CSNHS-M002-00(965)

Pavement Rehabilitation for

Interstate I-75 from the State Route 5 Connector

P.I. No. M002965

Cobb, Cherokee, and Bartow Counties, Georgia

Value Engineering Study Report

Concept Design Stage

September 2004

Design Consultant

Georgia Department of Transportation

Value Engineering Consultant

Lewis & Zimmerman Associates, Inc.

Lewis & Zimmerman Associates, Inc.
Taking the Chance out of Change
6110 Executive Boulevard, Suite 512
Rockville, Maryland 20852-3903
301-984-9590 • Fax: 301-984-1369
info@lza.com • www.lza.com

September 23, 2004

Ms. Lisa L. Myers
Design Review Engineer Manager
State of Georgia Department of Transportation
General Office
No. 2 Capitol Square, Room 266
Atlanta, Georgia 30334-1002

re: Project Number CSNHS-M002-00(965),
I-75 from S.R. 5 Connector to S.R. 61/U.S. 411 in
Cobb, Cherokee, and Bartow Counties, Georgia
Value Engineering Study Report

Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the referenced report. The alternatives and design suggestion addressed during this VE effort deal with the primary focus areas and identify opportunities to improve the value of the project in terms of: precluding structure (roadway) failure, improved safety, accommodation of the future I-75 high occupancy vehicle lane, improved rideability, guardrail upgrading, potential capital cost reduction, soundness of solutions, and improved constructibility.

We thank you and the Georgia Department of Transportation participants for your efforts to assist the VE team in generating new, creative solutions for this project. We look forward to working with you on future assignments and are available to answer any questions you may have as you determine implementation.

Sincerely,

LEWIS & ZIMMERMAN ASSOCIATES, INC.

Luis M. Venegas, PE, CVS, CCE, LEED™ AP
Vice President

Attachment

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

This value engineering (VE) study report summarizes the events of the study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the State of Georgia Department of Transportation (GDOT), Atlanta, Georgia. The subject of the study was the rehabilitation of U.S. Interstate Highway 75 (I-75) from the State Route (SR) 5 Connector (Barrett Parkway) Interchange in Cobb County to SR 61/US 411 Interchange in Bartow County also known as Project CSNHS-M002-00(965) in Cobb, Cherokee, and Bartow Counties, Georgia. The project is being designed by GDOT and is at the concept design stage.

PROJECT DESCRIPTION

The project proposes to resurface and maintain the I-75 corridor between SR 5 Connector and SR 61/US 411 by performing deep milling, resurfacing, guardrail upgrades, and vegetation clearing for maintaining pavement and safety. The project is approximately 25 miles long and spans Cobb, Cherokee, and Bartow Counties. It begins commencing in Cobb County at milepost (MP) 12.11 to the county line at MP 17.85, continues through the southwest corner of Cherokee County from MP 0.00 to MP 2.1, and ends in Bartow County spanning from MP 0.00 to MP 16.69.

The current probable cost of construction has been identified at $59,811,419 as noted on the Estimate Report for file "M002965" for CSNHS-M002-00(965), printed September 1, 2004, and contains a 10.00% contingency.

CONCERNS AND OBJECTIVES

The project began as a maintenance undertaking to resurface the 25-mile corridor of I-75 from the SR 5 Connector in Cobb County to the SR 61/US 411 Interchange in Bartow County to rehabilitate the facility's pavement that had reached the end of its useful life. However, during the project's preliminary pavement evaluation, it was discovered that portions of the full-depth asphaltic concrete pavement within the identified I-75 corridor between MP 270± to MP 278± (roughly from the SR 5 Connector Interchange to south of the Glade Road Interchange) have stripped layers from about 4-in. below the surface extending to approximately 8.5 in. in all lanes. As a result of this discovery, the project's design responsibility was transferred from the Office of Maintenance to the Office of Urban Design.

Although the aforementioned design responsibility transfer is not a concern or problem, it placed the project into a category requiring a VE study due to federal funding requirements. However, this affords GDOT the opportunity to conduct a VE session on a very early concept level design. During the first day of the study, it was noted that alternatives developed at this early stage of design are general in nature and highly dependent on the information available – to include the preliminary cost estimate. It

appears that the current cost estimate does not take into account the added costs associated with multiple, complex staging/phasing of the project as all lanes are to remain operational during construction – with the exception of short off-peak hour instances required for proper milling and repaving. This situation appears to be the result of non-definitive design drawings and specifications and the fact that the project is anticipated to be let in May 2005.

Therefore, to accomplish the project's goals in an expeditious and cost-effective manner and to assist in ameliorating the concern noted, GDOT engaged this VE study. The objective of the effort was to identify opportunities to improve the value of the project in terms of: precluding imminent pavement failure, improved safety, the potential accommodation of future I-75 high occupancy vehicle lanes, upgrading to current standards, potential capital cost reductions, and improved constructibility.

HIGHLIGHTS OF THE STUDY

The project is a relatively straightforward concept to provide pavement rehabilitation along the I-75 corridor between the SR 5 Connector (Barrett Parkway) to the SR 62/US 411 Interchange. Since no definitive plans or designs have been produced, the VE team relied on the undated Project Concept Report, the Preliminary Pavement Rehabilitation Summery Report, dated September 18, 2002, and the Pavement Evaluation Report, dated June 18, 2004. Listed below are some of the more salient ideas developed.

To minimize the bottlenecking associated with complex and multiple stages/phases of the efforts to be accomplished, Alternative No. 9 would construct a new, full depth inside shoulder to be used for staging and not for capacity enhancement, although it would facilitate the addition of the proposed future high occupancy vehicle lanes. Although it adds close to $11,000,000 to the project, it affords the following two scenarios.

In either scenario, the inside shoulder can be constructed with traffic running in the existing inside lane with barrels and/or vertical panels for traffic control - no temporary concrete barrier - so long as the following conditions are satisfied: (1) Only 1,000 linear feet of shoulder at a time can be opened to sub-grade depth to limit the length of roadway with an adjoining drop-off, and (2) the lengths of shoulder beyond this limit can be cut to sub-grade depth so long as the drop-off is healed to reduce the limits to 1,000 ft. Constructing the inside shoulder full depth allows this area to be used as a travel lane for staging.

Scenario 1:

1. Construct full depth outside shoulder.
2. Shift traffic to the outside to open Lane 1 for milling and repaving.
3. Mill and repave Lane 1 and reconstruct inside shoulder (regular hours).
4. Mill and replace Lane 2 (off-peak hours).
5. Return lanes to permanent position.
6. Mill and replace Lane 3 (off-peak hours).
7. Overlay all lanes and shoulders with lane shifts and lane closures.

Scenario 2:

1. Construct full depth inside shoulder (STAGE 1).
2. Shift traffic to inside to open Lane 3 for milling and repaving (STAGE 2).
3. Mill and repave Lane 3 and reconstruct outside shoulder (regular hours).
4. Shift traffic to Lanes 2 and 3 and outside shoulder.
5. Mill and replace Lane 1 (regular hours).
6. Mill and replace Lane 2 (off-peak hours).
7. Overlay inside shoulder and Lane 1 (regular hours).
8. Overlay Lane 2 (off-peak hours).
9. Return lanes to permanent position.
10. Shift traffic to inside (STAGE 4).
11. Overlay Lane 3 and outside shoulder.

With this alternative, the contractor is not always working next to traffic. A 12-ft. buffer to traffic is often provided. Only one milling operation is in an off-peak time frame with this alternative versus two with the original design.

Since the worst case scenario for potential existing pavement failure is greatest at the southern end of the project, Alternative No. 4 narrates the potential of using rigid pavement for this section of the project in lieu of full-depth asphalt. Although it increases the project's cost by more than $15,000,000, it provides the maximum useful life pavement where the highest traffic density exists. A cursory life cycle cost analysis indicates a present worth recurring cost savings of almost $91,000,000 over the 35 year life span of the pavement that could render a present worth life cycle cost savings of about $75,000,000 when using concrete over asphalt. In a similar manner, Alternative No. 3 would use rigid pavement through the entire ±25-mile project length but at a cost exceeding an additional $79,000,000. Another epigrammatic life cycle cost analysis notes recurring cost savings of about $114,000,000, rendering a present worth life cycle cost savings of nearly $36,000,000.

If budgetary constraints are imposed where GDOT cannot afford the project as currently forecasted, Alternative No. 11 would limit the pavement rehabilitation to the southern end of the project between Barrett Parkway and the Glade Road Intersection since it is the most heavily trafficked segment of the project and contains the slipped asphalt sections that are in imminent danger of failure. The remaining northern ±16 miles would receive a sealing coat to extend the life of the existing pavement. This scenario could result in a savings of about $29,000,000.

The *Summary of Potential Cost Savings* worksheet follows this narrative outlining all of the alternatives and the design suggestion developed by the VE team. Some of the alternatives are mutually exclusive or interrelated so addition of all project cost savings does not equal total savings for the project. A full listing of all of the ideas considered by the VE team can be found on the *Creative Idea Listing* worksheets in Section 4 of this report.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **CSNHS-M002-00-(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
				PRESENT WORTH OF COST SAVINGS		
3	Use concrete pavement throughout	$42,227,516	$121,012,121	($78,784,605)	$114,324,187	$35,539,582
4	Use concrete pavement from Barrett Parkway to Glade Road	$29,922,200	$45,270,500	($15,348,300)	$90,668,726	$75,320,426
6	Do not disturb the recently upgraded pavement on the ramps at Glade Road, Old Allatoona Road, Red Top Mountain Road, SR 113/Main Street, and SR 20/Canton Highway Interchanges	D E S I G N S U G G E S T I O N				
9	Construct a new inside lane and then work on the outside lanes and shoulders	$3,762,330	$14,420,298	($10,657,968)		($10,657,968)
11	Limit the project between Barrett Parkway and Glade Road	$59,811,419	$31,259,165	$28,552,254		$28,552,254
12	Eliminate the concrete barriers	$1,014,488	$329,102	$685,386		$685,386

STUDY RESULTS

INTRODUCTION

The results are the major feature of a value engineering study since they represent the benefits that can be realized on the project by the owner, users, and designer. The results will directly affect the project design and will require coordination between the designer, and the GDOT project management team to determine the ultimate acceptance of each alternative.

The creative ideas are organized according to the order in which they were originally generated by the VE team during the function analysis and creative sessions.

RESULTS OF THE STUDY

The VE team generated 13 ideas for change during the Function Analysis and Creative Ideas phases of the VE Job Plan. The evaluation of these ideas was based upon their potential for capital cost savings, probability of acceptance, availability of information to properly develop an idea, compliance with perceived quality, adherence to universally-accepted standards and procedures, life cycle cost efficiency, safety, maintainability, constructibility and soundness of the idea.

Of the 13 ideas generated, four were sufficiently rated to warrant further investigation. Continued research and development of these ideas yielded five alternatives for change with an impact on project costs. One design suggestion that will enhance the value of the project in terms of: failure preclusion, improved safety, improved ride ability, accommodation of the future I-75 High Occupancy Vehicle (HOV) Lanes, and improved constructibility was also developed. These alternatives and the design suggestion are presented in detail following this narrative and on the *Summary of Potential Cost Savings* worksheets.

EVALUATION OF ALTERNATIVES

It is important to consider each part of an individual alternative on its own merit. There may be a tendency to disregard an alternative because of concern with one portion of it. Separate consideration should be given to each of the areas within an alternative that are acceptable and those parts should be considered in the final design, even if the entire alternative is not implemented.

Cost is the primary basis of comparison for alternative designs. To ensure that costs are comparable within the alternatives proposed by the VE team, the designer's cost estimates, where possible, are used as the pricing basis. Where appropriate, the impact of energy costs, replacement costs, and effect on operations and maintenance should be shown within each alternative.

Some of the alternatives are interrelated, so acceptance of one may preclude the acceptance of another. The reviewer should evaluate those alternatives carefully to select the ideas with the greatest beneficial impact to the project.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **CSNHS-M002-00-(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
				PRESENT WORTH OF COST SAVINGS		
3	Use concrete pavement throughout	$42,227,516	$121,012,121	($78,784,605)	$114,324,187	$35,539,582
4	Use concrete pavement from Barrett Parkway to Glade Road	$29,922,200	$45,270,500	($15,348,300)	$90,668,726	$75,320,426
6	Do not disturb the recently upgraded pavement on the ramps at Glade Road, Old Allatoona Road, Red Top Mountain Road, SR 113/Main Street, and SR 20/Canton Highway Interchanges	D E S I G N S U G G E S T I O N				
9	Construct a new inside lane and then work on the outside lanes and shoulders	$3,762,330	$14,420,298	($10,657,968)		($10,657,968)
11	Limit the project between Barrett Parkway and Glade Road	$59,811,419	$31,259,165	$28,552,254		$28,552,254
12	Eliminate the concrete barriers	$1,014,488	$329,102	$685,386		$685,386

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(965), P. I. NUMBER M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 3

DESCRIPTION: **USE RIGID PAVEMENT THROUGHOUT THE PROJECT LENGTH**

SHEET NO.: 1 of 4

ORIGINAL DESIGN:

The current concept calls for the use of full depth asphalt pavement for the entire project. Deep milling 8½ in. will be accomplished between Barrett Parkway (SR 5 Connector) and the Glade Road Interchange. Typical Milling, 3½ in. will be used for the remainder of the project from the Glade Road Interchange to the SR61/US411 Interchange.

ALTERNATIVE:

Use full-depth 12-in. thick concrete pavement throughout the entire project area.

ADVANTAGES:

- Longer lifespan
- Less long-term maintenance
- Common practice especially for high traffic volume areas
- Eliminates 86% of supped asphalt

DISADVANTAGES:

- More costly initially
- Different maintenance
- District may not have in-house maintenance capability for concrete pavement
- Production rate slower than asphalt
- Requires deeper milling

DISCUSSION:

This alternative, while significantly more costly, will provide full-width concrete pavement. Construction includes shoulders, which addresses long-term, continued resurfacing and maintenance and benefits future high occupancy vehicle (HOV) use and expansion projects. Other factors to consider are availability of each material and the contractor's expertise in respective materials.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 42,227,516**	**$ 128,272,033**	**$ 170,499,549**
ALTERNATIVE	**$ 121,012,121**	**$ 13,947,846**	**$ 134,959,967**
SAVINGS	**$ (78,784,605)**	**$ 114,324,187**	**$ 35,539,582**

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 3

DESCRIPTION:

Determine the quantity of concrete from typical cross sections:

1. From Barrett Parkway to NB Off Ramp at Chastain Road
(12.0LF shoulder+(12.0LF lane x 3) + 14.0LF shoulder/lane) x 2 x 1.21 MI x 5,280 LF / MI =
792,211 SF

2. From NB Off Ramp at Chastain Road to Frey Road
(12.0LF shoulder+(12.0LF lane x 3) + 14.0LF shoulder/lane) x 2 x 1.02 MI x 5,280 LF / MI =
667,814 SF

3. From Frey Road to Glade Road
(12.0LF shoulder+(12.0LF lane x 3) + 10.0LF shoulder) x 2 x 6.83 MI x 5,280 LF / MI =
4,183,238 SF

4. From Glade Road to SR 61
(12.0LF shoulder+(12.0LF lane x 3) + 10.0LF shoulder) x 2 x 15.47 MI x 5,280 LF / MI =
9,475,066 SF

TOTAL = (792,211 SF + 667,814 SF + 4,183,238 SF + 9,475,066 SF) = 15,118,329 SF

15,118,329 SF / 9 SF / SY = **1,679,814 SY**

Determine unit cost of deep milling to ±12

8.5" of deep milling is to $4.00 per SY as 12.0" of deep milling is to $X per SY =
8.5 • X : 4.00 • 12.0 =
8.5x = 48
x = 48 / 8.5
x = **$5.65 / SY**

The unit cost of 12" thick concrete comes from the *GEORGIA DEPARTMENT OF TRANSPORTATION ITEM MEAN SUMMARY FOR 07/2003 TO 06/2004 FOR SPEC YEAR 2001 CONTRACTS* dated July 20, 2004. This price is **$59.48 / SY**

COST WORKSHEET

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO: 3

DESCRIPTION

SHEET NO. 3 of 4

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Asphalt concrete 12.5mm SMA	TN	216,828	50.82	11,019,199			
Asphalt concrete 12.5mm PEM	TN	75,201	52.55	3,951,813			
Asphalt concrete 19mm Superpave	TN	71,999	44.46	3,201,076			
Recycled Asphalt 25mm Superpave	TN	494,132	35.08	17,334,151			
Mill asphalt 3.5"	SY	652,567	2.02	1,318,185			
Mill asphalt variable depth (±8.5")	SY	391,057	4.00	1,564,228			
Plain concrete pavement, CL HES Conc., 12-in. thick	SY				1,679,814	59.84	100,520,070
Mill asphalt variable depth (±12.0")	SY				1,679,814	5.65	9,490,949
	Sub-total			38,388,651			110,011,019
Mark-up at	**10.00%**			3,838,865			11,001,102
	TOTAL			42,227,516			121,012,121

LIFE CYCLE COST WORKSHEET

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO. 3

DESCRIPTION:

SHEET NO. 4 of 4

LIFE CYCLE PERIOD:	35	**years**					**ORIGINAL**	**PROPOSED**
INTEREST RATE:	5.00%	**ESCALATION RATE:**	3.00%					
A.	**INITIAL COST**						42,227,516	121,012,121
	Useful Life (Years)						7 TO 10	35±
						INITIAL COST SAVINGS		(78,784,605)
B.	**RECURRENT COSTS (Annual Expenditures)**							
	1.	Maintenance: Assume 2.0% of initial cost of asphalt pavement						
		($35,506,239 * 10.00% markup) *0.02					781,137	
	2.	Maintenance: Assume ½% of initial cost of concrete pavement						
		($100,520,070 * 10.00% markup) *0.005						552,860
						Total Annual Costs	781,137	552,860
	(An effective rate of 1.94% with 5.00% Interest and 3.00% Escal.)					**Present Worth Factor**	25.2285	25.2285
						Present Worth of RECURRENT COSTS	19,706,933	13,947,846
C.	**SINGLE EXPENDITURES**			**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
ORIG	PROP	< Put "x" in appropriate box (original design or proposed design)						
x		**1.** Mill and Resurface every 8 years		8	39,288,756	0.8574	33,686,174	-
x		**2.** Mill and Resurface every 8 years		16	39,288,756	0.7351	28,882,520	-
x		**3.** Mill and Resurface every 8 years		24	39,288,756	0.6303	24,763,869	-
x		**4.** Mill and Resurface every 8 years		32	39,288,756	0.5404	21,232,537	-
***Note**: Milling in out-years is for a depth 3.5" of for the entire project length; hence the difference in initial cost for years 8, 16, 24 and 32.*						1.0000	-	-
						1.0000	-	-
						1.0000	-	-
D.	**SALVAGE VALUE**			**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
		1.				1.0000	-	-
		2.				1.0000	-	-
						Present Worth of SINGLE EXPENDITURES	108,565,100	-
E.	**Total Recurrent Costs & Single Expenditures (B + C)**						128,272,033	13,947,846
						RECURRENT COSTS & SINGLE EXPENDITURES SAVINGS		114,324,187
						TOTAL PRESENT WORTH COST (A + D)	170,499,549	134,959,967
						TOTAL LIFE CYCLE SAVINGS		**35,539,582**

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(965), P. I. NUMBER M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: **USE RIGID PAVEMENT FROM BARRETT PARKWAY TO GLADE ROAD**

ORIGINAL DESIGN: (Sketch attached)

The current concept is to provide a full-depth asphalt pavement from Barrett Parkway (SR5 Connector) to Glade Road. Mill 8½ in. and construct asphalt.

ALTERNATIVE: (Sketch attached)

Construct full-depth 12-in. thick concrete pavement in lieu of asphalt from Barrett Parkway to Glade Road only. The segment of the project from Glade Road to the terminus at the SR61/US411 Interchange is to remain asphalt pavement.

ADVANTAGES:

- Longer lifespan
- Less long-term maintenance
- Provides rigid pavement at highest traffic density area of the project (100,000+ vehicles at peak hours)
- Further removal of existing supped asphalt

DISADVANTAGES:

- Costs more initially
- Deeper milling
- Production rate generally slower than asphalt
- Different maintenance/district not accustomed or prepared for concrete maintenance

DISCUSSION:

This alternative would construct concrete pavement rather than asphalt pavement described in the preliminary pavement report. While this alternative is certainly more costly initially, the overall maintenance costs are lower and most significantly, the lifespan of the concrete is longer than the asphalt, thereby not requiring additional resurfacing every 7 - 10 years. This section was last resurfaced in 1994 based on information provided by GDOT during the information gathering phase. Thus it has reached the end of its useful life.

A detailed life cycle analysis would be required to fully ascertain the long-term benefits of concrete versus asphalt. Other factors include the availability of each material as well as the contractor's respective expertise with each option. Additionally, if the staging alternate described in Alt. No. 9 is followed, much of the construction can occur during regular hours as opposed to off-peak hours which should not hinder productivity rates.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	$ 29,922,200	$ 96,231,876	$ 126,154,076
ALTERNATIVE	$ 45,270,500	$ 5,563,150	$ 50,833,650
SAVINGS	$ (15,348,300)	$ 90,668,726	$ 75,320,426

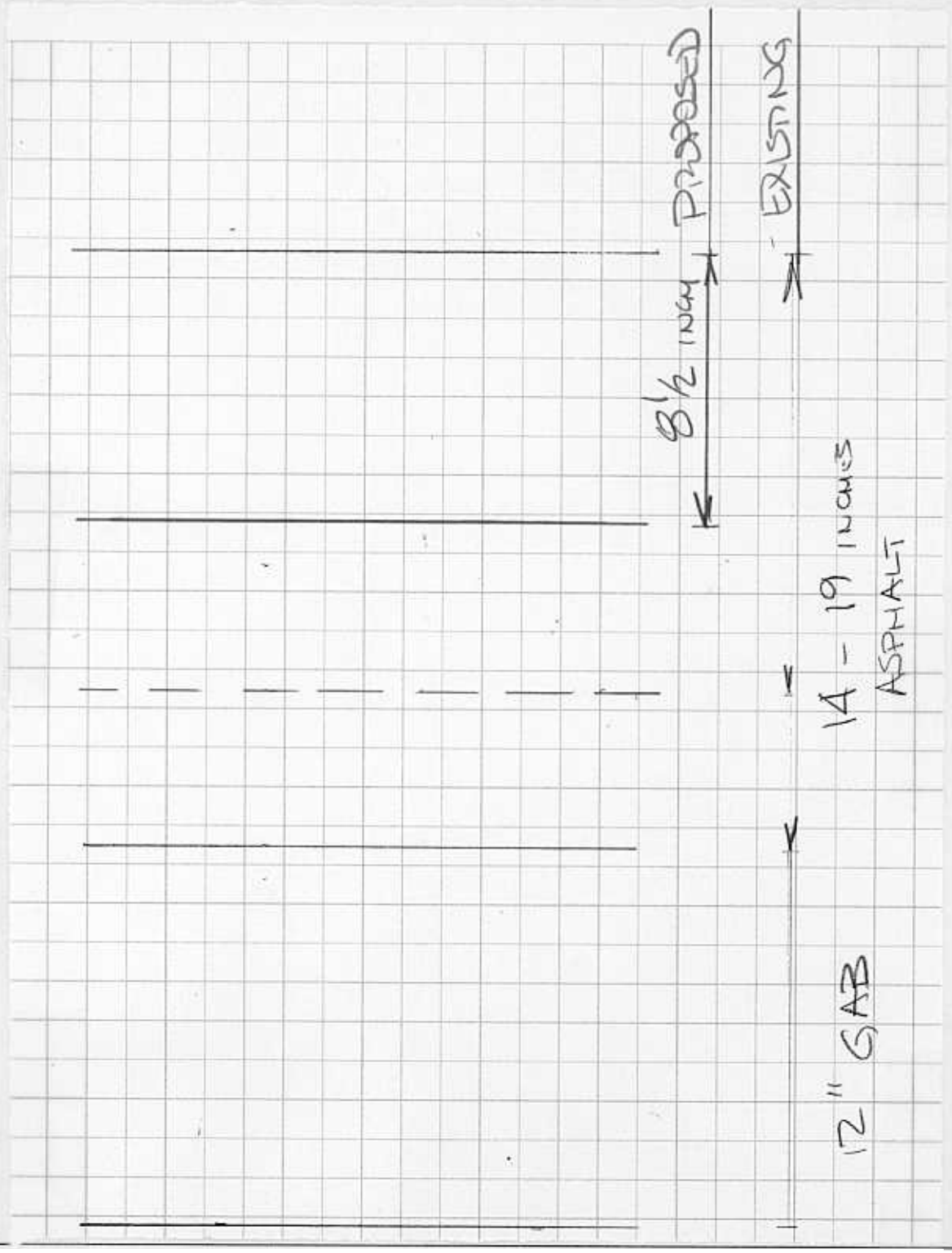
PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 4

☒ AS DESIGNED ☐ ALTERNATIVE

ASPHALT 8½" THICK

SHEET NO.: 2 of 7



SKETCHES

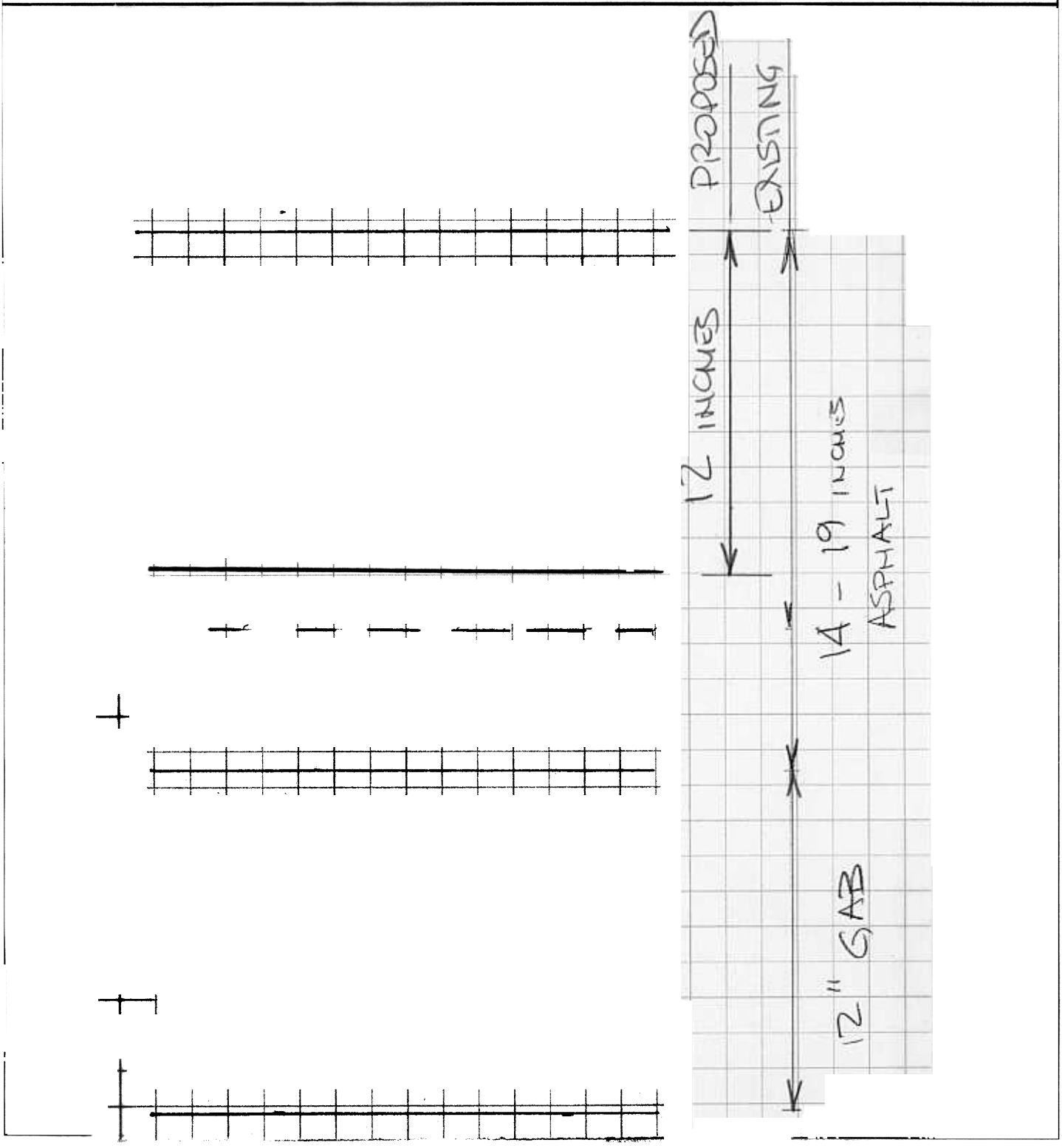
PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

CONCRETE 12" THICK

ALTERNATIVE NO.: 4

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 3 of 7



CALCULATIONS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION:

SHEET NO.: 4 of 7

DISTANCE FROM BARRETT PARKWAY TO GLADE ROAD IS 47,000 ft.

WIDTH TO MILL - 3 LANES - 36 FEET

WITH FOR FULL DEPTH PAVEMENT CONSTRUCTION - ASSUME FULL WIDTH INSIDE SHOULDER (12 FT.)

5 LANES - 60 feet.

MILLING - $47{,}000(36\text{ft})\frac{1}{9} = 188{,}000$ SQ. YDS.

ASPHALT PAVEMENT - 8½ IN THICK

$$\left[47{,}000\text{ft}(60\text{ft})\frac{8.5}{12}\text{ft}\right]150\ \#/\text{ft}^3\left(\frac{1\text{ TON}}{2000\#}\right) = 149{,}812$$

USE 150,000 TONS

CONCRETE - 12" THICK

$\times 2$ DIRECTIONS = 300,000 TONS

$47{,}000\text{ft}(60\text{ft})\frac{1}{9} = 313{,}333\ \text{yd}^2$

$\times 2 = 624{,}666 \Rightarrow$ USE $627{,}000\ \text{yd}^2$

CALCULATIONS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 1

DESCRIPTION:

SHEET NO.: 5 of 7

AT SHOULDERS - FULL DEPTH ASPHALT IS 28" THK.

28 IN − 9½ IN = 19½ INCHES ADDITIONAL ASPHALT AT SHOULDERS

$$47{,}000\ ft\left(24\ ft\right)\frac{19.5}{12}\ ft\left(150\ \#/ft^3\right)\frac{1\ TON}{2000} = 137{,}475\ TONS$$

× 2 DIRECTIONS

274,950 TONS

COST WORKSHEET

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO: 4

DESCRIPTION

SHEET NO. 6 of 7

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Asphalt at 8.5"	TN	300,000	46.00	13,800,000			
Additional asphalt at 19.5"	TN	275,000	46.00	12,650,000			
Mill asphalt variable depth (±8.5")	SY	188,000	4.00	752,000			
Plain concrete pavement, CL HES Conc., 12-in. thick	SY				670,000	59.84	40,092,800
Mill asphalt variable depth (±12.0")	SY				188,000	5.65	1,062,200
Note: See Alternative No. 3 for							
derivation of unit cost of 12" thick							
concrete and deeper milling.							
Sub-total				27,202,000			41,155,000
Mark-up at	**10.00%**			2,720,200			4,115,500
	TOTAL			29,922,200			45,270,500

LIFE CYCLE COST WORKSHEET

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO. 4

DESCRIPTION:

SHEET NO. 7 of 7

LIFE CYCLE PERIOD: 35 **years**

INTEREST RATE: 5.00% **ESCALATION RATE:** 3.00%

						ORIGINAL	PROPOSED
A.	**INITIAL COST**					29,922,200	45,270,500
	Useful Life (Years)					7 TO 10	35±
					INITIAL COST SAVINGS		(15,348,300)
B.	**RECURRENT COSTS (Annual Expenditures)**						
	1.	Maintenance: Assume 2.0% of initial cost of asphalt pavement					
		($26,450,000 * 10.00% markup) *0.02				581,900	
	2.	Maintenance: Assume ½% of initial cost of concrete pavement					
		($40,092,800 * 10.00% markup) *0.005					220,510
					Total Annual Costs	581,900	220,510
		(An effective rate of 1.94% with 5.00% Interest and 3.00% Escal.)			**Present Worth Factor**	25.2285	25.2285
					Present Worth of RECURRENT COSTS	14,680,473	5,563,150
C.	**SINGLE EXPENDITURES**		**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
ORIG	PROP	< Put "x" in appropriate box (original design or proposed design)					
x		**1.** Mill and Resurface every 8 years	8	29,512,736	0.8574	25,304,216	-
x		**2.** Mill and Resurface every 8 years	16	29,512,736	0.7351	21,695,831	-
x		**3.** Mill and Resurface every 8 years	24	29,512,736	0.6303	18,602,002	-
x		**4.** Mill and Resurface every 8 years	32	29,512,736	0.5404	15,949,354	-
		***Note**: Milling in out-years is for a depth 3.5" of for the entire project length; hence the difference in initial cost for years 8, 16, 24 and 32. [(188,000SY * $2.02/SY for milling to a depth of 3.5") = $379,760 vs. $752,000]*			1.0000	-	-
					1.0000	-	-
D.	**SALVAGE VALUE**		**Year**	**Amount**	**PW factor**	**Present Worth**	**Present Worth**
		1.			1.0000	-	-
		2.			1.0000	-	-
					Present Worth of SINGLE EXPENDITURES	81,551,403	-
E.	**Total Recurrent Costs & Single Expenditures (B + C)**					96,231,876	5,563,150
					RECURRENT COSTS & SINGLE EXPENDITURES SAVINGS		90,668,726
					TOTAL PRESENT WORTH COST (A + D)	126,154,076	50,833,650
					TOTAL LIFE CYCLE SAVINGS		**75,320,426**

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.:
6

DESCRIPTION: **DO NOT DISTURB OPEN FACE FRICTION COURSE ON RAMPS**

SHEET NO.: 1 of 1

ORIGINAL DESIGN:

The current concept design is not yet sufficiently developed to be able to understand the construction impact to the existing ramp pavement at the Glade Road, Old Allatoona Road, Red Top Mountain Road, SR 113/Main Street, and SR 20/Canton Highway Intersections.

However, per Dickey Forrester, PE, GDOT Construction Liaison Engineer for Districts 1 and 6, the ramps have been recently reconstructed.

ALTERNATIVE:

The design concept should take into account the new ramp pavements at the Glade Road, Old Allatoona Road, Red Top Mountain Road, SR 113/Main Street, and SR 20/Canton Highway Intersections.

The development of the design should use the new pavement without further modification. As such, designers should specify that the contractor take the necessary precautions not to disturb these new pavement sections.

ADVANTAGES:

- Reduces construction cost
- Takes advantage of existing assets
- Reconstruction for these ramps not needed
- Could result in a slight reduction of construction time

DISADVANTAGES:

- None apparent

DISCUSSION:

The construction effort should be minimized due to recent reconstruction and rehabilitation of the facility's sections. The northern intersections noted above fall precisely into this category and require no additional effort.

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

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(965), P. I. NUMBER M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 9

DESCRIPTION: **CONSTRUCT FULL-DEPTH INSIDE SHOULDER FOR STAGING**

SHEET NO.: 1 of 11

ORIGINAL DESIGN: (Sketch attached)

The original design mills and replaces three lanes of traffic and constructs a full-depth outside shoulder and a median shoulder (not full-depth).

ALTERNATIVE: (Sketch attached)

The construction sequence attached changes the median shoulder to full-depth to facilitate staging.

ADVANTAGES:

- Reduces construction time
- More of the project can be constructed during regular working hours
- Safer condition for worksite and traveling public
- Inside full-depth pavement construction can be used for future HOV project

DISADVANTAGES:

- Additional cost for full-depth shoulder

DISCUSSION:

This alternative would construct a full-depth inside shoulder to facilitate staging.

In the attached sequence, the inside shoulder would be constructed first. According to Dickey Forrester, PE, Construction Liaison Engineer for Districts 1 and 6, the inside shoulder can be constructed with traffic running in the existing inside lane with barrels and/or vertical panels for traffic control (no concrete temporary barrier) so long as the following conditions are satisfied:

1. Only 1,000 lf of shoulder at a time can be opened to sub-grade depth to limit the length of roadway with an adjoining drop-off.
2. Lengths of shoulder beyond this limit can be cut to sub-grade depth as long as the drop-off is healed to reduce the limits to 1,000 ft. (detail attached).

Constructing the inside shoulder full-depth allows this area to be used as a travel lane for staging.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 3,762,330**	¾	**$ 3,762,330**
ALTERNATIVE	**$ 14,420,298**	¾	**$ 14,420,298**
SAVINGS	**$ (10,657,968)**	¾	**$ (10,657,968)**

VALUE ENGINEERING ALTERNATIVE

PROJECT:	**CSNHS-M002-00(965), P. I. NUMBER M002965** **Cobb, Cherokee, and Bartow Counties** ***Concept Development***	ALTERNATIVE NO.: 9
DESCRIPTION:	**CONSTRUCT FULL-DEPTH INSIDE SHOULDER FOR STAGING**	SHEET NO.: 2 of 11

DISCUSSION Continued:

There are no details at this time for the construction sequence for the original design. However, it would likely be the following:

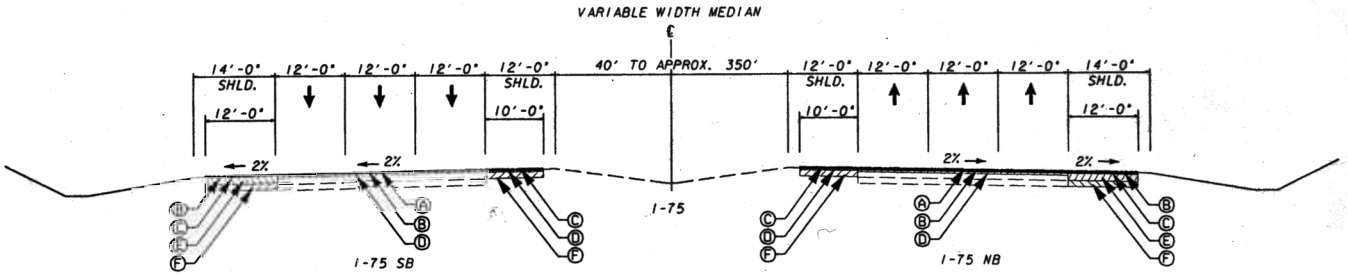
1. Construct full-depth outside shoulder.
2. Shift traffic to the outside to open Lane 1 for milling and repaving.
3. Mill and repave Lane 1 and reconstruct inside shoulder (regular hours).
4. Mill and replace Lane 2 (off-peak hours).
5. Return lanes to permanent position.
6. Mill and replace Lane 3 (off-peak hours).
7. Overlay all lanes and shoulders with lane shifts and lane closures.

The alternate construction sequence:

1. Construct full-depth inside shoulder (STAGE 1).
2. Shift traffic to inside to open Lane 3 for milling and repaving (STAGE 2).
3. Mill and repave Lane 3 and reconstruct outside shoulder (regular hours).
4. Shift traffic to Lanes 2 and 3 and outside shoulder.
5. Mill and replace Lane 1 (regular hours).
6. Mill and replace Lane 2 (off-peak hours).
7. Overlay inside shoulder and Lane 1 (regular hours).
8. Overlay Lane 2 (off-peak hours).
9. Return lanes to permanent position.
10. Shift traffic to inside (STAGE 4).
11. Overlay Lane 3 and outside shoulder.

With this alternative, the contractor is not always working next to traffic and is often provided with a 12-ft. buffer to traffic. Only one milling operation is in an off-peak time frame with this alternative versus two with the original design.

DATETIME## #USER#	TIME###	#PAF# ##PENTABLE##	/	#DGN#	COUNTY	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
					BARTOW, CHEROKEE, COBB	CSNHS-M002-0019651		



FREY RD TO GLADE RD

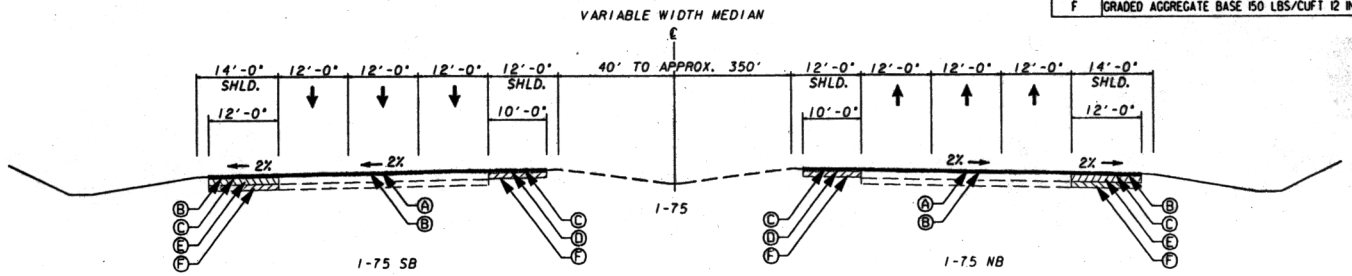
COBB COUNTY APPROXIMATE MP 14.34 TO MP 17.85 • 3.51 MI
CHEROKEE COUNTY APPROXIMATE MP 0.00 TO MP 2.10 • 2.10 MI
BARTOW COUNTY APPROXIMATE MP 0.00 TO MP 1.22 • 1.22 MI
TOTAL • 6.83 MI

MILL 8.5 INCHES OF EXISTING ASPH CONC
AND INLAY WITH 9.5 INCHES OF A, B, D

COBB COUNTY APPROXIMATE MP 15.58 NB OFF RAMP TO WEIGH STATION
COBB COUNTY APPROXIMATE MP 16.15 TO MP 17.83 SB 4 LANES

PRELIMINARY PAVEMENT DESIGN

SYMBOL	PAVEMENT SYMBOLS LEGEND DESCRIPTION
A	PEM, POLYMER MODIFIED 135 LBS/SY 12.5MM 1.25 IN
B	SMA, POLYMER MODIFIED 300 LBS/SY 12.5MM 2.75 IN.
C	SUPERPAVE 220 LBS/SY 19MM 2 IN.
D	SUPERPAVE 550 LBS/SY 25MM 5 IN. (USE 6" 660LBS/SY ON INSIDE SHLDRS)
E	SUPERPAVE 1540 LBS/SY 25MM 14 IN.
F	GRADED AGGREGATE BASE 150 LBS/CUFT 12 IN.



GLADE RD TO SR 61

BARTOW COUNTY APPROXIMATE MP 1.22 TO MP 16.69 • 15.47 MI

MILL 3.5 INCHES OF EXISTING ASPH CONC
AND INLAY WITH 4 INCHES OF A, B

BARTOW COUNTY APPROXIMATE MP 9.80 TO MP 12.36 NB 4 LANES

THE EXISTING OUTSIDE SHOULDER SHOULD BE RECONSTRUCTED AS A FUTURE TRAVEL LANE AT FULL DEPTH B, C, E, F

SURFACE TRAVEL WAY WITH PEM 135 LBS/SQYD 12.5 MM EXTENDING 12" ONTO INSIDE SHD AND 18" ONTO OUTSIDE SHD

GEORGIA
DEPARTMENT OF TRANSPORTATION

SCALE IN FEET
0 10 20 40

REVISION DATES		

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: URBAN DESIGN

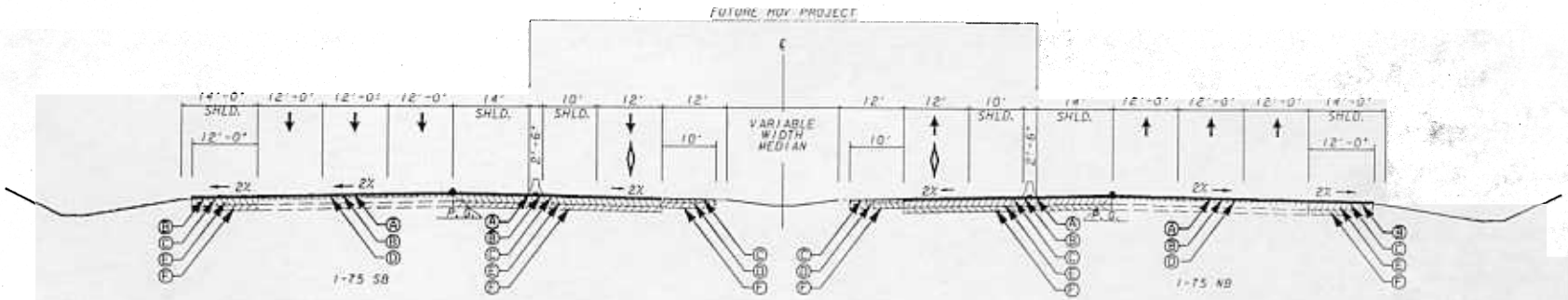
I-75 SR5 CONN TO SR61/US411
PI # M002965

DRAWING No.

ALTERNATE 2 30 of 11

.\M002965 Typical Sections.dgn 9/14/2004 8:40:55 AM

DATETIME$$	TIME$$	PRF	DGN	COUNTY	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
$USER$		$PENTABLE$		BARTOW, CHEROKEE, COBB	CSNHS-M002-00(965)		



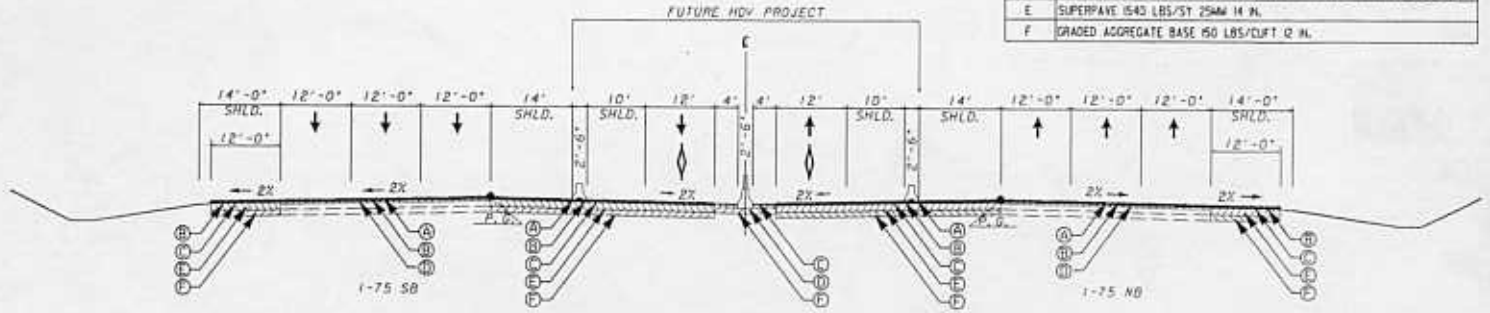
BARRETT PKWY TO NB OFF RAMP CHASTAIN RD

COBB COUNTY APPROXIMATE MP 12.11 TO MP 13.32 = 1.21 MI

MILL 8.5 INCHES OF EXISTING ASPH CONC AND INLAY WITH 9.5 INCHES OF A,B,D

PRELIMINARY PAVEMENT DESIGN

SYMBOL	PAVEMENT SYMBOLS LEGEND DESCRIPTION
A	PEM, POLYMER MODIFIED 135 LBS/SY @ 5MM L25 IN
B	SMA, POLYMER MODIFIED 320 LBS/SY @ 5MM 2.75 IN.
C	SUPERPAVE 220 LBS/SY 19MM 2 IN.
D	SUPERPAVE 550 LBS/SY 25MM 5 IN. (USE 6" 660LBS/SY ON INSIDE SHLDRS)
E	SUPERPAVE 1540 LBS/SY 25MM 14 IN.
F	GRADED AGGREGATE BASE 150 LBS/CUFT 12 IN.



NB OFF RAMP CHASTAIN RD TO FREY RD

COBB COUNTY APPROXIMATE MP 13.32 TO MP 14.34 = 1.02 MI

MILL 8.5 INCHES OF EXISTING ASPH CONC AND INLAY WITH 9.5 INCHES OF A,B,D

THE EXISTING OUTSIDE SHOULDER SHOULD BE RECONSTRUCTED AS A FUTURE TRAVEL LANE AT FULL DEPTH B,C,E,F

SURFACE TRAVEL WAY WITH PEM 135 LBS/SQYD 12.5 MM EXTENDING 12" ONTO INSIDE SHD AND 18" ONTO OUTSIDE SHD

GEORGIA
DEPARTMENT OF TRANSPORTATION

SCALE IN FEET
0 10 20 40

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE: URBAN DESIGN

I-75 SR5 CONN TO SR61/US41
P.I. # M002965

DRAWING No.

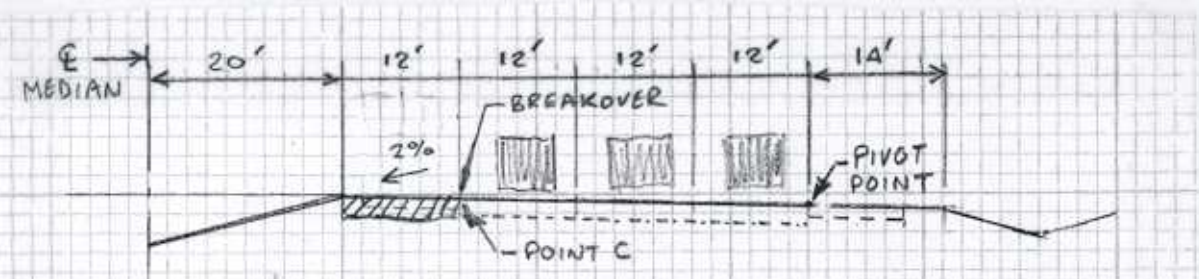
ALTERNATE 9 4 of 11

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

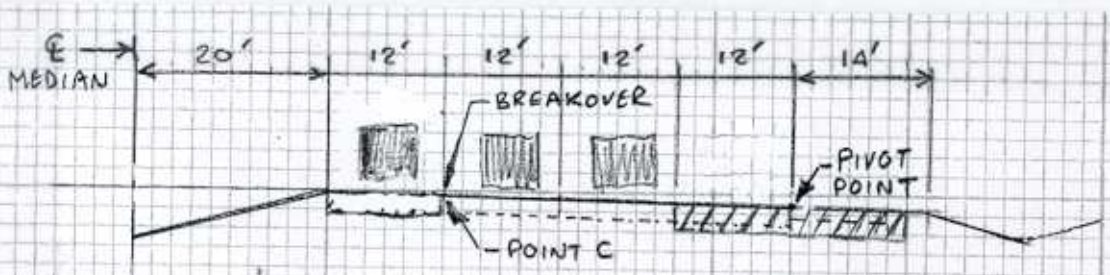
SHEET NO.: 5 of 11



STAGE 1 = CONSTRUCT INSIDE LANE

NOTE:

1. RECONSTRUCT INSIDE SHOULDER AS FULL DEPTH TRAVEL LANE
2. SLOPE INSIDE SHOULDER AT 2% TOWARDS THE MEDIAN MATCHING EDGE OF EXISTING LANE AT POINT C



STAGE 2 = CONSTRUCT INSIDE LANE

NOTES:

1. SHIFT TRAFFIC TO INSIDE
2. MILL AND REPLACE OUTSIDE EXISTING LANE
3. RECONSTRUCT OUTSIDE SHOULDER AS FULL DEPTH LANE

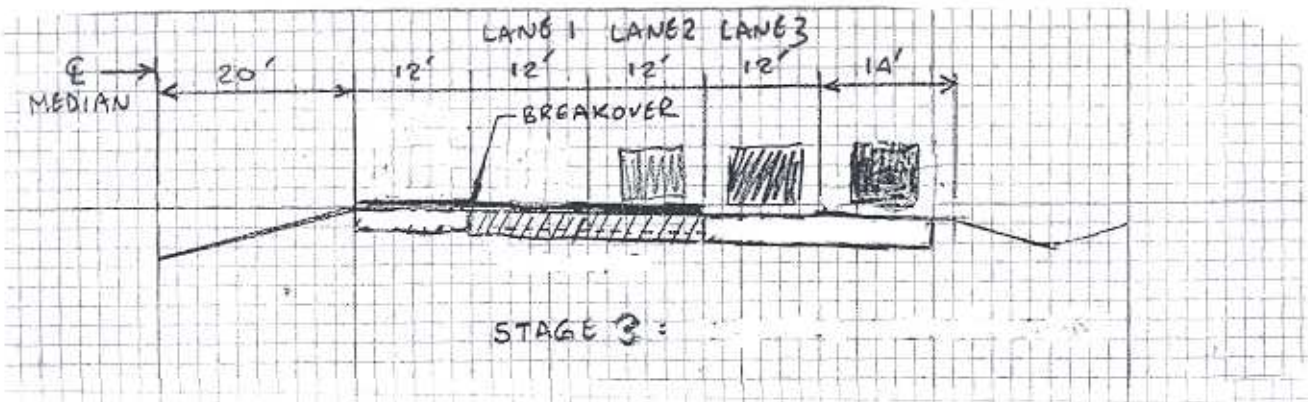
SKETCHES

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 6 of 11



STAGE 3:

NOTES:

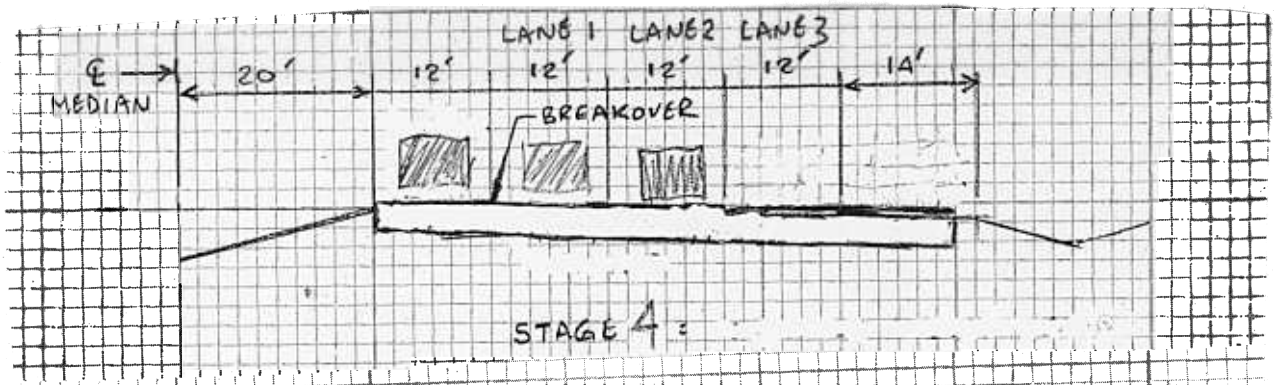
1. SHIFT TRAFFIC TO OUTSIDE
2. MILL AND REPLACE TWO EXISTING LANES (INSIDE)
   LANE 1 CAN BE DONE WITHOUT WORKING RESTRICTIONS
   LANE 2 MUST BE DONE UNDER OFF PEAK HOUR
3. OVERLAY TO FINAL GRADE IN INSIDE SHOULDER AND LANE 1 (NO WORKING RESTRICTIONS)
4. OVERLAY TO FINAL GRADE LANE 2 IN OFF-PEAK HOURS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 7 of 11



NOTES

1. SHIFT TRAFFIC TO INSIDE SHOULDER AND ADJACENT INSIDE LANES
2. OVERLAY OUTSIDE LANE AND SHOULDER
3. SHIFT TRAFFIC TO PERMANENT LOCATIONS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 8 of 11

OVERLAY CONSIDERATIONS:

MINIMUM OVERLAY @ PIVOT POINT = 1/2"

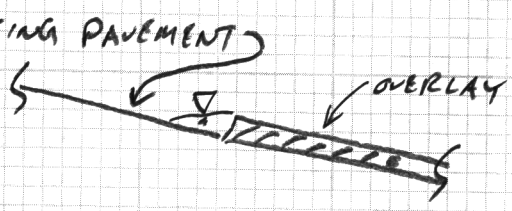
OVERLAY THICKNESS REQUIRED @ POINTS TO INCREASE CROSS-SLOPE TO 2%

3/16" .02-.0156 = .0044'

POINT	THICKNESS	
PIVOT POINT	1/2" − 0"	= 1/2"
A	1/2" + 12' × (.02' − .0156) × 12"/1'	= 1.13"
B	1.13" + 12 × .0044 × 12"/1'	= 1.76"
C	1.76" + 0.63"	= 2.39"
D	2.39" + 0.63"	= 3.02"

0.63

IT IS IMPORTANT TO NOT CREATE AN AREA TO CATCH WATER IN THE OVERLAY OPERATION.



PAVING FROM THE HIGH (INSIDE) TO THE OUTSIDE WILL PREVENT THIS

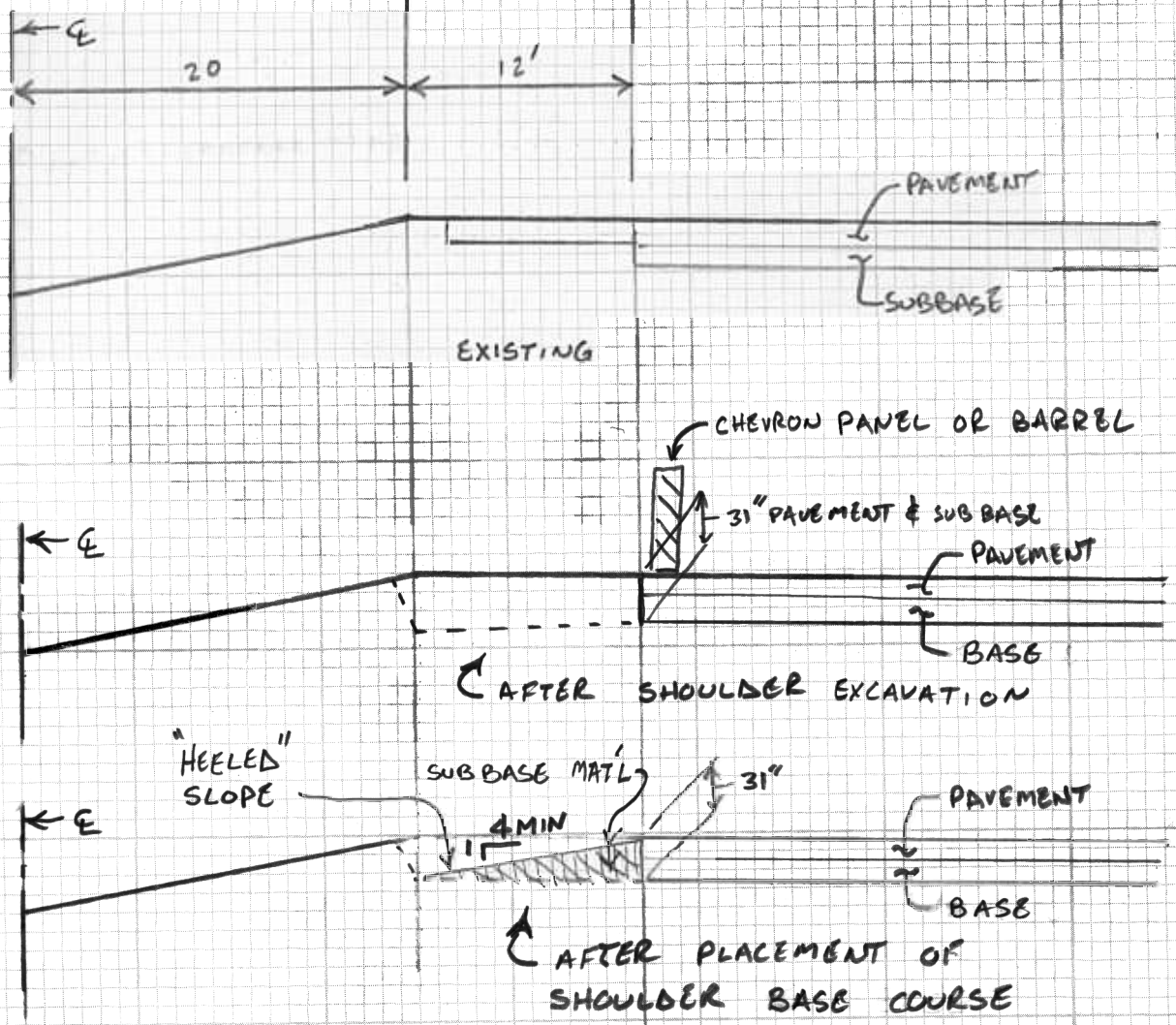
PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 9 of 11

HEALING DETAILS @ INSIDE SHOULDER CONSTRUCTION



NOTE:

CONTRACTOR WILL BLADE THE SHOULDER BASE MATERIAL PRIOR TO BEGINNING THE PAVING OPERATION.

CALCULATIONS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 9

DESCRIPTION:

SHEET NO.: 10 of 11

CALCULATE DIFFERENCE BETWEEN CURRENT DESIGN
10' WIDE C, D, F
&
PROPOSED,
12' WIDE, B, C, E, F

INSIDE SHOULDER

TOTAL LENGTH OF PROJECT - 24.53 MILES =
129,518 ft
× 2 DIRECTIONS
259,037 ft
USE 260,000 ft

B/PROPOSED
$260{,}000\,ft\left(12\,ft\right)\frac{2.75}{12}\,ft\left(150\,\#/ft^3\right)\frac{1\,TON}{2000\,\#} = 53625\ TONS$

C/EXISTING/PROPOSED - ADDITIONAL 2 FEET WIDE
10' / 12'
$260{,}000\,(2)\frac{2}{12}\left(150\,\#/ft^3\right)\frac{1\,TON}{2000\,\#} = 6500\ TONS$

D/EXISTING
$260{,}000\,ft\left(10\,ft\right)\frac{6}{12}\left(150\,\#/ft^3\right)\frac{1\,TON}{2000\,\#} = 97{,}500\ TONS$

E/PROPOSED
$260{,}000\left(12\right)\frac{14}{12}\,ft\left(150\,\#/ft^3\right)\frac{1\,TON}{2000\,\#} = 273{,}000\ TONS$

F/2 FT WIDER/PROPOSED
$260{,}000\left(2\right)\frac{12}{12}\,ft\left(150\,\#/ft^3\right)\frac{1\,TON}{2000\,\#} = 39{,}000\ TONS$

COST WORKSHEET

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO: 9

DESCRIPTION

SHEET NO. 11 of 11

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
ASPHALT							
B	TONS	—	—	—	53625	50.82	2,725,222
C	TONS	—	—	—	6500	44.46	288,990
D	TONS	97,500	35.08	3,420,300	—	—	—
E	TONS	—	—	—	273,000	35.08	9,576,840
F	TONS	—	13 —	—	39,000	13.29	518,310
	Sub-total			3,420,300			13,109,362
Mark-up at	10.00%			342,030			1,310,936
	TOTAL			3,762,330			14,420,298

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 11

DESCRIPTION: **LIMIT RECONSTRUCTION BETWEEN BARRETT PARKWAY AND GLADE ROAD**

ORIGINAL DESIGN:

The current concept design calls for the use of full-depth asphalt pavement for the entire project from Barrett Parkway (SR 5 Connector) at the southern end to the SR 61/US 411 intersection at the northern end. Deep milling at 8.5 in. is required at the southern end between Barrett Parkway and Glade Road while the remainder of the project will be milled 3.5 in. before applying the new pavement.

ALTERNATIVE:

Limit the reconstruction to the first 8.06 miles of the current project between Barrett Parkway and the Glade Road Intersection. This is the area where slipped asphalt has been encountered and where deep milling is necessary. In addition, it is the area with the highest traffic density at more than 100,000 vehicles per hour during peak times containing 23% truck traffic.

Provide a sealing coat over the remaining 15.47 miles of the project from north of the Glade Road Intersection to the terminus at the SR 61/US 411 Intersection.

ADVANTAGES:

- Reduces construction cost
- Provides needed reconstruction at the critical segment of project
- Northern 15.47 miles have not deteriorated at the same rate as the southern section
- Minimizes impact on the using public

DISADVANTAGES:

- Requires reconstruction of the northern segment within ten years after sealing segment
- Funds may not be available in the future
- Piece-meals the anticipated work

DISCUSSION:

One of the primary reasons this project has come to fruition is the known slipped asphalt at the southern end of the project which happens to encompass the highest traffic density. Reconstruction of this segment is required due to the imminent failure of the existing pavement. However, since the northern end of the project does not have the amount of traffic nor the slipped asphalt problem, its reconstruction could be postponed for several more years since the deterioration of the existing pavement is not to the same level as the southern end. A sealing coat of the northern end of the project corridor may provide a bridging period that could be as high as ten years before rehabilitation is required.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 59,811,419**	¾	**$ 59,811,419**
ALTERNATIVE	**$ 31,259,165**	¾	**$ 31,259,165**
SAVINGS	**$ 28,552,254**	¾	**$ 28,552,254**

COST WORKSHEET

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO: 11

DESCRIPTION

SHEET NO. 2 of 2

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Current concept (see estimate)	LS	1		54,374,017			
Asphalt at 8.5"	TN				300,000	46.00	13,800,000
Additional asphalt at 19.5"	TN				275,000	46.00	12,650,000
Mill asphalt variable depth (±8.5")	SY				188,000	4.00	752,000
Seal coat and cleaning / prep ((15.47 mi x 5,280 ft / mi x 36 ft lanes) x 2) ÷ 9 sf / sy = 653,453 SY	SY				653,453	1.86	1,215,423
Note: See Alternative No. 3 for							
derivation of quantities and unit							
costs of the southern end of project							
	Sub-total			54,374,017			28,417,423
Mark-up at	**10.00%**			5,437,402			2,841,742
	TOTAL			59,811,419			31,259,165

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(965), P. I. NUMBER M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 12

DESCRIPTION: **ELIMINATE CONCRETE BARRIER**

ORIGINAL DESIGN: (Sketch attached)

The original concept proposes a concrete barrier to separate the future HOV lanes from existing lanes of traffic. Concrete barriers, between northbound and southbound traffic are also included.

The HOV concrete barriers are used from Barrett Parkway to Frey Road.

ALTERNATIVE: (Sketch attached)

Remove the concrete barrier from this project between the existing lanes of traffic and the future HOV lanes. The barriers between the northbound and southbound traffic are to remain.

ADVANTAGES:

- Saves initial cost
- Saves construction time
- HOV lanes are covered under another project

DISADVANTAGES:

- None apparent

DISCUSSION:

Since the HOV lanes are not scheduled to be constructed until the year 2013, expenditure of funds under this contract is not warranted and should be funded as part of the future project.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,014,488**	¾	**$ 1,014,488**
ALTERNATIVE	**$ 329,102**	¾	**$ 329,102**
SAVINGS	**$ 685,386**	¾	**$ 685,386**

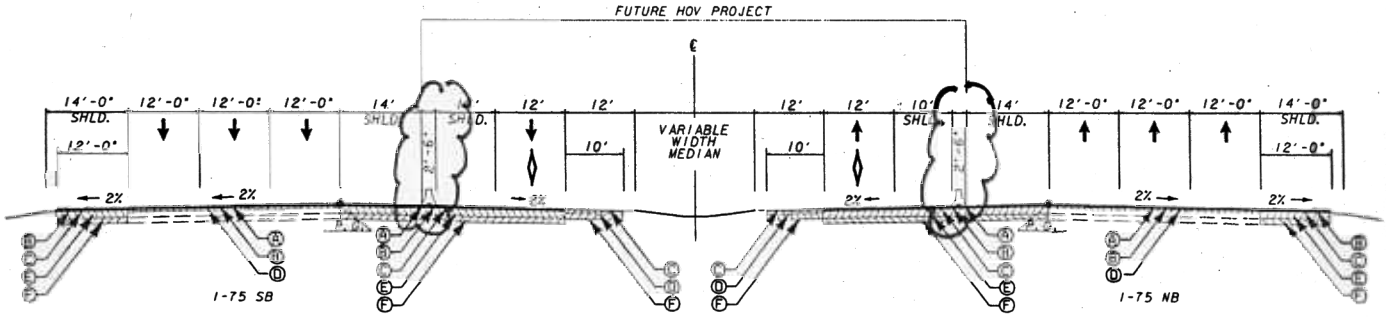
SKETCHES

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 12

☒ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 5



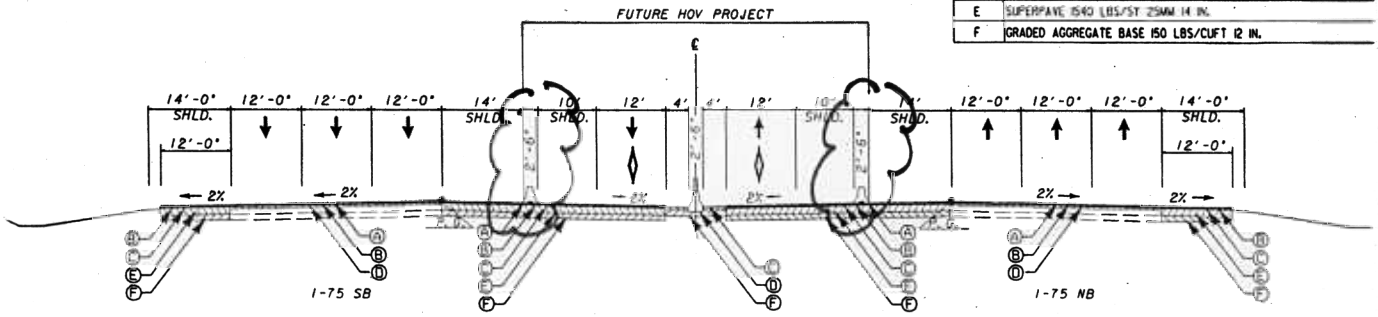
BARRETT PKWY TO NB OFF RAMP CHASTAIN RD

COBB COUNTY APPROXIMATE MP 12.11 TO MP 13.32 • 1.21 MI

MILL 8.5 INCHES OF EXISTING ASPH CONC AND INLAY WITH 9.5 INCHES OF A. B. D

PRELIMINARY PAVEMENT DESIGN

SYMBOL	PAVEMENT SYMBOLS LEGEND DESCRIPTION
A	PEM, POLYMER MODIFIED 135 LBS/SY 12.5MM 1.25 IN
B	SMA, POLYMER MODIFIED 300 LBS/SY 12.5MM 2.75 IN.
C	SUPERPAVE 220 LBS/SY 19MM 2 IN.
D	SUPERPAVE 550 LBS/SY 25MM 5 IN. (USE 6" 660LBS/SY ON INSIDE
E	SUPERPAVE 1540 LBS/SY 25MM 14 IN.
F	GRADED AGGREGATE BASE 150 LBS/CUFT 12 IN.



NB OFF RAMP CHASTAIN RD TO FREY RD

COBB COUNTY APPROXIMATE MP 13.32 TO MP 14.34 • 1.02 MI

MILL 8.5 INCHES OF EXISTING ASPH CONC AND INLAY WITH 9.5 INCHES OF A. B. D

THE EXISTING OUTSIDE SHOULDER SHOULD BE R
AS A FUTURE TRAVEL LANE AT FULL DEPTH B. C
SURFACE TRAVEL WAY WITH PEM 135 LBS/SOYD
EXTENDING 12" ONTO INSIDE SHD AND 18" ONT

GEORGIA
DEPARTMENT OF TRANSPORTATION

SCALE IN FEET
0 10 20 40

REVISION DATES

STATE OF
DEPARTMENT OF
OFFICE: URBAN DESI

I-75 SR5 CONN T
PI # M002965

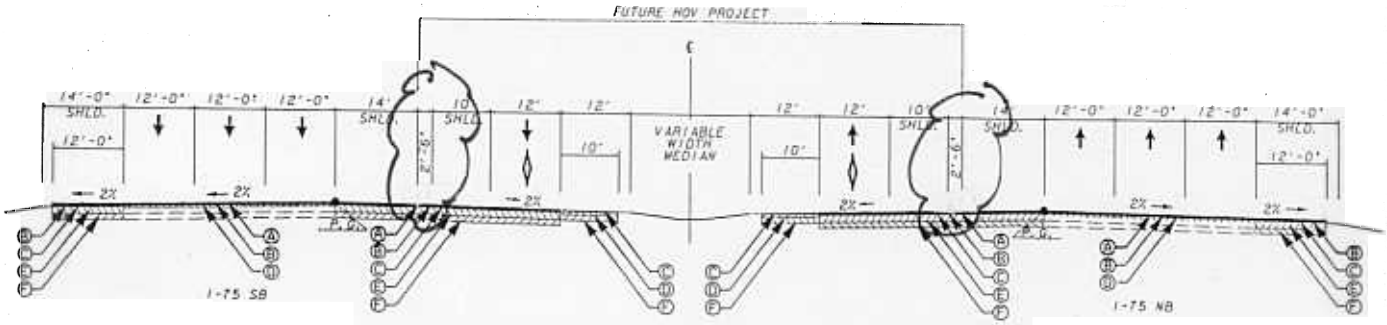
SKETCHES

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 12

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 5



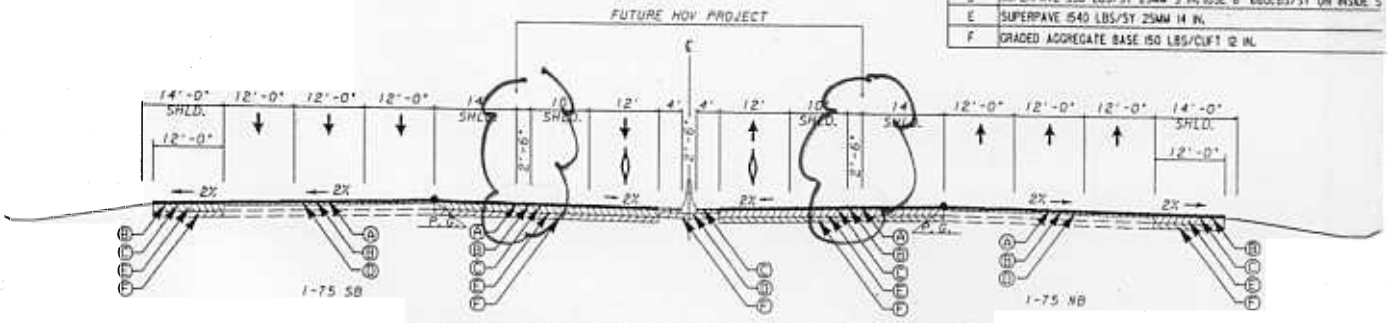
BARRETT PKWY TO NB OFF RAMP CHASTAIN RD

COBB COUNTY APPROXIMATE MP 12.11 TO MP 13.32 = 1.21 MI

MILL 8.5 INCHES OF EXISTING ASPH CONC AND INLAY WITH 9.5 INCHES OF A.B.D

PRELIMINARY PAVEMENT DESIGN

SYMBOL	PAVEMENT SYMBOLS LEGEND DESCRIPTION
A	PEM, POLYMER MODIFIED 135 LBS/SY 12.5MM 1.25 IN
B	SMA, POLYMER MODIFIED 300 LBS/SY 12.5MM 2.75 IN.
C	SUPERPAVE 220 LBS/SY 19MM 2 IN.
D	SUPERPAVE 550 LBS/SY 25MM 5 IN. (USE 6" 660LBS/SY ON INSIDE S
E	SUPERPAVE 1540 LBS/SY 25MM 14 IN.
F	GRADED AGGREGATE BASE 150 LBS/CUFT 12 IN.



NB OFF RAMP CHASTAIN RD TO FREY RD

COBB COUNTY APPROXIMATE MP 13.32 TO MP 14.34 = 1.02 MI

MILL 8.5 INCHES OF EXISTING ASPH CONC AND INLAY WITH 9.5 INCHES OF A.B.D

THE EXISTING OUTSIDE SHOULDER SHOULD BE REC. AS A FUTURE TRAVEL LANE AT FULL DEPTH B.C.E.

SURFACE TRAVEL WAY WITH PEM 135 LBS/SQYD 12. EXTENDING 12' ONTO INSIDE SHD AND 18" ONTO O

GEORGIA
DEPARTMENT OF TRANSPORTATION

SCALE IN FEET 0 10 20 40

REVISION DATES

STATE OF G
DEPARTMENT OF TR
OFFICE: URBAN DESIGN

I-75 SR5 CONN TO SR
PI # M002965

CALCULATIONS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO.: 12

DESCRIPTION:

SHEET NO.: 4 of 5

CONCRETE BARRIER TO BE REMOVED -

FROM BARRETT PKWY TO CHASTAIN RD - 1.21 mi = 6400 FT x 2 SIDES = 12800 FT
FROM CHASTAIN RD TO FREY RD - 1.02 mi = 5400 FT x 2 SIDES = 10800 FT

TOTAL TO BE REMOVED
= 12800 + 10800 = 23600 FT

TOTAL REQUIRED ⇒ 29204 - 23600 = 5604 FT

STRIPE OUT FUTURE HOV PAVEMENT

FROM BARRETT PKWY TO CHASTAIN RD = $\frac{6400\ FT \times 38.5\ FT}{9}$ = 27400 SY

FROM CHASTAIN RD TO FREY RD = $\frac{5400\ FT \times 38.5\ FT}{9}$ = 23100 SY

TOTAL TRAFFIC STRIPING
= 27400 + 23100 = 50500 SY

COST WORKSHEET

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

ALTERNATIVE NO: 12

DESCRIPTION

SHEET NO. 5 of 5

CONSTRUCTION ITEM		ORIGINAL ESTIMATE			PROPOSED ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
CONCRETE BARRIER	LF	29204	31.58	922,262.32	5604	31.58	176,974.32
THERMOPLASTIC TRAF. STRIPING	SY	—	—	—	50500	2.42	122,210.00
[illegible]							
	Sub-total			922,262.32			299,184.32
Mark-up at	10%			92,226.23			29,918.43
	TOTAL			1,014,488.55			329,102.75

PROJECT DESCRIPTION

NEED AND PURPOSE

The preliminary need for the project is the rehabilitation of the existing roadway to preserve the integrity and safety of the system. The majority of the pavement within the project is in poor to fair condition and will continue to deteriorate as traffic grows. The project is comprised of milling and resurfacing of US Interstate Highway 75 (I-75)/State Route (SR) 401 from SR 5 Connector (Barrett Parkway) to SR 61/US 411. The existing guardrail will be upgraded to current standards and vegetation will be cleared.

DESCRIPTION OF THE PROPOSED PROJECT

The project proposes to resurface and maintain the I-75 corridor between SR 5 Connector and SR 61/US 411. The work includes deep milling, resurfacing, guardrail upgrades, and vegetation clearing for pavement maintenance and safety. The project is approximately 25 miles long and spans Cobb, Cherokee, and Bartow Counties; commencing in Cobb County at milepost (MP) 12.11 and continuing to the Cobb county line at MP 17.85. The project continues through the southwest corner of Cherokee County from MP 0.00 to MP 2.1 and ends in Bartow County spanning from MP 0.00 to MP 16.69.

Existing Design Features:

Typical Section(s):	I-75 consists of six lanes, three lanes in each direction, with an average lane width of 12 ft. The inside shoulders are 12-ft. wide (10-ft. paved) and outside are 14-ft. wide (10-ft. paved). The median ranges from 40-ft. to approximately 350-ft.
Maximum Radius of Curve:	2,292 ft.
Maximum Super-Elevation Rate for Curve:	7.0%.
Maximum Grade:	3.6%.
Width of Right-of-Way:	300 – 600 ft.
Major Structures:	Barrett Parkway Interchange, Noonday Creek Mainline, Chastain Road Interchange, Frey Overpass, Shiloh Road Overpass, Wade Green Road Interchange, Hickory Grove Road Overpass, Clark Creek Mainline, Woodstock Road Overpass, Clark Creek Mainline, Priest Road Overpass, SR 92 Interchange, Glade Road Interchange, Tanyard Creek Mainline, Groovers Road Overpass, CSX Railroad Under Rail, Allatoona Shores Road Overpass, Allatoona Lake Mainline, Allatoona Lake Overpass, Joe Stella Road Overpass, Allatoona Road Interchange, CSX Railroad Under Rail, Red Top Mountain Road Interchange, Allatoona Dam Overpass,

	Etowah River Mainline, Old River Road Overpass, SR 113 Main Street Interchange, M-920 Center Road Overpass, SR 20/Canton Highway Interchange, and SR 62/US 411 Interchange.
Length of Segment for Cobb County:	5.74 miles (MP 12.11 to MP 17.85).
Length of Segment for Cherokee County:	2.10 miles (MP 0.00 to MP 2.10).
Length of Segment for Bartow County:	16.69 miles (MP 0.00 to MP 16.69).

Proposed Design Features:

Typical Section(s):	The number of lanes and lane width will remain the same at three in each direction. Cross slopes will be improved from 3/16th of an in. per ft. (in./ft.) to 1/4th in./ft. and outside shoulders will 12-ft. to serve as future travel lanes.
Design Speed Mainline:	70 mph.
Maximum Grade Mainline:	3.6%; maximum allowable 4.0%.
Maximum Grade Side Street:	Not Applicable (N/A); maximum allowable 6.0%.
Maximum Grade Driveway:	N/A.
Maximum Radius of Curve:	2,292 ft.; minimum allowable at 70 mph: 1,820 ft.
Maximum Super-Elevation Rate for Curve:	7.5%.
Right of Way:	All work is to be accomplished within the existing right-of-way.
Structures:	The bridge at Priest Road, Bridge Identification No. 057-0062-0 will be jacket to meet clearance requirements.
Major Intersections:	No changes are anticipated to the intersections within the project area.
Traffic Control During Construction:	Temporary lane closures will be required. Restricted work hours will be determined from GDOT analysis.
Design Exceptions:	No design exceptions are anticipated.
Design Variances:	No design variances are anticipated.
Environmental Concerns:	Tennessee Yellow Grass is located within the ramps at the SR 61/US 411 Interchange.
Utility Involvement:	Fiber optic trenching is located in the north and south bound outside shoulders between MP 270 and 273.

COST DATA

The current probable cost of construction has been identified at $59,811,419 as noted on the Estimate Report for file “M002965” for CSNHS-M002-00(965) Cobb, Cherokee, and Bartow Counties, printed September 1, 2004. The project contains a contingency of 10.00%.

VALUE ANALYSIS AND CONCLUSIONS

GENERAL

This section describes the value analysis procedure used during the value engineering study. It is followed by separate narratives and conclusions concerning:

- Value Engineering Workshop Participants
- Economic Data
- Cost Estimate Summary and Cost Histograms
- Function Analysis
- Creative Idea Listing and Judgment of Ideas

A systematic approach was used in the VE study and the key procedures involved were organized into three distinct parts: 1) preparation; 2) VE workshop; and 3) post-study. A Task Flow Diagram that outlines each of the procedures included in the VE study is attached for reference.

PREPARATION EFFORT

Pre-study preparation for the VE effort consisted of scheduling study participants and tasks; gathering necessary background information on the facility; and compiling project data into a cost model and graphic cost histogram. Information relating to the design, construction, and operation of the facility is important as it forms the basis of comparison for the study effort. Information relating to funding, project planning, operating needs, systems evaluations, basis of cost, soil conditions, and construction of the facility was also a part of the analysis.

VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a three-day effort (see attached agenda). During the workshop, the VE job plan was followed. The job plan guided the search for high cost areas in the project and included procedures for developing alternative solutions for consideration. It includes six phases:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase *(Not conducted)*

Value Engineering Study Task Flow Diagram

Preparation Effort

Coordinate Project

- Verify Schedule
- Suggest Format for Designer Presentation
- Outline Project Responsibilities
- Outline Needed Background Data
- Establish Performance and Acceptance Requirements
- Conduct Coordination Meeting
- Identify Project Constraints

→

Prepare for Workshop

- Collect Project Data
- Distribute Data to Team Members
- Team Members Become Familiar with Project
- Visit Project Site

→

Construct Cost, LCC, Energy Models

- Construct Models
- Identify High Cost and Consumption Areas

Workshop Effort

Information Phase

- VETL Opens Workshop
- Designer Gives Project Description/Presentation
- Discuss Owner Requirements
- Review Project Data
- Visit Project Site (Alt.)
- Finalize Cost, LCC, Energy Models

→

Function Identification and Analysis Phase

- Perform Function Analysis
- Calculate Cost/Worth Ratios

List Ideas Generated During Function Analysis

→

Creative Phase

- VETL Introduces Creative Thinking
- Prepare Creative Idea Listing. Seek:
  - Quantity of Ideas
  - Association of Ideas
- Brainstorm
- Do Creative Thinking
  - Group Thinking
  - Individual Thinking

→

Evaluation Phase

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

→

Development Phase

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

→

Presentation Phase

- Summarize Findings
- Present VE Ideas to Owner/User/Designer
- Prepare VE Report

Post-Workshop Effort

Implementation Phase

- Develop Implementation Plan
- Designer Prepares Responses to VE Report
- Participate in Implementation Meeting with Owner/User/ Designer/VE Team, as needed
- Owner Evaluates and Selects Preferred Alternatives

→

Final Acceptance

- Redesign by Designer

Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, the development manager presented information about the project to the VE team on the first day of the session. Following the presentation, the VE team discussed the project using the following documents:

- *Aerial Photograph Drawing* entitled I-75 FROM S.R.5 CONNECTOR TO S.R.61/U.S.411, Project CSNHS-M002-00(965), Cobb, Cherokee, Bartow, P.I. No. M002965, prepared by the Department of Transportation, State of Georgia, undated;
- *Project Concept Report* for the Project Number CSNHS-M002-00(965), County: Cobb, Cherokee, Bartow, P. I. No. M002965, prepared by the Department of Transportation, State of Georgia, Office of Urban Design, Federal Route Number: I-75; State Route Number: SR 401; undated;
- *Initial Concept Meeting Minutes* for CSNHS-M002-00(965), PI M002965, COBB-CHEROKEE-BARTOW COUNTIES; prepared by Georgia Department of Transportation Office of Urban Design; dated September 2, 2004;
- *Excerpt from Tabulation of Bids* for Contract ID B10715-045-000-2, prepared by Georgia Department of Transportation; dated June 25, 2005; and
- *Policy on Design Standards – Interstate System*; prepared by the Task Force on Geometric Design of AASHTO Highway Subcommittee on Design; dated July 1991.

Function Identification and Analysis Phase

Based on historical and background data, a cost model and graphic function analysis were developed for this project grouped by major construction elements. They were used to distribute costs by project element; serve as a basis for alternative functional categorization; and to assign worth to the categories, where worth is the least cost to provide the required function, as determined by the VE team. The VE team identified the functions of the various project elements and subsystems by using random function generation techniques resulting in the attached Random Function Analysis worksheet and/or Function Analysis Systems Technique (F.A.S.T.) diagram.

Creative Phase

This VE study phase involved the creation and listing of ideas. Creative idea worksheets were organized by project element. During this phase, the VE team developed as many ideas as possible to provide the necessary functions within the project at a lower cost to the owner, or to improve the quality of the project. Judgment of the ideas was restricted at this point. The VE team was looking for a large quantity of ideas and free association of ideas.

GDOT and Federal Highway Administration (FHWA) representatives may wish to review the creative list since it may contain ideas that can be further evaluated for potential use in the design.

Evaluation Phase

During this phase of the workshop, the VE team judged the ideas generated during the creative phase. Advantages and disadvantages of each idea were discussed to find the best ideas for development. Ideas found to be irrelevant or not worthy of additional study were discarded. Those that represented the greatest potential for cost savings or improvement to the project were then developed further.

The VE team would like to develop all ideas, but time constraints usually limit the number that can be developed. Therefore, each idea was compared with the present schematic design concepts in terms of how well it met the design intent. Advantages and disadvantages were discussed, and each team member rated the ideas on a scale of zero to five, with the best ideas rated five. Total scores were summed for each idea and only highly-rated ideas were developed into alternatives. In cases where there was little cost impact, but an improvement to the project was anticipated, the designation DS, for design suggestion, was used. The design team should review this listing for possible incorporation of ideas into the project.

The creative listing was re-evaluated frequently during the process of developing alternatives. As the relationship between creative ideas became more clearly defined, their importance and ratings may have changed, or they may have been combined into a single alternative. For these reasons, some of the originally high-rated items may not have been developed into alternatives.

Development Phase

During the development phase, each highly rated idea was expanded into a workable solution. The development consisted of a description of the alternative, life cycle cost comparisons, where applicable, and a descriptive evaluation of the advantages and disadvantages of the proposed alternatives. Each alternative was written with a brief narrative to compare the original design to the proposed change. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in the section entitled *Study Results.*

Presentation Phase

The last phase of the VE study would have been to present the findings of the study; however GDOT now conducts the presentation internally upon receipt of the report. The VE alternatives were screened by the VE team before draft copies of the *Summary of Potential Cost Savings* worksheets were provided to GDOT representatives. The VE alternatives were arranged in the same order as the idea listing sheets to facilitate cross-referencing.

POST-WORKSHOP EFFORT

The post-study portion of the VE study includes the preparation of this report. Personnel from GDOT will analyze each alternative and prepare a short response, recommending incorporating the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. Lewis & Zimmerman Associates, Inc. is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

VALUE ENGINEERING STUDY AGENDA

Lewis & Zimmerman Associates, Inc. (LZA) will conduct a 24-hour VE Study on the **ICSNHS-M002-00(965), P.I. No. M002965,** project located in Cobb, Cherokee, and Bartow Counties, Georgia. It is expected the owner, the Georgia Department of Transportation (GDOT) will be available to make a formal presentation concerning the project at the beginning of the workshop and be available to answer questions during the VE study effort.

VE Study Agenda

The VE study will follow the outline described below and be conducted September 14 - 16, 2004. The study will be conducted in Room 260 (Bridge Design Conference Room) in GDOT's General Office located at No. 2 Capitol Square Street, Atlanta, Georgia 30334. The point-of-contact is Ms. Lisa L. Myers, Design Review Engineer Manager, who can be reached at 404-651-7468.

Tuesday, September 14th

9:00 am - 9:15 am **General Introduction of all Parties and review of the VE Process**

9:15 am - 11:15 am **Owner's/Designer's Presentation**

GDOT is to present information concerning the project including, but not necessarily limited to: rationale for design; criteria for specific areas of study, project constraints and the reasons for design decisions.

11:15 am - 12:00 noon **Commence Function Analysis Phase**

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

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

1:00 pm - 5:00 pm **Conclude the Function Analysis Phase and Commence the Creative Phase**

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

Wednesday, September 15th

8:30 am - 10:00 am **Conclude Creative Phase and Complete Evaluation/Analytical Phase**

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

10:00 am - 12:00 noon **Development Phase**

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

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

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

Thursday, September 16th

8:30 am - 12:00 am **Continue Development Phase**

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

1:00 pm - 4:00 pm **Conclude Development Phase and Commence Summary Worksheets**

Upon completion of the Development Phase, the VE facilitator will commence preparation of the summary worksheets based on the alternatives developed by the VE team. The summary work sheets form the basis of the informal oral presentation.

4:00 – 5:00 pm **Finalize Summary Worksheets**

The VE team will provide draft copies of the *Summary of Potential Cost Savings* worksheets to GDOT representatives and be available to clarify any points.

Please note: This is the first time an Initial Concept Value Engineering Study is to be conducted at GDOT; as such, the flexibility and availability of all interested parties is important. Although all required steps and phases are to be followed, there may be a possibility the study could conclude at the end of the second day; however, plan your calendar for the potential of a full three-day effort.

VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise on the project elements involved. Team members consisted of a multidisciplinary group with professional design experience and a working knowledge of VE procedures. The VE team included the following professionals:

George A. Obaranec, PE	Civil/Roadway/Constructibility Engineer	Delon Hampton & Associates, Chartered
Gregory C. Grant, PE	Director, Structural Engineering, Bridge Engineer	HNTB
Edward F. Culican, Jr., PE	Senior Project Manager, Transportation/Roadway Engineer	HNTB
Luis M. Venegas, PE, CVS	VE Facilitator	Lewis & Zimmerman Associates, Inc.

OWNER'S/DESIGNER'S PRESENTATION

Representatives from the Georgia Department of Transportation administration and the Federal Highway Administration presented an overview of the project on Tuesday, September 14, 2004. The purpose of this meeting, in addition to being an integral part of the Information Gathering Phase of the VE Study, was to bring the VE team "up-to-speed" regarding the overall project. Additionally, the meeting afforded the design team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention.

VALUE ENGINEERING TEAM'S FINAL PRESENTATION

The VE team did not conduct a final, oral presentation on Friday, July 9, 2004 to GDOT. However, copies of the draft *Summary of Potential Cost Savings* worksheets were provided for interim use by GDOT and FHWA personnel.

A copy of the meeting participants sign-in sheet is attached for reference.

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965** **Cobb, Cherokee, and Bartow Counties** ***Concept Development***		Date: **September 14 - 16, 2004**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Ronald J. Chesser	Georgia Department of Transportation (GDOT), Traffic and Safety Design	ph: 404-635-8138
em: ronnie.chesser@dot.state.ga.gov	Traffic Design Supervisor and State Signal Design Engineer	fx: 404-635-8116
Dickey Forrester, PE	GDOT, Office of Construction	ph: 404-656-5306
em: dickey.forrester@dot.state.ga.us	Construction Liaison Engineer for Districts 1 and 6	fx: 404-657-0758
Theresa R. Holder, PE	GDOT, Office of Urban Design	ph: 404-656-5447
em: theresa.holder@dot.state.ga.us	Assistant Group Manager	fx: 404-657-7921
William E. Ingalsbe, III, PE	GDOT, Office of Bridge Design	ph: 404-656-5302
em: bill.ingalsbe@dot.state.ga.us	Bridge Design Group Leader	fx: 404-656-7076
Lisa L. Myers	GDOT, General Office (GO)	ph: 404-651-7468
em: lisa.myers@dot.state.ga.us	Design Review Engineer Manager	fx: 404-463-6131
E. Reid Mathews	GDOT, Office of Maintenance	ph: 404-635-8198
em: reid.mathews@dot.state.ga.us	Statewide Maintenance Project Coordinator	fx: 404-635-8172
J. T. Rabun, PE	GDOT, Office of Materials and Research	ph: 404-363-7583
em: jt.rabun@dot.state.ga.us	Assistant Materials and Research Engineer	fx: 404-363-7684
Kenny Beckworth	GDOT, District 6, Office of Construction	ph: 770-387-3609
em: kenny.beckworth@dot.state.ga.us	Assistant District Construction Engineer	fx: 770-387-3653
Walter E. Boyd, PE	U.S. Department of Transportation (US DOT), Federal Highway Administration (FHWA)	ph: 404-562-3651
em: walter.boyd@fhwa.dot.gov	Urban Transportation Engineer – Metro Atlanta Area	fx: 404-562-3703
Jessica L. Granell	FHWA, Georgia Division	ph: 404-562-3644
em: jessica.granell@fhwa.dot.gov	Transportation Engineer	fx: 404-562-3703
Floyd Moore	FHWA, Georgia Division	ph: 404-562-3654
em: floyd.moore@fhwa.dot.gov	Transportation Engineer	fx: 404-562-3703

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965** **Cobb, Cherokee, and Bartow Counties** ***Concept Development***		Date: **September 14 - 16, 2004**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
George A. Obaranec, PE em: gobaranec@delonhampton.com	Delon Hampton & Associates, Chartered Project Manager	ph: 404-524-8030 fx: 404-524-2575
Gregory C. Grant, PE em: ggrant@hntb.com	HNTB Director, Structural Engineering, Bridge Engineer	ph: 770-956-5770 fx: 770-956-5779
Edward F. Culican, Jr., PE em: eculican@hntb.com	HNTB Senior Project Manager	ph: 770-923-7775 fx: 770-279-9297
Luis M. Venegas, PE, CVS-Life, LEED™ AP em: lmvenegas@aol.com	Lewis & Zimmerman Associates, Inc. VE Facilitator	ph: 770-992-3032 fx: 770-992-0228
em:		ph: fx:
em:		ph: fx:
em:		ph: fx:
em:		ph: fx:
em:		ph: fx:
em:		ph: fx:
em:		ph: fx:
em:		ph: fx:

ECONOMIC DATA

The VE team developed the economic criteria to evaluate information gathered from GDOT. To express costs in a meaningful manner, the VE team alternatives are presented on the basis of discounted present worth. Criteria for planning project period interest rates are based on the following parameters:

Year of Analysis:	2004
Construction Start-Up:	August 2005
Construction Duration:	±24 Months
Economic Planning Life: Economic Planning Life:	35 years 50 years
Discount Rate/Interest:	3.00% (Latest United States Office of Management and Budget Circular A-94)
Inflation/Escalation Rate:	5.00% (GDOT)
Uniform Present Worth (UPW) Factor:	21.4872 for 35 years 25.7298 for 50 years
Cost of Power:	$0.07/kWHr (kilowatt hour) (assumed)
Operation and Maintenance Costs *(Industry Norms)*:	
Equipment - With Many Moving Parts	5.00%-5.50%+ of Capital Cost
Equipment - With Minimal Moving Parts	3.50%-4.00% of Capital Cost
Equipment - Electronic	3.00% of Capital Cost
Structural	1.00%-2.00% (or less) of Capital Cost
Overall Composite Mark-Up for Bricks and Mortar: *(Composed of: Contingency at 10.00%)*	10.00% (1.1000)

COST ESTIMATE SUMMARY AND COST HISTOGRAMS

The VE team prepared a cost model for the project that is included following this page. The cost model is arranged in the Pareto Charting/Cost Histogram format to aid in identifying high cost areas and is based on the *Estimate Report for file "M002965,"* printed *September 1, 2004* prepared by the GDOT Urban Design Office. As can be expected, judgment at this stage of the study is based on experience and intuition rather than on facts, which are not uncovered until farther along in the analysis of function. As a result of these qualified hypotheses, there appears to be a potential for initial savings in the following areas:

Asphalt Pavement
Aggregate Base Course
PC Concrete
Mill Asphalt Concrete
Non-Woven Filter Fabric and Geogrid
Traffic Control

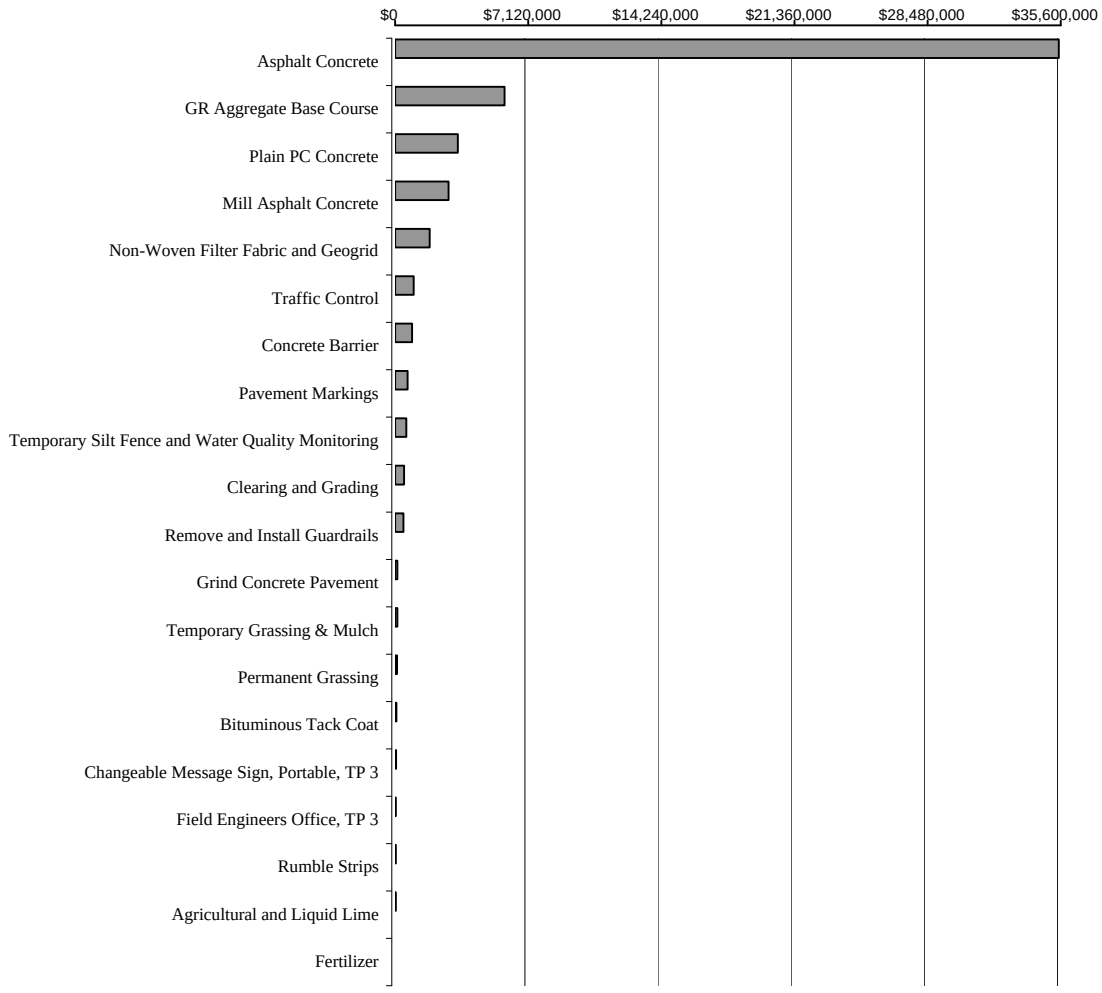
DESIGNER'S COST ESTIMATE

The cost estimate did contain sufficiently detailed information to perform a VE evaluation but was supplemented by an excerpt from a recent GDOT Tabulation of Bids, dated June 25, 2004, for Contract No. B10715-04-000-2 in Forsythe and Fulton Counties, and GDOT Item Mean Summary for 07/2003 to 06/2004 (English and Metric) for Specification Year 2001 Contracts.

COST HISTOGRAM

PROJECT: CSNHS-M002-00(965), P. I. Number M002965
Cobb, Cherokee, and Bartow Counties
Concept Development

TOTAL PROJECT	COST	PERCENT	CUM. PERCENT
Asphalt Concrete	35,506,239	65.30%	65.30%
GR Aggregate Base Course	5,871,642	10.80%	76.10%
Plain PC Concrete	3,371,874	6.20%	82.30%
Mill Asphalt Concrete	2,882,211	5.30%	87.60%
Non-Woven Filter Fabric and Geogrid	1,858,871	3.42%	91.02%
Traffic Control	1,008,678	1.86%	92.87%
Concrete Barrier	922,262	1.70%	94.57%
Pavement Markings	691,553	1.27%	95.84%
Temporary Silt Fence and Water Quality Monitoring	624,364	1.15%	96.99%
Clearing and Grading	500,000	0.92%	97.91%
Remove and Install Guardrails	456,025	0.84%	98.75%
Grind Concrete Pavement	143,902	0.26%	99.01%
Temporary Grassing & Mulch	135,967	0.25%	99.26%
Permanent Grassing	116,291	0.21%	99.48%
Bituminous Tack Coat	79,785	0.15%	99.62%
Changeable Message Sign, Portable, TP 3	64,080	0.12%	99.74%
Field Engineers Office, TP 3	47,493	0.09%	99.83%
Rumble Strips	41,935	0.08%	99.91%
Agricultural and Liquid Lime	32,412	0.06%	99.97%
Fertilizer	18,436	0.03%	100.00%
Construction Subtotal	**$ 54,374,020**	**100.00%**	
Contingency @ 10.00%	$ 5,437,402		
TOTAL	**$ 59,811,422**	**Comp Mark-up:**	10.00%



Costs in graph are not marked-up.

FUNCTION ANALYSIS

Function analysis was performed to: (1) define the requirements for each project element, and (2) to ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. A *Random Function Analysis* worksheet for the project is attached. This part of the function analysis stimulated the VE team members to think in terms of the areas in which to channel their creative idea development.

Function Analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project, or if there are disproportionate amounts of money spent on support functions. These elements add cost to the final product, but have a relatively low worth to the basic function.

The Random Function Analysis effort identified the project's basic function as: PRECLUDE/ FAILURE by Improving/Safety, Replace/Pavement, Improve/Ride-Ability and Restoring/Structure.

RANDOM FUNCTION ANALYSIS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

SHEET NO.: 1 of 1

DESCRIPTION	FUNCTION		
	VERB	NOUN	KIND
ENTIRE PROJECT	**Replace**	**Pavement**	**B_1**
	Improve	**Ride-ability**	**B_1**
	Improve	**Safety**	**B**
	Improve	Drainage	RS
	Improve	Life Cycle Cost of Facility	HO
	Restore	**Structure**	**B_1**
	Upgrade	Standards	RS
	Upgrade	Shoulders	RS
	Increase	Clearance	RS
	Reduce	Impact on Public (User Costs)	S
	Reestablish	Clear Zones	RS
	PRECLUDE	**FAILURE**	**B**
	Facilitate	Staging	S

Function defined as: Action Verb, Measurable Noun

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

CREATIVE IDEA LISTING AND JUDGMENT OF IDEAS

During the creative phase, numerous ideas, alternative proposals, and/or recommendations were generated using conventional brainstorming techniques as recorded on the following pages.

These ideas were then discussed and the advantages/disadvantages of each listed. The VE design team compared each of the ideas with the concept solution determining whether it improved value, was equal in value, or lessened the value of the solution.

The ideas were then ranked on a scale of one to five based on how well the design team believed the idea met necessary criteria and program needs. The higher rated ideas were then developed into formal alternatives and included in the VE workshop. Some ideas were judged to have minimal cost impacts on the project but provided enhancements in the form of improved operations, efficiency, constructibility or potential to save unknown or hidden costs. These were given the designation "DS" which indicates a design suggestion. This designation is also used when an idea is difficult to price but improves the functionality of the project or system, and is deemed to be of significant value to the owner, user, operator, or designer.

Typically, all ideas rated four or above are included in the Study Report. When this is not the case, an idea was combined with another related idea or discarded, as a result of additional research that indicated the concept was not cost-effective or technically feasible.

The reader is encouraged to review the *Creative Idea Listing and Evaluation* worksheets since they may suggest additional ideas that can be applied to the design.

CREATIVE IDEA LISTING

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965**
Cobb, Cherokee, and Bartow Counties
Concept Development

SHEET NO.: 1 of 1

NO.	IDEA DESCRIPTION	RATING
1	Do nothing	1
2	Fog-seal the facility	1
3	Use concrete pavement throughout	3+
4	Use concrete pavement from Barrett Parkway to Glade Road	4
5	Use concrete pavement for either northbound or southbound traffic from Barrett Parkway to Glade Road	2
6	Do not disturb open grade friction course (OGFC) on ramps of the Glade Road, Old Allatoona Road, Red Top Mountain Road, State Road (SR) 113, and SR 20 (Canton Highway)	DS
7	Do not replace the guardrail	1
8	Build median for future traffic and use as staging area	2
9	Construct a new inside lane and work on outside lanes and shoulder	5
10	Close one lane on each direction and allow 24 / 7 construction	1
11	Limit project between Barrett Parkway and Glade Road	3
12	Eliminate concrete barriers (HOV?)	4
13	Provide cross slope from inside lane to outside	2

Rating: 1®2 = Not to be Developed; 3®4 = Varying Degrees of Development Potential; 5 = Most likely to be Developed; DS = Design Suggestion; ABD = Already Being Done; N/A = Not Applicable