

# VALUE ENGINEERING REPORT

I-85 Widening to Add Two Managed Lanes  
NH-IM-85-2(164) & (165)  
PI No.'s 110600 & 110610  
Gwinnett/Barrow Counties

December 30, 2009

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## OWNER AND DESIGN TEAM:



Georgia Department of Transportation  
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## VALUE ENGINEERING CONSULTANT:



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Atlanta, Georgia  
I-85 Widening to Add Managed Lanes

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## **EXECUTIVE SUMMARY**

# Executive Summary

## VALUE ENGINEERING STUDY

### I-85 Widening to Add Two Managed Lanes

December 1 - 4, 2009

#### Introduction

This report presents the results of a value engineering (VE) study conducted on the proposed design for the I-85 widening and improvements from north of CR 14 / Old Peachtree Road to north of SR 211 / Farm Market Road, in Gwinnet and Barrow Counties. The work is broken out into 2 projects, No's. NH-IM-85-2(164) and NH-IM-85-2(165); PI No's 110600 and 110610. The total project length is 17.4 miles. The project limit between the 2 sections is north of CR 134 / Hamilton Mill Road.

The project improvements will add a managed lane in each direction within the project limits on I-85 and extend about 7,200 feet on I-985. The southern project limit will match the existing HOV lane which is scheduled to be converted to an HOT lane within 1-2 years. The northern project limits will extend beyond the SR 211 / Farm Market Road interchange and transition to the current general purpose lanes.

A key element of this project is the tolling infrastructure and equipment. This is currently being developed as part of the adjacent HOV / HOT conversion project and was not included as part of this VE study. Additionally, the Need and Purpose statement is also currently being prepared and was not included as part of the VE review documents.

Major contract work items include roadway pavement, bridge and wall construction, grading and drainage, traffic control and concrete median barrier. The estimated construction cost of the project is \$125,220,000, the R/W estimate is \$8,550,000 yielding a total project cost of \$133,770,000.

The VE study took place December 1-4, 2009, at the GDOT Headquarters Office in Atlanta, Georgia, using a six person VE team. This report presents the 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. The reader is encouraged to review all sections of the report in order to obtain a complete understanding of the VE process.

#### Considerations

The VE team was presented with several constraints to consider when developing their recommendations. The constraints were to eliminate any impacts to the environmentally sensitive area within the existing protected covenant between I-85 and I-985, and to provide a right side exit for the I-985 NB general purpose lanes.

The design is currently in the concept stage. It has been developed and redesigned over the last several years in conjunction with the corridor's plan for managed lane facilities which has been revised during this time. 30 % project plans are being developed for this project to be advertised as a design-build by Summer 2010. The environmental document is also being prepared and scheduled for approval in August, 2010.

### **Results Obtained**

The VE team focused their efforts on the high cost items of the project. Through the use of functional analysis and brain-storming techniques, the team generated 37 ideas with 11 identified for additional evaluation as recommendations. The VE team developed 10 independent recommendations and 1 alternative recommendation. 4 of the developed recommendations refer to the Alternate 1 Design option which was developed if the 45 mph design speed exception is not approved. A detailed write-up of each recommendation is contained in the respective portion of this report. A summary of the recommendations and design suggestions follows.

## Recommendation Highlights

### **Idea A-1; Substitute shoulder pavement for full-depth pavement.**

This idea proposes to reduce the full-depth shoulder width to 1.5 ft and replace the current full-depth pavement with shoulder pavement for the area from the I-985 interchange to the northern project limit, a distance of about 12.3 miles.

*The total potential savings if accepted is \$5,307,000*

### **Idea A-3; Reduce the 4 foot buffer to 2 feet.**

The current 4 foot buffer between the general purpose and HOT lane would be reduced to 2 feet which is consistent with the overall I-85 managed lane corridor design.

*The total potential savings if accepted is \$1,480,000*

### **Idea A-4; Modify the median work and use cable barrier.**

Reduce the 4 foot buffer between the general purpose and HOT lane, reduce the 8 foot shoulder to 4 feet, eliminate the asphalt section in the median and use cable barrier in lieu of concrete median barrier.

*The total potential savings if accepted is \$9,464,000*

### **Idea A-6; Reduce the width of the HOT lane from 12 feet to 11 feet.**

Use an 11 foot wide HOT lane. The 11 foot lane width will be suitable in conjunction with a 4 or 2 foot buffer.

*The total potential savings if accepted is \$2,033,000*

### **Idea B-1; Eliminate the general purpose resurfacing.**

Eliminate the milling and resurfacing of the general purpose lanes north of I-985 interchange. The general purpose lanes north of the I-985 interchange are in good condition and have been resurfaced and rehabilitated within the last few years

*The total potential savings if accepted is \$6,395,000*

**Idea C-7; Defer the I-985 Southbound HOT lane construction.**

Current and projected traffic volumes do not justify the extension of the HOT lanes to I-985. Defer this work until traffic volumes can sustain HOT lanes on I-985.

*The total potential savings if accepted is \$2,838,000*

**Idea C-8.1; Realign the I-985 HOT lanes; use a flyover ramp for I-985 HOT SB.**

The current preferred alignment for the I-985 HOT lanes requires a design exception for 45 mph design speed. If this exception is not approved, this idea proposes to use the existing I-985 exit road for the I-985 NB HOT lane and construct a new flyover ramp for the I-985 SB HOT lane.

*The total potential savings if accepted is \$1,495,000*

**Idea C-8.2; Realign I-985 HOT lanes; use underpass for I-985 HOT SB.**

The current preferred alignment for the I-985 HOT lanes requires a design exception for 45 mph design speed. If this exception is not approved, this idea proposes to use the existing I-985 exit road for the I-985 NB HOT lane and construct a new underpass ramp for the I-985 SB HOT lane.

*The total potential savings if accepted is \$1,591,000*

**Idea C-9; Use I-85 SB detour for permanent relocation.**

Under a construction staging scenario where an I-85 SB detour roadway will be constructed, using the current Alternate 1 Design Option Concept Alternative”, permanently realign and reconstruct the I-85 SB roadway.

*The total potential savings if accepted is \$493,000*

**Idea C-10; Reduce the length of the I-85 SB over I-985 HOT lanes bridge.**

The current span arrangement of 134 and 84.5 feet can be reduced to a single span of 134 feet.

*The total potential savings if accepted is \$498,000*

**Idea J-2; Rehab the existing I-985 SB bridge over Ivy Creek.**

This bridge is currently not included within the project limits however it has several deficiencies, including existing brush curb and bridge rail. This would be an opportune time to construct the needed improvements to update the structural components to current standards, even though it will add costs to the project.

*The total potential increase if accepted is \$792,000*

**I-85 HOT Lane Widening – Gwinnett/Barrow Counties**

**SUMMARY OF POTENTIAL COST SAVINGS**

<b>IDEA No.</b>	<b>CREATIVE IDEA DESCRIPTION</b>	<b>ORIGINAL COST</b>	<b>PROPOSED COST</b>	<b>POTENTIAL COST SAVINGS</b>	<b>COMMENTS</b>
	<b>RECOMMENDATIONS</b>				
<b>A-1</b>	Substitute shoulders pavement for the full depth pavement along the added HOT lane shoulders north of I-985.	\$7,703,000	\$2,396,000	<b>\$5,307,000</b>	
<b>A-3</b>	Reduce the 4-foot buffer zone next to the HOT lanes to a 2-foot buffer zone.	\$1,700,000	\$220,000	<b>\$1,480,000</b>	
<b>A-4</b>	Modify the median north of the SR-20 Interchange and use cable barrier.	\$10,960,000	\$1,496,000	<b>\$9,464,000</b>	Includes Idea A-3
<b>A-6</b>	Reduce the width of the HOT lane to 11 feet.	\$2,033,000	\$0	<b>\$2,033,000</b>	
<b>B-1</b>	Eliminate the general purpose lane resurfacing north of I-985.	\$6,395,000	\$0	<b>\$6,395,000</b>	
<b>C-7</b>	Defer the SB extension of the HOT lane from I-985.	\$2,838,000	\$0	<b>\$2,838,000</b>	Defer construction until HOT lanes are extended on I-985
<b>C-8.1</b>	Alternate 1 Design: Realign the I-985 SB HOT lane to a new flyover structure over I-85 SB.	\$4,255,000	2,760,000	<b>1,495,000</b>	See Note 1 Does not require the I-85 SB detour roadway
<b>C-8.2</b>	Alternate 1 Design: Realign the I-985 SB HOT lane to a new underpass at I-85 SB	\$1,591,000	\$0	<b>\$1,591,000</b>	See Note 1

<b>IDEA No.</b>	<b>CREATIVE IDEA DESCRIPTION</b>	<b>ORIGINAL COST</b>	<b>PROPOSED COST</b>	<b>POTENTIAL COST SAVINGS</b>	<b>COMMENTS</b>
<b>C-9</b>	Alternate 1 Design: Shorten the detour alignment and use it for permanent relocation.	\$2,927,000	\$2,348,000	<b>\$493,000</b>	See Note 1
<b>C-10</b>	Alternate 1 Design: reduce the length of the I-85 SB bridge over the I-985 HOT lanes.	\$2,196,000	\$1,698,000	<b>\$498,000</b>	See Note 1
<b>J-2</b>	Widen and rehabilitate the SB I-985 Bridge to eliminate the narrow 2-foot shoulders, brush curb, and old railing.	\$0	\$792,000	<b>(\$792,000)</b>	Improve safety, Bring to current standards

**Note 1.** Ideas C – 8.1, C – 8.2, C - 9 and C – 10 apply to the Alternate 1 Design option only; if the 45 mph design exception is not granted.

## **STUDY IDENTIFICATION**

## Study Identification

<b>Project:</b> I-85 Widening to Add Managed Lanes	<b>Date:</b> December 1-4, 2009
<b>Location:</b> Atlanta, Georgia	

### VE Team Members

Name:	Title:	Organization:	Telephone:
George Obaranec	Design	MACTEC	770-421-3346
Lenor Bromberg	Design	Kennedy Engineering Assoc.	404-805-8244
Steven Gaines	Design	Wolverton and Associates	770-447-8999
Greg Grant	Structures	Wolverton and Associates	770-447-8999
Dan Cogan	Construction	Kennedy Engineering Assoc.	404-290-6424
Keith Borkenhagen	VE Team Facilitator	MACTEC	623-556-1875

### Project Description

The project improvements will add a managed lane in each direction within the project limits on I-85 and extend about 7,200 feet on I-985. This project will be coordinated with the tolling of this section of I-85 by the State Road and Tollway Authority (SRTA). The southern project limit will match the existing HOV lane which is scheduled to be converted to an HOT lane within 1-2 years. The northern project limits will extend beyond the SR 211 / Farm Market Road interchange and transition to the current general purpose lanes.

### Project Design Briefing

At the initiation of the study, the design team provided a project briefing on the current design status of the project. The following items were discussed:

- This project will extend the existing I-85 HOT lanes north of I-985. This project will add the additional lanes, but not any of the tolling hardware. The tolling hardware will be added by a future contract.
- The widening will use asphalt concrete alongside asphalt mainline pavement and PCC concrete alongside PCC mainline pavement. The additional lanes will be added to the outside in the eight-lane section and to the inside in the four-lane section. All ramp work will be PCC concrete.
- The environmental review is underway. There is an existing environmentally sensitive

area within a protected covenant located between the I-85 SB lanes and I-985 NB. This area cannot be affected. The proposed Categorical Exclusion document is scheduled for completion by August 2010.

- A requirement of the project, as directed by FHWA is to eliminate the left-side I-985 NB exit and provide it as a conventional right-side exit.
- The recommended design uses the existing left-off ramp for the HOT lane connection to I-985. Since both the NB and SB HOT lanes are combined through this area, the installation of a barrier between the lanes results in the curve having a reduced design speed of 45 MPH (sight distance issue). A design exception for this curve will be required.
- The existing mainline pavements on I-85 and I-985 are in good condition. The pavements have been resurfaced, re-habilitated and/or refinished recently, most since 2002.
- Funding for this project is not available at this time however, the 30% plans for this project are scheduled to be ready by August 2010. This project will be let as a Design/Build project.

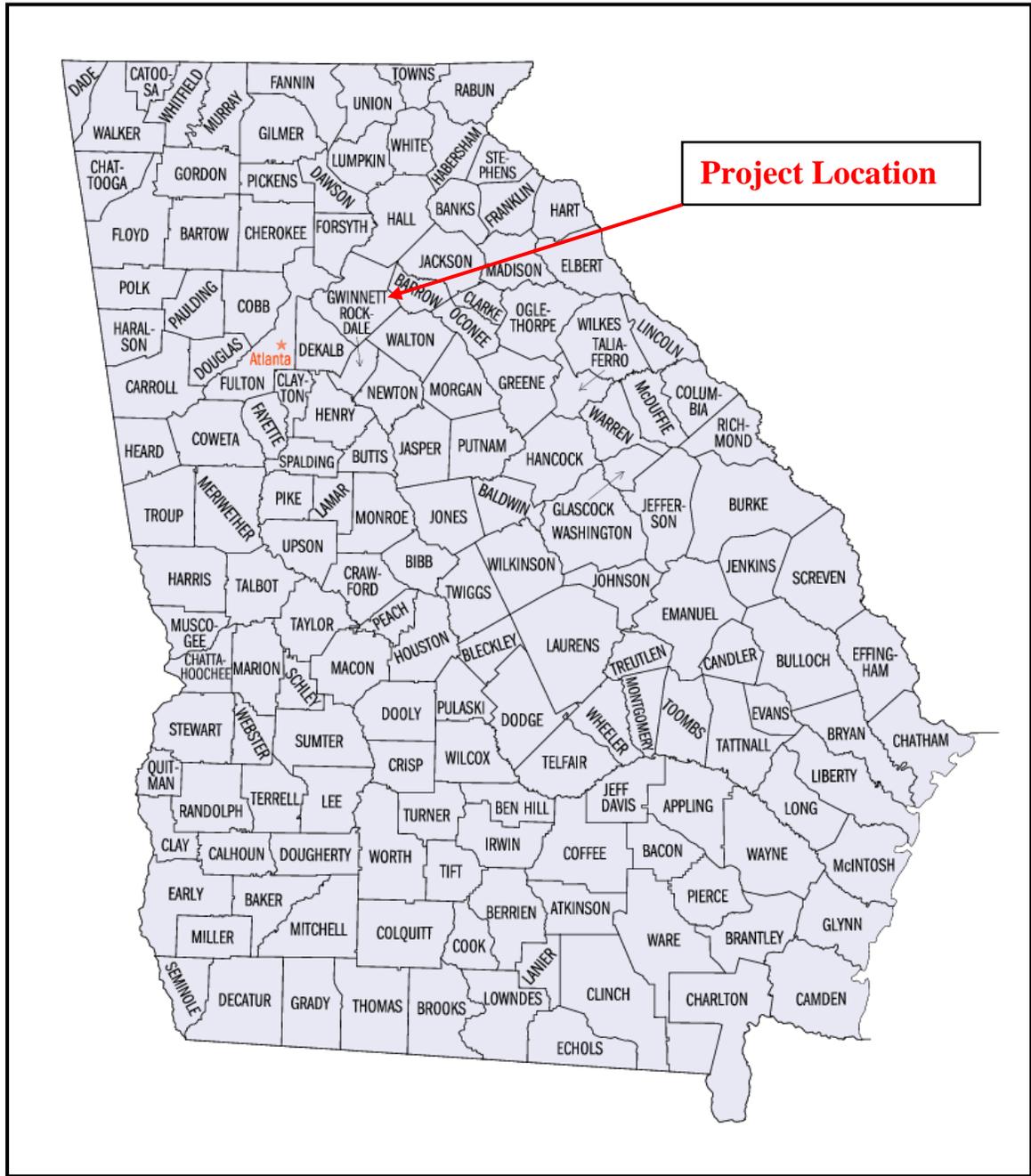
### **Project Constraints**

The VE team was given the following constraints.

- Encroachment into the environmentally sensitive area within the existing protected covenant is not permitted.
- The I-985 NB general purpose lanes exit shall be a right side exit

### **Project Site Visit**

After the project design briefing, the VE team conducted a site visit and project drive-thru. An additional resource used during the study was GDOT's video log inventory.



**Project Location Map  
Figure 1**

# VE RECOMMENDATIONS

## DEVELOPMENT AND RECOMMENDATION PHASE

### I-85 HOT Lanes

<b>IDEA No.:</b> A-1	<b>Sheet No.:</b> 1 of 3	<b>CREATIVE IDEA:</b> Reduce Full Depth Inside Shoulder Width North of I-985
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Comp By: SG    Date: 12-4-09    Checked By: KB    Date: 12-4-09

**Original Concept:** The original concept proposes full depth 8' inside shoulders north of I-985. One typical section indicates that a 12' inside shoulder is proposed for a portion of I-85. A constant width of 8' has been assumed for the development of this idea.

**Proposed Change:** The revised concept proposes to reduce the full depth shoulder width to 1.5' and install the standard shoulder pavement section for the remaining 6.5' width.

**Justification:** The need and purpose for the project is to add two managed lanes to I-85. This need and purpose can be accomplished by reducing the width of the full depth shoulder pavement section.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	\$7,703,000		
<b>- Proposed</b>	\$2,396,000		
<b>- Savings</b>	\$5,307,000		
<b>FUTURE COST: - Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$5,307,000</b>

## CALCULATIONS

**Project: I-85 Widening to Add Two Managed Lanes**

Idea No.: A-1  
Client: GDOT  
Sheet 2 of 3

Approximate Project Length (North of I-985)

PI 110610 – 5.8 miles

PI 110600 - 6.5 miles

Total – 12.3 miles

### **Original Concept**

Full Depth Shoulder Area = (12.3 miles)(5280 ft/mile)[2\*(8-1.5) ft](1 sy/9 sf) = 93,808 sy

Full Depth Pavement Section Rates

220 -12.5 mm SMA - 0.11 tons/sy

275 - 19 mm - 0.14 tons/sy

1320 -25 mm - 0.66 tons/sy

12" GAB - 0.66 tons/sy

### Pavement

Wt (12.5 mm SMA) = (93,808 sy)(0.0675 tons/sy) = 6,332 tons

Wt (19 mm SMA) = (93,808 sy)(0.14 tons/sy) = 13,133 tons

Wt (25 mm SMA) = (93,808 sy)(0.66 tons/sy) = 61,913 tons

Area (12" GAB) = 93,808 sy

### **Revised Concept**

Shoulder Pavement Section Rates

220 -12.5 mm SMA - 0.11 tons/sy

275 - 19 mm - 0.14 tons/sy

6" GAB - 0.33 tons/sy

### Pavement

Wt (12.5 mm SMA) = (93,808 sy)(0.0675 tons/sy) = 6,332 tons

Wt (19 mm SMA) = (93,808 sy)(0.14 tons/sy) = 13,133 tons

Area (6" GAB) = 93,808 sy

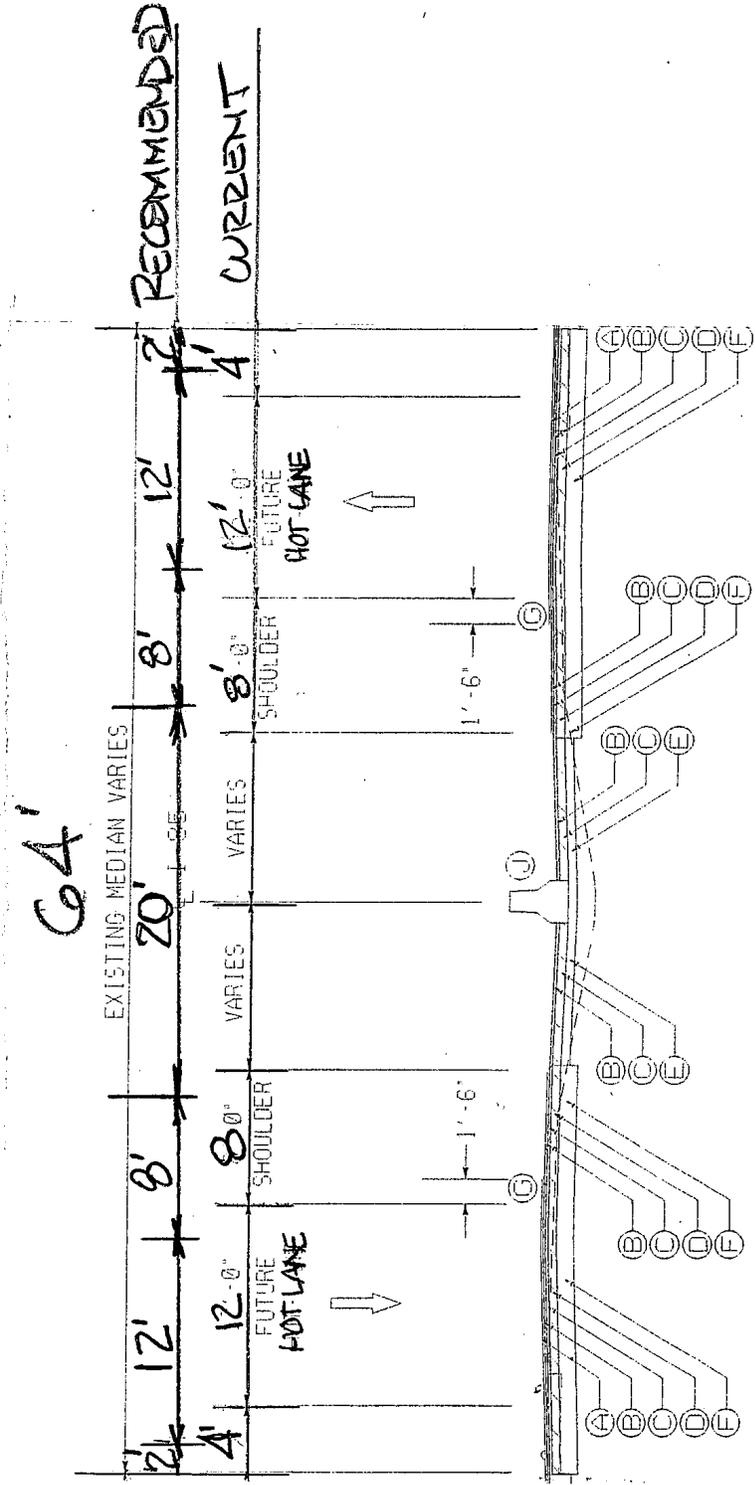


<b>DEVELOPMENT AND RECOMMENDATION PHASE</b>			
<b>Project: I-85 Widening to Add Two Managed Lanes</b>			
<b>IDEA No.:</b> A-3	<b>Sheet No.:</b> 1 of 4	<b>CREATIVE IDEA:</b> <b>Reduce the 4 foot buffer to 2 feet</b>	
Comp By: GAO	Date:	Checked By: KB	Date: 12-4-09
<p><b>Original Concept:</b> Provide a 4 foot buffer area between the general purpose and HOT lane using full depth pavement.</p>			
<p><b>Proposed Change:</b> Reduce the 4 foot buffer to 2 feet.</p>			
<p><b>Justification:</b> A 2 foot buffer area between the general purpose and HOT lane is sufficient and consistent with the managed lane development along the I-85 corridor.</p>			
<b>LIFE CYCLE COST SUMMARY</b>	<b>CAPITAL COST</b>	<b>FUTURE COST</b>	<b>TOTAL COST</b>
<b>INITIAL COST: - Original</b>	1,700,000		
<b>- Proposed</b>	220,000		
<b>- Savings</b>	1,480,000		
<b>FUTURE COST: - Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>1,480,000</b>

# SKETCH

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: **A-3**  
 Client: GDOT  
 Sheet **2** of **4**



I-85 HOT-LANES SECTION A-A  
 (DOES NOT REQUIRE ADDITIONAL RIGHT-OF-WAY)

**COST WORKSHEET**

PROJECT: I-85 Widening - Managed Lanes	IDEA No: A - 3
	CLIENT: GDOT
Sheet 3 of 4	

CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
ITEM	UNITS	No. UNITS	COST/ UNIT	TOTAL COST	No. UNITS	COST/ UNIT	TOTAL COST
A - 135 #/SY - PEM	tons	1,584	95.00	150,480			
D - 1320 #/SY - 25 mm super	tons	15,480	65.00	1,006,200			
F - GAB; 12 in	sy	23,467	23.00	539,741			
E - GAB;6 in	sy				23467	9	218,947
SUBTOTAL				1,696,421			218,947
Markup @	0.00%			0			0
TOTAL				1,696,421			218,947
TOTAL ROUNDED				1,700,000			220,000

## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: A-3  
 Client: GDOT  
 Sheet 4 of 4

This recommendation applies to the area from the SR 20 interchange to the northern project limit, a distance of 10 miles; 52,800 ln ft.

$$52,800 \text{ ft} \times 2 \text{ directions} \times 2 \text{ ft wide} = 211,200 \text{ sq ft} = 23,467 \text{ sq yd}$$

A – 135 #/sy - 12.5 mm PEM

$$23,467 \text{ sq yd} \times 135 \text{ \#/sy} (1 \text{ Ton} / 2,000 \text{ Ton}) = 1,584 \text{ Tons}$$

D – 1,320 #/sy - 25 mm Superpave

$$23,467 \text{ sq yd} \times 1,320 \text{ \#/sy} (1 \text{ Ton} / 2,000 \text{ Ton}) = 15,488 \text{ Tons}$$

## DEVELOPMENT AND RECOMMENDATION PHASE

**Project: I-85 Widening to Add Two Managed Lanes**

<b>IDEA No.:</b> A-4	<b>Sheet No.:</b> 1 of 4	<b>CREATIVE IDEA:</b> <b>Modify median work, use cable barrier</b>
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Comp By: GAO    Date: 12-3-09                      Checked By: KB                      Date: 12-3-09

**Original Concept:** Provide a 4 foot buffer area between the general purpose and HOT lane, an 8 foot full depth shoulder and concrete median barrier within the 64 ft median.

**Proposed Change:** Reduce the 4 foot buffer to 2 feet, reduce the 8 ft shoulder to 4 feet, eliminate asphalt section in median and substitute cable rail for the concrete median barrier.

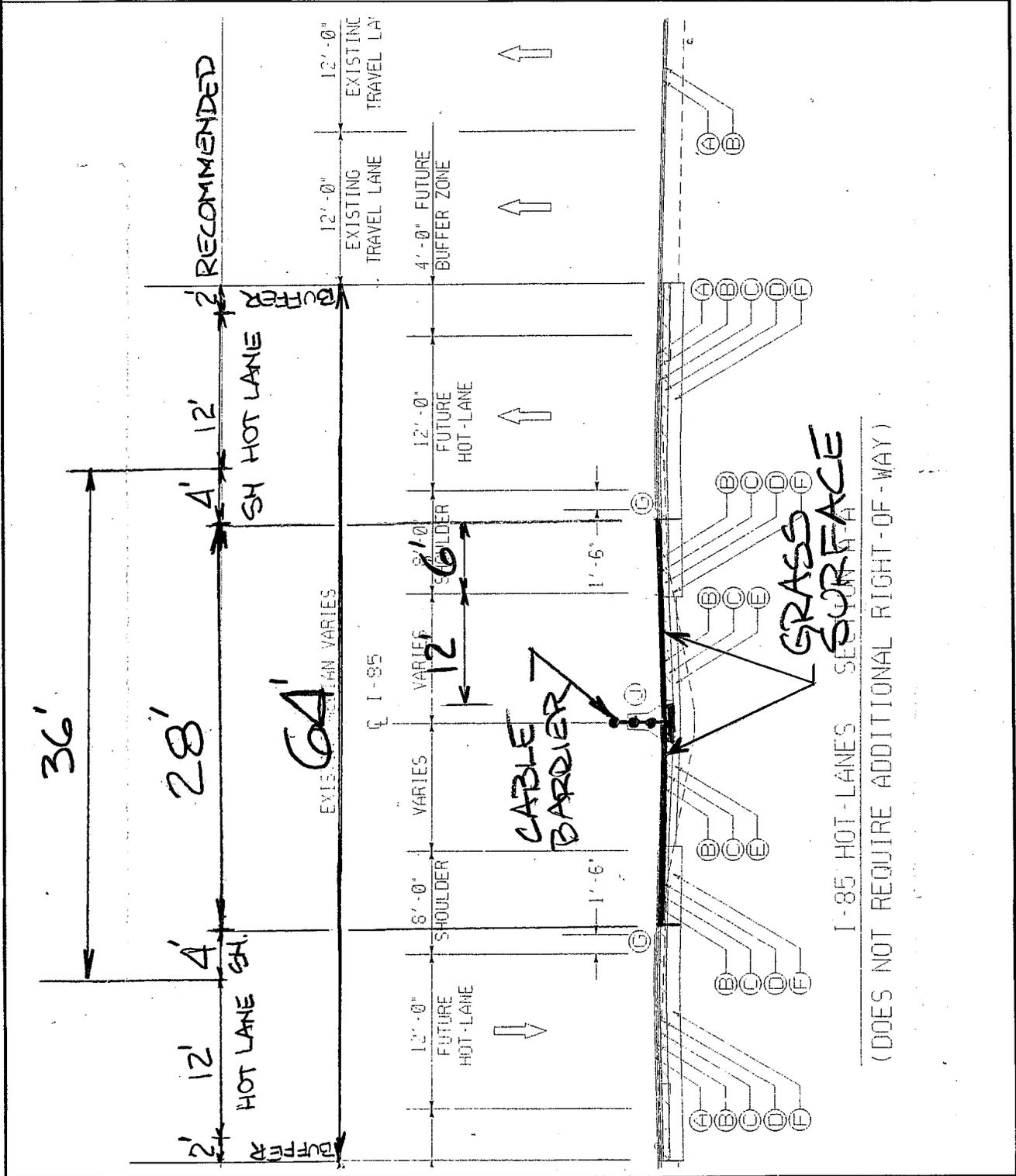
**Justification:** The existing 64 ft median provides ample space for a 2 ft buffer, the new HOT lane a 4 ft shoulder and allows the use of cable barrier in lieu of the concrete median barrier. It significantly reduces construction costs while providing the same project function. This recommended section is consistent with the managed lane development and current median treatment along the I-85 corridor.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	10,960,000		
<b>- Proposed</b>	1,496,000		
<b>- Savings</b>	9,464,000		
<b>FUTURE COST: - Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>9,464,000</b>

# SKETCH

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: **A-4**  
 Client: **GDOT**  
 Sheet **2** of **4**



I-85 HOT-LANES SECTION A-A  
 (DOES NOT REQUIRE ADDITIONAL RIGHT-OF-WAY)

**COST WORKSHEET**

PROJECT: I-85 Widening - Managed Lanes	IDEA No: A - 4
	CLIENT: GDOT
	Sheet 3 of 4

CONSTRUCTION ELEMENT		ORIGINAL ESTIMATE			NEW ESTIMATE		
ITEM	UNITS	No. UNITS	COST/ UNIT	TOTAL COST	No. UNITS	COST/ UNIT	TOTAL COST
A - 135 #/SY - PEM	tons	4,752	95.00	451,440			
D - 1320 #/SY - 25 mm super	tons	46,464	65.00	3,020,160			
	tons	-	0.00				
B and C	tons	34,848	70.00	2,439,360			
E - GAB, 6 in	sy	140,800	9.33	1,313,664			
F - GAB, 12 in	sy	70400.0	23	1,619,200			
Concrete Median Barrier	lf	52800	40	2,112,000			
Cable Barrier	lf				52,800	15	792,000
Turf / Grass Strip	sf				140800	5	704,000
SUBTOTAL				10,955,824			1,496,000
Markup @ 0.00%				0			0
TOTAL				10,955,824			1,496,000
TOTAL ROUNDED				10,960,000			1,496,000

## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: A - 4  
Client: GDOT  
Sheet 4 of 4

This recommendation applies to the area from the SR 20 interchange to the northern project limit, a distance of 10 miles; 52,800 ln ft.

### Overall 6 ft reduction from full depth to shoulder pavement

$$52,800 \text{ ln ft} \times 6 \text{ ft} \times 2 \text{ directions} = 633,600 \text{ sq ft} = 70,400 \text{ sq yd}$$

A – 135 #/sy - 12.5 mm PEM

$$70,400 \text{ sq yd} \times 135 \text{ \#/sy} (1 \text{ Ton} / 2,000 \text{ Ton}) = 4,752 \text{ Tons}$$

D – 1,320 #/sy - 25 mm Superpave

$$70,400 \text{ sq yd} \times 1,320 \text{ \#/sy} (1 \text{ Ton} / 2,000 \text{ Ton}) = 46,464 \text{ Tons}$$

### Overall 12 ft reduction from shoulder pavement to turf strip; keep 4 ft asphalt strip for cable rail

B and C; 220 +275 #/sy = 495 #/sy

$$52,800 \text{ lf ft} \times 2 \text{ directions} \times 12 \text{ ft} = 1,267,200 \text{ sq ft} = 140,800 \text{ sq yd}$$

$$140,800 \text{ sq yd} \times 495 \text{ \#/sy} (1 \text{ Ton} / 2,000 \text{ \#}) = 34,848 \text{ Tons}$$

## DEVELOPMENT AND RECOMMENDATION PHASE

### Project: I-85 Widening to Add Two Managed Lanes

<b>IDEA No.:</b> A-6	<b>Sheet No.:</b> 1 of 3	<b>CREATIVE IDEA:</b> Widen proposed HOT lanes using an 11-foot wide lane versus a 12-foot wide lane.
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Comp By: dpc      Date: 12.2.09      Checked By: kb      Date: 12.3.09

**Original Concept:**

I-85 mile marker 110.4 to 126.1 and I-985 mile marker 0.0 to 1.7 equates to approximately 17.4 miles of the proposed roadway typical sections which currently propose the use of 12-foot wide HOT lanes.

**Proposed Change:** It is recommended that an 11-foot wide HOT lane be used in-lieu-of a 12-foot wide HOT lane throughout the entire project limits.

**Justification:** Reduction of 1-foot of roadway section per each HOT lane reduces pavement section, bridge width, and earthwork costs.

The reduction in lane width would reduce the amount of roadway and bridge section construction costs. The 11-foot lanes would accommodate current and future local AADT traffic demands and provide adequate offset including the buffer area.

This concept results in significant cost savings to the project.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	\$2,033,000		
<b>- Proposed</b>			
<b>- Savings</b>	\$2,033,000		\$2,033,000
<b>FUTURE COST: - Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			\$2,033,000

## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: A-6  
Client: GDOT  
Sheet 2 of 3

### I-85 HOT Lane Section: 15.5 miles (15.7 minus 0.2 bridge lengths)

Total pavement width 1-foot reduction per HOT lane =  $(15.5 \text{ miles} \times 5,280 \text{ LF} \times 1.0 \text{ LF}) \times 2$  (NB & SB HOT lanes) = 163,680 SF / 9 SY = 18,187 total SY.

**Asphalt - SY to Ton conversion calculations:** (GAB already provided in estimate in a SY format)

1. 12.5 mm PEM mix –  $135 \text{ \#/SY} \times 18,187 \text{ SY} / 2,000 \text{ \#/TN} = \mathbf{1,228 \text{ Tons}}$
2. 12.5 mm SMA mix –  $220 \text{ \#/SY} \times 18,187 \text{ SY} / 2,000 \text{ \#/TN} = \mathbf{2,000 \text{ Tons}}$
3. 19 mm mix –  $275 \text{ \#/SY} \times 18,187 \text{ SY} / 2,000 \text{ \#/TN} = \mathbf{2,500 \text{ Tons}}$
4. 25 mm mix –  $1,320 \text{ \#/SY} \times 18,187 \text{ SY} / 2,000 \text{ \#/TN} = \mathbf{12,003 \text{ Tons}}$

**Bitum. Tack Coat:** Use percentage calculation for cost estimate – We are reducing lane width by 1 foot out of a 12 foot lane = 8% reduction. Total estimated quantity of tack provided in current GDOT detailed estimate is 146,000 gallons. An 8% reduction would calculate to **11,680 G** (gallons).

**Drainage System:** No drainage plans available for review.

**Bridge Width Decrease:** Several bridge structure widths to be reduced by 1.0 LF each lane direction.

1. I-85 NB over SR 20 at 304 LF in length x 1.0 LF in width = 304 SF
  2. I-85 SB over SR 20 at 304 LF in length x 1.0 LF in width = 304 SF
  3. Existing I-85 SB over I-985 NB at 213 LF in length x 1.0 LF in width = 213 SF
  4. Proposed I-85 SB over I-985 NB at 299 LF in length x 1.0 LF in width = 299 SF
- I-85 bridge width decrease = 1,120 SF

### I-985 HOT Lane Section: 1.7 miles (Alternate 1)

a.) Total pavement width 1-foot reduction per HOT lane =  $(1,000 \text{ LF} \times 5.0 \text{ LF}) = 5,000 \text{ SF} / 9 \text{ SY} = 556 \text{ SY}$ .

b.) Total pavement width 1-foot reduction per HOT lane =  $(1.51 \text{ miles} \times 5,280 \text{ LF} \times 1.0 \text{ LF}) = 7,973 \text{ SF} / 9 \text{ SY} = 886 \text{ SY}$ .

Total Plain Concrete Pavement Reduction = **1,442 SY**

**Plain Concrete Pavement** payment item already provided in cost estimate in a SY format.

**Drainage System:** No drainage plans available for review.

**Bridge Width Decrease:** Two bridge structures to be reduced by 1.0 LF each lane direction:

1. I-985 NB over Ivy Creek at 171 LF in length x 1.0 LF in width = 171 SF
  2. I-985 SB over Ivy Creek at 171 LF in length x 1.0 LF in width = 171 SF
- I-985 bridge width decrease = 342 SF

**TOTAL Bridge width decrease = 1,462 SF**



## DEVELOPMENT AND RECOMMENDATION PHASE

### I-85 HOT Lanes

<b>IDEA No.:</b> B-1	<b>Sheet No.:</b> 1 of 4	<b>CREATIVE IDEA:</b> Eliminate General Purpose Lane Resurfacing North of I-985
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Comp By: SG    Date: 12-4-09    Checked By: KB    Date: 12-4-09

**Original Concept:** The original concept proposes to mill and resurface the general purpose lanes from north of I-985 to SR 211

**Proposed Change:** The revised concept proposes to eliminate all milling and resurfacing on the general purpose lanes from north of I-985 to SR 211.

**Justification:** The existing pavement for the general purpose lanes is in good condition and does not require milling and resurfacing at this time. The construction of the proposed two managed lanes does not require modification of the general purpose lanes. Additionally, in the area north of the I-985 interchange, no lane shifts or transitions are proposed and therefore no pavement markings will be obscured or confusing. The need and purpose of the project can be achieved without rehabilitating these lanes while providing a significant cost savings.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	\$6,395,000		
<b>- Proposed</b>	\$,000		
<b>- Savings</b>	\$6,395,000		
<b>FUTURE COST: – Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>\$6,395,000</b>

## CALCULATIONS

**Project: I-85 Widening to Add Two Managed Lanes**

Idea No.: B-1  
Client: GDOT  
Sheet 2 of 4

Approximate Project Length (North of I-985)

Total – 12.3 miles

### **Original Concept**

General Purpose Lane Area = (12.3 miles)(5280 ft/mile)(48 ft)(1 sy/9 sf) = 346,368 sy

### **Pavement Section Rates**

135 -12.5 mm PEM - 0.0675 tons/sy

220 -12.5 mm SMA - 0.11 tons/sy

### Pavement

Wt(12.5 mm PEM) = (346,368 sy)(0.0675 tons/sy) = 23,380 tons

Wt (12.5 mm SMA) = (346,368 sy)(0.11 tons/sy) = 38,100 tons

### Milling

Area = 346,368 sy

### **Revised Concept**

### Pavement

Wt(12.5 mm PEM) = 0 tons

Wt (12.5 mm SMA) = 0 tons

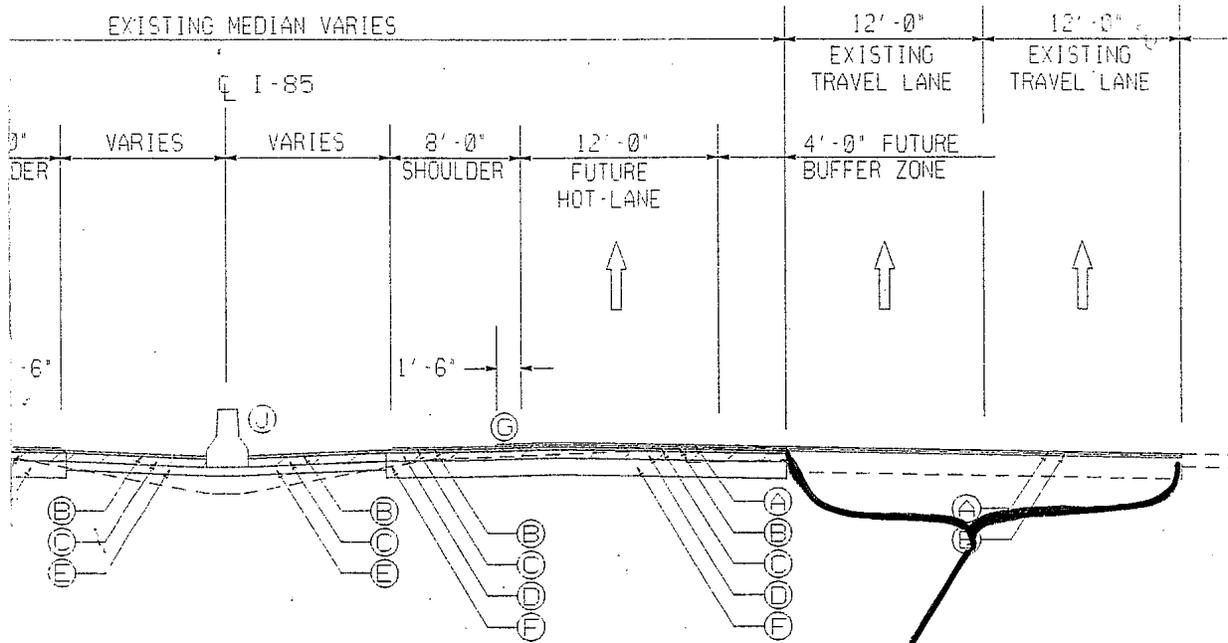
### Milling

Area = 0 sy

# SKETCH

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: B-1  
Client: GDOT  
Sheet ~~2~~ 3 of 4



ELIMINATE  
RE SURFACING



## DEVELOPMENT AND RECOMMENDATION PHASE

### Project: I-85 Widening to Add Two Managed Lanes

<b>IDEA No.:</b> C-7	<b>Sheet No.:</b> 1 of 3	<b>CREATIVE IDEA:</b> Defer the Southbound extension of the HOT lane to I-985.
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Comp By: dpc      Date: 12.3.09      Checked By: kb      Date: 12.3.09

**Original Concept:**

Construct approximately 1.7 miles of I-985 Southbound HOT lane until it merges into the proposed I-85 Southbound HOT lane.

**Proposed Change:** It is recommended that we entirely remove the 1.7 mile section of I-985 Southbound HOT lane from beginning point to the I-85 Southbound HOT lane merge point.

**Justification:** The current Southbound HOT lane only extends approximately ¾ mile north of the I-85 split. The currently projected I-985 southbound user volumes do not justify a HOT lane component. Reduction of the I-985 Southbound HOT lane will reduce both PCC and asphalt pavement costs, eliminate bridge costs over Ivy Creek and delete 1.7 miles of concrete median costs. This concept results in significant cost savings to the project and will continue to provide for future I-985 HOT expansion once user volumes validate.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	\$2,838,000		
<b>- Proposed</b>			
<b>- Savings</b>	\$2,838,000		\$2,838,000
<b>FUTURE COST: - Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			\$2,838,000

## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C-7  
Client: GDOT  
Sheet 2 of 3

### I-985 SB HOT Lane Section F-F to Section K-K:

Assume 3,400 LF of 12 LF HOT lane; 8 LF partial depth inside shoulder, 2 LF full depth outside shoulder, and concrete barrier wall.

**GAB:** 12 LF lane + 8 LF outside shoulder + 2 LF inside shoulder = 22 LF x 3,400 LF = 74,800 SF / 9 = **8,311 SY**.

**Asphalt Section without surface PEM:** SY to Ton conversion calculations:

1. 12.5 mm SMA mix – 220 #/SY x 8,311 SY / 2,000 #/TN = **915 Tons**
2. 19 mm mix – 275 #/SY x 8,311 SY / 2,000 #/TN = **1,143 Tons**
3. 25 mm mix – 1,320 #/SY x 8,311 SY / 2,000 #/TN = **5,486 Tons**

**Asphalt PEM surface:**

1. 12.5 mm PEM mix – 135 #/SY x 4,533 SY / 2,000 #/TN = **306 Tons**

**Bitum. Tack Coat:** Spread rate anticipated near 0.06 gal. Per square foot between each of the 3 layers. 74,800 SF x 3 layers = 224,400 SF x 0.05 gal/SF = **11,220 gal.**

**Concrete Barrier Wall:** Full length of section has barrier = **3,400 LF.**

**Bridge:** None in this section.

### I-985 SB HOT Lane Section K-K to Section I-I:

Assume 1,600 LF of 4 LF HOT lane; 0 LF partial depth inside shoulder (already there), 3.5 LF full depth outside shoulder, and concrete barrier wall.

**Bridge:** Reduce need for I-985 SB HOT lane bridge structure over Ivy Creek. **\$654,000.**

**Plain Concrete 12" Thick Pavement:**

1. 1,600 LF x (4 LF + 3.5 LF) (balance added to existing pavement in place) = 12,000 SF / 9 = **1,333 SY**

**Concrete Barrier Wall:** Full length of section has barrier = **1,600 LF.**

### I-985 SB HOT Lane Section I-I to tie-in:

Assume 3,900 LF of 12 LF PCC HOT lane; 2.0 LF full depth asphalt inside shoulder, 8.0 LF partial depth outside asphalt shoulder, and concrete barrier wall.

**GAB:** 2 LF inside shoulder + 8 LF outside shoulder = 10 LF x 3,900 LF = 39,000 SF / 9 = **4,333 SY.**

**Bridge:** None in this section.

**Plain Concrete 12" Thick Pavement:**

1. 3,900 LF x 12 LF = 46,800 SF / 9 = **5,200 SY**

**Asphalt Shoulder:**

1. 12.5 mm SMA mix – 220 #/SY x 4,333 SY / 2,000 #/TN = **477 Tons**
2. 19 mm mix – 275 #/SY x 4,333 SY / 2,000 #/TN = **596 Tons**
3. 25 mm mix – 1,320 #/SY x 4,333 SY / 2,000 #/TN = **2,860 Tons**  
(Insignificant tack coat quantities)

**Concrete Barrier Wall:** Full length of section has barrier = **3,900 LF.**



## DEVELOPMENT AND RECOMMENDATION PHASE

### Project: I-85 Widening to Add Two Managed Lanes

<b>IDEA No.:</b> C – 8.1	<b>Sheet No.:</b> 1 of 5	<b>CREATIVE IDEA:</b> Relocate I-985 SB HOT lane to new flyover structure over I-85 SB.
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Comp By: GCG    Date: 12-03-09    Checked By: GAO    Date: 12-15 -09

**Original Concept:**

The preferred option for the proposed HOT lanes connecting I-85 and I-985 are on an alignment that follows the existing I-985 NB exit ramp from I-85 NB. This requires a design exception for the 45 mph design speed. The Alternate 1 design option is developed if the design exception is not granted. It provides for both I-985 HOT lanes to be constructed on new alignment, with new bridges at I-85 SB and Ivy Creek. This requires a complete I-85 SB detour roadway through the interchange.

**Proposed Change:**

The proposed alignment will be a new flyover ramp and bridge for the I-985 SB HOT lane. Only the I-985 SB HOT lane will be carried on this new alignment. The I-985 NB HOT lane will utilize the existing bridge and road alignment of the current I-985 NB exit lanes. A new bridge will still be required for the I-985 SB HOT lane over Ivy Creek however the existing bridge will be retained and rehabilitated to carry the I-985 NB HOT lane.

**Justification:**

If the design exception is not granted, this recommendation will retain the existing I-85 SB bridge over the I-985 NB exit for use as the new I-985 NB HOT lane alignment and construct a new flyover ramp and bridge for the new I-985 SB HOT lane only. This recommendation will salvage some of the construction costs with the reuse of the existing span below I-85 SB lanes, rather than the total elimination of it. It also provides an alternate method of construction if the Alternate 1 design option is required – overpass rather than underpass which requires a full I-85 SB detour.

The cost comparison (savings) is compared to the Alternate 1 design, not the preferred option which requires the 45 mph design exception. The savings is due to the reduction in structural and roadway costs.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	4,255,000		
<b>- Savings</b>	<b>2,760,000</b>		
<b>- Savings</b>	1,495,000		
<b>FUTURE COST: – Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>1,495,000</b>

# SKETCH

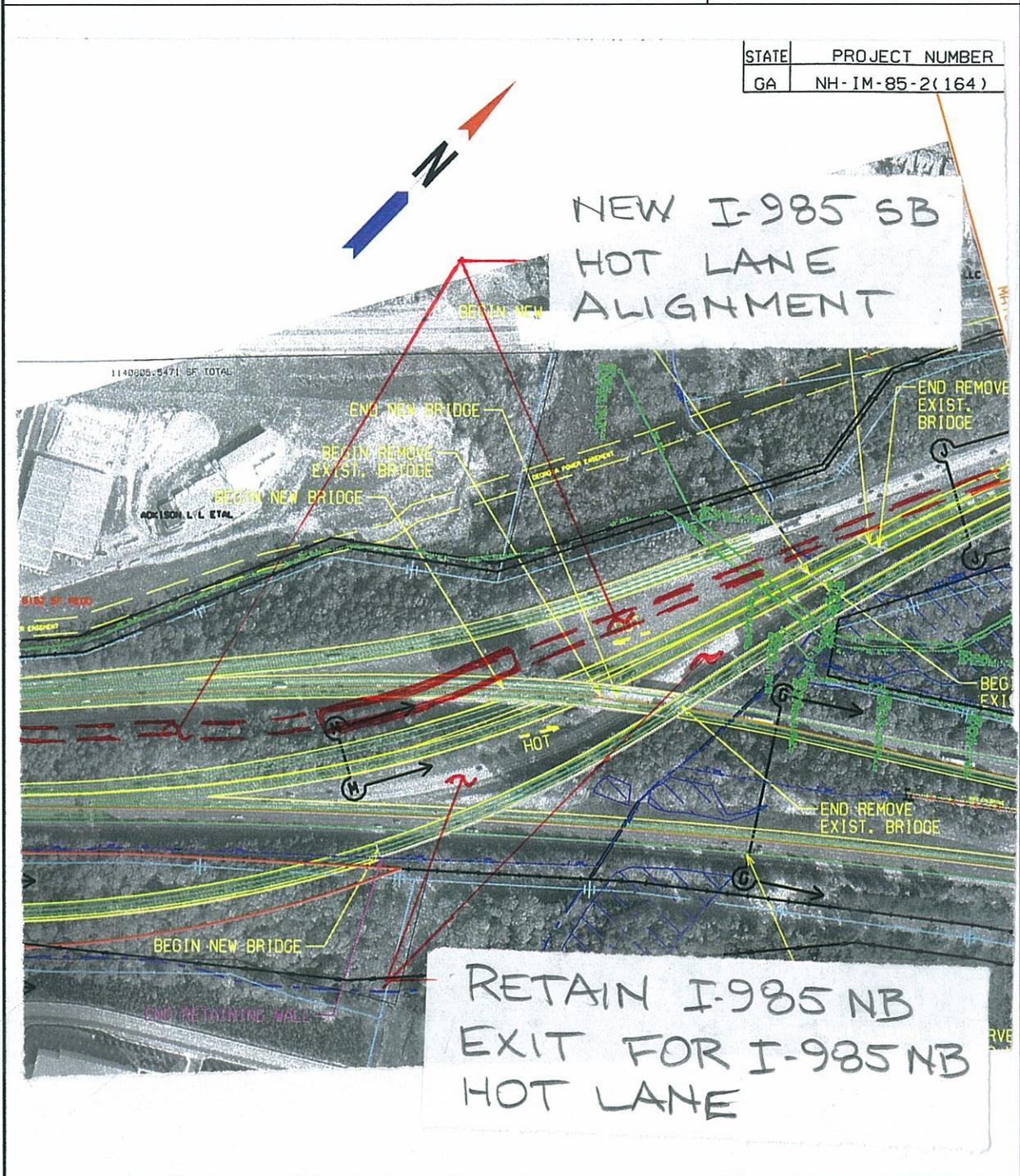
**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C-8.1

Client: GDOT

Sheet 2 of 5

STATE	PROJECT NUMBER
GA	NH-IM-85-2(164)





## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C – 8.1

Client: GDOT

Sheet 4 of 5

**Bridge reduction:**

I-985 NB HOT lane:  $61.25 \times 298.5 = 18,283$  sq ft

I-985 NB HOT over Ivy Creek:  $29 \times 171 = 4,959$  sq ft

Total bridge area –  $18,283 + 4,959 = 23,242$  sq ft

**Added / new bridge**

I-985 SB HOT flyover ramp over I-85 SB:  $600 \times 30 = 18,000$  sq ft

**Roadway reduction: I-985 HOT lanes, 30 ft wide**

NB – 2,500 lf; use existing I-985 exit roadway

SB – 600 lf; flyover bridge

Total  $(2,500 + 600) \times 30 = 93,000$  sq ft

**Additional walls required for flyover:**

$[(400 \text{ ft long} \times 30 \text{ ft high}) \frac{1}{2}] \times 2 \text{ sides} \times 2 \text{ approaches} = 24,000$  sq ft

Eliminate the I-85 SB detour roadway, approximately 1 mile long – Lump Sum; assume \$1,000,000

All other items are relatively comparable between the 2 proposed alignments.

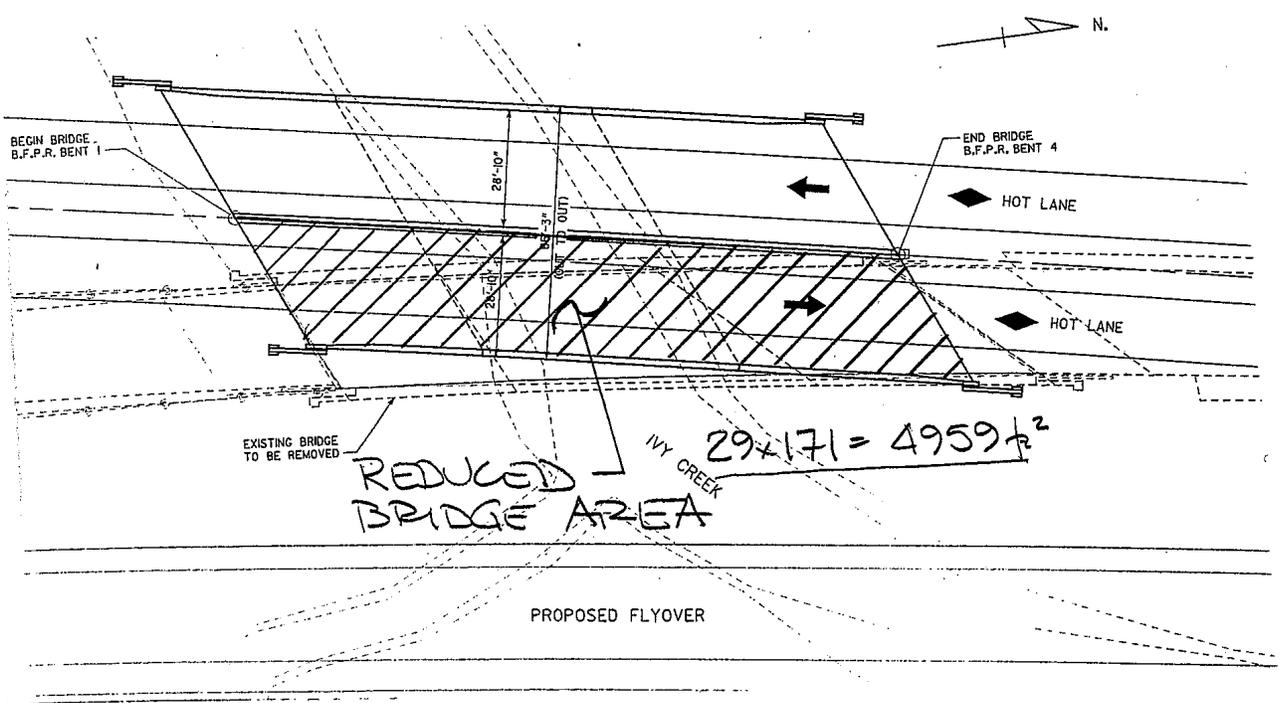
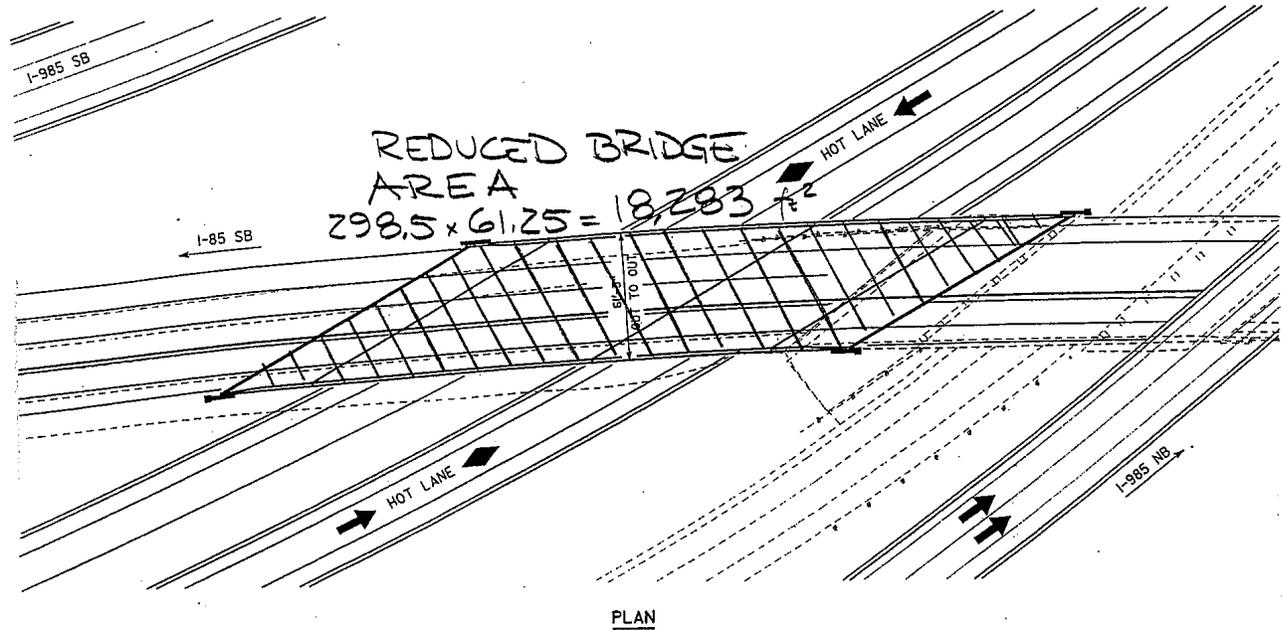
# CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C-8.1

Client: GDOT

Sheet ~~4~~ 4 of 4



**DEVELOPMENT AND RECOMMENDATION PHASE**

**Project: I-85 Widening to Add Two Managed Lanes**

<b>IDEA No.:</b> C – 8.2	<b>Sheet No.:</b> 1 of 5	<b>CREATIVE IDEA:</b> Relocate I-985 SB HOT lane to new underpass structure under I-85 SB.
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Comp By: GCG      Date: 12-03-09      Checked By: GAO      Date: 12-13-09

**Original Concept:**

The preferred option for the proposed HOT lanes connecting I-85 to I-985 are on an alignment that follows the existing I-985 NB exit ramp from I-85 NB. This requires a design exception for the 45 mph design speed. The Alternate 1 design option is developed if the design exception is not granted. It provides for both I-985 HOT lanes to be constructed on new alignment, with new bridges at I-85 SB and Ivy Creek. This requires a complete I-85 SB detour roadway through the interchange.

**Proposed Change:**

The proposed alignment will be a new underpass ramp for the I-985 SB HOT lane. Only the I-985 SB HOT lane will be carried on this new alignment. The I-985 NB HOT lane will utilize the existing bridge and road alignment of the current I-985 NB exit lanes. A new bridge will still be required for the I-985 SB HOT lane over Ivy Creek however the existing bridge will be retained and rehabilitated to carry the I-985 NB HOT lane.

**Justification:**

If the design exception is not granted, this recommendation will retain the existing I-85 SB bridge over the I-985 NB exit for use as the new I-985 NB HOT lane alignment and construct a new underpass ramp and bridge for the new I-985 SB HOT lane only. This recommendation will salvage some of the construction costs with the reuse of the existing span below I-85 SB lanes, rather than the total elimination of it.

It will require the I-85 SB detour roadway construction similar to the current Alternate 1 design option however an alternate staging option should be developed to eliminate this detour.

The cost comparison (savings) is compared to the Alternate 1 design, not the preferred option which requires the 45 mph design exception. The savings is due to the reduction in structural and roadway costs.

<b>LIFE CYCLE COST SUMMARY</b>	<b>CAPITAL COST</b>	<b>FUTURE COST</b>	<b>TOTAL COST</b>
<b>INITIAL COST: - Original</b>	1,591,000		
<b>- Proposed</b>	0		
<b>- Savings</b>	1,591,000		
<b>FUTURE COST: – Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>1,591,000</b>

# SKETCH

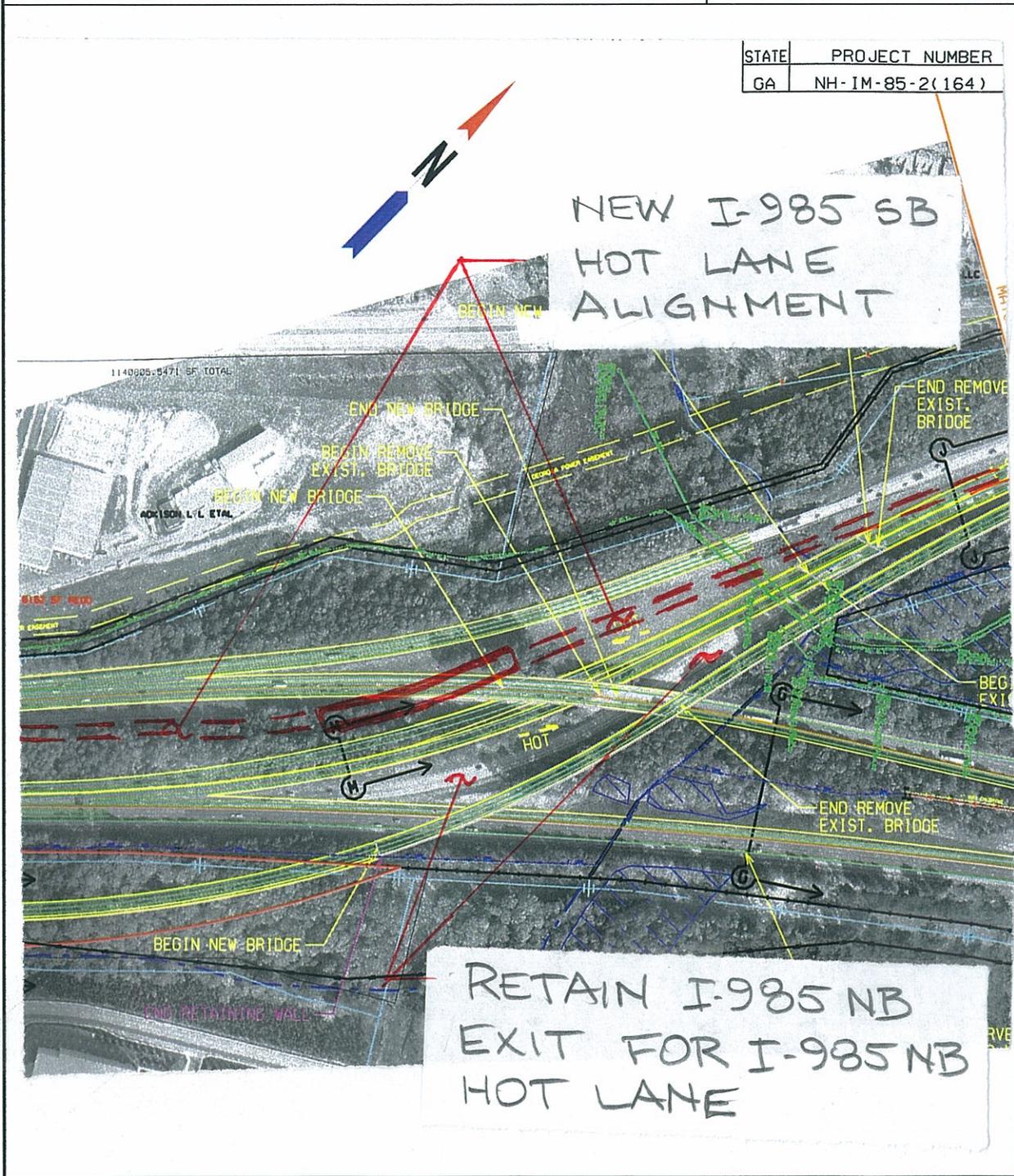
**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C-8.1

Client: GDOT

Sheet 2 of 5

STATE	PROJECT NUMBER
GA	NH-IM-85-2(164)





## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C8-2  
Client: GDOT  
Sheet 4 of 5

Cost Reductions include:

- I-985 NB HOT lane, about 2,500 feet in length, 30 feet wide
- I-85 SB bridge over I-985 HOT lanes and I-985 NB HOT lane over Ivy Creek

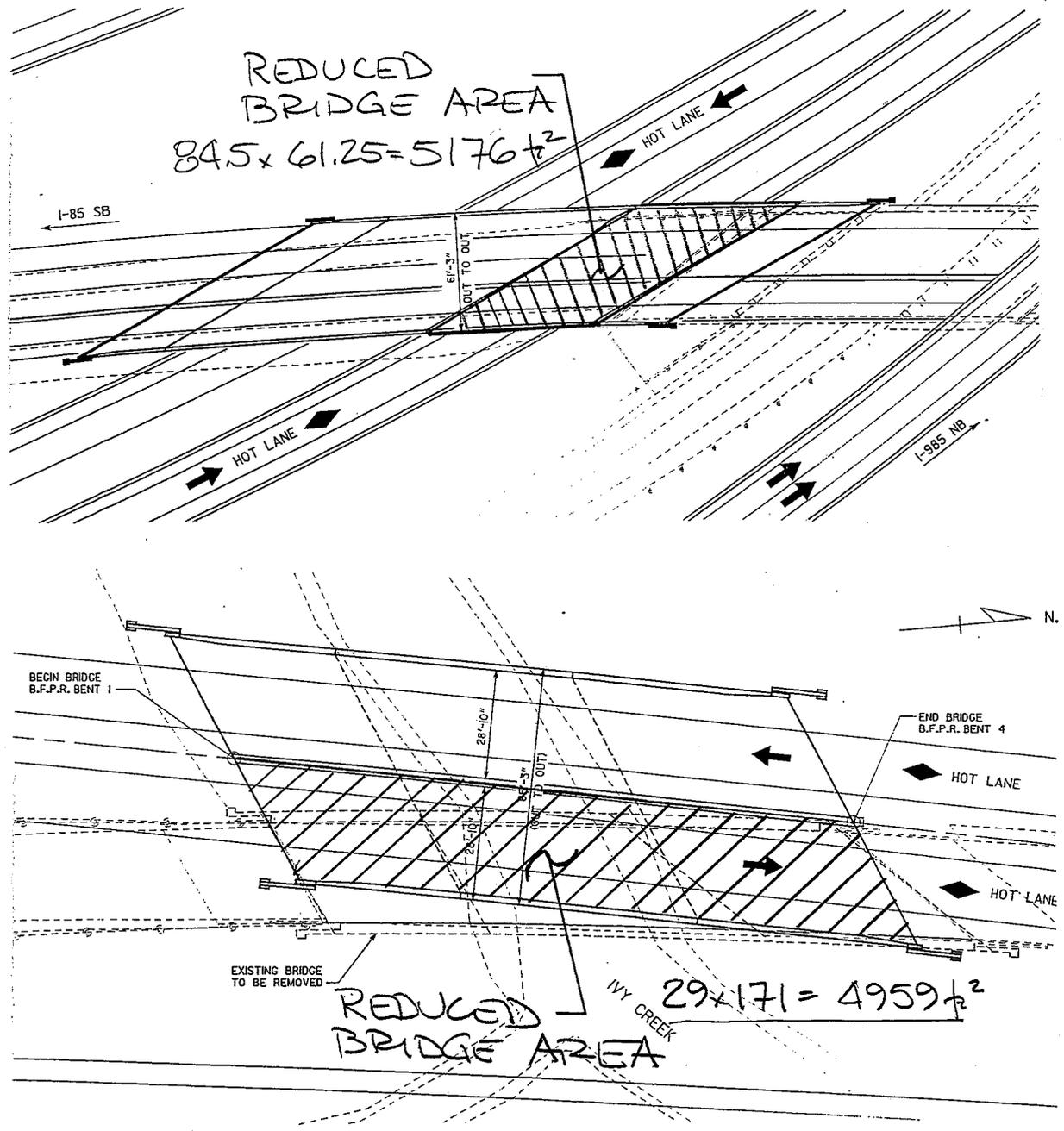
Ramp area

$$2,500 \text{ ft} \times 30 \text{ ft} = 75,000 \text{ sq ft} = 8,333 \text{ sq yd}$$

# CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C-8.2  
 Client: GDOT  
 Sheet 5 of 5



**TOTAL -  $5,176 + 4,959 = 10,135$  SQ. FT.**

## DEVELOPMENT AND RECOMMENDATION PHASE

### Project: I-85 Widening to Add Two Managed Lanes

<b>IDEA No.:</b> C-9	<b>Sheet No.:</b> 1 of 5	<b>CREATIVE IDEA:</b> For Alternate 1 Design option: use I-85 SB detour roadway for permanent realignment.
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Comp By: LB                      Date: 12-03-09                      Checked By: GAO                      Date: 12-15-09

**Original Concept:** Alternate 1 Design option is the developed alternative if the design exception for the 45 mph design speed on the I-985 HOT lane alignment is not granted. This alternate design requires a full detour for the I-85 SB roadway through the interchange utilizing temporary pavement to facilitate the construction of the new bridge for the I-985 HOT lanes.

**Proposed Change:** Use the I-85 SB temporary detour as the permanent realignment. This will allow for much of the construction to be performed in the existing median, without significant disruption to existing I-85 traffic patterns (in the clear).  
Widen I-85 SB to the inside and permanently realign the SB lanes. The proposed I-85 SB bridge over the I-985 HOT lanes and all the new pavement section would be constructed to the inside of the existing I-85 SB lanes. Once complete, I-85 SB traffic would be shifted to the new roadway section and the existing I-85 SB roadway section and bridge over I-985 NB lanes would be removed.

**Justification:** The current construction staging for the alternate design requires a complete I-85 SB temporary detour. This detour would be constructed in the existing median between the NB and SB lanes and would have wetlands impacts however it is the most convenient method to construct the required grade separations with the least disruption to existing traffic patterns. It will allow the bridges and most of the detour roadway to be constructed “in the clear”.  
Designing and constructing a shorter detour for permanent realignment of I-85 SB will improve the alignment and allow most of the significant construction to be built while maintaining the existing traffic away from the construction site. This alignment will also be further away from the protected covenant area and the old I-85 SB roadbed can be removed and the area restored.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	\$2,739,000		
<b>- Proposed</b>	\$2,246,000		
<b>- Savings</b>	\$493,000		
<b>FUTURE COST: – Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>493,000</b>

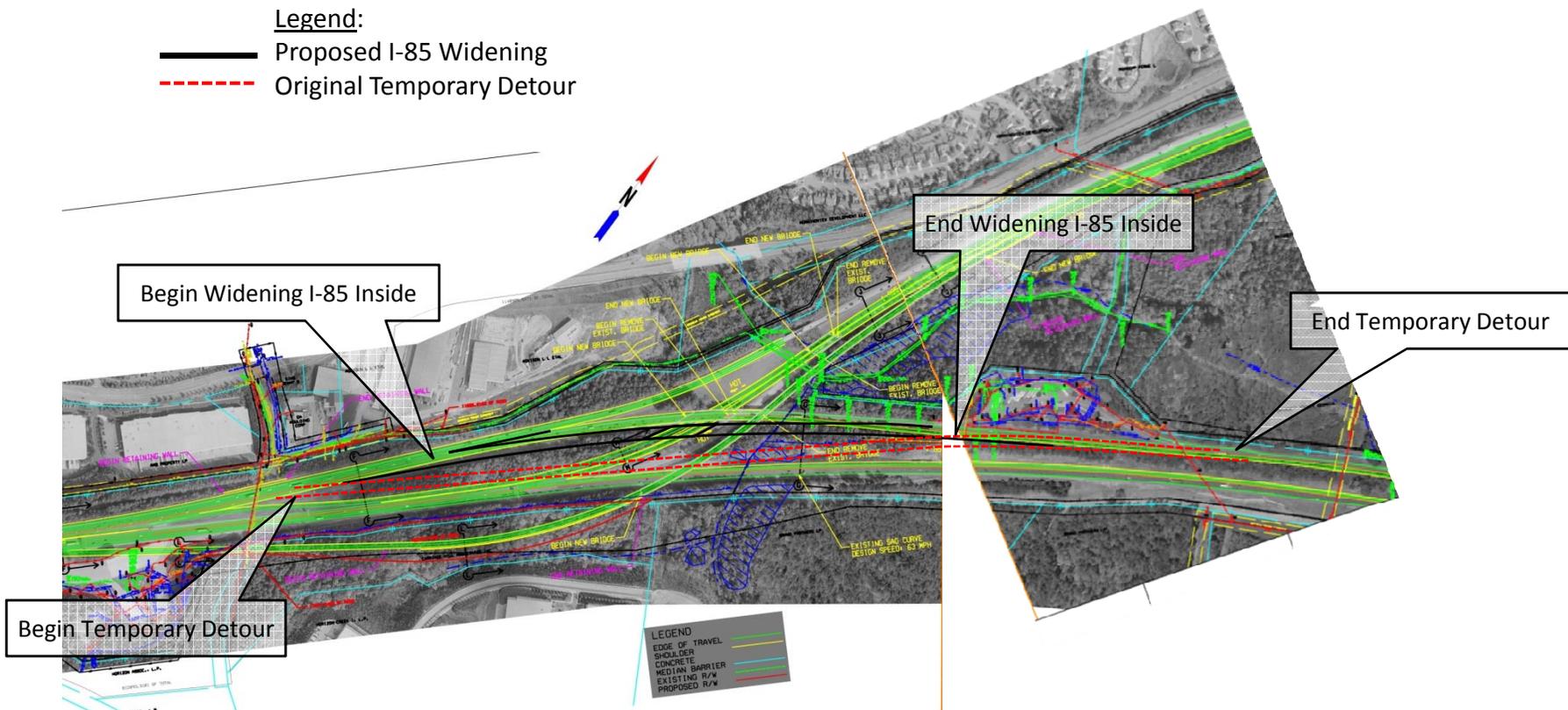
# SKETCH

Project: I-85 Widening to Add Two Managed Lanes

Idea No.: C-9  
Sheet 2 of 5

Legend:

- Proposed I-85 Widening
- - - Original Temporary Detour



C-9: Alternative Concept – Widen I-85 Southbound to the inside



## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C - 9  
Client: GDOT  
Sheet 4 of 5

**Cost estimate for Widening I-85 to the inside.**

Length = Approx. 3035 linear feet  
Shoulder Width = 20' total (10' inside and 10' outside):  $(20 \text{ lf})(1 \text{ lf})/9 = 2.22 \text{ sy}$   
Lane Width = 38' total (two 12' lanes, 2' buffer, 12' HOT lane) :  $(38 \text{ lf})(1 \text{ lf})/9 = 4.22 \text{ sy}$

***Lane Pavement Section Rates***

135 - 12.5 PEM - 0.0675  
220 -12.5 mm SMA - 0.11 tons/sy  
275 - 19 mm - 0.14 tons/sy  
1320 -25 mm - 0.66 tons/sy  
12" GAB - 0.66 tons/sy

**Pavement**

Wt (12.5 mm PEM) =  $(4.22 \text{ sy})(0.0675 \text{ tons/sy}) = 0.28 \text{ tons}$   
Wt (12.5 mm SMA) =  $(4.22 \text{ sy})(0.0675 \text{ tons/sy}) = 0.28 \text{ tons}$   
Wt (19 mm) =  $(4.22 \text{ sy})(0.14 \text{ tons/sy}) = 0.59 \text{ tons}$   
Wt (25 mm) =  $(4.22 \text{ sy})(0.66 \text{ tons/sy}) = 2.79 \text{ tons}$   
Area (12" GAB) = 4.22 sy

***Shoulder Pavement Section Rates***

220 -12.5 mm SMA - 0.11 tons/sy  
275 - 19 mm - 0.14 tons/sy  
6" GAB - 0.33 tons/sy

**Pavement**

Wt (12.5 mm SMA) =  $(2.22 \text{ sy})(0.0675 \text{ tons/sy}) = 0.15 \text{ tons}$   
Wt (19 mm SMA) =  $(2.22 \text{ sy})(0.14 \text{ tons/sy}) = 0.31 \text{ tons}$   
Area (6" GAB) = 2.22 sy

Calculated cost per linear foot = \$403.00  
*Pavement Cost =  $(\$403/\text{lf})(3035 \text{ lf}) = \$1,223,100$*

**Determine Cost/linear foot for earthwork:**

Cost per lf – Assume 10ft depth earthwork on avg spread across shoulder & travel lanes  
Area per lf =  $(1)(10)(58) = 580 \text{ cf} = 64 \text{ cy} * \$5 = \$320$   
*Earthwork Cost =  $(\$320/\text{lf})(3035 \text{ lf}) = \$972,200$*

**Determine Cost for Pavement Removal:**

Approx. 2200 lf at 42' width and 2.5' depth =  $[(2200 \text{ lf})(42')(2.5')/(27)](\$6/\text{cy}) = \$51,333$

ITEM	Units	No. Units	Cost/ Unit	Total Cost
12.5 mm PEM	TN	0.28	\$95.00	\$26.60
12.5 mm SMA	TN	0.28	\$95.00	\$26.60
19 mm Superpave	TN	0.59	\$70.00	\$41.30
25 mm Superpave	SY	2.79	\$65.00	\$181.35
12" GAB	SY	4.22	\$23.00	\$97.06
<b>Shoulder Pavement</b>				
12.5 mm SMA	TN	0.15	\$95.00	\$14.25
19 mm Superpave	TN	0.31	\$70.00	\$21.70
6" GAB	SY	2.22	\$9.33	\$20.71
SUBTOTAL				\$402.97
TOTAL				\$402.97
TOTAL ROUNDED				\$403

## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C - 9  
Client: GDOT  
Sheet 5 of 5

**Cost estimate for temporary detour.**

Length = Approx. 5280 linear feet  
Shoulder Width = 8' total (4' inside and 4' outside) :  $(8 \text{ lf})(1 \text{ lf})/9 = 0.89 \text{ sy}$   
Lane Width = 24' total (two 12' general purpose lanes) :  $(24 \text{ lf})(1 \text{ lf})/9 = 2.67 \text{ sy}$

***Lane Pavement Section Rates***

135 - 12.5 PEM - 0.0675  
220 -12.5 mm SMA - 0.11 tons/sy  
275 - 19 mm - 0.14 tons/sy  
1320 -25 mm - 0.66 tons/sy  
12" GAB - 0.66 tons/sy

**Pavement**

Wt (12.5 mm PEM) =  $(2.67 \text{ sy})(0.0675 \text{ tons/sy}) = 0.18 \text{ tons}$   
Wt (12.5 mm SMA) =  $(2.67 \text{ sy})(0.0675 \text{ tons/sy}) = 0.18 \text{ tons}$   
Wt (19 mm) =  $(2.67 \text{ sy})(0.14 \text{ tons/sy}) = 0.37 \text{ tons}$   
Wt (25 mm) =  $(2.67 \text{ sy})(0.66 \text{ tons/sy}) = 1.76 \text{ tons}$   
Area (12" GAB) = 2.67 sy

***Shoulder Pavement Section Rates***

220 -12.5 mm SMA - 0.11 tons/sy  
275 - 19 mm - 0.14 tons/sy  
6" GAB - 0.33 tons/sy

**Pavement**

Wt (12.5 mm SMA) =  $(0.89 \text{ sy})(0.0675 \text{ tons/sy}) = 0.06 \text{ tons}$   
Wt (19 mm SMA) =  $(0.89 \text{ sy})(0.14 \text{ tons/sy}) = 0.12 \text{ tons}$   
Area (6" GAB) = 0.89 sy

Calculated cost per linear foot = \$241.00  
*Pavement Cost =  $(\$241/\text{lf})(5280 \text{ lf}) = \$1,272,480$*

**Determine Cost/linear foot for earthwork:**

Cost per lf – Assume 10ft depth earthwork on avg spread across shoulder and travel lanes  
Area per linear foot =  $(1)(10)(32) = 320 \text{ cf} = 36 \text{ cy} * \$5 = \$180$   
*Earthwork Cost =  $(\$180/\text{lf})(5280 \text{ lf}) = \$950,400$*

**Determine Cost for Pavement Removal:**

Approx. 5280 lf at 32' width and 2.5' depth =  $[(5280 \text{ lf})(32')(2.5')/(27)](\$6/\text{cy}) = \$93,867$

ITEM	Units	No. Units	Cost/Unit	Total Cost
12.5 mm PEM	TN	0.18	\$95.00	\$17.10
12.5 mm SMA	TN	0.18	\$95.00	\$17.10
19 mm Superpave	TN	0.37	\$70.00	\$25.90
25 mm Superpave	SY	1.76	\$65.00	\$114.40
12" GAB	SY	2.67	\$23.00	\$61.41
<b>Shoulder Pavement</b>				
12.5 mm SMA	TN	0.06	\$95.00	\$5.70
19 mm Superpave	TN	0.12	\$70.00	\$8.40
6" GAB	SY	0.89	\$9.33	\$8.30
SUBTOTAL				\$241.21
TOTAL				\$241.21
TOTAL ROUNDED				\$241

## DEVELOPMENT AND RECOMMENDATION PHASE

### Project: I-85 Widening to Add Two Managed Lanes

<b>IDEA No.:</b> C - 10	<b>Sheet No.:</b> 1 of 4	<b>CREATIVE IDEA:</b> Reduce the length of the I-85 SB over I-985 Hot lanes
----------------------------	-----------------------------	--

Comp By: GCG    Date: 12/4/09    Checked By: KB    Date: 12-04-09

**Original Concept:**

Original Concept is a 4 span, PSC beam bridge with end spans of 40 feet, I-985 HOT SB span of 134 feet and I-985 HOT NB span of 84.5 feet.

**Proposed Change:**

The proposed recommendation is a 3 span, PSC beam bridge with end spans of 40 feet and a main center span of 134 feet. The existing typical section M-M requires a 66 ft clear width which can be provided by a 134 ft bridge opening based on the current alignment skew.

**Justification:**

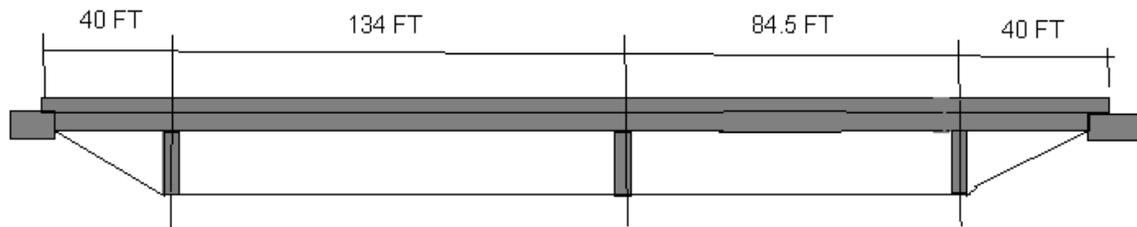
Minor alignment adjustments could bring the I-985 NB & SB HOT lanes to be concentric and eliminate the excessively wide left shoulder on the I-985 SB HOT left shoulder. The overall benefits include a reduction in the bridge length and the associated construction costs.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	2,196,000		
<b>- Proposed</b>	1,698,000		
<b>- Savings</b>	498,000		
<b>FUTURE COST: - Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>498,000</b>

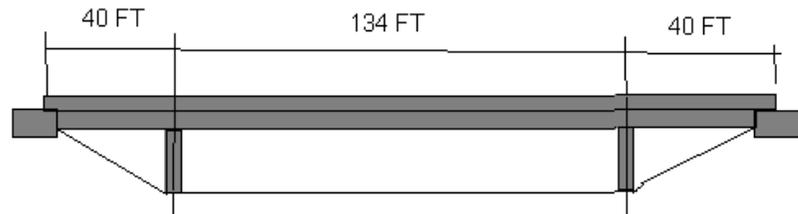
# SKETCH

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C - 10  
Client: GDOT  
Sheet 2 of 4



ORIGINAL CONCEPT



PROPOSED CHANGE



## CALCULATIONS

**Project:** I-85 Widening to Add Two Managed Lanes

Idea No.: C - 10  
Client: GDOT  
Sheet 4 of 4

### Proposed bridge

Length = 40 + 134 + 40 = 214 feet

Width = 61.25

Area = 214 ft x 61.25 = 13,108 sq ft

### Earth work

84 ft long x 26 ft tall x 61.25 wide + 26x2 wide 26 ft high x 84 ft long = 247338 ft<sup>3</sup>

$247338 \text{ ft}^3 / 27 = 9161 \text{ yd}^3$

### Pavement & Base

Use \$400 sq ft

Additional length = 84 ft

ITEM	Units	No. Units	Cost/ Unit	Total Cost
12.5 mm PEM	TN	0.28	\$95.00	\$26.60
12.5 mm SMA	TN	0.28	\$95.00	\$26.60
19 mm Superpave	TN	0.59	\$70.00	\$41.30
25 mm Superpave	SY	2.79	\$65.00	\$181.35
12" GAB	SY	4.22	\$23.00	\$97.06
<b>Shoulder Pavement</b>				
12.5 mm SMA	TN	0.15	\$95.00	\$14.25
19 mm Superpave	TN	0.31	\$70.00	\$21.70
6" GAB	SY	2.22	\$9.33	\$20.71
SUBTOTAL				\$402.97
TOTAL				\$402.97
TOTAL ROUNDED				\$403

## DEVELOPMENT AND RECOMMENDATION PHASE

### I-85 HOT Lanes

<b>IDEA No.:</b> J-2	<b>Sheet No.:</b> 1 of 3	<b>CREATIVE IDEA:</b> Rehabilitate the existing I-985 SB Bridge over Ivy Creek
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Comp By: SG      Date: 12-4-09      Checked By: KB      Date: 12-4-09

**Original Concept:** The original concept is to perform no improvements on the I-985 SB bridge over Ivy Creek. The project starts at the approach slab south of the beginning of the bridge.

**Proposed Change:** Extend the project north along I-985 SB alignment to the end of the approach slab and rehabilitate / reconstruct the existing bridge. The brush curb will be replaced with 'jersey' style side barrier with appropriate width shoulders.

**Justification:** The existing bridge possesses substandard side barrier and outside shoulders. All other bridges in the interchange are being replaced or rehabilitated. Excluding this bridge from the project would present an inconsistency with driver expectation.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
<b>INITIAL COST: - Original</b>	\$0		
<b>- Proposed</b>	\$		
<b>- Savings</b>	(\$792,000)		
<b>FUTURE COST: - Savings</b>			
<b>TOTAL PRESENT WORTH SAVINGS</b>			<b>(\$792,000)</b>

## CALCULATIONS

**Project: I-85 Widening to Add Two Managed Lanes**

Idea No.: J-2  
Client: GDOT  
Sheet 2 of 3

### **Original Concept**

No work performed

Refurbish Existing Bridge = \$0

### **Revised Concept**

Assume \$120/sf for refurbish existing bridge to account for widening

Area of Bridge Widening = (22')(300') = 6,600 sf

Total = (6,600 sf)(\$120/sf) = \$ 792,000



**APPENDIX**

## Sources

### Approving/Authorizing Persons

<b>Name:</b>	<b>Position:</b>	<b>Telephone:</b>
Ron Wishon	Director, Engineering Services	404-631-1753

### Personal Contacts

<b>Name:</b>	<b>Telephone:</b>	<b>Notes:</b>
Ashley Chan, HNTB	404-946-5716	Request cross sections for mainline roadway through Interchange
Ashley Chan, HNTB	404-946-5716	Request CAD files for project
Ashley Chan, HNTB	404-946-5716	Ask if Detour Costs are included in the Traffic Control Item
Dan Hood, HNTB	404-946-5734	CAD Files
Larry Prescott, HNTB	404-946-5743	Discuss various bridge options / elevations
Julio Castillo, HNTB	404-946-5735	Discuss the different size openings for the I-85 bridge over the HOT lanes

### Documents/Abstracts

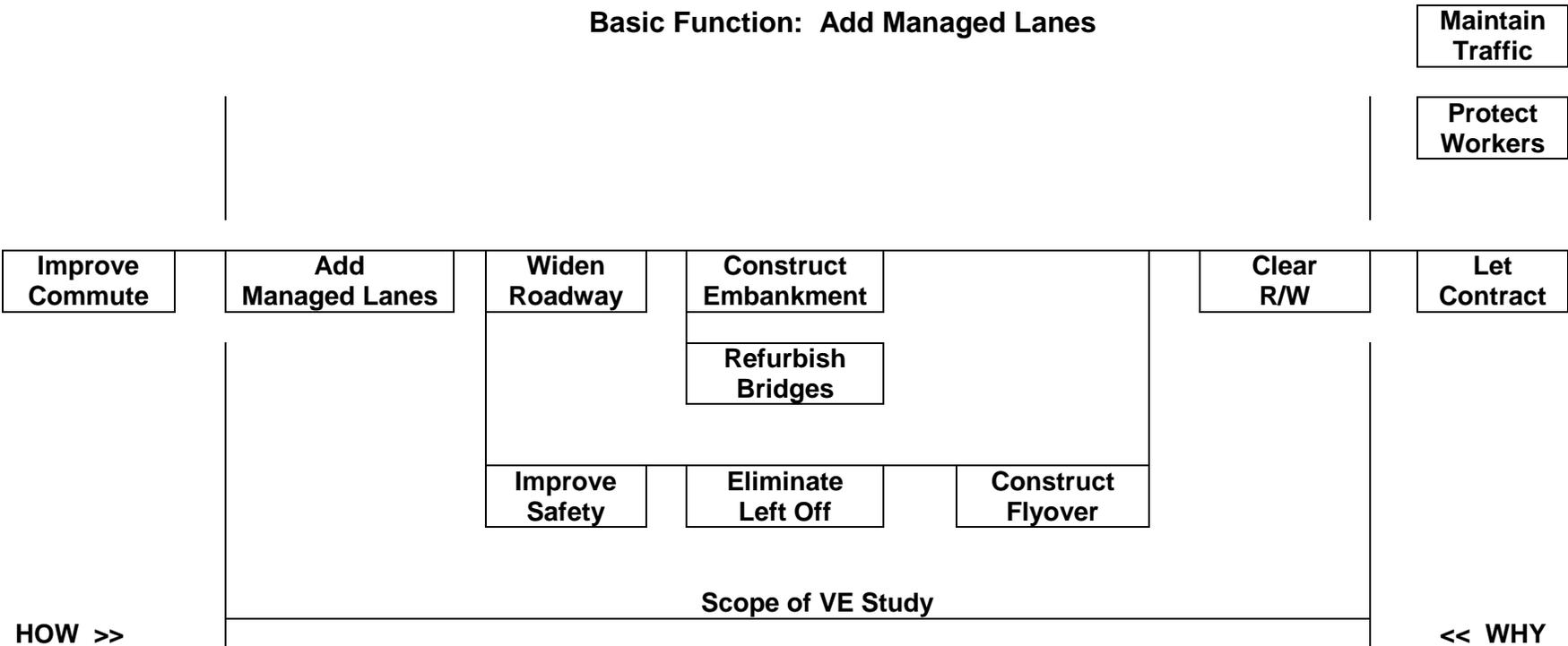
<b>Reference:</b>	<b>Reference:</b>
Project Concept Report	PDF files of concept report
Project Cost Estimate	PDF files of bridge layouts
Pavement PACES Ratings	
PDF files of existing roadway plans	
PDF files of proposed roadway plans	



# FAST DIAGRAM

## I-85 Widening to Add Two Managed Lanes

Basic Function: Add Managed Lanes



## INFORMATION PHASE – FUNCTION ANALYSIS

**Project:** I-85 Widening to Add Two Managed Lanes

**Function:** Add Managed Lanes

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
A	Recycle Asphalt Concrete	Widen	Roadway	\$34,016,000	25.4%	Yes
		Increase	Capacity			
		Extend	HOT Lanes			
		Provide	Shoulders			
		Allow	Future Lanes			
B	Asphalt Concrete	Provide	Full Surface	\$21,169,000	15.8%	Yes
		Provide	Overlay			
		Reduce	Spray			
		Cover	Striping			
C	NB I-85 to I-985 Flyover Bridge	Separate	Traffic	\$14,412,000	10.8%	Yes
		Eliminate	Left Off			
		Provide	Access			
		Avoid	Wetlands			
		Reduce	Shoulder Width			

## INFORMATION PHASE – FUNCTION ANALYSIS

**Project:** I-85 Widening to Add Two Managed Lanes

**Function:** Add Managed Lanes

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
<b>D</b>	Contingency	Construct	Project	\$14,081,000	10.5%	No
		Inform	Public			
<b>E</b>	Aggregate Base Course	Support	Roadway	\$12,101,000	9.0%	Yes
		Widen	Roadway			
		Provide	Shoulders			
		Allow	Future Lanes			
<b>F</b>	Right of Way	Accommodate	NB Off Ramp	\$8,550,000	6.4%	Yes
<b>G</b>	Overhead Signs	Inform	Motorists	\$4,060,000	3.0%	Yes
		Provide	Information			
		Sign	HOT Lanes			
		Identify	HOT Lanes			
<b>H</b>	Drainage	Remove	Water	\$4,011,000	3.0%	No
		Drain	Roadway			

## INFORMATION PHASE – FUNCTION ANALYSIS

**Project:** I-85 Widening to Add Two Managed Lanes

**Function:** Add Managed Lanes

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
<b>I</b>	Traffic Control	Stage	Construction	\$3,555,000	2.7%	Yes
		Detour	Traffic			
		Protect	Workers			
		Protect	Public			
<b>J</b>	Other Bridges	Separate	Grades	\$3,229,000	2.4%	Yes
		Accommodate	Widening			
		Accommodate	Shoulders			
<b>K</b>	Concrete Barrier	Separate	Traffic	\$3,054,000	2.3%	Yes
		Separate	HOT Lanes			
<b>L</b>	MSE Walls	Separate	Grades	\$2,495,000	1.9%	Yes
		Minimize	Slopes			
		Protect	Road			
<b>M</b>	Miscellaneous	Complete	Construction	\$2,271,000	1.7%	No
		Complete	Design/Build			

## INFORMATION PHASE – FUNCTION ANALYSIS

**Project:** I-85 Widening to Add Two Managed Lanes

**Function:** Add Managed Lanes

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
N	Unclassified Excavation	Widen	Roadway	\$2,250,000	1.7%	Yes
		Establish	Grade			
		Construct	Grades			
O	Signing & Marking	Advise	Motorists	\$1,442,000	1.1%	No
		Delineate	Lanes			
		Designate	HOT Lanes			
P	Clearing & Grubbing	Clear	R/W	\$1,432,000	1.1%	No
		Remove	Unsuitable			
		Allow	Construction			
Q	Mill Asphalt	Prepare	Surface	\$931,000	0.7%	No
R	Guardrail	Replace	Existing	\$711,000	0.5%	No
		Protect	Slopes			

<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>Recycle Asphalt Concrete Pavement</b>		
A-1	Eliminate the full depth shoulders from the added lane north of I-985.	Reduce cost, simplify construction	✓
A-2	Eliminate the 4-foot buffer area from the HOT lane pavement section.	The dual HOT lane striping requires at least 18-24 inches of space.	X
A-3	Reduce the 4-foot buffer area to a 2-foot buffer area.	Reduce cost, sufficient space for dual striping	✓
A-4	Construct a 2-foot buffer area and construct cable barrier in-lieu-of concrete barrier in the median.	Reduce cost	✓
A-5	Reduce the 4-foot buffer area, 12-foot HOT lane, and 8-foot full depth shoulder (24 feet) width.	See Idea A-3 and A-4	X
A-6	Reduce the width of the HOT lane to 11 feet.	Reduce cost, meets current HOT lane width	✓
A-7	Reduce the 16-foot width of the HOT lane through the Intersection.	Needed for single lane ramp or roadway	X
<b>B</b>	<b>Asphalt Concrete Pavement.</b>		
B-1	Eliminate the general purpose lane resurfacing north of I-985.	Current pavement condition does not require resurfacing.	✓
B-2	Eliminate/reduce the SMA pavement layer in the areas to be resurfaced and mill and replace only the PEM layer.	Cost savings if feasible from a construction standpoint.	X
✓ = Will be considered further; X = will be dropped; DC = Design Consideration –written for consideration by design team			

		<b>JUDGMENT PHASE Idea Evaluation</b>	
<b>No.</b>	<b>CREATIVE IDEA</b>	<b>COMMENTS</b>	<b>IDEA RATING</b>
<b>C</b>	<b>I-85 NB to I-985 NB Flyover Bridge</b>		
C-1	Eliminate the Flyover Bridge and go under the NB Road.	Requires review of existing topo	DC
C-2	Realign the Flyover Bridge approach closer to I-85.	See Idea C-8	X
C-3	Replace the SB I-85 Bridge with a longer/wider bridge to provide more space to place the dual HOT lanes.	Additional cost to replace bridge, improve HOT lane clear zones, and eliminate 45 MPH sight distance issue.	✓
C-4	Reduce the total length of the NB Flyover Bridge to several shorter sections with MSE wall enclosed embankments.	Reduce cost, reduce construction time.	✓
C-5	Shift the SB HOT lane to inside the existing end span and widen out the lanes to eliminate the 45 MPH SD issue.	Likely to provide unacceptable shoulder widths.	X
C-6	Flatten out the 45 MPH SD issue curve.	See Idea C-8	X
C-7	Eliminate the SB extension of the HOT lane from I-985.	Reduce cost, Simplify construction, save time	✓
C-8	Realign the SB HOT lane to a separate Flyover Bridge south of the current HOT lane alignment under SB I-85.	Simplify construction, improve ramp alignment, eliminate SB I-85 detour,	✓
C-9	In the Alternate Concept, Widen SB I-85 to the inside to allow construction of the new longer bridge to be done alongside the existing bridge. Use detour for final I-85 SB	Eliminate the cost of the detour road, simplify construction	✓
C-10	Reduce the length of the I85 SB over I-985 HOT lanes.	Reduces bridge span	✓
✓ = Will be considered further; X = will be dropped; DC = Design Consideration –written for consideration by design team			

<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>E</b>	<b>Aggregate Base Course</b>		
E-1	Eliminate the 4-foot buffer area along the HOT lane.	See Idea A-2, need 2-feet for striping	X
E-2	Reduce the 4-foot buffer area to a 2-foot area.	See Idea A-3	X
E-3	Reduce the HOT lane width to 11 feet.	See Idea A-6	X
<b>F</b>	<b>Right of Way</b>		
F-1	Shift the NB Flyover to the south and move it in closer to I-85.	See Idea C-8	X
<b>G</b>	<b>Overhead Signs</b>		
G-1	Consider placing the signs consistent with the locations required by the HOT lane management equipment/signs.	Eliminate the need to construct later and again impact traffic.	DC
G-2	Install the sign footings in the median for the future HOT lane management equipment/signs.	Eliminate the need to construct later and again impact traffic.	DC
<b>H</b>	<b>Drainage</b>		
H-1	Modify the median drainage in the areas where the concrete barrier will be replaced by cable barrier.	See Idea A-4	X
✓ = Will be considered further; X = will be dropped; DC = Design Consideration –written for consideration by design team			

<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>I</b>	<b>Traffic Control</b>		
I-1	Construct a HOV lane Flyover and eliminate 1 staging phase and the detour.	See Idea C-8	X
I-2	Verify the detour cost is included in the cost of the Traffic Control work.	Checked with the designer and cost are included.	X
<b>J</b>	<b>Other Bridges</b>		
J-1	The HOT lane Flyover Bridge would eliminate the need to lengthen the SB I-85 Bridge as shown in concept 2	See Idea C-8	X
J-2	Widen and rehabilitate the SB I-985 Bridge to eliminate the narrow 2-foot shoulders, brush curb, and old railing.	Additional work to project. Existing bridge does not meet current standards.	✓
J-3	Use Vertical Abutments in-lieu-of 2:1 End Slopes for the SB I-85 Bridge over the I-985 HOT lanes.	Possible cost reduction, reduced construction time.	✓
J-4	Reduce the width of the bridge widening on the SR-20 Bridge.	Reducing the widening would not provide any additional value.	X
J-5	Replace the SB I-85 Bridge with a longer bridge to allow more room for the HOT lanes underneath.	See Idea C-3	X
J-6	Review/revise the Flyover Bridge typical section.	Possible width reduction, reduced cost	X
✓ = Will be considered further; X = will be dropped; DC = Design Consideration –written for consideration by design team			

<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>K</b>	<b>Concrete Barrier</b>		
K-1	Use cable barrier in-lieu-of concrete barrier in the median north of I-985.	See Idea A-4	X
K-2	Separate the HOT lanes to reduce the amount of barrier.	Not possible without lengthening the SB I-85 Bridge	X
<b>L</b>	<b>MSE Walls</b>		
L-1	Use MSE walled embankments in-place of a bridge in various locations along the NB Flyover Bridge.	See Idea C-4	X
✓ = Will be considered further; X = will be dropped; DC = Design Consideration –written for consideration by design team			



## VE STUDY SIGN-IN SHEET

Project No.: NHIMO-0085-02(164)(165)

County: Barrow/Gwinnett

PI No.: 110600 & 110610 Date: Dec. 1-4, 2009

1	4	NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
✓	✓	Lisa L. Myers		Engineering Services	404-631-1770	lmyers@dot.ga.gov
✓	✓	Matt Sanders		Engineering Services	404-631-1752	msanders@dot.ga.gov
		<del>Tommy Magnus</del>		<del>Construction</del>	<del>404-631-1971</del>	<del>jmagnus@dot.ga.gov</del>
✓		Ken Werho		Traffic Operations	404-635-8144	kwerho@dot.ga.gov
		<del>Ron Wishon</del>		<del>Engineering Services</del>	<del>404-631-1753</del>	<del>rwishon@dot.ga.gov</del>
✓	✓	GEORGE OBARANEC	—	MACTEC	770-421-3346	GAOBARANEC@MACTEC.COM
✓	✓	GREG GRANT	—	WOLVERTON ASSOC	770-447-8999	greg.grant@wolverton-assoc.com
✓	✓	DAN COGAN	—	KEA GROUP	404.290.6424	dcogan@keagroup.com
✓		Vince Wilson		GDOT-Bridge Design	404.631.1907	vwilson@dot.ga.gov
✓	✓	Lenor Bromberg	—	KEA Group	404 805 8244	lbromberg@keagroup.com
✓	✓	Keith Berkenhagen	—	MACTEC	623-556-1875	kberkenhagen@msn.com
✓	✓	Steven Gaines	—	Wolventon + Assoc	770-447-8999	stevan.gaines@wolventon-assoc.com
✓	✓	John Hancock	—	Innovative Program Delivery	404-631-1711	jhancock@dot.ga.gov
✓		Dominic Saulino	—	HNTB	4-946-5745	dsaulino@hntb.com
✓	✓	ASHLEY CHAN	—	HNTB	404.946.5716	aschan@hntb.com
✓		Tim Heilmeyer	—	HNTB	404.946.5710	theilmeyer@hntb.com
✓		Laura Rish		Environmental Services	404-631-1415	LRish@dot.ga.gov
✓		MIKE DOVER		GDOT IPD	404-631-1733	MDOVER@DOT.GA.GOV
✓		LARRY PRESLOTT	—	HNTB	404-946-5743	LPRESLOTT@HNTB.COM

✓ Check all that apply

15 Attended Project Overview (Day 1)

11 Attended Project Presentation (Day 4)