GEORGIA DEPARTMENT OF TRANSPORTATION

CR 787/Islands Expressway Bridge Replacement

Chatham County

CSBRG-0007-000(128) – P.I. No. 0007128

VALUE ENGINEERING REPORT

OCTOBER 2010

Submitted by:

PBSJ an Atkins company

PBSJ
an Atkins company

October 20, 2010

Ms. Lisa Myers, AVS
Design Review Engineer Manager/VE Coordinator
Georgia Department of Transportation-Engineering Services
One Georgia Center
600 W. Peachtree Street NW
Atlanta, GA 30308

RE: Value Engineering Report
CSBRG-0007-00(128) – P.I. No. 0007128
CR787/Islands Expressway Bridge Replacement
Chatham County

Dear Ms. Myers:

Please find enclosed two (2) hard copies and one (1) CD of our Value Engineering Report for the replacement of the bridges on Islands Expressway over the Wilmington River at Causton Bluff in Chatham County. Using the Value Engineering "Job Plan" – Investigation, Analysis (*Function)*, Speculation, Evaluation & Development, the VE Team identified:

Ten (10) Alternatives recommended for improving the project value.

We trust that you will find this report to be in proper order. It should be noted that the results of this workshop are volatile in that they can be overcome by the events that accompany the expeditious continuance of the design process. Accordingly, we encourage an equally expeditious implementation meeting to design the disposition of the contents of this report.

Please contact me at 678-677-6420 should you have any questions regarding this submittal.
On behalf of our VE Team, we thank you very much for the opportunity to work with you and the hard working staff of the Georgia Department of Transportation.

Yours truly,

Les M. Thomas

Les M. Thomas, P.E., CVS-Life
VE Team Leader

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1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

The subject of this Value Engineering study is the replacement of the two existing parallel bridges at Causton Bluff that span the Wilmington River on the Islands Expressway/CR 787 in Chatham County. The design for this project has been prepared by the LPA Group Transportation Consultants. The project's design is at the construction documents submittal stage.

1.2 PROJECT DESCRIPTION

The project is CSBRG-0007-00(128) - PI No. : 0007128, which consists of replacing the existing two parallel bascule bridges with two fixed span structures having a minimum vertical clearance of 65 feet above the channel and a minimum horizontal clearance of 195 feet for the channel. The existing bridges are functionally obsolete and require being opened an average of ten times a day causing frequent travel delays and inconvenience to motorists on the Islands Expressway. The existing travel volume exceeds 2,100 vehicles per day. Traffic heading westbound in the am peak hours is six times greater than traffic moving eastbound. In the peak pm hours, the heavy flow is reversed and eastbound traffic is four times greater than the westbound traffic.

The Islands Expressway is a four-lane rural divided highway with a grassed median. The functional classification is Urban Principal Arterial. The project area is surrounded by coastal marshland. The road connects with US 80/SR 26 east of the Wilmington River, which provides direct access to Tybee Island. Since it serves as a hurricane evacuation route, no less than three lanes must remain open during construction. The length of the project is 1.2 miles and the design speed is 55 mph.

At this stage of planning, LPA has considered eight alternative designs plus a ninth (no build) alternative. The designers have narrowed their alternatives to two designs.

Figure 1-1: CR-787 Current River Crossing

1.3 VALUE ENGINEERING PROCESS

The Value Engineering (VE) team followed the six-step Value Engineering Job Plan as promulgated by SAVE International. Refer to Section 4.2 of this report for additional information on the VE process. The six-step plan includes the following:

Information Phase – during this phase the team received a briefing from the GDOT project manager and LPA Group project manager. This briefing included discussions of the design intent behind the project, the cost concerns, and the physical project limitations. In the working session that followed, the VE team developed cost models from the cost data provided by the designers and familiarized themselves with the construction drawings and other data that was made available to the team.

Function Analysis Phase – during this phase the VE Team determined the "**Functions"** of the project. This was accompanied by reviewing the project by asking the questions, "What is the project supposed to do?" and "How is it supposed to accomplish this purpose?" In the Value Engineering vernacular, the answers to these questions are cast in the form of active verbs and measurable nouns. These verb/noun pairs form the basis of the function analysis which distinguishes a Value Engineering effort from a potentially damaging cost-cutting exercise. A FAST diagram was prepared highlighting the project's required functions.

Creative Phase – The VE Team performed a brainstorming session to identify ideas that might help meet the project objectives. These ideas fell into the following major headings:

- Bridge Horizontal and Vertical Alignment
- River Crossing
- Staging of construction

The brainstorming session identified twenty (20) ideas, which are shown on pages 1-3, 1-4, and 1-5.

Evaluation Phase – During this phase, the VE Team determines which of the creative ideas offer the best opportunity to improve the value of the project for further development. The first step is to determine the criteria that the ideas should be evaluated against. The VE Team reflected back on the project constraints and objectives shared with the team by the Owner's representatives and the design team members and listed the following:

- Number of lanes open during construction; bridge width; existing utility impacts; salt water marsh impacts, subdivision impacts; and construction staging

The VE Team then prepared a matrix evaluating each of the LPA alternative programs to give an objective opinion of them. It is important to note that LPA Alternatives 1 and 7 had the highest scores, provided #7 could be constructed conventionally as the VE Team suggests. The matrix follows:

ANALYSIS MATRIX

EVALUATION PHASE - LPA ALTERNATIVE CONSTRUCTION PLANS 1-9

PROJECT: CSBRG-0007-00(128) - P.I. No. 0007128 CR 787/Islands Expressway Bridge Replacement		No. of Lanes Open	Bridge Width	Existing Utility Impact	Salt Marsh Impact	S/D Impact	Staging	
Weight of Importance (1-10)		1	1	1	1	1	1	Total Score
LPA 1	rating 1-5	5	5	5	3	4	4	
	Score	5	5	5	3	4	4	26
LPA 2	rating 1-5	5	2	5	1	4	5	
	Score	5	2	5	1	4	5	22
LPA 3	rating 1-5	0	2	5	5	5	0	
	Score	0	2	5	5	5	0	17
LPA 4	rating 1-5	0	5	3	5	5	0	
	Score	0	5	3	5	5	0	18
LPA 5	rating 1-5	1	2	3	5	4	1	
	Score	1	2	3	5	4	1	16
LPA 6	rating 1-5	5	5	0	3	4	4	
	Score	5	5	0	3	4	4	21
LPA 7	rating 1-5	5	5	5	3	4	4	
	Score	5	5	5	3	4	4	26
LPA 8	rating 1-5	3	4	5	3	4	3	19
	Score	3	4	5	3	4	3	
LPA 9	rating 1-5	0	5	5	5	5	5	25
	Score	0	5	5	5	5	5	

CREATIVE IDEA LISTING

PROJECT:
Georgia Department of Transportation / CSBRG-0007-00(128) – P.I. No. 0007128
CR 787/Islands Expressway Bridge Replacement

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No.	IDEA DESCRIPTION	Rating
	Bridge Replacement	
BR-1	Delay demolition of operator's house until project completion	4
BR-2	Construct all new lanes (Urban X) north of existing; reduce intersection widths (similar to LPA Alternative #7)	1
BR-3	Leave portions of existing bridges	4
BR-4	Reduce outside shoulders to 6'0"	4
BR-5	Construct two new bridges (rural) north of southerly two lanes (east bridge); avoid utilities; 32' median; reduce intersection widths	1
BR-6	Construct "jug" handles to move locations of intersections	2
BR-7	Use sheet pile walls on approaches	2
BR-8	Move channel to the east	1
BR-9	Signalize the reversible lanes in lieu of manually controlling	4
BR-10	Use a barrier separation on single structure	2
BR-11	Maximize similar beam types	2
BR-12	Verify 65' > at fenders	1
BR-13	Optimize spam arrangement BT 74", 165' spans, 10 ksi	4
BR-14	Use pre-stressed girders in lieu of a box girder for bridge structure –LPA Alternative #7	5

Rating Scores:

1→2 = Not to be Developed; 3 = Varying Degrees of Development Potential;

4→5 = Most likely to be Developed; DS = Design Suggestion; ABD = Already Being Done; OBS=Observation

CREATIVE IDEA LISTING

PROJECT:
Georgia Department of Transportation / CSBRG-0007-00(128) – P.I. No. 0007128
CR 787/Islands Expressway Bridge Replacement

PBSJ an Atkins company

No.	IDEA DESCRIPTION	Rating
BR-15	Partial demolition of eastbound bridge and widen proposed median (LPA Alternative #7)	See BR-14
BR-16	Minimize roadway in LPA Alternative #7, reduce separation of bridges, arrange to fit existing R/W and minimize impact to marsh	2
BR-17	Include the time differential value in alternative selection process	4
BR-18	Utilize alternative bidding	4
BR-19	Consider alternative delivery	OBS
BR-20	Extend MSE wall to eliminate west end span	3

Development Phase – During this phase, the VE Team developed each of the selected alternatives whose score was 4 or greater because of time constraints. If time permits, the team will develop additional recommendations. This effort included a detailed explanation of the idea with sketches as appropriate to clarify the idea from the original concept, advantages and disadvantages, a technical explanation, and an estimation of the cost and resultant cost savings if implemented.

Recommendation Phase – During this phase, the VE Team reviews the alternative ideas to confirm which alternatives are appropriate for the project, provide an opportunity for success, and improve the value of the project if implemented.

Presentation Phase – the team made a presentation to the Georgia Department of Transportation on the last day of the workshop. This presentation was designed to express the intent and clarify each of the recommended alternatives. This report is intended to formalize those findings.

1.4 OBSERVATIONS

The VE Team noted that it might be reasonable to consider using an alternative delivery method, which might provide greater construction flexibility and possibly lower the overall cost of construction.

1.5 CONCLUSIONS AND RECOMMENDATIONS

The VE Team identified, developed, and recommends the following alternatives for implementation:

SUMMARY OF ALTERNATIVES

PROJECT:
Georgia Department of Transportation / CSBRG-0007-00(128) – P.I. No. 0007128
CR 787/Islands Expressway Bridge Replacement

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VE Idea Number	Description of alternatives	Initial cost
	LPA Bridge Replacement Alternate Design 1	
BR-1	Delay demolition of operator's house until project completion	$ 550,000
BR-3	Retain portions of existing bridge	$ 747,810
BR-4	Reduce Outside Shoulders to 6’-0”	$ 807,840
BR-13	Optimize Span Arrangement	$ 361,068
BR-17	Include the time differential value in alternative selection process	$ 252,000
BR-18	Utilize alternate bidding	$2,200,923
BR-20	Extend MSE Wall To Eliminate West End Spans	$ 752,275
	LPA Bridge Replacement Alternate Design 8	
BR-3	Retain portions of existing bridge	$ 747,810
BR-4A	Reduce Outside Shoulder on Eastbound Bridge to 6’-0”	$ 403,920
BR-9	Signalize the reversible lanes in lieu of manually controlling traffic	$ 320,500
BR-13	Optimize Span Arrangement	$ 361,068
BR-17	Reflect the time differential value in alternative selection process	$ 252,000
BR-18	Utilize alternate bidding	$2,200,923
BR-20	Extend MSE Wall To Eliminate West End Spans	$ 752,275
	LPA Bridge Replacement Alternate Design 7	
BR-3	Retain portions of existing bridge	$ 747,810
BR-14	Use pre-stressed girders in lieu of segmental concrete box girders	$764,115

2 STUDY RESULTS

2.1 INTRODUCTION

This section includes the study results presented in the form of fully developed value engineering alternatives that include: descriptions of the original design; description of the alternative design; opportunities and risks; technical discussions; sketches; calculations; and a cost estimate of the impact of the alternative.

It should be noted that the estimated cost/savings calculated for these alternatives are very preliminary and are only presented to indicate a probable magnitude of cost impact on the project.
Also, these alternatives are "stand alone" ideas. In some cases, they may be "added" to another alternative, or in other cases they may present a different method of constructing the same elements and are therefore not additive. A summary is provided in Section 1-5 "Executive Summary Conclusions and Recommendations."

The users of this report are asked to consider these alternatives and design suggestions as a smorgasbord of choices for selection and use as appropriate as the project progresses.

2.2 COST CALCULATIONS

The cost calculations are intended only as an indicator to the approximate results that might be expected from implementation of the alternatives. They should be helpful in making clear choices as to the pursuit of individual alternatives.

2.3 ALTERNATIVES AND DESIGN SUGGESTIONS

Following are the ***design alternatives*** for implementation to improve the value of the project:

2.3.1 ALTERNATIVE NUMBER BR - 1

Value Analysis Design Alternative

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PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-1**
DESCRIPTION:	**Delay demolition of the Operators House until the second bridge is opened to traffic. (LPA Alternative #1)**	SHEET NO.: **1** of **4**

Original Design:

The original design proposes relocating the Operator's House to the existing eastbound bridge during stage 2 construction when the eastbound traffic is relocated from the south bridge to the north bridge.

Alternative: The alternative design would propose delaying the demolition of the Operator's House. It can be removed with the existing westbound bridge after the completion of new eastbound bridge.

Opportunities:

- Eliminate the cost of a temporary Operator House.
- Eliminate any interruption of bridge operation during the transfer of control.
- Simplify construction.

Risks:

- Beam placement and overhead construction will require coordination with the opening of the bridge.
- Additional protection such as debris/safety netting may be required.

Technical Discussion:

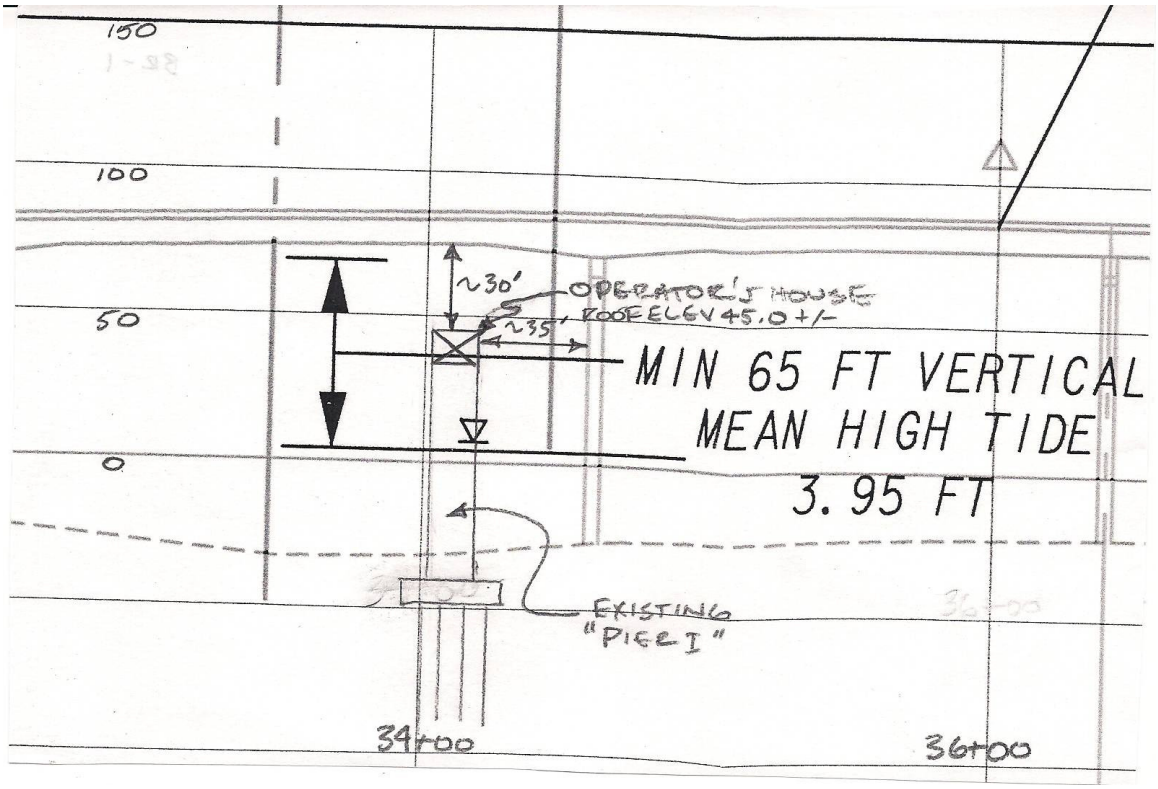
It appears that Pier I of the existing eastbound bridge and the Operator's House could remain in operation until the existing westbound bridge is taken out of operation. The height and length of the main span for the new eastbound bridge should be sufficient to straddle the existing Pier I and the Operator's House. Access to the Operator's House would be via the existing access bridge from the westbound bridge. Any issues with regard to parking for or shuttling of the Operator should be the same for either alternative. During placement of the beam over the Operator's House it would be necessary for the Operator to vacate the premises. However this should not create a problem, as the navigational channel should be shut down and the bridge closed during beam placement so this is simply a coordination issue.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 550,000**	**$ 0**	**$ 550,000**
ALTERNATIVE	**$ 0**	**$ 0**	**$ 0**
SAVINGS	**$ 550,000**	**$ 0**	**$ 550,000**

Illustrations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-1**
DESCRIPTION:	**Delay demolition of the Operators House until the second bridge is opened to traffic. (LPA Alternative #1)**	SHEET NO.: **2** of **4**



Calculations

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PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-1**
DESCRIPTION:	**Delay demolition of the Operators House until the second bridge is opened to traffic. (LPA Alternative #1)**	SHEET NO.: **3** of **4**

From the Consultant's estimate:

Bridge Items, Item# 000-0001, Relocation of Bridge Tender House, Lump Sum 1, $500,000

Cost Worksheet

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PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-1**
DESCRIPTION:	**Delay demolition of the Operators House until the second bridge is opened to traffic. (LPA Alternative #1)**	SHEET NO.:	**4** of **4**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Relocate Operator's House prior to construction	LS	1	$ 500,000	$ 500,000	0	$ 500,000	$ -
Sub-total				$ 500,000			$ -
Cons't Mark-up 10.00%				$ 50,000			$ -
TOTAL				**$ 550,000**			**$ -**
Estimated Savings:							$550,000

2.3.2 ALTERNATIVE NUMBER BR-3

Value Analysis Design Alternative

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PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR - 3**
DESCRIPTION:	**Retain portions of existing bridges**	SHEET NO.: **1** of **5**

Original Design:

The original design proposes the complete removal of all existing roadway and bridge structures.

Alternative Design:

The alternative design proposes to leave portions of the existing bridges and roadways, which would not be an obstruction to navigation and which might be beneficial to the residents and visitor of Chatham County. Such beneficial uses may be: fishing piers, basketball courts, tennis courts, shuffle board, racketball, volleyball, etc. Reuse the bridge sections that must be removed to lessen risks to boating traffic to be relocated elsewhere and used a fish havens. Specifically, the bridge sections to remain would be:

- West Bound from Sta. 159+49 to Sta. 161+27 = 178'; and from Sta. 163+72 to Sta.167+83 = 411' for a total of 589'
- East Bound from Sta. 159+89 to Sta. 161+27 = 138'; and from Sta. 163+72 to Sta.167+83 = 411' for a total of 549'

Opportunities:

- Reduce Project Cost
- Increase County recreational facilities
- Increase opportunities for sporting activities
- Increase community spirit
- Demonstrate desire to go "Green"

Risks:

- None apparent

Technical Discussion:

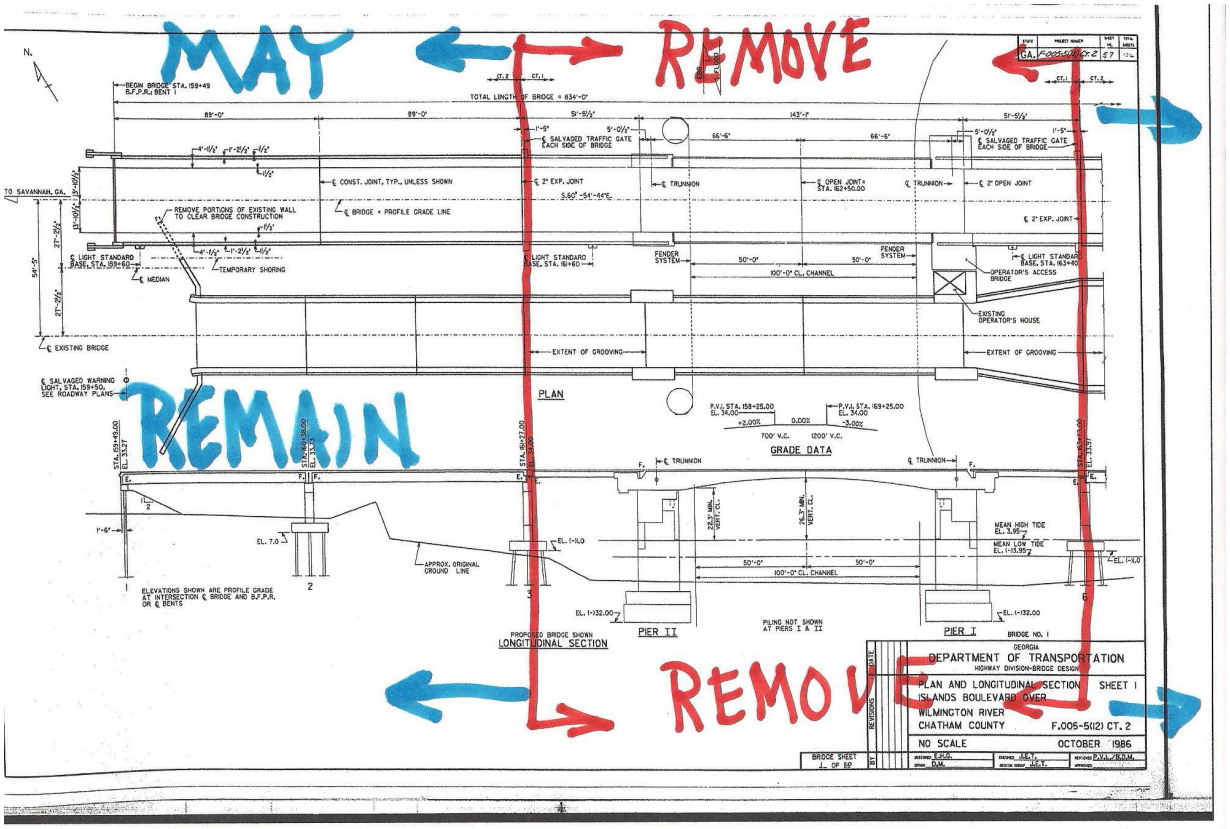
The portions of the existing bridge structures which would be eligible to remain are of concrete construction. They are also in an apparent state of good repair as they were given sufficiency ratings of over 60.00. Therefore, they should not be present the county with a maintenance problem.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,999,646**	**$ 0**	**$ 1,999,646**
ALTERNATIVE	**$ 1,251,836**	**$ 0**	**$ 1,251,836**
SAVINGS	**$ 747,810**	**$ 0**	**$ 747,810**

Illustrations

PBSJ an Atkins company

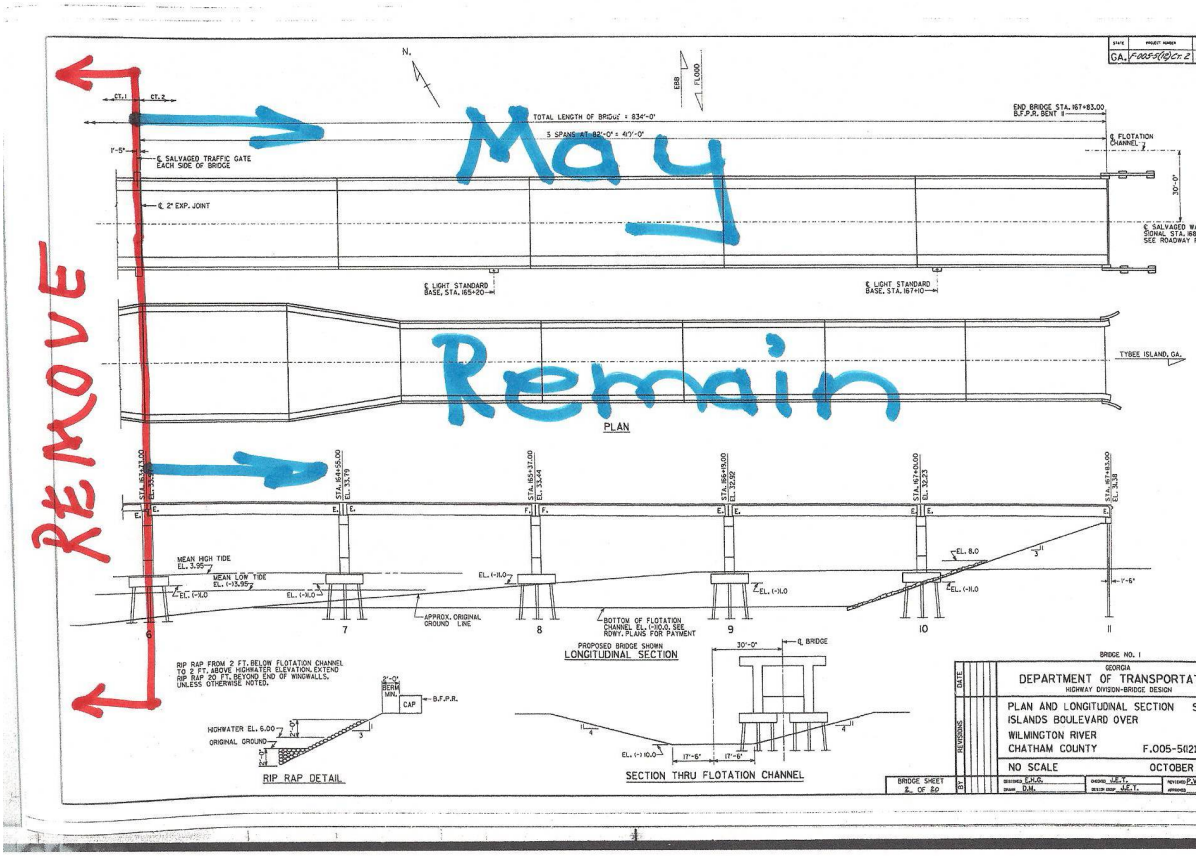
PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-3**
DESCRIPTION:	**Retain portions of existing bridges**	SHEET NO.: **2** of **5**



Illustrations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-3**
DESCRIPTION:	**Retain portions of existing bridges**	SHEET NO.: **3** of **5**



Calculations

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PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-3**
DESCRIPTION:	**Retain portions of existing bridges**	SHEET NO.: **4** of **5**

The current estimate for removal of the existing bridges is $2,000,000

The existing bridge is as follows:

West Bound
"Plain Structure"

Westerly portion Sta. 159+49 to Sta. 161+27 =	178'
Easterly portion Sta. 163+72 to Sta.167+83 =	411'
Traffic Gate Section Sta. 161+27 to Sta. 161+78 =	51'
Traffic Gate Section Sta. 163+21 to Sta. 163 + 72 =	51'
Total length of "plain structure" =	691'

East Bound
"Plain Structure"

Westerly portion Sta. 159+89 to Sta. 161+27 =	138'
Easterly portion Sta. 163+72 to Sta. 167+83 =	411'
Traffic Gate Section Sta. 161+27 to Sta. 161+78 =	51'
Traffic Gate Section Sta. 163+21 to Sta. 163 + 72 =	51'
Total length of "plain structure" =	651'
Total length of all "plain structure"=	1,342'

"Difficult Structures"
Piers I and II, Fenders, and movable sections Sta. 161+78 to Sta. 163+21 = 143' x 2 = 286'

Assumptions:

Assume that the removal of the "difficult structures" = $1,000,000/286 or $3,496/ft
And, removal of the "plain structure" would be $1,000,000/1,342 or $745/ft
Cost to construct new "end walls" to close off bridge portion that remains - say $100,000

Cost Worksheet

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PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-3**
DESCRIPTION:	**Retain portions of existing bridges**	SHEET NO.:	**5** of **5**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Remove WB Bridge							
Sta. 159+49 to Sta. 161+27	LF	178	$ 745	$ 132,610	0	$ 745	$ -
Sta. 163+72 to Sta.167+83	LF	411	$ 745	$ 306,195	0	$ 745	$ -
Sta. 161+27 to Sta. 161+78	LF	51	$ 745	$ 37,995	51	$ 745	$ 37,995
Sta. 163+21 to Sta. 163 + 72	LF	51	$ 745	$ 37,995	51	$ 745	$ 37,995
Sta. 161+78 to Sta. 163+21	LF	143	$ 3,496	$ 499,928	143	$ 3,496	$ 499,928
Remove EB Bridge		834					
Sta. 159+89 to Sta. 161+27	LF	138	$ 745	$ 102,810	0	$ 745	$ -
Sta. 163+72 to Sta.167+83	LF	411	$ 745	$ 306,195	0	$ 745	$ -
Sta. 161+27 to Sta. 161+78	LF	51	$ 745	$ 37,995	51	$ 745	$ 37,995
Sta. 163+21 to Sta. 163 + 72	LF	51	$ 745	$ 37,995	51	$ 745	$ 37,995
Sta. 161+78 to Sta. 163+21	LF	143	$ 3,496	$ 499,928	143	$ 3,496	$ 499,928
		794					
Construct End Barriers	LS	0	$ 100,000	$ -	1	$ 100,000	$ 100,000
Sub-total				$1,999,646			$ 1,251,836
Cons't Mark-up 0.00%				$ -			$ -
TOTAL				**$1,999,646**			**$ 1,251,836**
Estimated Savings:							$747,810

2.3.3 ALTERNATIVE NUMBER BR-4

Value Analysis Design Alternative

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PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-4**
DESCRIPTION:	**Reduce Outside Shoulders to 6'-0"**	SHEET NO.: **1** of **4**	

Original Design:

The original design alternate (LPA – 1) proposes the construction of 1836' twin bridges across the Wilmington Canal with deck cross sectional widths that would accommodate a 4' inside shoulder, two 12' travel lanes and an 8' outside shoulder.

Alternative:

The alternative design proposes reduction of the outside shoulder to 6'-0" to more closely match the approach roadway cross section.

Opportunities:

- Reduction in cost
- Section more closely matches approach roadway

Risks:

- Minimal redesign required

Technical Discussion:

The reduction in bridge width will not affect staging as originally proposed.

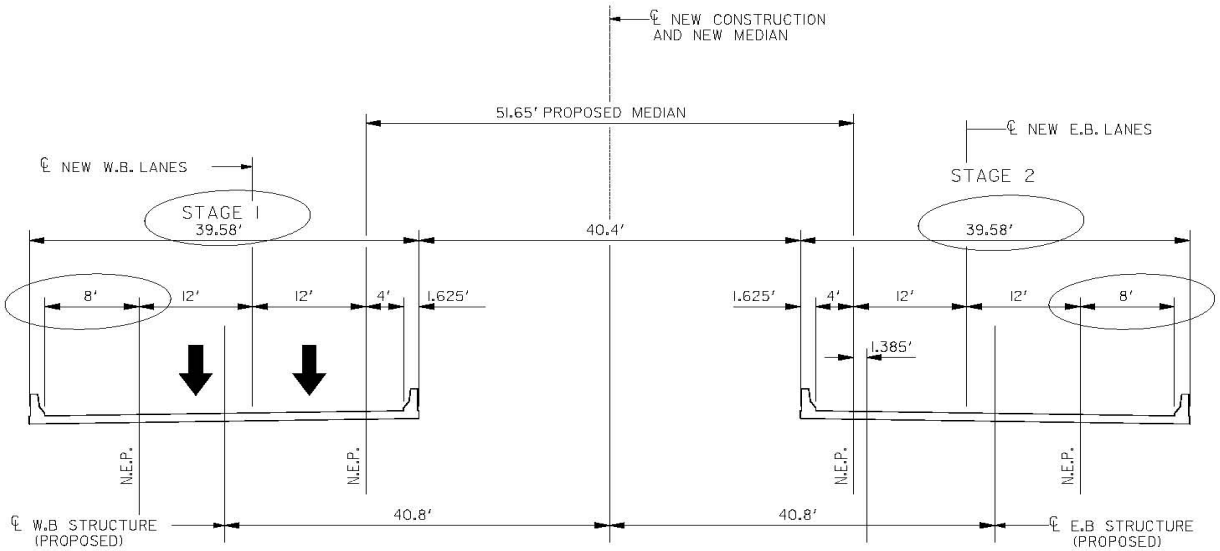
See the following pages for calculations of cost savings.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 807,840**	**$ 0**	**$ 807,840**
ALTERNATIVE	**$ 0**	**$ 0**	**$ 0**
SAVINGS	**$ 807,840**	**$ 0**	**$ 807,840**

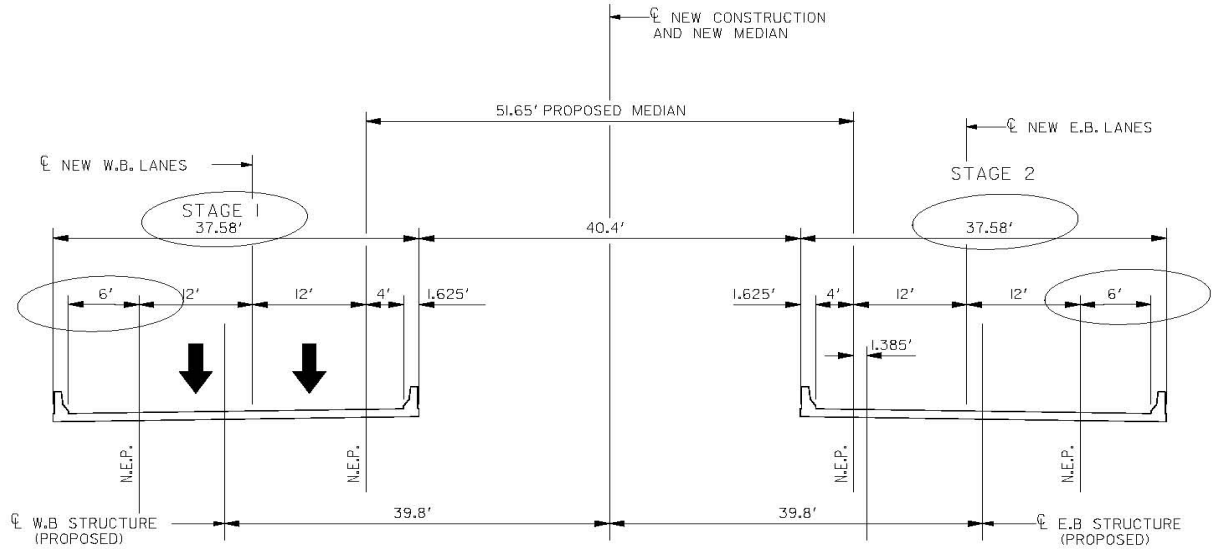
Illustrations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-4**
DESCRIPTION:	**Reduce Outside Shoulders to 6'-0"**	SHEET NO.: **2** of **4**



CURRENT DECK SECTIONS - ALT - 1



ALTERNATIVE DECK SECTIONS - BR-4

Calculations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-4**
DESCRIPTION:	**Reduce Outside Shoulders to 6'-0"**	SHEET NO.: **3** of **4**

Note:

1) Reduction from current design = savings for alternative
2) Cost per SF of new construction (assumed) = $100
3) Cost for current design as provided to the VE Team at the time of the study

Current design (twin bridges, 12 spans – 1836' long – spans vary, 39.58' out-to-out bridge widths).

Alternative design (twin bridges, 12 spans – 1836' long – spans vary, 37.58' out-to-out bridge widths).

Bridge length (total) = 2 X 1836'

New bridge width (after 2' reduction) = 37.58'

Reduction in deck area of bridge (alternative versus current design LPA-1) = [(1836' X 2) X 2'] = 7344 SF

Other treatments (assumed same for current design and alternative; therefore, not considered).

Note:
A more detailed cost analysis may be performed on sufficiently developed alternative bridge plans to be able to itemize major components and realize greater cost savings than that shown in this study.

Cost Worksheet

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**					ALTERNATIVE NO.: **BR-4**		
DESCRIPTION:	**Reduce Outside Shoulders to 6'-0"**					SHEET NO.: **4** of **4**		
CONSTRUCTION ITEM			ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM		UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Alternative Design (Reduction in Deck Area)		SF	7,344	$100.00	$734,400	0	$100.00	$ -
Note: Reduction from current design = savings for alternative								
Lump Sum amount for current design as provided to the VE Team.								
Assume $100 per SF of bridge for new construction								
	Sub-total				$734,400			$ -
Cons't Mark-up	**10.00%**				$ 73,440			$ -
	TOTAL				**$807,840**			**$ -**
Estimated Savings:								$807,840

2.3.4 ALTERNATIVE NUMBER BR-4A

Value Analysis Design Alternative

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-4A**
DESCRIPTION:	**Reduce Outside Shoulder on Eastbound Bridge to 6'-0" (Alternative LPA 8 only)**	SHEET NO.: **1** of **3**	

Original Design:

The original design alternates (LPA – 8) proposes the construction of 1836' twin bridges across the Wilmington Canal. The with deck cross-sectional width of the westbound bridge is 43.48' to accommodate 3 lanes during construction staging while that of the eastbound is 39.58' to accommodate a 4' inside shoulder, two 12' travel lanes and an 8' outside shoulder.

Alternative:

The alternative design proposes reduction of the outside shoulder to 6'-0" on the eastbound bridge to more closely match the approach roadway cross section.

Opportunities:

- Reduction in cost
- Section more closely matches approach roadway

Risks:

- Minimal redesign required

Technical Discussion:

The reduction in width of the eastbound bridge will not affect staging as originally proposed.

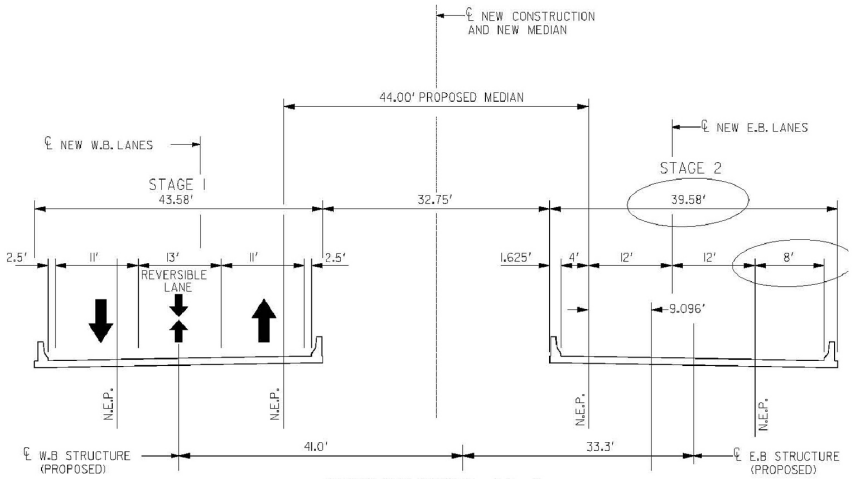
See the following pages for calculations of cost savings.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 403,920**	**$ 0**	**$ 403,920**
ALTERNATIVE	**$ 0**	**$ 0**	**$ 0**
SAVINGS	**$ 403,920**	**$ 0**	**$ 403,920**

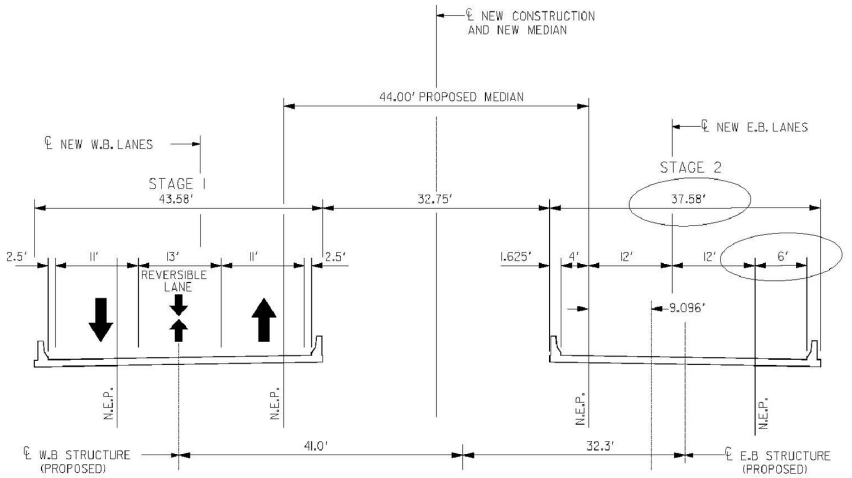
Illustrations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-4A**
DESCRIPTION:	**Reduce Outside Shoulder on Eastbound Bridge to 6'-0"** **(Alternative LPA 8 only)**	SHEET NO.: **2** of **3**



CURRENT DECK SECTIONS - ALT - 8



ALTERNATIVE DECK SECTIONS - BR-4A

(Alternative LPA 8 only)

Cost Worksheet

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-4A**
DESCRIPTION:	**Reduce Outside Shoulder on Eastbound Bridge to 6'-0"**	SHEET NO.:	**3 of 3**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Alternative Design (Reduction in Deck Area)	SF	3,672	$100.00	$367,200	0	$100.00	$ -
Note: Reduction from current design = savings for alternative							
Lump Sum amount for current design as provided to the VE Team.							
Assume $100 per SF of bridge for new construction							
Sub-total				$367,200			$ -
Cons't Mark-up	**10.00%**			$ 36,720			$ -
TOTAL				**$403,920**			**$ -**
Estimated Savings:							$403,920

2.3.5 ALTERNATIVE NUMBER BR-9

Value Analysis Design Alternative

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-9**
DESCRIPTION:	**Signalize the three lane reversing section (Alternative LPA 8 only)**	SHEET NO.: **1** of **2**	

Original Design:

The original design proposes to maintain traffic by operating two lanes leaving the island in the morning with one lane entering, and reversing the traffic in the pm to have two lanes entering the island and one leaving. The design proposes to perform this manually by moving routing barrels to define the proper route.

Alternative:

The alternative design proposes to provide a signalized system of routing the traffic.

Opportunities:

- The signalized system should be more reliable than a manual system
- The signalized system would minimize the use of barrels which could become a hazard on the confined space of the bridge
- Reduction in construction cost.

Risks:

- None apparent

Technical Discussion:

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 820,500**	**$ 0**	**$ 820,500**
ALTERNATIVE	**$ 500,000**	**$ 0**	**$ 500,000**
SAVINGS	**$ 320,500**	**$ 0**	**$ 320,500**

Cost Worksheet

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-9**
DESCRIPTION:	**Signalize the three lane reversing section**	SHEET NO.:	**2** of **2**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Manual Control of traffic							
Move Barrels	daily	547	$ 1,500.00	$ 820,500	0	$1,500.00	$ -
				$ -			$ -
Automatic Lane Control System	LS	0	$ 500,000	$ -	1	$500,000	$ 500,000
Sub-total				$ 820,500			$ 500,000
Cons't Mark-up 0.00%				$ -			$ -
TOTAL				**$ 820,500**			**$ 500,000**
Estimated Savings:							$320,500

2.3.6 ALTERNATIVE NUMBER BR-13

Value Analysis Design Alternative

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-13**
DESCRIPTION:	**Optimize Span Arrangement**	SHEET NO.: **1** of **3**	

Original Design:

The original design alternates (especially, LPA – 1 and LPA – 8) propose the construction of 1836' twin bridges across the Wilmington Canal. The 12-span arrangements on both alternates include 2 @ 120.5' = 241', BT-63; 3 @ 180'-225'-180' = 585', FBT-78; 5 @ 160' = 800', FBT-78; 2 @ 105' = 210', BT-54.

Alternative:

The alternative design proposes optimizing the span arrangement by using BT-74 Girders of similar lengths. The span arrangement in this alternative provides 10 spans, thus eliminating the need for two intermediate bents.

Opportunities:

- Savings in cost by realizing economies of scale
- Savings in substructure by eliminating two bents
- Enhanced aesthetics
- Reduction in construction time
- Reduced wetland impacts
- BT-74 Girder is more common in Georgia

Risks:

- None apparent

Technical Discussion:

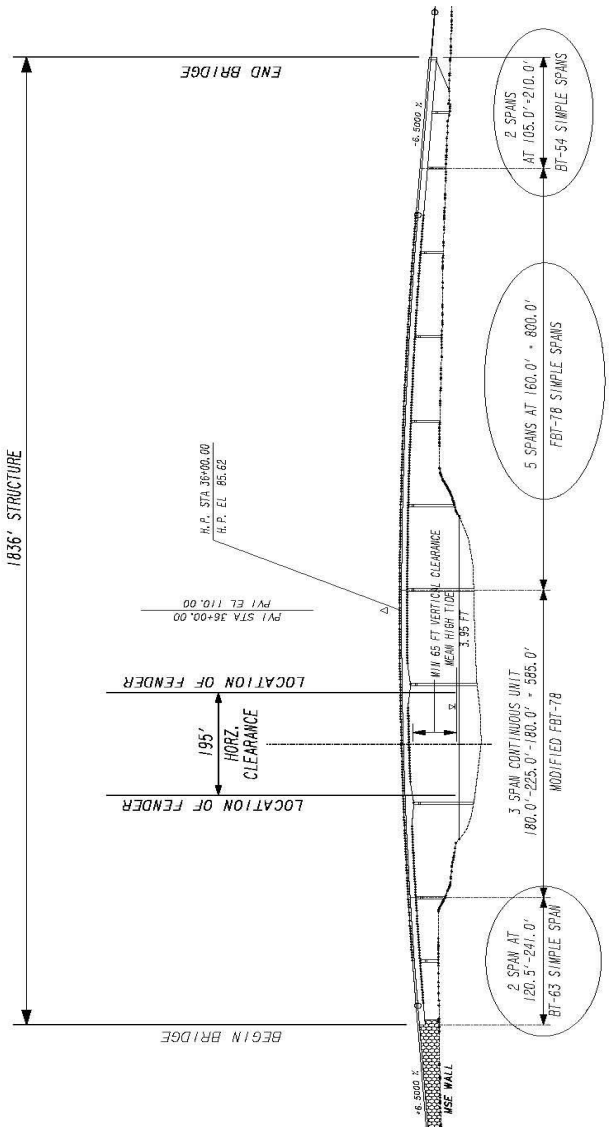
Span lengths of 166' can be achieved by using BT-74 Girders made of high strength concrete (f'c = 10 ksi). The revised span configuration can be 1 @ 166' = 165', BT-74; 3 @ 180'-225'-180' = 585'+/-, FBT-78; 6 @ 166' = 996', BT-74. In order to center the main span over the navigation channel while maintaining the 1836' length, the begin and end stations of bridge may have to be shifted to the west by about 25'.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 361,068**	**$ 0**	**$ 361,068**
ALTERNATIVE	**$ 0**	**$ 0**	**$ 0**
SAVINGS	**$ 361,068**	**$ 0**	**$ 361,068**

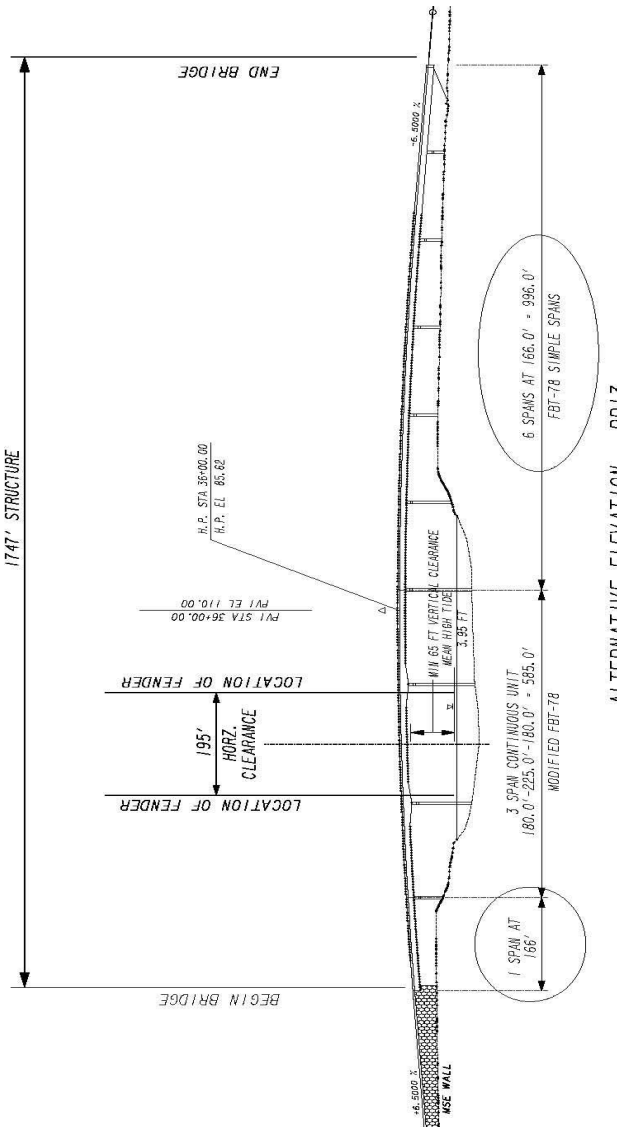
Illustrations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-13**
DESCRIPTION:	**Optimize Span Arrangement**	SHEET NO.: **2** of **3**



CURRENT ELEVATION - BR13



ALTERNATIVE ELEVATION - BR13

Cost Worksheet

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-13**
DESCRIPTION:	**Optimize Span Arrangement**	SHEET NO.:	**3** of **3**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Class B Concrete (Incl. Reinf.)	CY	480	$439.31	$210,869	0	$439.31	$ -
18" PPC Piles	LF	2,160	$ 54.34	$117,374	0	$ 54.34	$ -
Note: Reduction from current design = savings for alternative							
Lump Sum amount for current design as provided to the VE Team.							
Assume $100 per SF of bridge for new construction							
Cofferdams, etc. not considered (conservative)							
Sub-total				$328,243			$ -
Cons't Mark-up	**10.00%**			$ 32,824			$ -
TOTAL				**$361,068**			**$ -**
Estimated Savings:							$361,068

2.3.7 ALTERNATIVE NUMBER BR-14

Value Analysis Design Alternative

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-14**
DESCRIPTION:	**Use pre-stressed girders in lieu of segmental concrete box girders. (LPA Alternative #7)**	SHEET NO.: **1** of **4**	

Original Design:

The original design proposes the use of segmental concrete box girders.

Alternative:

The alternative design would propose using a pre-stressed girder design as proposed in the other alternatives. In addition to changing the beam type we would propose a slightly wider median. The new alternative would utilize the proposed alignment for the new westbound bridge and would shift the new eastbound bridge to the south providing a 36' median.

Opportunities:

- Reduced bridge cost.
- Increase median width over original LPA Alternative #7.
- Reduced impact to subdivision (wider median).

Risks:

- Partial removal of the existing eastbound bridge.

Technical Discussion:

The use of a pre-stressed girder design poses no issues other than those faced by all the other alternatives. The original typical section can be modified to utilize a 36' median. The wider median can be more easily transitioned to provide a refuge area at the subdivision entrance. This alternative will require a partial demolition of the extra width of the existing eastbound bridge. A portion of the bridge will need to be removed to construct the piers on the east side of the main navigation channel.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 7,131,740	$ 0	$ 7,131,740
ALTERNATIVE	$ 6,367,625	$ 0	$ 6,367,625
SAVINGS	$ 764,115	$ 0	$ 764,115

Illustrations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-14**
DESCRIPTION:	**Use pre-stressed girders in lieu of segmental concrete box girders. (LPA Alternative #7)**	SHEET NO.: **2** of **4**

Note:
Savings in not having to provide cofferdams, concrete diaphragms, etc., have not been considered in determining the approximate cost savings. (Conservative).

Calculations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-14**
DESCRIPTION:	**Use pre-stressed girders in lieu of segmental concrete box girders. (LPA Alternative #7)**	SHEET NO.: **3** of **4**

Assume Alternative #7 only utilizes segmental box girders on the three span continuous beams.

(2 bridges) x (39.58 lf) x (585 lf) => 46,310 sf

From the LPA Structure Type Study:

Concrete Deck/Pre-stressed Girder Continuous Span => $85-$125/SF
Segmental Concrete Box Girders-Cantilever Construction => $95- $140/SF

Cost Worksheet

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-14**
DESCRIPTION:	**Use pre-stressed girders in-lieu of segmental concrete box girders. (LPA Alternative #7)**	SHEET NO.:	**4** of **4**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Segmental Box Girder	SF	46,310	$ 140.00	$ 6,483,400	0	$ 125.00	$ -
Prestressed Girder	SF	0	$ 125.00	$ -	46,310	$ 125.00	$ 5,788,750
Sub-total				$ 6,483,400			$ 5,788,750
Cons't Mark-up	**10.00%**			$ 648,340			$ 578,875
TOTAL				**$ 7,131,740**			**$ 6,367,625**
Estimated Savings:							$764,115

2.3.8 ALTERNATIVE NUMBER BR-17

Value Analysis Design Alternative

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-17**
DESCRIPTION:	**Consider the time differential value in alternative selection**	SHEET NO.: **1** of **3**	

Original Design:

The original design proposes a cost estimate prepared for the project that does not assign a cost value to project time required to construct.

Alternative:

The alternative proposes assigning a cost value to time for construction of the project to more accurately reflect the true costs of construction to all stakeholders.

Opportunities:

- Provide incentive to reduce construction time
- Faster project delivery
- Reduced E&I costs

Risks:

- None apparent

Technical Discussion:

The alternative suggests that adding a cost value to anticipated construction time will provide a more clear direction on total construction costs to all stakeholders involved. The project will require a major bridge replacement on a heavily traveled, primary hurricane evacuation route. The length and severity of disruption to the travelling public is a major project issue. In GDOT Standard Specifications Sec 108.08, the Liquidated Damages provisions gives guidance on the reasonable costs incurred by the Owner due to lack of use of the facilities under construction. For projects in excess of $40,000,000 in construction value, the LD's are assessed at $2,100/Calendar Day. In choosing among alternatives, it may be useful to examine the cost of time measured by these parameters to assign a finite value to the construction time differences in each alternative. Implementation of an incentive/disincentive special provision may be an avenue to explore to reduce the time required to construct the project and minimize disruption to the travelling public.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 2,142,000**	**$ 0**	**$ 2,142,000**
ALTERNATIVE	**$ 1,890,000**	**$ 0**	**$ 1,890,000**
SAVINGS	**$ 252,000**	**$ 0**	**$ 252,000**

Calculations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-17**
DESCRIPTION:	**Consider the time differential value in alternative selection**	SHEET NO.: **2** of **3**

Illustrative example of time cost differential between Alternative #1 and Alternative #8:

Estimated time of construction Alt. 1 = 1,020 Calendar days (34 months)
Estimated time of construction Alt. 8 = 900 Calendar days (30 months)

ALT 1= 1,020 Calendar days @ $2,100/Calendar day = $2,142,000
ALT 8= 900 Calendar days @ $2,100/Calendar day = $1,890,000

Difference = $252,000

Cost Worksheet

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-17**
DESCRIPTION:	**Consider the time differential value in alternative selection**	SHEET NO.:	**3** of **3**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Time Costs per GDOT 108.08	CD	1,020	$2,100	$ 2,142,000	900	$2,100	$ 1,890,000
Sub-total				$ 2,142,000			$ 1,890,000
Cons't Mark-up	**10.00%**			$ -			$ -
TOTAL				**$ 2,142,000**			**$ 1,890,000**
Estimated Savings:							$252,000

2.3.9 ALTERNATIVE NUMBER BR-18

Value Analysis Design Alternative

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-18**
DESCRIPTION:	**Utilize alternate bidding**	SHEET NO.: **1** of **3**

Original Design:

The original design proposes developing a single preferred alternate to let this project.

Alternative:

The alternative recommends plan development for multiple alternatives to let the project, which aims to produce the project functional equivalent at the lowest bid price.

Opportunities:

- Reduction in construction costs
- Possible reduction in construction time

Risks:

- Increase in design costs
- Non-conventional bidding process required

Technical Discussion:

This alternative aims to create construction plans for the two viable project alternates for letting to determine which alternative would provide the same functional equivalent at the lowest bid price. Alternatives 1 and 8 provide the same functional utility, but have several differences between the two alternatives. Alt 1 provides four lanes of through traffic during all phases of construction, and requires two mobilization efforts for demolition of the existing bridge. Alt 8 provides three lanes of through traffic during Phase II construction using a reversible lane scheme, and all demolition of existing bridges may be accomplished in one mobilization. The extra costs of mobilization and the risk incurred by demolishing the existing structures in ALT 1 account for the higher estimated costs than ALT 8, despite the additional traffic control costs incurred in ALT 8 due to twice daily lane shifts to accommodate the reversible lanes. The development of construction plans for both alternatives, and subsequent letting, would allow the risk relative to the two projects to be reflected in the bid price.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 44,018,458.59**	**$ 0**	**$ 44,018,458.59**
ALTERNATIVE	**$ 41,817,535.66**	**$ 0**	**$ 41,817,535.66**
SAVINGS	**$ 2,200,922.93**	**$ 0**	**$ 2,200,922.93**

Calculations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-18**
DESCRIPTION:	**Utilize alternate bidding**	SHEET NO.: **2** of **3**

The latest estimated costs for Alternative 1: $44,018,458.59
The latest estimated costs for Alternative 8: $42,585,574.53

Conservatively estimate 5% bid variance on-
Alt #1= +/-$2,200,922.93
Alt #8=+/-$2,129,278.73

5% Range bracket for Alt #1= $41,817,535 - $46,219,381
5% Range bracket for Alt #8= $40,456,295 - $44,714,853

As shown above, there is significant total cost estimate overlap with a 5% bid variance on each alternate without consideration for risk allocation or time costs attached to either alternative. Using the traditional design-bid-build approach currently underway for this project, this example provides a method of bid comparison to ascertain total construction costs to construct in the most efficient means possible with respect to construction costs, time, and risk.

Cost Worksheet

PBS&J an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-18**
DESCRIPTION:	**Utilize alternate bidding**	SHEET NO.: **3** of **3**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/UNIT	TOTAL	NO. OF UNITS	COST/UNIT	TOTAL
Alternate 1 Total Cost	1	LS	$44,018,459	$44,018,459	0.95	$44,018,459	$ 41,817,536
Sub-total				$ 44,018,459			$ 41,817,536
Cons't Mark-up	**10.00%**						
TOTAL				**$ 44,018,459**			**$ 41,817,536**
Estimated Savings:							$2,200,923

2.3.10 ALTERNATIVE NUMBER BR-20

Value Analysis Design Alternative

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-20**
DESCRIPTION:	**Extend MSE Wall To Eliminate West End Spans**	SHEET NO.: **1** of **3**	

Original Design:

The original design alternates (especially, LPA – 1 and LPA - 8) propose the construction of 1836' twin bridges across the Wilmington Canal. The 12-span arrangements on both alternates include 2 @ 120.5' = 241', BT-63; 3 @ 180'-225'-180' = 585', FBT-78; 5 @ 160' = 800', FBT-78; 2 @ 105' = 210', BT-54.

Alternative:

The alternative design proposes extending the MSE Wall to eliminate the need for the west end span from the current design.

Opportunities:

- Savings in cost
- Savings in substructure by eliminating one bent
- Added aesthetics

Risks:

- Non apparent

Technical Discussion:

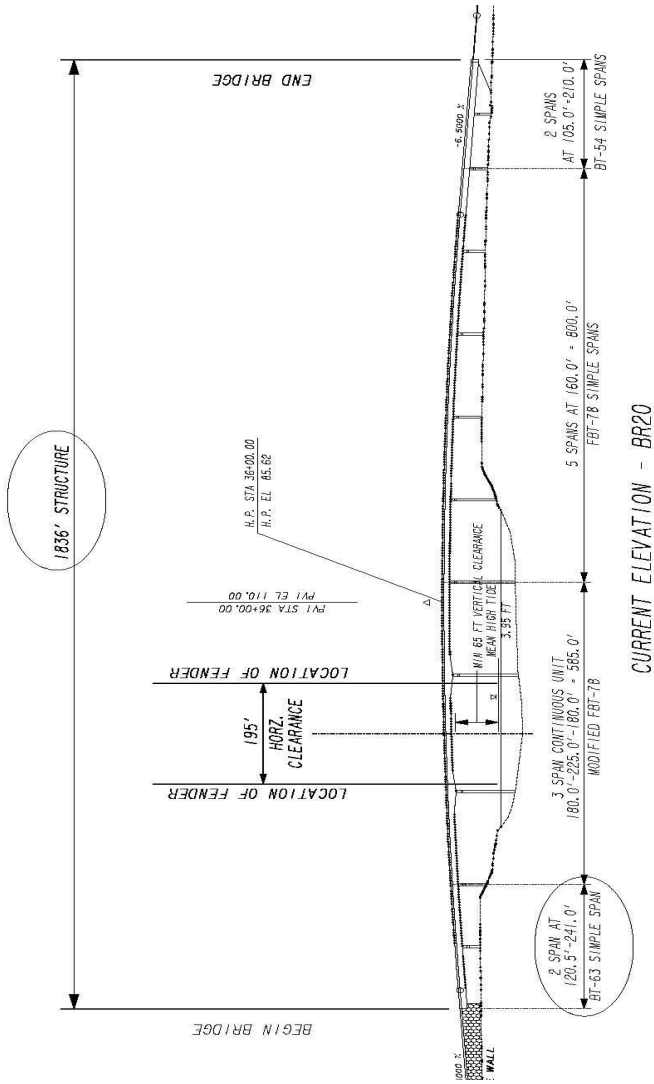
Per the concept report, MSE Walls up to 40' can be built on the soil type in this area. Extending the MSE Wall by 120' eastward would eliminate the need for the end spans at this end of the bridge and also the first interior bents.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,229,778**	**$ 0**	**$ 1,229,778**
ALTERNATIVE	**$ 477,502**	**$ 0**	**$ 477,502**
SAVINGS	**$ 752,275**	**$ 0**	**$ 752,275**

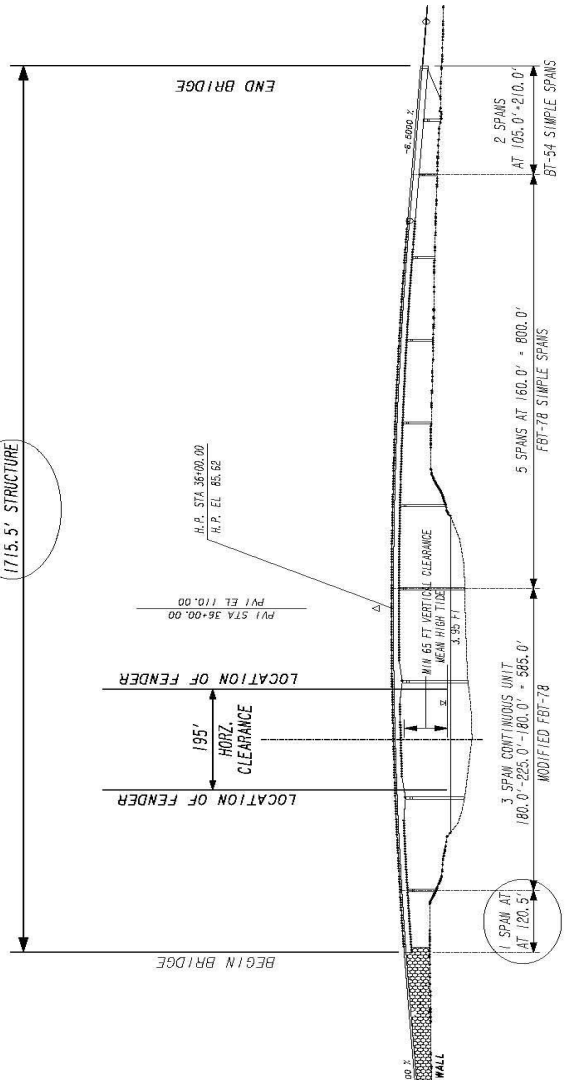
Illustrations

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **R 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.: **BR-20**
DESCRIPTION:	**Extend MSE Wall To Eliminate West End Spans**	SHEET NO.: **2** of **3**



CURRENT ELEVATION - BR20



ALTERNATIVE ELEVATION - BR20

Cost Worksheet

PBSJ an Atkins company

PROJECT:	**Georgia Department of Transportation** **CSBRG-0007-00(128) - P.I. No. 0007128** **CR 787/Islands Expressway Bridge Replacement** **Chatham County**	ALTERNATIVE NO.:	**BR-20**
DESCRIPTION:	**Extend MSE Wall To Eliminate West End Spans**	SHEET NO.:	**3** of **3**

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Bridge	SF	9,539	$ 100.00	$ 953,858	0	$ 124.00	$ -
Asphalt Paving	SY	0	$ 75.00	$ -	1060	$ 75.00	$ 79,500
Guardrail	LF	0	$ 17.34	$ -	482	$ 17.34	$ 8,358
MSE Wall (30' average height)	SF	0	$ 40.00	$ -	7230	$ 40.00	$ 289,200
Coping	LF	0	$ 35.00	$ -	241	$ 35.00	$ 8,435
Backfill	CY	0	$ 3.00	$ -	16200	$ 3.00	$ 48,600
Class B Concrete (Incl. Reinf.)	CY	240	$ 439.31	$ 105,434	0	$ 439.31	$ -
18" PPC Piles	LF	1,080	$ 54.34	$ 58,687	0	$ 54.34	$ -
Note: Reduction from current design = savings for alternative							
Assume $100 per SF of Bridge for End Spans							
Cofferdams, etc. not considered (conservative)							
Sub-total				$ 1,117,980			$ 434,093
Cons't Mark-up	**10.00%**			$ 111,798			$ 43,409
TOTAL				**$ 1,229,778**			**$ 477,502**
Estimated Savings:							$752,275

3 PROJECT DESCRIPTION

3.1 NEED AND PURPOSE

The Islands Expressway is a four-lane rural divided highway with a grassed median. The project area is surrounded by coastal marshland. The road connects with US 80/SR 26 east of the Wilmington River which provides direct access to Tybee Island. It also serves as a hurricane evacuation route. The existing two parallel bascule bridges are functionally obsolete and require being opened an average of ten times per day causing frequent travel delays and inconvenience to motorists on the Islands Expressway. The existing travel volume exceeds 2,100 vehicles per day. Traffic heading westbound in the am peak hours is six times greater than traffic moving eastbound. In the peak pm hours, the heavy flow is reversed and eastbound traffic is four times greater than the westbound traffic. The length of the project is 1.2 miles and the design speed is 55 mph.

3.2 KICK-OFF PRESENTATION BY LPA

LPA made a presentation to the VE Team on Monday morning of the VE Study as part of the information phase. They described the project and its constraints and discussed the environmental permitting status and needs of the project.

4 VALUE ENGINEERING PROCESS

4.1 WORK SHOP TEAM

PBS&J's Value Engineering (VE) team performed a VE study September 13-16, 2010 in the offices of Georgia Department of Transportation, Atlanta, Georgia. The team followed the SAVE International's six-step Value Engineering job plan as outlined in this section. The VE Study team consisted of the following members:

Les Thomas, P.E., CVS	Team Leader
Luke Clarke, P.E., AVS	Team Highway Design Engineer
Ramesh Kalvakaalva, P.E., AVS	Team Structural Engineer
Kevin Martin, Esq., AVS	Team Construction Specialist

4.2 SIX-STEP VALUE ENGINEERING JOB PLAN

The VE team followed the SAVE International's six-step Value Engineering job plan:

1. Information Phase
2. Function Analysis Phase
3. Creative Phase
4. Evaluation Phase
5. Development Phase
6. Presentation Phase

Information Phase— during this phase of the VE Team's work, the team received a briefing from the GDOT staff members and their design team. This briefing included discussions of the design intent behind the project, the cost concerns, and the physical project limitations. In the working session that followed, the VE team developed cost models from the cost data provided by the designers and familiarized themselves with the construction drawings and other data that was made available to the team.

Function Analysis Phase— during this phase the VE Team determined the "**Functions**" of the project. This was accompanied by reviewing the project by asking the questions such as: "*What is the project supposed to do?*" and "*How is it supposed to accomplish this purpose?*" In the Value Engineering vernacular, the answers to these questions are cast in the form of active verbs and measurable nouns. These verb/noun pairs form the basis of the function analysis that distinguishes a Value Engineering effort from a potentially damaging cost-cutting exercise. A Functional Analysis System Technique (FAST) diagram was prepared highlighting the projects required functions.

Creative Phase — The VE Team performed a brainstorming session to identify ideas that might help meet the project objectives. The brainstorming session identified twenty (20) ideas. See page 1-7 for listing.

Evaluation Phase— Once the VE team identified the creative ideas, it was necessary to decide which ones should be carried forward. This is the work of the Evaluation or Judgment phase. The VE Team reflected on the project constraints and objectives shared with the team by the Owner's representatives and the design team members. This guidance emerged on the first day of the study at the kick-off meeting. From that guidance, the team was able to select ideas that they believed would improve the project. The VE team used the following values as measures of whether or not an alternative had enough merit to be carried forward in the VE process:

- First Costs
- Permit-ability
- Constructability
- Reliability
- Operating Costs
- Impact on salt marsh, existing sub-division, and existing utilities

Development Phase— During this phase, the VE team developed each of the selected alternatives whose score was 4 or higher because of time constraints. This effort included a detailed explanation of the idea with sketches as appropriate to clarify the idea from the original concept, advantages and disadvantages, a technical explanation and an estimation of the cost and resultant savings if implemented (see the tabbed section titled ***Study Results***).

Presentation Phase— As noted earlier, the team made an informal "out-briefing" on the last day of the workshop. This presentation was designed to inform the Owners and the Designers of the initial findings of the VE study. This written report is intended to formalize those findings.

The following is a flow chart that represents the work done prior to, during, and after the VE workshop is completed on site:

Source: SAVE International

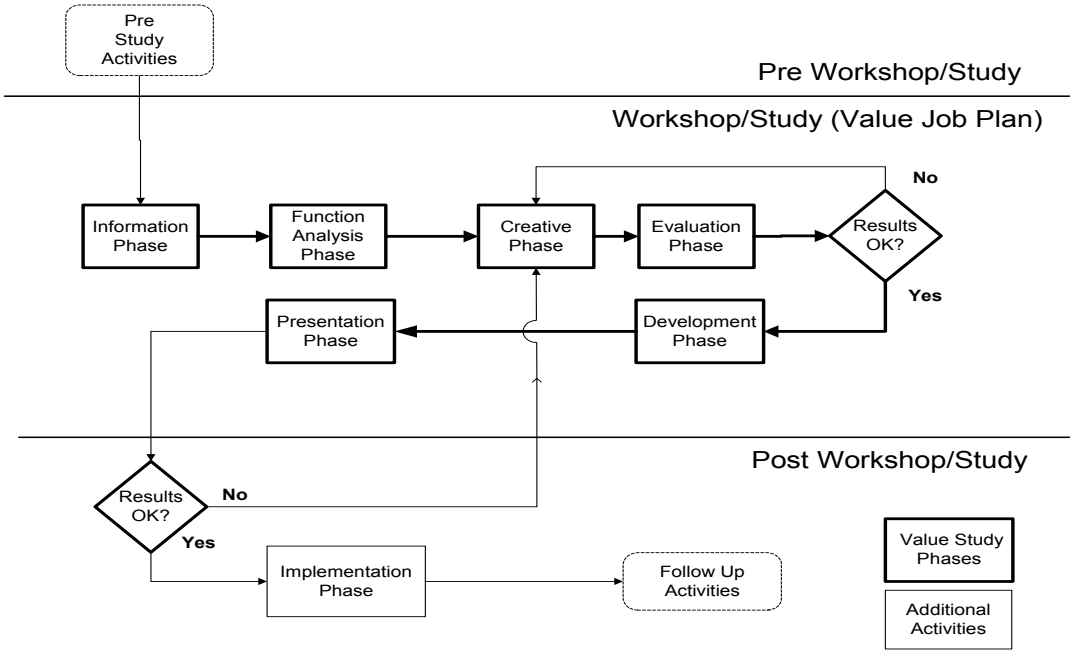


Figure 0-1 – Value Engineering Job Plan

4.3 VE WORKSHOP AGENDA

VALUE ENGINEERING STUDY AGENDA

CR 787 Bridge Replacement Chatham County

October 4-7, 2010

Pre-Workshop Activities: VE team leader organizes study, coordinates with the Owner and Designer to attain the project objectives and materials necessary. The VE Team receives and reviews all project documents. The team develops a Pareto chart and/or cost model for the project.

Day One

9:00-10:30 Design Team Presentation (Information Phase)
Introduction of participants, owner, designer, and VE Team members
Presentation of the project by the design engineer including:

- History and background
- Design criteria and constraints
- Special needs
- Current construction completion schedule
- Project cost estimate if available and budget constraints

Owner Presentation – special requirements, definition of life-cycle period and interest rate for life-cycle costs
Review VE Pareto chart/cost model
Discussion, questions and answers
Overview of the VE process and agenda – Workshop goals and project goals

10:30-12:00 VE Team reviews project (Information Phase)
Review design team's presentation
Review agenda and goals of the study
Visit project site

1:00-2:30 Function Analysis Phase
Analyze cost model – Pareto
Identify basic and secondary functions
Complete function matrix/FAST diagram

2:30-5:00 Creative Phase
Brainstorming of alternative ideas

Day Two

8:00-10:00 Evaluation Phase
Establish criteria for evaluation
Rank ideas
Identify "best" ideas for development
Identify those ideas that will become design suggestions
Identify a "champion" for each idea to be developed

10:00-5:00 Development Phase
Develop alternative ideas design suggestions with assessment of original design and write up new alternatives including:

- Opportunities and risks
- Illustrations
- Calculations
- Cost worksheets
- Life-cycle cost analysis

Day Three

8:00-5:00 Development Phase
Continue developing alternative ideas
Continue developing design suggestions
Prepare for presentation to Owners and Designers

Day Four

8:00-5:00 Development Phase
Continue developing alternative ideas
Continue developing design suggestions
Prepare for presentation to Owners and Designers

Day Five

8:00-9:00 Prepare presentation

9:00-10:00 VE team presentation

4.4 CONSTRUCTION CAPITAL COST ESTIMATE

The VE Team was provided with a construction cost estimate. An estimate of the right-of-way acquisition cost was also given to the Team. The Team used this information to concentrate its efforts towards the area of the project having the least value.

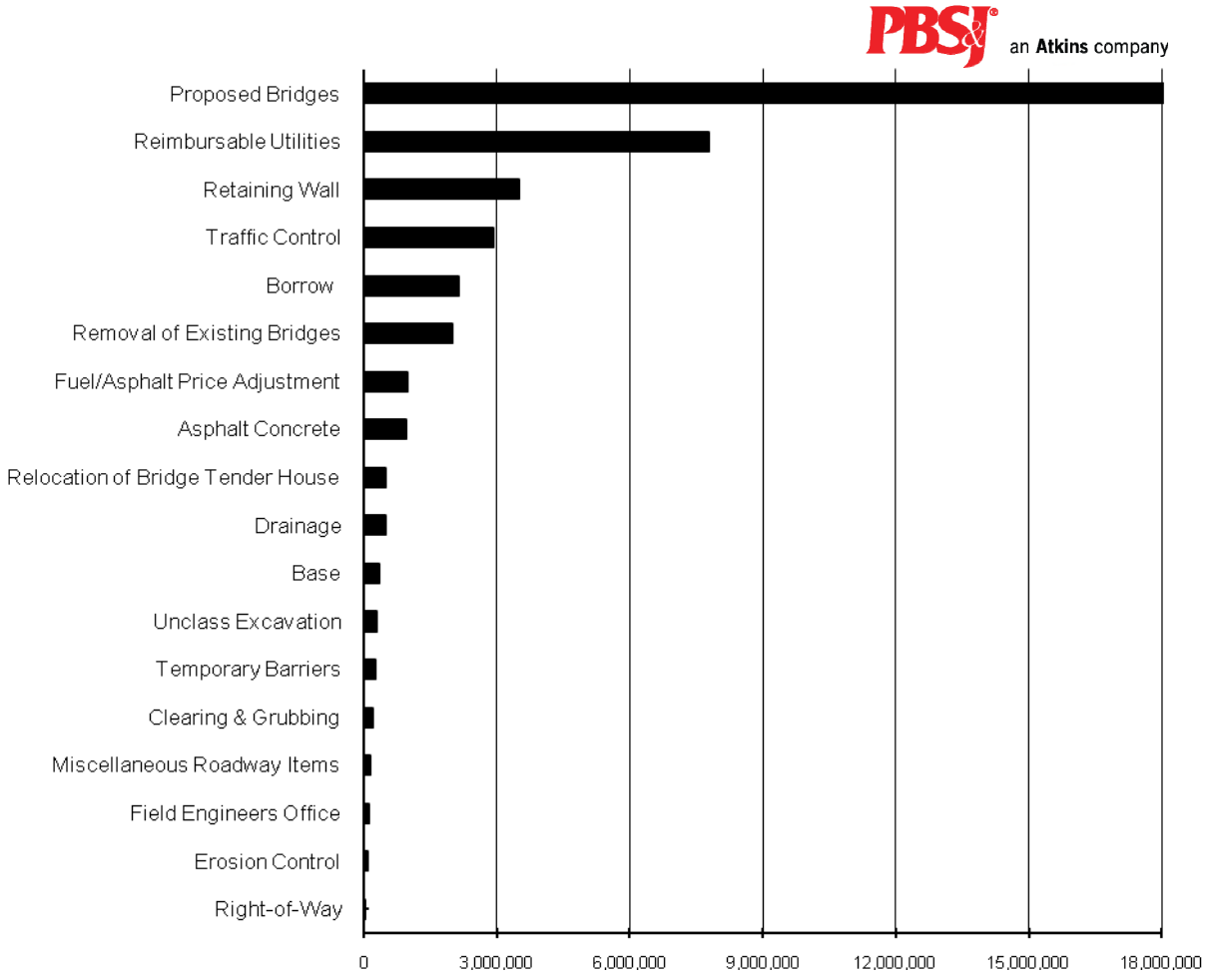
4.5 PARETO CHARTS

Pareto Chart – Cost Histogram

PBSJ an Atkins company

PROJECT:	Georgia Department of Transportation CSBRG-0007-00(128) - P.I. No. 0007128 Chatham County		
PROJECT ELEMENT	**COST**	**PERCENT**	**CUM. PERCENT**
Proposed Bridges	18,048,200	56.36%	56.36%
Reimbursable Utilities	7,776,500	17.67%	74.03%
Retaining Wall	3,488,650	10.90%	84.93%
Traffic Control	2,910,936	9.09%	94.02%
Borrow	2,138,820	6.68%	100.70%
Removal of Existing Bridges	2,000,000	6.25%	106.94%
Fuel/Asphalt Price Adjustment	985,430	3.08%	110.02%
Asphalt Concrete	959,501	3.00%	113.02%
Relocation of Bridge Tender House	500,000	1.56%	114.58%
Drainage	480,838	1.50%	116.08%
Base	344,270	1.08%	117.16%
Unclass Excavation	298,100	0.93%	118.09%
Temporary Barriers	247,400	0.77%	118.86%
Clearing & Grubbing	200,000	0.62%	119.48%
Miscellaneous Roadway Items	155,759	0.49%	119.97%
Field Engineers Office	125,000	0.39%	120.36%
Erosion Control	90,487	0.28%	120.64%
Right-of-Way	34,200	0.11%	120.75%
Pavement Markings	20,079	0.06%	120.81%
Signing Items	12,259	0.04%	120.85%
Subtotal not including ROW costs, reimbursable utilities, fuel adjustment costs	**$ 32,020,298**	**120.85%**	
E & C Rate @ 10%	**$ 3,202,030**		
Subtotal =	**$ 35,222,328**		
Total Construction Cost =	**$ 35,222,328**		
Right-of-Way =	**$ 34,200**		
Reimb. Utilities =	**$ 7,776,500**		
fuel/asphalt price adjustment	**$985,430.00**		
TOTAL	**$ 44,018,458**	**Comp Mark-up:**	10%

Pareto - CR 787 Bridge Replacement, Chatham County



4.6 FUNCTIONAL ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM

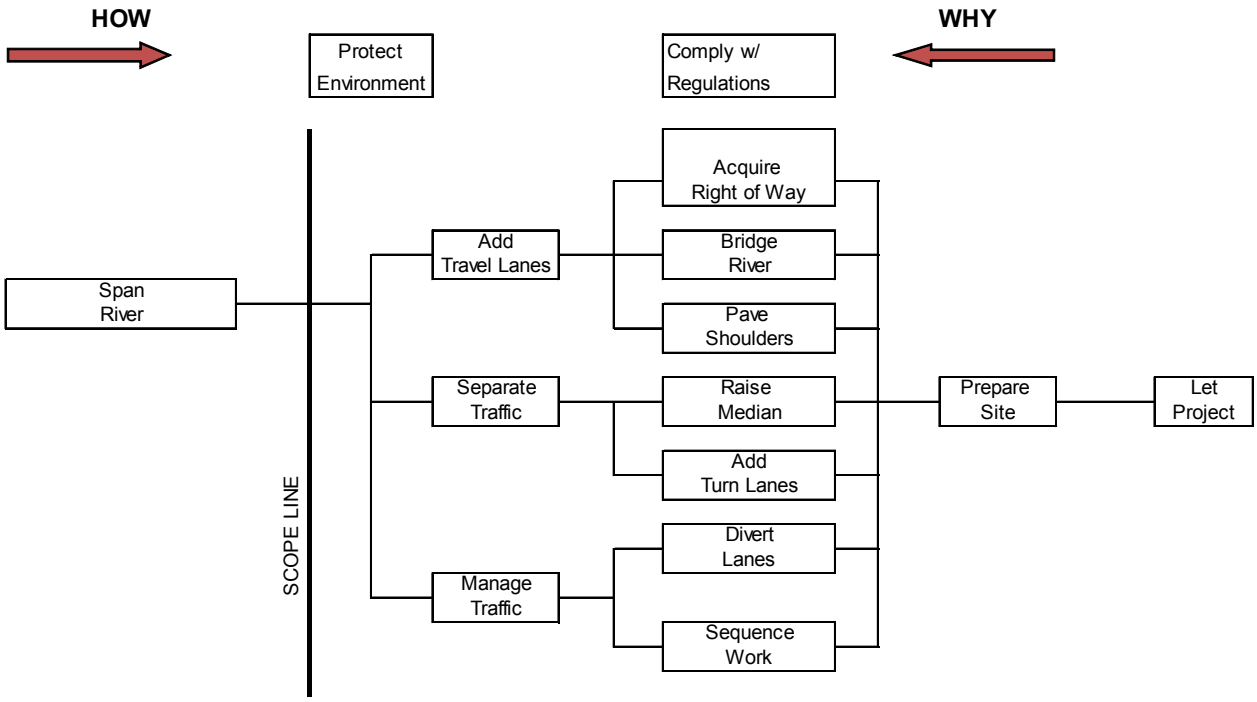
FUNCTIONAL ANALYSIS SYSTEMS TECHNIQUE (FAST)

CR 787/Islands Expressway Bridge Replacement

Project No. CSBRG-0007-00(128) - P.I. No. 0007128

Georgia Department of Transportation

Chatham County



4.7 ATTENDANCE SHEET FOR DESIGNERS AND VE TEAM PRESENTATIONS

VE TEAM PRESENTATION

Geogia Department of Transportation		MEETING PARTICIPANTS		October 7, 2010
CSBRG-0007-00(128) - P.I. No. 0007128 Chatham County				
NAME		ORGANIZATION & TITLE	E-MAIL	PHONE
Lisa Myers		GDOT-Engineering Services	lmyers@dot.ga.gov	404-631-1770
Matt Sanders		GDOT-Engineering Services	msanders@DOT.GA.GOV	404-631-1752
Ron Wishon		GDOT-Engineering Services	rwishon@dot.ga.gov	404-631-1753
Bill DuVall		GDOT-Bridge Design	bduvall@dot.ga.gov	404-631-1883
Al Bowman		LPA Group	abowman@lpagroupcom	770-263-9118
Jim Kennerly		LPA Group	jkennelry@lpagroup.com	770-263-9118
Brad Gowen		LPA Group	bgowen@lpagroup.com	770-263-9118
Luke Clarke		PBS&J	lwclarke@pbsj.com	205-969-3776
Kevin Martin		PBS&J	klmartin@PBSJ.com	205-969-2776
Ramesh Kalvakaalva		Civil Services, Inc.	rameshk@civilservicesinc.com	770-312-2019
Les Thomas		PBS&J	lmthomas@pbsj.com	678-677-6420
Robert Murphy		GDOT	romurphy@dot.ga.gov	404-631-1586

DESIGNER PRESENTATION

Geogia Department of Transportation		MEETING PARTICIPANTS		October 4, 2010
CSBRG-0007-00(128) - P.I. No. 0007128 Chatham County				
NAME		ORGANIZATION & TITLE	E-MAIL	PHONE
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Ron Wishon		GDOT-Engineering Services	rwishon@dot.ga.gov	404-631-1753
Ken Werho		GDOT-Traffic Operations	kwerho@dot.ga.gov	404-635-8144
Bill DuVall		GDOT-Bridge Design	bduvall@dot.ga.gov	404-631-1883
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Jim Kennerly		LPA Group	jkennelry@lpagroup.com	770-263-9118
Brad Gowen		LPA Group	bgowen@lpagroup.com	770-263-9118
Luke Clarke		PBS&J	lwclarke@pbsj.com	205-969-3776
Kevin Martin		PBS&J	klmartin@PBSJ.com	205-969-2776
Ramesh Kalvakaalva		Civil Services, Inc.	rameshk@civilservicesinc.com	770-312-2019
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Randy Thomas		PBS&J	rsthomas@pbsj.com	770-883-1545
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Robert Murphy		GDOT	romurphy@dot.ga.gov	404-631-1586
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Troy Pittman		GDOT-Savannah	trpittman@dot.ga.gov	912-651-2144
Brad Saxon		GDOT-District 5 Preconstruction	bsaxon@dot.ga.gov	912-427-5715
Teresa Scott		GDOT-District 5 Preconstruction	tscott@dot.ga.gov	912-427-5788