIZATION/TITLE | PHONE/FAX |
| Name: Russell B. Daughtry GDOT Employee No.: em: russell.daughtry@dot.state.ga.us | Organization: Georgia Department of Transportation (GDOT), General Office Title: Construction Liaison Engineer | ph: 404-656-5306 cell: fx: |
| Name: Steve Gaston, PE GDOT Employee No.: em: steve.gaston@dot.state.ga.us | Organization: GDOT, Office of Bridge Design Title: Assistant Group Leader | ph: 404-656-5197 cell: fx: |
| Name: Ronnie Hall GDOT Employee No.: em: ronnie.hall@dot.state.ga.us | Organization: GDOT, District 4 Title: Assistant District Construction Engineer | ph: 229-386-3465 cell: 229-309-9750 fx: 229-386-3612 |
| Name: Jerry Hughes GDOT Employee No.: em: jerry.hughes@dot.state.ga.us | Organization: GDOT, District 4 Title: Area Engineer | ph: 229-333-5287 cell: 229-245-4333 fx: 229-309-9885 |
| Name: Alexis John GDOT Employee No.: em: alexis.john@dot.state.ga.us | Organization: GDOT, Office of Environmental/Location Title: Transportation Environmental Planner II | ph: 404-699-4409 cell: fx: |
| Name: Gerald A. Milligan GDOT Employee No.: em: jerry.milligan@dot.state.ga.us | Organization: GDOT, Office of Right of Way Title: Supervisor Appraisal Estimator | ph: 770-986-1541 cell: fx: 770-986-1558 |
| Name: Lisa L. Myers GDOT Employee No.: em: lisa.myers@dot.state.ga.us | Organization: GDOT, Office of Engineering Services Title: Design Review Engineer Manager, Value Engineering Coordinator | ph: 404-651-7468 cell: fx: 404-463-6131 |
| Name: Brian K. Summers, PE GDOT Employee No.: em: brian.summers@dot.state.ga.us | Organization: GDOT, Office of Engineering Services Title: Project Review Engineer | ph: 404-656-6846 cell: fx: 404-463-6131 |
| Name: Yun Tang, PE GDOT Employee No.: em: yun.tang@dot.state.ga.us | Organization: GDOT, Office Consultant Design Title: Project Manager | ph: 404-463-0290 cell: fx: 404-463-6136 |
| Name: Ken Werho GDOT Employee No.: em: ken.werho@dot.state.ga.us | Organization: GDOT, Office of Traffic Safety and Design Title: Design Review Engineer | ph: 404-635-8144 cell: fx: 404-635-8116 |

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS



| PROJECT: EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125, US 84/SR 38 Widening and Reconstruction Clinch and Ware Counties, Georgia DOT, Districts 4 and 5 Final Design Stage | | DATE: July 23 – 26, 2007 |
|---|--|--|
| NAME & E-MAIL (PLEASE PRINT) | ORGANIZATION/TITLE | PHONE/FAX |
| Name: Ron Wishon GDOT Employee No.: em: ron.wishon@dot.state.ga.us | Organization: GDOT, Office of Engineering Services Title: Assistant Project Review Engineer | ph: 404-651-7470 cell: fx: 404-463-6131 |
| Name: Rudolph L. Frampton, PE GDOT Employee No.: em: rframpton@heath-lineback.com | Organization: Heath & Lineback Engineers, Inc. (H&L) Title: Project Manager | ph: 770-424-1668 cell: 404-234-4315 fx: 770-424-2907 |
| Name: W. Allen Krivsky, PE GDOT Employee No.: em: akrivsky@heath-lineback.com | Organization: H&L Title: Vice President and Manager of Transportation Engineering | ph: 770-424-1668 cell: 404-375-3062 fx: 770-424-2907 |
| Name: Joseph A. Leoni, PE GDOT Employee No.: em: jleoni@arcadis-us.com | Organization: ARCADIS Title: Roadway QA/QC Manager | ph: 770-431-8666 cell: 770-294-9970 fx: 770-435-2666 |
| Name: Paresh J. Parikh, PE GDOT Employee No.: em: pparikh@delonhampton.com | Organization: Delon Hampton & Associates, Chartered Title: Manager, Engineering Services | ph: 404-524-8030 cell: fx: 404-524-2575 |
| Name: Molapo R. M. Kgabe, PE GDOT Employee No.: em: mkgabo@hntb.com | Organization: HNTB Corporation Title: Bridge/Structural Engineer | ph: 404-946-5700 cell: fx: 404-841-2820 |
| Name: Luis M. Venegas, PE, CVS-Life, LEED® AP, FSAVE GDOT Employee No.: em: lvenegas@lza.com | Organization: Lewis & Zimmerman Associates, Inc. Title: Value Engineering Facilitator | ph: 770-992-3032 cell: 678-488-4287 fx: 770-435-2666 |
| Name: GDOT Employee No.: em: | Organization: Title: | ph: cell: fx: |
| Name: GDOT Employee No.: em: | Organization: Title: | ph: cell: fx: |
| Name: GDOT Employee No.: em: | Organization: Title: | ph: cell: fx: |

ECONOMIC DATA

The VE team developed economic criteria used for evaluation with information gathered from the State of Georgia Department of Transportation and Heath & Lineback Engineers, Inc. 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: | 2007 |
| Construction Start Up: | ±2009 (October) |
| Construction Duration: | ±36 Months (October 2012) |
| Economic Planning Life: | 35 years for Pavement |
| Economic Planning Life: | 50 years for Bridges |
| Inflation/Escalation Rate: | 8.00% (Per GDOT) |
| Uniform Present Worth (UPW) Factor: | 23.1452 for 35 years 28.3623 for 50 years |
| Composite Mark-Up for Construction: (Composed of: Engineering and Construction at 10.00%.) | 10.00% (1.1000) |
| Composite Mark-Up (Right-of-Way): (Composed of: Scheduling Contingency at 55.00%; Administration/Court Costs at 60.00%; and Inflation Factor at 40.00 %.) | 247.20% (3.4720) |

COST ESTIMATE SUMMARY AND COST HISTOGRAMS

The VE team prepared several cost models for the project follow this page. The cost models are arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and are based on the Estimate Report for file “EDS-84(23) P. I. No. 422120_2007-06-19” construction cost estimate which was prepared by Heath & Lineback Engineers, Inc. dated June 21, 2007. 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:

- Required Pavement
 - Aggregate Base Course
 - Recycled Asphaltic Concrete
- Roadway
 - Borrow Excavation
 - Unclassified Excavation
 - Clearing and Grubbing
- Bridges

DESIGNER’S COST ESTIMATE

It was noted during H&L’s presentation that the cost estimate did not reflect the amount of borrow needed for the project. As such, H&L provided the following information after their presentation:

| No. | LOCATION | FILL (CY) | CUT (CY) |
|-----|-------------------|----------------|---------------|
| 1 | US 1/SR 4 | 662,171 | 89,222 |
| 2 | CR 128 | 3,730 | 2,952 |
| 3 | CR 194 | 121 | 298 |
| 4 | CR 136 | 149 | 263 |
| 5 | CR 141 | 92 | 135 |
| 6 | CR 134 | 11,630 | 3,645 |
| 7 | CR 143 | 154 | 44 |
| 8 | CR 518 | 1,005 | 609 |
| 9 | CR 9 | 57 | 394 |
| 10 | CR 27 | 2,737 | 1,212 |
| 11 | CR 24 | 21 | 194 |
| 12 | CR 472 South | 1,035 | 29 |
| 13 | CR 472 North | 29 | 68 |
| 14 | CR 26 North | 12 | 182 |
| 15 | CR 26 South | 405 | 251 |
| 16 | CR 517 | 39 | 235 |
| | TOTAL (CY) | 683,387 | 99,733 |

In order to determine the amount of borrow missing form the estimate, the following assumptions and calculations were undertaken:

| | |
|-------------------------------|------------------|
| Indicated excavation = | 99,793 CY |
| Less 15% shrinkage factor = | <u>14,969 CY</u> |
| ∴ Neat amount of excavation = | 84,824 CY |

| | |
|---|------------------|
| Indicated neat (assumed) amount of borrow = | 683,387 CY |
| Less neat amount of excavation = | <u>84,824 CY</u> |
| ∴ Neat amount of borrow = | 598,563 CY |

| | |
|---------------------------------------|------------------|
| Calculate neat amount of borrow = | 598,563 CY |
| Plus 15% moisture /swelling content = | <u>89,784 CY</u> |
| ∴ Neat amount of borrow = | 688,347 CY |

Unit cost of borrow (from GDOT's Item Mean Summary, Item No. 206-0002; Borrow Excavation, Including Material, Weighted Average) = \$7.90/CY.

∴ Neat amount of borrow = 688,347 CY x \$7.90/CY = \$5,437,945.
(\$5,437,945/12 mile = \$453,162/mile)

The following additional calculations and unit process were developed during the VE study:

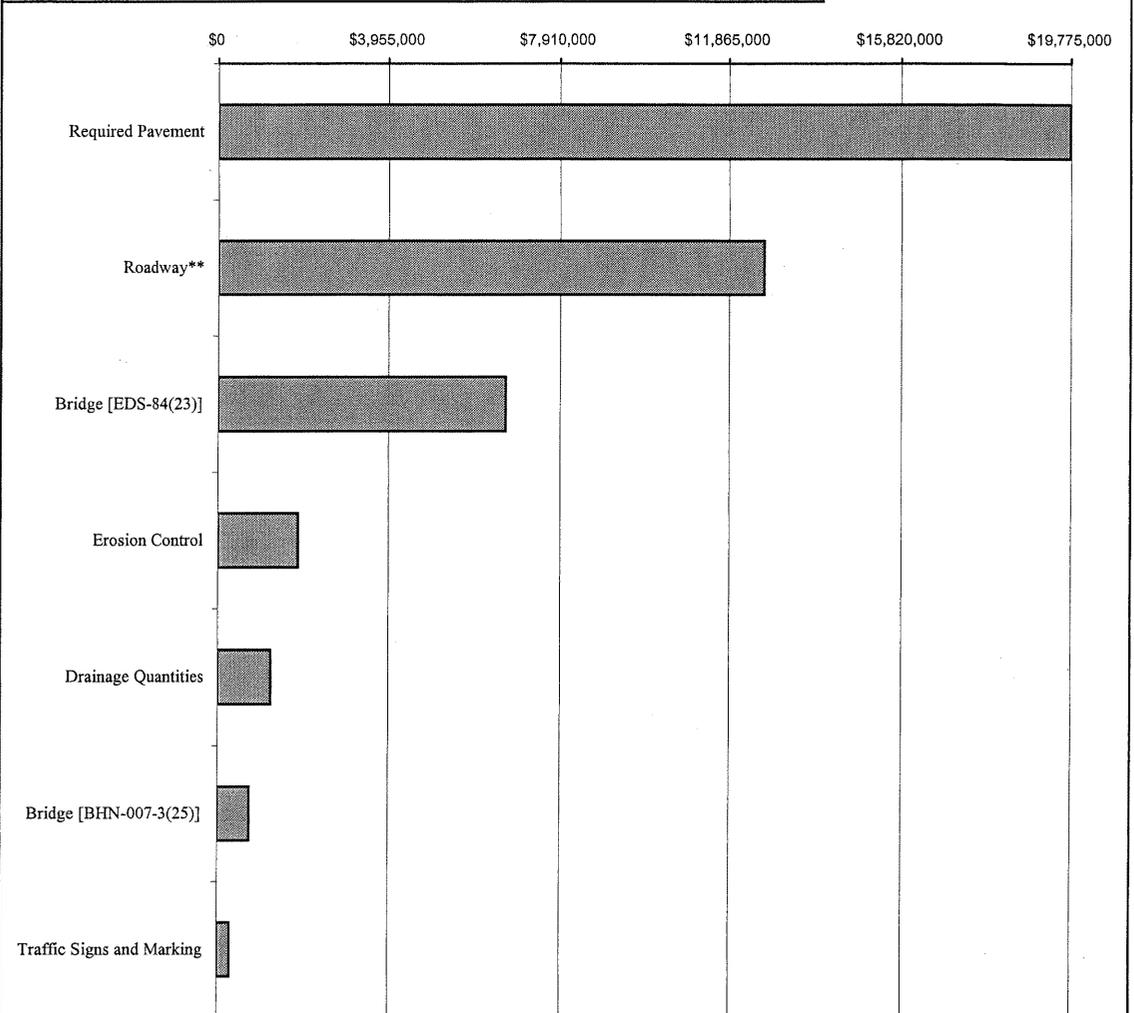
| | |
|------------------------------|--|
| Pavement cost per mile: | \$1,811,601 |
| Roadway cost per mile: | \$1,115,897 (\$662,735 w/o borrow; borrow = \$453,162) |
| Right-of-Way per mile: | \$ 2,100 (average) |
| Total project cost per mile: | \$3,601,706 |

COST HISTOGRAM



Project: EDS-84(23) and BHN-007-3(25) US 84 / SR 38 WIDENING & RECONSTRUCTION
 Clinch and Ware Counties, Georgia Department of Transportation, Districts 4 and 5
 Final Design Stage

| TOTAL PROJECT - US 84 / SR 38 WIDENING AND RECONSTRUCTION | COST | PERCENT | CUM. PERCENT |
|---|----------------------|-------------------------------------|--------------|
| Required Pavement | 19,762,925 | 45.73% | 45.73% |
| Roadway** | 12,667,783 | 29.31% | 75.04% |
| Bridge [EDS-84(23)] | 6,659,480 | 15.41% | 90.44% |
| Erosion Control | 1,853,060 | 4.29% | 94.73% |
| Drainage Quantities | 1,235,372 | 2.86% | 97.59% |
| Bridge [BHN-007-3(25)] | 748,040 | 1.73% | 99.32% |
| Traffic Signs and Marking | 293,816 | 0.68% | 100.00% |
| Construction Subtotal | \$ 43,220,476 | 100.00% | |
| Engineering and Construction at 10.00% | \$ 4,322,048 | | |
| Inflation Based on 8.00%* per annum for Zero Years 0.00% | \$ - | | |
| Construction Total | \$ 47,542,524 | Construction Mark-Up: 10.00% | |
| Right-of-Way Costs; EDS-84(23) | \$ 2,369,300 | | |
| Right-of-Way Subtotal | \$ 2,369,300 | | |
| Scheduling Contingency 55.00% | \$ 1,303,115 | | |
| Administration / Court Costs 60.00% | \$ 2,203,449 | | |
| Inflation Factor 40.00% | \$ 2,350,346 | | |
| Right-of-Way Total | \$ 8,226,210 | ROW Mark-Up: 247.20% | |
| GRAND TOTAL | \$ 55,768,733 | | |



Costs in graph are not marked-up.

* Escalation rate provided by GDOT based on immediate past experience.

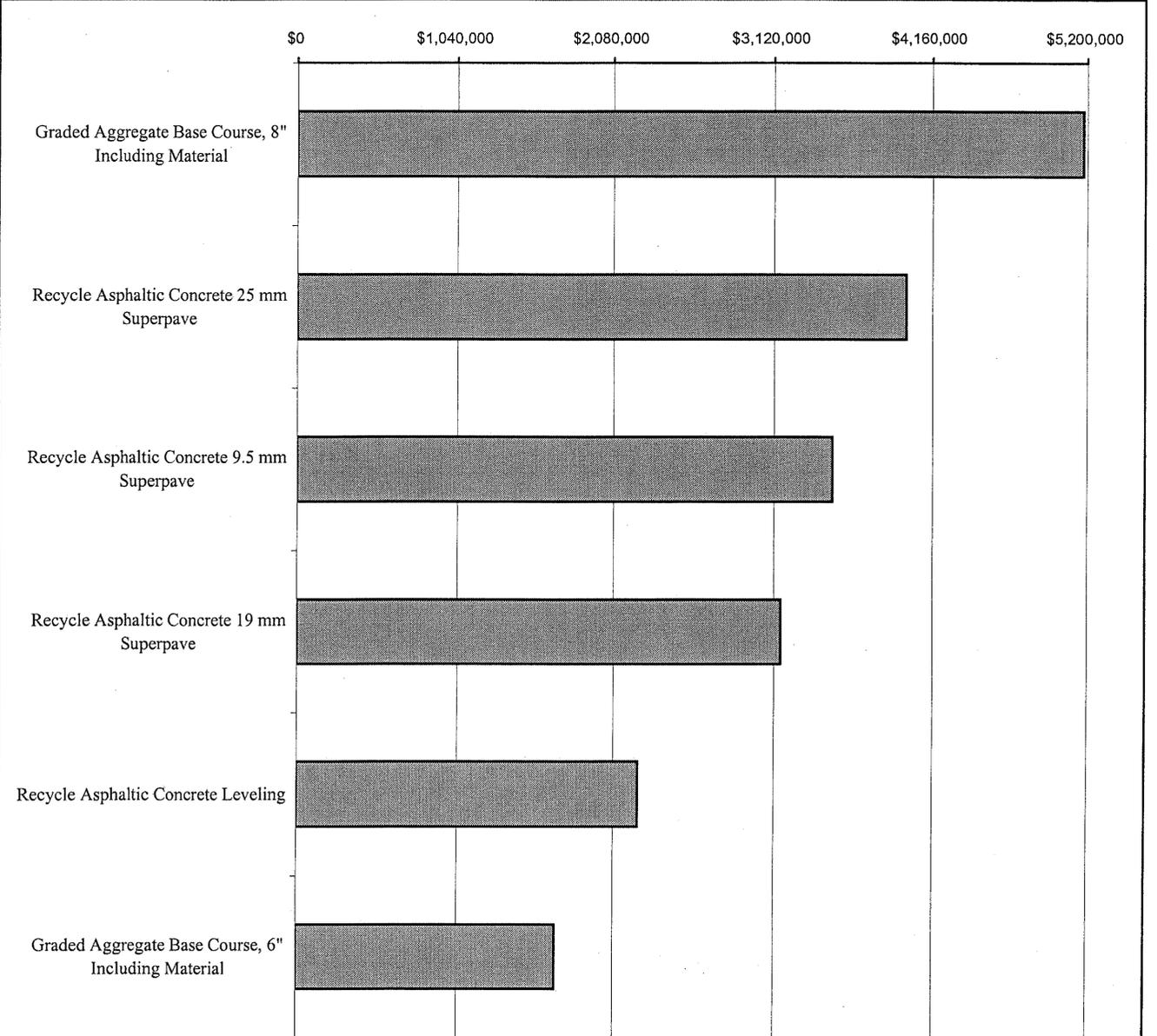
** Altered during VE Study per quantities provided by H&L. See "Cost Estimate Summary and Cost Histograms" section of the report.

COST HISTOGRAM



Project: EDS-84(23) and BHN-007-3(25) US 84 / SR 38 WIDENING & RECONSTRUCTION
Clinch and Ware Counties, Georgia Department of Transportation, Districts 4 and 5
Final Design Stage

| REQUIRED PAVEMENT | COST | PERCENT | CUM. PERCENT |
|---|----------------------|---------------------|-----------------|
| Graded Aggregate Base Course, 8" Including Material | 5,176,178 | 26.19% | 26.19% |
| Recycle Asphaltic Concrete 25 mm Superpave | 3,985,709 | 20.17% | 46.36% |
| Recycle Asphaltic Concrete 9.5 mm Superpave | 3,498,792 | 17.70% | 64.06% |
| Recycle Asphaltic Concrete 19 mm Superpave | 3,163,760 | 16.01% | 80.07% |
| Recycle Asphaltic Concrete Leveling | 2,245,280 | 11.36% | 91.43% |
| Graded Aggregate Base Course, 6" Including Material | 1,693,206 | 8.57% | 100.00% |
| Construction Subtotal | \$ 19,762,925 | 100.00% | |
| Engineering and Construction at | 10.00% | \$ 1,976,293 | |
| Inflation Based on 8.00%* per annum for Zero Years | 0.00% | \$ - | |
| Construction Total | \$ 21,739,218 | Construction | |
| | | Mark-Up: | 10.00% |



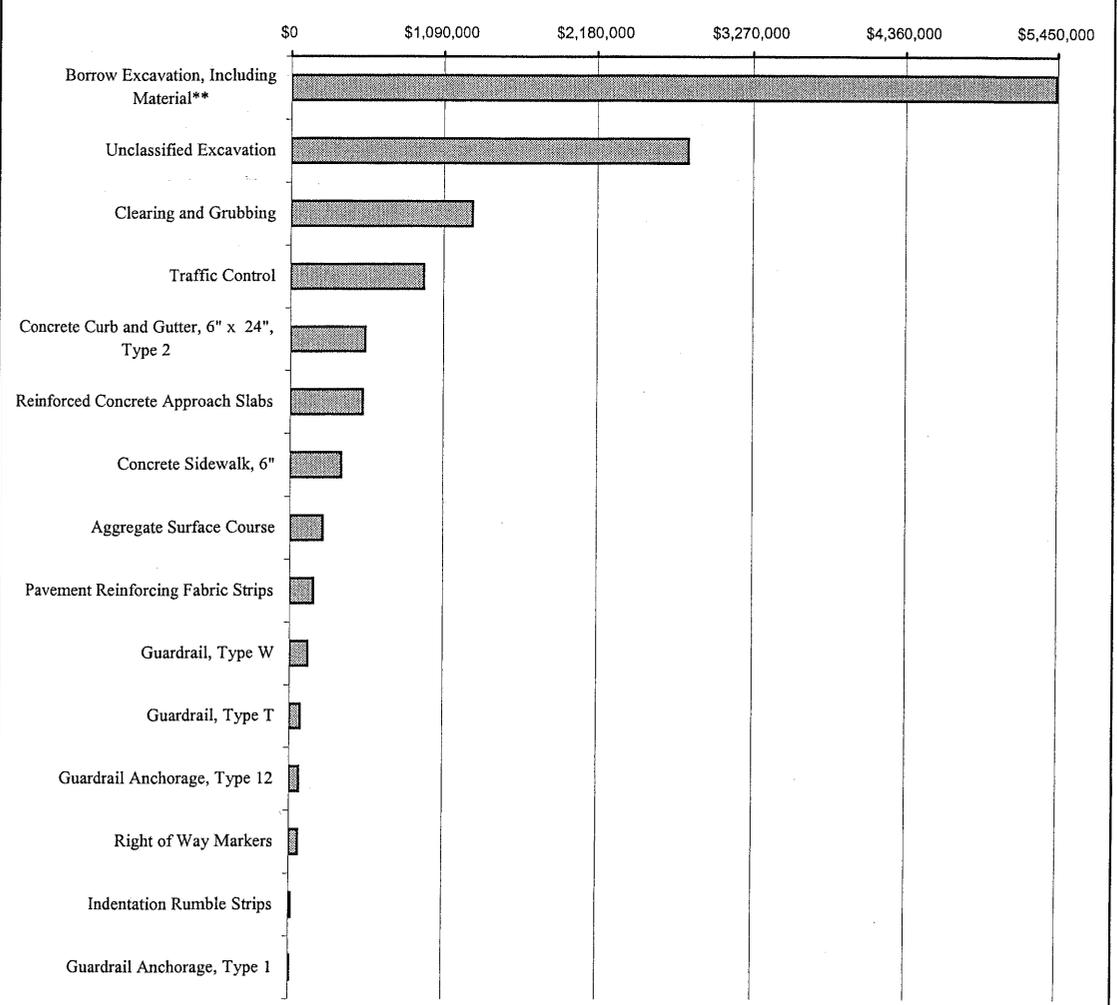
Costs in graph are not marked-up.

* Escalation rate provided by GDOT based on immediate past experience.

COST HISTOGRAM

Project: EDS-84(23) and BHN-007-3(25) US 84 / SR 38 WIDENING & RECONSTRUCTION
Clinch and Ware Counties, Georgia Department of Transportation, Districts 4 and 5
Final Design Stage

| ROADWAY | COST | PERCENT | CUM. PERCENT |
|--|----------------------|---------------------|-----------------|
| Borrow Excavation, Including Material** | 5,437,945 | 42.93% | 42.93% |
| Unclassified Excavation | 2,813,400 | 22.21% | 65.14% |
| Clearing and Grubbing | 1,300,000 | 10.26% | 75.40% |
| Traffic Control | 948,913 | 7.49% | 82.89% |
| Concrete Curb and Gutter, 6" x 24", Type 2 | 529,485 | 4.18% | 87.07% |
| Reinforced Concrete Approach Slabs | 513,747 | 4.06% | 91.12% |
| Concrete Sidewalk, 6" | 362,042 | 2.86% | 93.98% |
| Aggregate Surface Course | 232,560 | 1.84% | 95.82% |
| Pavement Reinforcing Fabric Strips | 168,583 | 1.33% | 97.15% |
| Guardrail, Type W | 128,155 | 1.01% | 98.16% |
| Guardrail, Type T | 76,748 | 0.61% | 98.77% |
| Guardrail Anchorage, Type 12 | 68,851 | 0.54% | 99.31% |
| Right of Way Markers | 63,264 | 0.50% | 99.81% |
| Indentation Rumble Strips | 16,246 | 0.13% | 99.94% |
| Guardrail Anchorage, Type 1 | 7,844 | 0.06% | 100.00% |
| Construction Subtotal | \$ 12,667,783 | 100.00% | |
| Engineering and Construction at 10.00% | \$ 1,266,778 | | |
| Inflation Based on 8.00%* per annum for Zero Years 0.00% | \$ - | Construction | |
| Construction Total | \$ 13,934,561 | Mark-Up: | 10.00% |



Costs in graph are not marked-up.
 * Escalation rate provided by GDOT based on immediate past experience.
 ** Altered during VE Study per quantities provided by H&L. See "Cost Estimate Summary and Cost Histograms" section of the report.

FUNCTION ANALYSIS

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

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

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

This F.A.S.T. diagram notes the critical function paths and identifies the projects' basic functions as FULFILLING/G.R.I.P. (Governor's Road Improvement Program) by Completing/Corridor and Connecting/Termini, and INCREASING/CAPACITY by Separating/Traffic Flow. The F.A.S.T. diagram is included at the end of this section of the report.

RANDOM FUNCTION ANALYSIS



PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84/SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

SHEET NO.: 1 of 1

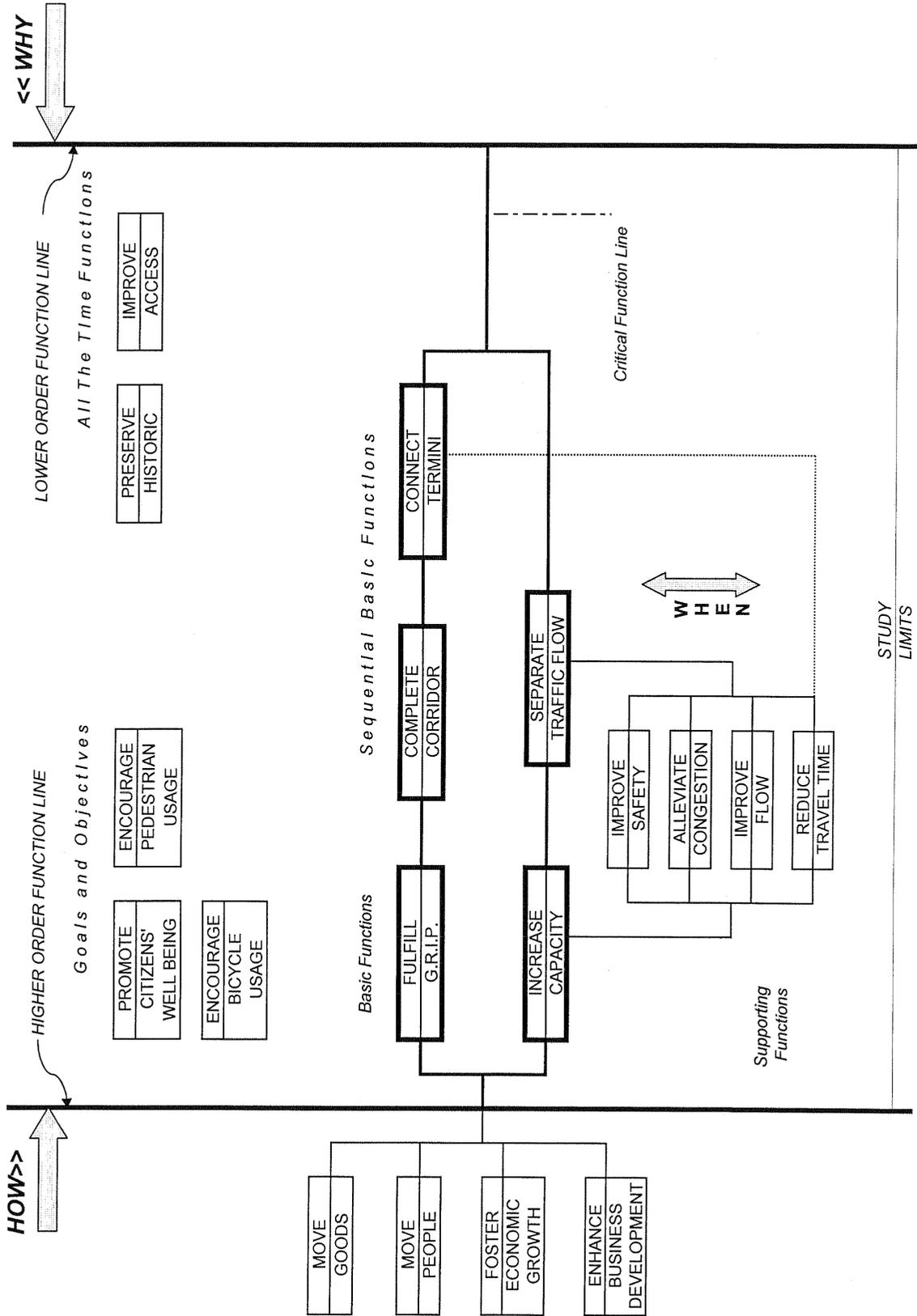
| DESCRIPTION | FUNCTION | | |
|---|-----------------|--|----------|
| | VERB | NOUN | KIND |
| US 84/SR 38 WIDENING AND RECONSTRUCTION | Increase | Capacity | B |
| Widen Roadway/Improve Intersections | Improve | Safety | RS |
| Enhance Accessibility/Widen Roadway/Improve Intersections | Foster | Economic Growth | HO |
| Widen Roadway/Improve Intersections | Reduce | Travel Time | S |
| Roadway | Move | People | HO |
| Roadway | Move | Goods | HO |
| Widen Roadway/Improve Intersections | Reduce | Congestion | S |
| Connect termini | Fulfill | G.R.I.P. [Governor's Road Improvement Program] | RS |
| Widen Roadway/Improve Intersections | Improve | Level of Service | S |
| Improve Intersections | Access | Town(s) | RS |
| Improve Safety/Avoid Congestion | Bypass | Argyle | S |
| Avoid Property | Preserve | Historic Property | RS |
| Sidewalks/Bicycle Paths | Promote | Citizens' Well Being | G/O |
| Sidewalks | Encourage | Pedestrian Usage | G/O |
| Bicycle Paths | Encourage | Bicycle Usage | G/O |
| Enhance Accessibility | Enhance | Business Development | HO |
| Bridges | Span | Water Feature | RS |
| Connect Termini | Complete | Corridor | B |
| Bridges | Replace | Aged Structures | RS |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | | | | | |
|----------------------|-----------------|-------|-------------------------|-------------------|--------------|
| Function defined as: | Action Verb | Kind: | B = Basic | HO = Higher Order | G = Goal |
| | Measurable Noun | | S = Secondary | LO = Lower Order | U = Unwanted |
| | | | RS = Required Secondary | O = Objective | |



FUNCTION ANALYSIS SYSTEMS TECHNIQUE (F. A. S. T.)
US 84/SR 38 WIDENING AND RECONSTRUCTION

EDS-84(23) and BHN-007-03(25); P. I. Nos. 422120 and 422125
 Georgia Department of Transportation, Districts 4 and 5
 Clinch and Ware Counties, Georgia



CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

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

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

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

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

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

CREATIVE IDEA LISTING



PROJECT: **EDS-84(23), P. I. No. 422120 and BHN-007-3(25), P. I. No. 422125,**
US 84/SR 38 Widening and Reconstruction
Clinch and Ware Counties, Georgia DOT, Districts 4 and 5
Final Design Stage

SHEET NO.: 1 of 2

| NO. | IDEA DESCRIPTION | RATING |
|-----|--|--------|
| 1 | Use culvert over Woodyard Creek/Darby Creek – Bridge No. 1 | 3 |
| 2 | Eliminate intermediate bents at Bridge No. 1 over Woodyard Creek/Darby Creek | 4 |
| 3 | Eliminate flush median at the beginning of the project | 4 |
| 4 | Use culvert over Woodyard Creek Overflow – Bridge No. 2 | 4 |
| 5 | Use culvert over Cane Creek – Bridge No. 3 | 2 |
| 6 | Minimize median width throughout the rural section | 5 |
| 7 | Reduce the design speed to 60 miles per hour (mph) | 4 |
| 8 | Use a one-way pair at Argyle | 5 |
| 9 | Use culvert over Peters Branch – Bridge No. 4 | 4 |
| 10 | Relocate start of the Argyle west side bypass | 5 |
| 11 | Do not bypass Argyle | 5 |
| 12 | Eliminate intermediate bents at Bridge No. 5 over Box Creek | 4 |
| 13 | Use culvert over Little Suwanee Creek – Bridge No. 6 | 4 |
| 14 | Eliminate intermediate bents at Bridge No. 7 over Suwanee Creek | 4 |
| 15 | Use an urban median prior to County Road (CR) 27 new intersection | 5 |
| 16 | Start 55 mph zone on the east side of Manor after Greasy Branch Creek – Bridge No. 8 | 4 |
| 17 | Eliminate the intersection at CR 24/Cherry Road | 4 |
| 18 | Eliminate the intersection at CR 26/Mills Street | 4 |
| 19 | Eliminate the intersection at CR 517/Hoke Street | 4 |
| 20 | Realign US 84/SR 38 south of the CSX Railroad | 1 |
| 21 | Provide sidewalks on one side only in urban section | 4 |
| 22 | Eliminate sidewalks | 2 |
| 23 | Provide a multi-use path on one side of the urban area | 3 |
| 24 | Use 24-inch curb and gutter versus 30-inch curb and gutter | 4 |
| 25 | Provide a multi-use path on one side and sidewalks on the other side of the urban area | 4 |
| 26 | Do not provide the sidewalk paving | 4 |
| 27 | Use a 14-foot flush median throughout the project length | 4 |
| 28 | Minimize the width of the right-of-way | 4 |

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

