

# VALUE ENGINEERING TRAINING STUDY REPORT

I-95 and SR 99 – Interchange Reconstruction

Project No. NHS00-0001-00(585)

Glynn County

PI No. 0001585

November 12, 2009

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OWNER:



Georgia Department of Transportation  
600 West Peachtree Street  
Atlanta, GA 30308  
(404.631.1770)

VALUE ENGINEERING  
INSTRUCTOR:



MACTEC Engineering and Consulting, Inc.  
3200 Town Point Drive NW, Suite 100  
Kennesaw, GA 30144  
(770.421.3400)

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I-95 and SR 99 - Interchange Reconstruction

Project No. NHS00-0001-00(585)  
PI No. 0001585

**November 12, 2009**

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## **EXECUTIVE SUMMARY**

## EXECUTIVE SUMMARY

# VALUE ENGINEERING TRAINING STUDY REPORT

### I-95 and SR 99 - Interchange Reconstruction

Project No. NHS00-0001-00(585)  
PI No. 0001585

**November 12, 2009**

#### **Study Background**

This report presents the results of a value engineering (VE) study for the interchange reconstruction of I-95 at SR 99 in Glynn County. The study was conducted as part of a VE training session held for GDOT staff on October 19 to 23, 2009.

SR 99 is a 2-lane facility that begins at US 84 / GA 520 and continues in a NE direction through Glynn County ending at Ocean Highway / SR 25 / US 17. SR 99 provides NE Glynn County access to I-95 and 3 designated hurricane evacuation routes; US 341 / US 25, SR 32 and US 82 / SR 520. Currently the land surrounding the SR 99 interchange is undeveloped however, this is a rapidly growing area with several large, planned developments including residential, commercial and recreational. Traffic is projected to increase in this area in the near future and to plan for future traffic conditions and growth patterns, improvements are needed. Replacing this bridge will improve safety and operations at the interchange as ongoing growth and development occur. Turn lanes will improve traffic flow and reduce the likelihood of crashes. In addition, this interchange reconstruction will provide the required vertical and horizontal clearance for improvements to I-95.

The proposed construction will widen SR 99 to provide 2-12 ft through lanes with a 6.5ft paved outside shoulder and a 4 ft bike lane in each direction separated by a variable width, raised median (20' to 32'). Six lanes will be required across the bridge; 2 EB through lanes, an EB left turn lane, a WB left turn lane and 2 WB through lanes. The ramps will be reconstructed and realigned to accommodate turning lanes at the ramp termini. The existing bridge will be replaced with a new 430' x 106' bridge with suitable horizontal clearances to accommodate future improvements on I-95.

The estimated construction cost of the project is \$14,118,311, the R/W estimate is \$130,000 yielding a total project cost of \$14,248,311. On Monday, October 19, 2009, the design team gave an overview of the project to the VE team and on Friday, October 23, 2009, the VE Team presented their recommendations.

This report presents the VE Team's recommendations and all back-up information for consideration by the decision-makers. This **Executive Summary** includes a brief description of each recommendation. The **Study Identification** section contains information about the project and the team. The **Recommendations** section presents a more detailed description and support information about each recommendation. The **Appendix** includes a complete record of the Team's activities and findings as well as the worksheets developed during the information, creative and evaluation phases of the study. The reader is encouraged to review all sections of the report in order to obtain a complete understanding of the VE process.

## VE-11

<b>DEVELOPMENT PHASE - EXECUTIVE SUMMARY</b>	
<b>Project:</b> NHS00-0001-00(585), PI 0001585	<b>Team:</b> 2
<b>Location:</b> I-95 @ SR 99 Interchange Reconstruction – Glynn County	<b>Date:</b> 22-Oct-2009

### **INTRODUCTION**

This project proposes to reconstruct the interchange of I-95 and SR 99 in Glynn County. The project is needed to eliminate substandard clearances and shoulder widths created when I-95 was widened underneath SR 99. Additional improvements are proposed to accommodate long-range improvements to both I-95 and SR 99 and for operational improvements at the ramp intersections.

### **CONSIDERATIONS**

SR 99 is included as part of the local bike plan. Additionally, a lake is located in the southeast quadrant of the I-95 and SR 99 interchange. SR 99 is proposed to be widened from US 341 to US 17 but the projects are inactive and no funding is identified. I-95 is currently under construction and being widened to 6 lanes. A project to widen I-95 to 8 lanes is in the long range plan with no funding identified.

### **RESULTS OBTAINED**

The team generated 35 ideas that resulted in 7 recommendations as summarized below:

#### **A2: Reduce Bridge Width**

This concept eliminates 8 feet of bridge width by shifting the alignment 4 feet to the north.  
Estimated Savings: \$350,000

#### **A3: Reduce Bridge Length**

This idea proposes to eliminate the two proposed end spans by constructing MSE walls.  
Estimated Savings: \$800,000

#### **B3: Eliminate Interstate Work**

This idea proposes to eliminate the paving proposed that will not be utilized until a future project is constructed. Estimated Savings: \$324,000

## VE-11

<b>DEVELOPMENT PHASE - EXECUTIVE SUMMARY</b>	
<b>Project:</b> I-95 @ SR 99 Interchange	<b>Team:</b> 2
<b>Location:</b> Glynn County	<b>Date:</b> 22-Oct-2009

### **RESULTS OBTAINED (continued)**

#### B4: Eliminate Ramp Work

This idea proposes to eliminate the widening on the ramps that would not really be needed until a future widening of SR 99 is constructed.

Estimated Savings: \$1,600,000

#### B7: Replace SR 99 Concrete with Asphalt

This concept proposes to utilize asphalt pavement on SR 99 in lieu of the proposed concrete pavement. Estimated Savings: \$1,100,000

#### B8/L1: Reduce SR 99 Typical Section Width

This idea proposes to eliminate portions of the turn lanes and median on SR 99. Estimated Savings: \$3,800,000

#### J2: Eliminate Lighting

This idea proposes to eliminate the street lighting proposed on the project. Estimated Savings: \$520,000

**VE-10**

<b>DEVELOPMENT PHASE - SUMMARY OF COST SAVINGS</b>						
<b>Project:</b> NHS00-0001-00(585), PI 0001585					<b>Team No.:</b> 2	
<b>Location:</b> I-95 @ SR 99 Interchange Reconstruction – Glynn County					<b>Date:</b> 22-Oct-2009	
<b>Idea No.</b>	<b>Creative Idea Description</b>	<b>Original Initial Cost</b>	<b>Proposed Initial Cost</b>	<b>Initial Cost Savings</b>	<b>Future Savings</b>	<b>Total Life Cycle Savings</b>
A2	Reduce Extra Bridge Width Due to Staging	\$3,700,000	\$3,350,000	\$350,000	\$0	\$350,000
A3	Reduce Bridge Length with MSE Walls	\$3,700,000	\$2,900,000	\$800,000	\$0	\$800,000
B3	Eliminate Interstate Work	\$324,000	\$0	\$324,000	\$0	\$324,000
B4	Eliminate Ramp Widening	\$1,600,000	\$0	\$1,600,000	\$0	\$1,600,000
B7	Replace SR 99 Concrete with Asphalt	\$2,300,000	\$1,100,000	\$1,200,000	(\$100,000)	\$1,100,000
B8	Reduce SR 99 Typical Section Width	\$7,300,000	\$3,500,000	\$3,800,000	\$0	\$3,800,000
J2	Eliminate Lighting	\$500,000	\$0	\$500,000	\$20,000	\$520,000

**VE-10**

<b>DEVELOPMENT PHASE - SUMMARY OF COST SAVINGS</b>						
<b>Project:</b> NHS00-0001-00(585), PI 0001585					<b>Team No.:</b> 2	
<b>Location:</b> I-95 @ SR 99 Interchange Reconstruction – Glynn County					<b>Date:</b> 22-Oct-2009	
<b>Idea No.</b>	<b>Creative Idea Description</b>	<b>Original Initial Cost</b>	<b>Proposed Initial Cost</b>	<b>Initial Cost Savings</b>	<b>Future Savings</b>	<b>Total Life Cycle Savings</b>
A2	Reduce Extra Bridge Width Due to Staging	\$3,700,000	\$3,350,000	\$350,000	\$0	\$350,000
A3	Reduce Bridge Length with MSE Walls	\$3,700,000	\$2,900,000	\$800,000	\$0	\$800,000
B3	Eliminate Interstate Work	\$324,000	\$0	\$324,000	\$0	\$324,000
B4	Eliminate Ramp Widening	\$1,600,000	\$0	\$1,600,000	\$0	\$1,600,000
B7	Replace SR 99 Concrete with Asphalt	\$2,300,000	\$1,100,000	\$1,200,000	(\$100,000)	\$1,100,000
B8	Reduce SR 99 Typical Section Width	\$7,300,000	\$3,500,000	\$3,800,000	\$0	\$3,800,000
J2	Eliminate Lighting	\$500,000	\$0	\$500,000	\$20,000	\$520,000

## **STUDY IDENTIFICATION**

## VE-1

# STUDY IDENTIFICATION

<b>Project:</b> NHS00-001-00(585)	<b>Date:</b> October 19, 2009
<b>Location:</b> I-95/SR 99 Interchange Reconstruction-Grants Ferry Road	

## VE Team Members

<b>Name:</b>	<b>Position:</b>	<b>Organization:</b>	<b>Telephone:</b>
Ben Buchan	Director of Engineering	GDOT	404-631-1700
Mike Dover	Asst IPD Engineer	GDOT	404-631-1733
Steve Gaston	Asst Group Leader Brid	GDOT	404-631-1874
Lenora Leigh	Bridge Design	GDOT	404-631-1918
Michelle Pate	DE 3 Design	GDOT	404-631-1613
Dwayne Wilson	DE 2 Design	GDOT	404-631-1720

## Project Description

Interchange Reconstruction/Bridge Replacement I-95 at SR 99 in Glynn County. This includes the widening of SR 99 for additional turn lanes, widening of ramps for future traffic, paving and striping out 1 additional lane plus shoulder on each side of I-95 and replacing the existing bridge structure with a new structure that matches the widened section of SR 99 and provides minimum vertical and horizontal clearances for I-95.

## Project Constraints

- Lake at NB off ramp

## **VE RECOMMENDATIONS**

VE-9

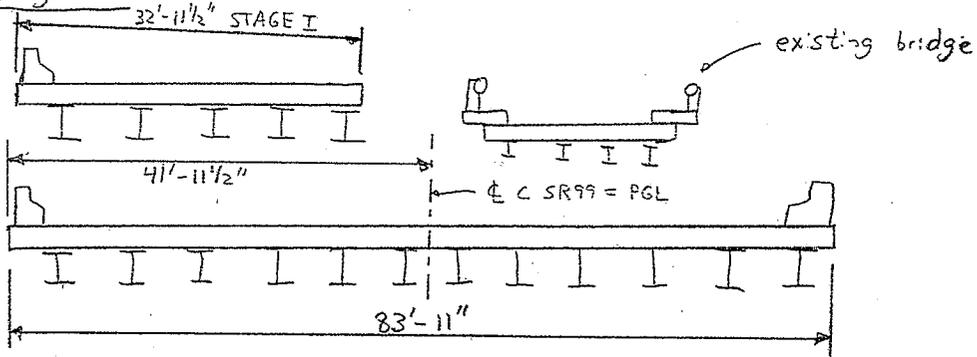
<b>DEVELOPMENT AND RECOMMENDATION PHASE</b>			
<b>Project: NHS00-0001-00(585)</b> <b>I-95 @ SR 99 Interchange Reconstruction</b> <b>GLYNN COUNTY PI 001585</b>			
<b>Idea No.:</b> A2	<b>Sheet No.:</b> 1 of 4	<b>CREATIVE IDEA:</b> Shift Roadway alignment to reduce bridge width due to staging.	
Comp By: SKG    Date: 22-Oct-2009    Checked By: LEL    Date: 22-Oct-2009			
<p><b>Original Concept:</b> Bridge is being built to a width of 83'-11" with 12' shoulders. The left side of the bridge is being built over further than the roadway section requires to allow stage I to be built with 2 traffic lanes while maintaining traffic on the existing bridge. This extra width is being carried over to the other side of the bridge for symmetry and to minimize the impact of an anticipated future widening of SR 99.</p> <p><b>Proposed Change:</b> Shifting the alignment 4 ft to the North to utilize all the width of Stage I to match the typical section of the current proposed project.</p> <p><b>Justification:</b> By shifting the alignment 4' to the North, 8' of bridge width can be eliminated for Stage II construction. This will still provide enough width for 8' minimum shoulders as required by Department guidelines, instead of the 12' shoulders originally proposed. This bridge would still be suitable for widening if the future widening of SR 99 is realized.</p>			
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
<b>INITIAL COST: Original</b>	\$3,700,000		
<b>Proposed</b>	\$3,350,000		
<b>Savings</b>	\$350,000		
<b>FUTURE COST: Savings</b>		-	-
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$350,000</b>

### SKETCH

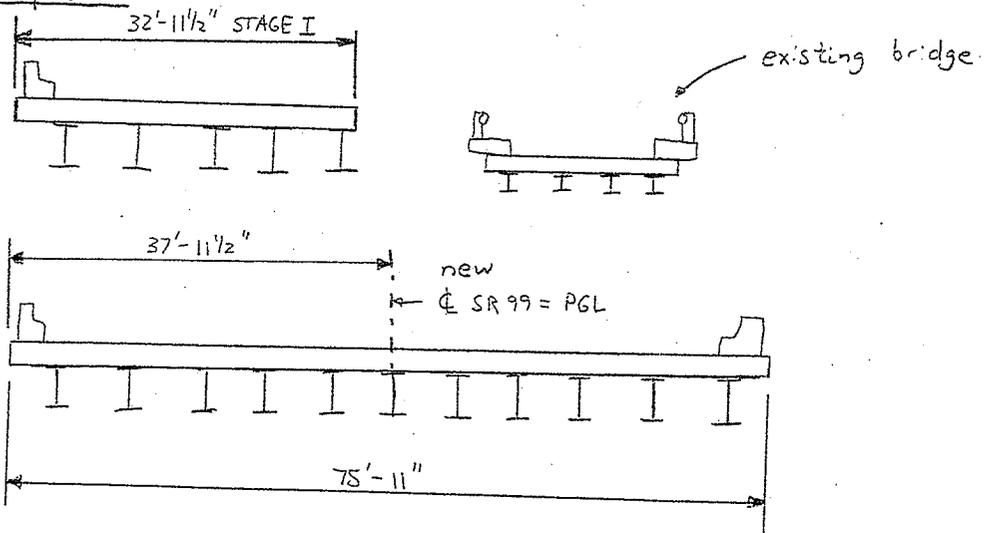
Project: NHS00-0001-00(585)

Idea No. : A2  
Client: GDOT  
Sheet 2 of 4

Original:



Proposed:





## CALCULATIONS

**Project:** NHS00-0001-00(585)

Idea No.: A2

Client: GDOT

Sheet 4 of 4

### Assumptions:

- Cost per sq. ft. of bridge for a PSC beam bridge over a roadway is \$100 per sq. ft. This cost was discussed with Bill DuVall, Asst. State Bridge Engineer.
- Roadway cost difference due to shifting the alignment only 4 ft will be negligible.
- Due to low possibility of future widening SR 99 to 4 lane, future widening costs of bridge were not considered.

### Necessary width of Bridge:

$$\begin{aligned}
 W &= 2 \text{ barriers} + 2 \cdot 8' \text{ shoulders} + TW + 8' \text{ median} (2' \text{ gutter} + 4' \text{ median} + 2' \text{ gutter}) \\
 &= 2(1.9583') + 2(8') + 24' + 24' + 8' \\
 &= 73.9167' \Rightarrow 73' - 11" \blacktriangleleft
 \end{aligned}$$

For 2 lane rural road with ADT > 2000, bridge width = TW + 8' + 8'

Per Policies and Procedures, 4265-10

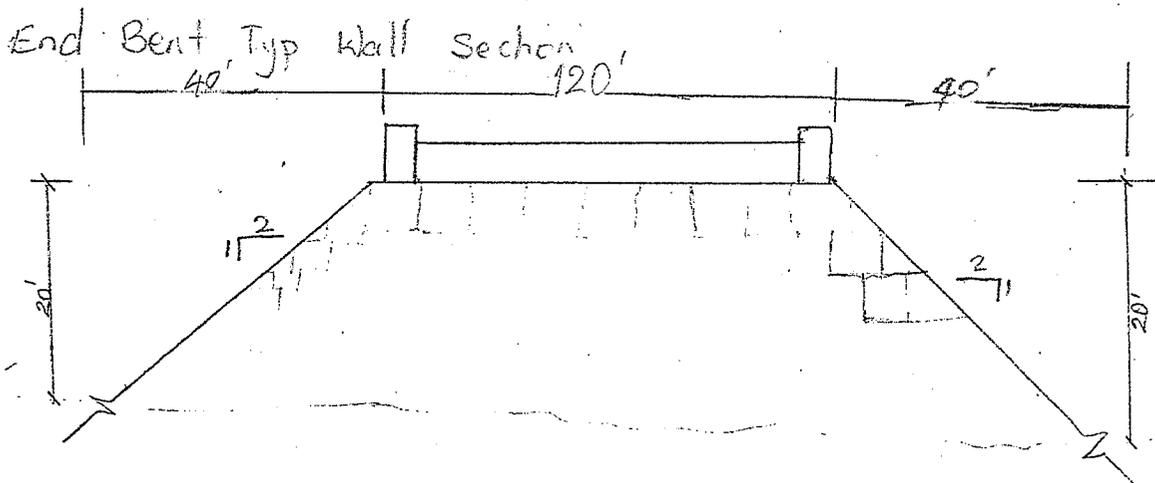
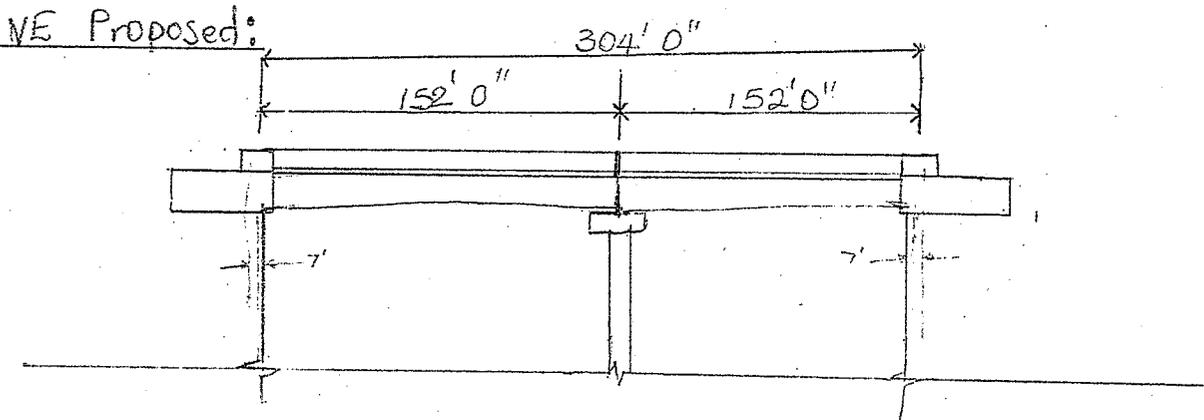
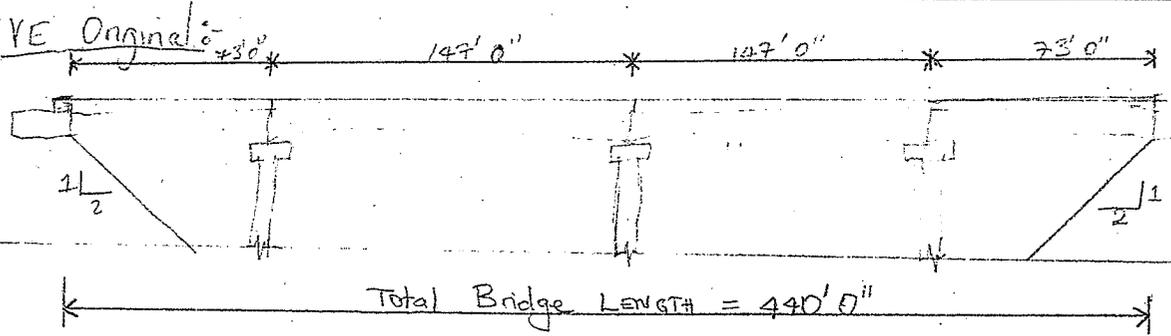
VE-9

<b>DEVELOPMENT AND RECOMMENDATION PHASE</b>			
<b>Project: NHS00-0001-00(585)</b> <b>I-95 @ SR 99 Interchange Reconstruction</b> <b>GLYNN COUNTY PI 001585</b>			
<b>Idea No.:</b> A3	<b>Sheet No.:</b> 1 of 4	<b>CREATIVE IDEA:</b> Reduce Bridge Length to 304' with 2-spans and MSE walls at end bents.	
Comp By: LEL    Date: 22-Oct-2009    Checked By: SKG    Date: 22-Oct-2009			
<p><b>Original Concept:</b> A 4-span bridge with 147' spans for spans 2 and 3 and 73'-0" spans for spans 1 and 4. This bridge will include 3 intermediate concrete bents and 2 pile end bents.</p> <p><b>Proposed Change:</b> A 2-span bridge with 152'-0" spans for spans 1 and 2. This bridge will include 1 intermediate concrete bent and 2 pile end bents. Also included will be a MSE wall at each end bent.</p> <p><b>Justification:</b> Adding the MSE walls maintains the horizontal clearance provided by the current project but allows the elimination of the 2-73'-0" end spans at a significant cost savings. The roadway area should be able to drain in front of the walls.</p>			
<b>LIFE CYCLE COST SUMMARY</b>	<b>INITIAL Project Cost</b>	<b>FUTURE Project Cost</b>	<b>TOTAL Present Worth Cost</b>
<b>INITIAL COST: Original</b>	\$3,700,000		
<b>Proposed</b>	\$2,900,000		
<b>Savings</b>	\$800,000		
<b>FUTURE COST: Savings</b>		-	-
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$800,000</b>

### SKETCH

Project: SR 99 (GRANTS FERRY ROAD)  
OVER I-95

Idea No.: A3  
Client: GDOT  
Sheet 2 of 4





## CALCULATIONS

<b>Project:</b> SR 99 (GRANTS FERRY ROAD) OVER I-95	Idea No. : A3 Client: GDOT Sheet 4 of 4
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ORIGINAL :-

Avg Cost/sf = \$100

Total Cost of Completed Bridge Construction

440'0" Long  
84'0" wide = \$3,696,000

Proposed :-

Bridge cost =

304'0" Long = \$2,553,600

84'0" wide

MSE Wall - Both Bents -

Area =  $2 \times 2 (40 \times 20 \times 5)$

+  $2 [120 \times 20] = 6400 \text{ SF}$

Cost

$6400 \text{ SF} \times \$55/\text{SF} = \$352,000$

ASSUMPTIONS

Avg Cost/sf = \$100  
PSC Beam Bridge

Cost of MSE = \$55/sf

Total Proposed Cost:-

$\$2,553,600 + 352,000 = 2,905,600$   
 $\approx \$2,906,000$

Proposed Cost Savings :-

= ORIGINAL - PROPOSED =  $3,696,000 - 2,906,000$   
= \$790,000

VE-9

<b>DEVELOPMENT AND RECOMMENDATION PHASE</b>			
<b>Project: NHS00-0001-00(585)</b> <b>I-95 @ SR 99 Interchange Reconstruction</b> <b>GLYNN COUNTY PI 001585</b>			
<b>Idea No.:</b> B3	<b>Sheet No.:</b> 1 of 4	<b>CREATIVE IDEA:</b> Eliminate paving on I-95	
Comp By:MP    Date:Oct 22, 2009    Checked By:BB    Date: October 22, 2009			
<p><b>Original Concept:</b> To pave a 13' concrete lane for future use and a 11' asphalt shoulder.</p> <p><b>Proposed Change:</b> Do not place this in the project. The interstate is going to be widened in the future, it can be placed in then.</p> <p><b>Justification:</b> The recommendation is to change this job to asphalt. This would be left as the only location for concrete. Concrete would be at a better price in bulk. The project to widen I-95 to eight lanes is in long range and funding is not identified for construction. A specific time frame for when this section will be utilized is not determined.</p>			
<b>LIFE CYCLE COST SUMMARY</b>	<b>INITIAL Project Cost</b>	<b>FUTURE Project Cost</b>	<b>TOTAL Present Worth Cost</b>
<b>INITIAL COST: Original</b>	\$324,000		
<b>Proposed</b>	\$0		
<b>Savings</b>	\$324,000		
<b>FUTURE COST: Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$324,000</b>

# SKETCH

**Project:** NHS00-0001-00(585)  
 Allyn County

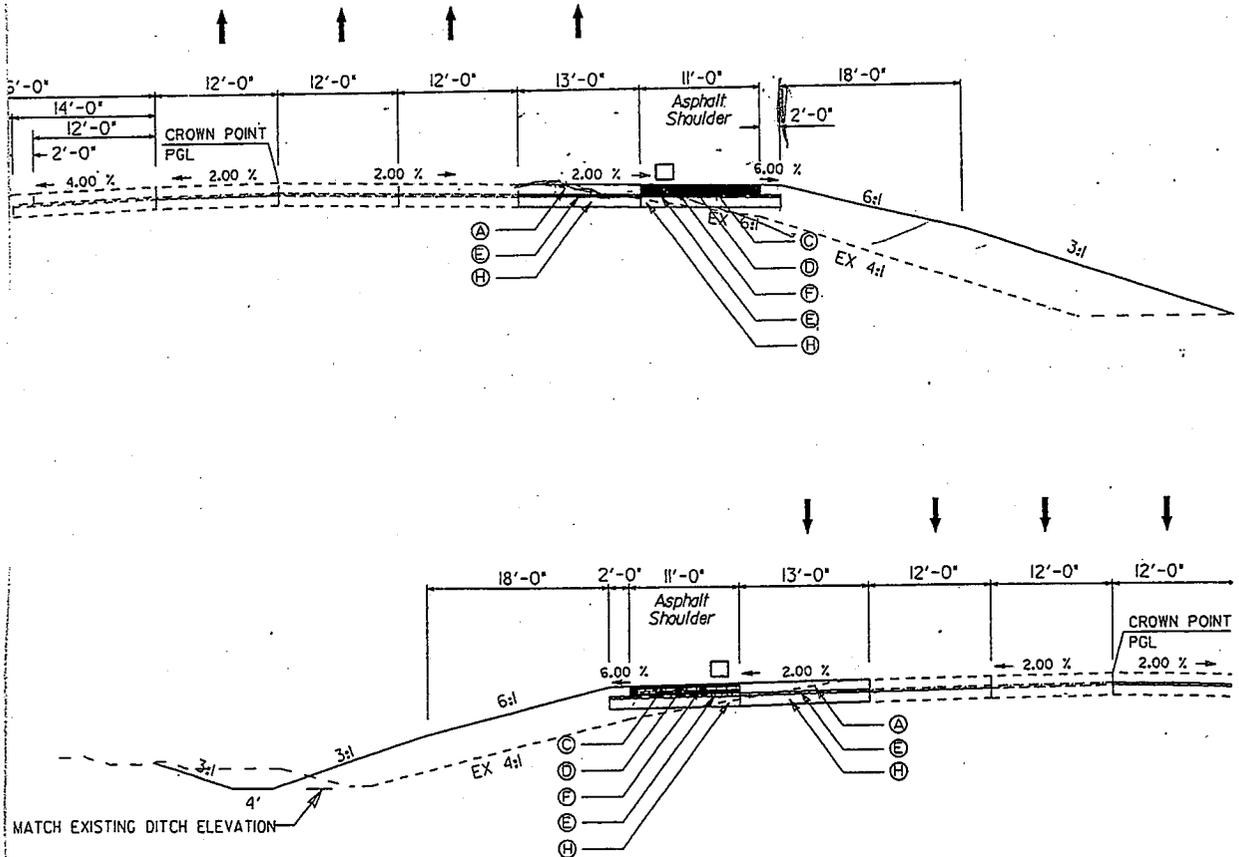
Idea No. : B3  
 Client: GDOT  
 Sheet 2 of 4

**REQUIRED PAVEMENT**

- Ⓐ CONTINUOUSLY REINFORCED CONCRETE, 12'
- Ⓑ PLAIN PC CONCRETE PVMT, 12'
- Ⓒ ASPHALTIC CONCRETE 12.5 mm SUPERPAVE, 165 LB/SY
- Ⓓ ASPHALTIC CONCRETE 19 mm SUPERPAVE, 220 LB/SY
- Ⓔ ASPHALTIC CONCRETE 19 mm SUPERPAVE, 330 LB/SY
- Ⓕ ASPHALTIC CONCRETE 25 mm SUPERPAVE, 935 LB/SY
- Ⓖ ASPHALTIC CONCRETE 25 mm SUPERPAVE, 330 LB/SY
- Ⓗ GRADED AGGREGATE BASE, 12'
- Ⓙ GRADED AGGREGATE BASE, 10'
- Ⓜ CONCRETE MEDIAN, 6"
- Ⓝ CONCRETE CURB & GUTTER, TP 7
- ☐ INDENTATION RUMBLE STRIPS, GROUND-IN-PLACE

TS-08  
 TANGENT SECTION

APPLIES TO I-95  
 STA. 211+00.00 TO STA. 217+00.00





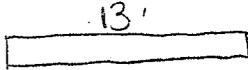
**CALCULATIONS**

Project: NHS00 - 0001 - 00(585)  
 Glynn County

Idea No.: B3  
 Client: GDOT  
 Sheet 4 of 4

1-95

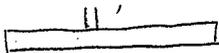
(21700 - 21100) = 600ft length



12" CRC  
 19mm 330#/sy  
 12" GAB

$(13 \times 600) = 7800 \text{ ft}^2 \rightarrow 867 \text{ yd}^2 \text{ CRC } 12" \times 2$

$(600 \times 13) = 7800 \text{ ft}^2 \rightarrow 867 \text{ yd}^2 \left( \frac{330\#}{\text{yd}^2} \right) \left( \frac{1\text{T}}{2000\#} \right) = 143 \text{ T } 19\text{mm} \times 2$   
 $(13 \times 600) = 867 \text{ yd}^2 \text{ GAB} \times 2$

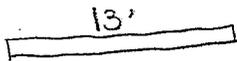


12.5mm 165#/sy  
 19mm 220#/sy  
 25mm 935#/sy

$11(600) = 6600 \text{ ft}^2 \quad 733 \text{ yd}^2 (165) = 61 \text{ T } 12.5 \times 2$

$733 \text{ yd}^2 (220) = 81 \text{ T } 19\text{mm} \times 2$

$733 \text{ yd}^2 (935) = 343 \text{ T } 25\text{mm} \times 2$



19mm 330#/yd<sup>2</sup>  
 GAB 12"

$13(600) = 7800 \text{ ft}^2 \quad 867 \text{ yd}^2 \left( \frac{330\#}{\text{yd}^2} \right) = 143 \text{ T } 19\text{mm} \times 2$

$13(600) = 7800 \text{ ft}^2 \rightarrow 867 \text{ yd}^2 \text{ GAB} \times 2$

VE-9

<b>DEVELOPMENT AND RECOMMENDATION PHASE</b>			
<b>Project: NHS00-0001-00(585)</b> <b>I-95 @ SR 99 Interchange Reconstruction</b> <b>GLYNN COUNTY PI 001585</b>			
<b>Idea No.:</b> B4	<b>Sheet No.:</b> 1 of 3	<b>CREATIVE IDEA:</b> Eliminate Ramp Construction	
Comp By: MD Date: 22-Oct-2009 Checked By: DOW Date: 22-Oct-2009			
<p><b>Original Concept:</b> The original concept recommends reconstructing the existing asphalt ramp shoulders to full depth inside and outside concrete shoulders and adding turn lanes at the off ramps.</p> <p><b>Proposed Change:</b> Performing no construction on the ramps at the interchange.</p> <p><b>Justification:</b> The existing ramp conditions are adequate to handle the future traffic projections.</p>			
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
<b>INITIAL COST: Original</b>	\$1,600,000		
<b>Proposed</b>	-		
<b>Savings</b>	\$1,600,000		
<b>FUTURE COST: Savings</b>		-	-
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$1,600,000</b>



### CALCULATIONS

**Project:** NHS 00-0001-00(505) GLYNN

Idea No.: B4  
 Client: GDOT  
 Sheet 3 of 3

RAMP A  $(1034.96 \rightarrow 1150)(42) + (1150 \rightarrow 1644.80)(22) = 5921 \text{ SF}$   
 RAMP B  $(1400 \rightarrow 1520)(30) + (1520 \rightarrow 2366)(42) = 39132 \text{ SF}$   
 RAMP C  $(1350 \rightarrow 1860)(30) + (1840 \rightarrow 2682)(42) = 50064 \text{ SF}$   
 RAMP D  $(1031.89 \rightarrow 1200)30 + (1200 \rightarrow 1781.60)(22) = 17839 \text{ SF}$

$\underline{112,956 \text{ SF}}$   
 $\quad \quad \quad \underline{\quad \quad \quad 9}$   
 $12,550 \text{ SY}$

concrete  $(12,550)(\$90/\text{SY}) = \underline{\$1,130,000.00}$

Bidder  
 12,550 SY  $\left( \frac{330 \text{ lbs}}{\text{SY}} \right) / 2000 \text{ lbs/TN} = (2070 \text{ TONS}) \quad \$80/\text{TON} \quad \underline{\$165,660}$

CAB

$(12,550 \text{ SY})(\$21.00/\text{SY}) = \$263,550$

TOTAL COST -  $\$1,559,210$       USE \$1,600,000

VE-9

<b>DEVELOPMENT AND RECOMMENDATION PHASE</b>			
<b>Project: NHS00-0001-00(585)</b> <b>I-95 @ SR 99 Interchange Reconstruction</b> <b>GLYNN COUNTY PI 001585</b>			
<b>Idea No.:</b> B7	<b>Sheet No.:</b> 1 of 5	<b>CREATIVE IDEA:</b> Replacing Concrete with Asphalt on SR 99 between ramps	
Comp By: DOW Date: October 22, 2009 Checked By: MD Date: October 22, 2009			
<p><b>Original Concept:</b> Proposes using a concrete section on SR 99 at station 39+88.11 to 69+80, excluding the bridge section.</p> <p><b>Proposed Change:</b> Asphalt section on SR 99. Asphalt would replace the concrete section at 39+88.11 to 69+80.</p> <p><b>Justification:</b> Traffic does not warrant the use of a concrete section. Life of Asphalt will suffice based on low traffic projection and small percentage of trucks.</p>			
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
<b>INITIAL COST: Original</b>	\$2,300,000		
<b>Proposed</b>	\$1,100,000		
<b>Savings</b>	\$1,200,000		
<b>FUTURE COST: Savings</b>		(\$100,000)	(\$100,000)
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$1,100,000</b>

## SKETCH

Project: NH500-000-00(585)

Idea No.: B7  
Client: GDOT  
Sheet 2 of 5Plans

See TS 03 &amp; TS 04

Proposed

Same typical with the use of the following

Pavement Sections

- Asp Conc 12.50 mm SP, 165  $\frac{1}{2}$  sy
- Asp Conc 19.00 mm SP, 220  $\frac{1}{2}$  sy
- Asp Conc 25.00 mm SP, 330  $\frac{1}{2}$  sy
- GAB, 12 in
- Tack, 0.04/gal



## CALCULATIONS

Project: NHS00-0001-00 (585)

Idea No.: B7

Client: GDOT

Sheet 4 of 5

$$\text{Concrete} \Rightarrow (39 + 88.11 \rightarrow 69 + 80) (48 \text{ ft}) \approx 15,957 \text{ yd}^2$$

$$: (15,957 \text{ yd}^2) (\$90/\text{yd}^2) \approx \$1,436,130$$

$$19 \text{ mm} \Rightarrow (15,957 \text{ yd}^2) (330 \frac{\text{lb}}{\text{yd}^2}) (\frac{1 \text{ Ton}}{2000}) (\$80/\text{Ton}) \approx \$210,640$$

$$\text{G.A.B} \Rightarrow (15,957 \text{ yd}^2) (\$21) \approx \$335,097$$

w/shoulder

$$12.5 \text{ mm} : (507.38 \text{ Tons}) (\$85/\text{Ton}) \approx \$43,127$$

$$19 \text{ mm} : (1015 \text{ Tons}) (\$80/\text{Ton}) \approx \$81,200$$

$$25 \text{ mm} : (1015 \text{ Tons}) (\$65/\text{Ton}) \approx \$65,975$$

$$\text{G.A.B} : (6150 \text{ yd}^2) (\$20/\text{yd}^2) \approx \$123,000$$

$$\text{Tack} : (738 \text{ Gal}) (\$2/\text{gal}) \approx \$1476$$

Proposed Asphalt

$$12.5 \text{ mm} : (1317 \text{ Ton}) (\$85/\text{Ton}) \approx \$111,945$$

$$19 \text{ mm} : (2633 \text{ Ton}) (\$80/\text{Ton}) \approx \$210,640$$

$$25 \text{ mm} : (2633 \text{ Ton}) (\$65/\text{Ton}) \approx \$171,145$$

$$\text{G.A.B} : (1773 \text{ SY}) (\$21/\text{SY}) \approx \$37,233$$

$$\text{TACK} : (1914 \text{ Gal}) (\$2/\text{Gal}) \approx \$3828$$

Add Shoulder Qty to Asphalt Roadway Qty since shoulder remains the same.

**VE-9D**

**Life Cycle Cost Analysis – Present Worth Method  
Future Cost Calculation**

**PROJECT:** NHSOO-0001-00(585)

Creative Idea No. B7

Sheet: 5 of 5

Discount Rate: 4%

Economic Life: 20 Years

	A	B	C	D
	<b>Original Design</b>		<b>Alternate Design</b>	
	Cost	PW	Cost	PW
<b>1. Single Expenditures:</b> (i.e., stage Construction, Major Maintenance)	\$2,259,000	\$2,259,000	\$1,105,000	\$1,105,000
a. Year <u>10</u> PWF <u>0.676</u>			\$88,012	\$59,496
b. Year _____ PWF _____				
c. Year <u>20</u> PWF <u>0.456</u>			\$88,012	\$40,133
d. Salvage / Unused Service Life Year _____ PWF _____				
<b>1. Total Future Single Costs:</b>				\$99,629
<b>2. Annual Costs:</b>				
a. General Maintenance PWF' = 13.59	500	\$6,795	\$500	\$6,795
b. Other Annual Costs PWF' =				
<b>2. Total Future Annual Costs</b>		\$6,795		\$6,795
<b>3. Total Future Costs: (1 + 2)</b>		\$6,795		\$106,424
<b>4. Total Future Cost Savings on a Present Worth Basis (3B-3D)</b>		(\$100,000)		
<b>5. Total Future Cost Savings on an Annual Basis (4B X crf)</b>				

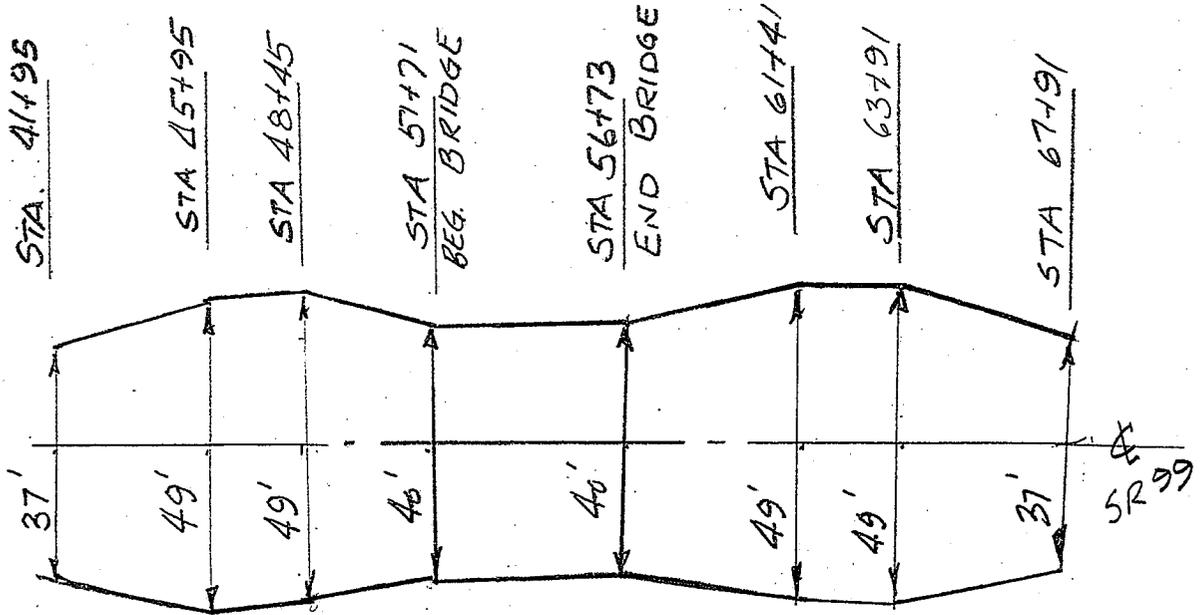
VE-9

<b>DEVELOPMENT AND RECOMMENDATION PHASE</b>			
<b>Project: NHS00-0001-00(585)</b> <b>I-95 @ SR 99 Interchange Reconstruction</b> <b>GLYNN COUNTY PI 001585</b>			
<b>Idea No.:</b> B8	<b>Sheet No.:</b> 1 of 6	<b>CREATIVE IDEA:</b> Reduce scope of SR.99 Widening	
Comp By: MD    Date: Oct. 22 2009    Checked By: SKG    Date: 22 October 2009			
<p><b>Original Concept:</b> Widen and Reconstruction of SR. 99 for 1.5 miles within the Interchange at I-95. Includes concrete 20' median, curb and gutter, drainage with concrete pavement.</p> <p><b>Proposed Change:</b> Decrease the scope of S.R. 99 Reconstruction to 2-lanes with bike lanes and turn lanes onto the ramps from east and west</p> <p><b>Justification:</b> The original design allotted for the future widening of SR 99 from US 341 to US 17 (PI's 0000422&amp; 0001036) which included two lanes in each direction with a 20' raised median. These projects are inactive and unfunded at this time with no defined delivery date. This idea will allow for the turn lane operation.</p>			
LIFE CYCLE COST SUMMARY	INITIAL Project Cost	FUTURE Project Cost	TOTAL Present Worth Cost
<b>INITIAL COST: Original</b>	\$7,300,000		
<b>Proposed</b>	\$3,500,000		
<b>Savings</b>	\$3,800,000		
<b>FUTURE COST: Savings</b>		-	-
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$3,800,000</b>

### SKETCH

Project: NHS00-0001-00(585)

Idea No.: B8  
Client: GDOT  
Sheet 2 of 6





### CALCULATIONS

**Project:** NHS00-0001-00(585)

Idea No. : B8  
 Client: GDOT  
 Sheet 4 of 6

SR 99

<u>STATION</u>	<u>WIDTH</u>
6791	37
>400	
6391	49
>250	
6141	49
>468	
5673	40
>502	
5171	40
>326	
4845	49
>250	
4595	49
>400	
4195	37

$$\begin{aligned}
 & 400(38) + 250(49) + 326(44.5) + 468(44.5) \\
 & + 250(49) + 400(38) \\
 & = 90233 \text{ ft}^2 \left( \frac{1 \text{ yd}^2}{9 \text{ ft}^2} \right) \\
 & = 10,026 \text{ yd}^2 \\
 & 10,470 \text{ yd}^2
 \end{aligned}$$

ORIGINAL ESTIMATE

NHS00-0001-00(585)

38  
42

IDEA 88

Client: GDOT

Sheet: 5 of 6

CURB & CUTTER \$ 75,000

10" GAB \$ 334,000

12.5 MM SP \$ 102,340

CONC. PAVEMENT 246,425<sup>12,550</sup> - RAMP = 12,092<sup>54</sup>

(12,092)(90) = \$ 1,088,280

19MM SP

\$ 576,240 - \$ 165,669 (RAMP) = 410,571

- \$ 58,720 (1-95) = \$ 351,851

25 MM

\$ 283,205.00 - (1-95) \$ 45,500 =

\$ 237,705

EARTHWORK

\$ 637,074

MEDIAN

\$ 395,833

CATCH BASINS

\$ 27,450

12" GAB

\$ 701,358 - RAMP

\$ 365,000

\$ 263,564

\$ 72,828 (195)

TOTAL - \$ 3,239,533

Original Bridge : (83.9167')(440')(\$100/SF) = \$3,692,335 ⇒ USE \$3,700,000

Reduced width Bridge : (43.9167')(440')(\$100/SF) = \$1,932,335 ⇒ USE \$1,900,000

# COST OF REDUCED PROJECT SCOPE

$$\begin{aligned} \text{CONCRETE PAVEMENT} &= \frac{\text{TOTAL}}{10,470} \text{ SY} - 3023 \text{ (SHOULDERS)} = \frac{7003}{7447} \text{ SY} \end{aligned}$$

$$\left(\frac{7003}{7447}\right) (\$90) = \underline{\$630,270} \quad \$670,230$$

## GAB

$$\left(\frac{\text{TOTAL}}{10,470} \text{ SY}\right) (\$21.00) = \underline{\$210,546} \quad \$219,870$$

## 19 MM SUPERPAVE M

$$\left(\frac{7447}{7003 \text{ SY}}\right) (330 \text{ lbs/SY}) / 2000 = \left(\frac{1228.8}{1455.5 \text{ TONS}}\right) (\$80/\text{TON}) = \underline{\$98,300} \quad \underline{\$92,500}$$

$$\left(\frac{\text{SHOULDERS}}{3023 \text{ SY}}\right) (220 \text{ lbs/SY}) / 2000 = (333 \text{ TONS}) (\$80/\text{TON}) = \underline{\$26,602}$$

## 25MM BASE - SHOULDERS

$$\left(\frac{3023}{\text{SY}}\right) (330 \text{ lbs/SY}) / 2000 = (500 \text{ TONS}) (\$65.00) = \underline{\$32,500}$$

## 12.5 MM TOPPING - SHOULDERS

$$\left(\frac{3023 \text{ SY}}{\text{SY}}\right) (165 \text{ lbs/SY}) / 2000 = (250 \text{ TONS}) (\$85.00) = \underline{\$22,000}$$

## EARTHWORK 20% SAVINGS

$$\underline{\$ (637,074) / (0.8) = \$796,342} \quad \begin{array}{r} \text{TOTAL} \\ + - \end{array}$$





**VE-9D**

**Life Cycle Cost Analysis – Present Worth Method  
Future Cost Calculation**

**PROJECT:** NHS00-0001-00(585)

Creative Idea No. J2

Sheet: 3 of 3

Discount Rate: 4%

Economic Life: 20 Years

	A		B		C		D	
	Original Design		Alternate Design					
	Cost	PW	Cost	PW	Cost	PW	Cost	PW
<b>1. Single Expenditures:</b> (i.e., stage Construction, Major Maintenance)	\$500,000	\$500,000						
a. Year <u>10</u> PWF <u>0.676</u>	\$4,000	\$2,704	\$0	\$0				
b. Year _____ PWF _____								
c. Year <u>20</u> PWF <u>0.456</u>	\$8,000	\$3,648	\$0	\$0				
d. Salvage / Unused Service Life Year _____ PWF _____								
<b>1. Total Future Single Costs:</b>		\$6,352		\$0				
<b>2. Annual Costs:</b>								
a. General Maintenance PWF' = 13.59	\$1,000	\$13,590	\$0	\$0				
b. Other Annual Costs PWF' =								
<b>2. Total Future Annual Costs</b>		\$13,590		\$0				
<b>3. Total Future Costs: (1 + 2)</b>		\$19,942		\$0				
<b>4. Total Future Cost Savings on a Present Worth Basis (3B-3D)</b>		\$20,000						
<b>5. Total Future Cost Savings on an Annual Basis (4B X crf)</b>								

**APPENDIX**

VE-2

**INFORMATION PHASE - SOURCES**  
**Approving/Authorizing Persons**

<b>Name:</b>	<b>Position:</b>	<b>Telephone:</b>
Gerald Ross	Chief Engineer	404-631-1004
FHWA	Division Office	

**Personal Contacts**

<b>Name:</b>	<b>Telephone:</b>	<b>Notes:</b>
David Powell	404-631-1620	Project Designer/Introduction
Ayodele Gilpin	404-631-1624	Project Introduction
Bill DuVall	404-631-1883	Asst. State Bridge Engineer

**Documents/Abstracts**

<b>Reference:</b>	<b>Notes:</b>
Project Concept	Originally approved March 2005
Revised Concept	Not approved
Bridge Layout	
Design Exceptions/Variances	For I-95 widening project
Plans	Not in agreement with Revised Concept
Bridge Design Manual	74" Bulb Tee Beam Spacing/Span Length Chart



**VE-4**

**INFORMATION PHASE – FUNCTION ANALYSIS**

**Project:** NHS00-001-00(585)

**Project Function:** Improve Safety

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	Worth	Comments
A	Structure	Span Span Increase	Exist Roadway Prop Roadway Function	\$2,830,000.00	\$2,030,000.00	Reduce length Reduce width
B	Concrete Pavement	Support	Roadway	\$2,217,780.00	\$1,500,000	Change to asphalt Eliminate Interstate work Reduce SR 99 x- section
C	Clearing and Grubbing	Prepare	Site	\$1,500,000.00	\$1,500,000.00	No change
D	Traffic Control	Increase	Safety	\$1,300,000.00	\$1,000,000.00	Different staging
E	Bridge Removal	Prepare Improve Improve	Site Clearance Safety	\$1,087,699.00	\$1,087,699.00	Suspect
F	G.A.B	Support Reduce	Load maintenance	\$1,035,198.00	\$1,200,198.00	Increased pav't
G	Asphalt	Support	Roadway	\$1,013,460.00	\$1,075,000.00	Increased pav't
H	Grading and Drainage	Remove	Water	\$773,544.00	\$773,544.00	No change
I	Misc Roadway	Increase Provide	Safety Support	\$663,429.00	\$663,429.00	No Change
J	Lighting	Provide Illuminate	Safety Site	\$500,000.00	\$0.00	Eliminate on project

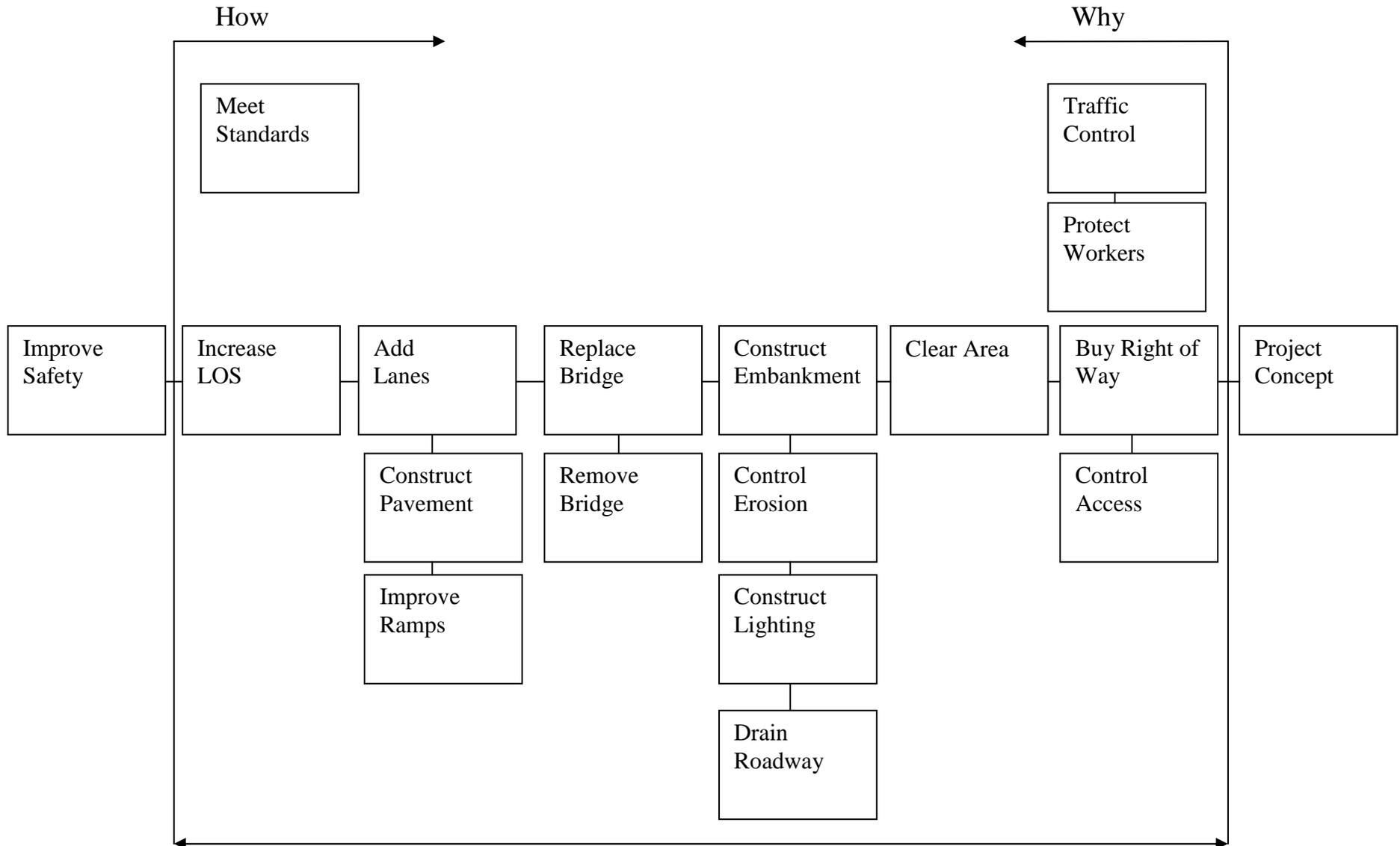
## INFORMATION PHASE – FUNCTION ANALYSIS

**Project:** NHS00-001-00(585)

**Project Function:** Improve Safety

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	Worth	Comments
K	Erosion control	Protect Prevent	Environment Erosion	\$427,554.00	\$427,554.00	No Change
L	Concrete Median, 6 in	Separate	Traffic	\$385,833.00	\$250,833.00	Eliminate
M	Signing and Marking	Direct Convey Display	Traffic Information Boundary	\$240,623.00	\$250,623.00	Increase pav't marking on bridge
N	Miscellaneous	Administrate	Project	\$143,191.00	\$143,191.00	No Change
O	Right of Way	Store	Project	\$130,000.00	\$130,000.00	Suspect

### INVESTIGATION PHASE - FAST DIAGRAM



**VE-6 & 7**

<b>CREATIVE PHASE Creative Idea Listing</b>		<b>JUDGMENT PHASE Idea Evaluation</b>	
<b>No.</b>	<b>CREATIVE IDEA</b>	<b>COMMENTS</b>	<b>IDEA RATING</b>
<b>A</b>	<b>Structure</b>		
A1	Prefabricated Material	reduce construction time, cost?	5
A2	Reduce Width	reduces typical, cost savings	9
A3	Reduce length	reduce cost	8
A4	Realign roadway	too costly	2
<b>B</b>	<b>Concrete Pavement</b>		
B1	Asphalt	look at life cycle cost, ease of const, low initial cost	8
B2	Realign roadway	require extra r/w, utilites, cost	2
B3	Eliminate Interstate work	potential to affect I-95 twice, future improvement	5
B4	Leave Ramps	eliminate ramp widening	7
B5	Thinner section	design will dictate	2
B6	Narrow lanes	low cost savings	2
B7	Change to Asphalt on SR 99	look at life cycle cost, ease of const, low initial cost	8
B8	Reduce SR 99 typical section at bridge	substantial cost savings	9
<b>D</b>	<b>Traffic Control</b>		
D1	Reduce staging	detour traffic, reduce constr time	5
D2	shut down road during bridge removal	detour to ramps	5
D3	reduce construction time	reduce cost	5

<b>CREATIVE PHASE</b> <b>Creative Idea Listing</b>		<b>JUDGMENT PHASE</b> <b>Idea Evaluation</b>	
<b>No.</b>	<b>CREATIVE IDEA</b>	<b>COMMENTS</b>	<b>IDEA RATING</b>
D4	work on weekends, night	not significant, more expensive	3
<b>E</b>	<b>Bridge Removal</b>		
E1	Staging	redone	4
E2	Salvage/recycle	cost already included	1
<b>F</b>	<b>GAB</b>		
F1	Thinner section	design dictates	2
F2	soil cement base	design dictates	1
F3	reinforcing fabric/ geo-textile	high cost compared to savings	1
F4	recycled material	already included in spec	1
<b>G</b>	<b>Asphalt</b>		
G1	recycled asphalt	already in spec	1
G2	eliminate bike lanes	high cost savings; requested by local gov't	4
G3	narrow shoulders	reduce to 6.5 ft shoulders	5
G4	narrow lanes/width	low savings	2
G5	Use existing section	up to 1' below finished grade	5
<b>H</b>	<b>Grading and Drainage</b>		
H1	Change profile	not cost efficient option	3
<b>J</b>	<b>Lighting</b>		
J1	solar	cost benefit to depart not substantial	1
J2	no lighting	high cost savings	10

<b>CREATIVE PHASE</b> <b>Creative Idea Listing</b>		<b>JUDGMENT PHASE</b> <b>Idea Evaluation</b>	
<b>No.</b>	<b>CREATIVE IDEA</b>	<b>COMMENTS</b>	<b>IDEA RATING</b>
J3	larger interval for spacing	cost savings; no lighting plans included	4
<b>K</b>	<b>Erosion Control</b>		
K1	BMP's	environmentally sensitive	2
<b>L</b>	<b>Concrete median</b>		
L1	Eliminate median	Reduce typical section; cost savings	7
<b>O</b>	<b>Right of Way</b>		
O1	Reduce footprint	cost savings	5
O2	temporary easement	area specific, cost savings	5