



SR 96 Widening and Reconstruction

STP-155-1(21)

CSNHS-0008-00(406)(407)

Houston and Peach Counties, Georgia

P.I. Nos. 322450, 0008046, 0008407

Value Engineering Study Report

Preliminary Design Stage

February 2008

Design Consultant



Value Engineering Consultant



Lewis & Zimmerman Associates, Inc.



Lewis & Zimmerman Associates, Inc.

Taking the Chance out of Change

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February 21, 2008

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

re: STP-155-1(21) CSNHS-0008-00(406)(407)
P.I. Nos. 322450, 0008046, 0008407
SR 96 Widening and Reconstruction Project
Houston and Peach Counties, Georgia
Value Engineering Study Report

Dear Ms. Myers:

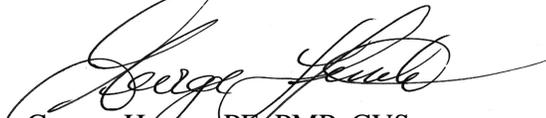
Lewis & Zimmerman Associates, Inc. (LZA) is pleased to submit four hard copies and one CD-ROM of the referenced value engineering (VE) study report, which documents the results of the VE study conducted February 5-8, 2008 with members of ARCADIS, HNTB Corporation and Delon Hampton & Associates. This project has a current probable construction cost of \$57.2 million and \$16.9 million for right-of-way and utilities.

The VE team developed 18 alternatives that provide improvements to the typical section, alignment, intersection and bridge components of the project.

We thank you, the DOT staff and the design team for assisting the VE team in completing this assignment. Please do not hesitate to call upon LZA for assistance in implementing the alternatives presented.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



George Hunter, PE, PMP, CVS
Vice President

Attachment

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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 Georgia Department of Transportation (GDOT). The subject of the study was the SR 96 Widening and Reconstruction project, P.I. Nos. 322450, 0008046, 0008407 being designed by PBSJ. The plans are currently at the preliminary plan level of development.

The VE workshop was conducted February 5-8, 2008 in GDOT's offices in Atlanta using a multidisciplinary team comprised of highway design, structures and construction professionals. The team followed the six-phase VE Job Plan to guide its deliberations:

- Information Gathering
- Function Identification and Analysis
- Creative Idea Generation
- Evaluation of Creative Ideas
- Development of Alternatives
- Presentation of Results

PROJECT DESCRIPTION

Georgia Department of Transportation
SR 96 Widening and Reconstruction
STP-155-1(21)
CSNHS-0008-00(406)(407)
Houston and Peach Counties
P.I. Nos. 322450, 0008046, 0008407

The project is the widening and reconstruction of SR 96 from I-75 to SR 247 for a total of 8.3 miles. The project length excludes a portion of SR 96 currently under construction between Sutherlin Street and Starlight Drive. This project, in conjunction with project STP-115-1(22) and (23), will improve truck access and provide a multi-lane facility between I-75 and I-16. The base year traffic (1999) is 10,950 vehicles per day (VPD), and the design year traffic (2019) is 19,700 VPD. The posted speed limit and design speed is 55 mph.

The existing roadway consists of two 12-ft. lanes with rural shoulders. The proposed construction will provide four 12-ft. lanes with a 44-ft. depressed grassed median from I-75 to CR 143, CR414 to CR398, and CR 158 to CR 133. A four-lane section with a 20-ft. raised median will be used for the remainder of the project. Several small box culverts will be extended to appropriate lengths to accommodate the widened section. The roadway will remain open to traffic during construction.

Environmental concerns include requirements for a COE 404 permit and Environmental Assessment, potential historical impacts, possible 106/4(f) involvement, archeological surveys and public hearings.

The project is to be let April 2010. The current project cost estimate (2008 dollars) is as follows:

| | |
|------------------------|------------------|
| Construction | \$57,174,319 |
| Right-of-way | 15,693,854 |
| Reimbursable Utilities | <u>1,250,000</u> |
| Total | \$74,118,173 |

CONCERNS AND OBJECTIVES

The key project concerns and objectives are listed below.

Concerns

- The bike lane proposed within the SR 96 roadbed is a state designated bicycle route.
- Sidewalk and possibly some of right-of-way are being financed by Houston County.
- Phase I contains a 44-ft. depressed median. To accommodate a long-term, future 6-lane facility, the remaining portions of the project (Phase II and III) will carry a 24-ft. raised median (without provisions to build two more lanes to the inside).
- The roadway vertical alignment will be upgraded and two large box culverts will be replaced just east and west of US 41.
- A cemetery near Mt. Zion Road and a historical church property opposite Ballyhara Drive will be avoided by using asymmetrical roadbed widening. The church has been placed on blocks and is being offered for sale.
- The design of the eastern end of Phase III was revised by the designers from new location alignment tying in just east of the Norfolk Southern Railroad to a revised, longer new location alignment tying in east of Thompson Mill Road. The revision will include a grade separation with SR 247, running adjacent and east of the railroad, with a trumpet interchange consisting of an eastbound loop off ramp and a westbound loop on ramp. The portion of revised alignment east of the proposed interchange to the new terminus (Thompson Mill Road) will not be part of this project.

GDOT and its designers requested that the VE team not change the following project features:

- Avoid three historical properties: 1) church property east of Ballyhara Drive, 2) cemetery west of Mt. Zion Road, and 3) properties located north of Old SR 96 and east of the Norfolk Southern Railroad.
- Acquired right-of-way at Lake Joy Road (some additional property must still be purchased at this location due to changes in the layout at SR 96/ Lake Joy).

Objectives

The VE team was requested to investigate the following:

- Retain the 16-ft. urban shoulder width (plans show 12-ft. urban shoulder, but the right-of-way reflects a 16-ft. width).
- Review the logic of placing signals at the Houston County High School entrance in lieu of at Bear Drive.
- Consider the multi-use trail in lieu of separate bike lanes, adjacent to the travel lanes and sidewalks placed within urban shoulders.
- Review the proposed interchange at SR 96/ SR 247.

RESULTS

Eighteen alternatives were developed by the VE team to address the concerns and issues described above. The key alternatives and design suggestions are described below.

Typical Section

Seven alternatives to the current design's typical sections were developed by the VE team. These are denoted by specific Alternative Numbers (Alt. No.).

- Alt. Nos. TS-1 and TS-2 suggest that GDOT consider all 11-ft. lanes or 11-ft. outer lanes, respectively, for reductions in right-of-way and pavement section construction.
- Alt. Nos. TS-3 and TS-4 propose that the project's raised medians be reduced by eliminating the 2-ft. inside shoulder and by further reducing the distance between curbs.
- Alt. No. TS-5 is a recommendation to eliminate the 44-ft. depressed median (for future widening to a six-lane section) in favor of all 24-ft. raised medians.
- Alt. Nos. TS-6A and TS-6B suggest eliminating the bike lanes and one or more of the concrete sidewalks for asphalt concrete multi-use paths.
- Alt. No. TS-7 suggests a 24-in. curb and gutter be considered.
- Alt. No. TS-8 is a recommendation to use the standard 16-ft. urban shoulder.

Alignment

Alt. No. A-1 is a recommendation to place the easterly terminus, new location alignment within the Oglethorpe Road right-of-way.

Intersections

Four alternatives were developed in this category that would modify or eliminate the local street connections to SR 96.

Bridges (B)

Four alternatives were developed in this category. Alt. Nos. B-2A and B2-B deal with the double 12 ft. x 6 in. RCB at Station 1452+17. Alt. Nos. B-4 and B-5 recommend that the long multi-span bridge over SR 247 and the Norfolk Southern Railroad be split as two shorter bridges separated with fill in between.



SUMMARY OF VALUE ENGINEERING ALTERNATIVES

PROJECT: **Project No.: STP-155-1(21), P.I. No.: 322450**
Houston and Peach Counties

PRESENT WORTH OF COST SAVINGS

| ALT. NO. | DESCRIPTION | ORIGINAL COST | ALTERNATIVE COST | INITIAL COST SAVINGS | RECURRING COST SAVINGS | TOTAL PW LCC SAVINGS |
|-----------------------------|---|---------------|------------------|----------------------|------------------------|----------------------|
| TYPICAL SECTION (TS) | | | | | | |
| TS-1A | Construct 11-ft. travel lanes | \$ 2,677,013 | \$ - | \$ 2,677,013 | | \$ 2,677,013 |
| TS-1B | Construct 11-ft. inside travel lanes | \$ 1,367,078 | \$ - | \$ 1,367,078 | | \$ 1,367,078 |
| TS-3 | Reduce 24-ft. raised median to a 20-ft. raised median | \$ 1,366,384 | \$ - | \$ 1,366,384 | | \$ 1,366,384 |
| TS-4 | Reduce 24-ft. raised median to an 18-ft. raised median | \$ 1,612,923 | \$ - | \$ 1,612,923 | | \$ 1,612,923 |
| TS-5 | Reduce 44-ft. depressed median to a 24-ft. raised median | \$ 2,805,130 | \$ 352,858 | \$ 2,452,272 | | \$ 2,452,272 |
| TS-6A | Replace the bike lanes in the roadbed and one 5-ft. sidewalk with a 10-ft. multi-use path | \$ 5,903,958 | \$ 329,428 | \$ 5,574,530 | | \$ 5,574,530 |
| TS-6B | Replace the bike lanes in the roadbed and the 5-ft. sidewalks with an 8-ft. multi-use path on each side of the roadbed | \$ 5,903,958 | \$ 119,796 | \$ 5,784,162 | | \$ 5,784,162 |
| TS-7 | Use 24-in. curb and gutter in lieu of 30-in. curb and gutter | \$ 342,775 | \$ - | \$ 342,775 | | \$ 342,775 |
| TS-8 | Build 16-ft. urban shoulders instead of 12-ft. urban shoulders | \$ - | \$ 249,630 | \$ (249,630) | | \$ (249,630) |
| ALIGNMENT (A) | | | | | | |
| A-1 | Align SR 96 along Oglethorpe Road | \$ 531,742 | \$ - | \$ 531,742 | | \$ 531,742 |
| INTERSECTIONS (I) | | | | | | |
| I-1 | Cul-de-sac Granville Drive | | | | DESIGN SUGGESTION | |
| I-2 | Align the CR 82/CR 81 intersection with a realignment of CR 82 | \$ 216,400 | \$ - | \$ 216,400 | | \$ 216,400 |
| I-6 | Signalize Bear Drive/SR 96 intersection in lieu of High School Drive/SR 96 access point | | | | DESIGN SUGGESTION | |
| I-7 | Cul-de-sac connection at Forest Road/SR 96 and replace with a new, all movement connection at Forest Road/Moody Road | \$ 25,520 | \$ 42,059 | \$ (16,539) | | \$ (16,539) |
| BRIDGES (B) | | | | | | |
| B-2A | In lieu of a double 6-ft. x 6-ft. box culvert, consider a single 12-ft. x 6-ft. box culvert at Station 1452+17 | \$ 75,161 | \$ 126,553 | \$ (51,392) | | \$ (51,392) |
| B-2B | In lieu of a double 6-ft. x 6-ft. box culvert, consider a single 12-ft. x 6-ft. three-sided concrete culvert at Station 1452+17 | \$ 75,161 | \$ 235,118 | \$ (159,957) | | \$ (159,957) |
| B-4 | In lieu of one long multi-span bridge, create 2 short bridges with fill in between | \$ 7,153,927 | \$ 5,446,325 | \$ 1,707,602 | | \$ 1,707,602 |
| B-5 | In lieu of one long multi-span bridge, create 2 short bridges with fill in between, retained by MSE walls | \$ 7,153,927 | \$ 5,759,096 | \$ 1,394,831 | | \$ 1,394,831 |

STUDY RESULTS

INTRODUCTION

The results are the major feature of the value engineering study conducted on the SR 96 Widening and Reconstruction project since they portray the benefits that can be realized by the Georgia Department of Transportation and the designers. The results will directly affect the project's design and will require coordination between the owner and the design team to determine the disposition of each alternative.

During the study, many ideas for potential value enhancement were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet the owner's project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that comprise the project. These may be in the form of VE alternatives (accompanied by cost estimates) or design suggestions (typically without cost estimates). For each alternative developed the following information is provided:

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

The capital cost comparisons used unit quantities contained in the project cost estimate prepared by the designers, whenever possible. If unit quantities were not available, published databases, such as the one produced by the RS Means Company, or team member or owner databases were consulted. A composite markup of 10 %, as described in the Value Analysis and Conclusions section of the report, was used to generate an all-inclusive project cost for the construction items being compared.

Each design suggestion contains the same information as the VE alternatives, except that no cost information is included. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed for reasons other than cost. Examples of these reasons include improved facility operation, ease of maintenance, ease of construction, safer working conditions, reduction in project risk, etc. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.

Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) to track through the value analysis process and thus facilitate referencing among the Creative Idea

Listing and Evaluation worksheets, the alternatives, and the Summary of Value Engineering Alternatives table. The Alt. No. includes a prefix that refers to a major project design category listed below:

| Design Category | Prefix | No. of Ideas |
|------------------------|---------------|---------------------|
| Typical Sections | TS | 10 |
| Bridge | BR | 5 |
| Intersections | I | 9 |
| Alignment | A | 4 |
| | Subtotal: | 28 |

Summaries of the alternatives and design suggestions are provided on the Summary of Value Engineering Alternatives tables. The tables are divided into project design categories and divide the results section. The complete documentation of the developed alternatives and design suggestions follows each of the Summary of Value Engineering Alternatives tables.

KEY ISSUES

The key project issues and constraints are listed below:

- The bike lane proposed within the SR 96 roadbed is a state designated bicycle route.
- Sidewalk and possibly some of right-of-way are being financed by Houston County.
- Phase I contains a 44-ft. depressed median. To accommodate a long-term, future 6-lane facility, the remaining portions of the project (Phase II and III) will carry a 24-ft. raised median (without provisions to build two more lanes to the inside).
- The roadway vertical alignment will be upgraded and two large box culverts will be replaced just east and west of US 41.
- A cemetery near Mt. Zion Road and a historical church property opposite Ballyhara Drive will be avoided by using asymmetrical roadbed widening. The church has been placed on blocks and is being offered for sale.
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STUDY OBJECTIVES

The VE team was requested to investigate the following:

- Review the logic of placing signals at the Houston County High School entrance as opposed at Bear Drive.

- Consider the multi-use trail in lieu of separate bike lanes adjacent to the travel lanes and sidewalks placed within urban shoulders.
- Review the proposed interchange at SR 96/SR 247.

GDOT and its designers requested that the VE team not change the following project features:

- Avoid three historical properties: 1) church property east of Ballyhara Drive, 2) cemetery west of Mt. Zion Road, and 3) properties located north of Old SR 96 and east of the Norfolk Southern Railroad.
- Acquired right-of-way at Lake Joy Road (some additional property must still be purchased at this location due to changes in the layout at SR 96/Lake Joy).
- Retain the 16-ft. urban shoulder width (plans show 12-ft. urban shoulder, but the right-of-way reflects a 16-ft. width).

RESULTS OF THE STUDY

Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 18 alternatives for consideration by the owner and designer.

EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS

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

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

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



SUMMARY OF VALUE ENGINEERING ALTERNATIVES

Project No.: STP-155-1(21), P.I. No.: 322450
Houston and Peach Counties

PRESENT WORTH OF COST SAVINGS

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| TS-1B | Construct 11-ft. inside travel lanes | \$ 1,367,078 | \$ - | \$ 1,367,078 | | \$ 1,367,078 |
| TS-3 | Reduce 24-ft. raised median to a 20-ft. raised median | \$ 1,366,384 | \$ - | \$ 1,366,384 | | \$ 1,366,384 |
| TS-4 | Reduce 24-ft. raised median to an 18-ft. raised median | \$ 1,612,923 | \$ - | \$ 1,612,923 | | \$ 1,612,923 |
| TS-5 | Reduce 44-ft. depressed median to a 24-ft. raised median | \$ 2,805,130 | \$ 352,858 | \$ 2,452,272 | | \$ 2,452,272 |
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| TS-7 | Use 24-in. curb and gutter in lieu of 30-in. curb and gutter | \$ 342,775 | \$ - | \$ 342,775 | | \$ 342,775 |
| TS-8 | Build 16-ft. urban shoulders instead of 12-ft. urban shoulders | \$ - | \$ 249,630 | \$ (249,630) | | \$ (249,630) |
| ALIGNMENT (A) | | | | | | |
| A-1 | Align SR 96 along Oglethorpe Road | \$ 531,742 | \$ - | \$ 531,742 | | \$ 531,742 |
| INTERSECTIONS (I) | | | | | | |
| I-1 | Cul-de-sac Granville Drive | | | | DESIGN SUGGESTION | |
| I-2 | Align the CR 82/CR 81 intersection with a realignment of CR 82 | \$ 216,400 | \$ - | \$ 216,400 | | \$ 216,400 |
| I-6 | Signalize Bear Drive/SR 96 intersection in lieu of High School Drive/SR 96 access point | | | | DESIGN SUGGESTION | |
| I-7 | Cul-de-sac connection at Forest Road/SR 96 and replace with a new, all movement connection at Forest Road/Moody Road | \$ 25,520 | \$ 42,059 | \$ (16,539) | | \$ (16,539) |
| BRIDGES (B) | | | | | | |
| B-2A | In lieu of a double 6-ft. x 6-ft. box culvert, consider a single 12-ft. x 6-ft. box culvert at Station 1452+17 | \$ 75,161 | \$ 126,553 | \$ (51,392) | | \$ (51,392) |
| B-2B | In lieu of a double 6-ft. x 6-ft. box culvert, consider a single 12-ft. x 6-ft. three-sided concrete culvert at Station 1452+17 | \$ 75,161 | \$ 235,118 | \$ (159,957) | | \$ (159,957) |
| B-4 | In lieu of one long multi-span bridge, create 2 short bridges with fill in between | \$ 7,153,927 | \$ 5,446,325 | \$ 1,707,602 | | \$ 1,707,602 |
| B-5 | In lieu of one long multi-span bridge, create 2 short bridges with fill in between, retained by MSE walls | \$ 7,153,927 | \$ 5,759,096 | \$ 1,394,831 | | \$ 1,394,831 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-1A**

DESCRIPTION: **CONSTRUCT 11-FT. TRAVEL LANES**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for 12-ft. travel lanes throughout the four-lane facility within the project limits.

ALTERNATIVE: (Sketch attached)

Construct 11-ft. travel lanes throughout the four-lane facility within the project limits.

ADVANTAGES:

- Reduces footprint
- Reduces right-of-way takes
- Reduces project costs

DISADVANTAGES:

- Reduces buffer between adjacent traveling vehicles
- Does not meet driver expectancy

DISCUSSION:

The current design has a 2-ft. inside shoulder and a 4-ft. outside shoulder/bike lane, for an additional 6 ft. of roadway per direction. In the context of the overall roadbed, reducing the travel lanes to 11-ft. causes a reduction from 30-ft. to 28-ft. In metropolitan Atlanta, many of the freeways operate at high speeds with 11-ft. travel lanes without any known safety issues. The design speed for this facility is 45 mph; it would appear that 11-ft. travel lanes should not have any perceivable safety impacts. This alternative would require a design variance.

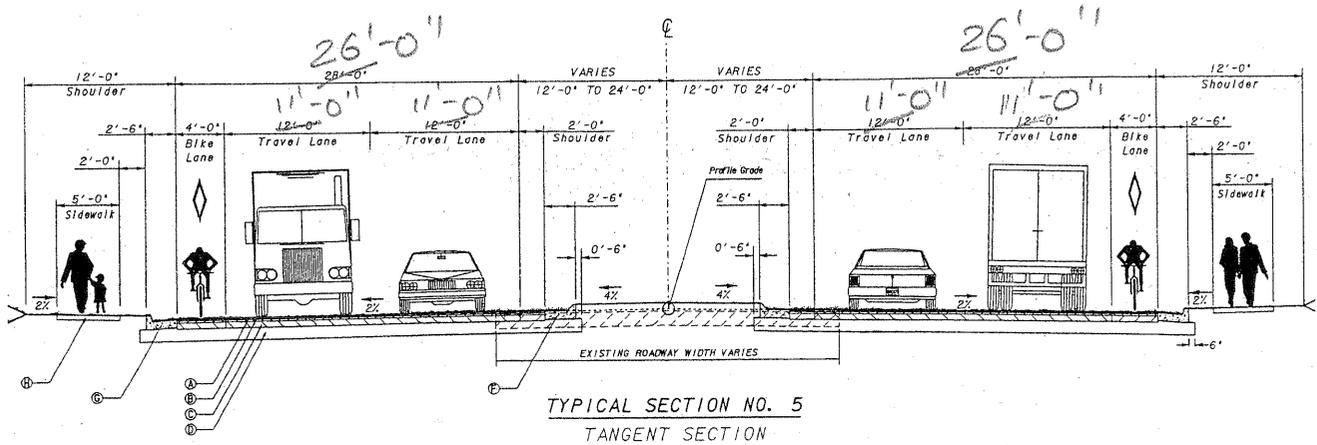
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 2,677,013 | — | \$ 2,677,013 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 2,677,013 | — | \$ 2,677,013 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.:
TS-1A

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: *2 of 4*



CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-1A

SHEET NO.:

3 of 4

Cost for full-depth mainline pavement

$$165 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{T}}} \times \$75/\text{T} = \$6.19/\text{sy}$$

$$330 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$70/\text{T} = \$11.55/\text{sy}$$

$$880 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$72/\text{T} = \$31.68/\text{sy}$$

G AB

$$= \$21.15/\text{sy}$$

$$\$70.57/\text{sy}$$

Total SY of A.C. Pavement Saved:

$$\frac{4' \times 9.1 \times 5,240}{9} = 21,193 \text{ SY}$$

Total SF of R/W Sand:

$$4' \times 9.1 \text{ miles} \times 5,240 = 190,736 \text{ SF}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-1B**

DESCRIPTION: **CONSTRUCT 11-FT. INSIDE TRAVEL LANES**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for 12-ft. travel lanes throughout the four-lane facility within the project limits.

ALTERNATIVE: (Sketch attached)

Construct 11-ft. travel lanes for the inside lanes, and retain 12-ft. lanes for the outside lanes throughout the four-lane facility within the project limits.

ADVANTAGES:

- Reduces footprint
- Reduces right-of-way takes
- Reduces project costs

DISADVANTAGES:

- Reduces buffer between adjacent, traveling vehicles
- Does not meet driver expectancy

DISCUSSION:

The current design has a 2-ft. inside shoulder and a 4-ft. outside shoulder/bike lane, for an additional 6 ft. of roadway per direction. If alternative TS-1A, which recommends reducing all lanes to 11 ft., is not acceptable to GDOT, then providing 11-ft. inside lanes could be considered. Trucks generally use outside lanes which are accompanied by a 4-ft. shoulder in this project. This alternative would require a design variance.

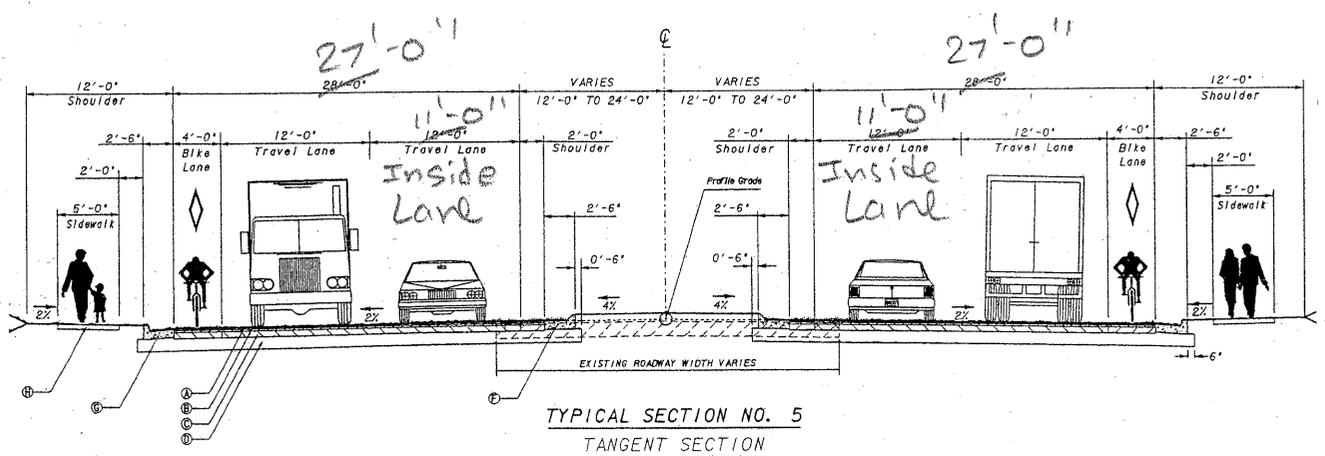
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,367,078 | — | \$ 1,367,078 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 1,367,078 | — | \$ 1,367,078 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.:
TS-13

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2 of 4**



TYPICAL SECTION NO. 5
TANGENT SECTION

CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-1B

SHEET NO.:

3 of 4

Cost for full-depth mainline pavement

$$165 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{T}}} \times \$75/\text{T} = \$6.19/\text{sy}$$

$$330 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$70/\text{T} = \$11.55/\text{sy}$$

$$880 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$72/\text{T} = \$31.68/\text{sy}$$

$$\begin{array}{r} \text{G AB} \\ \hline = \$21.15/\text{sy} \\ \hline \$70.57/\text{sy} \end{array}$$

Total SY of A.C. Pavement Saved:

$$\frac{2 \times 9.1 \times 5,240}{9} = 10,596 \text{ SY}$$

Total SF of R/W Sand:

$$2 \times 9.1 \text{ miles} \times 5,240 = 95,368 \text{ SF} \checkmark$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-3**

DESCRIPTION: **REDUCE 24-FT. RAISED MEDIAN TO A 20-FT. RAISED
 MEDIAN**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design proposes a 24-ft. raised median for the mainline roadbed, which includes paved 2-ft. inside shoulders.

ALTERNATIVE: (Sketch attached)

Eliminate the 2-ft. inside shoulders for a revised 20-ft. median.

ADVANTAGES:

- Reduces footprint
- Reduces right-of-way takes
- Reduces cost

DISADVANTAGES:

- Eliminates the 2-ft. flush/buffer paved shoulder adjacent to the curb and gutter
- Reduces separation of opposing traffic
- Reduces median width for left-turn separations

DISCUSSION:

The 24-ft. median has been employed in recent years. However, a 20-ft. raised median has been employed by GDOT in recent past. The GDOT design manual calls for medians to be between 20-ft. to 24-ft., with the larger dimension desirable. GDOT should weigh the cost benefits against any known operational degradation associated with the deletion of the inside shoulder.

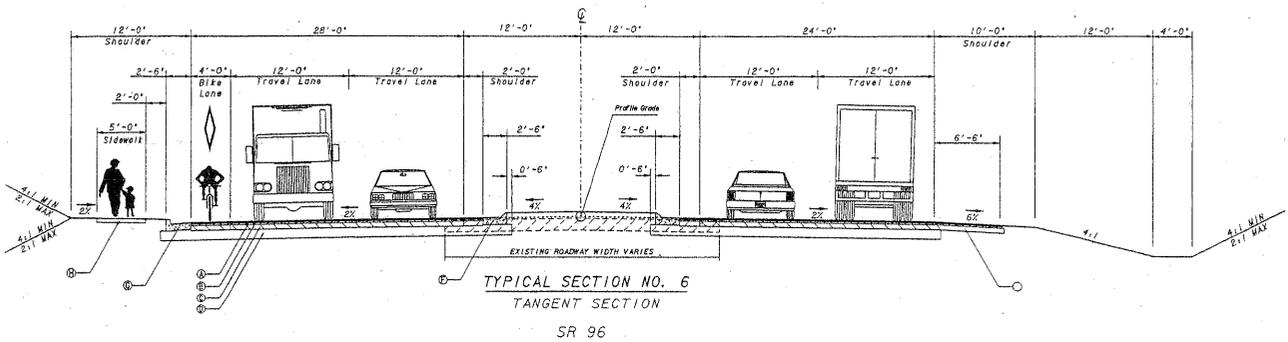
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 1,366,384 | — | \$ 1,366,384 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 1,366,384 | — | \$ 1,366,384 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

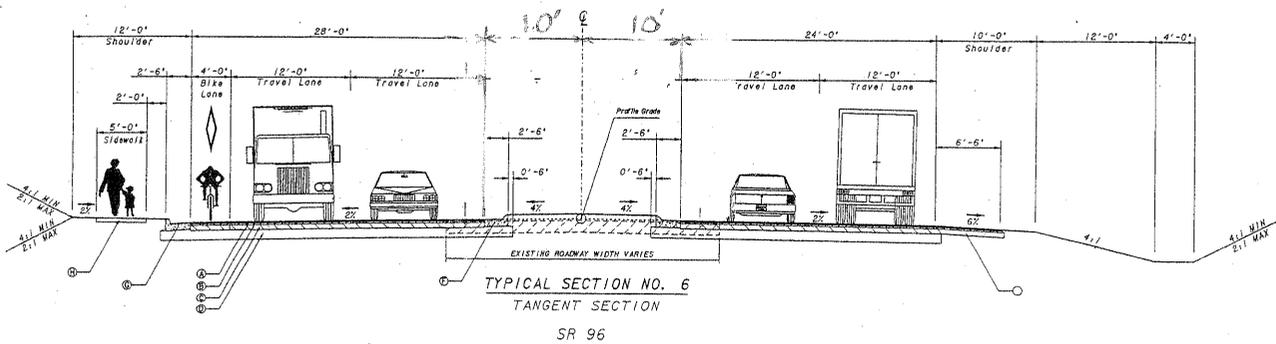
ALTERNATIVE NO.: **TS-3**
 SHEET NO.: **2 of 5**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

ORIGINAL (24') median



Alternate (20') median



CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TG 3

SHEET NO.:

3 of 5

Cost for full-depth mainline pavement

$$165 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{ft}}} \times \$75/\text{ft} = \$6.19/\text{sy}$$

$$330 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$70/\text{ft} = \$11.55/\text{sy}$$

$$880 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$72/\text{ft} = \$31.68/\text{sy}$$

$$\text{G AB } 12'' = \$21.15/\text{sy}$$

$$\$70.57/\text{sy}$$

The Above pavement section is
The section recommended by the
Soil Survey Report.

CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TS3

SHEET NO.:

4 of 5

Savings: Original costs that would be decreased if the ^{RAISED} median was reduced to 20' wide.

full depth pavement saved. $2' + 2' = 4'$

$$\frac{4' \times 25,312'}{9 \text{ sf.} / \text{sf.}} = 11,250 \text{ sf}$$

SAVE R/W 4' width

$$4' \times 25,312' = 101,248 \text{ SF}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-4**

DESCRIPTION: **REDUCE 24-FT. RAISED MEDIAN TO AN 18-FT. RAISED
 MEDIAN**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The current design proposes a 24-ft. raised median for the mainline roadbed, which includes paved 2-ft. inside shoulders.

ALTERNATIVE: (Sketch attached)

Eliminate the 2-ft. inside shoulders and reduce the distance between the curbs by two feet for a revised 18-ft. median.

ADVANTAGES:

- Reduces footprint
- Reduces right-of-way takes
- Reduces cost

DISADVANTAGES:

- Eliminates the 2-ft. flush/buffer paved shoulder adjacent to the curb and gutter
- Reduces separation of opposing traffic
- Reduces median width for left-turn separations

DISCUSSION:

The GDOT design manual calls for medians to be 20 ft. to 24 ft., with the larger dimension desirable. Eighteen feet is the minimum acceptable median width acceptable the AASHTO 2004 guidelines. The 18-ft. median would allow for a 12-ft. lane with a 6-ft. island in the turn lane. The island should be delineated with paint and pavement markers.

GDOT should weigh the cost benefits against any known operational degradation associated with the deletion of the inside shoulder and reduced distance between curbs.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 1,612,923 | — | \$ 1,612,923 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 1,612,923 | — | \$ 1,612,923 |

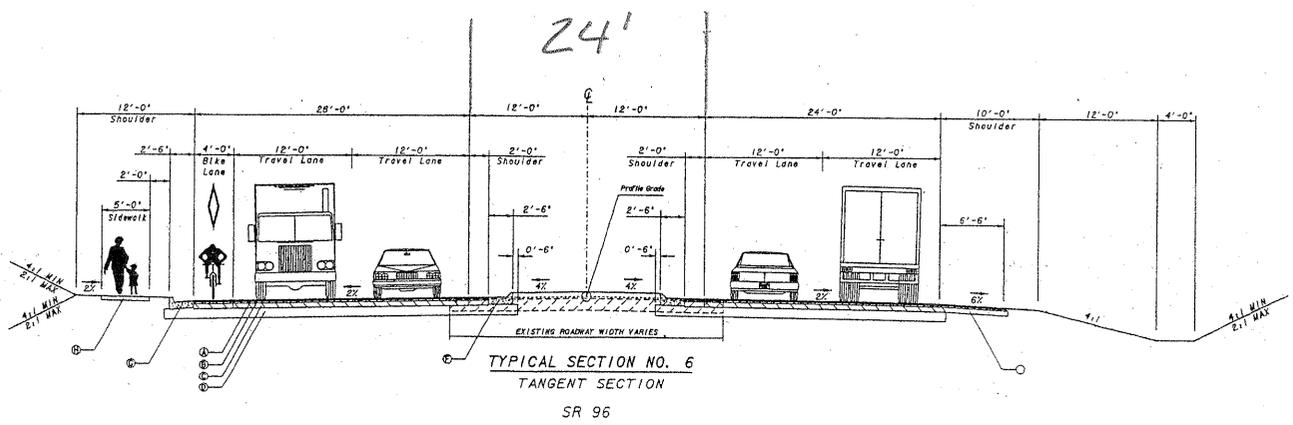
PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.: **TS-4**

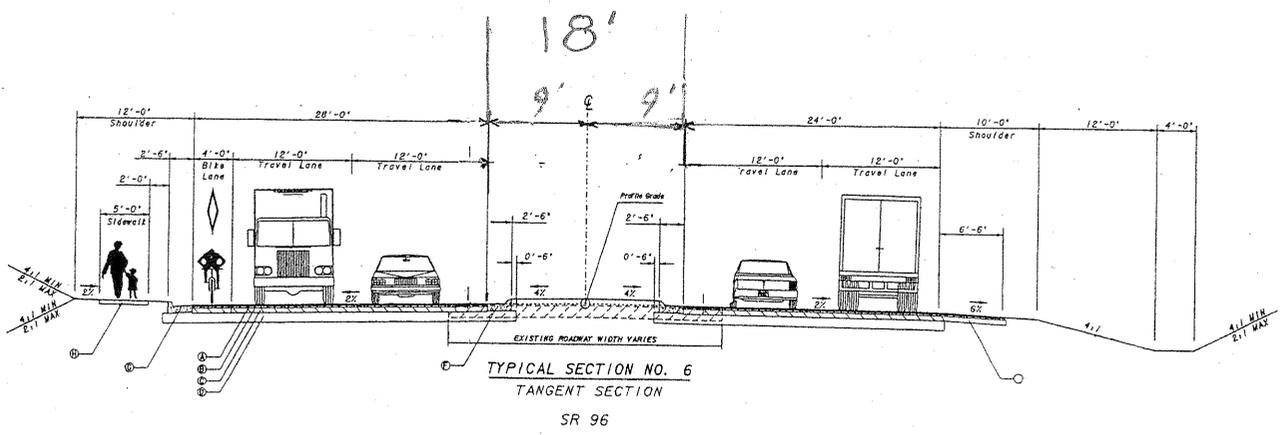
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2** of **4**

ORIGINAL (24') median



Alternate (18') median



CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-4

SHEET NO.:

3 of 4

Cost for full-depth mainline pavement

$$165 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$75/\text{T} = \$6.19/\text{sy}$$

$$330 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$70/\text{T} = \$11.55/\text{sy}$$

$$880 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$72/\text{T} = \$31.68/\text{sy}$$

G AB

$$= \$21.15/\text{sy}$$

$$\$70.57/\text{sy}$$

Savings: Original costs eliminated

Full-Depth pavement: 11,250 sy

$$\text{SAVE RIW: } 6' \times 25,312' = 151,872 \text{ SF}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-5**

DESCRIPTION: **REDUCE 44-FT. DEPRESSED MEDIAN TO 24-FT. RAISED
 MEDIAN**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design calls for a 44-ft. depressed median from approximately Station 1079+51 to Station 1472+51 in Phase 1, and Station 1424+31 to Station 1472+51 in Phase 3.

ALTERNATIVE: (Sketch attached)

Conform at the west end of Phase 1 to the existing 44-ft. median, tapering out to a 24-ft. raised median beginning at Station 1079+00, the Johnson Road intersection. Revise the all of the project's remaining 44-ft. depressed median to a 24-ft. raised median.

ADVANTAGES:

- Maintains consistency in median treatment
- Reduces cost

DISADVANTAGES:

- Eliminates easy addition of lanes in the future

DISCUSSION:

The current design would allow the expansion from 4 lanes to 6 lanes into the median for approximately 3 out of the 9 miles. The addition of lanes for this corridor into the 44-ft. depressed median would be discontinuous. It may behoove GDOT, in a cost saving mode now, to save the investment of planning for the future lane addition that may never be built. Constructing a 24-ft. raised median is a reasonable, logical way to carry out this project.

The 24-ft. median would be compatible with the current construction on SR 96 at Houston Lake Road.

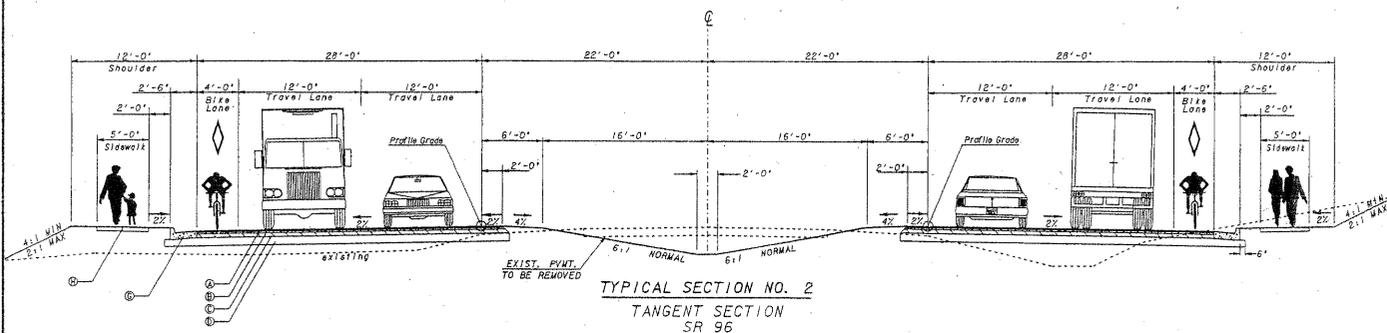
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 2,805,130 | — | \$ 2,805,130 |
| ALTERNATIVE | \$ 352,858 | — | \$ 352,858 |
| SAVINGS (Original minus Alternative) | \$ 2,452,272 | — | \$ 2,452,272 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

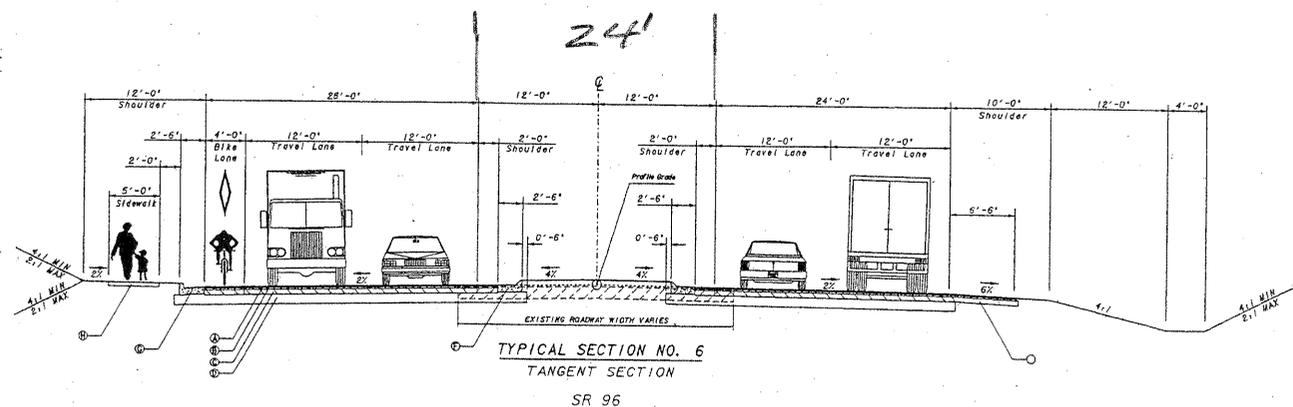
ALTERNATIVE NO.: **TS-5**
 SHEET NO.: **2 of 5**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

ORIGINAL (44' depressed med.)



Alternate (24' raised median)



CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-5

SHEET NO.: 3 of 5

Length of Roadway of 44' median to be
reduced to a 24' raised median &
depressed

$$\text{STA. } 1078+51 - \text{STA. } 1184+47 = 10,596'$$

$$\text{STA. } 1424+31 - \text{STA. } 1472+51 = 4,821'$$

$$\text{total length} = 15,417'$$

Savings in S.F. (R/W & grassing)

$$(44' - 24') \times 15,417' = 308,340 \text{ SF} = 7.08 \text{ AC}$$

Original costs saved using 24' median in
place of 44' median.

- SAVED R/W $(\frac{20' \times 3' \times 15,417'}{27 \text{ CF/CY}}) = 34,260 \text{ cy}$
- SAVED earthwork (wider construction limits)
- SAVED grassing/Eros. (Temporary & permanent)
- SAVED full depth pavement thru inter sections

EXTRA Costs for alternate: * (see next sheet)

- TP 7 curb & gutter for median
- Catch Basins & Storm drain pipe when water flows toward the median.

$$\frac{(20' \times 150') + (400' \times 16' \times 2 \text{ EA.})}{9 \text{ sf/sy}} = \frac{15,800 \text{ SF}}{9 \text{ sf/sy}} = 1,755 \text{ sy} \quad \left(\begin{array}{l} \text{PER MEDIAN} \\ \text{OPENING} \end{array} \right)$$

$$1,755 \text{ sy} \times 6 \text{ median openings/intersections} = 10,530 \text{ sy}$$

$$\$1,006,800 \times 35.8\% \times 20\% = \$72,090$$

→ All projects ↑ 44' Length of total width 20' in = 20%

CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.: TS-5

SHEET NO.: 4 of 5

* extra costs for more 24' median
 $(15,417' - (6EA \times 200')) = 14,217 LF$
 $14,217 LF \times 2 \text{ sides} = 28,438 LF \text{ at } \$7 (\text{c\&g})$

The DRAINAGE costs for the Original 24' raised median and the Alt. 44' depressed median were considered a "wash" basically equal after comparing the two. There is a cost for the 24' median in curves for catch basins and extra storm drain pipe (both out fall & possibly some longitudinal). However the 44' depressed median have a drainage cost for both tangent and curve sections to detain the median with drop inlets and out fall pipes. In fact, a detailed drainage cost estimate may reveal further savings for the 24' raised median over the 44' depressed median.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-6A**

DESCRIPTION: **REPLACE THE BIKE LANES IN THE ROADBED AND ONE
 5-FT. SIDEWALK WITH A 10-FT. MULTI-USE PATH**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Current design calls for 4-ft.-wide bike lanes/shoulders, adjacent to the outside travel lane, on full-depth pavement and urban shoulders that include 5-ft. concrete sidewalks.

ALTERNATIVE: (Sketch attached)

Eliminate the bike lanes from both sides of the road. Keep a 5-ft. sidewalk on one side of the road and replace the opposite sidewalk with a single 10-ft.-wide multi-use path. The multi-use path pavement section would consist of 2-in. asphalt concrete over 4-in. G.A.B. on a compacted subgrade.

ADVANTAGES:

- Reduces right-of-way impacts
- Reduces bicycle/vehicles conflicts
- “Softer” surfacing
- Reduces cost

DISADVANTAGES:

- Increases pedestrian/bicycle conflicts

DISCUSSION:

This alternative will reduce costs by removing full-depth pavement for the construction of a bicycle lane and removing bicyclists from the roadbed. The conflicts of pedestrians and bicyclists may be justified by an 8-ft. reduction in right-of-way and a pedestrian/bicyclist path that has more recreational value. Due to some previously acquired right-of-way along Lake Joy Road, the stated right-of-way savings may need to be slightly overstated.

The AASHTO Guide for the Development of Bicycle Facilities recommends a 10-ft.-wide, two-directional shared use path. The guide also states that it may be desirable to increase this width to 12-ft. or even 14-ft. due to substantial use of bicycles, joggers, skaters and pedestrians.

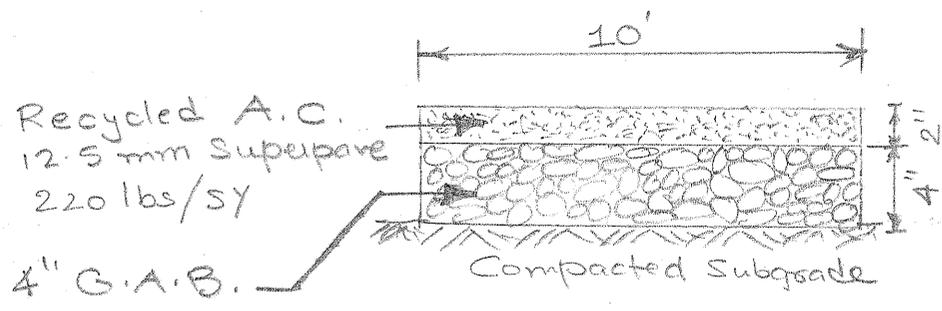
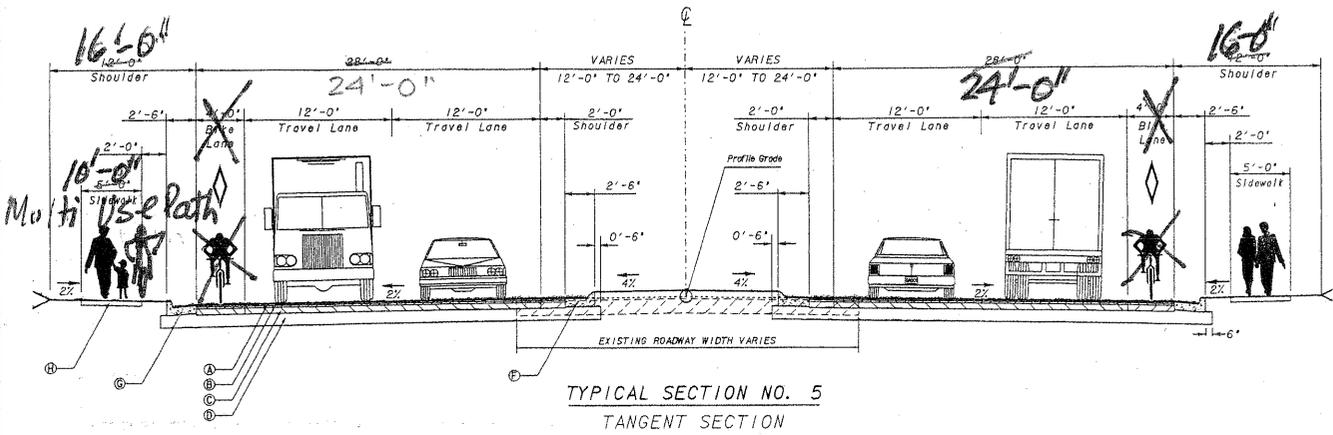
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 5,903,958 | — | \$ 5,903,958 |
| ALTERNATIVE | \$ 329,428 | — | \$ 329,428 |
| SAVINGS (Original minus Alternative) | \$ 5,574,530 | — | \$ 5,574,530 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.: **TS-6A**

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: **2 of 4**



Multi-Use Path Section

CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-6A

SHEET NO.:

3 of 4

Cost for full-depth mainline pavement

$$165 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{T}}} \times \$75/\text{T} = \$6.19/\text{sy}$$

$$330 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$70/\text{T} = \$11.55/\text{sy}$$

$$880 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$72/\text{T} = \$31.68/\text{sy}$$

GAB (12")

$$= \$21.15/\text{sy}$$

$$\underline{\$70.57/\text{sy}}$$

$$\text{Bike Lanes: } \frac{(4 \times 9.1 \text{ miles} \times 5,280) \times 2}{9} = 42,709 \text{ sy}$$

Cost for Multiuse Path

$$220 \text{ lbs/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{T}}} \times \frac{\$75}{\text{T}} = \$8.25/\text{sy} \rightarrow \text{A.C.}$$

$$4'' \text{ of G.A.B. } \frac{21.15}{3} = \$7.05/\text{sy}$$

$$\underline{\$15.30/\text{sy}}$$

$$10' \text{ wide path: } \frac{10}{12} \times \frac{(9.1 \text{ miles} \times 5,280)}{9} = 4,449 \text{ sy}$$

$$\text{R/W Savings: } 42,709 \times 9 = 384,381 \text{ sf}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-6B**

DESCRIPTION: **REPLACE THE BIKE LANES IN THE ROADBED AND THE
 5-FT. SIDEWALKS WITH AN 8-FT. MULTI-USE PATH ON
 EACH SIDE OF THE ROADBED**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Current design calls for 4-ft.-wide bike lanes/shoulders adjacent to the outside travel lane on full-depth pavement, and urban shoulders that include 5-ft. concrete sidewalks.

ALTERNATIVE: (Sketch attached)

Eliminate the bike lanes and the 5-ft.-wide concrete sidewalks on both sides of the road and replace with two 8-ft.-wide multi-use paths/per direction. The multi-use path pavement section would consist of 2-in. asphalt concrete over 4-in. G.A.B. on a compacted subgrade.

ADVANTAGES:

- Reduces right-of-way impacts
- Reduces bicycle/vehicles conflicts
- “Softer” surfacing
- Reduces costs

DISADVANTAGES:

- Increases pedestrian/bicycle conflicts

DISCUSSION:

This alternative, like Alt. No. TS-6A, will reduce cost by removing full-depth pavement for the construction of a bicycle lane and bicyclists from the roadbed. The conflicts of pedestrians and bicyclists may be justified by an 8-ft. reduction in right-of-way and a pedestrian/bicyclist path that has more recreational value. Due to some previously acquired right-of-way along Lake Joy Road, the stated right-of-way savings may need to be slightly overstated. The 8-ft.-wide multi-use paths, in lieu of 10 ft., have been used elsewhere in the state, when paths are located on both sides of the roadway. The presumption is that bicyclists will travel in opposite directions using opposite paths. This alternative, therefore, should have fewer conflicts between bicycle/pedestrian and bicycle/bicycle than Alt. No. TS-6A.

The AASHTO Guide for the Development of Bicycle Facilities recommends a minimum 6-ft.-wide, two-directional shared use path. However, the guide also recognizes that one-way paths will be used as two-way facilities unless effective measures are taken to assure one-way operation.

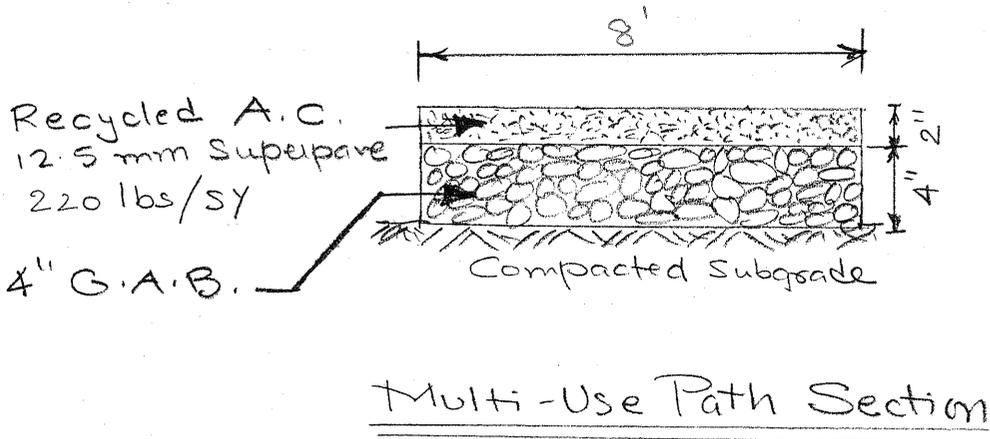
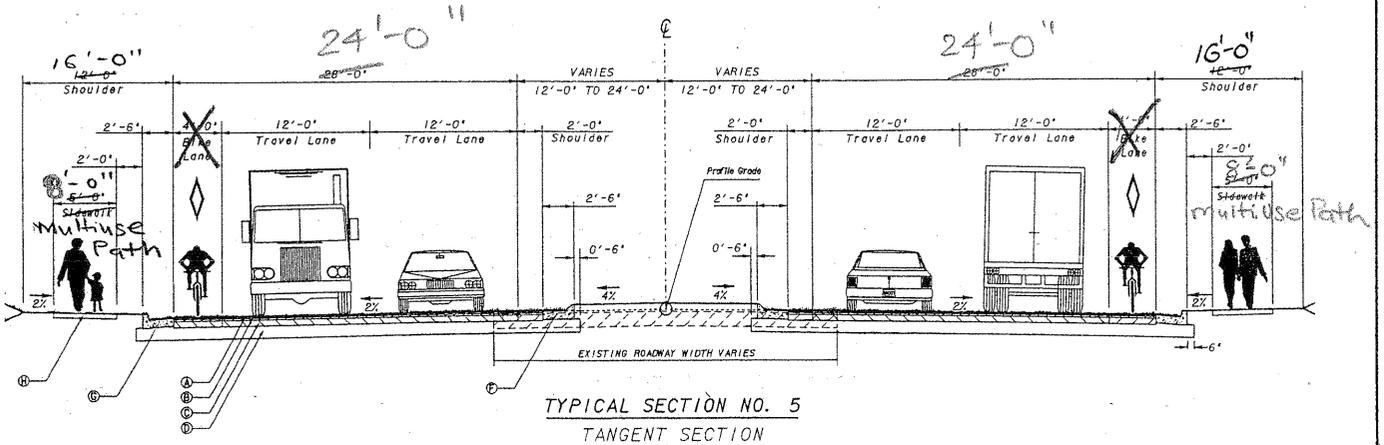
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 5,903,958 | — | \$ 5,903,958 |
| ALTERNATIVE | \$ 119,796 | — | \$ 119,796 |
| SAVINGS (Original minus Alternative) | \$ 5,784,162 | — | \$ 5,784,162 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.:
 TS-6B

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 2 of 4



CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

TS-6B

SHEET NO.:

3 of 4

Cost for full-depth mainline pavement

$$165 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{T}}} \times \$75/\text{T} = \$6.19/\text{sy}$$

$$330 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$70/\text{T} = \$11.55/\text{sy}$$

$$880 \text{ Lb/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{sy}}} \times \$72/\text{T} = \$31.68/\text{sy}$$

$$\text{GAB (12")} = \$21.15/\text{sy}$$

$$= \$70.57/\text{sy}$$

$$\text{Bike Lanes: } \left(\frac{4 \times 9.1 \text{ miles} \times 5,280}{9} \right) \times 2 = 42,709 \text{ sy}$$

Cost for Multiuse Path

$$220 \text{ lbs/sy} \times \frac{1}{2000 \frac{\text{Lb}}{\text{T}}} \times \frac{\$75}{\text{T}} = \$8.25/\text{sy} \rightarrow \text{A.C.}$$

$$4" \text{ of G.A.B. } \frac{21.15}{3} = \$7.05/\text{sy}$$

$$= \$15.3/\text{sy}$$

$$8' \text{ wide path: } \frac{8}{12} (9.1 \times 5,280) / 9 = 3,559 \text{ sy}$$

$$\text{Total on both sides of the road: } 3,559 \times 2 = 7,118 \text{ sy}$$

$$\text{R/W Savings: } 42,709 \text{ sy} \times 9 = 384,381 \text{ \$}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **TS-7**

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

SHEET NO.: **1 of 2**

ORIGINAL DESIGN: (Sketch attached)

Current design calls for 30-in. curb and gutter on both sides of the median on both sides of the road.

ALTERNATIVE: (Sketch attached)

Use a 24-in. curb and gutter on both sides of the raised median and along side the urban shoulders.

ADVANTAGES:

- Reduces right-of-way takes
- Reduces costs

DISADVANTAGES:

- Slightly increases gutter spread extending into the pavement

DISCUSSION:

Decreasing the gutter width from 24 in. to 18 in. also decreases the right-of-way requirement by 6 in. Thus, the total right-of-way savings is 6 in. + 6 in. + 6 in. + 6 in. = 24 in. Although the gutter spread increases somewhat, it is minimal. The construction cost of 30-in. curb and gutter is more or less the same as that of 24-in. curb and gutter. So no adjustment is made in the alternative cost estimate.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 342,775 | — | \$ 342,775 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 342,775 | — | \$ 342,775 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: TS-8

DESCRIPTION: **BUILD 16-FT. URBAN SHOULDERS INSTEAD OF 12-FT. URBAN SHOULDERS**

SHEET NO.: 1 of 4

ORIGINAL DESIGN: (Sketch attached)

Current design proposes to build 12-ft. urban shoulders, even though the planned right-of-way acquisition currently accommodates 16-ft. urban shoulders.

ALTERNATIVE: (Sketch attached)

Build 16-ft. urban shoulders since the required right-of-way is being set to accommodate a shoulder 16-ft.-wide. Increase the grass strip to 6-ft.-wide.

ADVANTAGES:

- Locates sidewalks at the desirable ADA location
- Widens grass strip

DISADVANTAGES:

- Increases grading and grassing costs

DISCUSSION:

The 16-ft. urban shoulder would offset the sidewalk 6 ft. (grass strip) behind the back of the curb instead of only 2-ft. (minimum). This location of the sidewalk would be the most desirable for ADA requirements lining up the sidewalk behind the driveway's concrete valley gutter. There would be additional costs for grading the shoulders 4-ft.-wider and grassing (temporary and permanent).

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 0 | — | \$ 0 |
| ALTERNATIVE | \$ 249,630 | — | \$ 249,630 |
| SAVINGS (Original minus Alternative) | \$ (249,630) | — | \$ (249,630) |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

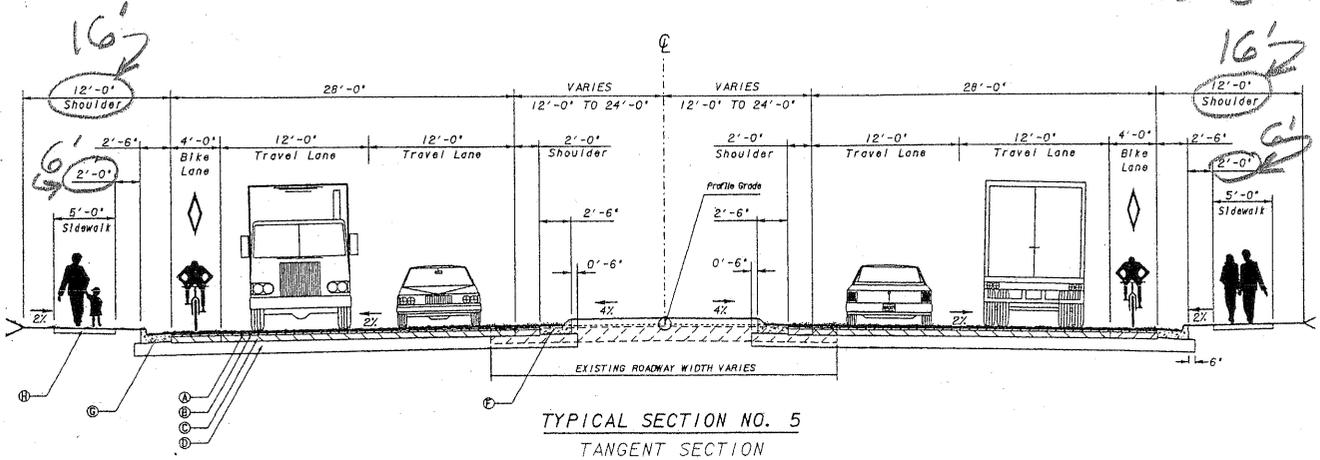
ALTERNATIVE NO.:

TS-8

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 2 of 4

Original Annotated with Alternate Dimensions



TYPICAL SECTION NO. 5
 TANGENT SECTION

CALCULATIONS



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.:
 TS-8

SHEET NO.: 3 of 4

Additional Costs for Alternate
 16' urban shoulders (extra 4' on each outside shoulder)

Additional earthwork: $38,000' \times 4' \text{ avg} \times (4'+4') = 45,040$
 $= 45,040 \text{ cy}$

27 ac/cy
 length which excludes the exception at Houston Lake Rd. and the Rural shoulder thru the wetlands.

Additional grassing (Temp. / Perm.)
 $\frac{(4'+4') \times 38,000'}{43,560} = 6.98 \text{ AC. say } 7 \text{ AC}$

27 AC (project) of grassing = \$67,000 for grassing
 from cost estimate

$\frac{\$67,000}{27 \text{ AC}} \approx \$2,500/\text{AC}$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **A-1**

DESCRIPTION: **REALIGN SR 96 ALONG OGLETHORPE ROAD**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (Sketch attached)

The current design locates SR 96 within the current roadway until just west of Old Perry Road. The alignment then swerves north on a new location until SR 247. The close proximity of relocated SR 96/Old Perry Road and the Old SR 96/Old Perry Road intersections require a relocation of Old SR 96 just east of Old Perry Road.

ALTERNATIVE: (Sketch attached)

Revise the SR 96 alignment in this vicinity to follow along Oglethorpe Road. Use the existing Oglethorpe Road right-of-way to relocate SR 96. The new alignment would allow approximately 700-ft. between the relocated SR 96/Old Perry Road and the Old SR 96/Old Perry Road intersections. The relocation of Old SR 96 just east of Old Perry Road would be eliminated.

ADVANTAGES:

- Substantially increases intersection distance between relocated SR 96/Old Perry Road and Old SR 96/Old Perry Road
- Eliminates S-curves in the mainline alignment
- Increases Old SR 96 city street conversion
- Allows commercialization along Oglethorpe Road
- Reduces right-of-way requirements
- Reduces cost

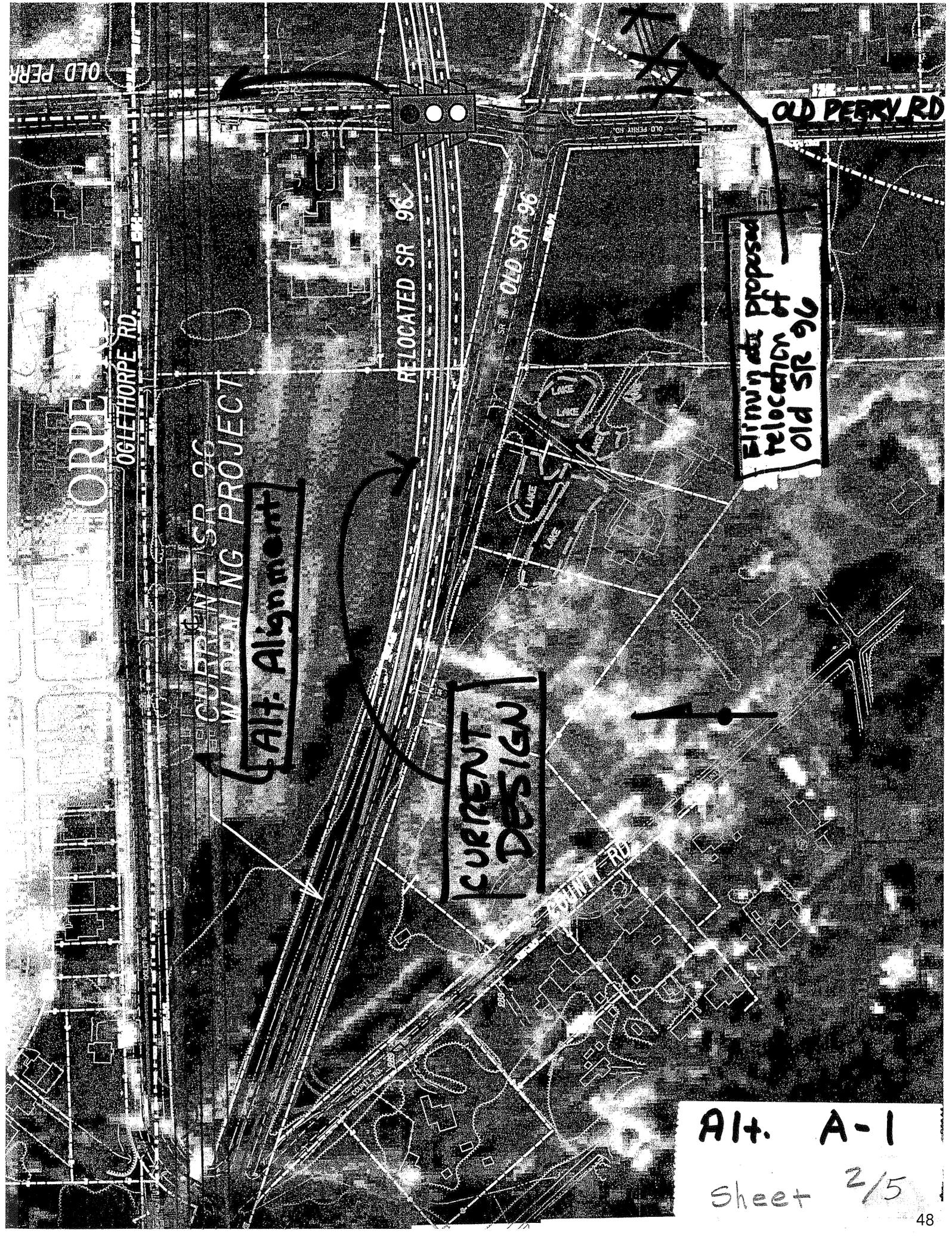
DISADVANTAGES:

- Possible resistance by residents along Oglethorpe Road
- Requires driveway connections along Oglethorpe Road
- Requires community input

DISCUSSION:

The proposed design would eliminate the S-curve alignment, the poor intersection spacing and the relocation of Old SR 96 east of Old Perry Road. The new alignment would be 150 linear feet shorter than the current design and would reduce the overall right-of-way requirements. The main disadvantage of this proposal is community input would be required. The VE team understands that the environmental document for this portion of the project is currently being reevaluated, therefore, the addition of this alternative is timely.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 531,742 | — | \$ 531,742 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 531,742 | — | \$ 531,742 |



OLD PERRY

OLD PERRY RD

OGLETHORPE RD.

RELOCATED SR 96

SR 96 OLD SR 96

CURRENT SR 96
WIDENING PROJECT

GALT Alignment

CURRENT
DESIGN

Firming and Proposed
relocation of
old SR 96

Alt. A-1

Sheet 2/5

BERNICE D. W.

SR 247

R-

NORFOLK
R.F. 247

Alt. Alignment

CURRENT
DESIGN

Alt. A-1

Sheet 3/5

CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

A-1
SHEET NO.: 4 of 5

Alt. Alignment of SR 96 is to align along Oglethorpe Rd.

SAVED ORIGINAL COSTS:

Original Alignment is 150 LF longer than Alt. Alignment.

$$\frac{150' \times (24' + 24')}{9 \text{ SF/SY}} = 800 \text{ SY}$$

$$\text{(Saved R/W by Alt.)} = (1800' \times 70') + (150' \times 250') = 181,500 \text{ SF}$$

$$\text{(Saved R/W by Original)} = (100' \times 1100') = 110,000 \text{ SF}$$

$$\text{SAVED R/W} = 71,500 \text{ SF}$$

SAVED COST to Realign Old SR 96 at Old Perry Rd.

$$\frac{(400' \times 24')}{9} = 1,067 \text{ SY}$$

↑
Length

COST WORKSHEET

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.: **A-1**
 SHEET NO.: **5** of **5**

| PROJECT ITEM | | ORIGINAL ESTIMATE | | | Alt. PROPOSED ESTIMATE | | |
|--|-------|-------------------|-----------|----------------|------------------------|-----------|----------|
| ITEM | UNITS | NO. OF UNITS | COST/UNIT | TOTAL | NO. OF UNITS | COST/UNIT | TOTAL |
| SAVED Full Depth Pavement | SY | 800 | 70.57 | \$56,456 | | | |
| (SAVED Realignmant of Old SR96 Pavement) | SY | 1067 | 70.57 | \$75,298 | | | |
| SAVED RIW | SF | 71,500 | 5.11 | \$365,365 | | | |
| Const. Subtotal | | | | 131,754 | | | |
| Markup 10% | | | | 13,176 | | | |
| RIW Subtotal | | | | 365,365 | | | 0 |
| Markup (%) at 5.87% | | | | 21,447 | | | |
| TOTAL | | | | 531,742 | | | 0 |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **I-1**

DESCRIPTION: **CUL-DE-SAC GRANVILLE DRIVE**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

Current design calls for a right in-right out intersection of Granville Drive with SR 96.

ALTERNATIVE: (Sketch attached)

Eliminate the intersection by make Granville Drive a cul-de-sac. Eliminate the concrete island and the right-turn lane into Granville Drive.

Access to Granville Drive would be maintained at the current access point along Moody Road.

ADVANTAGES:

- Improves safety

DISADVANTAGES:

- Creates an inconvenience to drivers who are accustomed to entering SR 96 from Granville Drive
- Requires local government concurrence

DISCUSSION:

Granville Drive intersection is only 500-ft. away from SR 96 intersection with Moody Road. Drivers exiting Granville onto SR 96 will have less time to get into the left lanes of SR 96 since traffic turning left on Moody is heavy. Cost of cul-de-sacking Granville will be offset by the elimination of right-turn lane into Granville Drive and the island.

This alternative costs approximately the same as the original design. The costs for the cul-de-sac are offset by the elimination of the right-turn lane.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | | | |
| ALTERNATIVE | | | |
| SAVINGS (Original minus Alternative) | | | |

DESIGN SUGGESTION

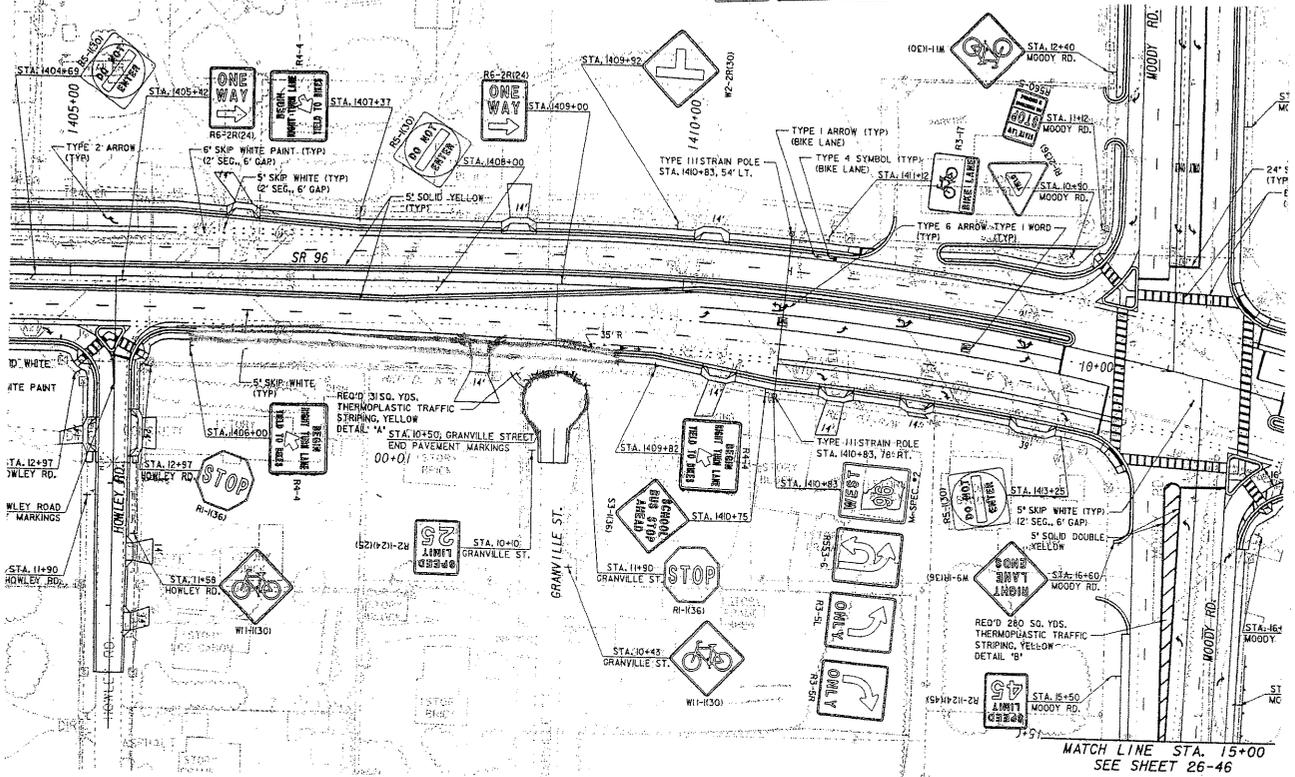
PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.:

I-1

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

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



VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **I-2**

DESCRIPTION: **ALIGN THE CR 82/CR 81 INTERSECTION WITH A
 REALIGNMENT OF CR 82**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

Align CR 81/Smyrna Church Road so that it intersects SR 96 opposite CR 82/Johnson Road. Build 650-ft. of curb and gutter on CR 81 and 150-ft. of curb and gutter on CR 82 on both sides of the road.

ALTERNATIVE: (Sketch attached)

Align CR 82 to intersect SR 96 opposite existing CR 81 and eliminate construction of curb and gutter on CR 81. Increase the length of curb and gutter on CR 82 to 600 ft.

Make opposite changes in the median opening.

ADVANTAGES:

- Reduces right-of-way cost

DISADVANTAGES:

- None apparent

DISCUSSION:

Shifting the street intersection to the east by 150-ft. saves money since the commercial property west of CR 82 owned by the Dent family will not have to be acquired. Land will need to be acquired east of CR 82 from the Dent family, but this cost will be offset by money saved from not having to acquire land around CR 81/Smyrna Church Road.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 216,400 | — | \$ 216,400 |
| ALTERNATIVE | \$ 0 | — | \$ 0 |
| SAVINGS (Original minus Alternative) | \$ 216,400 | — | \$ 216,400 |

SKETCH



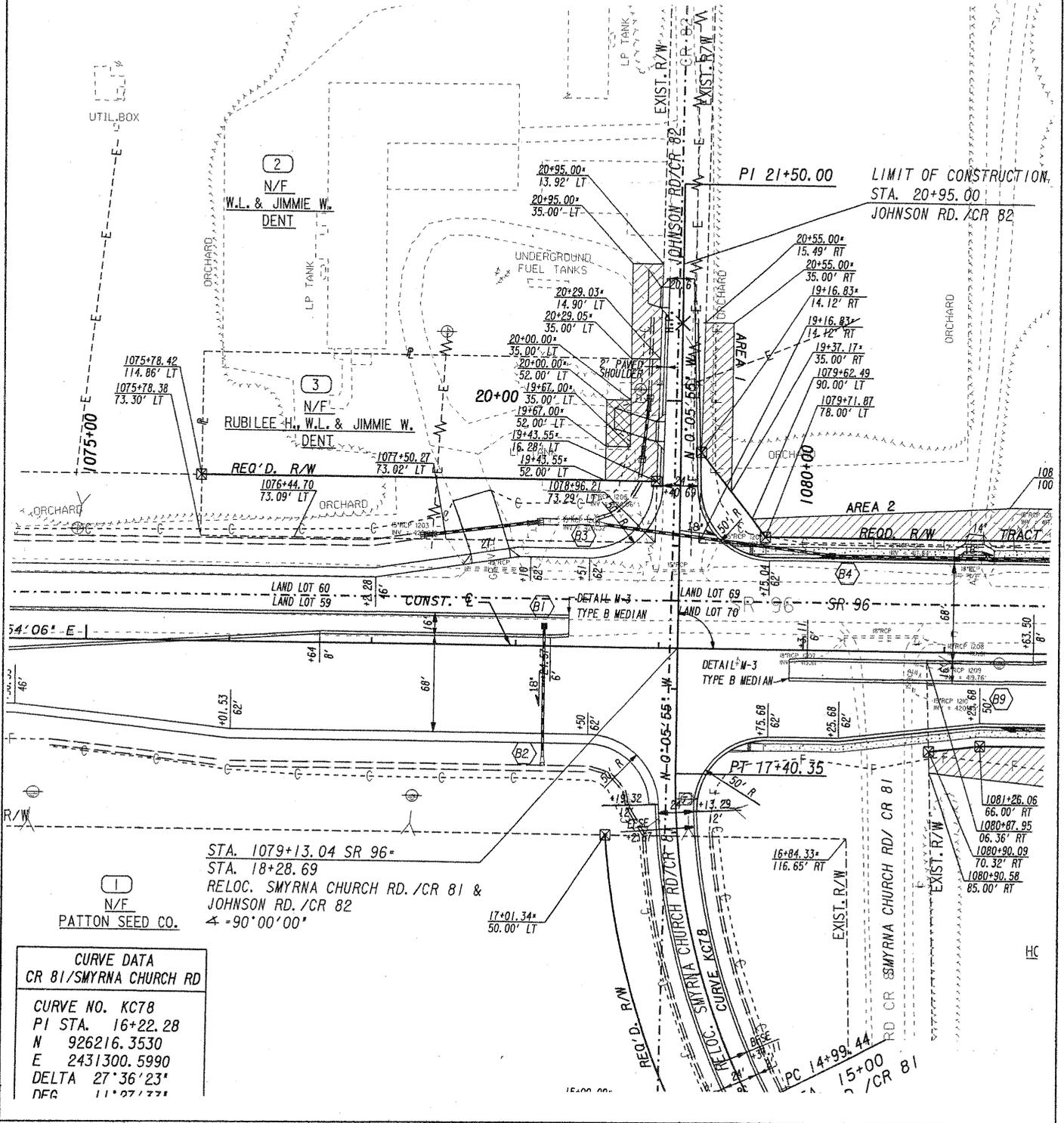
PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.:

I-2

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: 2 of 4



(1)
 N/F
 PATTON SEED CO.

STA. 1079+13.04 SR 96
 STA. 18+28.69
 RELOC. SMYRNA CHURCH RD./CR 81 &
 JOHNSON RD./CR 82
 Δ = 90°00'00"

| CURVE DATA | |
|------------------------|--------------|
| CR 81/SMYRNA CHURCH RD | |
| CURVE NO. | KC7B |
| PI STA. | 16+22.28 |
| N | 926216.3530 |
| E | 2431300.5990 |
| DELTA | 27°36'23" |
| DFC | 11°27'22" |

SKETCH

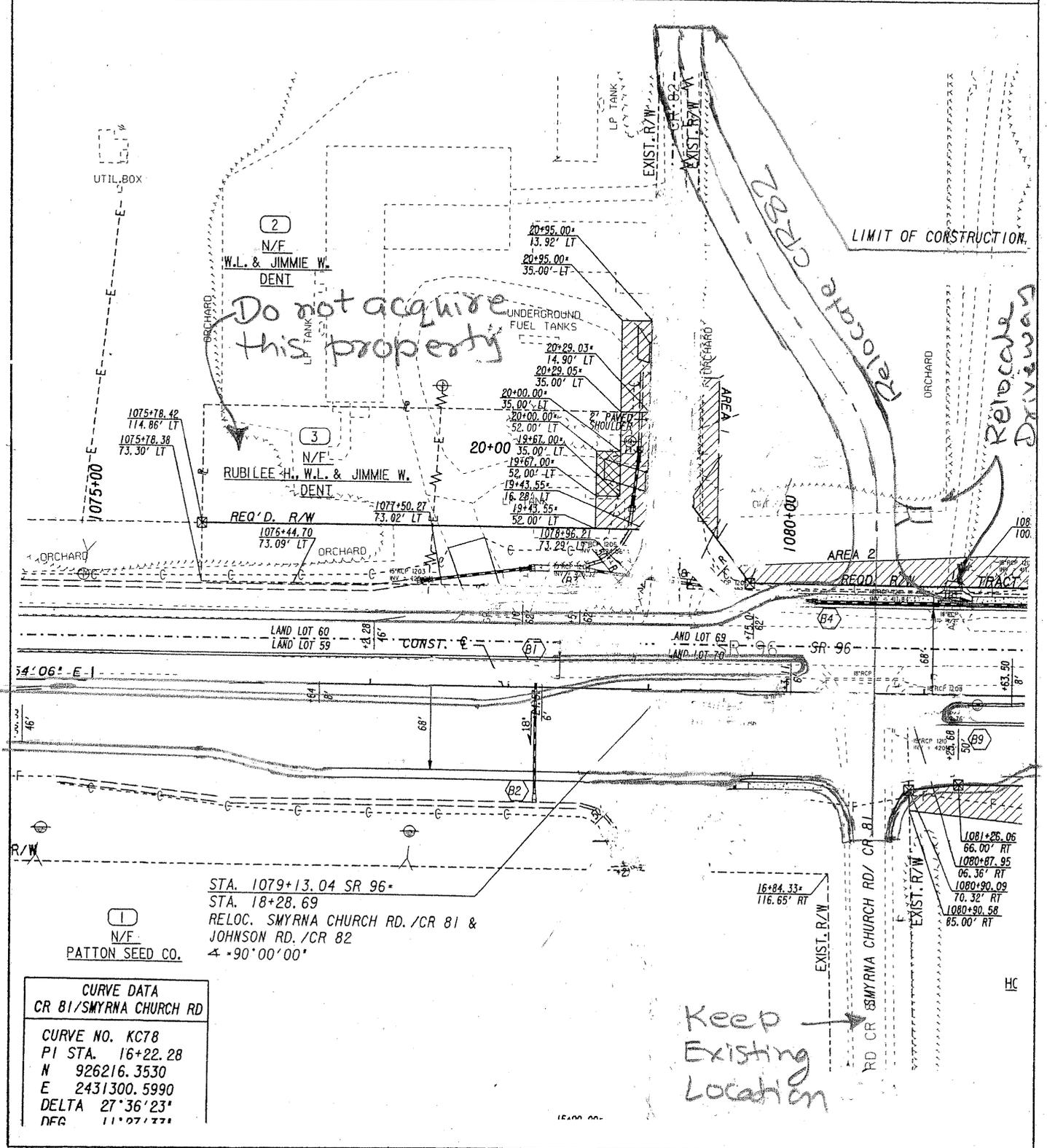


PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.:

I-2 3 of 4
 SHEET NO.:

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH



Do not acquire this property

Keep Existing Location

2
 N/F
 W.L. & JIMMIE W. DENT
 LP TANK

3
 N/F
 RUBILEE H., W.L. & JIMMIE W. DENT
 REQ'D. R/W

LAND LOT 60
 LAND LOT 59
 CONST. E
 SR 96
 LAND LOT 69
 LAND LOT 70

1
 N/F
 PATTON SEED CO.
 STA. 1079+13.04 SR 96
 STA. 18+28.69
 RELOC. SMYRNA CHURCH RD. /CR 81 &
 JOHNSON RD. /CR 82
 Δ +90°00'00"

| CURVE DATA | |
|------------------------|--------------|
| CR 81/SMYRNA CHURCH RD | |
| CURVE NO. | KC78 |
| PI STA. | 16+22.28 |
| N | 926216.3530 |
| E | 2431300.5990 |
| DELTA | 27°36'23" |
| DFG | 11'27'37" |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **I-6**

DESCRIPTION: **SIGNALIZE BEAR DRIVE/SR 96 INTERSECTION IN LIEU
 OF HIGH SCHOOL DRIVE/SR 96 ACCESS POINT**

SHEET NO.: **1 of 3**

ORIGINAL DESIGN: (Sketch attached)

The current design proposes to signalize the intersection at High School Drive and SR 96 access point.

ALTERNATIVE: (Sketch attached)

Move the proposed signal from High School Drive to Bear Drive.

ADVANTAGES:

- Bear Drive is accessible to several parking lots
- Phase signals at Bear Drive and Sutherlin Drive to allow High School Drive to operate
- Improves spacing between signals

DISADVANTAGES:

- High School Drive would be unsignalized at SR 96

DISCUSSION:

Current design proposes signals at High School Drive and Sutherlin Drive. The alternative design would move the signal from the High School Drive to Bear Drive. This would improve the operation of the intersection which accesses several additional parking lots. It is important to note that the High School Drive is between Bear Drive and Sutherlin Drive, therefore, if these two signals were synchronized properly, it would allow a break in traffic for the High School Drive to operate efficiently.

There is no cost to compare between the original and alternative designs since this idea is moving a proposed signal.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | | | |
| ALTERNATIVE | DESIGN SUGGESTION | | |
| SAVINGS (Original minus Alternative) | | | |



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

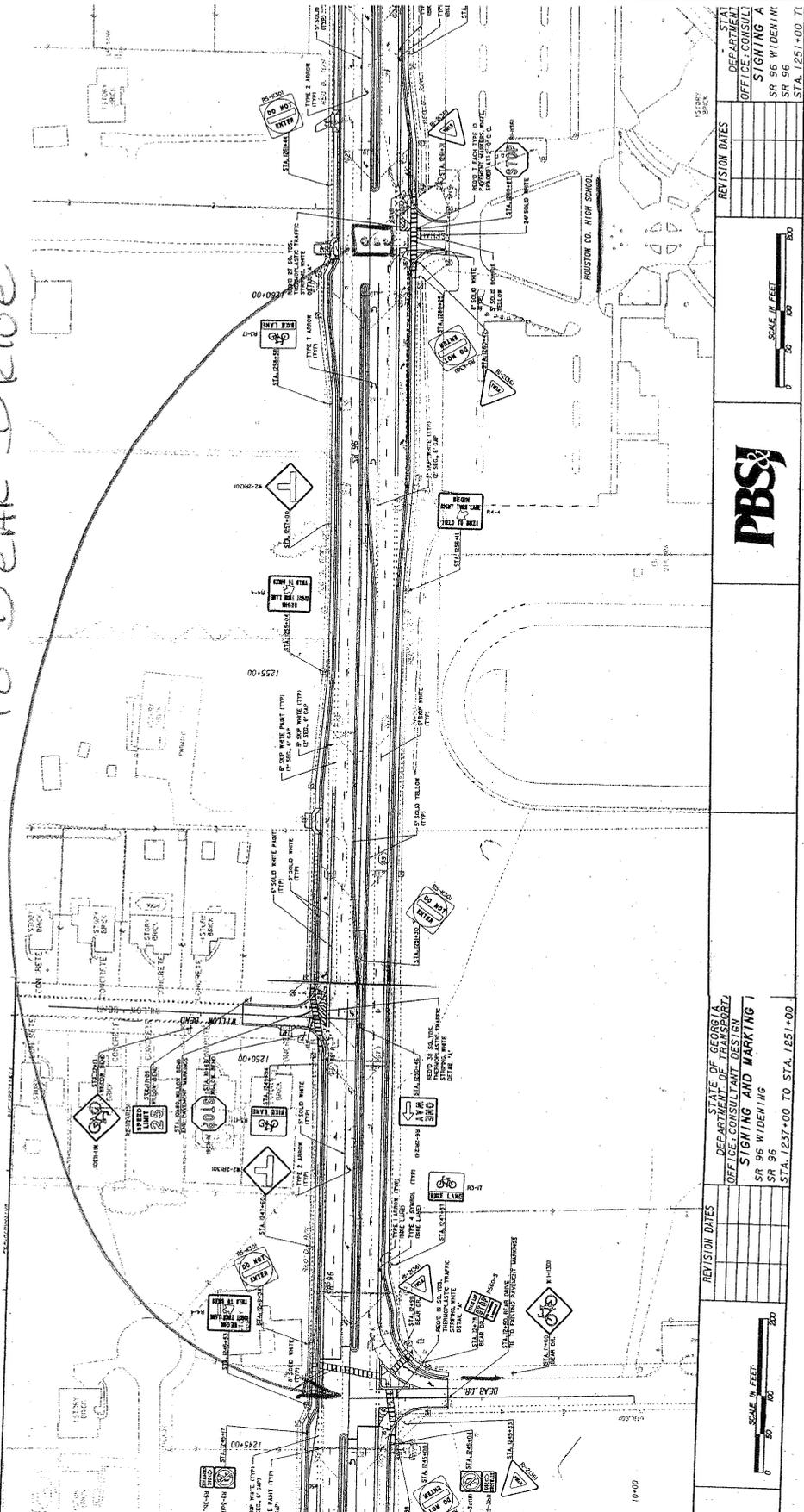
I-6

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.:

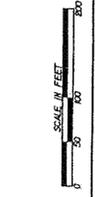
3 of 3

Move Proposed Signal from High School Drive to Bear Drive



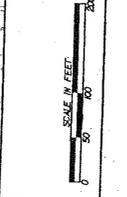
STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE CONSULTANT DESIGN
SR 96 WIDENING
SR 96
STA. 1237+00 TO STA. 1251+00

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



STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE CONSULTANT DESIGN
SR 96 WIDENING
SR 96
STA. 1237+00 TO STA. 1251+00

| REVISION DATES |
|----------------|
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VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **I-7**

DESCRIPTION: **CUL-DE-SAC CONNECTION AT FOREST ROAD/SR 96 AND
 REPLACE WITH A NEW, ALL MOVEMENT CONNECTION
 AT FOREST ROAD/MOODY ROAD**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN:

Current design calls for a Forest Road/SR 96 right-in right-out movement.

ALTERNATIVE: (Sketch attached)

Cul-de-sac Forest Road at SR 96 and provide a new connection at Forest Road/Moody Road where a displaced, full-take parcel is available.

ADVANTAGES:

- Provides a full movement access point
- Eliminates a long out of direction travel for Forest Road/westbound SR 96 movements
- Eliminates a short decel lane into Forest Road

DISADVANTAGES:

- Slightly increases cost
- Forest Road/SR 96 traffic must travel through Moody Road/SR 96 intersection
- Requires public/local government coordination

DISCUSSION:

The current design proposes the access at Forest Road/SR 96 as a right-in right-out only movement. Forest Road/eastbound SR 96 traffic must travel westbound along SR 96 and make a u-turn at the Scarlett Drive signalized intersection (almost 1 mile out of direction travel distance). Also, the current design allocates a very short deceleration lane preceding the right-in movement that would be eliminated with the alternative design. The alternative design would make use of a displaced parcel to make the new, full movement connection from Forest Road to Moody Road. The additional construction costs are low due to the tradeoff of the 150-ft.-long deceleration lane/Forest Road/SR 96 intersection improvements for the new connection costs.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 25,520 | — | \$ 25,520 |
| ALTERNATIVE | \$ 42,059 | — | \$ 42,059 |
| SAVINGS (Original minus Alternative) | \$ (16,539) | — | \$ (16,539) |



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.:

T-7

SHEET NO.: 3 of 4

Alternate Costs for ^{New} Connector Rd.
Pavement Section 165 lb/sy (Asph. Surface)
220 lb/sy (Asph. Border)

G.A.B 12"

$$165 \text{ lb/sy} \times \frac{1}{2000 \frac{\text{lb}}{\text{T}}} \times \$75/\text{T} = \$6.20/\text{sy}$$

$$220 \text{ lb/sy} \times \frac{1}{2000 \frac{\text{lb}}{\text{T}}} \times 70/\text{T} = \$7.70/\text{sy}$$

GAB 6" = \$12.50/sy (from Item Means Summary)

QUANTITIES: Use for Connector & cul-de-sac = \$26.40/sy

$$\rightarrow (24' \times 200' \text{ Length}) / 9 \text{ SF/SF} = 534 \text{ sy (Conn.)} + 100 \text{ sy} = 634 \text{ sy} \quad \text{PAVEMENT}$$

$$\rightarrow \text{Est. EARTH work } \frac{50' \times 4' \text{ Avg} \times 200'}{27} \approx 1,500 \text{ cy}$$

$$\rightarrow \text{Est. AREA GRASSING/EROS. CONTROL} = \frac{60' \times 200'}{43,560 \frac{\text{SF}}{\text{AC}}} = 0.28 \text{ AC}$$

$$\rightarrow 400 \text{ L.F. (for C\&G) (Conn.)} + 200 \text{ L.F. (cul-de-sac)} = 600 \text{ L.F. C\&G}$$

Original Costs Saved

Main Line Pavement: $\frac{12' \times 210'}{9 \text{ SF/SY}} = 280 \text{ sy}$

SAVE 200 L.F. of C&G

COST WORKSHEET



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.:

SHEET NO.:

T-7

of 4

| PROJECT ITEM | | ORIGINAL ESTIMATE | | | Alt PROPOSED ESTIMATE | | |
|-------------------------------|-------------|-------------------|----------------|---------------|----------------------------------|-----------------|-----------------|
| ITEM | UNITS | NO. OF UNITS | COST/UNIT | TOTAL | NO. OF UNITS | COST/UNIT | TOTAL |
| <i>EXTRA Cost for</i> | | | | | | | |
| <i>Conn. & cut-de-sac</i> | | | | | | | |
| <i>PAVEMENT SECTION</i> | <i>SY.</i> | | | | <i>634</i> | <i>\$26.40</i> | <i>16,740</i> |
| <i>Curb & gutter</i> | <i>L.F.</i> | | | | <i>600</i> | <i>\$17.20</i> | <i>10,320</i> |
| <i>extra EXCAV</i> | <i>CY</i> | | | | <i>1500</i> | <i>\$4.65</i> | <i>6,975</i> |
| <i>GLASSING/EDOS COT</i> | <i>AC</i> | | | | <i>.28</i> | <i>\$15,000</i> | <i>4,200</i> |
| | | | | | | | |
| <i>Original Cost saved</i> | | | | | | | |
| <i>Decel Lane Pavement</i> | <i>SY</i> | <i>280</i> | <i>\$70.57</i> | <i>19,760</i> | | | |
| <i>curb & gutter</i> | <i>LF</i> | <i>200</i> | <i>\$17.20</i> | <i>3,440</i> | | | |
| | | | | | | | |
| <i>Constl. Subtotal</i> | | | | <i>23,200</i> | | | <i>38,235</i> |
| <i>Markup (%) at</i> | | | | <i>2,320</i> | | | <i>3,824</i> |
| TOTAL | | | | <i>25,520</i> | | | <i>42,059</i> ✓ |

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **B-2A**

DESCRIPTION: **CONSIDER A SINGLE 12-FT. X 6-FT. BOX CULVERT IN
 LIEU OF DOUBLE 6-FT. X 6-FT. BOX CULVERTS AT
 STA 1452+17**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design indicates a double 6-ft. x 6-ft. box culvert, 146 ft. long at STA 1452+17.

ALTERNATIVE: (Sketch attached)

Use a 12-ft. x 6-ft. single box culvert, 146 ft. long at this location.

ADVANTAGES:

- Improves hydraulics
- Reduces maintenance
- Accelerates construction

DISADVANTAGES:

- May increase transportation costs
- May increase project cost

DISCUSSION:

Even though the alternative design will increase initial cost to implement, the duration of construction may be reduced, as will the probability of debris being trapped inside the box culvert.

The lump sum dollar amount in the cost estimate for the 12-ft. x 12-ft. box culvert was obtained from Oldcastle's representative Kirk Harvey at (770) 981-2860.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 75,161 | — | \$ 75,161 |
| ALTERNATIVE | \$ 126,553 | — | \$ 126,553 |
| SAVINGS (Original minus Alternative) | \$ (51,392) | — | \$ (51,392) |



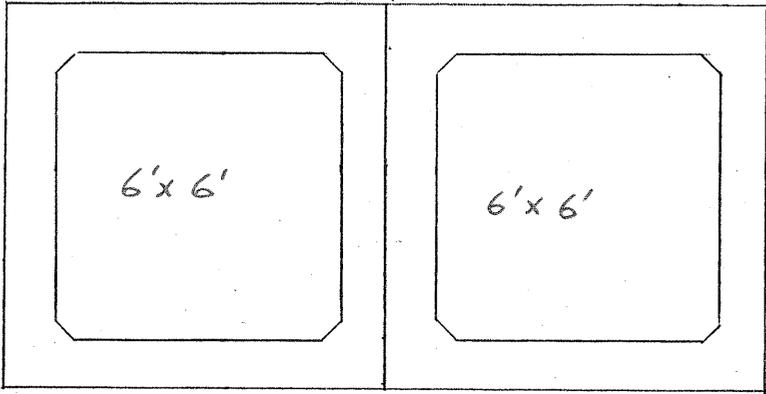
PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.: *B-2 A*

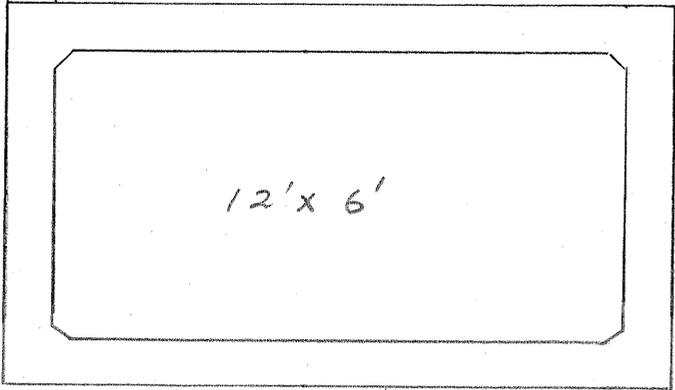
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: *2 of 4*

ORIGINAL DESIGN



ALTERNATIVE DESIGN



CALCULATIONS



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.: **B-2A**

SHEET NO.: **3 of 4**

ORIGINAL DESIGN

6'x6' double box culvert = 146' x 2 eq.
= 292'

ALTERNATIVE DESIGN

Total Cost (Provided by = \$115,000

Oldcastle (770)-981-2860

Kirk Harvey)

Length of culvert = 146'

Cost per linear foot = \$788/lin. ft.

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **B-2B**

DESCRIPTION: **CONSIDER A SINGLE 12-FT. X 6-FT. THREE-SIDED
 CONCRETE CULVERT AT STA 1452+17 IN LIEU OF
 DOUBLE 6-FT. X 6-FT. BOX CULVERTS**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design indicates a double 6-ft. x 6-ft. box culvert, 146 ft. long at STA 1452+17.

ALTERNATIVE: (Sketch attached)

Use a 12-ft. x 6-ft. three-sided box culvert, 146 ft. long at this location.

ADVANTAGES:

- Improves hydraulics
- Reduces maintenance
- Naturalizes streambed

DISADVANTAGES:

- May increase transportation costs
- May increase project cost

DISCUSSION:

Even though it will increase the initial cost to implement this alternative, the riverbed will be less impacted, and the probability of debris being trapped inside the box culvert will be reduced. Also, there may be an advantage to naturalizing the streambed.

Costs were obtained from a local vendor.

| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|----------------------------------|----------------------------------|
| ORIGINAL DESIGN | \$ 75,161 | — | \$ 75,161 |
| ALTERNATIVE | \$ 235,118 | — | \$ 235,118 |
| SAVINGS (Original minus Alternative) | \$ (159,957) | — | \$ (159,957) |

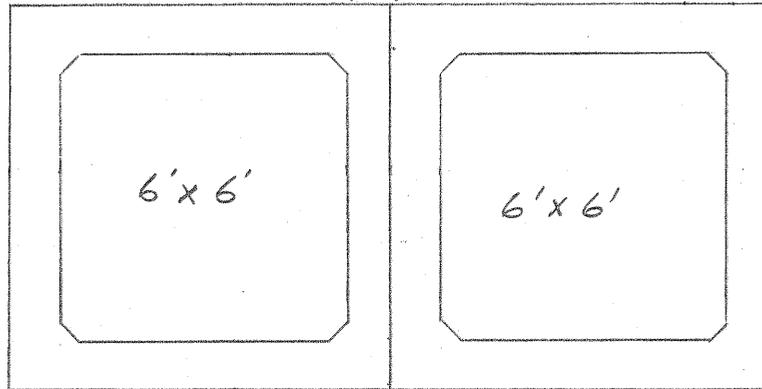
PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.: *B-2B*

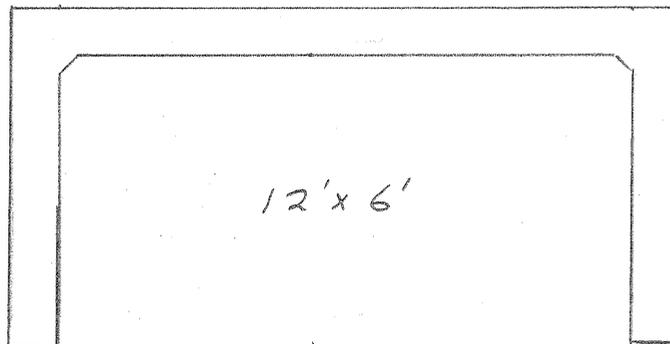
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: *2 of 4*

ORIGINAL DESIGN



ALTERNATIVE DESIGN



CALCULATIONS



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Georgia Department of Transportation

ALTERNATIVE NO.: **B-2B**

SHEET NO.: **3** of **4**

ORIGINAL DESIGN

$$\begin{aligned} 6' \times 6' \text{ double } \overset{\text{box}}{\underset{\wedge}{\text{culvert}}} &= 146' \times 2 \text{ ea.} \\ &= 292' \end{aligned}$$

ALTERNATIVE DESIGN

$$\begin{aligned} 12' \times 6' \text{ three-sided culvert} &= 12' \times 146' \\ &= 1,752 \text{ sf} \end{aligned}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **B-4**

DESCRIPTION: **CREATE TWO SHORT BRIDGES WITH FILL IN BETWEEN
 IN LIEU OF ONE LONG MULTI-SPAN BRIDGE**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design indicates a double 6-ft. x 6-ft. box culvert, 146-ft. long at STA 1452+17.

ALTERNATIVE: (Sketch attached)

Fill spans 3 and 4 with earth-filling and revise the lengths of spans 1, 2, 5 and 6. Convert intermediate bents 3 and 5 to end bents. Provide MSE walls in front of the end bents to retain earth-fill. MSE walls to be installed parallel to the centerline of the railroad and SR-247.

ADVANTAGES:

- Reduces intermediate bents
- Reduces cost
- Accelerates construction

DISADVANTAGES:

- Future expansion/widening of SR 247 may be costly

DISCUSSION:

The substructure of each bridge will align with the centerline of the railroad tracks and the centerline of SR-247, respectively. The use of earth-fill will reduce the construction cost by \$1,707,602 and there will also be a reduction in the construction schedule.

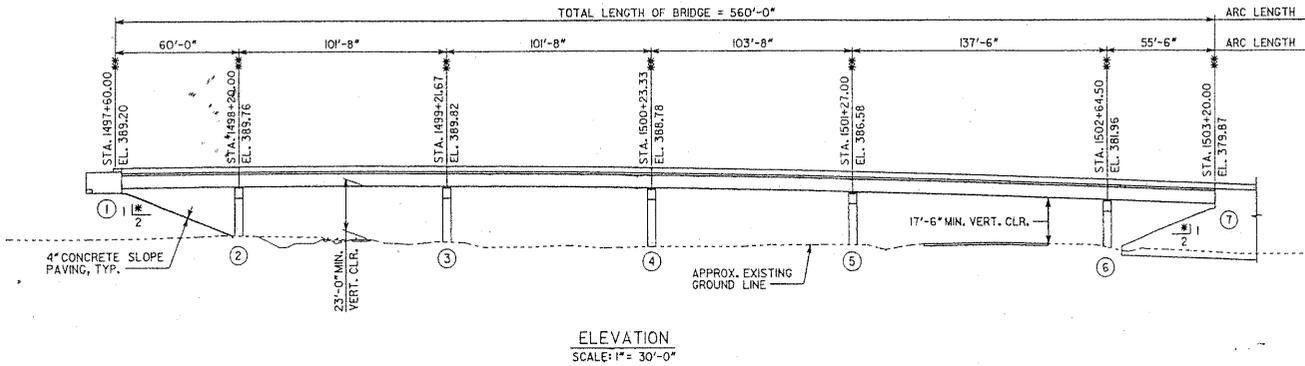
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 7,153,927 | — | \$ 7,153,927 |
| ALTERNATIVE | \$ 5,446,325 | — | \$ 5,446,325 |
| SAVINGS (Original minus Alternative) | \$ 1,707,602 | — | \$ 1,707,602 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

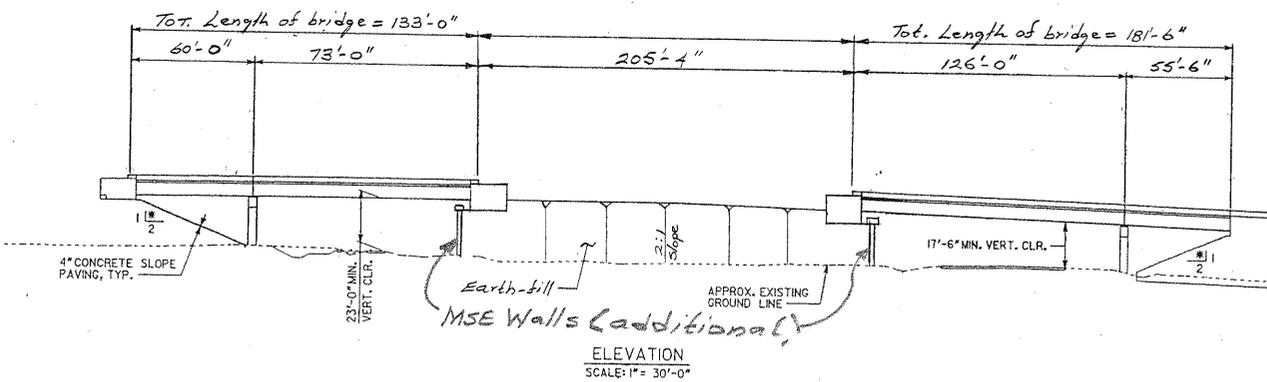
ALTERNATIVE NO.: *B-4*

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: *2 of 4*



ORIGINAL DESIGN



ALTERNATIVE DESIGN

CALCULATIONS



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

ALTERNATIVE NO.: B-4

SHEET NO.: 3 of 4

ORIGINAL DESIGN

$$\begin{aligned} \text{Deck surface} &= 560' \times 98.42' \\ &= 55,115 \text{ sf.} \end{aligned}$$

ALTERNATIVE DESIGN

$$\begin{aligned} \text{Deck Surface} &= 120' \times (133' + 181.5') \\ &= 37,740 \text{ sf.} \end{aligned}$$

$$\begin{aligned} \text{MSE Walls} &= (22' \times 120') + 2 \left(\frac{1}{2} \times 44' \times 22' \right) + (15.5' \times 120') + 2 \left(\frac{1}{2} \times 31' \times 15.5' \right) \\ \text{(Additional)} &= 2,640 \text{ sf} + 968 \text{ sf} + 1,860 \text{ sf} + 480.5 \text{ sf.} \\ &= 5,949 \text{ sf} \end{aligned}$$

$$\begin{aligned} \text{Earth. fill} &= 205.33' \times \left[(120' \times 21.25') + 2 \times \frac{1}{2} (21.25' \times 42.5') \right] \\ &= 205.33' \times (2550 \text{ sf} + 903.13 \text{ sf}) \\ &= 709,031 \text{ cf} \div 27 \\ &= 26,260 \text{ cy} \end{aligned}$$

VALUE ENGINEERING ALTERNATIVE



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties

ALTERNATIVE NO.: **B-5**

DESCRIPTION: **CREATE TWO SHORT BRIDGES WITH FILL IN BETWEEN
 AND MSE WALLS IN LIEU OF ONE LONG MULTI-SPAN
 BRIDGE**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (Sketch attached)

The original design indicates Bridge No. 1 (SR 96 over Norfolk Southern Railroad and SR 247) is a six-span bridge with PSC beams and concrete bents.

ALTERNATIVE: (Sketch attached)

Fill spans 3 and 4 with earth-fill and revise the lengths of spans 1, 2, 5 and 6. Convert intermediate bents 3 and 5 to end bents. Install MSE walls to retain the earth-fill on all four sides.

ADVANTAGES:

- Reduces intermediate bents
- Reduces bridge cost
- Accelerates construction

DISADVANTAGES:

- Future expansion/widening of SR 247 may be costly

DISCUSSION:

The use of earth-fill instead of bridge spans will reduce the cost of construction by \$1,394,831. Construction schedule will also be reduced. The substructures will be aligned with the centerline of the railroad tracks and centerline of the roadway, respectively.

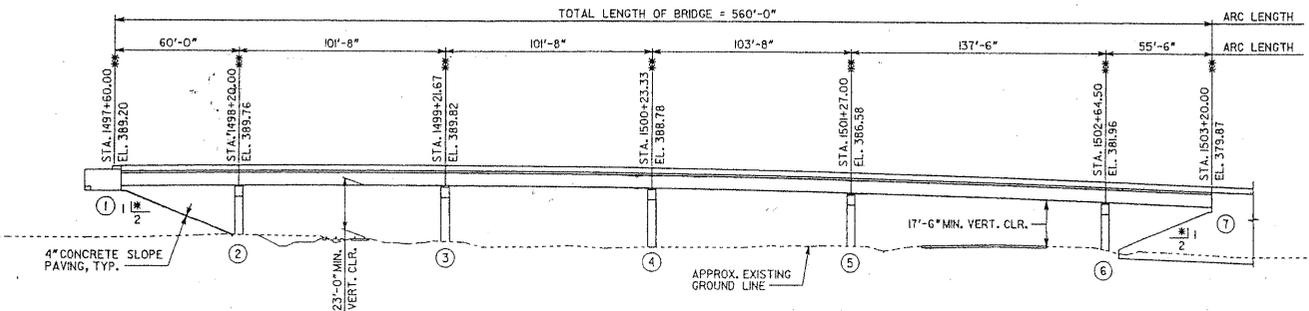
| COST SUMMARY | INITIAL COST | PRESENT WORTH RECURRING COSTS | PRESENT WORTH LIFE-CYCLE COST |
|--------------------------------------|--------------|-------------------------------|-------------------------------|
| ORIGINAL DESIGN | \$ 7,153,927 | — | \$ 7,153,927 |
| ALTERNATIVE | \$ 5,759,096 | — | \$ 5,759,096 |
| SAVINGS (Original minus Alternative) | \$ 1,394,831 | — | \$ 1,394,831 |

PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
 Georgia Department of Transportation

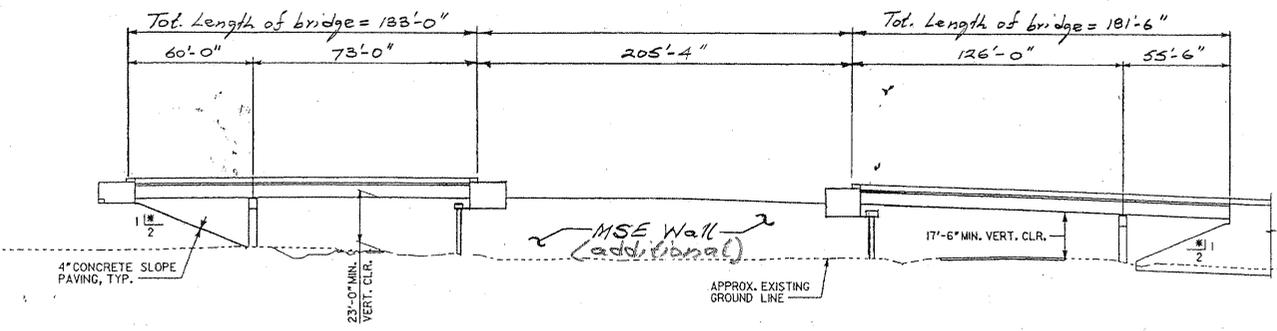
ALTERNATIVE NO.: *B-5*

ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH

SHEET NO.: *2* of 4



ORIGINAL DESIGN



ELEVATION
 SCALE: 1" = 30'-0"

ALTERNATIVE DESIGN

CALCULATIONS



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Georgia Department of Transportation

ALTERNATIVE NO.: B-5

SHEET NO.: 3 of 4

ORIGINAL DESIGN

$$\begin{aligned} \text{Deck surface} &= 560' \times 98.42' \\ &= 55,115 \text{ sf.} \end{aligned}$$

ALTERNATIVE DESIGN

$$\begin{aligned} \text{Deck surface} &= 120' \times (133' + 181.5') \\ &= 37,740 \text{ sf.} \end{aligned}$$

$$\begin{aligned} \text{MSE Walls} &= (22' \times 120') + 2 \times (205.33' \times 18.75' \text{ }^{ave. \text{ ht}}) + (15.5' \times 120') \\ (\text{Additional}) &= 2,640 \text{ sf} + 7,700 \text{ sf} + 1,860 \text{ sf} \\ &= 12,200 \text{ sf.} \end{aligned}$$

$$\begin{aligned} \text{Earth. fill} &= 120' \times 18.75' \times 205.33' + 27 \\ &= 17,111 \text{ cy.} \end{aligned}$$

PROJECT DESCRIPTION

Information taken from Revised Project Concept Report.

Georgia Department of Transportation
SR 96 Widening and Reconstruction
STP-155-1(21), CSNHS-0008-00(406)(407)
P.I. Nos. 322450, 0008046, 0008407
Houston and Peach Counties

Need and Purpose

This project is the widening and reconstruction of SR 96 from I-75 to SR 247 for a total 8.97 miles. The existing roadway consists of two 12-foot lanes with rural shoulders. This project in conjunction with projects STP-1151(22) and (23) will improve truck access and provide a multi-lane facility between I-75 and I-16. The base year traffic (1999) is 10,950 VPD and the design year traffic (2019) is 19,700 VPD. The posted speed limit and the design speed limit is 55 mph.

The proposed construction will provide four 12-foot lanes with a 44-foot depressed grassed median from I-75 to CR 143, CR 414 to CR 398, and from CR 158 to CR 133. A four-lane section with a 20-foot raised median will be utilized for the remainder of the project. Several small box culverts will be extended to appropriate lengths to accommodate the widened section. This roadway will remain open to traffic during construction.

Environmental concerns include requiring a COE 404 permit and Environmental Assessment, potential historic impacts, possible 106/4(f) involvement, archaeology survey requirement, and a public hearing requirement. Time saving procedures are not appropriate.

Project location:

The proposed project is located within Peach County and Houston County. The project begins approximately 0.4 miles east of the I-75/SR 96 interchange (milepost 13.95) in Peach County and continues east along SR 96 for approximately 8.97 miles to just east of SR 247/US129 (milepost 7.48) in Houston County.

Description of the approved concept:

The approved concept proposes to expand the existing two-lane section to a four-lane section with 12-foot lanes, either a 44-foot depressed median or 20-foot raised median, and turn lanes as required. The shoulders are to be 10 feet wide with curb and gutter.

PDP Classification: Major , Minor

Federal Oversight: Full Oversight (), Exempt (), SF () Other ()

Functional Classification: Rural Minor Arterial (Peach County) and an Urban Principal Arterial (Houston County)

U.S. Route Number: NA **State Route Number:** SR 96

Traffic (AADT) as shown in the approved concept:

Opening Year (1999): 10,950 ADT Design Year (2019): 19,700 ADT

Proposed features to be revised:

- Typical Section—changed the sections with raised median from a 20-foot raised median to a 24-foot raised median and added bike lanes, curb and gutter, and sidewalks throughout the entire project.
- Project Termini and Limits—separated into three phases.
- Right-of-Way—changed right-of-way width from a constant 200-foot width to a variable width of 124 to 148 feet.
- Design Speed—reduced from 55 mph to 45 mph.
- Updated Traffic

Describe the revised features to be approved:

Typical Section

The approved concept report shows two lanes in each direction with either a 44-foot depressed median. The new section would be two lanes each direction with either a 44-foot depressed median or a 24-foot raised median (adding two, 2-foot shoulders/buffers on inside lanes). Additionally, 4-foot bike lanes and 5-foot sidewalks will be required in both directions throughout the project. The proposed changes to the shoulders will make the project compliant with current ADA guidelines. In areas where there are right-turn lanes, the shoulders will be reduced to 12 feet. This shoulder will have a 2-foot textured strip instead of a 6-foot grass strip. This change in shoulder width will not affect ADA compliance because there are no driveways with valley gutters in any of the right-turn lanes.

Project Termini and Limits

The SR 96 Widening project will be presented to the public in three phases. The limits of the three phases will be shown as follows:

- Phase 1 – I-75 to Lake Joy Road
- Phase 2 – Lake Joy Road to Moody Road
- Phase 3 – Moody Road to SR 247/US 129

The project will be designed as one job, but may be constructed in the phases described above depending on funding availability.

Right-of-Way

The right-of-way was previously shown as 200 feet throughout the project. However, this revision will decrease the total right-of-way required relocating it to shoulder break points. Right-of-way will vary from 124 feet, in areas with no right-turn lanes, to 148 feet, where there are right-turn lanes on both sides of the road. This will allow for the construction of sidewalk through the area, as well as improvements to the shoulders. Easements will be purchased as required where the construction limits extend beyond the required right-of-way line.

Speed Reduction

The AASHTO Roadside Design Guide (2002) states in Section 10.7 (“Curbs”) that curbed sections are generally restricted to design speeds of 45 mph or less on roadways in urban or highly developed areas. In order to retain the 55 mph design speed with an urban shoulder section, the curb would need to be shifted 12 feet from the edge of travel lane, in accordance with the AASHTO Policy on Geometric Design of Highways and Streets, 2004, page 322. The expense for the additional right-of-way required to accommodate this shift eliminated this from consideration and a design speed reduction from 55 mph to 45 mph was requested.

Design Exceptions and Variance

None anticipated.

The project was changed from Metric units, as in the approved concept report, to English units.

Updated traffic data (AADT):

Opening Year (2012): 30,000 ADT

Design Year (2032): 42,750 ADT

Programmed/Schedule:

P.E.: 2006

Right-of-Way: 2007

Construction: 2009

Revised Cost Estimates:

1. Construction cost including inflation and E&C:
 - Phase 1 – I-75 to Lake Joy Road \$13,900,000
 - Phase 2 – Lake Joy Road to Moody Road 15,500,000
 - Phase 3 – Moody Road to SR 247/US 129 17,800,000
 - Total \$47,200,000**

2. Right-of-Way:
 - Phase 1 – I-75 to Lake Joy Road \$2,970,000
 - Phase 2 – Lake Joy Road to Moody Road 3,330,000
 - Phase 3 – Moody Road to SR 247/US 129 2,700,000
 - Total \$9,000,000**

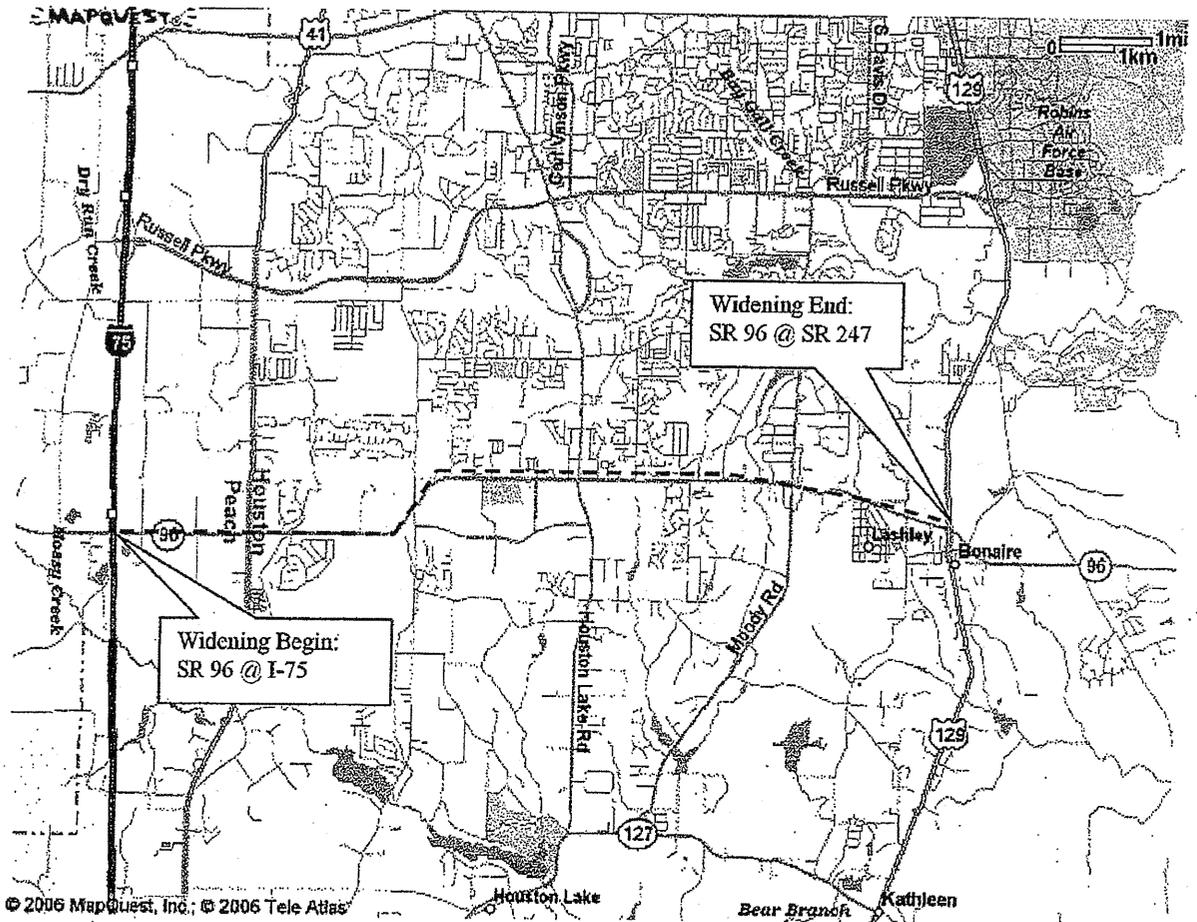
3. Utilities:

| | |
|---|--------------------|
| • Phase 1 – I-75 to Lake Joy Road | \$412,500 |
| • Phase 2 – Lake Joy Road to Moody Road | 462,500 |
| • Phase 3 – Moody Road to SR 247/US 129 | 375,000 |
| Total | \$1,250,000 |

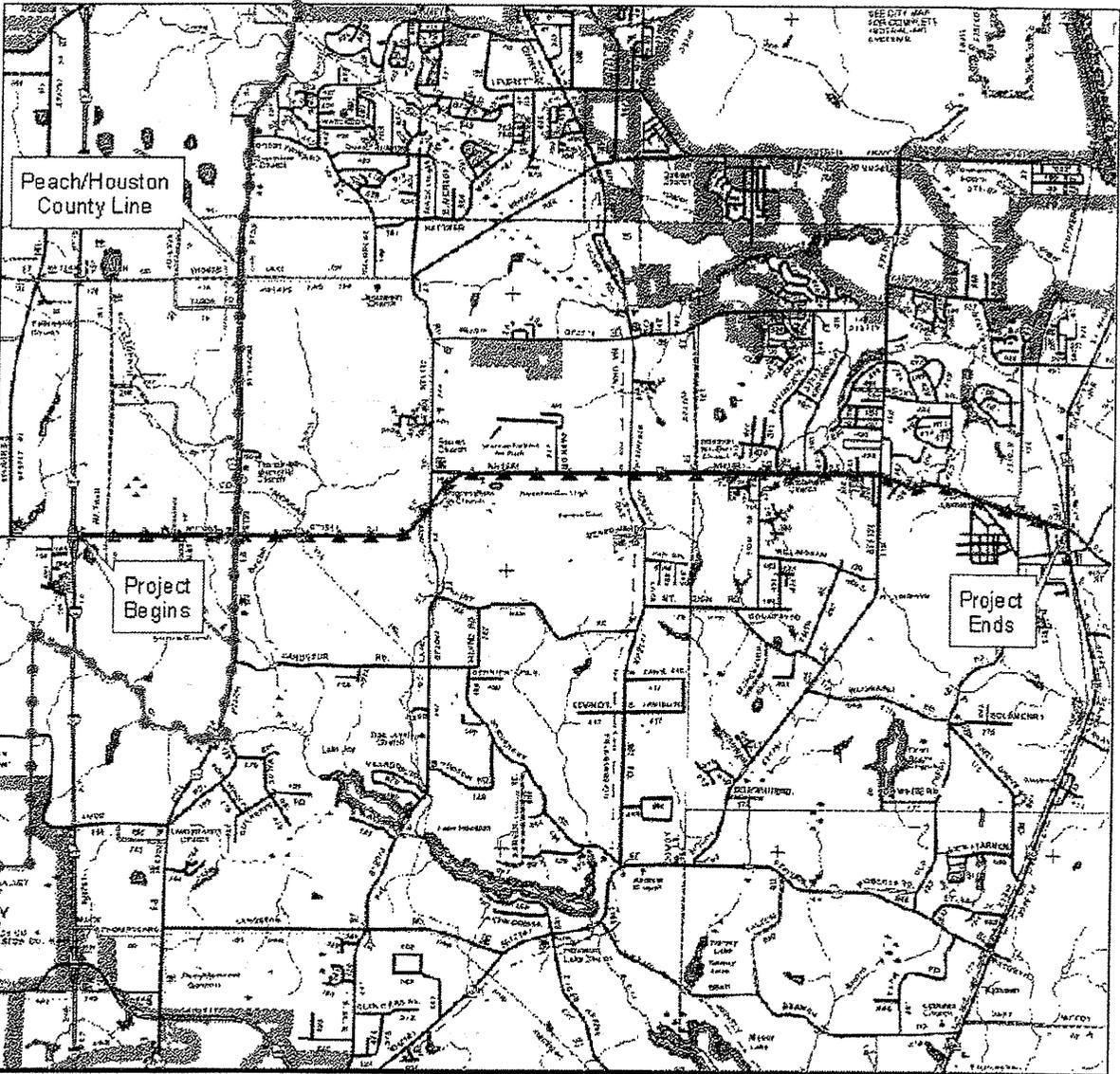
Is the project located in a non-attainment area? Yes No

The proposed project concept matches the conforming plan's model description. The project proposes to widen SR 96 to a four-lane divided section from I-75 to SR 247/US 129. The proposed changes are scheduled to be open to traffic in 2012.

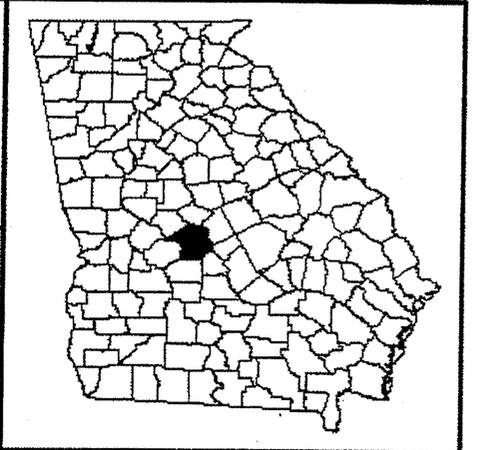
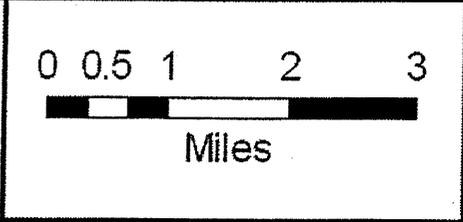
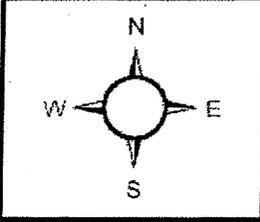
Project Limits:



Map of STP-155-1(21), Houston County PI NO. 322450



Project Location Map
 STP-155-1(21)
 Peach & Houston Counties
 PI No. 322450
 Widening and Reconstruction of State Route 96



VALUE ANALYSIS AND CONCLUSION

INTRODUCTION

This section describes the procedures used during the value engineering study on the SR 96 Widening and Reconstruction project, P.I. Nos. 322450, 0008046, 0008407 conducted by Lewis & Zimmerman Associates, Inc. for the Georgia Department of Transportation. The workshop was performed February 5-8, 2007 in GDOT's offices in Atlanta, Georgia. The design firm, PBSJ, was selected by the owner to assist with the development of the project and provided information for the VE team to use as the basis of the study.

A systematic approach was used in the VE study. The key steps taken were organized into three distinct parts: 1) pre-study preparation; 2) VE orientation/kickoff meeting and workshop; and 3) post-study reporting and implementation. A Task Flow diagram, which outlines each of the procedures included in the VE study, is attached for reference.

In the sections following the procedures, separate narratives and supporting documentation identify the following:

- Value Engineering Workshop Agenda
- Workshop Participants
- Economic Data used in the workshop
- Cost Model(s) developed for use in the workshop
- Function Analysis performed by the team
- Creative Ideas and Evaluation of the ideas performed by the team

PREPARATION EFFORT

A workshop format was used to conduct the study. Pre-study preparation for the workshop consisted of scheduling study participants and tasks and gathering necessary project documents to distribute to team members for review prior to attending the workshop. Throughout the study the following documents were used as the basis for generating alternative approaches for achieving project functions and for determining the cost implications of the alternatives that have potential for enhancing the value of the project.

- Project plans and cross-sections at the preliminary plan stage of development, dated January 2008, prepared by PBSJ.
- Approved Revised Project Concept Report, dated September 2006, prepared by the Georgia Department of Transportation
- Cost Estimate Report Summary, dated 11/6/2007, prepared by PBSJ for the Georgia Department of Transportation



Value Engineering Study Task Flow Diagram

Preparation Effort

Coordinate Project

- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Define *Project Value Objectives*
- Identify Project Constraints

Prepare for Workshop

- Collect Project Data
- Distribute Data to Team Members
- Verify Cost Data
- Team Members Become Familiar with Project

Construct Cost Models

- Construct Cost Models
- Construct Graphic Function Analysis
- Outline High Cost Areas

LCC Model

- Process Areas
- Staffing
- Chemicals
- Energy
- User Impact

Workshop Effort

Information Phase

- Introduction by VETL
- Project Description and Presentation by Designer
- Outline Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)

Function Identification and Analysis Phase

- Analyze Project Costs and Energy Usage
- Perform Function Analysis and FAST Diagram
- Identify High Cost and Energy Areas
- Calculate Cost/Worth Ratios
- Identify Paradigms
- List Ideas Generated During Function Analysis

Creative Phase

- Introduction by VETL
- Creative Idea Listing:
 - Quantity of Ideas
 - Association of Ideas
- Brainstorming
- Creative Thinking:
 - Group & Individual
- Use Checklist for Ideas

Evaluation Phase

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

Development Phase

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

Presentation Phase

- Summarize Findings
- Present VE Ideas to Owner/User/Designer
- Oral Presentation

Post-Workshop Effort

VE Study Report

- Prepare Preliminary VE Report
- Designer Prepares Responses to VE Report
- Owner Evaluates Recommendations

Implementation Phase

- Participate in Implementation Meeting with Owner/User/Designer/VE Team, as needed
- Prepare Final VE Report

Final Acceptance

- Redesign by Designer

- Preliminary (Rough) Right of Way Estimate, emailed on February 5, 2008, by PBSJ.
- Pavement Evaluation Report, dated July 2007, prepared by Willmer Engineering, Inc.
- Soil Survey Report, dated November 2006, prepared by Willmer Engineering, Inc.

Information relating to the project's purpose and need, owner concerns, project stakeholder concerns, design criteria, project constraints, funding sources and availability, regulatory agency approval requirements, and the project's schedule and costs are very important as they provide the VE team with insight as to how the project has progressed to its current state.

Project cost data provided by the designers was used by the VE team as the basis for a comparative analysis with other similar projects. To prepare for this exercise, the VE Team Leader used the cost estimate prepared by the designers to develop cost models for the project. The models (described in the Cost Model section of this report) were used to distribute the total project cost among the various elements or functions comprising the project. The VE Team used this data to identify the high cost elements or functions that drive the project and the elements or functions providing little or no value so that the team could effectively use its time and focus on reducing or eliminating the impact of those elements.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop effort consisted of a 4-day workshop beginning with an orientation/kickoff meeting February 5, 2008 and concluding with the final VE Presentation on February 8, 2008. During the workshop, the VE Job Plan was followed in compliance with FHWA and SAVE International guidelines for VE studies. The job plan guided the search for alternatives to mitigate or eliminate high cost drivers, support functions providing little or no value, and potential project risk elements. Alternatives to specifically address the owner's project concerns and enhance value by improving operations, reducing maintenance requirements, enhancing constructibility, and providing missing or less than optimum functionality were also entertained. The Job Plan includes six phases:

- Information Gathering Phase
- Function Identification and Analysis Phase
- Creative Idea Generation Phase
- Evaluation of Creative Ideas Phase
- Alternative Development Phase
- Presentation Phase

Information Gathering Phase

At the beginning of the study, the decisions that have influenced the project's design and proposed construction methods had to be reviewed and understood. For this reason, the Georgia Department of Transportation and the design teams sent information (described above) to the VE team prior to the study and, following a short orientation session, the workshop was kicked off with a presentation of the project to the team. The presentation highlighted the information provided in the written documentation and

expanded on that information to include a history of the project’s development and any underlying influences that caused the design to develop to its current state. During this presentation, VE team members were given the opportunity to ask questions and obtain clarifications of the information provided.

Function Identification and Analysis Phase

Having gained some information on the project, the VE team proceeded to further enhance its project knowledge by defining the functions provided, identifying the costs to provide these functions, and determining whether the value provided by the functions has been optimized. Function analysis is a means of evaluating a project to determine if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. The elements performing support functions add cost to the final product, but have a relatively low worth to the basic function.

Function is defined as the “intended use” of a physical or process element. In the VE process, the team attempted to identify functions in the simplest manner using active verb/measurable noun word combinations. Sometimes modifying adjectives were used with the noun to clarify the definition. To accomplish this, the team first looked at the project in its entirety and randomly listed its functions which were recorded on Random Function Analysis Worksheets (provided in the Function Identification and Analysis section). Then the individual function(s) were identified for the major components of the project depicted on the cost model(s).

After identifying the functions, the team classified the functions according to the following:

| Abbreviation | Type of Function | Definition |
|---------------------|-------------------------|---|
| HO | Higher Order | The primary reason the project is being considered or project goal |
| B | Basic | A function that must occur for the project to meet its higher order functions |
| S | Secondary | A function that occurs because of the concept or process selected and may or may not be necessary |
| R/S | Required Secondary | A secondary function that may not be necessary to perform the basic function but must be included to satisfy other requirements or the project cannot proceed |
| G | Goal | Secondary goal of the project |
| O | Objective | Criteria to be met |
| LO | Lower Order | A function that serves as a project input |

Higher order and basic functions provide value while secondary functions tend to reduce value. Thus, the team works in future phases to reduce the impact of secondary functions and thus enhance project value.

To further clarify the impact of the various functions, the team assigned costs to provide the functions or group of functions provided by a specific project element using the cost estimate and cost model(s). Where possible they seek to benchmark the costs for providing functions, i.e., finding the lowest cost, or worth, to perform the function, using published data from other sources or team knowledge obtained from working on other similar projects to establish cost goals and then comparing them to the current

costs. By identifying the cost and worth of a function or group of functions, cost/worth ratios were calculated. Cost/worth ratios greater than 1 indicated that less than optimum value was being provided. Those project functions or elements with high cost/worth ratios became prime targets for value improvement.

As well as looking at areas with high cost/worth ratios, the team used the cost model(s) to seek out the areas where most of the project funds are being applied. Because of the absolute magnitude of these high cost elements or functions, they too became initial targets for value enhancement.

Overall, these exercises stimulated the VE team members to focus on apparently low value areas and initially channel their creative idea development in these places.

Creative Idea Generation Phase

This VE study phase involved the creation and listing of ideas. Starting with the functions or project elements with high cost/worth ratios, a high absolute cost compared to other elements in the project, and secondary functions providing little or no value, the VE team generated as many ideas as possible to provide the necessary functions at a lower total life cycle cost, or to improve the quality of the project. Ideas for improving operation and maintenance, reducing project risk, and simplifying constructibility were also encouraged. At this stage of the process the VE team was looking for a large quantity of ideas and free association of ideas. Creative Idea Listing worksheets were generated and organized by the function or project element being addressed.

The Georgia Department of Transportation and the design team may wish to review these creative lists since they may contain ideas that were not pursued by the VE team but can be further evaluated for potential use in the design.

Evaluation/Judgment Phase

Since the goal of the Creative Idea Generation phase was to conceive as many creative ideas as possible without regard for technical merit or applicability to respond to the project goals, this phase of the workshop focused on identifying those ideas that respond to the project value objectives and are worthy of additional research and development before being presented to the owner. The selection process consisted of evaluating the ideas originated during the Creative Idea Generation phase based on the project value objectives identified through conversations at the Designer's Briefing.

Based on the team's understanding of the owner's value objectives, each idea was compared with the present design concept and the advantages and disadvantages of each idea were discussed (and recorded on the Creative Idea Listings). How well an idea met the design criteria was also reviewed. Based on the results of these reviews, the VE team rated the idea by consensus using a scale of 1 to 3, with 3 indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project, 2 indicating an idea that provides moderate value improvement and 1 indicating an idea with a major technical flaw that does not respond to project requirements. Generally, ideas rated 2 and 3 are continued in the next phase and presented during the presentation phase.

The team also used the designation “DS” to indicate a Design Suggestion, which is an idea that may not have specific quantifiable cost savings, but may reduce project risk, improve constructibility, help to minimize claims, enhance operability, ease maintenance, reduce schedule time or enhance project value in other ways. Design suggestions could also increase a project’s cost but provide value in areas not currently addressed. These are also developed in the next phase of the VE process.

Development Phase

In this phase, each highly-rated idea was expanded into a workable solution designated as a Value Engineering Alternative. The development consists of describing the current design and the alternative solution, preparing a life cycle cost comparison where applicable, describing the advantages and disadvantages of the proposed alternative solution, and a writing a brief narrative to compare the original design to the proposed change and provide a rationale for implementing the idea into the design. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The Value Engineering Alternatives are included in the Study Results section of this report. Design suggestions include the same information as the alternatives except that no cost analysis is performed. These too are included in the Study Results section of the report.

Presentation Phase

The last phase of the workshop was to summarize the results of the study and prepare draft Summary of Value Engineering Alternatives worksheets to handout at the presentation and to present the key Value Engineering Alternatives and design suggestions to the Georgia Department of Transportation and the design teams. The purpose of the presentation meeting was to provide the attendees with an overview of the suggestions for value enhancement resulting from the VE study, and afford them the opportunity to ask questions to clarify specific aspects of the alternatives presented. Procedures for implementing the results of the study were discussed and arrangements were made for the reviewers of the VE report to contact the VE Team in order to obtain further clarifications, if necessary. Draft copies of the Summary of Potential Cost Savings worksheets were given the owner and design team to facilitate a timely review and speedy implementation of the selected ideas.

POST STUDY PROCEDURES

The post-study portion of the VE study consisted of the preparation of this Value Engineering Study Report. Personnel from Georgia Department of Transportation and the design team will analyze each alternative and prepare a short response, recommending incorporation of the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. LZA is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

Upon completing their reviews, the owner and designer will meet and, by consensus, select those Value Engineering Alternatives and Design Suggestions that provide good value to incorporate into the project.

Tuesday, February 5, 2008 (continued)

1:00 pm – 2:00 pm **Functional Analysis** **(VE Team)**

Identify basic and secondary functions
Analyze cost model(s) and worth assignments

2:00 pm – 3:00 pm **Identification of Major Project Risks, Project Constraints and Key Issues**

3:00 pm – 5:00 pm **Creative Phase** **(VE Team)**

Brainstorm to generate ideas through free association. Defer judgment.

5:00 pm **Daily Wrap-up Session** **(VE Team)**

Wednesday, February 6, 2008

8:00 am – 10:00 am **Creative Phase (cont.)** **(VE Team)**

10:00 am – 11:00 am **Evaluation Phase** **(VE Team)**

Establish the criteria for evaluation and rate each idea on a scale of 1 to 5, identifying the “best” ideas for development.

11:00 am - noon **Development Phase** **(VE Team)**

The VE team develops creative ideas into value engineering alternatives with sketches, calculations and written justifications. Initial and life-cycle cost estimates comparing baseline and proposed designs will be prepared.

1200 pm – 1:00 pm **Lunch**

1:00 pm – 5:00 pm **Development Phase (Cont.)** **(VE Team)**

Thursday, February 7, 2008

8:00 am – 5:00 pm **Development Phase (continued)** **(VE Team)**

Friday, February 8, 2008

8:00 am – 9:00 am **Development Phase (continued)** **(VE Team)**

9:00 am – 10:00 am **Presentation Phase** **(All Participants)**

The VE team presents the value engineering alternatives to the Designers and GDOT representatives. A draft copy of the Summary of Value Engineering Alternatives will be distributed.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the project elements involved with the SR 96 widening project. Team members consisted of a multidisciplinary group with professional highway design, structures and construction experience and a working knowledge of VE procedures. The VE team included the following:

| <u>Participant</u> | <u>Specialization</u> | <u>Affiliation</u> |
|-------------------------------|-----------------------|------------------------------|
| Joe Leoni, P.E. | Highway Design | ARCADIS U.S., Inc. |
| Molapo Kgabo, P.E. | Structural Design | HNTB Corporation |
| Paresh Parikh, P.E. | Constructability | Delon Hampton & Associates |
| George Hunter, P.E., PMP, CVS | VE Team Leader | Lewis & Zimmerman Associates |

DESIGNER'S PRESENTATION

An overview of the project was presented on February 5, 2008 by representatives from the owner and the design teams. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE study, was to bring the VE team up-to-speed regarding the overall project specifics. Additionally, the meeting afforded the owner and design staff the opportunity to highlight in greater detail, those areas of the project requiring additional or special attention. An attendance list for the meeting entitled Designer's Presentation Meeting Participants is attached.

Site Visit

No site visit was done on this VE study.

VALUE ENGINEERING TEAM'S PRESENTATION

A VE presentation was conducted on February 8, 2008 at the Georgia Department of Transportation Headquarters offices in Atlanta, Georgia to review VE alternatives with the owner and representatives from the design team. Copies of the draft Summary of Value Engineering Alternatives were provided to the attendees. An attendance list for the meeting entitled VE Team Presentation Meeting Participants is attached.

VE STUDY SIGN-IN SHEET 2/5/08 & 2/8/08

Project No.: STP-155-1(21) CSNHS-0008-00(406)(407) Counties: Peach Houston PI Nos.: 322450/0008406/0008407 Date: 2/5-8/08

2/5/08

| NAME | EMPLOYEE ID NO. | DOT OFFICE OR COMPANY | PHONE NUMBER | EMAIL ADDRESS |
|--------------------------|---------------------|-----------------------|-----------------------|-------------------------------|
| Lisa L. Myers | 00244168 | Engineering Services | 404-651-7468 | lmyers@dot.ga.gov |
| Joe Leoni | | ALCADIS | 7-431-8666 | Joe.Leonis@ALCADIS-US.COM |
| MOLAPO KGABO | | HNTB | 4-946-5740 | mkgabos@HNTB.com |
| KEN WEERD | 00258268 | GDOT-TO | 404-635-8144 | KWEERHO@DOT.GA.GOV |
| PATRICK ALLEN | 00883521 | GDOT-TO | 4/635-8138 | paallen@dot.ga.gov |
| Brink Stokes | 00260211 | GDOT - AE-Ferry | (470) 988-7157 | bstokes@--- |
| KAMAR M. SMITH, JR. | 00229230 | GDOT - DIST. CONST. | 706 646-6911 | kprimita-dot.ga.gov |
| RON WISHON | 00208180 | GDOT-ENG SVCS | 404-651-7470 | rwishon@dot.ga.gov |
| PARESH J. PARIKH | | DHA | 404-419-8434 | pparikh@delonhampton.com |
| JAMES MAGNUS | 00208161 | GDOT CONSTR | 404-666-5306 | jmagnus@dot.ga.gov |
| SCOTT DUBORD | | PBS+J | 770-933-0280 | sdubord@psj.com |
| GEORGE HUNTER | | LEWIS & ZIMMERMAN | 916-224-9812 | ghunter@lzo.com |
| MACE MASHONARD | 00307963 | GDOT | 4) 656-5306 | M.mashonard@dot.ga.gov |
| Michael Harbeck | 00229229 | GDOT | 4) 657-9758 | Michael.Harbeck@dot.skk.js. |
| JERRY MILLIGAN | | GDOT | 770 986 1541 | jerry.millig@dot |
| EMMANUELLA MYRTHILL | 00841437 | ADOT/OEL | 4-699-6967 | emmyrthill@dot.ga.gov |
| Laura Rish | 00901402 | OEL | 4-699-4439 | Lrish@dot... |
| Stanley Hsu | 00232993 | OCD/CADOT | 4-656-6109 | sthanleed@dot.ga.gov |
| Brian Summers | 00208180 | ENG SVCS | 4-651-7470 | rwishon@dot.ga.gov |
| Brian Summers | | | | |
| Todd Long | | | | |

COST MODEL

This project is divided into three phases that may represent three construction contracts, depending on availability of funds. The following breakdown identifies the project costs by phase, construction and right-of-way components:

| PROJECT ELEMENT | PHASE I COST | PHASE II COST | PHASE III COST | PROJECT TOTAL |
|------------------------------------|----------------------|----------------------|----------------------|----------------------|
| SUBTOTAL | \$ 14,532,542 | \$ 16,388,964 | \$ 21,055,148 | \$ 45,076,812 |
| E&C 10.00% | \$ 1,453,254 | \$ 1,638,896 | \$ 2,105,515 | \$ 5,197,665 |
| Inflation TBD | | | | \$ - |
| TOTAL CONSTRUCTION | \$ 15,985,796 | \$ 18,027,860 | \$ 23,160,663 | \$ 57,174,319 |
| Right of Way Note 1 | \$ 5,178,972 | \$ 5,806,726 | \$ 4,708,156 | \$ 15,693,854 |
| Reimbursable Utilities | \$ 412,500 | \$ 462,500 | \$ 375,000 | \$ 1,250,000 |
| TOTAL PROJECT COSTS | \$ 21,577,268 | \$ 24,297,086 | \$ 28,243,819 | \$ 74,118,173 |
| PERCENTAGE OF PROJECT TOTAL | 29% | 33% | 38% | 100% |
| TOTAL PROJECT COSTS | | | | \$ 74,118,173 |

The combined construction and right-of-way costs are \$ 74.1 million.

The VE Team Leader prepared a Pareto Chart, or cost histogram, for the project that follows this page. This cost histogram displays the major construction elements identified in the cost estimate prepared by the designer in descending order of magnitude and thus identifies the high cost areas in the project and provides the VE team with a focus for its work during the study. For this project, approximately 19% of the construction items represent about 80% of the project costs. They are as follows:

- Roadway Pavement Section \$30,860,940
- Right-of-way \$15,693,854
- Bridge \$7,589,826
- Drainage (S.D. Pipe & Inlets) \$4,761,754

The construction costs include an E&C mark-up of 10%.

The raw unit prices for right-of-way amount to \$222,810 per acre for right-of-way acquisition and \$101,647 per acre for permanent easement. The right-of-way mark-up, which accounts for the estimate improvement costs and estimated damages, amounts to 5.87%. The right-of-way costs are based on rough data provided by the designers at the request of the VE team. See attached right-of-way memo.



COST SUMMARY

PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)

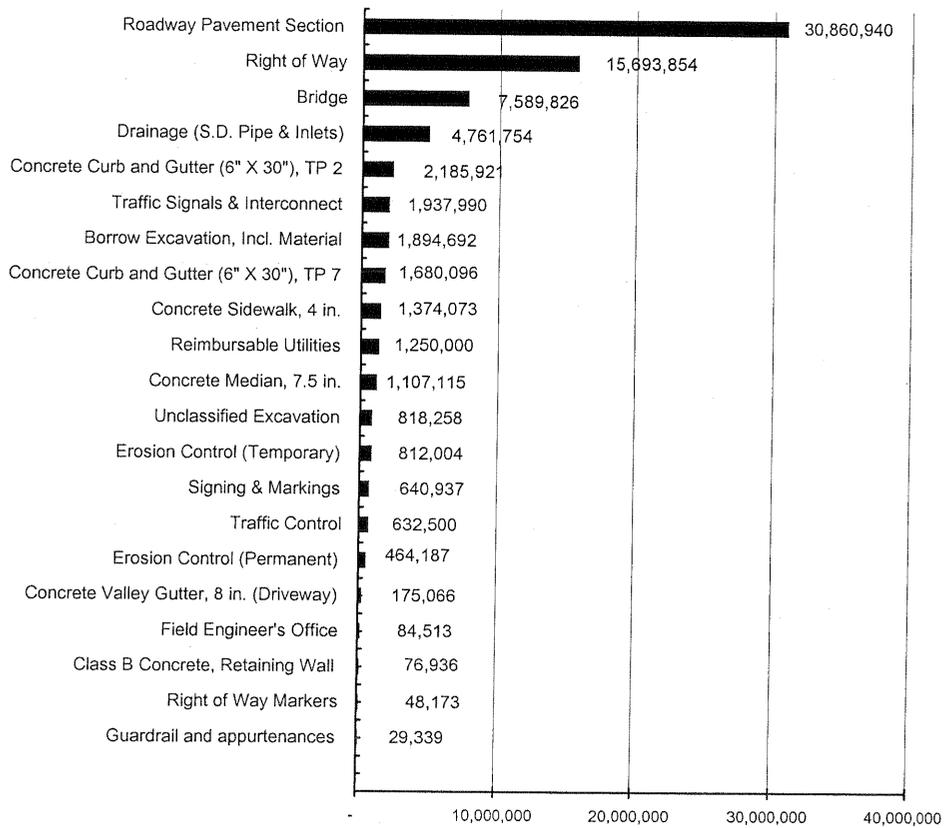
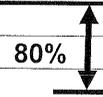
| PROJECT ELEMENT | PHASE I COST | PHASE II COST | PHASE III COST | PROJECT TOTAL | PERCENT | CUM. PERCENT |
|---|----------------------|----------------------|----------------------|----------------------|--------------|-----------------|
| Traffic Control | \$ 165,000 | \$ 185,000 | \$ 225,000 | \$ 575,000 | 1.28% | 1.28% |
| Field Engineer's Office | \$ 76,830 | \$ - | \$ - | \$ 76,830 | 0.17% | 1.45% |
| Unclassified Excavation | \$ 245,483 | \$ 275,222 | \$ 223,166 | \$ 743,871 | 1.65% | 3.10% |
| Borrow Excavation, Incl. Material | \$ 568,381 | \$ 637,332 | \$ 516,734 | \$ 1,722,447 | 3.82% | 6.92% |
| Roadway Pavement Section | \$ 8,858,854 | \$ 9,938,434 | \$ 9,258,112 | \$ 28,055,400 | 62.24% | 69.16% |
| Concrete Curb and Gutter (6" X 30"), TP 2 | \$ 655,776 | \$ 735,265 | \$ 596,160 | \$ 1,987,201 | 4.41% | 73.56% |
| Concrete Curb and Gutter (6" X 30"), TP 7 | \$ 504,029 | \$ 565,123 | \$ 458,208 | \$ 1,527,360 | 3.39% | 76.95% |
| Concrete Sidewalk, 4 in. | \$ 477,777 | \$ 535,690 | \$ 235,690 | \$ 1,249,157 | 2.77% | 79.72% |
| Concrete Median, 7.5 in. | \$ 305,958 | \$ 342,978 | \$ 357,532 | \$ 1,006,468 | 2.23% | 81.96% |
| Concrete Valley Gutter, 8 in. (Driveway) | \$ 52,520 | \$ 58886 | \$ 47,745 | \$ 159,151 | 0.35% | 82.31% |
| Drainage (S.D. Pipe & Inlets) | \$ 1,429,535 | \$ 1,602,688 | \$ 1,296,644 | \$ 4,328,867 | 9.60% | 91.91% |
| Right of Way Markers | \$ 14,930 | \$ 15,925 | \$ 12,939 | \$ 43,794 | 0.10% | 92.01% |
| Guardrail and appurtenances | \$ 5,587 | \$ 6,264 | \$ 14,821 | \$ 26,672 | 0.06% | 92.07% |
| Erosion Control (Temporary) | \$ 245,637 | \$ 271,565 | \$ 220,983 | \$ 738,185 | 1.64% | 93.71% |
| Erosion Control (Permanent) | \$ 139,299 | \$ 156,101 | \$ 126,588 | \$ 421,988 | 0.94% | 94.64% |
| Signing & Markings | \$ 218,235 | \$ 206,682 | \$ 157,753 | \$ 582,670 | 1.29% | 95.94% |
| Traffic Signals & Interconnect | \$ 498,769 | \$ 855,809 | \$ 407,231 | \$ 1,761,809 | 3.91% | 99.84% |
| Class B Concrete, Retaining Wall | \$ 69,942 | \$ - | \$ - | \$ 69,942 | 0.16% | 100.00% |
| Bridge | \$ - | \$ - | \$ 6,899,842 | \$ - | 0.00% | 100.00% |
| SUBTOTAL | \$ 14,532,542 | \$ 16,388,964 | \$ 21,055,148 | \$ 45,076,812 | 100% | |
| E&C | 10.00% | \$ 1,453,254 | \$ 1,638,896 | \$ 2,105,515 | \$ 5,197,665 | |
| Inflation | TBD | | | \$ - | | |
| TOTAL CONSTRUCTION | \$ 15,985,796 | \$ 18,027,860 | \$ 23,160,663 | \$ 57,174,319 | | |
| Right of Way Note 1 | \$ 5,178,972 | \$ 5,806,726 | \$ 4,708,156 | \$ 15,693,854 | | |
| Reimbursable Utilities | \$ 412,500 | \$ 462,500 | \$ 375,000 | \$ 1,250,000 | | Computed |
| TOTAL PROJECT COSTS | \$ 21,577,268 | \$ 24,297,086 | \$ 28,243,819 | \$ 74,118,173 | 38% | Mark-up |
| PERCENTAGE OF PROJECT TOTAL | 29% | 33% | 38% | 100% | | 10% |
| TOTAL PROJECT COSTS | | | | \$ 74,118,173 | | |

COST HISTOGRAM



PROJECT: SR 96 WIDENING (P.I. 322450, 0008406, 0008407)
Peach and Houston Counties

| PROJECT ELEMENT | COST | PERCENT | CUM. PERCENT |
|---|------------|----------------|-----------------|
| Roadway Pavement Section | 30,860,940 | 41.64% | 41.64% |
| Right of Way | 15,693,854 | 21.17% | 62.81% |
| Bridge | 7,589,826 | 10.24% | 73.05% |
| Drainage (S.D. Pipe & Inlets) | 4,761,754 | 6.42% | 79.48% |
| Concrete Curb and Gutter (6" X 30"), TP 2 | 2,185,921 | 2.95% | 82.43% |
| Traffic Signals & Interconnect | 1,937,990 | 2.61% | 85.04% |
| Borrow Excavation, Incl. Material | 1,894,692 | 2.56% | 87.60% |
| Concrete Curb and Gutter (6" X 30"), TP 7 | 1,680,096 | 2.27% | 89.86% |
| Concrete Sidewalk, 4 in. | 1,374,073 | 1.85% | 91.72% |
| Reimbursable Utilities | 1,250,000 | 1.69% | 93.40% |
| Concrete Median, 7.5 in. | 1,107,115 | 1.49% | 94.90% |
| Unclassified Excavation | 818,258 | 1.10% | 96.00% |
| Erosion Control (Temporary) | 812,004 | 1.10% | 97.10% |
| Signing & Markings | 640,937 | 0.86% | 97.96% |
| Traffic Control | 632,500 | 0.85% | 98.82% |
| Erosion Control (Permanent) | 464,187 | 0.63% | 99.44% |
| Concrete Valley Gutter, 8 in. (Driveway) | 175,066 | 0.24% | 99.68% |
| Field Engineer's Office | 84,513 | 0.11% | 99.79% |
| Class B Concrete, Retaining Wall | 76,936 | 0.10% | 99.90% |
| Right of Way Markers | 48,173 | 0.06% | 99.96% |
| Guardrail and appurtenances | 29,339 | 0.04% | 100.00% |
| \$ 74,118,173 | | 100.00% | |



Costs in graph include appropriate mark-ups

RIGHT OF WAY MEMO

From: Dubord, Scott M [SMDubord@pbsj.com]
Sent: Wednesday, February 06, 2008 11:08 AM
To: Hunter, George
Cc: Lisa.Myers@dot.state.ga.us
Subject: FW: SR 96 R/W estimate - rough draft

George,

Our r/w acquisition folks prepared this **rough** estimate based on \$100,000 per acre of r/w and perm easement (see chart below). In my concept estimate, I doubled that to account for contingencies. She has allotted for them separately.

However, the area estimates below (in blue) represent a more realistic breakdown of area costs....

Residential Lots (Developed): \$1.00 - \$1.50/SF
Residential Acreage: \$0.50 - \$0.60/SF
Commercial Acreage: \$4.00 - \$6.00/SF
Commercial (Sm. Tracts) \$10.00 - \$12.00/SF

Gene states that this preliminary unit estimate is based on sales, discussion with realtors in the area and other research as well as consideration for current market conditions.

| Estimate Right-of- Way Proj. Needs (Ac.) | Estimate PCE-Proj. Needs (Ac.) | Estimate Right-of-Way Cost | Estimate Cost | Estimate Improvement Cost | Estimate Damages | Estimate Total Cost |
|--|---|----------------------------------|------------------|---------------------------------|---------------------|------------------------|
| 46 | 45 | \$10,249,242 | \$4,574,111 | \$650,500 | \$220,000 | \$15,693,854 |

Scott,

This is a very rough draft.

Per your email, you used 44.91 acres and \$100,000 per unit for your basis. Based on the last set of plans, Kerry estimated approx. 46 acres of ROW and 45 for easement for construction and maintenance (PCE). Does that sound about right ?

We need today and tomorrow. I expect to have it ready to submit to Jerry Friday as I had originally anticipated.

Debra

FUNCTION ANALYSIS

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

The result of the function analysis exercise identified that the basic functions of the project are reduce congestion and reduce accidents in the in the SR 96 corridor, between I-75 and I-16. The addition of the grade separation at SR 247/SR 96, the addition of lanes (two to four lanes), the raised and flush medians and the turning lanes support the basic functions.

RANDOM FUNCTION ANALYSIS



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties, Georgia

SHEET NO.: 1 of 3

| DESCRIPTION | FUNCTION | | |
|---|-----------|--------------------------------|------|
| | VERB | NOUN | KIND |
| Global Project | Improve | I-75/I-16 Connection | B |
| | Increase | M/L Capacity | B |
| | Improve | Truck Operations | B |
| | Improve | Local Operations | B |
| | Improve | Safety | B |
| Pavement | Provide | Riding Surface | RS |
| | Add | Lanes | RS |
| | Improve | LOS | RS |
| | Allow | Passing | RS |
| | Allow | Maneuverability | RS |
| | Reduce | Rear End Collisions | RS |
| SR 247/SR 96 | Separate | Roadway Grades | S |
| | Separate | Roadway/Railroad Grades | RS |
| | Bypass | Bonaire | U |
| | Eliminate | Access Loss (during train ops) | S |
| | Convert | "Old SR 96" (to city street) | U |
| Intersections (Turn Lanes – Left and Right, Signals, Interconnect, Realignments, Add Access Points) | Store | Turning Vehicles | RS |
| | Remove | Slowing Vehicles | RS |
| | Signalize | Intersections | RS |

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

RANDOM FUNCTION ANALYSIS



PROJECT: **SR 96 WIDENING (P.I. 322450, 0008406, 0008407)**
Houston and Peach Counties, Georgia

SHEET NO.: **2 of 3**

| DESCRIPTION | FUNCTION | | |
|--|-------------|---------------------------------|------|
| | VERB | NOUN | KIND |
| Intersections (Turn Lanes – Left and Right, Signals, Interconnect, Realignment, Add Access Points) (continued) | Synchronize | Intersections Green Lights | S |
| | Improve | Intersection Skew Angles | RS |
| | Reduce | Side Collisions | RS |
| | Increase | Mainline Capacity | B |
| | Reduce | Rear Ends | RS |
| | | | |
| Medians (All- Depressed and Raised) | Separate | Opposing Traffic | B |
| | Locate | Left Turn Lanes | R |
| | Refuge | Pedestrians | S |
| | Recover | Errant Vehicles | S |
| | Refuge | Emergency Vehicles | S |
| | Minimize | Headlight Glare | RS |
| | Reduce | Head-on Collisions | S |
| | | | |
| Median (44' Depressed) | Drain | Roadbed | S |
| | Beautify | Roadbed | S |
| | Add | Future Lanes | S |
| Median (Raised) | Delineate | Turning Movements | RS |
| | | | |
| Sidewalks | Encourage | Alternative Transportation Mode | S |
| | Move | Pedestrians | S |
| | Comply with | ADA Requirement | RS |
| | Reduce | Vehicle/Pedestrian Conflicts | S |

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

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the creative phase, numerous ideas were generated for this project using conventional brainstorming techniques as recorded on the following pages. For the convenience of tracking an idea through the VE process, the ideas were grouped into the following design categories and numbered according to the order in which they were conceived. The following letter prefixes were used to identify the design categories.

| Design Category | Prefix | No. of Ideas |
|------------------------|---------------|---------------------|
| Typical Sections | TS | 10 |
| Bridge | BR | 5 |
| Intersections | I | 9 |
| Alignment | A | 4 |
| | Subtotal: | 28 |

The ideas were ranked on a qualitative scale of 1 to 3 on how well the VE team believed the idea met the project purpose and need criteria. To assist the team in evaluating the creative ideas, the advantages and disadvantages of each new idea compared to the existing design solution were discussed based on the responses of owner during the project briefings identified the following as below:

- Capital Investment
- Wetlands Impacts
- Environmental Impacts
- Level of Service of Traffic Operations
- Highway User Safety
- Right-of-way Impacts

After discussing each idea, the team then evaluated the ideas by consensus. This produced 18 ideas evaluated as 2's and 3's to carry forward and research and develop into formal Value Engineering Alternatives. When this is not the case, an idea may have been combined with another related idea or discarded, as a result of the additional research that indicated the concept as not being cost-effective or technically feasible. The reader is encouraged to review the Creative Idea Listing and Evaluation worksheets since they may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING



PROJECT: **PROJECT NO.: STP-155-1(21), HOUSTON, P.I. NO.: 322450** SHEET NO.: **1 of 2**
Houston and Peach Counties, Georgia

| NO. | IDEA DESCRIPTION | RATING |
|------------------------------|--|-------------|
| TYPICAL SECTIONS (TS) | | |
| TS-1A | Use 11-ft. thru lanes | 3 |
| TS-1B | Use 11-ft. inside lanes with 2-ft. inside shoulders and 12-ft. outside lanes | 2 |
| TS-2 | Use 11-ft. turning lanes | 1 |
| TS-3 | Reduce 24-ft. raised median to 20-ft. raised median (remove 2-ft. inside paved shoulder) | 3 |
| TS-4 | Reduce 24-ft. raised median to 18-ft. raised median | 2 |
| TS-5 | Reduce 44-ft. depressed median to 24-ft. raised median | 3 |
| TS-6A | Remove bike lanes; convert 5-ft. sidewalk to a 10-ft. multi-use path on one side only; keep 5-ft. sidewalk on the other side | 3 |
| TS-6B | Remove bike lanes, convert 5-ft. shoulder width to two 8-ft. multi-use paths | 2 |
| TS-7 | In lieu of 30-in. curb and gutter, use 24-in. curb and gutter | 2 |
| TS-8 | Use 16-ft. urban shoulder with 6-ft. grassed strip in lieu of a 2-ft. grassed strip | 2 |
| ALIGNMENT (A) | | |
| A-1 | Align SR 96 through Oglethorpe Road | 3 |
| A-2 | Retain the access of Oglethorpe Road to SR 96 as right-in/right-out | See I-9 |
| A-3 | Reduce vertical alignment changes at Culverts east and west of US 41 | See B-2/B-3 |
| A-4 | Do not realign at Church site, mitigate impacts | 1 |
| INTERSECTIONS (I) | | |
| I-1 | Cul de Sac Granville Street | 3 |
| I-2 | Realign CR 82 into Smyrna Church Road (avoid/reduce take) | 2 |
| I-3 | Provide Cohen Walker Drive/SR 96 with an intersection | 1 |
| I-4 | I-3 and eliminate Lake Joy (between Cohen Walker Drive and SR 96) | 1 |
| I-5 | Continuous Cohen Walker Drive Lake Joy Roadbed, tie in Lake Joy Road | 1 |
| I-6 | Signalize Bear Drive and retain unsignalized high school access | 3 |
| I-7 | Relocate Forest Road connection to Moody Road | 3 |
| I-8 | Cul-de-sac Sasser Drive (verify road network permissible) | 1 |
| I-9 | Retain access to Oglethorpe Road (right-in/right-out) | 1 |

| | | | |
|---------|-------------------------|------------------------------------|---------------------------------|
| Rating: | 1 = Not to be developed | 2 = Possible development potential | 3 = Most likely to be developed |
| | DS = Design suggestion | ABD = Already being done | |

