Georgia Department of Transportation

US 1/SR 4 Bridge Replacement Over Altamaha River, Overflow 1 and Williams Creek

BR000-0001-00(216), P.I. No. 0001216

Appling and Toombs Counties, Georgia

Value Engineering Study Report

February 2010

Designer

Heath & Lineback Engineers, Inc.

Value Engineering Consultant

Lewis & Zimmerman Associates

an ARCADIS company

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Mr. Matthew J. Sanders, AVS
Value Engineering Specialist
Georgia Department of Transportation - Engineering Services
One Georgia Center – 5th Floor
600 West Peachtree Street
Atlanta, Georgia 30308

Re: US 1 / SR 4 Bridge Replacement over Altamaha River,
Overflow 1 and Williams Creek
BR000-0001-00(216) P.I. No. 0001216
Value Engineering Study Report

Date:
February 23, 2010

Contact:
David Hamilton

Phone:
253.229.7703

Email:
dahamilton@lza.com

Our ref:
LZ083353.0000

Dear Mr. Sanders:

Lewis & Zimmerman Associates, Inc. is pleased to submit two hard copies and one electronic copy of the referenced value engineering (VE) study report documenting the study that took place on February 8-11, 2010. The objective of the VE effort was to identify opportunities to enhance the value of the roadway and bridge improvements over the Altamaha River.

The VE team developed several ideas to reduce the construction by minimizing the width of the bridge, optimizing the travel lane and paved shoulder widths, and evaluated several combinations of shoulder pavement thickness to maximize durability over a 30 year life cycle. The greatest potential for savings though would be realized by replacing Bridge #2 (Overflow #1) with an embankment section.

We thank you for your assistance during the course of the VE team's work. Please do not hesitate to call upon us if you or any of the reviewers have any questions regarding the information presented in this report.

Sincerely yours,

LEWIS & ZIMMERMAN ASSOCIATES, INC.
an ARCADIS company

David A. Hamilton, PE, CVS, CCE, LEED^{AP}
Vice President/VE Team Leader

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report documents the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. for the Georgia Department of Transportation (GDOT). The subject of the study was the US 1 / SR 4 Bridge Replacement Project over Altamaha River, Overflow 1, and Williams Creek, BR000-0001-00(216), P.I. No. 0001216 located in Appling and Toombs Counties, GA. The total estimated construction cost of the project is $14.2M.

The workshop was performed at the preliminary design completion stage as developed by Heath & Lineback Engineers Incorporated. GDOT has provided information for the VE team to use as the basis of the study. The preliminary design documents and updated GDOT cost estimates were used as the focus of the VE study which was conducted February 8 - 11, 2010, at GDOT's Atlanta, Georgia headquarters.

Comprising the VE team were a highway engineer, a bridge engineer, construction specialist, and a Certified Value Specialist (CVS) team leader. The team used the following six-phase VE job plan to guide its deliberations.

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

PROJECT DESCRIPTION

Bridge project BR000-0001-00(216) is located in South Georgia, approximately 80 miles west of Savannah, and will replace three functionally inadequate bridges on US 1/SR 4 over Altamaha River, Overflow 1 and Williams Creek. The project site is located approximately 10 miles north of the City of Baxley in Appling and Toombs Counties. The project begins at mile post 20.6 in Appling County and ends at mile post 1.8 in Toombs County, for a total project length of 2.5 miles. The existing roadway section south of the Altamaha River is 4 lanes, transitioning to 2 lanes from the Altamaha River north. The approved concept for BR-0001-00(216) in Appling and Toombs Counties proposes to replace and demolish the existing bridges over the Altamaha River, Overflow 1, and Williams Creek. Existing right of way along US l/SR 4 varies from 184 feet to 253 feet. The speed is 65 mph, and access would be by permit except for the new location where access would be partially controlled.

Need and Purpose

The need and purpose of the proposed improvements is to replace the three functionally and structurally obsolete bridges on US l / SR 4 over Altamaha River, Overflow 1, and Williams Creek, which have sufficiency rates of 32.50, 42.45, and 42.45, respectively. Replacing these bridges will bring them up

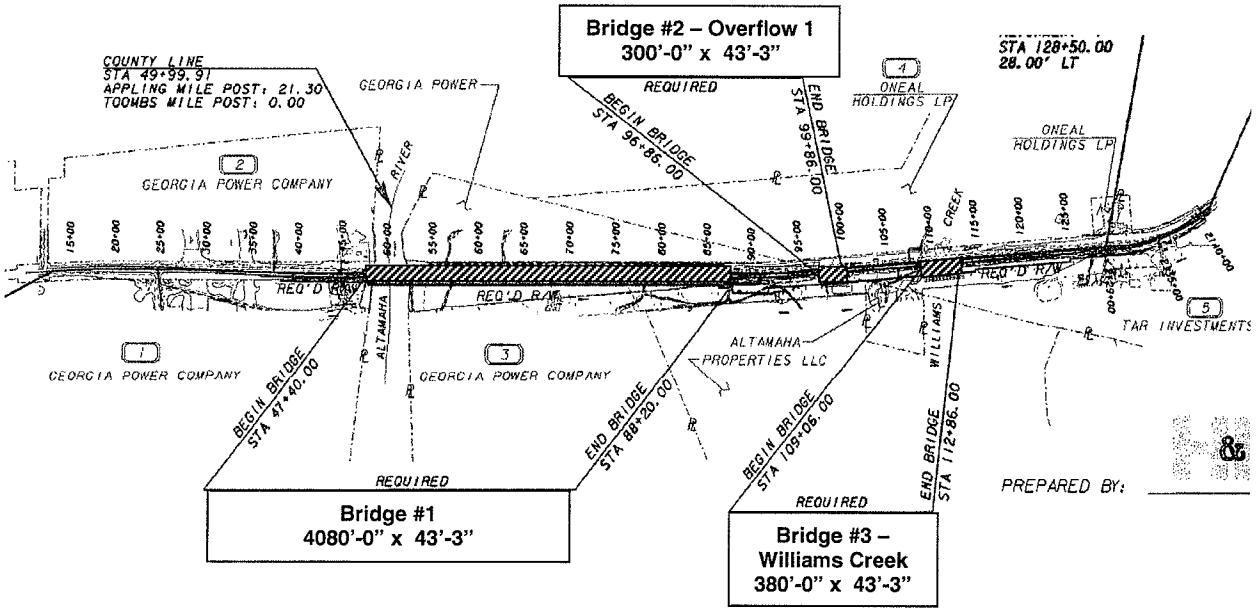
to current design standards and will improve the condition of this section of US 1/SR 4. The low bridge ratings reflect both structural deficiencies and functional issues such as inadequate shoulders. Traffic analysis for the current year (2008) show AADT's of 5500 and design year (2028 of 8,000. Updated projections reveal current year AADT's (2012) of 5,900 with design year (2032) of 10,350. Approximately 0.7 miles of the project is in Appling County and approximately 1.7 miles is in Toombs County.

Bridge Design Elements

Three bridges are included in this project, Altamaha River Bridge – 4,080ft, Overflow 1 Bridge – 300ft, and Williams Creek Bridge – 380ft. Each bridge is designed for two 12ft wide traffic lanes with 10ft wide shoulders on each side. The truck counts for the corridor are relatively high with values in the range of 17%. The new bridge decks are being designed for 40ft wide, gutter to gutter, and use AASHTO girders supported by precast concrete friction piles. Span lengths vary from section to section depending upon locations and range from the river. Geotechnical conditions in the area have been surveyed and competent soils are generally found 20 to 25ft below the ground surface. Some over excavation of water bearing organics and muck may be required in specific locations.

Project Cost and Schedule

This project has a total estimated construction cost of $14.2M, plus right-of-way and utilities, and was originally scheduled for the construction in FY 2011, but is currently pending funding.



PROJECT ALIGNMENT

CONCERNS AND OBJECTIVES

This project encompasses the replacement of three bridges, all within the floodplain of the Altamaha River. The following key concerns were noted by the team as they reviewed the various projects.

- The drainage area of the Altamaha River is substantial, with peak storm flows in the range of 170,000cfs, and any variation in the current river crossection could impact backwater conditions in the area.
- Truck volumes though the corridor and higher than normal, in the range of 17%, and the final design of roadway geometrics must incorporate features to optimize safety through careful selection of lane and shoulder widths.
- The pavement on the shoulders uses a thinner section than the travel lanes, potentially impacting total life cycle cost.
- Altamaha River is deemed a navigable waterway by the U.S. Coast Guard and minimum bridge clearances are required.
- Traffic must be maintained on the existing bridges during construction of the new facilities.

With this background, the VE team was tasked with identifying opportunities that will enhance the functionality of the project and reduce impacts on right-of-way located along the project site.

RESULTS OF THE STUDY

The value engineering team developed 12 alternatives and one design suggestion to address the concerns noted above with the emphasis being on reducing the total life cycle cost to replace the bridges. All of the alternatives are shown on the following Summary of Value Engineering Alternatives table and detailed in Section Two of the report. The following highlights those alternatives having the greatest potential impact on the project.

The largest potential for project savings involves the three bridges (4,080LF, 300LF, and 380LF) and their interaction with the hydraulic analysis on the Altamaha River. Alternative B2-4 recommends eliminating the shortest of the three structures, Bridge #2 (300LF) and replacing it with an embankment section. To achieve this savings though, the hydraulic model would need to be re-run simulating the backwater and river scour velocities assuming a shorter channel width (4,080ft + 380ft). Backwater conditions would need to be carefully reviewed, but replacing this bridge with embankment could result in a net savings approaching $900,000.

Alternative B3-4 presents a concept to replace Bridge #3 (Williams Creek) with a 380LF long embankment section for a net savings approaching $1.2M. More than likely only one of the two bridges could be replaced with embankment, but either structure could be evaluated for backwater impacts to the overall Altamaha River floodway. The potential return on investment for the added hydraulic analysis could be substantial in both alternatives, but verification of scour velocities, backwater, and the potential need for guide banks requires a rigorous evaluation.

Geometrics of the roadway are also a key driver in the project cost and shoulder widths could be optimized by reducing them from 8ft wide to 6ft wide. Based upon the heavy truck traffic in the area, the travel lanes should remain at 12ft wide, but it appears reasonable to reduce the shoulder width from 8ft to 6ft. Alternatives B1-1, B2-1, and B3-1 reduce the width of Bridge #1, 2, and 3 respectively from 40ft to 36ft wide. Total potential aggregate savings by reducing the shoulder widths on all three bridges is in the range of $450,000.

Various combinations of total shoulder width and paved sections were explored by the team along with the life cycle cost associated with varying thicknesses of shoulder pavement. Based upon a 30

year life cycle analysis, Alternative S-6, offers the greatest potential life cycle cost savings in the range of $365,000 by using 11ft wide travel lanes with 10ft wide shoulders with a 4ft wide full depth paved section. The narrower travel lanes would be complemented by the 4ft wide full depth paved shoulder section. Another possibility is presented in Alternative S-5 and suggests using 12ft wide travel lanes with a 10ft wide shoulder and 4ft wide full depth paved section for a total life cycle cost savings of $76,000.

In summary, the roadway geometric alternatives offer some potential for optimizing the project, but the major impact to project cost is being driven by the river hydraulics. Any substantial savings in construction cost hinges upon additional hydraulic modeling efforts and a careful evaluation and balancing of risk, impacts, and construction cost. These are agreeably difficult issues which need substantiation supporting the final bridge design lengths.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216), P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
GENERAL CONCEPTS (G)						
G-5	Reduce the amount of right-of-way being purchased between STA 47+50 to STA 86+00 and use a 20 ft. temporary easement instead.	$118,296	$20,088	$98,208	$0	$98,208
SECTION (S)						
S-1	Use a 10-ft.-wide shoulder with 4 ft. paved section in lieu of 6.5-ft.-wide paved section.	$80,072	$0	$80,072	$0	$80,072
S-3	Revise the pavement section on the boat access road and use surface treatment in lieu of 1 1/2-in.-thick asphalt with graded aggregate base.	$14,542	$2,010	$12,532	($2,538)	$9,994
S-5	Use 10-ft.-wide shoulder with a 4-ft.-wide full depth paved section in lieu of thinner 6.5-ft.-wide paved section.	$208,179	$257,147	($48,968)	$125,706	$76,738
S-6	Use 11-ft.-wide travel lanes with 10-ft.-wide shoulders and 4-ft.-wide full depth paved shoulder section in lieu of 12-ft.-wide lanes with 6.5-ft.-wide paved thinner section.	$5,837,027	$5,597,106	$239,921	$125,706	$365,627
S-8	Do not demolish the existing pavement and bridges after the new parallel road is complete. Demo cost would be saved in this phase, deferred, but added to the future four-lane project.	$500,000	$0	$500,000	$0	$500,000

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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PROFILE (P)						
P-1	Change the profile slope from STA 63+84 to STA 113+16 from 0% to a minimum of 0.25% slope to improve drainage.	DESIGN SUGGESTION				
BRIDGE #1 (B1) (ALTAMAHA RIVER)						
B1-1	Reduce the bridge gutter-to-gutter width from 40ft to 36ft by using 6ft wide shoulders in lieu of 8ft shoulders.	$4,210,388	$3,820,988	$389,400	$0	$389,400
BRIDGE #2 (B2) (OVERFLOW 1)						
B2-1	Reduce the bridge gutter-to-gutter width from 40 ft. to 36 ft. by using 6-ft.-wide shoulders in lieu of 8-ft.-wide shoulders.	$285,450	$259,050	$26,400	$0	$26,400
B2-4	Re-run the hydraulics program to evaluate the possibility of eliminating Bridge #2 and replacing it with an embankment roadway section.	$1,141,800	$249,369	$892,431	$0	$892,431
BRIDGE #3 (B3) (WILLIAMS CREEK)						
B3-1	Reduce the bridge gutter-to-gutter width from 40 ft. to 36 ft. by using 6-ft.-wide shoulders in lieu of 8-ft.-wide shoulders.	$361,570	$328,130	$33,440	$0	$33,440
B3-4	Re-run the hydraulics program to evaluate the possibility of eliminating Bridge #3 (Williams Creek) and replacing it with an embankment roadway section.	$1,446,280	$258,813	$1,187,467	$0	$1,187,467

STUDY RESULTS

GENERAL

The results of this value engineering study conducted on the US 1 / SR 4 Bridge Replacement Project over Altamaha River, Overflow 1, and Williams Creek portray the benefits that can be realized by GDOT, the owner, Appling and Toombs Counties, the users and the Heath & Lineback Engineers design team. The results will directly affect the project's design and will require coordination among GDOT staff to determine the disposition of each alternative.

During the conduct of the study, many ideas for potential value enhance were conceived and evaluated by the team for technical merit, applicability to the project, implementability considering the project's status, and the ability to meet the owner's project value objectives. Research performed on those ideas considered to have potential to enhance the value of the project resulted in the development of individual alternatives identifying specific changes to the project as a whole, or individual elements that 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 data bases, such as the one produced by the RS Means Company, or the GDOT cost data bases 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 usually 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.) track it through the value analysis process and thus facilitating referencing between the Creative Idea

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

PROJECT ELEMENT	PREFIX
General Comments	G
Alignment	A
Section	S
Bridge #1 – Altamaha River	B1
Bridge #2 – Overflow 1	B2
Bridge #3 – Williams Creek	B3

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

KEY ISSUES

This project is being developed to improve traffic operations and replace structures which have low bridge sufficiency ratings due to geometric limitations, structural condition, and the fact that the bridges are approaching their useful expected life.

To achieve these goals and desired improvements, it will be necessary to acquire some right-of-way, align the three new bridges on a parallel alignment over Altamaha River, raise the profile to meet the 100 year flood elevation, and construct the embankment roadway sections. The key cost driver on the project is the length, width, and height of the bridges. The width is controlled by the lane and shoulders dimensions, the length by the hydraulic conditions, primarily scour velocity, and the height of the bridge and embankment quantity by the 100 year flood elevation and backwater. The interaction between the hydraulic analysis and the bridge design is a key element and cost driver on this project.

STUDY OBJECTIVES

To assist GDOT achieve its project goals in a cost-effective manner, it convened this VE study. The study team was tasked with identifying specific changes to the current design that will enhance its value by improving functionality, saving cost or a combination of the two.

RESULTS OF THE STUDY

Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 12 alternatives and one design suggestion for consideration by GDOT. These alternatives address the key issues described above and are detailed in the remainder of this section of the report. The results focus upon the following key areas:

- Bridge travel lane and shoulder width
- Embankment section paved shoulder width, pavement design, and life cycle impacts
- Total bridge length as a function of the interaction with the hydraulic analysis and backwater impacts
- The use of temporary easements instead of permanent right-of-way

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 POTENTIAL COST SAVINGS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216), P.I. No. 0001216
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GENERAL CONCEPTS (G)						
G-5	Reduce the amount of right-of-way being purchased between STA 47+50 to STA 86+00 and use a 20 ft. temporary easement instead.	$118,296	$20,088	$98,208	$0	$98,208
SECTION (S)						
S-1	Use a 10-ft.-wide shoulder with 4 ft. paved section in lieu of 6.5-ft.-wide paved section.	$80,072	$0	$80,072	$0	$80,072
S-3	Revise the pavement section on the boat access road and use surface treatment in lieu of 1 1/2-in.-thick asphalt with graded aggregate base.	$14,542	$2,010	$12,532	($2,538)	$9,994
S-5	Use 10-ft.-wide shoulder with a 4-ft.-wide full depth paved section in lieu of thinner 6.5-ft.-wide paved section.	$208,179	$257,147	($48,968)	$125,706	$76,738
S-6	Use 11-ft.-wide travel lanes with 10-ft.-wide shoulders and 4-ft.-wide full depth paved shoulder section in lieu of 12-ft.-wide lanes with 6.5-ft.-wide paved thinner section.	$5,837,027	$5,597,106	$239,921	$125,706	$365,627
S-8	Do not demolish the existing pavement and bridges after the new parallel road is complete. Demo cost would be saved in this phase, deferred, but added to the future four-lane project.	$500,000	$0	$500,000	$0	$500,000

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** ***BR000-0001-00(216) P.I. No. 0001216*** ***Appling/Toombs Counties, GA – Preliminary Engineering Submittal***	ALTERNATIVE NO.: **G-5**
DESCRIPTION:	**REDUCE THE AMOUNT OF RIGHT-OF-WAY BEING PURCHASED BETWEEN STA 47+50 TO STA 86+00 AND USE A 20 FT. TEMPORARY EASEMENT INSTEAD**	SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

The original design proposes to purchase a 60 ft. strip of right-of-way from Station 47+50 to Station 86+00.

ALTERNATIVE: (sketch attached)

Purchase a 20-ft.-wide strip of temporary construction easement from Station 47+50 to Station 86+00 instead of purchasing the 60-ft.-wide right-of-way.

ADVANTAGES:

- Less right-of-way required
- Property reverts to original owner upon completion of construction

DISADVANTAGES:

- Modified right-of-way approach

DISCUSSION:

The edge of the new bridge is about 25 ft. inside the existing right-of-way which provides adequate access for future maintenance of the bridge. Purchasing a 20 ft. strip of temporary construction easement will provide adequate room for the contractor's use in constructing the bridge and reduce the right-of-way required.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 118,296	$	$ 118,296
ALTERNATIVE	$ 20,088	$	$ 20,088
SAVINGS	$ 98,208	$	$ 98,208

SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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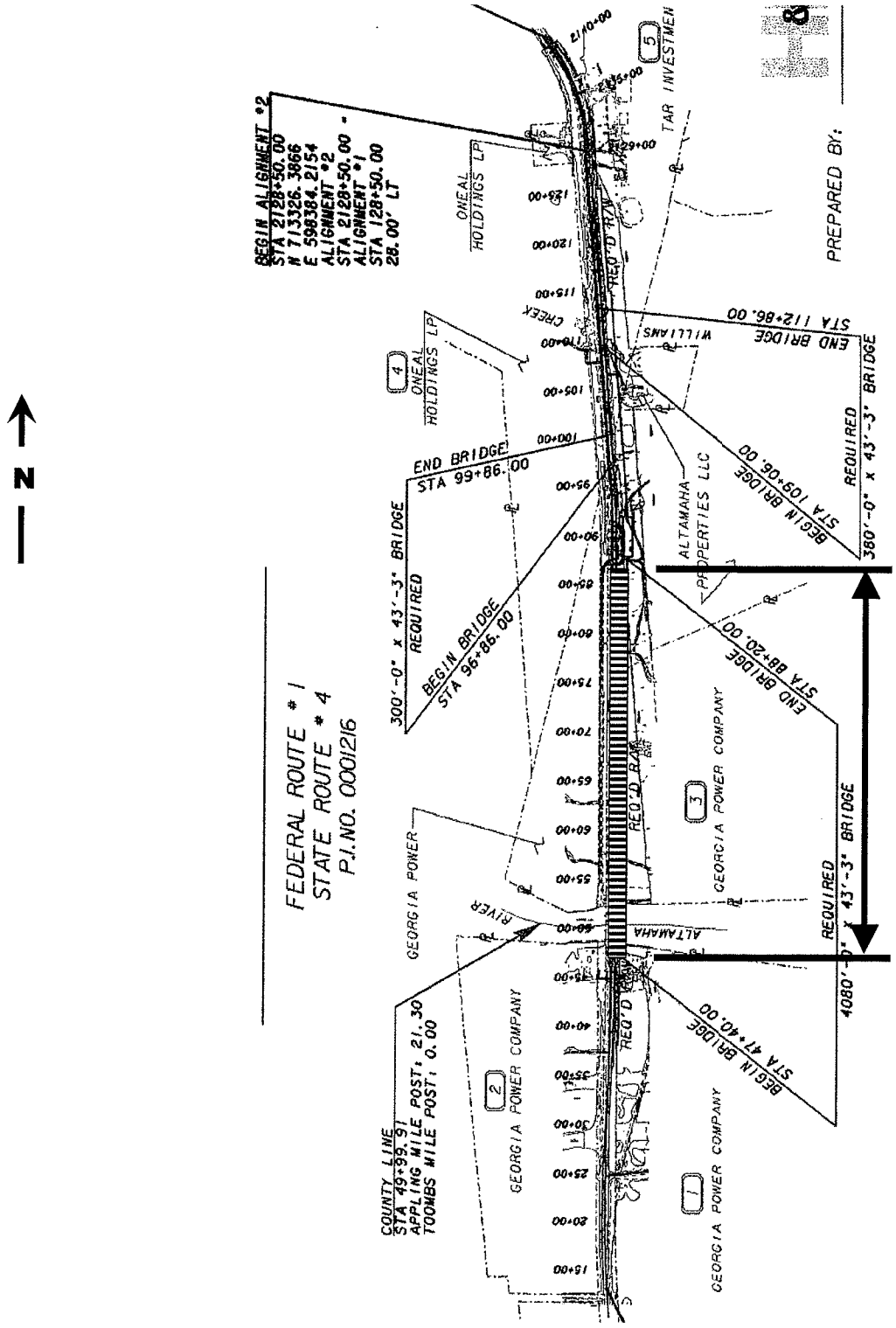
ALTERNATIVE NO.: **G-5**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: **2 of 5**



SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
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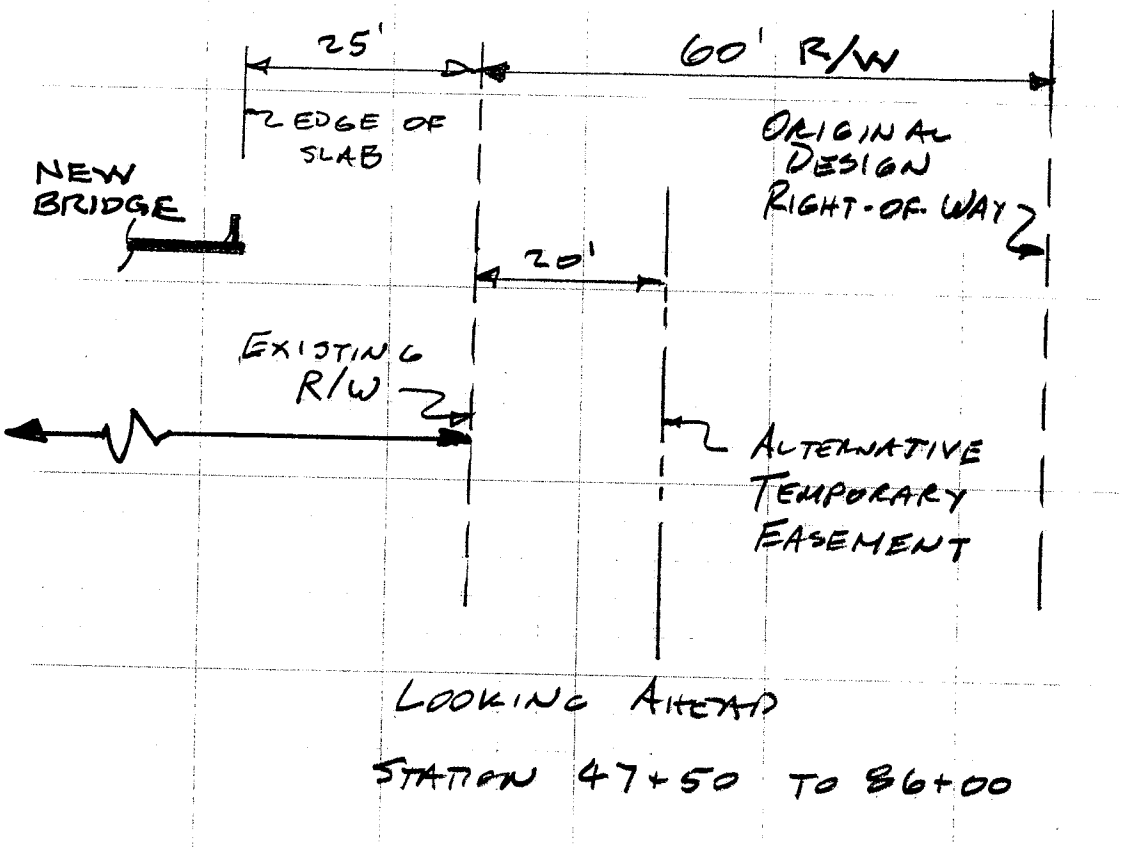
ALTERNATIVE NO.: G-5

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: 3 of 5



PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **G-5**

SHEET NO.: **4 of 5**

Original Design:

R/W Area = 60ft(8600-4750)/43,560ft2/ac = 5.3 AC

Alternative Design:

Easement Area = 20ft(8600-4750)/43,560ft2/ac = 1.8 AC

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **G-5**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Right-of-Way	AC	5.3	9,000.00	47,700			
Temporary Easement	AC				1.8	4,500.00	8,100
Subtotal				47,700			8,100
Markup (%) at 148%				70,596			11,988
TOTAL				118,296			20,088

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **S-1**

DESCRIPTION: **USEA 10-FT.-WIDE SHOULDER WITH 4-FT.-WIDE PAVED SECTION IN LIEU OF 6.5 FT. PAVED SECTION**

SHEET NO.: **1 of 4**

ORIGINAL DESIGN: (sketch attached)

The original design includes 10-ft.-wide shoulders, 6.5 ft. paved and 3.5 ft. unpaved.

ALTERNATIVE: (sketch attached)

Use a 10-ft.-wide shoulder with 4 ft. paved and 6 ft. unpaved. The pavement design would remain the same.

ADVANTAGES:

- Reduces construction material and labor requirements
- Reduces field efforts
- Less impervious surface
- Reduces pavement maintenance

DISADVANTAGES:

- Narrower paved shoulder section

DISCUSSION:

Originally, the 6.5 ft. paved section was used on designated bike routes in the state, but this section of US 1/ SR 4 is not a designated bike route. It is important to note that even though this route will eventually be widened to four lanes, it is still acceptable design practice to use a 4-ft.-wide paved section on the shoulders.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 80,072	$	$ 80,072
ALTERNATIVE	$ 0	$	$ 0
SAVINGS	$ 80,072	$	$ 80,072

SKETCH

PROJECT: US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK
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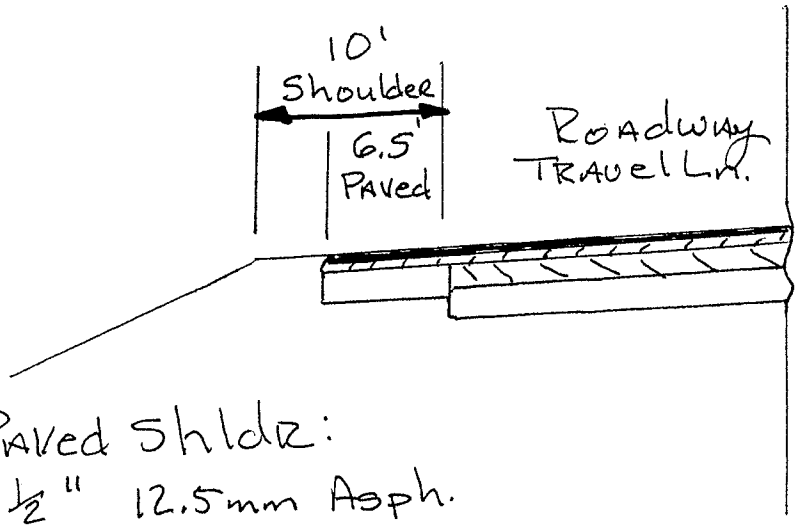
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: S-1

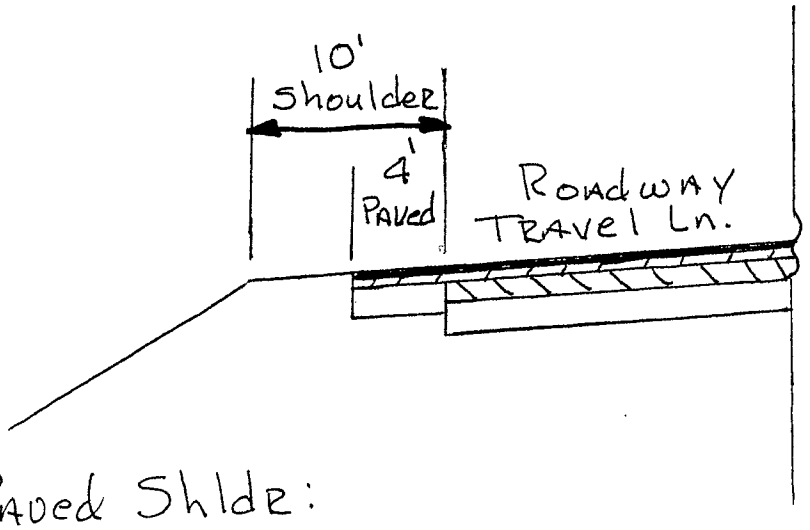
ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: 2 of 4



Paved Shldr:
1½" 12.5mm Asph.
2" 19 mm Asph.
6" GAB

NTS

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐



Paved Shldr:
Same as Above

NTS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **S-1**

SHEET NO.: **3 of 4**

COST ASSUMPTIONS

The cost saved using a 4 ft wide paved section in lieu of a 6.5 ft wide paved section on the shoulder:

Shoulder pavement area saved

Area Saved = [(6.5'- 4') (1.503mi x 5,280'/mi) x 2 shoulders]/ 9sf/sy = **4,409 sy**

Shoulder Pavement Unit Cost ($/SY):

12.5mm:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
6in GAB:	0.5ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton	=	$4.96/SY
	Total Shoulder Pavement Unit Cost	=	**$16.51/SY**

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **S-1**

SHEET NO.: **4 of 4**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Cost saved for 4ft wide pavement							
Shoulder pavement saved	SY	4,409	$16.51	$72,793			
Subtotal				$72,793			
Markup (%) at 10%				$7,279			
TOTAL				$80,072			

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** ***BR000-0001-00(216) P.I. No. 0001216*** ***Appling/Toombs Counties, GA – Preliminary Engineering Submittal***	ALTERNATIVE NO.: **S-3**
DESCRIPTION:	**REVISE THE PAVEMENT SECTION ON THE BOAT ACCESS ROAD AND USE SURFACE TREATMENT IN LIEU OF 1½-IN.-THICK ASPHALT WITH GRADED AGGREGATE BASE**	SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

The original design calls for constructing the access road to the boat ramp utilizing 1½-in.-thick asphalt and graded aggregate base (GAB).

ALTERNATIVE: (sketch attached)

Use surface treatment in lieu of asphalt with GAB for the access road to the boat ramp.

ADVANTAGES:

- Reduces construction material and labor requirements
- Faster to install paving

DISADVANTAGES:

- Increases maintenance

DISCUSSION:

The current access road to the boat ramp is a dirt road. This access road appears to be frequented by fisherman only. By only surface treating the road instead of constructing a full depth pavement, a considerable amount of material and labor can be saved. The resulting road connecting US1/SR4 to the dirt road will be a stable section with good drainage capability although it will require more maintenance than an asphalt section would.

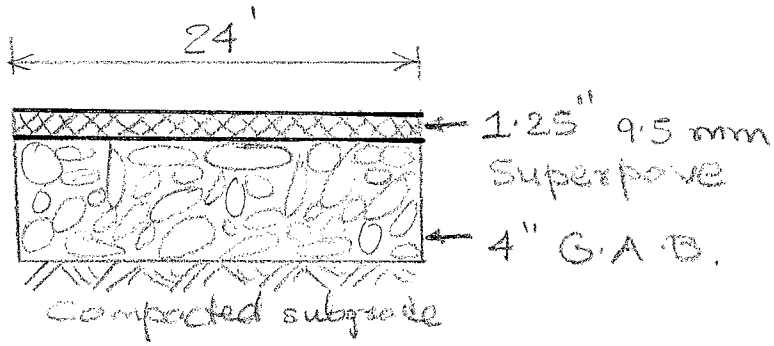
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 14,542	$ 0	$ 14,542
ALTERNATIVE	$ 2,010	$ 2,538	$ 4,548
SAVINGS	$ 12,532	$ (2,538)	$ 9,994

SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

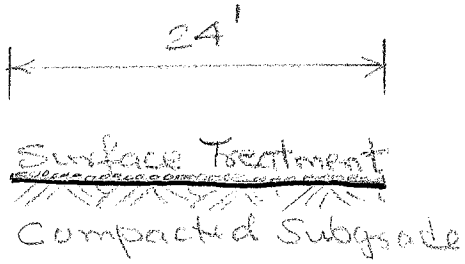
ALTERNATIVE NO.: S-3

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: 2 of 5



Original Design

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐



Alternate Design

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **S-3**

SHEET NO.: **3 of 5**

Original Design:

Length of Access Road = 685ft

Width of Access Road = 24ft

Area of Access Road = 685ft x 24ft/ 9sf/sy = 1,827 square yards

9.5 mm recycled asphalt = 135 lbs/sy

Total Weight: (135/2000) x 1,827 = 123 tons

4in thick graded aggregate base (GAB)

Total Weight: (4x110/2000) x 1,827 = 402 tons

Alternative Design:

Surface Treatment Area = 1,827 sy

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **S-3**

SHEET NO.: 4 of 5

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
9.5 mm recycled asphalt	Tons	123	58.49	7,194			
Graded aggregate base course	Tons	402	14.99	6,026			
Surface Treatment	SY				1,827	1.00	1,827
Subtotal				13,220			1,827
Markup (%) at 10%				1,322			183
TOTAL				14,542			2,010

LIFE CYCLE COST WORKSHEET

PROJECT: **US 1/SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
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ALTERNATIVE NO.: **S-3**

SHEET NO.: **5 of 5**

LIFE CYCLE PERIOD: 30 **years**
INTEREST RATE: 3.20% **ESCALATION RATE:** 0.00%

						ORIGINAL	ALTERNATIVE
A.	**INITIAL COST**					14,542	2,010
	Useful Life (Years)					30	10
					INITIAL COST SAVINGS		12,532
B.	**RECURRENT COSTS (Annual Expenditures)**						
	1. Maintenance:						
	2. Operating						
	3. Energy						
	4.						
	5.						
	6.						
					Total Annual Costs	-	-
					Present Worth Factor	19.1033	19.1033
					Present Worth of RECURRENT COSTS	-	-
C.	**SINGLE EXPENDITURES**		**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
ORIG	PROP	< Put "x" in appropriate box (original design or proposed design)					
		1.			1.0000	-	-
	X	2. Surface Treatment	10	2,010	0.7298	-	1,467
	X	3. Surface Treatment	20	2,010	0.5326	-	1,071
		4.			1.0000	-	-
		5.			1.0000	-	-
		6.			1.0000	-	-
		7.			1.0000	-	-
		8.			1.0000	-	-
D.	**SALVAGE VALUE**		**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
		1.			(1.0000)	-	-
		2.			(1.0000)	-	-
					Present Worth of SINGLE EXPENDITURES	-	2,538
E.	**Total Recurrent Costs & Single Expenditures (B + C + D)**					-	2,538
					RECURRENT COSTS & SINGLE EXPENDITURES SAVINGS		(2,538)
					TOTAL PRESENT WORTH COST (A + E)	14,542	4,548
					TOTAL LIFE CYCLE SAVINGS		**9,994**

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **S-5**

DESCRIPTION: **USE 10-FT.-WIDE SHOULDER WITH A 4-FT.-WIDE FULL DEPTH PAVED SECTION IN LIEU OF A THINNER 6.5-FT.-WIDE PAVED SECTION**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

The original design uses a 10-ft.-wide shoulder with a 6.5-ft.-wide thin pavement section. The shoulder pavement includes 1.5-in.-thick 12.5mm A/C, 2-in.-thick 19mm A/C, and 6-in.-thick GAB.

ALTERNATIVE: (sketch attached)

Use 10-ft.-wide shoulders with a 4-ft.-wide, full-depth, paved section. The shoulder pavement would include 1.5-in.-thick 12.5mm A/C, 2-in.-thick 19mm A/C, 4-in.-thick 25mm A/C, and 12-in.-thick GAB.

ADVANTAGES:

- Reduces future maintenance requirements
- More compatible for the 18.5% trucks
- Reduces life cycle material and labor requirements

DISADVANTAGES:

- Higher initial material and labor requirements
- Narrower paved shoulder

DISCUSSION:

The original design uses a thin paved shoulder that may not be as durable near the heavy truck traffic (18.5 %). The alternative design uses a full-depth pavement shoulder that would be the same pavement structure as the travel lanes. This thicker paved shoulder section will improve bearing capacity and will have a significantly longer life that the thinner pavement section. Reducing the paved section width from 6.5 ft. wide to 4 ft. wide is acceptable design practice for this type of highway and aids in offsetting the added material and labor requirements for the full depth pavement. The added durability and reduction in future maintenance requirements results in a net savings when viewed from a 30yr life cycle perspective.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 208,179	$ 141,096	$ 349,275
ALTERNATIVE	$ 257,147	$ 15,390	$ 272,537
SAVINGS	$ (48,968)	$ 125,706	$ 76,738

SKETCH

PROJECT: US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK
BR000-0001-00(216) P.I. No. 0001216
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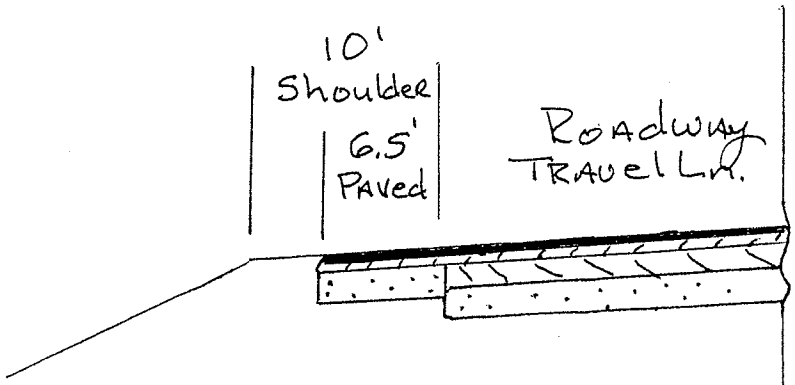
ALTERNATIVE NO.: S-5

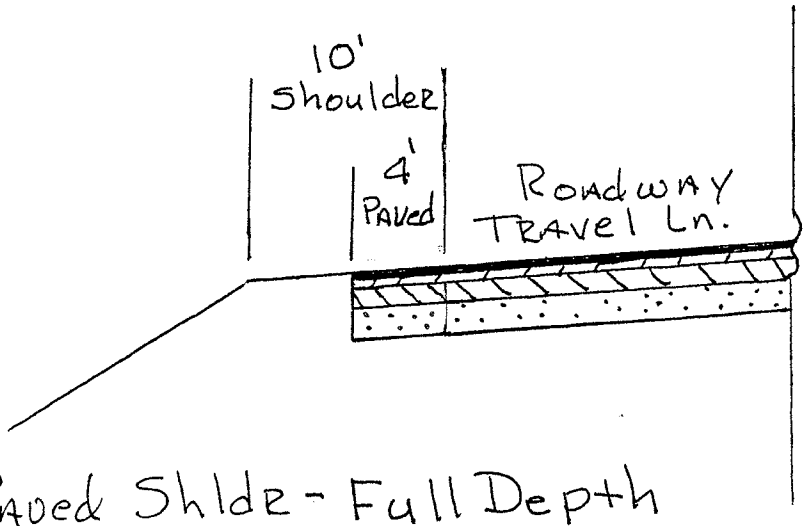
ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: 2 of 5



Paved Shldr
1½" 12.5mm Asph.
2" 19 mm Asph.
6" GAB

NTS

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐



Paved Shldr - Full Depth
1½" 12.5mm Asph.
2" 19mm Asph.
4" 25mm Asph.
12" GAB

NTS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **S-5**

SHEET NO.: **3 of 5**

COST ASSUMPTIONS

Original Design construction cost for 6.5ft paved shoulder:

Pavement area = (6.5' x 2 shoulders) (1.503mi x 5,280'/mi)/9sf/sy = 11,463 sy

Original Design Shoulder Pavement Unit Cost ($/SY)

12.5mm:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
6" GAB:	(0.5ft)(147#/CF)(Ton/2,000#)(9SF/SY)($14.99/Ton)	=	$4.96/SY
	Original Design Shoulder Pavement Unit Cost	=	**$16.51/SY**

Alternate Design construction cost for 4.0ft paved shoulder:

Pavement area = (4.0' x 2 shoulders) (1.503mi x 5,280'/mi)/9sf/sy = 7,054 sy

Alternate Design Full Depth Pavement Unit Cost ($/SY):

12.5mm:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
25mm:	440#/SY x Ton/2,000# x $53.04/Ton	=	$11.67/SY
12" GAB:	1ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton	=	$9.92/SY
	Alternate Design Pavement Unit Cost	=	**$33.14/SY**

Life Cycle Cost Assumptions

Overlay cost for 2" Asphalt overlay (every 10 years) for "Original" design thin shoulder

Use $6.45/SY for 2" overlay

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **S-5**

SHEET NO.: **4 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
6.5 ft wide thinner paved shoulder	SY	11,463	$16.51	$189,254			
4.0 ft wide full depth shoulder	SY				7,054	$33.14	$233,770
Subtotal				$189,254			$233,770
Markup (%) at 10%				$18,925			$23,377
TOTAL				$208,179			$257,147

LIFE CYCLE COST WORKSHEET

PROJECT:	**US 1/SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1, AND WILLIAMS CREEK** ***BR000-0001-00(216) P.I. No. 0001216*** ***Appling/Toombs Counties, GA – Preliminary Engineering***	ALTERNATIVE NO.:	**S-5**
		SHEET NO.:	**5 of 5**

							ORIGINAL	ALTERNATIVE
LIFE CYCLE PERIOD:	30	**years**						
INTEREST RATE:	3.20%	**ESCALATION RATE:**	0.00%					
A.	**INITIAL COST**						208,179	257,147
	Useful Life (Years)						10	20
						INITIAL COST SAVINGS		(48,968)
B.	**RECURRENT COSTS (Annual Expenditures)**							
	1. Maintenance: Assume 50MH @ $50/hr for annual pothole repair = $2500/yr.						2,500	
	2. Operating							
	3. Energy							
	4.							
	5.							
	6.							
						Total Annual Costs	2,500	-
						Present Worth Factor	19.1033	19.1033
						Present Worth of RECURRENT COSTS	47,758	-
C.	**SINGLE EXPENDITURES**			**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
ORIG	PROP	**< Put "x" in appropriate box (original design or proposed design)**						
X		1. 2" A/C Shoulder Overlay - 6.5ft		10	73,936	0.7298	53,959	-
X		2. 2" A/C Shoulder Overlay - 6.5ft		20	73,936	0.5326	39,379	-
	X	3. 2" A/C Shoulder Overlay - 4ft		20	45,499	0.5326	-	24,233
		4.				1.0000	-	-
		5.				1.0000	-	-
		6.				1.0000	-	-
		7.				1.0000	-	-
		8.				1.0000	-	-
D.	**SALVAGE VALUE**			**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
	X	1. 2" A/C Shoulder Overlay Salvage		30	22,750	(0.3887)	-	(8,843)
		2.				(1.0000)	-	-
						Present Worth of SINGLE EXPENDITURES	93,338	15,390
E.	**Total Recurrent Costs & Single Expenditures (B + C + D)**						141,096	15,390
						RECURRENT COSTS & SINGLE EXPENDITURES SAVINGS		125,706
						TOTAL PRESENT WORTH COST (A + E)	349,275	272,537
						TOTAL LIFE CYCLE SAVINGS		**76,738**

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **S-6**

DESCRIPTION: **USE 11-FT.-WIDE LANES WITH 10-FT.-WIDE SHOULDERS AND 4-FT.-WIDE FULL-DEPTH PAVED SHOULDER SECTION IN LIEU OF 12-FT.-WIDE LANES AND 6.5-FT.-WIDE THINNER SECTION**

SHEET NO.: **1 of 6**

ORIGINAL DESIGN: (sketch attached)

Uses 12-ft.-wide travel lanes with 10-ft.-wide shoulders, and a 6.5-ft.-wide paved shoulder section consisting of 3½-in.-thick asphalt pavement.

ALTERNATIVE: (sketch attached)

Use 11-ft.-wide travel lanes, 10-ft.-wide shoulders, and a 4-ft.-wide paved shoulder section of a full-depth (7½-in.-thick) pavement.

ADVANTAGES:

- Less shoulder maintenance
- Longer pavement life for shoulders
- Reduces travel lane cost
- Wider area with full-depth pavement

DISADVANTAGES:

- Narrower travel lanes and shoulders

DISCUSSION:

The main idea behind this alternate is to provide full-depth pavement on a narrower shoulder adjacent to the 11-ft.-wide travel lanes. The savings in the life cycle costs will make this alternate more cost effective than the Original Design. Also, since this road is a designated Governor's Road Improvement Program (GRIP) corridor, the roadway will eventually be widened to four lanes and the two lanes under consideration will become one-way. In light of the future four lane concept, the 11-ft.-wide travel lanes are a logical choice.

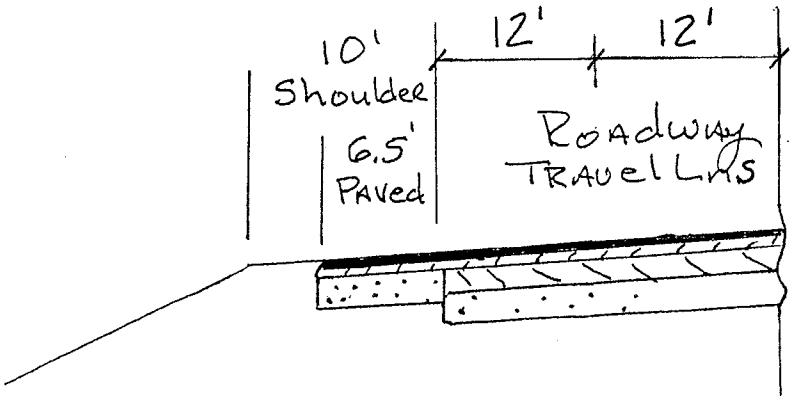
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 5,837,027	$ 141,096	$ 5,978,123
ALTERNATIVE	$ 5,597,106	$ 15,390	$ 5,612,496
SAVINGS	$ 239,921	$ 125,706	$ 365,627

SKETCH

PROJECT: US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: S- 6

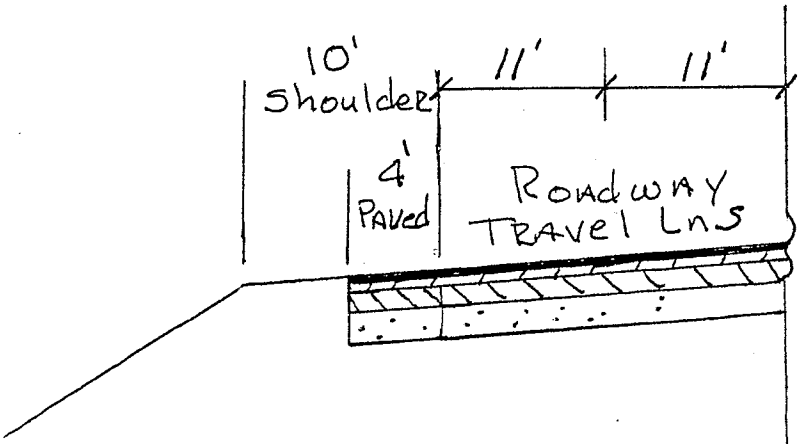
ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: 2 of 6



Paved Shldr
1½" 12.5mm Asph.
2" 19 mm Asph.
6" GAB

NTS

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐



Paved Shldr - Full Depth
1½" 12.5mm Asph.
2" 19mm Asph.
4" 25mm Asph.
12" GAB

NTS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **S-6**

SHEET NO.: **3 of 6**

Original cost for 12ft lanes (full-depth) and 6.5ft paved shoulders (thin section):

Full-depth 12ft-lanes pavement area = (12' x 2 lanes) (1.503mi x 5,280'/mi)/ 9sf/sy = 21,162 sy

Original Shoulder Pavement area = (6.5' x 2 shoulders) (1.503mi x 5,280'/mi)/ 9sf/sy = 11,463 sy

Original Design 6.5' Shoulder "thin" Pavement Unit Cost ($/SY):

12.5mm:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
6" GAB:	0.5ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton	=	$4.96/SY
	Original Design Shoulder Pavement Unit Cost	=	**$16.51/SY**

Alternate Design construction cost for 4.0ft paved shoulder:

Alternate 11ft lanes Pavement area = (11' x 2 lanes) (1.503mi x 5,280'/mi)/ 9sf/sy = 19,399 sy

Alternate Design 4ft shoulder Pavement area = (4.0' x 2 shoulders)(1.503mi x 5,280'/mi)/ 9sf/sy = 7,054 sy

Full Depth Pavement Unit Cost ($/SY):

12.5mm:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
25mm:	440#/SY x Ton/2,000# x $53.04/Ton	=	$11.67/SY
12" GAB:	(1ft)(147#/CF)(Ton/2,000#)(9SF/SY)($14.99/Ton)	=	$9.92/SY
	Total Full Depth Pavement Unit Cost	=	**$33.14/SY**

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **S-6**

BRIDGE #1 - (ALTAMAHA RIVER)

Original Design:
140ft and 85ft Span Bridge Area = [5(140) + 8(85)](43.25) = 59,685 SF
60ft Span Bridge Area = 45(60)(43.25) = 116,775 SF

Alternative Design:
140ft and 85ft Span Bridge Area = [5(140) + 8(85)](41.25) = 56,925 SF
60ft Span Bridge Area = 45(60)(41.25) = 111,375 SF

Bridge costs:
$100/SF for 140ft and 85ft spans (long spans)
$80 for 60ft spans (short spans)
These costs are for all components of the bridge. Since this reduction in width will not reduce the number of beams or substantially reduce the substructure required, use 25% of the bridge unit costs for this alternative.
Use $25/SF for 140ft and 85ft spans (long spans)
Use $20/SF for 60ft spans (short spans)

BRIDGE #2 – (OVERFLOW 1)

Original Design:
60ft Span Bridge Area = 5(60)(43.25) = 12,975 SF

Alternative Design:
60ft Span Bridge Area = 5(60)(41.25) = 12,375 SF

Bridge cost:
$80 for 60ft spans
This cost is for all components of the bridge. Since this reduction in width will not reduce the number of beams or substantially reduce the substructure required, use 25% of the bridge unit costs for this alternative.
Use $20/SF for 60ft spans

BRIDGE #3 - (WILLIAMS CREEK)

Original Design:
40ft and 60ft Span Bridge Area = [5(60) + 2(40)](43.25) = 16,435 SF

Alternative Design:
40ft and 60ft Span Bridge Area = [5(60) + 2(40)](41.25) = 15,675 SF

Bridge cost:
Use $80/SF for 60ft and 40ft spans
This cost is for all components of the bridge. Since this reduction in width will not reduce the number of beams or substantially reduce the substructure required, use 25% of the bridge unit costs for this alternative.
Therefore, use $20/SF for 60ft and 40ft spans

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **S-6**

SHEET NO.: **5 of 6**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Full depth 12 ft lanes	SY	21,162	$33.14	$701,309			
"thin" 6.5 ft paved shoulders	SY	11,463	$16.51	$189,254			
Alternate 11ft lanes	SY				19,399	$33.14	$642,883
Alternate 4 ft full depth shoulders	SY				7,054	$33.14	$233,770
Bridge no. 1							
Long span bridge area	SF	59,685	25.00	$1,492,125	56,925	25.00	$1,423,125
Short span bridge area	SF	116,775	20.00	$2,335,500	111,375	20.00	$2,227,500
Bridge no. 2							
Short Span Bridge Area	SF	12,975	20.00	$259,500	12,375	20.00	$247,500
Bridge no. 3							
Short Span Bridge Area	SF	16,435	20.00	$328,700	15,675	20.00	$313,500
Subtotal				$5,306,388			$5,088,278
Markup (%) at 10%				$530,639			$508,828
TOTAL				$5,837,027			$5,597,106

LIFE CYCLE COST WORKSHEET

PROJECT: **US 1/SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **S-6**

Use 11ft wide lanes with full depth shoulders in lieu of 12ft lanes with thin shoulder.

SHEET NO.: **6 of 6**

LIFE CYCLE PERIOD: 30 **years**
INTEREST RATE: 3.20% **ESCALATION RATE:** 0.00%

						ORIGINAL	ALTERNATIVE
A.	**INITIAL COST**					5,837,027	5,597,106
	Useful Life (Years)					10	20
					INITIAL COST SAVINGS		239,921
B.	**RECURRENT COSTS (Annual Expenditures)**						
	1. Maintenance: Assume 50MH @ $50/hr for annual pothole repair = $2500/yr.					2,500	
	2. Operating						
	3. Energy						
	4.						
	5.						
	6.						
					Total Annual Costs	2,500	-
					Present Worth Factor	19.1033	19.1033
					Present Worth of RECURRENT COSTS	47,758	-
C.	**SINGLE EXPENDITURES**		**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
ORIG	PROP	< Put "x" in appropriate box (original design or proposed design)					
X		1. 2" A/C Shoulder Overlay	10	73,936	0.7298	53,959	-
X		2. 2" A/C Shoulder Overlay	20	73,936	0.5326	39,379	-
	X	3. 2" A/C Shoulder Overlay	20	45,499	0.5326	-	24,233
		4.			1.0000	-	-
		5.			1.0000	-	-
		6.			1.0000	-	-
		7.			1.0000	-	-
		8.			1.0000	-	-
D.	**SALVAGE VALUE**		**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
	X	1. 2" A/C Shoulder Overlay Salvage	30	22,750	(0.3887)	-	(8,843)
		2.			(1.0000)	-	-
					Present Worth of SINGLE EXPENDITURES	93,338	15,390
E.	**Total Recurrent Costs & Single Expenditures (B + C + D)**					141,096	15,390
					RECURRENT COSTS & SINGLE EXPENDITURES SAVINGS		125,706
					TOTAL PRESENT WORTH COST (A + E)	5,978,123	5,612,496
					TOTAL LIFE CYCLE SAVINGS		**365,627**

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** ***BR000-0001-00(216) P.I. No. 0001216*** ***Appling/Toombs Counties, GA – Preliminary Engineering Submittal***	ALTERNATIVE NO.: **S-8**
DESCRIPTION:	**DEFER THE DEMOLITION OF THE EXISTING PAVEMENT AND BRIDGES AFTER THE NEW PARALLEL ROAD IS COMPLETE**	SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

The existing pavement will be demolished along with the three existing bridges on the old alignment after the new roadway and bridges are complete.

ALTERNATIVE:

Defer demolition of the old pavement and bridges until the next phase of construction which will widen the roadway from two lanes to four lanes.

ADVANTAGES:

- Reduces current demolition efforts
- Existing pavement could still be recycled in the future

DISADVANTAGES:

- Liability from old bridge structures

DISCUSSION:

US 1 / SR 4 is part of a GRIP (Governors Road Improvement Program) corridor. In the future, this road will be widened to four lanes. It makes sense not to demolish the existing roadway so that it can be reused as a base course. It should be noted that the current cost estimate does not include funds for demolishing the roadway, but it does include $500,000 to demolish the three bridges. By not demolishing the bridges now, this requirement could be deferred to a later date.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 500,000	$ 0	$ 500,000
ALTERNATIVE	$ 0	$ 0	$ 0
SAVINGS	$ 500,000	$ 0	$ 500,000

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216), P.I. No. 0001216
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ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
PROFILE (P)						
P-1	Change the profile slope from STA 63+84 to STA 113+16 from 0% to a minimum of 0.25% slope to improve drainage.	DESIGN SUGGESTION				
BRIDGE #1 (B1) (ALTAMAHA RIVER)						
B1-1	Reduce the bridge gutter-to-gutter width from 40ft to 36ft by using 6ft wide shoulders in lieu of 8ft shoulders.	$4,210,388	$3,820,988	$389,400	$0	$389,400
BRIDGE #2 (B2) (OVERFLOW 1)						
B2-1	Reduce the bridge gutter-to-gutter width from 40 ft. to 36 ft. by using 6-ft.-wide shoulders in lieu of 8-ft.-wide shoulders.	$285,450	$259,050	$26,400	$0	$26,400
B2-4	Re-run the hydraulics program to evaluate the possibility of eliminating Bridge #2 and replacing it with an embankment roadway section.	$1,141,800	$249,369	$892,431	$0	$892,431
BRIDGE #3 (B3) (WILLIAMS CREEK)						
B3-1	Reduce the bridge gutter-to-gutter width from 40 ft. to 36 ft. by using 6-ft.-wide shoulders in lieu of 8-ft.-wide shoulders.	$361,570	$328,130	$33,440	$0	$33,440
B3-4	Re-run the hydraulics program to evaluate the possibility of eliminating Bridge #3 (Williams Creek) and replacing it with an embankment roadway section.	$1,446,280	$258,813	$1,187,467	$0	$1,187,467

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** ***BR000-0001-00(216) P.I. No. 0001216*** ***Appling/Toombs Counties, GA – Preliminary Engineering Submittal***	ALTERNATIVE NO.: **P-1**
DESCRIPTION:	**CHANGE THE PROFILE SLOPE FROM 0% TO A MINIMUM 0.25% FROM STA 63+84 TO STA 113+16 TO IMPROVE DRAINAGE**	SHEET NO.: **1 of 1**

ORIGINAL DESIGN:

The original design includes construction of the new road with zero percent longitudinal slope from Station 63+84 to Station 113+16.

ALTERNATIVE:

Change the profile slope from 0% to a minimum of 0.25% and preferably 0.50% from Station 63+84 to Station 113+16 to improve drainage.

ADVANTAGES:

- More positive drainage
- Reduces ponding
- Reduces pavement deterioration caused by ponding

DISADVANTAGES:

- Profile would need to be changed

DISCUSSION:

For nearly 5,000 feet, the design of US1/SR4 calls for a flat longitudinal slope. Although the 2% cross slope is adequate to drain water from the road to the side, the water could pond if the construction is not carried out accurately. Even if the road is constructed perfectly, over time, the pavement is likely to deteriorate due to the heavy (18%) truck traffic. Water is the biggest culprit in the pavement deterioration. A 0.25% to 0.50% longitudinal slope can mitigate drainage problems and reduce pavement deterioration. The redesign of profile should also attempt to reduce earthwork quantities if possible.

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

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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ALTERNATIVE NO.: **B1-1**

DESCRIPTION: **REDUCE THE BRIDGE GUTTER-TO-GUTTER WIDTH FROM 40 FT. TO 36 FT. BY USING 6-FT.-WIDE SHOULDERS IN LIEU OF 8-FT.-WIDE SHOULDERS**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

The original design for the 4,080-ft.-long bridge over the Altamaha River uses a gutter-to-gutter width of 40 ft., with a structure out-to-out width of 43 ft. 3 in. The typical section consists of two 12-ft.-wide travel lanes with 8-ft.-wide shoulders on each side. The bridge begins at Station 47+40.00 and ends at Station 88+20.00.

ALTERNATIVE: (sketch attached)

Use a gutter-to-gutter width of 36 ft. with an out-to-out width of 39 ft. 3 in. The typical section would consist of two 12-ft.-wide travel lanes with 6-ft.-wide shoulders on each side.

ADVANTAGES:

- Reduces construction requirements
- Less bridge deck to maintain

DISADVANTAGES:

- Reduces shoulder width

DISCUSSION:

The GDOT Bridge and Structures Design Policy Manual calls for gutter-to-gutter widths of 40 ft. for two-lane state routes with ADT over 2,000, and 36 ft. for multi-lane divided state routes with ADT over 2,000. While this route will have only two lanes in the initial construction phase, the future project will widen the road to a four-lane section to meet the requirements of a GRIP corridor. Since the bridges make up nearly half the length of this project, reducing the bridge width will greatly reduce the material and labor requirements for this phase of construction.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 4,210,388	$	$ 4,210,388
ALTERNATIVE	$ 3,820,988	$	$ 3,820,988
SAVINGS	$ 389,400	$	$ 389,400

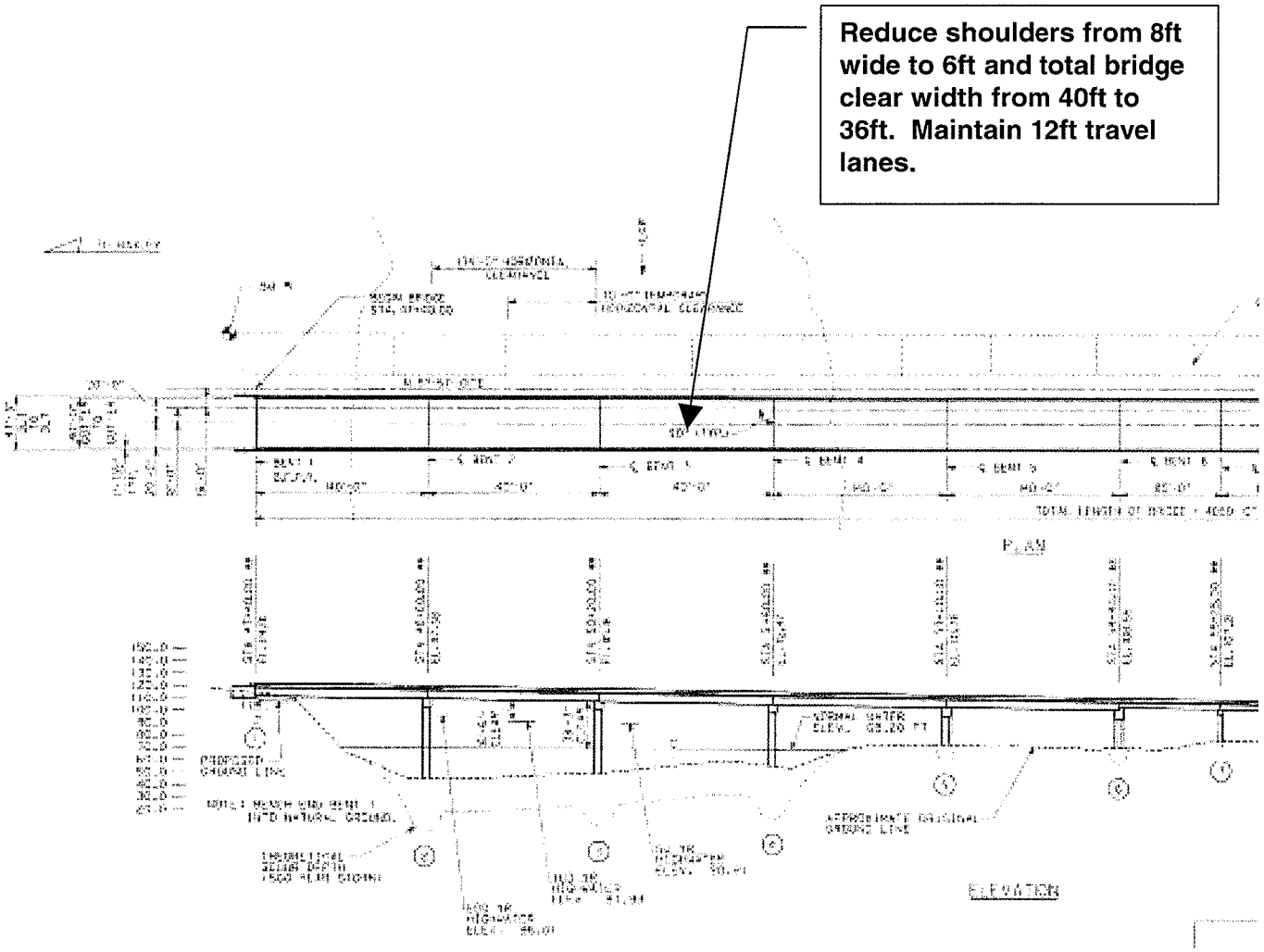
SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B1-1**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: **2 of 5**



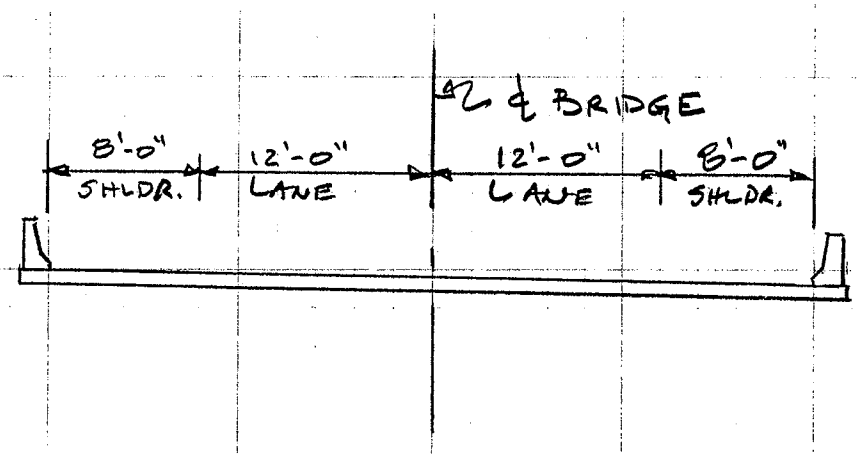
BRIDGE #1
PARTIAL PLAN & ELEVATION

SKETCH

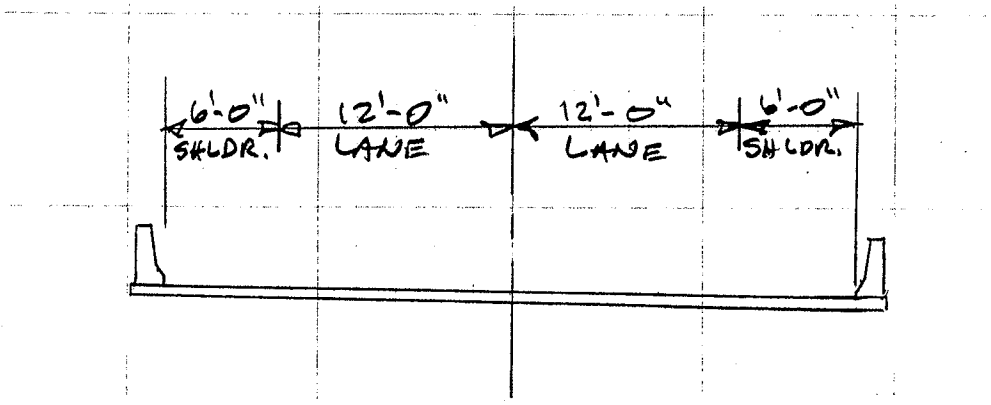
PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: B1-1

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: 3 of 5



ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐



SECTION

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B1-1**

SHEET NO.: **4 of 5**

Original Design:
Total 140' and 85' Span Bridge Area = [5(140) + 8(85)](43.25) = 59,685 SF (Long Span Bridge Area)

Total 60' Span Bridge Area = 45(60)(43.25) = 116,775 SF (Short Span Bridge Area)

Alternative Design:
Total 140' and 85' Span Bridge Area = [5(140) + 8(85)](39.25) = 54,165 SF

Total 60' Span Bridge Area = 45(60)(39.25) = 105,975 SF

Assumed Bridge Costs:
Use an average unit cost of $100/SF for 140' and 85' spans (long spans)

Use an average unit cost of $80/SF for 60' spans (short spans)

These costs are for all components of the bridge. Since this reduction in width will not reduce the number of beams or substantially reduce the substructure required, use 25% of the bridge unit costs for this alternative.

Use a unit cost of $25/SF for 140' and 85' bridge spans
Use a unit cost of $20/SF for 60' bridge spans

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B1-1**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Long span bridge area	SF	59,685	25.00	1,492,125	54,165	25.00	1,354,125
Short span bridge area	SF	116,775	20.00	2,335,500	105,975	20.00	2,119,500
Subtotal				3,827,625			3,473,625
Markup (%) at 10%				382,763			347,363
TOTAL				4,210,388			3,820,988

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B2-1**

DESCRIPTION: **REDUCE THE BRIDGE GUTTER-TO-GUTTER WIDTH FROM 40 FT. TO 36 FT. BY USING 6-FT.-WIDE SHOULDERS IN LIEU OF 8-FT.-WIDE SHOULDERS**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

The original design for the 300-ft.-long bridge over Overflow #1 includes a gutter-to-gutter width of 40 ft., with an out-to-out width of 43 ft. 3 in. The typical section consists of two 12-ft.-wide travel lanes with 8-ft.-wide shoulders. The bridge begins at Station 96+86 and ends at Station 99+86.

ALTERNATIVE: (sketch attached)

Use a gutter-to-gutter width of 36 ft. with an out-to-out width of 39ft-3in. The typical section would consist of two 12ft wide travel lanes with 6ft wide shoulders.

ADVANTAGES:

- Reduces construction requirements
- Less bridge deck to maintain

DISADVANTAGES:

- Reduces shoulder width

DISCUSSION:

The GDOT Bridge and Structures Design Policy Manual calls for gutter-to-gutter widths of 40 ft. for two-lane state routes with ADT over 2,000, and 36 ft. for multilane divided state routes with ADT over 2,000. While this route will have only two lanes when this initial phase of construction is completed, a future project will widen it to a four-lane section meeting the GRIP corridor criteria. Since the bridges make up nearly half the length of this project, reducing the bridge width will greatly reduce construction material and labor requirements.

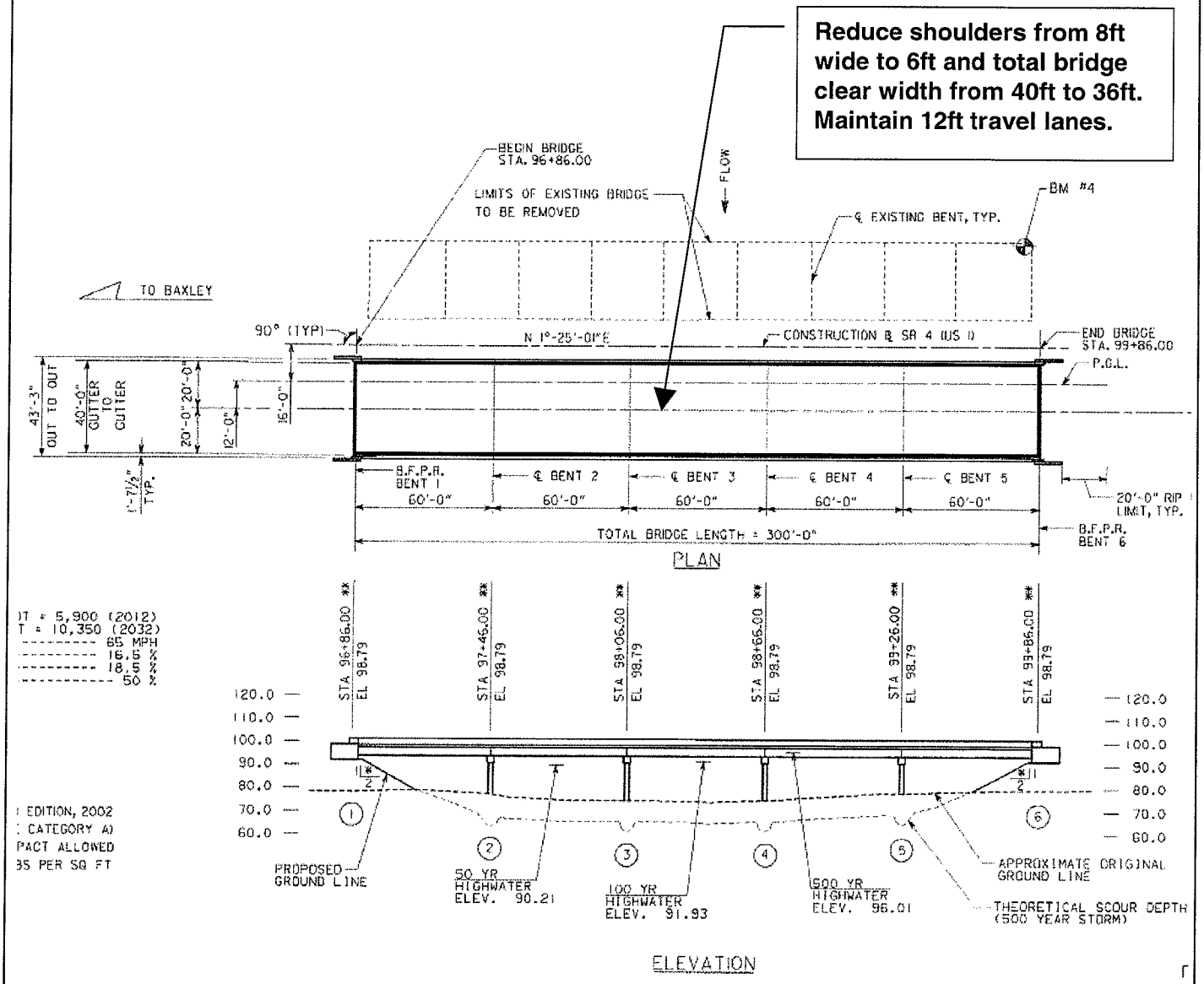
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 285,450	$	$ 285,450
ALTERNATIVE	$ 259,050	$	$ 259,050
SAVINGS	$ 26,400	$	$ 26,400

SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B2-1**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒ SHEET NO.: **2 of 5**



BRIDGE #2 (OVERFLOW #1)
PLAN & ELEVATION
(Length = 300ft)

SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
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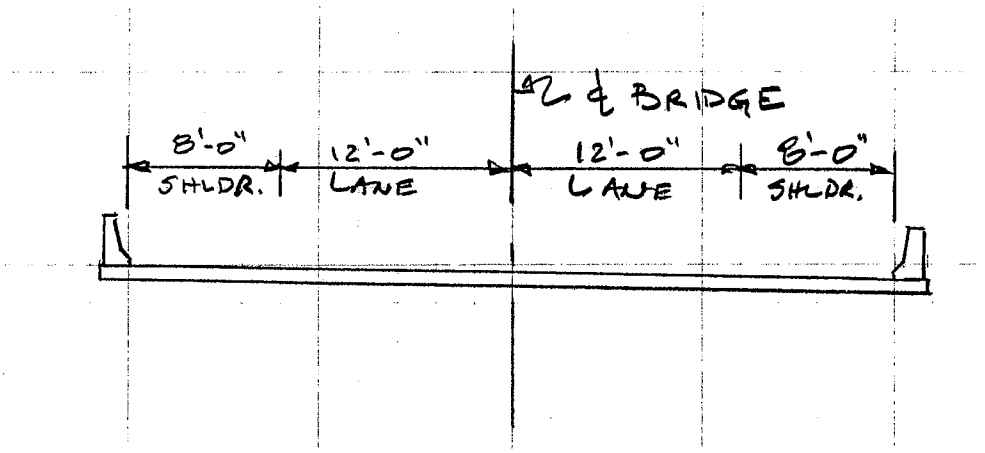
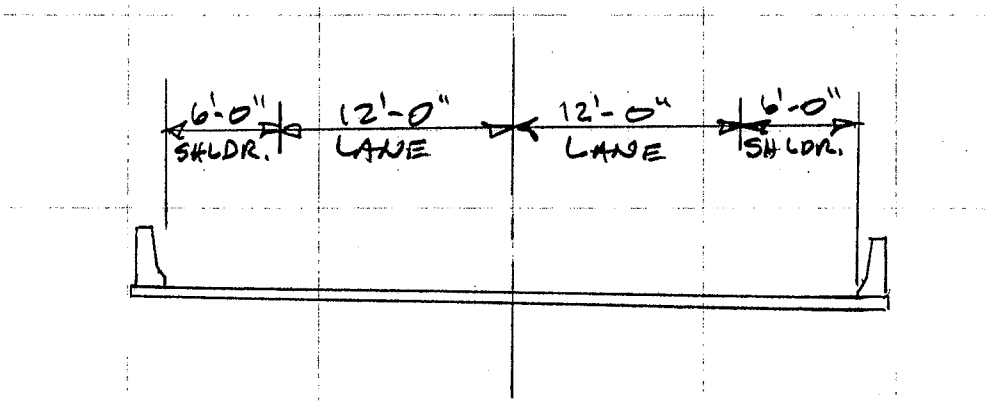
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: B2-1

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: 3 of 5



ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐



SECTION

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B2-1**

SHEET NO.: **4 of 5**

Original Design:
60ft Span Bridge Area = 5 spans x (60')(43.25') = 12,975 SF

Alternative Design:
60ft Span Bridge Area = 5 spans x (60')(39.25') = 11,775 SF

Bridge cost:
Use a unit price of $80/sf for 60ft spans

This cost is for all components of the bridge. Since this reduction in width will not reduce the number of beams or substantially reduce the substructure required, use 25% of the bridge unit costs for this alternative.

Use $20/sf for the 60ft spans

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B2-1**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge Area for 60ft spans	SF	12,975	20.00	259,500	11,775	20.00	235,500
Subtotal				259,500			235,500
Markup (%) at 10%				25,950			23,550
TOTAL				285,450			259,050

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B2-4**

DESCRIPTION: **RE-RUN THE HYDRAULICS PROGRAM TO EVALUATE THE POSSIBILITY OF ELIMINATING BRIDGE NO. 2 AND REPLACING IT WITH AN EMBANKMENT SECTION**

SHEET NO.: **1 of 8**

ORIGINAL DESIGN: (sketch attached)

The original design calls for a 300-ft.-long concrete structure at Overflow 1 (Bridge #2) from Station 96+86 to Station 99+86. The design assumes precast, pre-stressed concrete piles, AASHTO beams, and concrete deck.

ALTERNATIVE: (sketch attached)

Eliminate the 300-ft.-long Bridge #2 at Overflow #1and replace it with an embankment roadway section. A guide bank may be needed to protect the embankment and route the flow either to the Altamaha River or Williams Creek. Some mitigation or added right-of-way may also be required if a guide bank is needed.

ADVANTAGES:

- Reduces construction duration
- Reduces construction material and labor
- Less bridge to maintain

DISADVANTAGES:

- Likely increase in backwater
- Guide bank may be needed
- Additional hydraulic analysis needed

DISCUSSION:

The backwater at this site, per current calculations in the hydraulic study is 0.33 ft. and the allowable rise in backwater is 1.0 ft. While there is a tremendous amount of discharge at this site, nearly 170,000cfs, only about 5% of the flow goes through Bridge #2 (Overflow 1) during a 100-year flood. A quick evaluation to assess the backwater impact would validate whether an embankment section could be used in lieu of providing Bridge #2. It is possible that a guide bank would be needed since the flow currently being routed through this bridge would have to be directed to either Altamaha River (Bridge #1) or Williams Creek (Bridge #3). Since much of the detail analysis of the hydraulic model has been established, re-running the program is a manageable task considering the large potential savings in material and labor requirements. Liability of increasing the backwater must be carefully evaluated and weighed against the potential benefits of eliminating this bridge.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,141,800	$	$ 1,141,800
ALTERNATIVE	$ 249,369	$	$ 249,369
SAVINGS	$ 892,431	$	$ 892,431

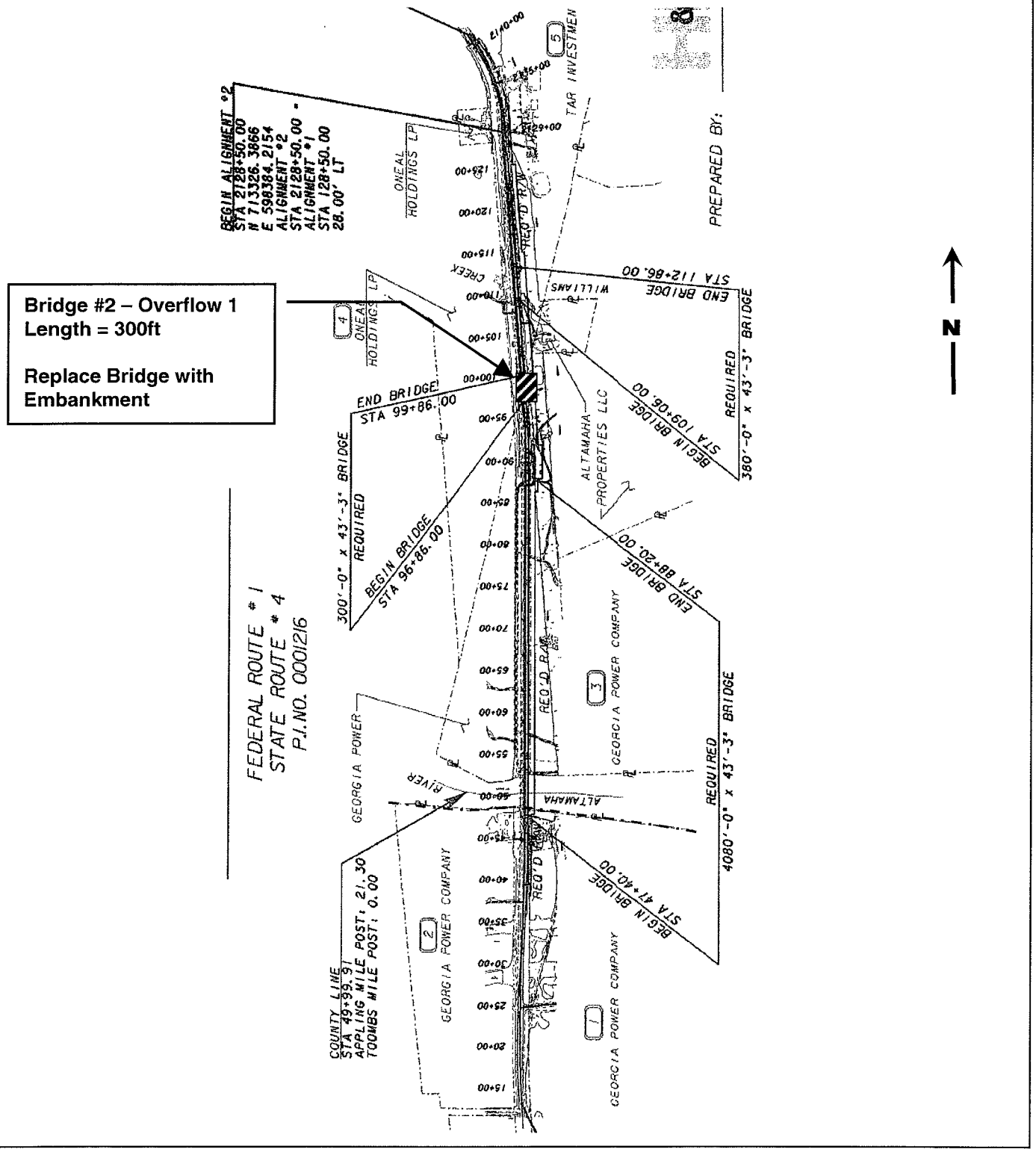
SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B2-4**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: **2 of 8**



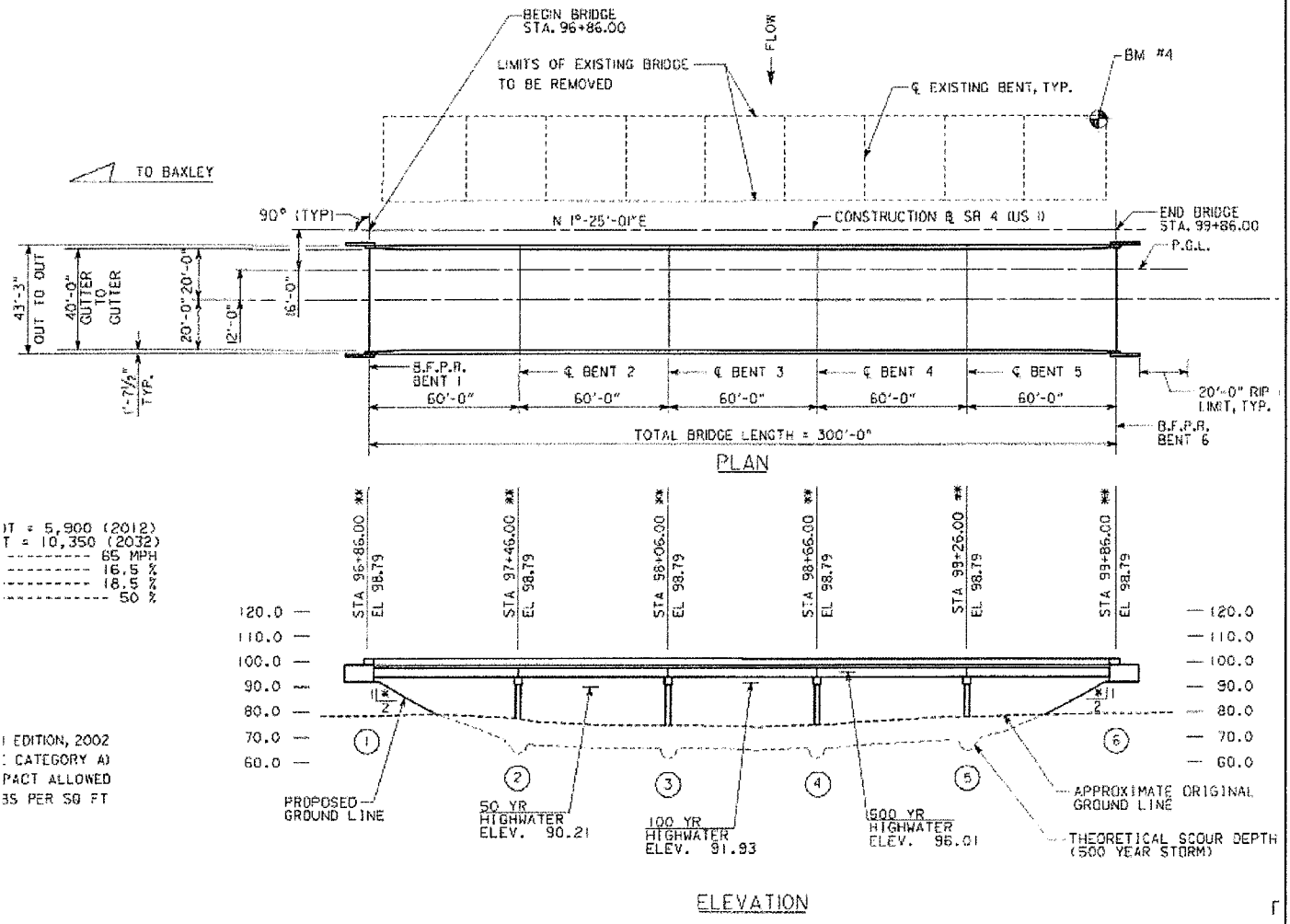
SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** ALTERNATIVE NO.: **B2-4**

BR000-0001-00(216) P.I. No. 0001216

Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: **3 of 8**



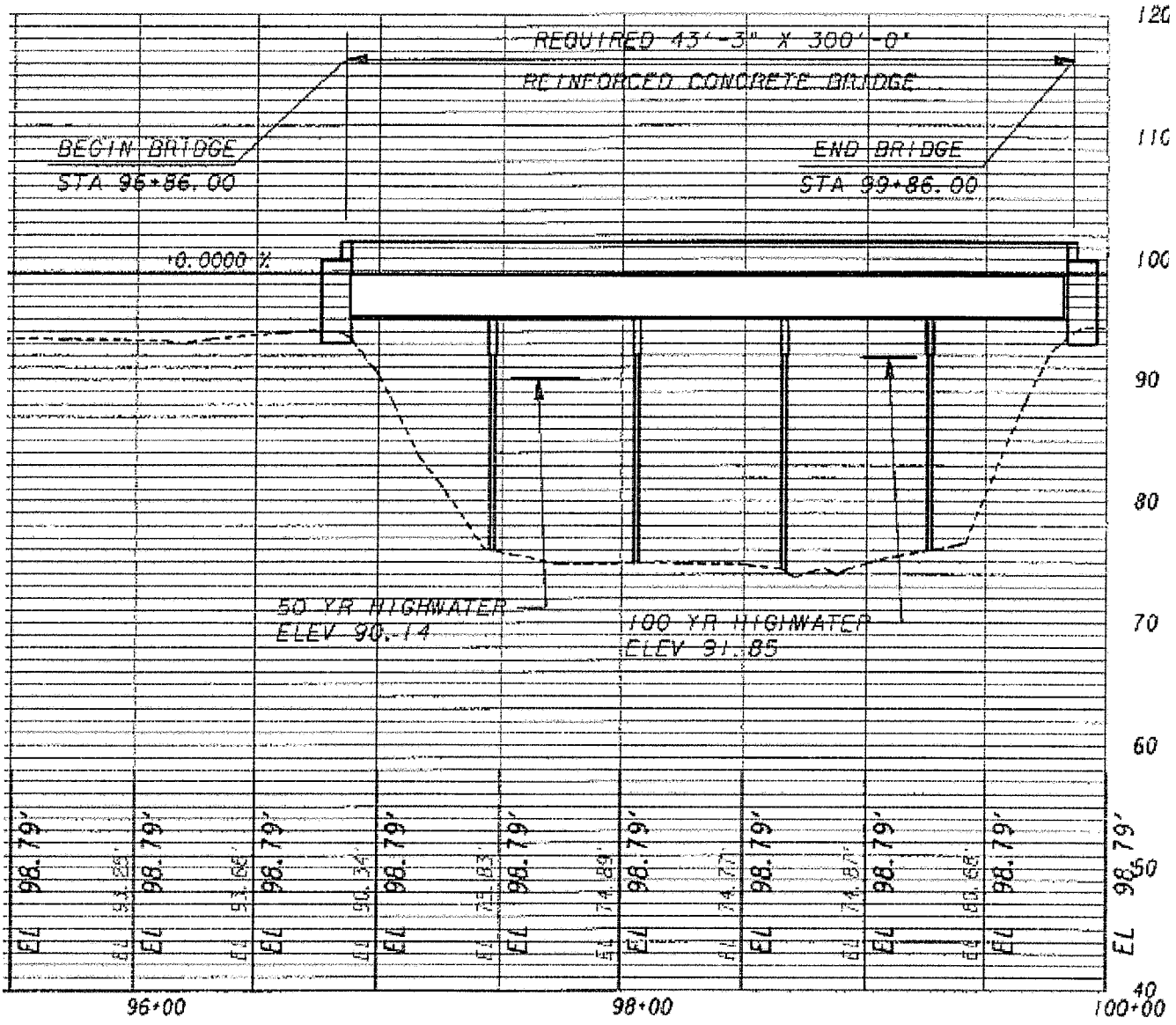
BRIDGE #2 (OVERFLOW #1)
PLAN & ELEVATION
(Length = 300ft)

SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B2-4**

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: **4 of 8**



BRIDGE #2 (OVERFLOW 1)
ELEVATION

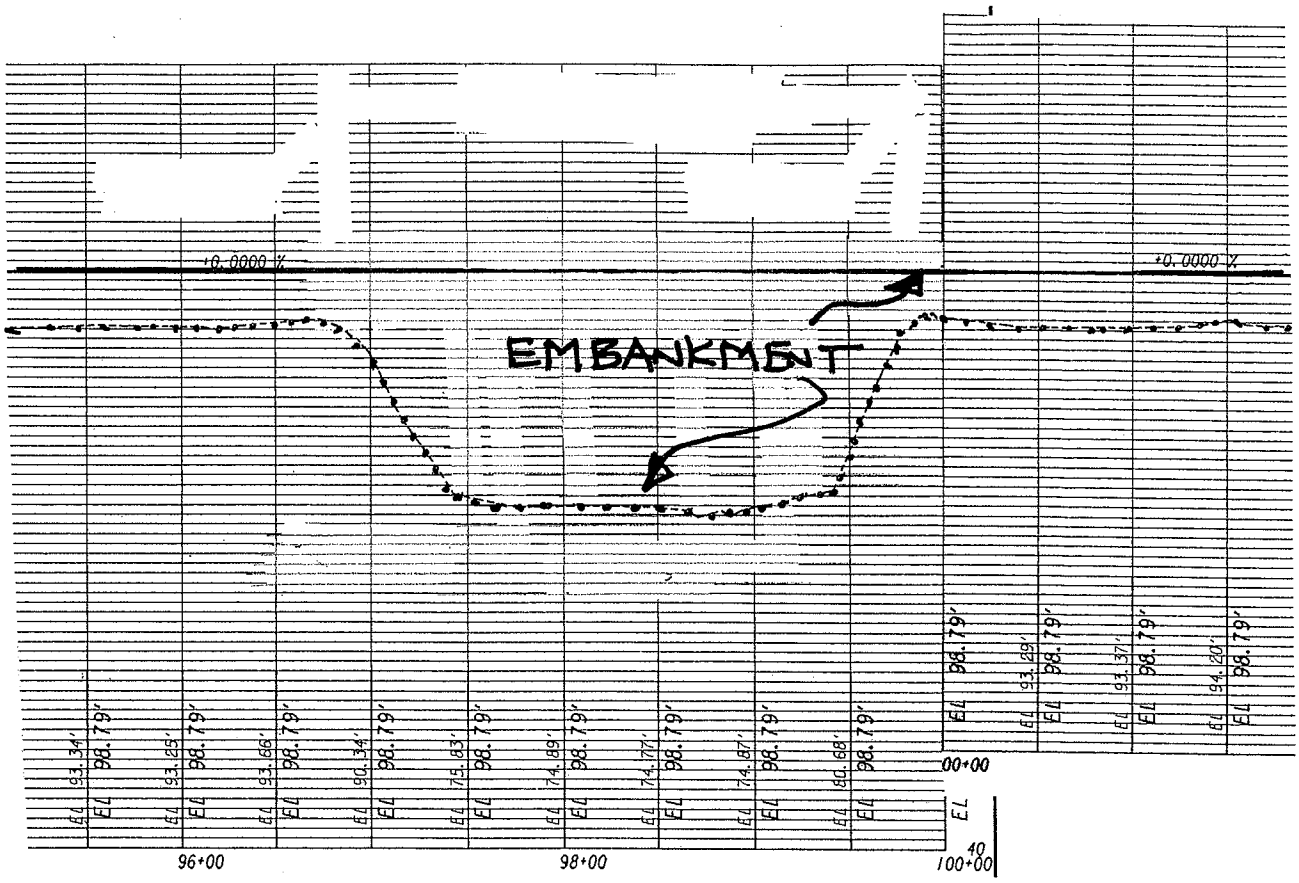
SKETCH

PROJECT: US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: B2-4

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 5 of 8



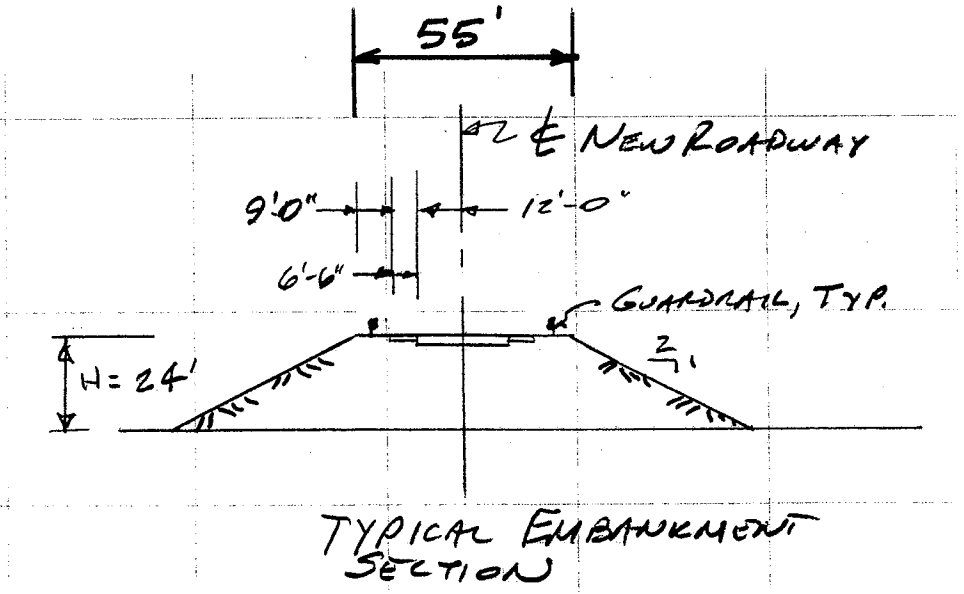
SKETCH

PROJECT: US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: B2-4

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 6 of 8



TYPICAL EMBANKMENT SECTION

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B2-4**

SHEET NO.: **7 of 8**

Original Design

Bridge area = (300ft long)(43.25ft wide) = 12,975 SF
Bridge unit cost = $80/SF

Alternative Design

Full-depth pavement area = (300ft)(24ft)/(9sf/sy) = 800 SY
Shoulder pavement area = 300(2)(6.5ft)/9sf/sy = 433 SY
Embankment width = 44ft+ 2(5.5ft) = 55ft at top (allowing for guardrail)
Embankment height = 98.79ft – 75ft = 23.79ft, Say 24ft
Embankment width at bottom = 55ft + 2(24ft)(2) = 151ft (assuming 2:1 slopes)
Embankment volume = 300ft(0.5)(55ft + 151ft)(24ft high)/27cf/CY = 27,500 CY
Guardrail length = 2(300ft) = 600 LF

Assumed Unit Costs
In-place Embankment: $4.39/CY
Guardrail: $15.01/LF

Full Depth Pavement Unit Cost ($/SY)

12.5mm:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
25mm:	440#/SY x Ton/2,000# x $53.04/Ton	=	$11.67/SY
12" GAB:	1ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton	=	$9.92/SY
	Total Pavement Unit Cost	=	**$33.14/SY**

Shoulder Pavement Unit Cost ($/SY)

12.5mm:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
6" GAB:	0.5ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton	=	$4.96/SY
	Total Shoulder Pavement Unit Cost	=	**$16.51/SY**

Environmental Mitigation
Mitigation area: use a factor of three acres for each acre disturbed
Area = 300ft (151ft)(3)/43560sf/ac = 3.12 AC
Right-of-way cost = $9,000/AC

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B2-4**

SHEET NO.: **8 of 8**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge Area	SF	12,975	80.00	1,038,000			
Full-depth Pavement	SY				800	33.14	26,512
Shoulder Pavement	SY				433	16.51	7,149
Type W Guardrail	LF				600	15.01	9,006
In-place Embankment	CY				27,500	4.39	120,725
Construction Subtotal				1,038,000			163,392
Construction Markup @ 10%				103,800			16,339
Construction Total				**1,141,800**			**179,731**
Right-of-way for mitigation	AC				3	9,000	28,080
Right-of-way markup @ 148%							41,558
Right-of-way Total							**69,638**
Subtotal				1,141,800			249,369
Markup (%) at Included							
TOTAL				1,141,800			249,369

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B3-1**

DESCRIPTION: **REDUCE THE BRIDGE GUTTER-TO-GUTTER WIDTH FROM 40 FT. TO 36 FT. BY USING 6-FT.-WIDE SHOULDERS IN LIEU OF 8-FT.-WIDE SHOULDERS**

SHEET NO.: **1 of 5**

ORIGINAL DESIGN: (sketch attached)

The original design for the 3,280-ft.-long bridge over Williams Creek is for a gutter-to gutter width of 40 ft., with an out-to-out width of 43 ft. 3 in. The typical section consists of two 12-ft.-wide travel lanes with 8-ft.-wide shoulders. The bridge begins at Station 109+06 and ends at Station 112+86.

ALTERNATIVE: (sketch attached)

Use a gutter-to-gutter width of 36 ft. with an out-to-out width of 39 ft. 3 in. The typical section would consist of two 12-ft.-wide travel lanes with 6-ft.-wide shoulders.

ADVANTAGES:

- Reduces construction material and labor requirements
- Less bridge deck to maintain

DISADVANTAGES:

- Reduces shoulder width

DISCUSSION:

The GDOT Bridge and Structures Design Policy Manual calls for gutter-to-gutter widths of 40 ft. for two-lane state routes with ADT over 2,000, and 36 ft. for multilane divided state routes with ADT over 2,000. While this route will have only two lanes when construction is finished, in the future it will be widened to a 4-lane section since this is a GRIP corridor. Since the bridges make up nearly half the length of this project, reducing the bridge width will greatly reduce construction material and labor requirements.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 361,570	$	$ 361,570
ALTERNATIVE	$ 328,130	$	$ 328,130
SAVINGS	$ 33,440	$	$ 33,440

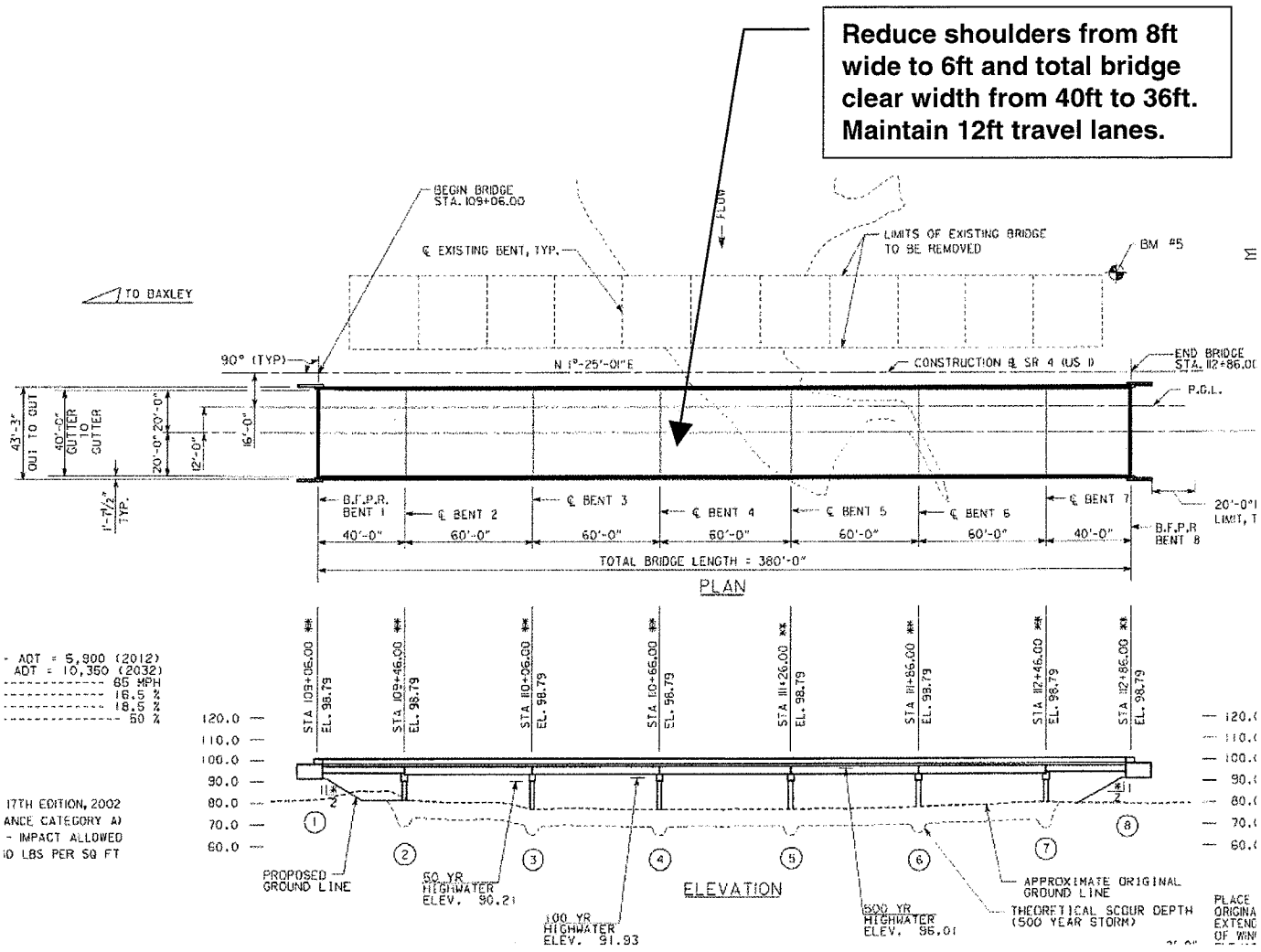
SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B3-1**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☐

SHEET NO.: **2 of 5**



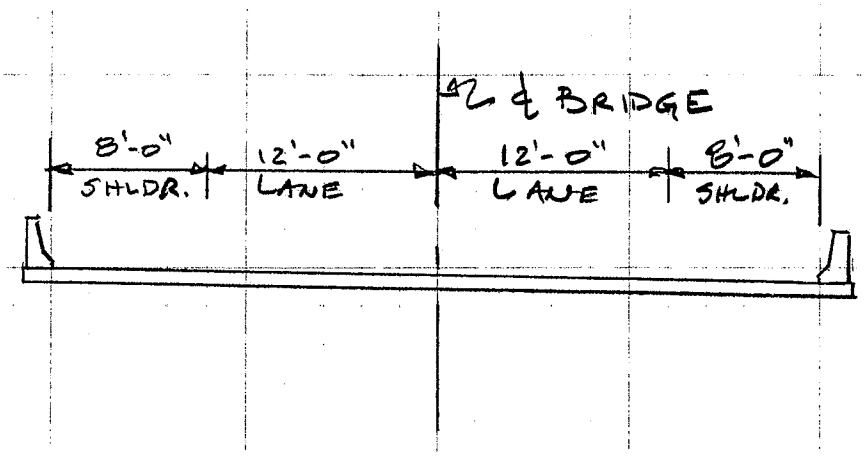
BRIDGE #3 (WILLIAMS CREEK)
PLAN & ELEVATION
(Length = 380ft)

SKETCH

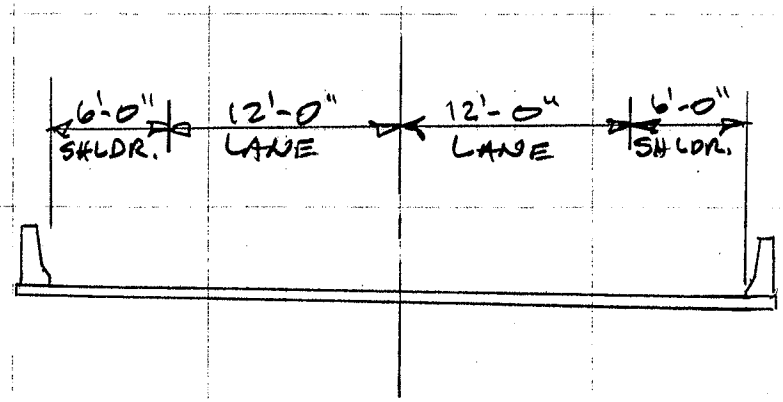
PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: B3-1

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: 3 of 5



ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐



SECTION

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B3-1**

SHEET NO.: **4 of 5**

Original Design:
40ft and 60ft Span Bridge Area = [5spans x (60ft) + 2spans x (40ft)](43.25ft wide) = 16,435 SF

Alternative Design:
40' and 60' Span Bridge Area = [5spans x (60ft) + 2spans x (40ft)](39.25ft wide) = 14,915 SF

Bridge unit cost:
Use $80/sf for total cost of 60ft long spans

This cost is for all components of the bridge. Since this reduction in width will not reduce the number of beams or substantially reduce the substructure required, use 25% of the bridge unit costs for this alternative.

Use $20/SF for savings in deck area on 60ft spans

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B3-1**

SHEET NO.: **5 of 5**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge Deck Area Reduction	SF	16,435	20.00	328,700	14,915	20.00	298,300
Subtotal				328,700			298,300
Markup (%) at 10%				32,870			29,830
TOTAL				361,570			328,130

VALUE ENGINEERING ALTERNATIVE

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B3-4**

DESCRIPTION: **RE-RUN THE HYDRAULICS PROGRAM TO EVALUATE THE POSSIBILITY OF ELIMINATING BRIDGE #3 AND REPLACING IT WITH AN EMBANKMENT SECTION**

SHEET NO.: **1 of 8**

ORIGINAL DESIGN: (sketch attached)

Bridge #3 over Williams Creek will be replaced with a new 380-ft.-long bridge using concrete piles and precast AASHTO beams. The bridge begins at Station 109+06 and ends at Station 112+86.

ALTERNATIVE: (sketch attached)

Re-run the hydraulics model and consider replacing the existing Bridge #3 with a roadway embankment section.

ADVANTAGES:

- Reduces construction duration
- Reduces construction material and labor requirements
- Less bridge to maintain

DISADVANTAGES:

- Likely increase in backwater
- Possibility of guide bank
- Additional hydraulic analysis

DISCUSSION:

The backwater at this site is 0.33 ft. (from the Hydraulic Study) and the allowable is 1.0 ft. While there is a tremendous amount of discharge at this site, only about 5% of the flow goes through this bridge for the 100-year flood. A quick evaluation to assess the backwater impact would validate whether an embankment section could be used in lieu of providing Bridge #3. It is possible that a guide bank would be needed since the flow going through this bridge would have to be directed to one of the remaining bridges.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 1,446,280	$	$ 1,446,280
ALTERNATIVE	$ 258,813	$	$ 258,813
SAVINGS	$ 1,187,467	$	$ 1,187,467

SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

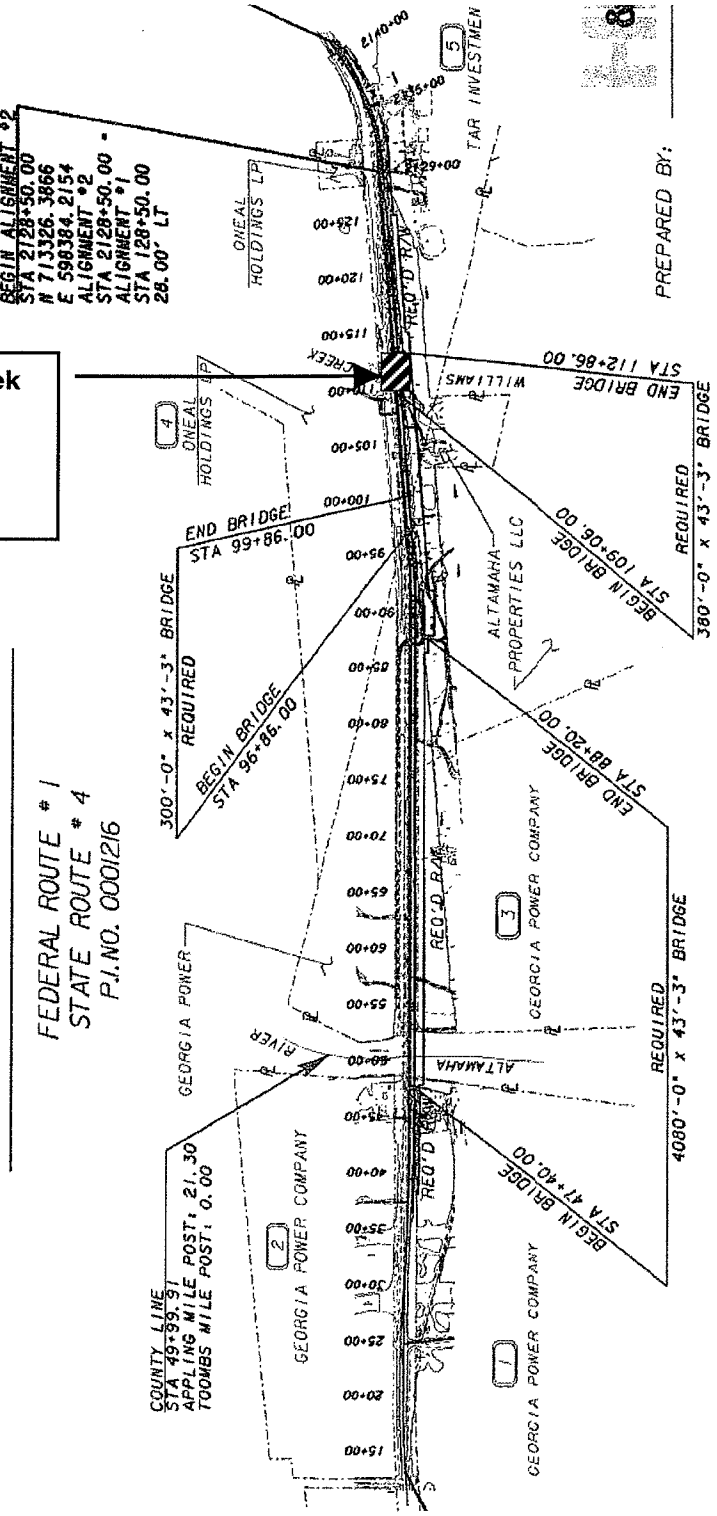
ALTERNATIVE NO.: **B3-4**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: **2 of 8**

Bridge #3 – Williams Creek
Length = 380ft

Replace Bridge with Embankment



SKETCH

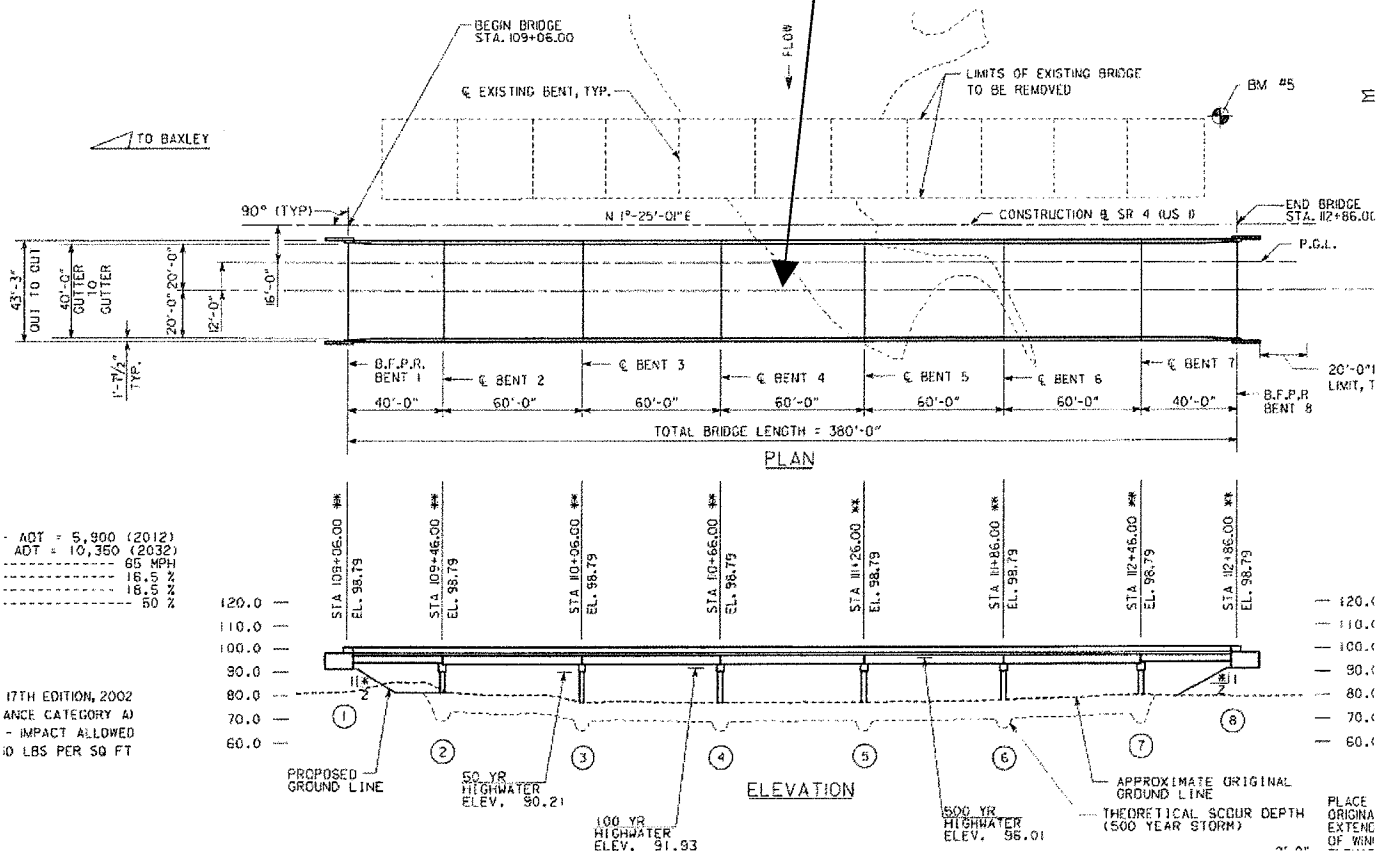
PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B3-4**

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☐ BOTH ☒

SHEET NO.: **3 of 8**

Eliminate Bridge #3 and replace with embankment section. Add environmental mitigation as necessary.



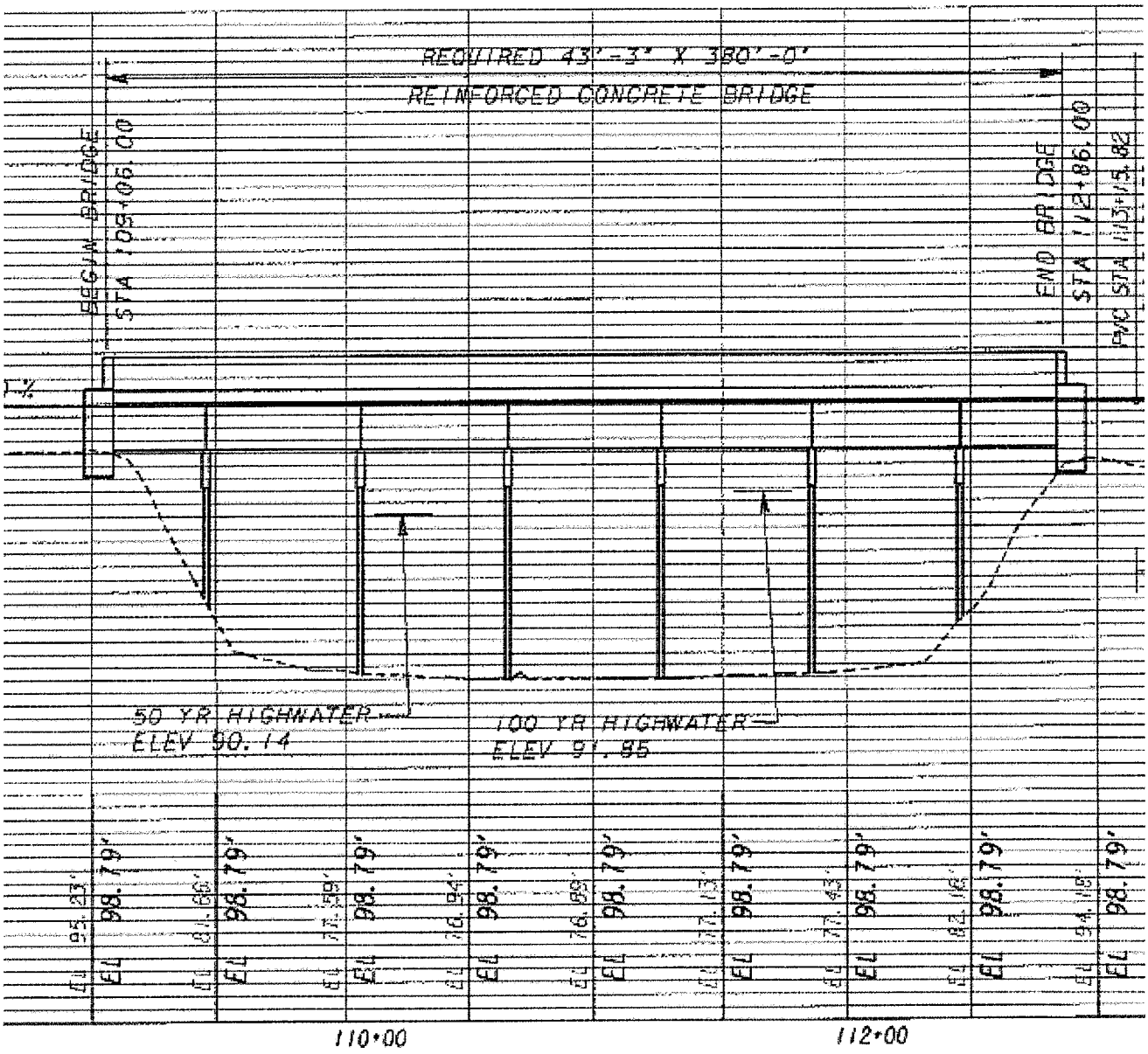
BRIDGE #3 (WILLIAMS CREEK)
PLAN & ELEVATION

SKETCH

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: **B3-4**

ORIGINAL DESIGN ☒ ALTERNATIVE DESIGN ☐ BOTH ☐ SHEET NO.: **4 of 8**



BRIDGE #3

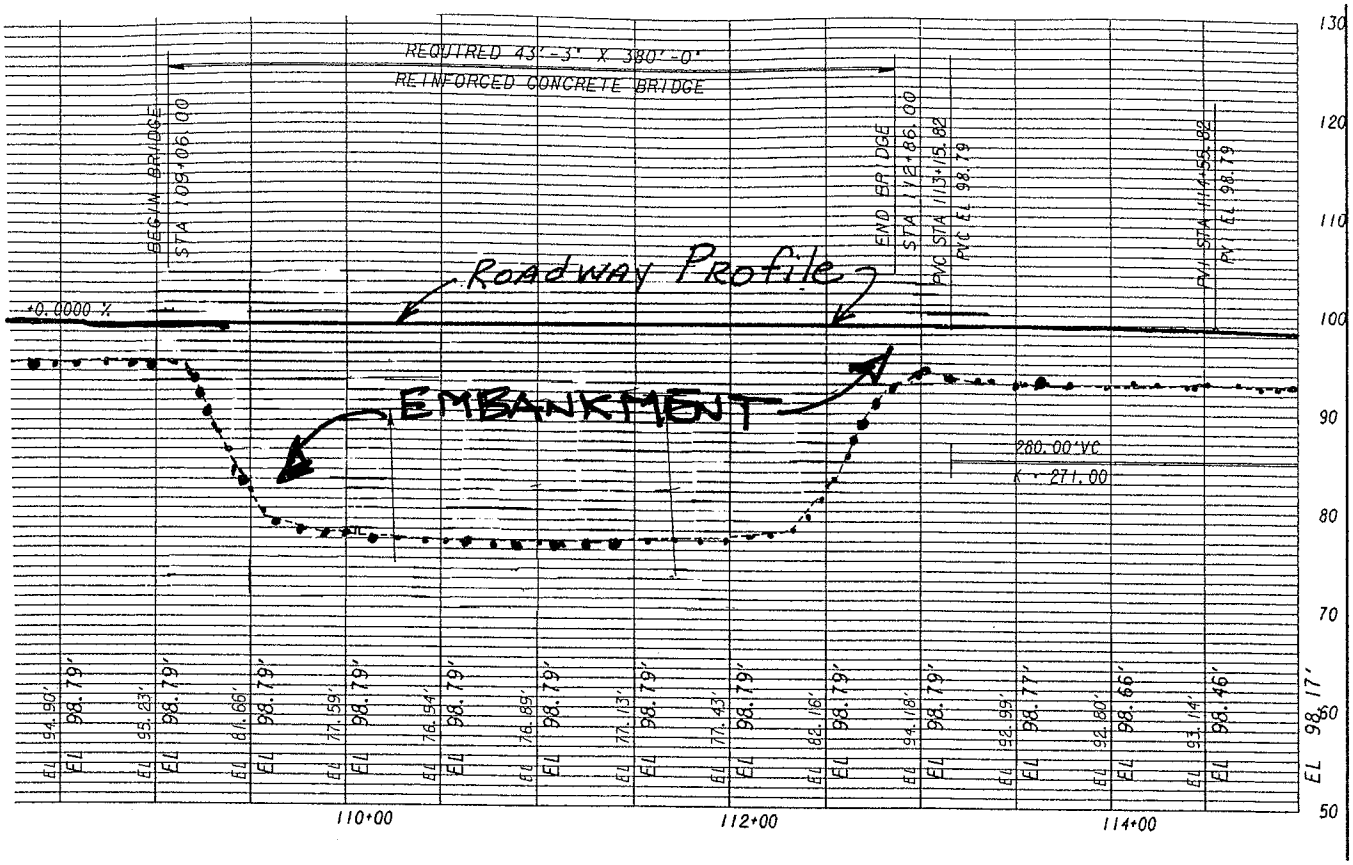
SKETCH

PROJECT: US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: B3-4

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 5 of 8



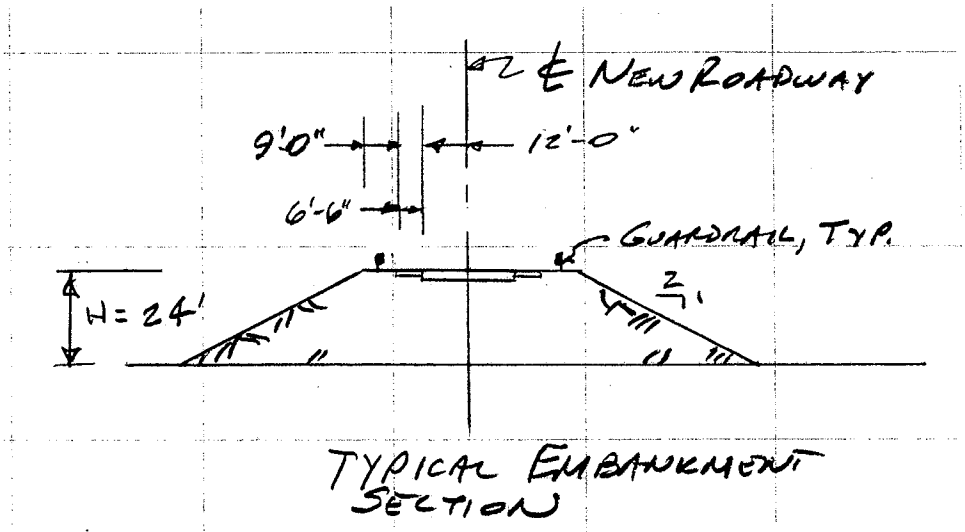
SKETCH

PROJECT: US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

ALTERNATIVE NO.: B3 - 4

ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☒ BOTH ☐

SHEET NO.: 6 of 8



TYPICAL EMBANKMENT SECTION

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B3-4**

SHEET NO.: **7 of 8**

Full Depth Pavement Area = (24' x 380') / 9sf/sy = 1,014 SY

Full Depth Pavement Unit Cost ($/SY):

12.5mm: 165#/SY x Ton/2,000# x $61.81/Ton = $5.10/SY

19mm: 220#/SY x Ton/2,000# x $58.67/Ton = $6.45/SY

25mm: 440#/SY x Ton/2,000# x $53.04/Ton = $11.67/SY

12" GAB: 1ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton = $9.92/SY

Total Pavement Unit Cost = $33.14/SY

Shoulder Pavement Area = (13' x 380') / 9sf/sy = 549 SY

Shoulder Pavement Unit Cost ($/SY):

12.5mm: 165#/SY x Ton/2,000# x $61.81/Ton = $5.10/SY

19mm: 220#/SY x Ton/2,000# x $58.67/Ton = $6.45/SY

6" GAB: 0.5ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton = $4.96/SY

Total Shoulder Pavement Unit Cost = $16.51/SY

Earthwork Embankment:

(380' x 24' x 104') / 27cy/cy = 35,130 CY

Guardrail = 2 sides x 380' = 760'

Bridge No. 3
Original Design:
40' and 60' Span Bridge Area = [5(60) + 2(40)](43.25) = 16,435 SF

Bridge cost:
$80/SF

Mitigation area = (152' x 380') / 43,560 sf/ac = 1.33 AC

COST WORKSHEET

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering

ALTERNATIVE NO.: **B3-4**

SHEET NO.: **8 of 8**

PROJECT ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Full depth Pavement	SY				1,014	33.14	33,604
Shoulder pavement (Thin section)	SY				549	16.51	9,064
W beam Guardrail	LF				760	15.01	11,408
Earthwork Embankment	CY				35,130	4.39	154,221
Mitigation Area					1.33	9,000.00	11,970
Bridge #3							
Bridge Area	SF	16,435	80.00	$1,314,800			
R/W Subtotal							11,970
R/W Markup 148%					1.48	11,970.00	17,716
Constrution Subtotal				$1,314,800			208,297
Constr Mkup 10%				$131,480			20,830
TOTAL				$1,446,280			258,813

PROJECT DESCRIPTION

Bridge project BR000-0001-00(216) is located in south Georgia, approximately 80 miles west of Savannah, and will replace the functionally inadequate bridges on US 1/SR4 over Altamaha River, Overflow 1 and Williams Creek. The project site is located approximately 10 miles north of the City of Baxley in Appling and Toombs Counties. See Figure 1: Site Map. The project begins at mile post 20.6 in Appling County and ends at mile post 1.8 in Toombs County, for a total project length of 2.5 miles. The existing roadway section south of the Altamaha River is 4 lanes, transitioning to 2 lanes from the Altamaha River north. The approved concept for BR-0001-00(216) in Appling and Toombs Counties proposes to replace and demolish the existing bridges over the Altamaha River, Altamaha River Overflow, and Williams Creek. Existing right of way along US 1/SR 4 varies from 184 feet to 253 feet. The speed is 65 mph, and access would be by permit except for the new location where access would be partially controlled. See Figure 3: Project Alignment, and Figure 4: Typical Section.

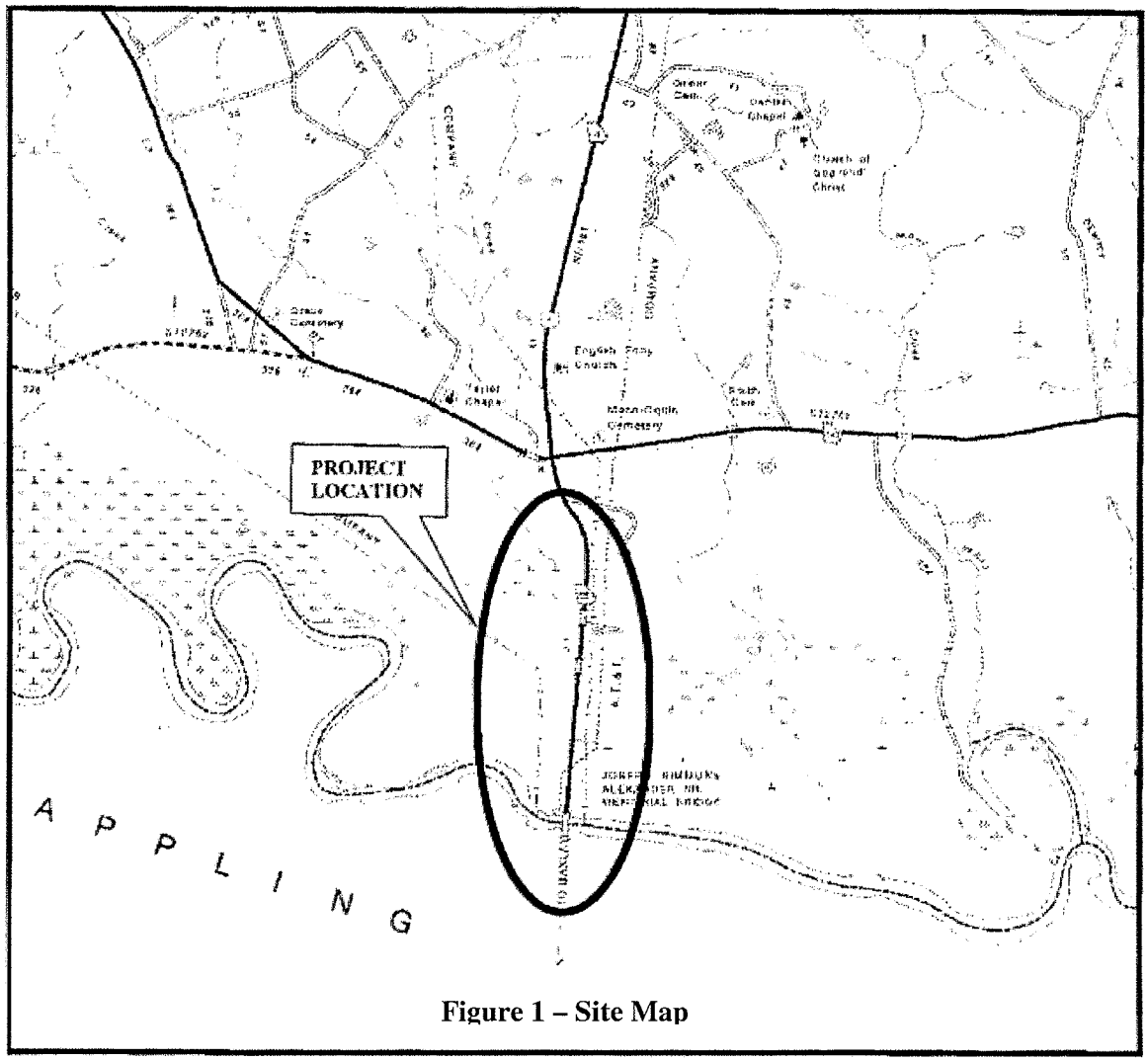


Figure 1 – Site Map

Bridge Condition

The bridge sufficiency ratings for the Altamaha River, Overflow 1 and Williams Creek bridges are 32.50, 42.45, and 42.45 respectively. The condition of the Altamaha River Bridge and the fact that it is a pin and hanger type bridge are the driving forces for replacement on this project. The Overflow 1 and Williams Creek bridges qualify for replacement due to the bridges proximity to the Altamaha River Bridge and their sufficiency ratings being less than 50. Replacing these bridges will bring them up to current design standards reduce the potential for accidents within this section of US 1/SR 4. The prominent types of accidents along US 1/SR 4 in the vicinity of the project are not accidents with other vehicles, but more typically with local deer. Approximately 0.7 miles of the project is in Appling County and approximately 1.7 miles is in Toombs County. See Figure 2: Project Summary.

Figure 2 – Project Summary

US 1 / SR 4D BRIDGE REPLACEMENT OVER ALTAMAHA RIVER
BR000-0001-00-00(216) - P.I. NO. 0001216, APPLING & TOOMBS COUNTIES

Length of Project

Recapitulation	Miles		
	Appling Co.	Toombs Co.	Total
Net Length of Roadway	0.651	0.885	1.503
Net Length of Bridges	0.049	0.853	0.934
Net Length of Project	0.700	1.737	2.437
Net Length of Exceptions	0.000	0.000	0.000
Gross Length of Project	0.700	1.737	2.437

Need and Purpose

The need and purpose of the proposed improvements is to replace the three functionally and structurally obsolete bridges on US 1/SR 4 over Altamaha River, Overflow 1, and Williams Creek. The low bridge ratings reflect both structural deficiencies and function issues such as inadequate shoulders. Traffic analysis for the current year (2008) show AADT's of 5500 and design year (2028) of 8,000. Updated projections reveal current year AADT's (2012) of 5,900 with design year (2032) of 10,350.

Bridge Design Elements

Three bridges are included in this project, Altamaha River Bridge – 4,080 ft., Overflow 1 Bridge – 300 ft., and Williams Creek Bridge – 380 ft. Each bridge is designed for two 12-ft.-wide traffic lanes with 10-ft.-wide shoulders on each side. The truck counts for the corridor are relatively high with values in the range of 17%. The new bridge decks are being designed for 40 ft. wide, gutter-to-gutter, and use AASHTO girders supported by precast concrete friction piles. Span lengths vary from section to section depending upon locations and range from the river. Geotechnical conditions in the area have been surveyed and competent soils are generally found 20 to 25 ft. below the ground surface. Some over excavation of water bearing organics and muck may be required in specific locations.

Project Cost and Schedule

This project has a total estimated construction cost of $14.2M, plus right-of-way and utilities, and was originally scheduled for the construction in FY 2011, but is currently pending funding. The following are the total program costs for the project.

Construction including contingencies:	$13,766,226
Fuel Adjustment:	$500,187
Right-of-Way:	$612,000

Utilities (reimbursable):	$330,000
Utility Contingencies:	$99,000

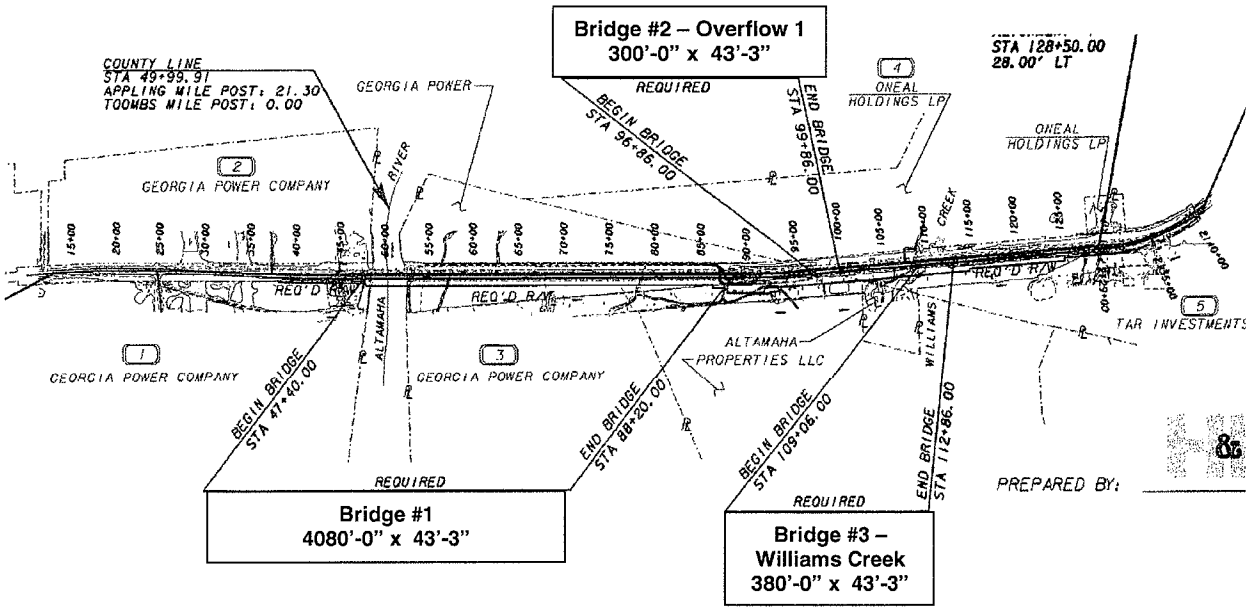


FIGURE 3: PROJECT ALIGNMENT

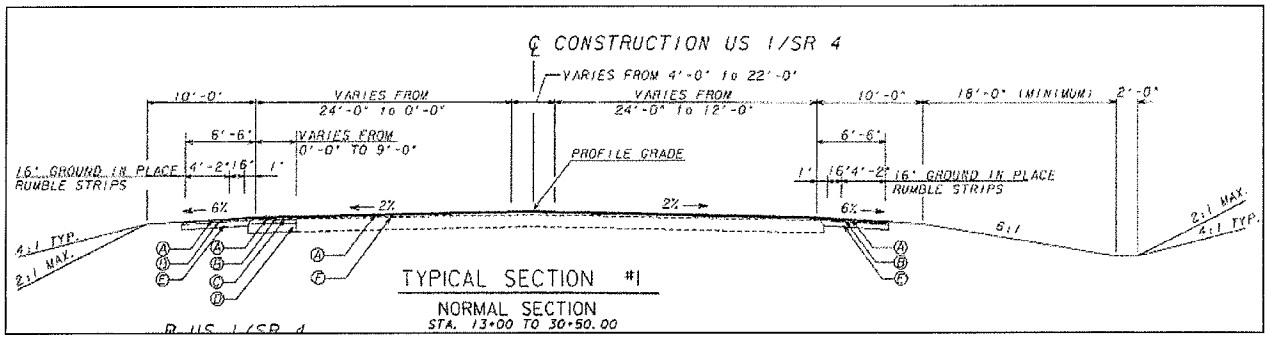
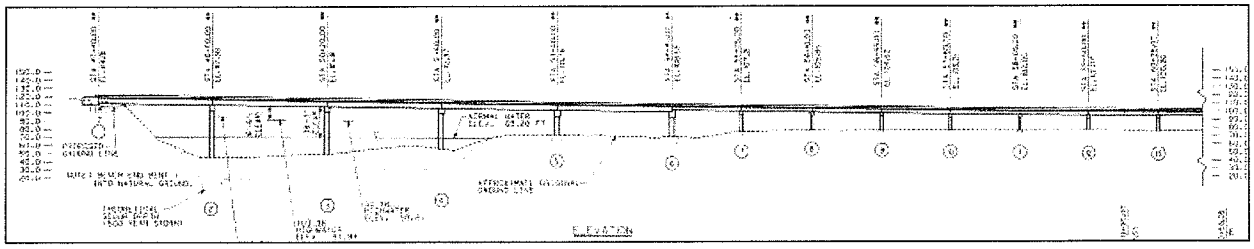


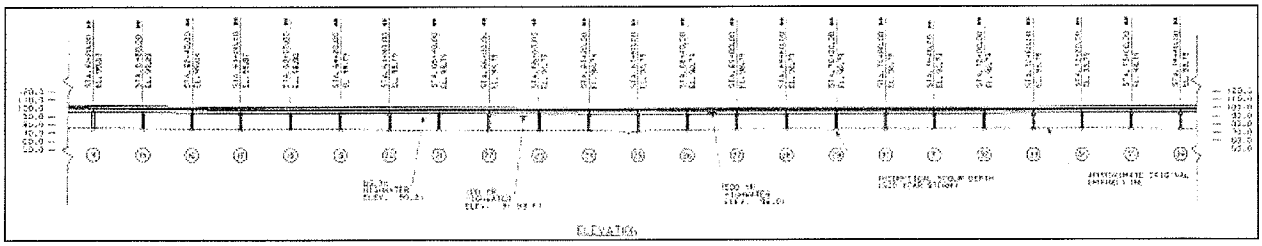
FIGURE 4: TYPICAL SECTION

The following details and exhibits are from the project submittal dated January 20, 2010, prepared by Heath & Lineback.

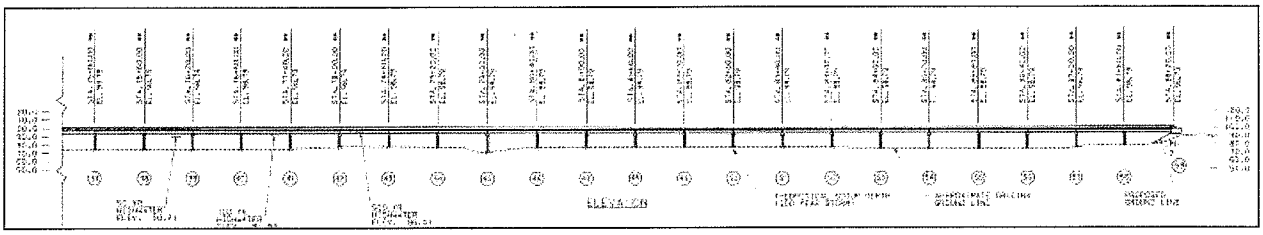
BRIDGE #1 – ALTAMAHA RIVER



BRIDGE #1 – PROFILE



BRIDGE #1 – (Cont.)



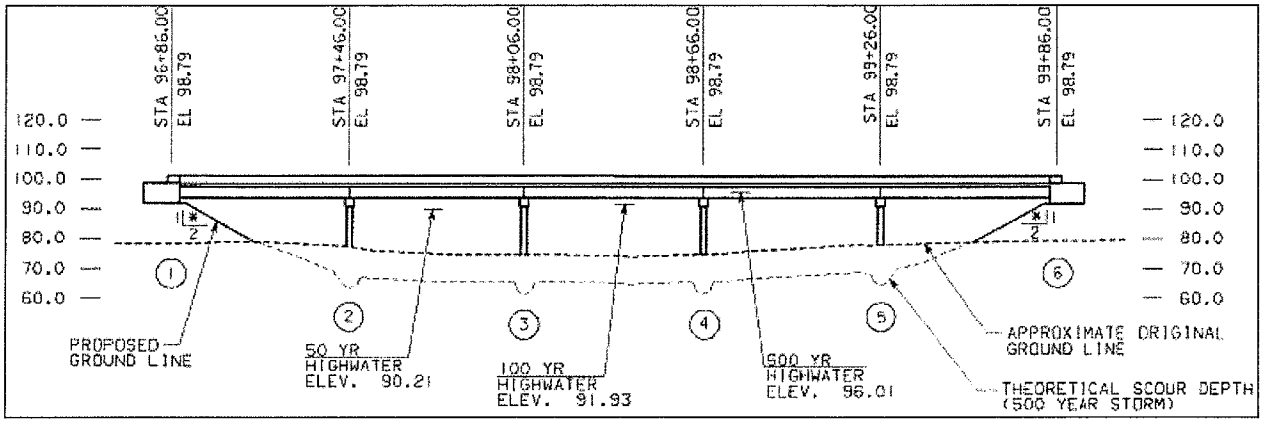
BRIDGE #1 – (Cont.)

PROPOSED BRIDGE CONSISTS OF

5	- 140'-0" BULB TEE, 74", PSC BEAM SPANS	SPECIAL DESIGN
8	- 85'-0" TYPE III PSC BEAM SPANS	SPECIAL DESIGN
45	- 60'-0" TYPE II PSC BEAM SPANS	SPECIAL DESIGN
2	- PSC PILE END BENTS	SPECIAL DESIGN
44	- PSC PILE INTERMEDIATE BENTS	SPECIAL DESIGN
13	- CONCRETE INTERMEDIATE BENTS	SPECIAL DESIGN
24" TYPE I RIPRAP		

BRIDGE #1 - STRUCTURAL DESIGN ELEMENTS
Altamaha River Bridge (Length: 4,080 ft.)

BRIDGE #2 – OVERFLOW 1



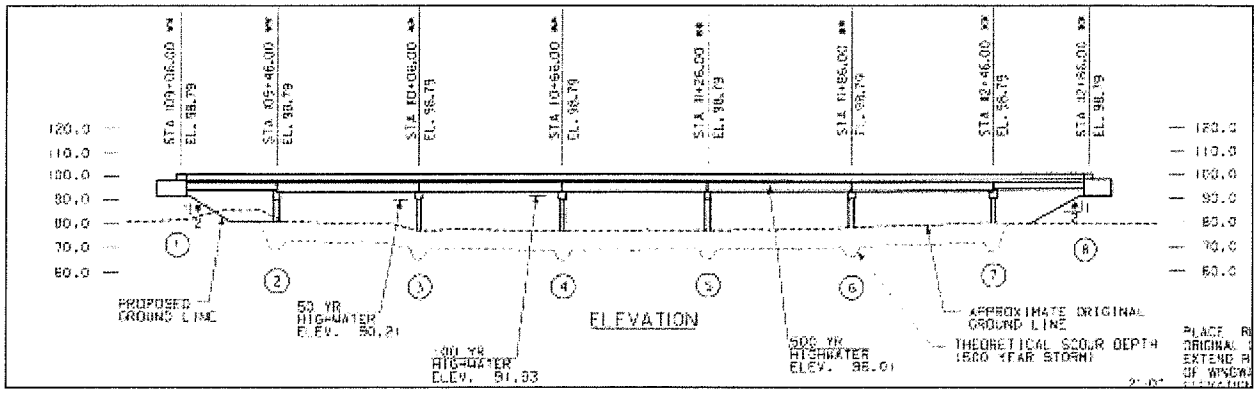
BRIDGE #2 - PROFILE

PROPOSED BRIDGE CONSISTS OF

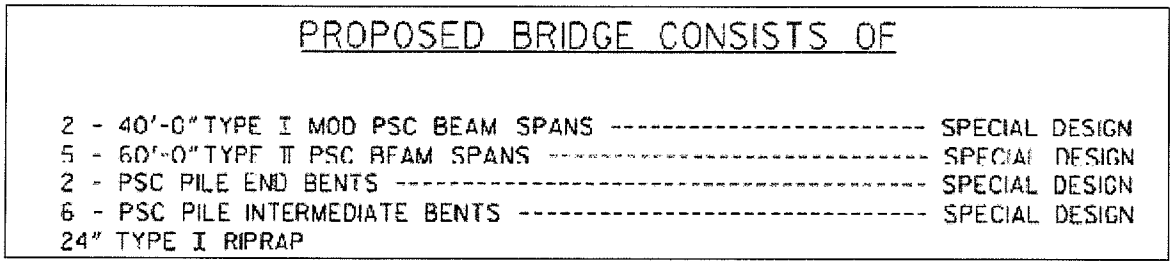
5 - 60'-0" TYPE II PSC BEAM SPANS	SPECIAL DESIGN
2 - PSC PILE END BENTS	SPECIAL DESIGN
4 - PSC PILE INTERMEDIATE BENTS	SPECIAL DESIGN
24" TYPE I RIPRAP	

BRIDGE #2 STRUCTURAL DESIGN ELEMENTS
(Overflow #1) Length: 300 ft.)

BRIDGE #3 – WILLIAMS CREEK



BRIDGE #3 - PROFILE



BRIDGE #3 – STRUCTURAL DESIGN ELEMENTS
(Williams Creek Bridge) (Length: 380 ft.)

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis (VA) procedure used during the VE study conducted for GDOT by Lewis & Zimmerman Associates, Inc. on the US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow #1, and Williams Creek, project in Appling and Toombs Counties. The workshop was performed at the preliminary design completion stage as developed by Heath & Lineback Engineers Incorporated. GDOT has provided information for the VE team to use as the basis of the study.

A systematic approach was used in the VE study, which was divided into three parts: (1) Preparation Effort, (2) Workshop Effort, and (3) Post-Workshop Effort. A task flow diagram outlining each of the procedures included in the VE study is attached for reference.

Following this description of the VA procedure, separate narratives and supporting documentation identify the following:

- VE workshop participants
- Economic data
- Cost model
- Function analysis
- Creative ideas and evaluations

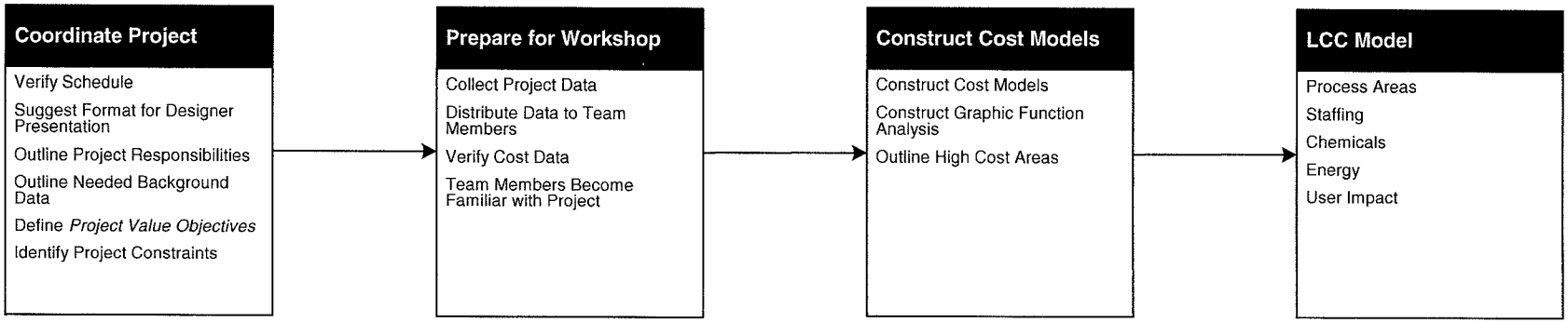
PREPARATION EFFORT

Preparation for the workshop consisted of scheduling workshop participants and tasks and gathering necessary project documents for team members to review before attending the workshop. Documents such as those listed below were used as the basis for generating VE alternatives and for determining the cost implications of the selected VE alternatives:

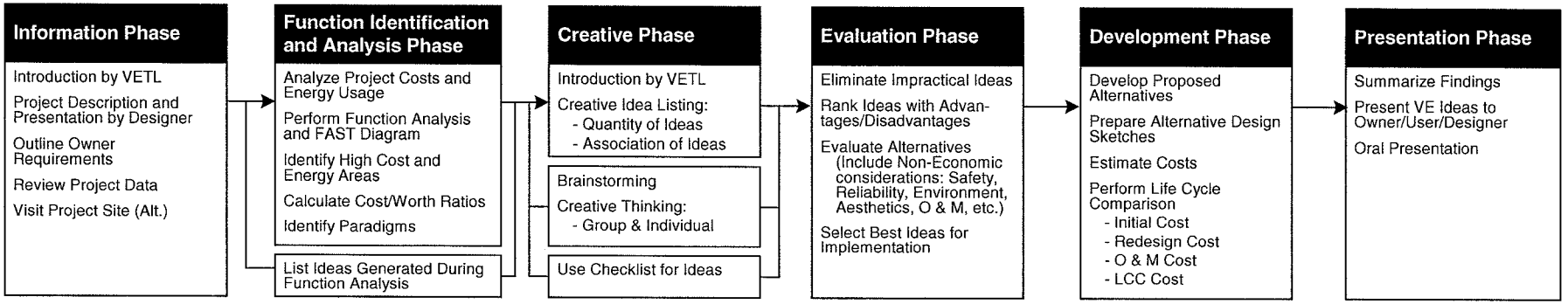
- US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow 1, and Williams Creek, BR000-0001-0001-00(216), P.I. No. 0001216, Preliminary Design Drawings, dated December 8, 2009, prepared by Heath & Lineback Engineers Incorporated
- Pavement Evaluation Summary - US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow 1, and Williams Creek, BR000-0001-0001-00(216), P.I. No. 0001216 - , dated January 25, 2010, prepared by United Consulting
- Revised Concept Report - US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow 1, and Williams Creek, BR000-0001-0001-00(216), P.I. No. 0001216 - , dated January 11, 2010 prepared by GDOT
- Project Cost Estimate - US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow 1, and Williams Creek, BR000-0001-0001-00(216), P.I. No. 0001216 - , dated October 29, 2009, prepared by GDOT

Value Engineering Study Task Flow Diagram

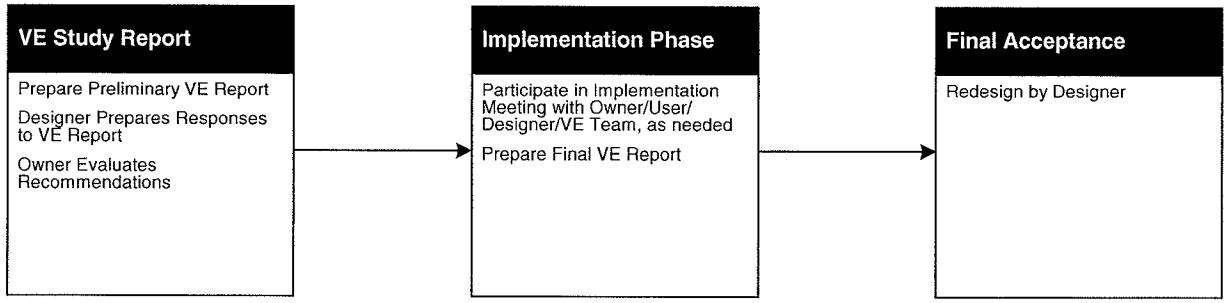
Preparation Effort



Workshop Effort



Post-Workshop Effort



- Soil Survey Report - US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow 1, and Williams Creek, BR000-0001-0001-00(216), P.I. No. 0001216 - , dated 2004, prepared by Willmer Engineering, Inc.
- Existing Bridge Plans – Altamaha River Bridge, dated 1969, prepared by GDOT
- Existing Bridge Plans – Overflow #1 Bridge, dated 1945, prepared by GDOT

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 is very important as it provides the VE team with insight about how the project has progressed to its current state.

Project cost information provided by the designers is used by the VE team as the basis for a comparative analysis with similar projects. To prepare for this exercise, the VE team leader used the Estimate Report for file "BR000-0001-00(216)_2009-10-29", prepared by GDOT, dated January 2010 to develop a cost models for the project. The model was used to distribute the total project cost among the various elements of the project. The VE team used this model to identify the high-cost elements that drive the project and the element providing little or no value so that the team could focus on reducing or eliminating their impact.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three and one-half-day effort beginning with an orientation/kickoff meeting on Monday, February 8, 2010, and concluding with the final VE Presentation on Thursday, February 11, 2010. During the workshop, the VE Job Plan was followed in compliance with the U.S. Federal Highway Administration guidelines for conducting a VE study. The Job Plan guided the search for alternatives to mitigate or eliminate high-cost drivers, secondary functions providing little or no value, and potential project risks. Alternatives to specifically address the owner's project concerns and enhance value by improving operations, reducing maintenance requirements, enhancing constructability, and providing missing functions were also considered. The Job Plan includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative/Speculation Phase
- Evaluation of Creative Ideas Phase
- Alternative Development Phase
- Presentation Phase

Information Phase

At the beginning of the study, the decisions that have influenced the project's design and proposed construction methods have to be reviewed and understood. For this reason, the workshop began with a presentation of the project by GDOT and the designers to the VE team. The presentation highlighted the information provided in the documentation reviewed by the VE team before the workshop and expanded on it 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 clarification about the information provided.

Function Identification and Analysis Phase

Having gained some information on the project, the VE team proceeded to define the functions provided by the project, 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 see if the expenditures actually perform the requirements of the project or if there are disproportionate amounts of money spent on support functions. Elements performing support functions add cost to the project but have a relatively low worth to the basic function.

Function is defined as the intended use of a physical or process element. The team attempted to identify functions in the simplest manner using measurable noun/verb word combinations. 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) of the major components of the project depicted on the cost models were identified.

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. The goal of the next job phase is to reduce the impact of secondary functions and thereby enhance project value.

To further clarify the impact of the various functions, the team assigned costs to provide the functions or group of functions indicated by a specific project element using the cost estimate and cost models. Where possible, they seek to find the lowest cost, or worth, to perform the function. This is accomplished 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 one 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 models previously prepared 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 also 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/Speculation 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 and using the classic brainstorming technique, the VE team began to generate 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 constructability 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. A Creative Idea Listing worksheet was generated and organized by the function or project element being addressed.

GDOT 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 Phase

Since the goal of the Creative/Speculation Phase was to conceive as many ideas as possible without regard for technical merit or applicability to the project goals, the Evaluation Phase focused on identifying those ideas that do 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 the VE team evaluating the ideas originated during the Creative/Speculation Phase based on GDOT's value objectives identified through conversations during the opening presentation. 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. 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 5, with 5 or 4 indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project, 3 indicating an idea that provides marginal value but could be used if the project was having budget problems, 2 indicating an idea with a major technical flaw, and 1 indicating an idea that does not respond to project requirements. Generally, ideas rated 4 and 5 are pursued in the next phase and presented to the owner 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 constructability, 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 VE alternative. The development consisted 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 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 VE 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. They too are included in the Study Results section.

Presentation Phase

The goals of the last phase of the workshop were to summarize the results of the study, to prepare draft Summary of Potential Cost Savings worksheets to hand out at the presentation, and to present the key VE alternatives to GDOT and the Heath & Lineback design team. The presentation was held on Thursday, February 11, 2010, at the GDOT Headquarters office in Atlanta, Georgia. The purpose of the 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 to the owner and design team to facilitate a timely review and speedy implementation of the selected ideas.

POST-WORKSHOP EFFORT

The post-workshop portion of the VE study consisted of the preparation of this VE Study Report. Personnel from GDOT will analyze each alternative and prepare a 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, GDOT will decide which alternatives to implement.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will facilitate a 30-hour value engineering (VE) study on the Preliminary Engineering Submittal for the **US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow 1 and Williams Creek, BR000-0001-00(216), P.I. No. 0001216**, Appling and Toombs Counties, Georgia. The project consists of multiple segments and P.I. numbers as presented below. The Georgia Department of Transportation (GDOT) project management and consultant design team will be available to formally present the project at the beginning of the workshop; attend a presentation of the VE alternatives at the conclusion of the VE study; and be available to answer questions during the VE study effort.

The VE study will follow the outline described below and be conducted February 8 - 11, 2010 at the offices of:

GDOT
600 West Peachtree Street
5th Floor, Engineering Services Conference Room (5CR1L2)
Atlanta, Georgia 30308

The point-of-contact is Ms. Lisa Myers, GDOT Value Engineering Coordinator, who may be reached at 404-631-1770, or Matt Sanders, AVS, GDOT Value Engineering Specialist, 404-631-1752.

PROJECT DATA

Project #	P.I. No.	Description
BR000-0001-00(216)	0001216	US 1 / SR 4 Bridge Replacement over Altamaha River, Overflow 1, and Williams Creek
Roadways	1.503 mi	
Bridges	0.934 mi	
Gross Length of Project	2.437 mi	

VE STUDY AGENDA

Monday, February 8, 2010

8:00 am - 9:00 am **VE Team Members Arrive and Review Documents**

9:00 am – 11:00 am **Owner's/Designer's Presentation - *(5th Fl. Engr. Services Conf. Rm)***

The Heath & Lineback Engineer, Inc. design team will present information concerning the project including, but not limited to: the Purpose and Need for the project, rationale for design; criteria for specific areas of study, project constraints and the reasons for design decisions.

11:00 am – 12:00 noon **VE Team Reviews Project Documents**

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

1:00 pm - 2:00 pm **Information Phase**

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

2:00 pm – 3:00 pm **Function Analysis**

The team will identify all project functions required to meet the established purpose and need. Functions will be identified as to basic, required secondary, secondary, or project goals.

3:00 pm - 5:00 pm **Speculation Phase**

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

Tuesday, February 9, 2010

8:00 am - 10:00 am **Speculation Phase (cont.)**

The VE team will continue the brainstorming exercise to capture ideas to improve the project in terms of initial and life cycle cost, technical aspects, schedule, and constructibility issues.

10:00 am – 12:00 noon **Analysis Phase**

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

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

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

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

Wednesday, February 10, 2010

8:00 am – 12:00 noon	**Development Phase (cont.)**
12:00 noon - 1:00 pm	**Lunch**
1:00 pm - 5:00 pm	**Development Phase (cont.)**

Upon completion of the Development Phase, the VE team leader will prepare the summary worksheets based on the alternatives developed by the VE team. The summary worksheets form the basis of the informal oral presentation to be made to GDOT, local representatives, and the Heath & Lineback design team representatives. The team will review all documentation and prepare for the presentation.

Thursday, February 11, 2010

8:00 am - 9:00 am	**Development Phase and Preparation for Presentation**
9:00 am – 12:00 noon	**Presentation Phase – *(5th Fl. Engr. Services Conf. Rm)***

Upon completion of the Development Phase, the VE team leader will prepare the summary worksheets based on the alternatives developed by the VE team. The summary worksheets form the basis of the informal oral presentation to be made to GDOT, local representatives, and the design team representatives. The team will review all documentation and prepare for the presentation.

Noon - Adjourn

POST-STUDY PHASE

Upon completion of the value engineering study, the VE team leader will prepare the Value Engineering Study Report and submit it to GDOT. The report will include the following material:

- Project description and design concept of project
- Cost models and graphic function analysis worksheets
- Value engineering alternatives: original design and proposed alternatives, including sketches, design calculations and initial and life cycle estimates
- Potential contract savings (capital construction and life cycle costs)

The GDOT design team will independently review the VE alternatives and classify them as accepted, accepted with modifications, needs further study, or rejected—accompanied by the reasons for rejection. A meeting with all stakeholders will then be convened to decide which VE alternatives to implement.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the unique project elements involved with the Altamaha River Bridge replacement project. The multidisciplinary team comprised professionals with highway design and construction experience and a working knowledge of VE procedures. The following lists the VE team members:

Participant	Specialization	Affiliation
Joe Leoni, PE	Highway Design	ARCADIS US, Inc.
John Tiernan, PE	Bridge Engineer	ARCADIS US, Inc
Paresh J. Parikh, PE	Constructability	Delon Hampton Associates
David Hamilton, PE, CVS, CCE	VE Team Leader/Civil	Lewis & Zimmerman Associates

DESIGNER'S PRESENTATION

An overview of the project was presented on Monday, February 8, 2010, by representatives from GDOT and the Heath & Lineback design consultant team. The purpose of this meeting, in addition to being an integral part of the Information 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 team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention. An attendance list for the meeting is attached.

VALUE ENGINEERING TEAM'S PRESENTATION

A VE presentation was conducted by the VE team on Thursday, February 11, 2010 at the GDOT Headquarters office in Atlanta, Georgia to review VE alternatives with the owner and representatives from the design team. Copies of the Draft Summary of Potential Cost Savings worksheet were provided to the attendees. Attendees checked off their names on the attendance list from the opening presentation.

VE STUDY SIGN-IN SHEET

Project No.: BR000-0001-00(216) County: Appling/Toombs PI No.: 0001216 Date: Feb. 8-11, 2010

1	4	NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
✓	✓	Lisa L. Myers	00244168	Engineering Services	404-631-1770	lmyers@dot.ga.gov
✓	✓	Matt Sanders	00284154	Engineering Services	404-631-1752	msanders@dot.ga.gov
✓	✓	Joe Leoni		ARCADIS	770-431-8666	joe.leoni@arcadis-us.com
✓	✓	JOHN TIERNAN		"	"	john.tiernan@arcadis-us.com
✓	✓	ALLEN KRIVSKY		H&L	770 424 1668	akrivsky@heath-lineback.com
✓	✓	RUDOLPH FRAMPTON		H&L	"	rframpton@heath-lineback.com
✓		Nabil Raad	00129514	Traffic Operations	404 635 8126	nraad@dot.ga.gov
✓		EUGENE LETSALO	00942553	OMR	(404) 362-0730	
✓	✓	Judy Meisner	00326591	Bridge	404) 631-1899	jmeisner@dot.ga.gov
✓		Amber Phillips	00550268	Env Services	404) 631-1117	aphillips@dot.ga.gov
✓		Marco Trigueros	00929039	Planning	404) 631-1780	mtrigueros@dot.ga.gov
✓	✓	ROBERT MURPHY	00951461	OPD	404) 631-1586	ROMURPHY@DOT.GA.GOV
✓	✓	DAVE HAMILTON		LZA	253.229.7703	DAHAMILTON@LZA.com
✓	✓	Paresh J. Parikh		DHA	404.419.8434	pparikh@delonhampton.com

✓ Check all that apply 14 Attended Project Overview(Day 1) 10 Attended Project Presentation (Day 4)

ECONOMIC DATA

The comparisons of life cycle costs between the VE alternatives and the current design solutions were performed on the basis of discounted present worth. To accomplish this, the VE team developed economic criteria to use in its calculations based on information gathered from GDOT and the design team. The following parameters were used when calculating discounted present worth, however, the schedule for the project is temporarily deferred and classified as long range.

Year of Analysis:	2010
Right of Way Purchase	2011
Construction Completion Date:	2013
Planning Period (n):	30
Discount Rate (i):	3%

When computing capital costs, direct material, labor and equipment costs are marked up using a composite markup of 10% that includes:

Engineering and Construction Inspection	10%

When computing right-of-way costs, a multiplier of 248% is used to account for the following:

Schedule Contingency (55% of net right-of-way cost)

Administrative/Court Costs (60% of net right-of-way cost plus schedule contingency)

Typical right-of-way cost = $9,000/ac land cost x 2.48 multiplier = $22,320/ac

Pavement Unit Price ($/SY)

The following square yard cost was developed by the VE team for all pavement work based on the values provided in the cost estimate:

12.5mm Superpave:	165#/SY x Ton/2,000# x $61.81/Ton	=	$5.10/SY
19mm Superpave:	220#/SY x Ton/2,000# x $58.67/Ton	=	$6.45/SY
25mm Superpave:	440#/SY x Ton/2,000# x $53.04/Ton	=	$11.67/SY
12" GAB:	1ft x 147#/CF x Ton/2,000# x 9SF/SY x $14.99/Ton	=	$9.92/SY
	Total Pavement Unit Cost	=	**$33.14/SY**

COST MODEL

The VE team 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. The high cost elements provide the VE team with one focus for its work during the study.

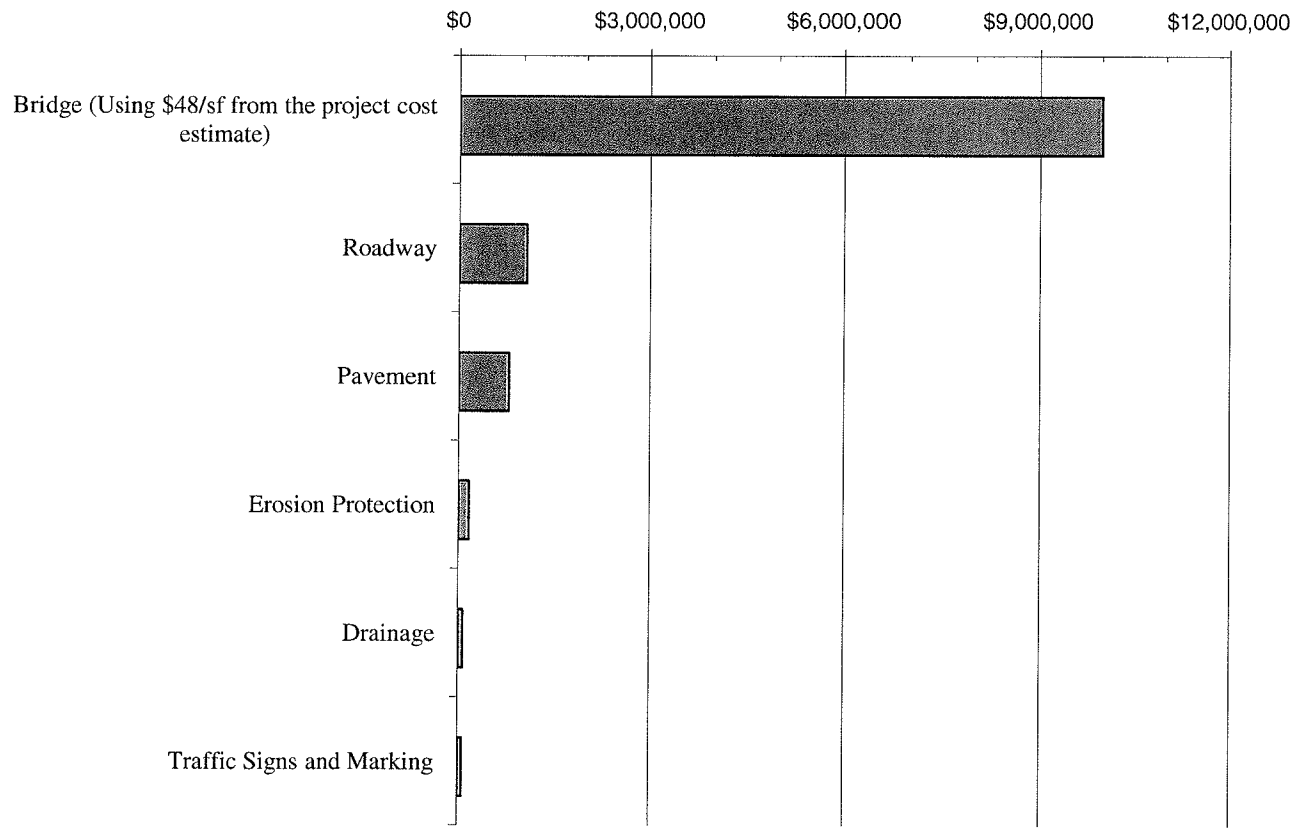
The project cost estimate contained a unit price for the bridges of approximately $48/sf which is considerably lower than historical GDOT bid results which have been averaging closer to $95/sf. This fact was pointed out during the design presentation on the first day of the VE study and it was agreed that all cost calculations for VE alternatives should use the more accurate bridge cost of $95/sf.

Changing the unit price on the bridges will have a major impact on the total project cost. Using the revised unit price of $95/sf for the bridges, the total project cost increases from $14.7M to approximately $25M. From a cost modeling perspective, the three bridges represent 38% of the total project length, but more than 80% of the total cost using the old bridge unit price of $48/sf. The three bridges increase to 90% of the total cost using the updated unit price of $95/sf. Clearly, the length of the bridges is the key driver in the study and was a major topic of discussion during the study.

COST HISTOGRAM

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK**
BR000-0001-00(216), P.I. No. 0001216

TOTAL PROJECT		COST	PERCENT	CUM. PERCENT
Bridge (Using $48/sf from the project cost estimate)		10,000,000	82.44%	82.44%
Roadway		1,049,141	8.65%	91.09%
Pavement		776,189	6.40%	97.49%
Erosion Protection		165,155	1.36%	98.85%
Drainage		73,690	0.61%	99.46%
Traffic Signs and Marking		65,389	0.54%	100.00%
Construction & Right of Way - Subtotal		***12,129,564***	100.00%	
Engineering and Inspection	5.00%	606,478		
Construction Contingency	4.00%	485,183		
Fuel Adjustment		288,130		
Total Liquid AC Adjustment		212,058		
Utility Cost Estimate		330,000		
Utility Contingency		99,000		
TOTAL PROJECT COST		**$ 14,150,413**	Comp Markup:	16.66%



FUNCTION ANALYSIS

A function analysis was performed to (1) understand the project purpose and need, (2) define the requirements for each project element, (3) ensure a complete and thorough understanding by the VE team of the basic 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 worksheet completed by the team for the project in its entirety and the various elements follow.

This project is quite well focused and is intended to "Eliminate Deficiencies" in the bridge cross section and structure. Re-investment in the three bridges is needed since they are between 40 and 60 years old and lack needed shoulders.

RANDOM FUNCTION ANALYSIS

PROJECT: **US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** SHEET NO.: **1 of 1**
BR000-0001-00(216) P.I. No. 0001216
Appling/Toombs Counties, GA – Preliminary Engineering Submittal

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
PROJECT ***(Greatest Magnitude of Function Impact)***	***Eliminate***	***Deficiencies***	***B***
	Span	***River***	***B***
	Accommodate	Growth	RS
	Renew	***Infrastructure***	***B***
	Maintain	Access	RS
	Meet	Criteria	RS
	Reduce	Time	RS
	Reduce	Maintenance	G
	Protect	Deer	G
	Minimize	Accidents	G
	Control	Budget	G
	Accommodate	Phasing	RS
	Upgrade	Shoulders	RS
	Maximize	Reliability	HO

Function defined as: Action Verb, Measurable Noun

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

CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

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

PROJECT ELEMENT	PREFIX
General Comments	G
Alignment	A
Section	S
Bridge #1 – Altamaha River	B1
Bridge #2 – Overflow 1	B2
Bridge #3 – Williams Creek	B3

The ideas were ranked on a qualitative scale of 1 to 5 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 owner's value objectives for the project. The following are the top value objectives for this project:

- Enhance functionality
- Maintain access during construction
- Reduce business and residential property impacts
- Reduce user impacts

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

CREATIVE IDEA LISTING

PROJECT:	**US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** ***BR000-0001-00(216) P.I. No. 0001216*** ***Appling/Toombs Counties, GA – Preliminary Engineering***	SHEET NO.:	**1 of 2**

NO.	IDEA DESCRIPTION	RATING
GENERAL CONCEPTS (G)		
G-1	Repair existing bridges in lieu of building new parallel road.	2
G-2	Do nothing.	Drop
G-3	Re-use existing bridge foundations, detour traffic, build new superstructure.	Drop
G-4	Replace only the bridge pin sections.	1
G-5	Reduce the right-of-way on the east side of the road.	4
G-6	Fill in Bridge #2 and #3 with embankment instead of using a bridge.	3
ALIGNMENT (A)		
A-1	Modify the termination point on the north end and tie-in at STA 128+00 in lieu of STA 2141+00.	2
A-2	Shorten the tie-in point on the south end and tie in sooner.	4
A-3	Shorten the access ramp to the boat ramp.	3
SECTION (S)		
S-1	Use 4ft wide shoulders in lieu of 6.5 ft. wide.	5
S-2	Make all traffic lanes 11 ft. wide in lieu of 12 ft. wide.	2
S-3	Revise access road pavement, use double surface treatment instead of asphalt.	4
S-4	Use full depth pavement for the 6.5-ft.-wide shoulders in lieu of partial depth section.	4
S-5	Use 4-ft.-wide, full-depth shoulders in lieu of 6.5-ft.-wide partial depth shoulders.	4
S-6	Use 11-ft.-wide travel lanes with 4-ft.-wide full depth shoulders.	4
S-7	Eliminate the ditch on the west side of the new road in specific locations.	4
S-8	Retain existing pavement and bridges, do not demolish.	DS
PROFILE (P)		
P-1	Change profile slope from 0% longitudinally to 0.25% or 0.5% to improve drainage.	DS
P-2	Lower the profile by 4 ft. to shorten the bridge columns between STA 40+00 to 50+00.	4

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

CREATIVE IDEA LISTING

PROJECT:	**US 1 / SR 4 BRIDGE REPLACEMENT OVER ALTAMAHA RIVER, OVERFLOW 1 AND WILLIAMS CREEK** ***BR000-0001-00(216) P.I. No. 0001216*** ***Appling/Toombs Counties, GA – Preliminary Engineering***	SHEET NO.:	**2 of 2**

NO.	IDEA DESCRIPTION	RATING
PROFILE (P) (cont.)		
P-3	Lower the profile between STA 88+00 and 130+00 by 1.4 ft. to shorten bridge columns.	4
BRIDGE #1 (B1) (ALTAMAHA RIVER)		
B1-1	Reduce bridge width from 40 ft. to 36 ft.	5
B1-2	Use a four-span continuous, spliced girder unit in lieu of the first five spans.	3
B1-3	Use two four-span spliced continuous units in lieu of first five spans.	4
B1-4	Use 31 spans – 85 ft. long, one 65 ft. long span in lieu of the first 13 spans.	3
B1-5	Use 29 – 140 ft.6 in. spans in lieu of existing design.	3
B1-6	Combine Alt. Nos. B1-2 and B1-4.	3
B1-7	Increase beam spacing.	3
B1-8	Use precast segmental bridge in lieu of AASHTO girders.	3
BRIDGE #2 (B2) (OVERFLOW 1)		
B2-1	Reduce bridge width from 40 ft. to 36ft.	3
B2-2	Use three spans at 100 ft. in lieu of five spans at 60 ft.	4
B2-3	Increase beam spacing.	3
B2-4	Replace the 300 ft. bridge with embankment.	5
BRIDGE #3 (B3) (WILLIAMS CREEK)		
B3-1	Reduce the bridge width from 40 ft. to 36 ft.	5
B3-2	Use three spans at 126 ft. 8 in. in lieu of five spans at 60 ft. and two spans at 40 ft.	3
B3-3	Increase beam spacing.	3
B3-4	Replace the 380 ft. bridge with embankment.	5

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