CSNHS-M002-00(965)
Pavement Rehabilitation for
Interstate I-20 from the Georgia-Alabama
State Line to S.R. 61
P.I. No. M002966

Cobb, Cherokee, and Bartow Counties, Georgia

Value Engineering Study Report

Concept Design Stage
March 2005

Design Consultant
Georgia Department of Transportation

Value Engineering Consultant

Lewis & Zimmerman Associates, Inc.

Lewis & Zimmerman Associates, Inc.
Taking the Chance out of Change
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March 11, 2005

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(966),
I-20 from Georgia – Alabama State Line to S.R. 61 in
Haralson and Carroll Counties, Georgia
Value Engineering Study Report

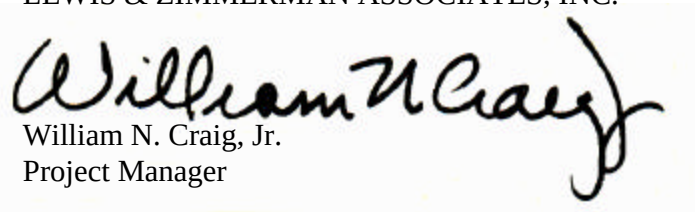
Dear Ms. Myers:

Lewis & Zimmerman Associates, Inc. is pleased to submit four hard copies and one electronic copy of the referenced report. The alternatives and design suggestions 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 lanes; 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 an implementation approach.

Sincerely,

LEWIS & ZIMMERMAN ASSOCIATES, INC.



William N. Craig, Jr.
Project Manager

Attachment

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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 20 (I-20) from the Georgia-Alabama State Line (Haralson County) to the I-20/SR 61 Interchange in Carroll County. The project designation is CSNHS-M002-00(966) CARROLL & HARALSON COUNTIES.

The project is being designed by the Georgia Department of Transportation and is at the concept design stage. The workshop was conducted February 17 – 18, 2005.

PROJECT DESCRIPTION

The project proposes to rehabilitate the I-20 corridor between the Georgia-Alabama State line and SR 61 by utilizing an un-bonded continuous reinforced concrete pavement (CRC) overlay. The outside shoulder will be replaced with full-depth continuous reinforced concrete, while the inside shoulder will be replaced with roller compacted concrete (RCC). The project will also upgrade the guardrails to current standards and all vegetation will b cleared according to current guidelines on both eastbound and westbound lanes. The western limit of the project is 0.00MP and the eastern limit is 23.62MP.

This project was originally conceived as a two part maintenance project to re-surface adjacent portions of I-20, but is now a single project for the entire 23.62 miles. Responsibility has been transferred from the Office of Maintenance to the Office of Road Design. The current probable cost of construction has been identified as $150,465,382, including a 10% allowance for E & C.

The proposed construction calls for a six-stage plan to accommodate continuous traffic operation. Cross sections of the existing roadway as well as each of the proposed roadways during the six stages are included in the Project Description.

OBJECTIVES AND CONCERNS

The objectives were expressed to the VE team by the GDOT project team. In addition to the primary objective of roadway surface rehabilitation the project seeks to maintain two lanes of traffic in each direction during peak travel hours, achieve a minimum clearance of 16 ft. 6 in., improve safety for users and ensure worker safety during construction, maintain safe alignments in core areas and in transitions to temporary roadways, maintain lane widths no less than 11 ft. during construction, and provide provisions for underdrains in sags and wet areas.

It appears that the preliminary cost estimate supplied to the VE team has not addressed the provisions for underdrains nor for extension of bridge culverts required by the additional fill slopes.

The clearance at the Norfolk-Southern rail overpass at the city limits of Bremen was unknown at the time of the study and is a concern if the overlay option is chosen since jacking the rail bridge is not feasible. If

the present clearance is found to be greater than 18 ft., then the loss of clearance due to the higher elevation at the top of the pavement can be accommodated and the minimum standard clearance can still be maintained.

HIGHLIGHTS OF THE STUDY

The project is a relatively straightforward concept to provide pavement rehabilitation along the I-20 corridor between the Georgia-Alabama state line and SR 61 in Carroll County. Since no definitive plans or designs have been produced, the VE team relied on the undated Project Concept Report, and GDOT internal memo "Life Cycle Cost and Pavement Type Recommendation for SR 402/I-20 Rehabilitation from the Alabama State Line to SR 61," dated December 28, 2004. Listed below are some of the more salient ideas developed during the VE workshop.

To minimize the bottlenecking associated with complex and multiple stages/phases of the efforts to be accomplished, Alternative No. 1 proposed re-routing all traffic to one side of the interstate and leaving the other side available for construction. The newly rehabilitated roadway would be used as the roadway for all traffic during the time that the second half of the project is under construction. While this approach adds significant temporary pavement costs, it has the off-setting features of substantially shorter construction duration, enhanced constructibility, and much greater construction safety. The extra $15 - $17 million dollars required by this alternative are offset by an estimated $15 million dollars in savings resulting from the shorter construction duration, better constructibility, and a more attractive and competitive bidding resulting from this construction approach.

Several options for the pavement design were proposed as alternatives and evaluated by the team. Use of a full depth CRC pavement design as opposed to the proposed overlay design was evaluated and found to be attractive from both the perspective of initial cost and the 25% longer service life (identified in the Pavement Type Recommendation memo.) The other evaluations are detailed in the Value Engineering alternatives.

The *Summary of Potential Cost Savings* worksheet follows this narrative outlining all of the alternatives and the design suggestions 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 the Value Analysis and Conclusions section of this report.

SUMMARY OF POTENTIAL COST SAVINGS

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
1	Stage traffic to one side*	$150,465,382	$150,306,781	$158,601		$158,601
3	Replace with full-depth pavement design	$16,612,107	$10,715,477	$5,896,630		$5,896,630
4	Use full-depth replacement at interchanges	$6,754,000	$2,932,500	$3,821,500		$3,821,500
6	Use “barn roof” side slopes to avoid extending bridge culverts and box culverts	$1,628,776	$0	$1,628,776		$1,628,776
9	Employ single lane traffic in each direction with contra-flow	$13,546,356	$6,773,178	$6,773,178		$6,773,178
12	Use 4:1 slopes in median and outside shoulders	DESIGN SUGGESTION				
14	Add underdrains at sags and wet areas	DESIGN SUGGESTION				
15	Use modified pavement design for the 18 miles of pavement between the two three mile sections at either end where the pavement is most severely degraded	$5,000,000	$0	$5,000,000		$5,000,000
	* This alternative results in a substantial decrease in total project duration					

STUDY RESULTS

INTRODUCTION

The results are the major feature of a VE 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 15 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 15 ideas generated, six were sufficiently rated to warrant further investigation and two were included as design suggestions. Continued research and development of these ideas yielded four alternatives for change with an impact on project costs. One design suggestion that will enhance the value of the project in terms of project duration, improved constructibility, improved safety, and accommodation of the future lane expansion was also developed. Another suggestion was developed that, if adopted, would obviate the need to increase the project cost to account for extension of bridge culverts, an item that has not yet been recognized in the project estimates. These alternatives and design suggestions 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(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	PRESENT WORTH OF COST SAVINGS: INITIAL COST SAVINGS	PRESENT WORTH OF COST SAVINGS: RECURRING COST SAVINGS	PRESENT WORTH OF COST SAVINGS: TOTAL PW LCC SAVINGS
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3	Replace with full-depth pavement design	$16,612,107	$10,715,477	$5,896,630		$5,896,630
4	Use full-depth replacement at interchanges	$6,754,000	$2,932,500	$3,821,500		$3,821,500
6	Use “barn roof” side slopes to avoid extending bridge culverts and box culverts	$1,628,776	$0	$1,628,776		$1,628,776
9	Employ single lane traffic in each direction with contra-flow	$13,546,356	$6,773,178	$6,773,178		$6,773,178
12	Use 4:1 slopes in median and outside shoulders	DESIGN SUGGESTION				
14	Add underdrains at sags and wet areas	DESIGN SUGGESTION				
15	Use modified pavement design for the 18 miles of pavement between the two three mile sections at either end where the pavement is most severely degraded	$5,000,000	$0	$5,000,000		$5,000,000
	* This alternative results in a substantial decrease in total project duration					

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: **1**

DESCRIPTION: **STAGE ALL TRAFFIC TO ONE SIDE**

ORIGINAL DESIGN:

The original design proposed staging with contra-flow and split traffic with off-peak lane closings.

ALTERNATIVE: (Sketch attached)

Shift all traffic to one roadway.

ADVANTAGES:

- Saves significant construction duration
- Improves work zone safety
- Improves work zone constructibility
- Saves potential costs – better bids
- Disrupts the traveling public less

DISADVANTAGES:

- Requires additional pavement

DISCUSSION:

Stage 1 – Construct outside shoulder improvements – 14 ft. wide – full-depth pavement with associated earthwork and grading/safety improvements.

Construct inside shoulder improvements 15 ft. wide – full depth pavement with associated earthwork and grading/safety improvements.

This construction yields a 55 ft.-wide full-depth roadway area suitable for 4 through lanes with a concrete barrier. Additional pull-off/emergency break down areas should also be constructed

Construct transition roadways from WB to EB roadway – at each end of project and at each side of three overpasses – Extend ramps at interchanges – divert all traffic to the new widened roadway.

Stage 2 – Construct one roadway "in the clear."

At this point there are two options:

1. The first option is to build the appropriate width pavement (55 ft.) on the first road for all four lanes of traffic, then divert all traffic to that roadway while building the second one "in the clear."
2. The second option is to revert to a type of staging with split traffic (contra-flow) and off-peak lane closings.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 150,465,382**	¾	**$ 150,465,382**
ALTERNATIVE	**$ 150,306,781**	¾	**$ 150,306,781**
SAVINGS	**$ 158,601**	¾	**$ 158,601**

Either option will increase the amount of pavement construction and therefore, cost, but the savings will be realized in shorter construction duration where significant savings can be achieved.

Some estimates for consideration:

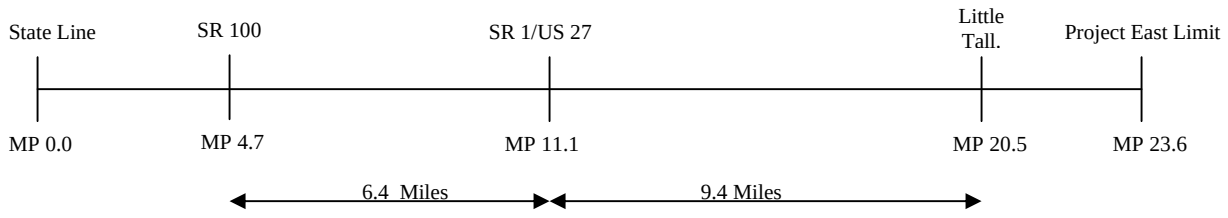
Under the originally proposed staging plan, productivity is about ½ mile, full-width, 2 lanes & shoulder, per weekend shutdown. Assume minimal productivity during the week, due to start and stop operations. Some clearing, prep work can occur but this will be minimal.

24 miles X 2 directions = 48 miles
48 miles X ½ mile per weekend = 96 weekends
USE 2 Years

For the alternate proposal, construction "in the clear", we can assume reasonably ½ mile per day- full width. Conservative estimate :
USE 2 miles per week
The resulting duration would be 48 miles I 2 miles per week = 24 week = 6 months
Assume up to 6 months of preparation and construction to prepare roadways for each alternate.
Duration under the currently proposed plan = 2 year construction + 6 months preparation = 30 months.
Duration under the proposed alternation = 6 months construction + 6 months preparation = 12 months.

The project duration under the proposed alternate is 40% of the duration under the originally proposed plan. This alternate would work ideally with the "remove and replace at similar grade" pavement design option. Otherwise there will be significant waste of labor and materials in temporary roadways.

This alternative can also be developed and managed from a constraints perspective as shown:



Since two of the constraints are relatively close to the project limits (4 miles +/-), it might not be worthwhile to construct the required crossovers.

Even though we estimate an additional $17,900,000 worth of pavement required to facilitate this alternative, the overall construction duration can be reduced by 12 – 18 months, while providing a safer construction work zone and greatly improved public traveling experience. Also, due to the shortened construction duration, the overall bid and individual cost should be much better, assuming a 10% -15% potential range of cost savings of the total project. Additionally, the extra pavement constructed can be used in the future to provide for additional widening.

Another benefit is that the overall driver experience should be safer and better defined. Splitting traffic into contra flow alignment is not a conventional, expected operation, even though it has been done in other states. A more desirable method would be to switch both lanes of traffic. If one lane is being shifted over, it is not much more to shift two lanes

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Concept Development

ALTERNATIVE NO.: 1

DESCRIPTION: **STAGE ALL TRAFFIC TO ONE SIDE**

Additional pavement area:

Outside shoulder: 12 ft. => 14 ft. = 2 feet additional

Inside shoulder: 4ft. => 15 ft = 11feet additional

Total 13 feet additional pavement (width)

13 feet (2 directions) x 24 miles x 5280feet/mile = 3,294,720 ft^2 = 366,080 yd^2

Use PCC cost of \$160 / yd^3 => 366,080 yd^2 x11in. x(1yd/36in.) x\$160 = \$17,897,244

Project estimated cost \$150,465,382

Range of savings in construction costs 10-15%

Say 12% for savings estimate => \$ 18,055,845

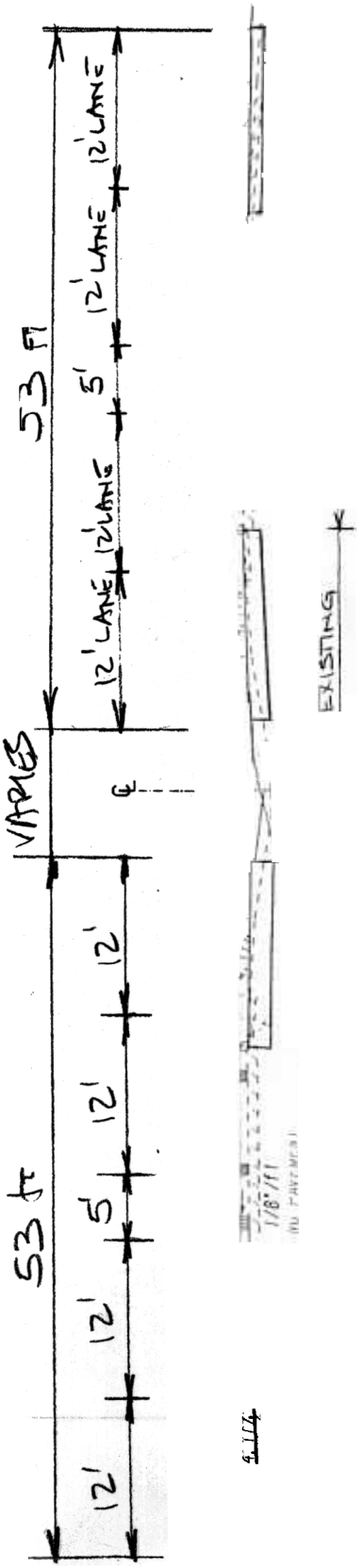
SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 1

SHEET NO.: 4 of 5

☐ AS DESIGNED ☑ ALTERNATIVE



SECTION

EXISTING

CALCULATIONS

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 1

DESCRIPTION:

SHEET NO.: 5 of 5

ADDITIONAL PAVEMENT AREA

OUTSIDE SHOULDER 12 ⇒ 14 ft - 2 FEET / ADDITIONAL

INSIDE SHOULDER 4 ft ⇒ 15 ft - 9 FEET ADDITIONAL

11 FEET ADDITIONAL PAVEMENT

$$1\ ft\ (2\ \text{DIRECTIONS})\ 24\ \text{MILES}\left(\frac{5280\ ft}{1\ \text{MILE}}\right) = 2,787,840\ ft^2$$

$$= 309,760\ yd^2$$

USE PCC COST - $160\ \$/yd^3$

$$309,760\ yd^2 \left(11\ \text{INCH}\ \frac{1\ yd}{36\ \text{IN}}\right) 160\ \$/yd^3 =$$

$\$15,143,822$

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: **3**

DESCRIPTION: **REPLACE PAVEMENT WITH FULL-DEPTH DESIGN**

ORIGINAL DESIGN: (Sketch attached)

The original design calls for the overlay of the existing concrete pavement section with continuous reinforced concrete, and the replacement of the paved concrete outside shoulders with full-depth concrete shoulder pavement. Sketches shown are typical sections.

ALTERNATIVE: (Sketch attached)

The alternative sign calls for the removal of the entire pavement section, and replacement with full-depth continuous reinforced concrete, including full-depth concrete shoulder pavement. Sketches shown are typical sections.

ADVANTAGES:

- Allows it to be built back at original profile grade line
- Traffic staging becomes easier to maintain
- Requires no bridge clearances
- Lengthens life and lowers initial cost

DISADVANTAGES:

- None apparent

DISCUSSION:

Revising the original design by replacing the overlay section with the full -depth section will allow rehabilitation of the roadway while maintaining the existing profile grade line. This will make the traffic staging easier to maintain and will maintain the bridge clearances that exist today, eliminating the need to jack the existing bridges.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 16,612,107**	¾	**$ 16,612,107**
ALTERNATIVE	**$ 10,715,477**	¾	**$ 10,715,477**
SAVINGS	**$ 5,896,630**	¾	**$ 5,896,630**

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: **3**

DESCRIPTION: **REPLACE WITH FULL DEPTH DESIGN**

The original design calls for the overlay of the existing pavement with an 11" continuous reinforced concrete overlay and a 330#/sy 19mm asphalt layer. The proposed alternative calls for a full depth replacement with an 11" continuous reinforced concrete layer, a 330#/sy 19mm asphalt layer and a 12" layer of GAB. The original design, since it will overlay the existing pavement by 14" will raise the profile grade line and will create substandard clearances at bridge overpasses. Therefore the original design will require jacking the existing bridges to establish acceptable clearances. The proposed alternative, since it will remove and replace the existing pavement at the existing profile grade line, will allow the clearances at bridge overpasses to remain as they exist and will not require jacking the bridges.

The cost differences between the original design and the proposed alternative will be limited to the differences in pavement cost in the travel lanes (full depth shoulder pavement for both the 12' outside land and the 4' inside lane are proposed in both alternatives), the costs for bridge jacking, drainage, culverts, approach slabs and earthwork.

The proposed limits of this project are from the Alabama state line to SR 61, a distance of 24 miles. Cross-overs and maintenance of traffic should be similar in both cases.

PAVEMENT COST – The difference between the two pavement sections is:

Original design – 11"CRC, 330#/sy19mm asphalt. Alternative – 11"CRC, 330#/sy19mm asphalt, 12"GAB

Therefore, there would be a cost increase in the GAB quantities

GAB area = 24 miles x 4 lanes x 24 miles x12' = 675,840 sy

GAB volume = 675,840 syx12"x 1yd / 36" = 225,280 cy

GAB tonnage = 225,280 cy x 2 tons/cy = 450,560 tons

GAB cost increase = 450,560 tons x $12.41/ton = $5,591,450

Note: Unit cost from concept estimate used. Unit cost may be low. Need to verify.

BRIDGE JACKING – Difference between the two alternatives:

Original – bridge jacking required Alternative – bridge jacking not required

Cost savings - $ 2,220,000 (from concept estimate item 1.b.)

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Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: **3**

DESCRIPTION: **REPLACE WITH FULL DEPTH DESIGN**

DRAINAGE – Difference between the two alternatives:

Original Design– 14"overlay required grading to establish shoulders and slopes, which require drainage improvements.

Proposed Design – Remove and replace existing pavement at existing grade. Only minor grading required which should not disturb existing system.

Cost savings $225,000 + $ 267, 850 = $49,2850 (from Concept Estimate, items 2.d.1 & 2.d.3)

CULVERTS – Difference between the two alternatives:

Original – 14"overlay required grading to establish shoulders and slopes, which require culvert extensions.

Proposed – Remove and replace existing pavement at existing grade. Only minor grading required which should not disturb the existing grade.

Box culvert cost savings = $ 265,000 (from Concept Estimate item 1.d)

Bridge culvert cost savings – Bridge culverts were included in the concept estimate, but was documented in Alternative No. 6 Cost savings = $ 1,192,500

APPROACH SLABS – Difference between the two alternatives:

Original – 14" overlay requires approach slab reconstruction

Proposed – Remove and replace existing pavement at existing grade does not require approach slab reconstruction.

Approach slab cost savings = $ 425,000 (Concept Estimate item 5.d)

EARTHWORK – Difference between two alternatives:

Original – 14" overlay will require grading to establish median shoulders and slopes and outside shoulders and slopes.

Proposed – Remove and replace existing pavement at existing grade. Only minor grading required for median and outside shoulder and slopes which is negligible.

Cost savings = $ 2,300950 + $ 4,511750 = $ 6,892,730 (Concept Estimate items 2.b & 2.c)

SKETCHES

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ALTERNATIVE NO.: 3

☒ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 4 of 16

ORIGINAL DESIGN TYPICAL SECTION

A- UNBONDED CONTINUOUS REINF. CONCRETE OVERLAY - 11"
B- CONTINUOUS REINFORCED CONCRETE - 11"
C- 19 MM SUPERPAVE, 330 #/SY
D- GAPS - 12"
E- POLYMER COMPACTED CONCRETE - 6"
F- 19 MM SUPERPAVE, 880 #/SY

SKETCHES

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 3

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 5 of 16

PROPOSED ALTERNATIVE TYPICAL SECTION

A - CONTINUOUS REIN FORCED CONCRETE - 11"
B - 19 mm SUPERPAVE, 330 lb/SY
C - GAB - 12"

SKETCHES

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 3

☐ AS DESIGNED ☒ ALTERNATIVE STAGING PLAN

SHEET NO.: 6 of 16

STAGE I

- MAINTAIN TRAFFIC IN CURRENT LANE CONFIGURATION
- CONSTRUCT PERMANENT FULL DEPTH 12' SHOULDER PAVEMENT IN EASTBOUND AND WESTBOUND DIRECTIONS
- CONSTRUCT PERMANENT FULL DEPTH 4' SHOULDER PAVEMENT IN EASTBOUND DIRECTION

EXISTING PAVEMENT - EXISTING PAVEMENT

- PERMANENT PAVEMENT CONSTRUCTED THIS STAGE

- PERMANENT PAVEMENT CONSTRUCTION PREVIOUS STAGES

- PERMANENT PAVEMENT CONSTRUCTION FUTURE STAGES

SKETCHES

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
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Concept Development

ALTERNATIVE NO.: 3

☐ AS DESIGNED ☒ ALTERNATIVE STAGING PLAN

SHEET NO.: 7 of 16

STAGE II

- INSTALL BARRIERS AND SHIFT TRAFFIC
  - SHIFT EASTBOUND TRAFFIC TO OUTSIDE EASTBOUND LANE AND 12' SHOULDER PAVEMENT
  - SHIFT INSIDE LANE OF WESTBOUND TRAFFIC TO INSIDE EASTBOUND LANE AND SHOULDER PAVEMENT
  - SHIFT OUTSIDE LANE OF WESTBOUND TRAFFIC TO 12' SHOULDER PAVEMENT
- CONSTRUCT PERMANENT FULL DEPTH 12' INSIDE LANE IN WEST BOUND DIRECTION
- CONSTRUCT PERMANENT FULL DEPTH 4' SHOULDER PAVEMENT IN WESTBOUND DIRECTION

EXISTING PAVEMENT - EXISTING PAVEMENT

- PERMANENT PAVEMENT CONSTRUCTED THIS STAGE
- PERMANENT PAVEMENT CONSTRUCTED PREVIOUS STAGES
- PERMANENT PAVEMENT CONSTRUCTION FUTURE STAGES

SKETCHES

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
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Concept Development

ALTERNATIVE NO.: 3

☐ AS DESIGNED ☒ ALTERNATIVE STAGING PLAN

SHEET NO.: 8 of 16

ULTIMATE SECTION

STAGE SECTION

STAGE III

- INSTALL BARRIERS AND SHIFT TRAFFIC
  - EASTBOUND AND INSIDE WESTBOUND TRAFFIC TO REMAIN AS SHOWN IN STAGE II
  - OUTSIDE WESTBOUND LANE TO BE SHIFTED TO INSIDE WESTBOUND LANE AND SHOULDER PAVEMENT
- CONSTRUCT PERMANENT FULL DEPTH 12' OUTSIDE LANE IN WESTBOUND DIRECTION

EXISTING PAVEMENT - EXISTING PAVEMENT

- PERMANENT PAVEMENT CONSTRUCTED THIS STAGE

- PERMANENT PAVEMENT CONSTRUCTED PREVIOUS STAGES

- PERMANENT PAVEMENT CONSTRUCTED FUTURE STAGES

SKETCHES

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 3

☐ AS DESIGNED ☒ ALTERNATIVE STAGING PLAN

SHEET NO.: 9 of 16

STAGE IV

- INSTALL BARRIERS AND SHIFT TRAFFIC
- SHIFT WESTBOUND TRAFFIC TO OUTSIDE WESTBOUND LANE AND 12' SHOULDER PAVEMENT
- SHIFT INSIDE LANE OF EAST BOUND TRAFFIC TO INSIDE WESTBOUND LANE AND 4' SHOULDER PAVEMENT
- SHIFT OUTSIDE LANE OF EAST BOUND TRAFFIC TO 12' SHOULDER PAVEMENT
- CONSTRUCT PERMANENT PAVEMENT FULL DEPTH 12' INSIDE LANE IN EASTBOUND DIRECTION

EXISTING PAVEMENT - EXISTING PAVEMENT

- PERMANENT PAVEMENT CONSTRUCTED THIS STAGE

- PERMANENT PAVEMENT CONSTRUCTED PREVIOUS STAGES

- PERMANENT PAVEMENT CONSTRUCTION FUTURE STAGES

SKETCHES

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
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Concept Development

ALTERNATIVE NO.: 3

☐ AS DESIGNED ☒ ALTERNATIVE STAGING PLAN

SHEET NO.: 10 of 16

STAGE V

- INSTALL BARRIERS AND SHIFT TRAFFIC
- WESTBOUND AND INSIDE EASTBOUND TRAFFIC TO REMAIN AS SHOWN IN STAGE IV
- OUTSIDE EASTBOUND LANE TO BE SHIFTED TO INSIDE EASTBOUND LANE AND SHOULDER PAVING
- CONSTRUCT PERMANENT FULL DEPTH 12' INSIDE LANE IN EASTBOUND DIRECTION.

EXISTING PAVEMENT - EXISTING PAVEMENT

- PERMANENT PAVEMENT CONSTRUCTED THIS STAGE

- PERMANENT PAVEMENT CONSTRUCTED PREVIOUS STAGES

- PERMANENT PAVEMENT CONSTRUCTED FUTURE STAGES

SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 2

☐ AS DESIGNED ☒ ALTERNATIVE STAGING PLAN

SHEET NO.: 11 of 16

COST WORKSHEET

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO: 3

Description REPLACE WITH FULL DEPTH DESIGN

SHEET NO. 12 of 12

CONSTRUCTION ITEM		RECONCILED ESTIMATE			ALTERNATIVE ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Graded aggregate base	tons	412,895	12.41	5,124,027	863,455	12.41	10,715,477
Raise existing bridges	Lump sum	1	2,220,000	2,220,000			
Drainage							
Cross drain pipes	From concept estimate			225,000			
Longitudinal system							
Median inlets adjust to grade	From concept estimate			267,850			
Culverts							
Box culverts	From concept estimate			265,000			
Bridge culverts	From concept estimate			1,192,500			
Approach slabs	From concept estimate			425,000			
Earthwork							
Median grading	CY	495,000	4.81	2,380,950			
Outside shoulder grading	CY	938,000	4.81	4,511,780			
	Sub-total			16,612,107			10,715,477
Markup @							
	TOTAL			16,612,107			10,715,477

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.:
4

DESCRIPTION: **USE FULL-DEPTH DESIGN AT INTERCHANGES**

ORIGINAL DESIGN:

The original design overlays the entire project except for full-depth replacement for the beginning and ending 3 miles (total of 6 miles). Existing crossover bridges must be jacked to accommodate the vertical clearance reduction due to the overlay.

ALTERNATIVE:

The alternative uses full-depth replacement (FDR) of the pavement in the interchange areas in addition to the beginning and ending locations that are to be full-depth replaced in the original design.

ADVANTAGES:

- Requires no bridge jacking
- Creates no conflict with existing ramp tie-ins

DISADVANTAGES:

- None apparent

DISCUSSION:

Replacing the pavement at the same elevation would remove the requirement to jack the existing concrete bridges while maintaining the existing vertical clearances.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 6,754,000**	¾	**$ 6,754,000**
ALTERNATIVE	**$ 2,932,500**	¾	**$ 2,932,500**
SAVINGS	**$ 3,821,500**	¾	**$ 3,821,500**

SKETCHES

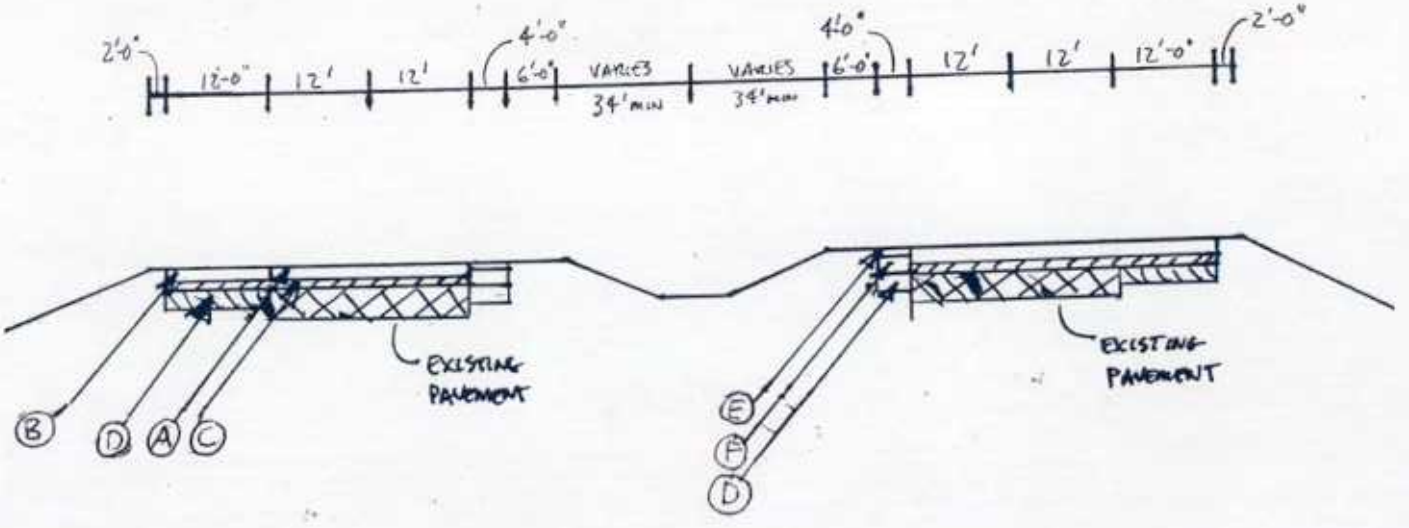
PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 4

SHEET NO.: 2 of 5

☒ AS DESIGNED ☐ ALTERNATIVE

ORIGINAL DESIGN TYPICAL SECTION



A- UNBONDED CONTINUOUS REINF. CONCRETE OVERLAY - 11"
B- CONTINUOUS REINFORCED CONCRETE - 11"
C- 19 mm SUPERPAVE, 330 #/SY
D- GAB - 12"
E- ROLLER COMPACTED CONCRETE - 6"
F- 19 mm SUPERPAVE, 880 #/SY

SKETCHES

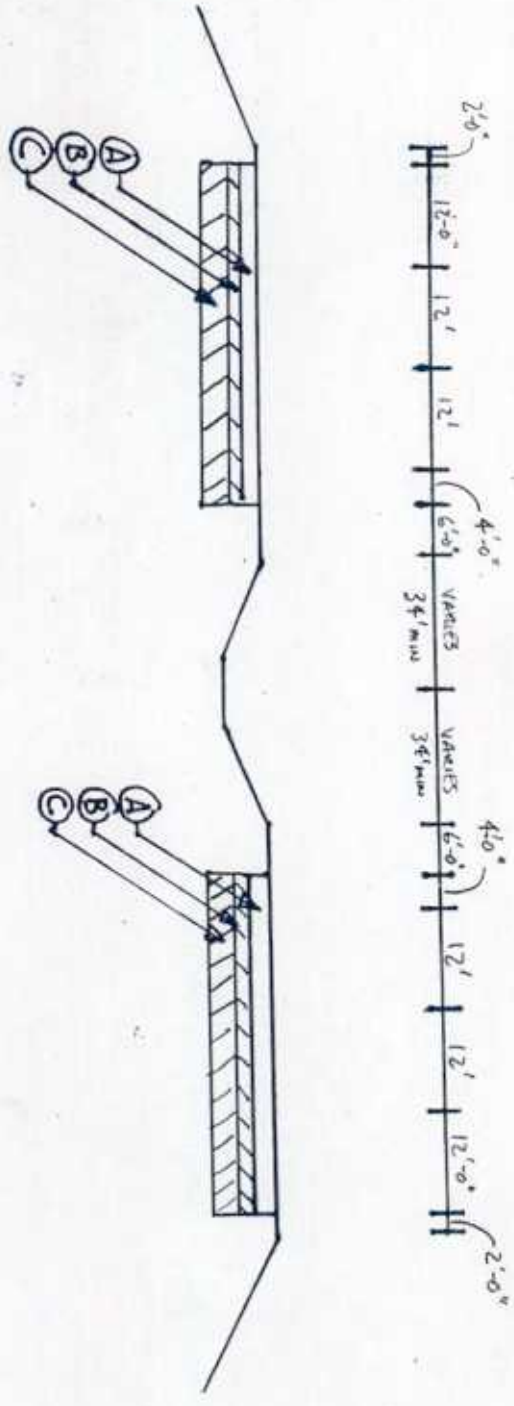
PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 4

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 3 of 5

PROPOSED ALTERNATIVE TYPICAL SECTION



A - CONTINUOUS REIN FORCED CONCRETE - 11"
B - 19 mm SUPERPAVE, 330 #/SY
C - GAB - 12"

CALCULATIONS

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 4

DESCRIPTION: US6 FULL DEPTH REPLACEMENT @ INTERCHANGES

SHEET NO.: 4 of 5

OVERPASSES

SR 402/I20	UNDER	CR 140	2100'
	UNDER	CR 348	5000' (INTERCHANGE)
	UNDER	CR 219	2100'
	UNDER	SOUTH. RR	600' (NOTE: REMAINDER INCLUDED IN FDR @ US 27)
	UNDER	CR 244	2100'
	UNDER	S-2185	2100'
	UNDER	CR 29	2100'
	UNDER	S-1809	2100'
	UNDER	SR 113	5000' (INTERCHANGE)
	UNDER	CR 319	2100'
	UNDER	CR 830	2100'
	UNDER	CR 356	2100'
	UNDER	SR 61	5000'

34,500 ft

AMOUNT OF ADDITIONAL FULL DEPTH REPLACEMENT REQUIRED FOR ALTERNATE DESIGN

COST WORKSHEET

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO: 4

CONSTRUCTION ITEM		RECONCILED ESTIMATE			ALTERNATIVE ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Overlay with 11" CRC	LFT	34,500	132.00	4,554,000			
Bridge jacking				2,200,000			
Full depth replacement pavement					34,500	85.00	2,932,500
	Sub-total			6,754,000			2,932,500
Markup @							
	TOTAL			6,754,000			2,932,500

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: **6**

DESCRIPTION: **USE BARN ROOF SIDE SLOPES TO AVOID EXTENDING CULVERTS**

ORIGINAL DESIGN: (Sketch attached)

The original design will add additional fill to the cross section and cause the side slopes to extend such that nine existing bridge culverts and five existing box culverts might need to be extended.

ALTERNATIVE: (Sketch attached)

Alternate design would use "barn roof" side slopes to tie fills in quicker (beyond the clear zone).

ADVANTAGES:

- No need to extend culverts
- Reduces earthwork
- Equal with regard to safety
- No work in streams or sensitive areas

DISADVANTAGES:

- None apparent

DISCUSSION:

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 1,628,776**	¾	**$ 1,628,776**
ALTERNATIVE	**$ 0**	¾	**$ 0**
SAVINGS	**$ 1,628,776**	¾	**$ 1,628,776**

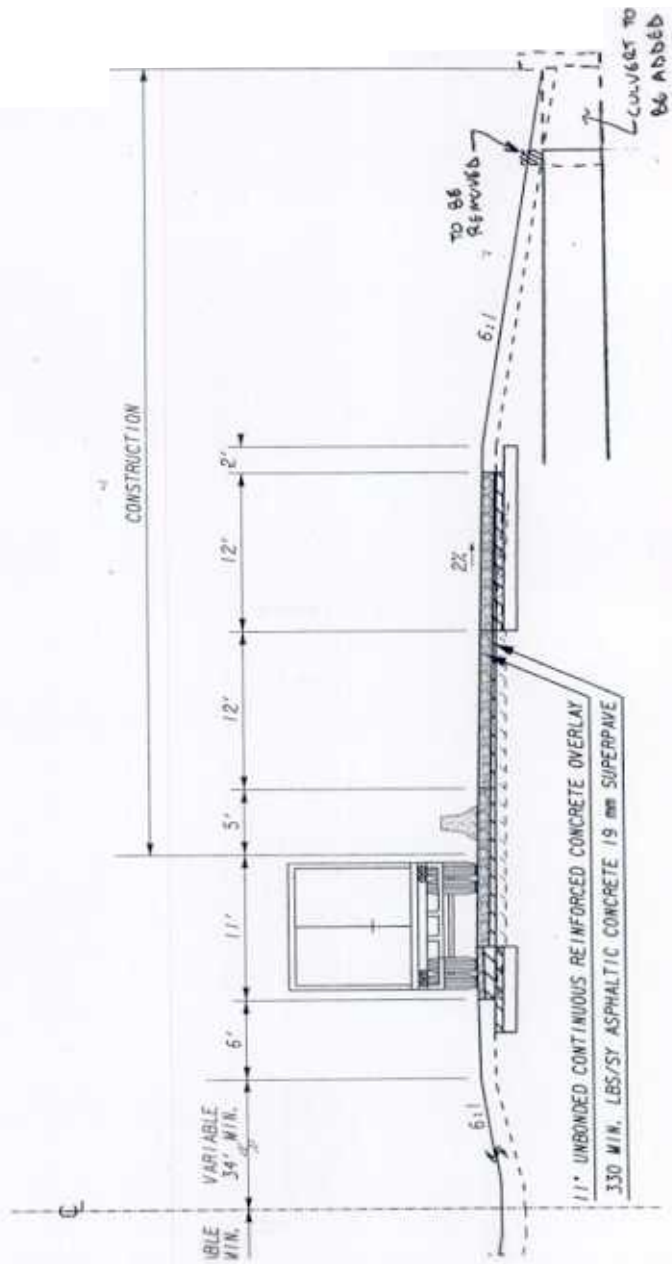
SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 6

■ AS DESIGNED ☐ ALTERNATIVE

SHEET NO.: 2 of 15



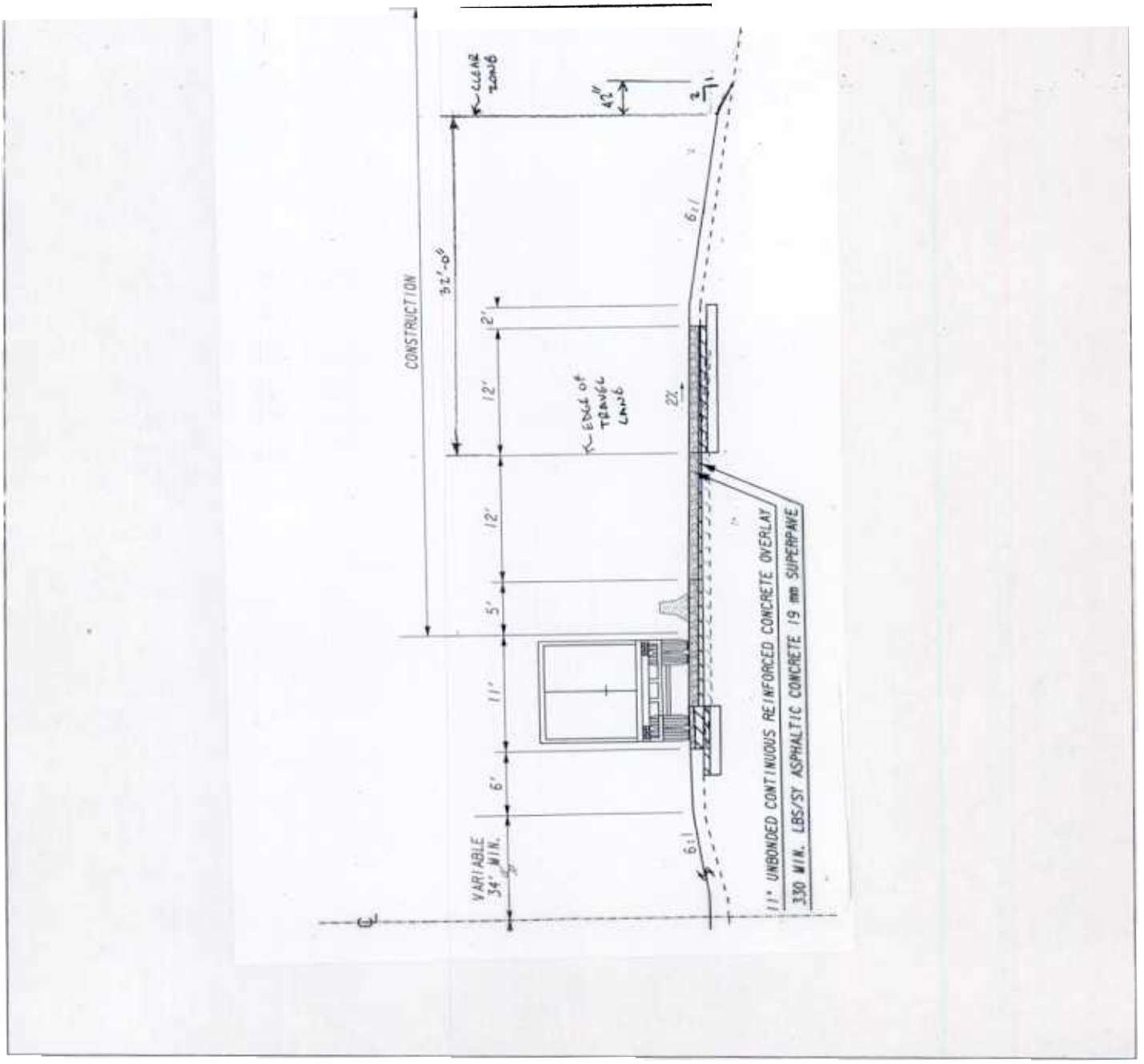
SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 6

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 3 of 15



CALCULATIONS

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 6

DESCRIPTION: USE "BARN ROOF" SIDE SLOPES TO ELIM. EXTENDING CULVERTS

SHEET NO. 4 of 15

COST/LF

10x8 CULVERT (SAY 30' FILL)

2003 CLASS A CONC.

3.375 yd³/LF × $387.13 x.03 × 1.08 = $14 /LF

539.33 #/LF × $0.51/# × 1.08 = $297/LF

4% markup for 2 years

$1708/LFT

10x6 CULVERT (SAY 30' FILL)

2.872 yd³/LF × $387.13 .08 = $1201

343.83 #/LF × $0.51/# × 1.08 = $189

$1390/LFT

OVERLAY OPTION ADDS 14" TO OVERALL HEIGHT

SO, AT SHOULDER BREAKPOINT GROUND IS 14" HIGHER.

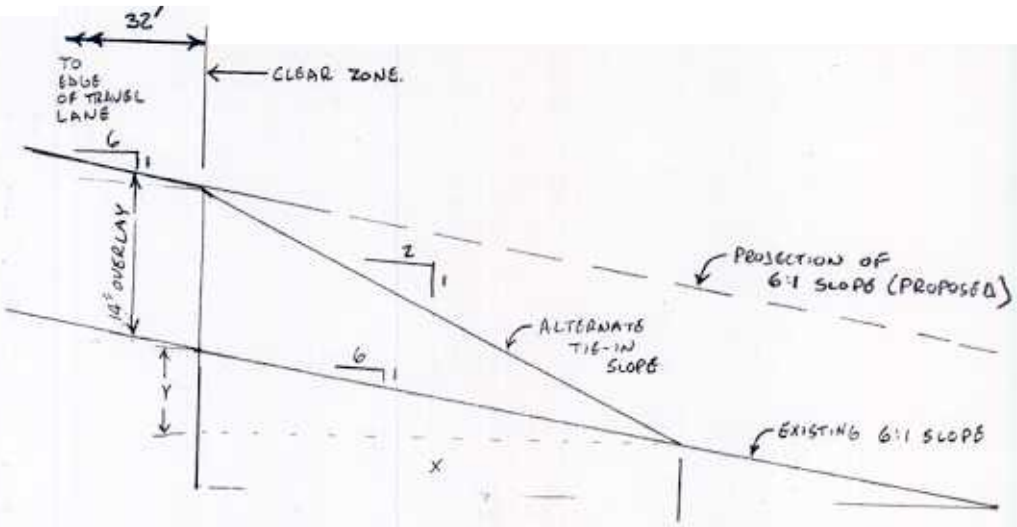
TO MAINTAIN SLOPES THE CULVERTS WOULD HAVE TO BE EXTENDED AS FOLLOWS:

SLOPE	LENGTH TO EXTEND
2:1	2.33'
3:1	3.50
4:1	4.67
5:1	5.83
6:1	7'00 ← SLOPES ON PROJECT

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 6

DESCRIPTION: USE "BARN ROOF" SIDE SLOPES TO ELIM. EXTENDING CULVERTS



$y = \frac{x}{2} - 14"$

$y = \frac{x}{6}$

$\frac{x}{6} = \frac{x}{2} - 14"$

$+14" - \frac{x}{6} \quad -\frac{x}{6} + 14"$

$14" = \frac{3x - x}{6}$

$14 = \frac{2x}{6}$

$14" = \frac{x}{3}$

$x = 42"$

2:1 SLOPE TIE-IN DETAIL

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 6

DESCRIPTION: USE "BARN ROOF" SIDE SLOPES TO ELIM. EXTENDING CULVERTS

FROM ANDY CASEY, GDOT PM, THE ESTIMATE CONSIDERS ADDING 10' TO THE BOX CULVERTS BUT DOESN'T CONSIDER ADDING LENGTH TO THE BRIDGE CULVERTS. IF THE SLOPES DON'T TIE IN QUICK ENOUGH THE BRIDGE CULVERTS WOULD NEED EXTENSION ALSO OR THE SLOPES WOULD BE WARPED TO TIE-IN.

VE COST ESTIMATE - BOX CULVERTS

EXTEND 3 10x8 CULVERTS & 1 10 x 6

(CULVERTS, SIDES)

10x8: 3 x 2 x 10' x $1708/LFT = $102,480

10x6: 1 x 2 x 10 x $1390/LFT = 27,800

$130,280

+ 8 headwalls @ $10K (est.) each = 80,000

+ remove 8 headwals @ $2759.44 (MEAN ITEM SUMMARY) = 22,076

232,356

GDOT ESTIMATE - BOX CULVERTS 265,000 (CLOSE) ← USE

COST EACH (AVG) = $66,250

FOR EXTENDING THE BRIDGE CULVERTS, EXPECT THESE TO BE TWICE AS EXPENSIVE AS EXTENDING A BOX CULVERT.

9 BRIDGE CULVERTS x $66,250 (BOX CULVT.) x 2 (TWICE AS MUCH) = $1,192,500

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 6

DESCRIPTION: USE "BARN ROOF" SIDE SLOPES TO ELIM. EXTENDING CULVERTS

TOTAL COST OF EXTENDING ALL CULVERTS

TOTAL = BOX CULVERT COST + BRIDGE CULV. COST

TOTAL = 265,000 + 1,192,500

TOTAL = $1,457,500

REDUCTION IN EARTHWORK: ← SEE PROV. CALC.

2:1 SLOPE TIES IN IN 42' FOR A 14' OVERLAY

6:1 SLOPE MAY NOT TIE IN AT ALL

SAY

6:1 TIES IN IN 10' ← GUESS — $14'/12 \times 0'/2 = 5.83\ ft^2/FT$

2:1 TIES IN IN 3'-6" — $\frac{14'}{12} \times 3.5'/2 = 2.04\ ft^2/FT$

DIFF = $3.79\ ft^2/Ft/side$

$\times$ 2 sides

$7.587\ ft^2/Ft$

24 miles & 100% FILL: $\times$ 126,720 ft $\times$ 1.0

961,425 ft^3

= 35,608 yd^3

$\times \$4.81/yd^3$

$171,276

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 6

DESCRIPTION:

SHEET NO.: 8 of 15

TOTAL COST OF ORIGINAL DESIGN

CULVERTS	$1,457,500
EARTHWORK	71,276
	$1,628,776

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: **9**

DESCRIPTION: **REDUCE TO ONE LANE CONTRA-FLOW TRAFFIC DURING STAGING**

ORIGINAL DESIGN:

The original design calls for two lanes of traffic in each direction to remain open during construction.

ALTERNATIVE: (Sketch attached)

The proposed design calls for the traffic to be reduced down to one lane in each direction and for traffic to be shifted to one side of the road to open up the opposing side of the road to construct the entire with of the road with minimal interference. Attached sketches are typical sections.

ADVANTAGES:

- Saves construction time
- Increases work zone safety
- Saves cost

DISADVANTAGES:

- Causes user delays during construction

DISCUSSION:

This alternative would open up the opposing side of the road to be free of traffic during construction, thereby creating a much safer construction work zone, and one that will allow the contractor to build the road much faster. This would significantly cut the construction time required, and reduce traffic control and other costs.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 13,546,356**	¾	**$ 13,546,356**
ALTERNATIVE	**$ 6,773,178**	¾	**$ 6,773,178**
SAVINGS	**$ 6,773,178**	¾	**$ 6,773,178**

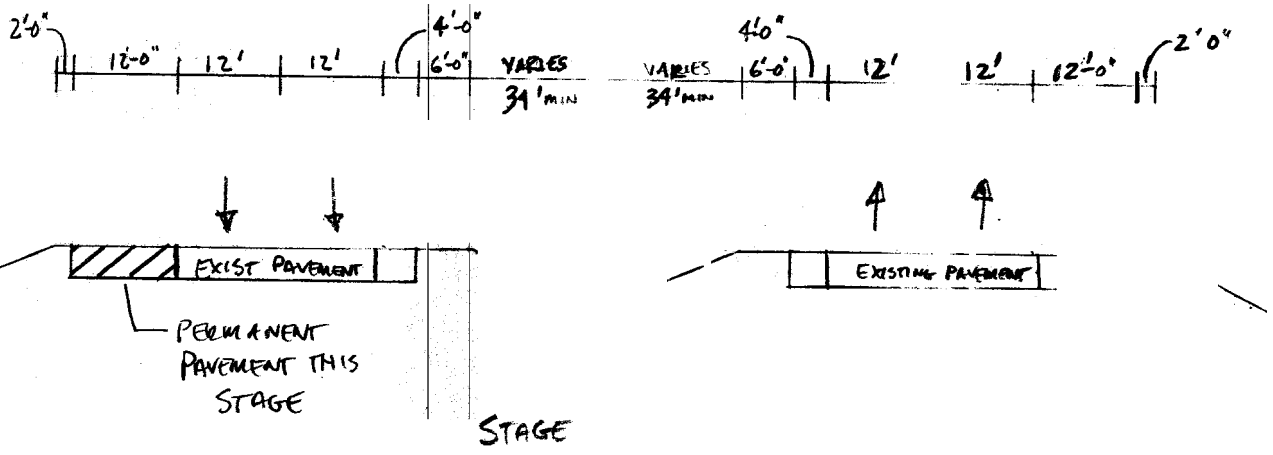
SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 2 of 8



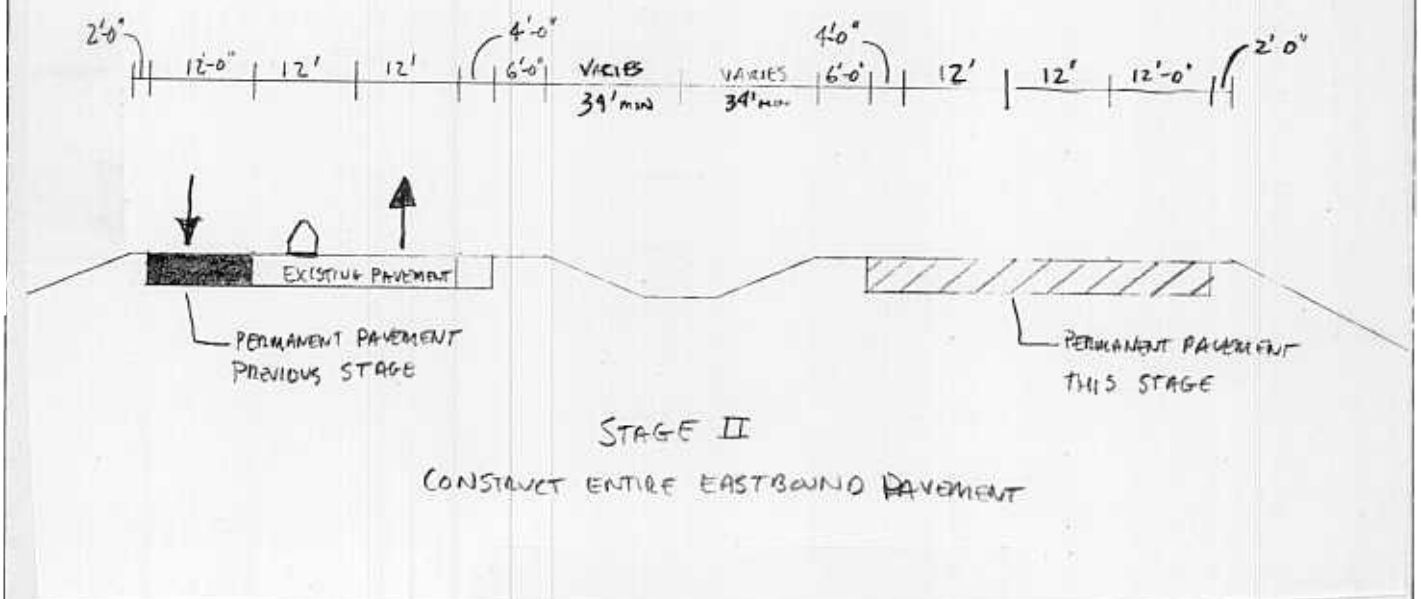
CONSTRUCT WESTBOUND 12' SHOULDER

SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE



STAGE II

CONSTRUCT ENTIRE EASTBOUND PAVEMENT

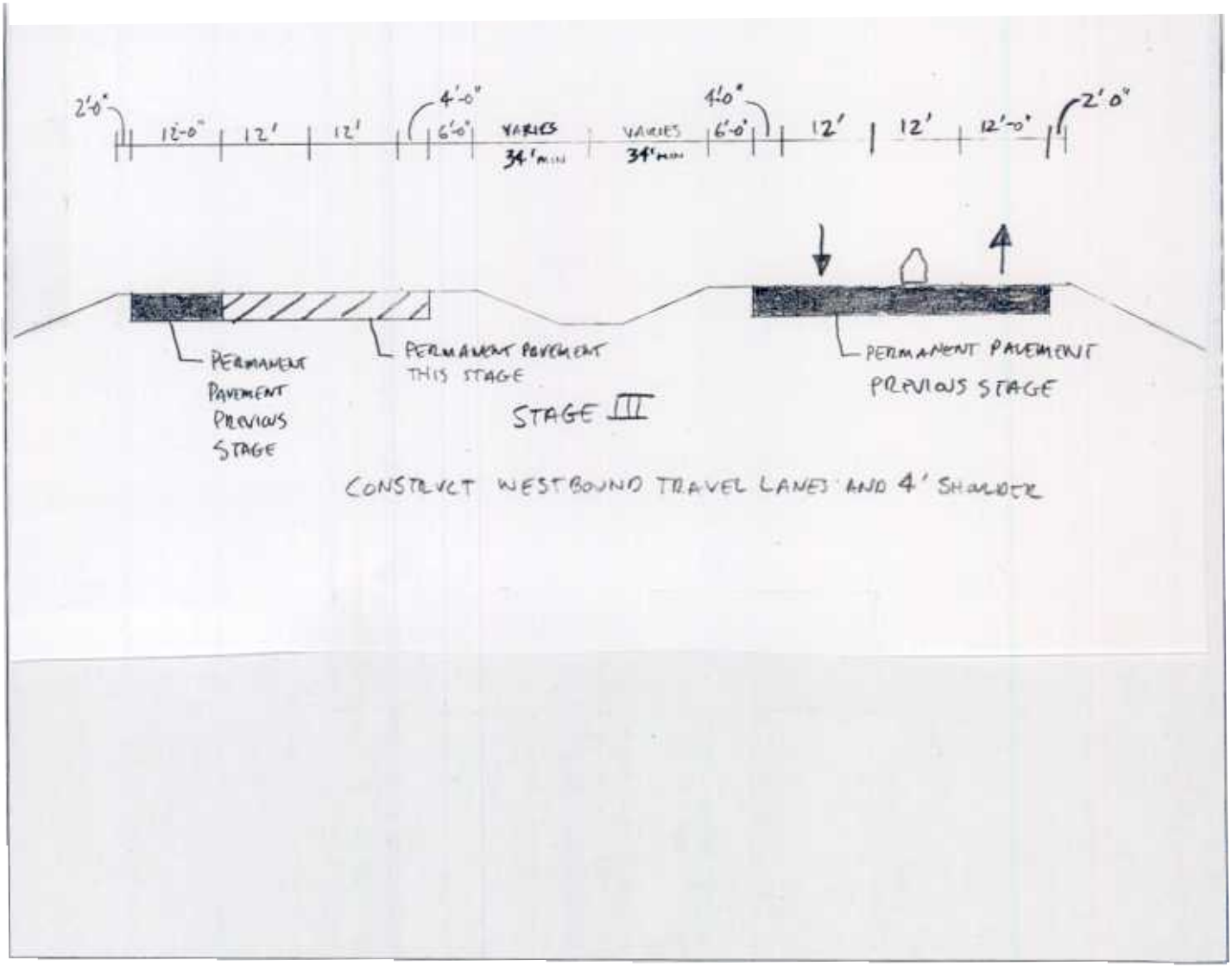
SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 4 of 8



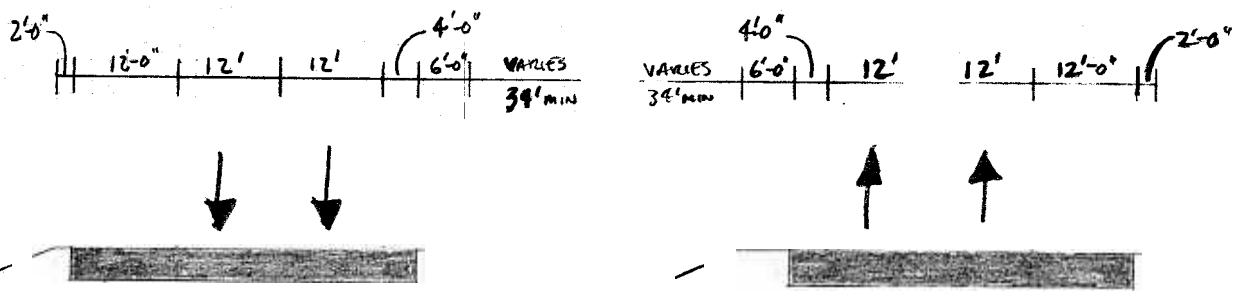
SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 9

☐ AS DESIGNED ☒ ALTERNATIVE

SHEET NO.: 5 of 8



STAGE IV

RETURN TRAFFIC TO NORMAL TRAFFIC FLOW PATTERNS

CALCULATIONS

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO. 9

DESCRIPTION: REDUCE TO ONE LANE CONTRAFLOW TRAFFIC DURING CONSTRUCTION

SHEET NO.: 6 of 8

BY REDUCING DOWN TO ONE LANE OF TRAFFIC EACH DIRECTION AND SHIFT TO ONE SIDE, SIGNIFICANT TIME SAVINGS WILL BE REALIZED. IN BOTH CASES, IT IS ANTICIPATED THAT TRAFFIC SHIFTS WILL BE REQUIRED AT ABOUT THE SAME INTERVAL FOR BOTH CASES. BY REDUCING THE TRAFFIC TO ONE LANE AND CONTRAFLOW, THE CONTRACTOR CAN CONSTRUCT THE ENTIRE WIDTH OF THE ROAD IN ONE STAGE INSTEAD OF PIECE MEAL IN THE ORIGINAL DESIGN. ALSO, IN THIS CASE REDUCING THE TRAFFIC TO ONE WAY CONTRAFLOW, THE CONTRACTOR WILL ONLY BE REQUIRED TO INSTALL MEDIAN BARRIER SEPARATION IN ONE LOCATION (TO SEPARATE THE OPPOSING TRAFFIC FLOW) AS OPPOSED TO TWO LOCATIONS IN THE ORIGINAL DESIGN (TO SEPARATE THE OPPOSING TRAFFIC FLOW, AND TO PROTECT THE WORK ZONE FROM TRAFFIC). COST SAVINGS WITH THE MEDIAN BARRIER CAN BE REALIZED IN THE FOLLOWING AMOUNT

ORIGINAL DESIGN - 24 MILES $\times \frac{5280'}{mi} \times$ 2 LOCATIONS $\times$ \$25.83 = \$6,546,356

PROPOSED ALTERNATIVE - 24 MILES $\times \frac{5280'}{mi} \times$ 1 LOCATION $\times$ \$25.83 = \$3,273,178

SAVINGS - \$3,273,177

WITH THE CONTRACTOR HAVING A FREE SIDE TO WORK ON, HE CAN CONSTRUCT THE ROAD IN LESS STAGES, ALLOWING THE CONTRACTOR TO MOVE IN BETWEEN WORK ZONES IN HALF THE TIME AS IN THE ORIGINAL DESIGN, WHICH WOULD REDUCE THE CONSTRUCTION CONTRACT TIME EFFECTIVELY IN HALF.

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 9

DESCRIPTION: REDUCE TO ONE LANE CONTRAFLOW TRAFFIC DURING CONSTRUCTION

THE ONE LANE CONTRAFLOW ALTERNATIVE ALSO CREATES A DRAMATICALLY SAFER CONSTRUCTION WORK ZONE ALLOWING THE CONSTRUCTION WORKERS TO WORK WITHOUT INTERRUPTION.

THE COMBINATION OF THE FREE WORK ZONE AND THE CONSTRUCTION TIME SAVINGS SHOULD SIGNIFICANTLY REDUCE THE CONTRACTORS TRAFFIC CONTROL PRICE BID. IT IS ASSUMED THAT THE CONSTRUCTION TIME SHOULD BE REDUCED IN HALF. SO TO DETERMINE THE COST SAVINGS, IT IS ASSUMED THE TRAFFIC CONTROL WOULD BE REDUCED IN HALF:

TRAFFIC CONTROL:

ORIGINAL DESIGN: $7,000,000 * - FROM CONCEPT ESTIMATE ITEM NO 4A.
PROPOSED ALTERNATIVE: $3,500,000

SAVINGS: $3,500,000

USER DELAYS DURING CONSTRUCTION WOULD BE INCREASED. HOWEVER, SINCE THE CONSTRUCTION TIME DURATION OF THE PROJECT WOULD BE CUT IN HALF, THE USER DELAY COSTS OVER THE DURATION OF EACH ALTERNATIVE WOULD BE SIMILAR IN EACH CASE, SO NO COST SAVINGS OR COST ADDITIONS WOULD BE REALIZED. THE USER WOULD ONLY BE SUBJECT TO DELAYS FOR HALF THE ORIGINAL DESIGN'S PROPOSED DURATION.

COST WORKSHEET

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO: 9

Description:

SHEET NO. 8 of 8

CONSTRUCTION ITEM		RECONCILED ESTIMATE			ALTERNATIVE ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Median Barrier	lf	253,440	26	6,546,355	126,720	25.83	3,273,178
Traffic Control	ls			7,000,000			3,500,000
Sub-total				13,546,355			6,773,178
Markup @							
TOTAL				13,546,355			6,773,178

VALUE ENGINEERING ALTERNATIVE

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: **12**

DESCRIPTION: **USE 4:1 SLOPES IN THE MEDIAN AND OUTSIDE SHOULDERS**

SHEET NO.: 1 of 1

ORIGINAL DESIGN:

The original design calls for matching the existing typical section with 6:1 slopes in the median and outside shoulders.

ALTERNATIVE:

Use 4:1 side slopes in lieu of 6:1 slopes.

ADVANTAGES:

- Reduces earthwork
- Lowers initial cost
- Disrupts less

DISADVANTAGES:

- Not a desirable option to the FHWA

DISCUSSION:

While not desirable to the FHWA, changing the slopes from 6:1 to 4:1 will have cost savings and benefits to the project, including less earthwork, less clearing, and less disruption.

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(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.:
14

DESCRIPTION: **ADD UNDERDRAINS AT SAGS AND WET AREAS**

SHEET NO.: 1 of 1

ORIGINAL DESIGN:

The original cost estimate does not include the cost of adding underdrains to any portion of the project. In conversations with Curtis Grovener of GDOT, it has become apparent that some of the degradation of the concrete pavement is due to water infiltration. This water may be trapped in the subgrade and will not be discovered if the overlay option is used.

ALTERNATIVE:

If the overlay option is used, include underdrains in the project and adjust the budget to account for the addition.

ADVANTAGES:

- Solves water infiltration problems

DISADVANTAGES:

- None apparent

DISCUSSION:

If the full-depth replacement option is chosen, the entire concrete slab and graded aggregate base will be removed. At that point, any trapped water will be discovered. The contract should include a pay item for installation of underdrains.

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(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.:
15

DESCRIPTION: **USE MODIFIED PAVEMENT SECTION**

ORIGINAL DESIGN:

The original design calls for maintaining the current design/pavement section.

ALTERNATIVE:

Use a modified pavement section within "non-problem" areas between the two three-mile sections at either end where the pavement is at its worst.

ADVANTAGES:

- Lowers initial cost
- Creates less traffic disruption
- Reduces grade differential vs. overlay option

DISADVANTAGES:

- None apparent

DISCUSSION:

During the information gathering phase of the VE study, we discussed that about six miles of the full project length of 24 miles were severely deteriorated and cracking. In these areas the existing base is in such poor condition that full replacement is required. In the other 18 miles, however, we are assuming that while the pavement has reached its maximum life expectancy and needs to be reconstructed, the existing base can be salvaged. Even if there will be some areas within the18 miles of "good" base that will require complete reconstruction, we expect these repairs to be relatively minor. We will use the three miles as an assumption; therefore out of the 24-mile length, nine miles will be total replacement and 15 miles will be a modified pavement design salvaging and reusing the existing base. This will result in significant cost savings to the project. An additional benefit of incorporating the reuse of the existing base will be that the overall grade differential will be reduced from 14 in. with the overlay option, to only 5 in. with the modified pavement section. This allows many other benefits including less earthwork, fewer grading and drainage modifications, less bridge jacking, and culvert extension. The smaller grade differential will also help the construction staging and traffic shifts along with matching the grades at the interchange ramps.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN	**$ 5,000,000**	¾	**$ 5,000,000**
ALTERNATIVE	**$ 0**	¾	**$ 0**
SAVINGS	**$ 5,000,000**	¾	**$ 5,000,000**

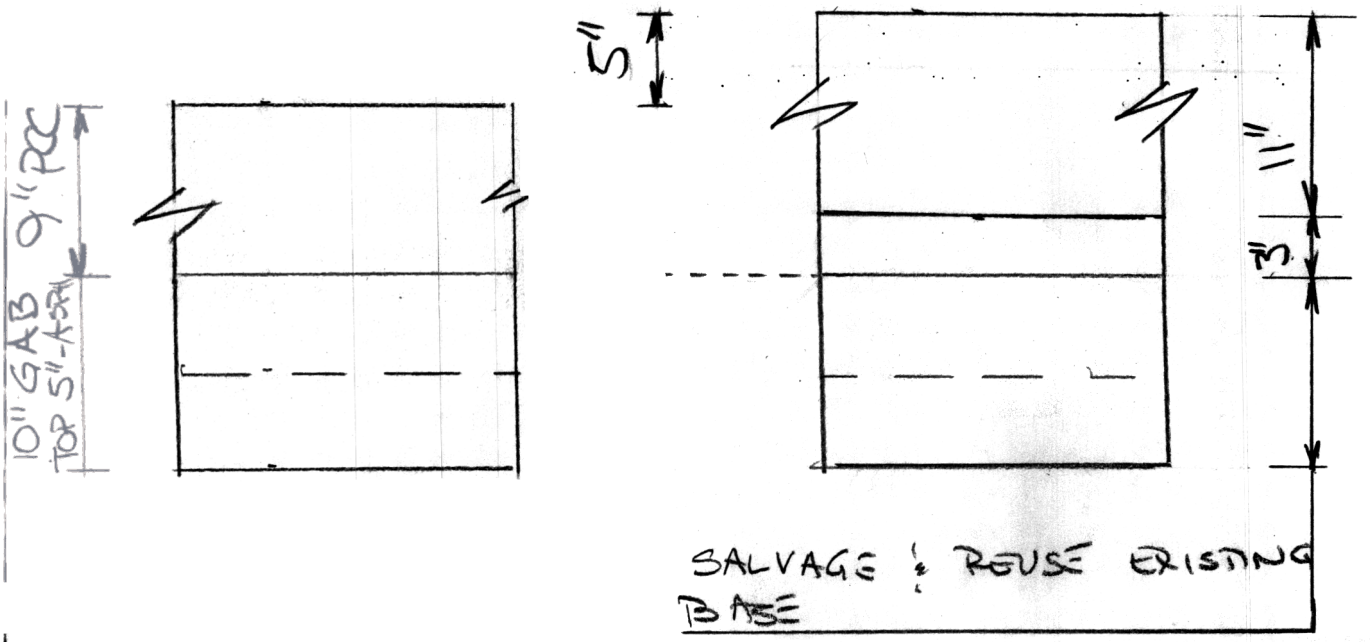
SKETCHES

PROJECT: **CSNHS-M002-00(966), P. I. Number M002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 15

☐ AS DESIGNED ☑ ALTERNATIVE

SHEET NO.: 2 of 4



EXISTING PAVEMENT

MODIFIED PAVEMENT DESIGN

CALCULATIONS

PROJECT: CSNHS-M002-00(966), P. I. Number M002966
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO.: 15

DESCRIPTION:

SHEET NO.: 3 of 4

THIS ALTERNATE WOULD ELIMINATE $\frac{9}{24}$ OF TOTAL G.A.B.

$412{,}895 \text{ TONS} \left(12.41 \frac{\$}{\text{TON}}\right) \frac{9}{24} = \$1{,}921{,}510$

SAVINGS

REDUCE BRIDGE JACKING FROM 14 INCHES TO 5 INCHES / USE 50% REDUCTION

$\$2{,}220{,}000 \left(0.5\right) = 1{,}100{,}000$

ASSUME NOMINAL SAVINGS ON OTHER ITEMS

EARTHWORK / DRAINAGE
TRAFFIC CONTROL USE 2,000,000

$\$ 5{,}021{,}510$

USE $\$ 5{,}000{,}000$

COST WORKSHEET

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties
Concept Development

ALTERNATIVE NO: **15**

Description: USE MODIFIED PAVEMENT SECTION

SHEET NO. 4 of 4

CONSTRUCTION ITEM		RECONCILED ESTIMATE			ALTERNATIVE ESTIMATE		
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Graded aggregate base (net savings)				1,921,510			
Bridge jacking (net savings)				1,100,000			
Miscellaneous items (net savings)				2,000,000			
Sub-total				5,021,510			
Markup @							
TOTAL				5,021,510			

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 three miles of the pavement at each end of the 24 miles included in the project is in poor condition and will continue to deteriorate as traffic grows. The remaining 18 miles of pavement is in the terminal stage of pavement life. The project consists of rehabilitation of the pavement on Interstate Highway 20 (I-20) from the Georgia-Alabama state line to the intersection with SR 61. 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-20 corridor between the Georgia-Alabama state line to the intersection with SR 61. The work includes overlaying the existing pavement with continuous reinforced concrete and replacing the outside shoulder with full depth pavement and the inside shoulder with roller compacted concrete. The project is approximately 24 miles long and spans Haralson and Carroll Counties.

Existing Design Features:

Typical Section(s):	I-20 consists of 4 lanes: two lanes in each direction with 10-ft. inside shoulders, 14-ft. outside shoulders, and a variable width (88 ft. – 150 ft.) depressed median
Maximum Degree of Curve:	2,292 ft.
Maximum Super-Elevation Rate for Curve:	.3.70%
Maximum Grade:	4.0%
Width of Right-of-Way:	300 ft.
Major Structures:	Six mainline bridges crossing SR100, SR1/US 27, and the Little Tallapoosa River, respectively One railroad bridge (I-20 under Norfolk Southern RR) Thirteen bridges where I-20 passes under various State and County roads Nine bridge culverts Five box culverts
Major Interchanges Along the Project	I-20 at SR100 in Haralson County I-20 at CR 348 in Haralson County I-20 at US 27 in Carroll County I-20 at SR 113 in Carroll County
Length of Segment in Haralson County	9.32 miles (MP 0.00 to MP 9.32)
Length of Segment for Carroll County:	14.30 miles (MP 9.32 to MP 23.62)

Proposed Design Features:

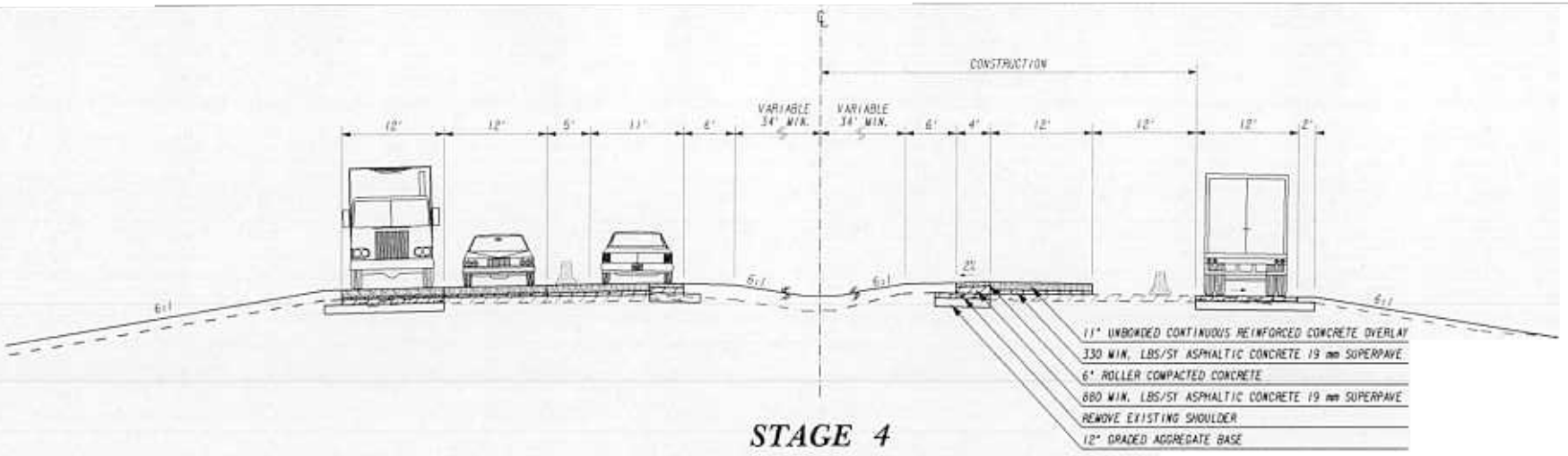
Typical Section(s):	4-12 ft. lanes (2 in each direction) with 10 ft. inside shoulders, 14 ft. outside shoulders and a variable width (88 ft. – 150 ft.) depressed median
Design Speed Mainline:	70 mph
Maximum Grade Mainline:	4.0%; maximum allowable 5.0%
Maximum Grade Side Street:	Not Applicable (N/A); maximum allowable 6.0%
Maximum Grade Driveway:	N/A
Proposed Maximum Degree of Curve:	1° 00'00"
Maximum Degree Allowable	3° 00'00"
Maximum Super-Elevation Rate for Curve:	3.70%
Right-of-Way:	Width: Utilize existing 300 ft. of right-of-way.
Structures:	Eleven highway bridges will be jacked to meet clearance requirements. The status of the railroad bridge was undetermined at the time of the VE workshop
Major Intersections:	No changes are anticipated to the intersections within the project area
Traffic Control during Construction:	Stage traffic control will be utilized on this project
Design Exceptions:	No design exceptions are anticipated
Design Variances:	No design variances are anticipated
Environmental Concerns:	None listed in the Project Concept Report supplied to the VE team
Utility Involvement:	None listed in the Project Concept Report supplied to the VE team

STAGING PLAN

The proposed project includes a six-stage staging plan involving. Graphic depictions of the six stages are attached for reference.

COST DATA

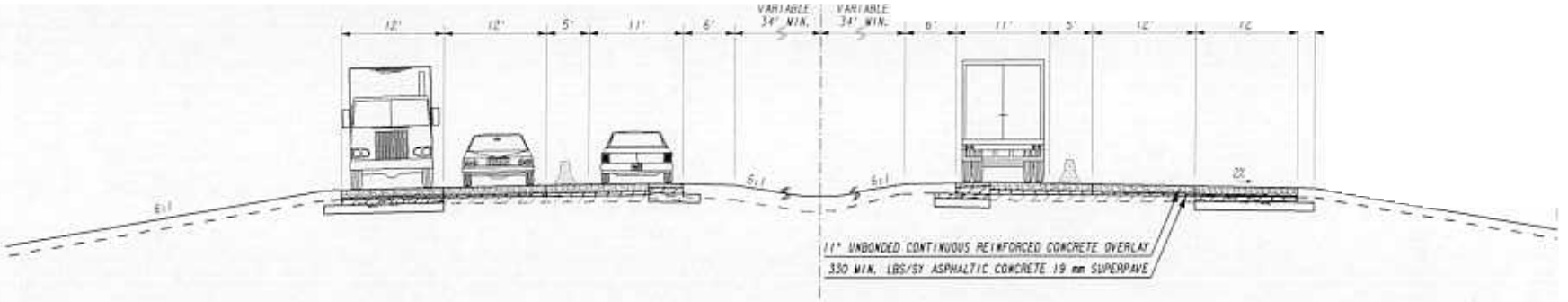
The current probable cost of construction has been identified at $150,365,382 as noted on the Estimate Report for file "M002966" for CSNHS-M002-00(966) Haralson and Carroll Counties. The project contains an E & C item of 10.00%.



STAGE 4

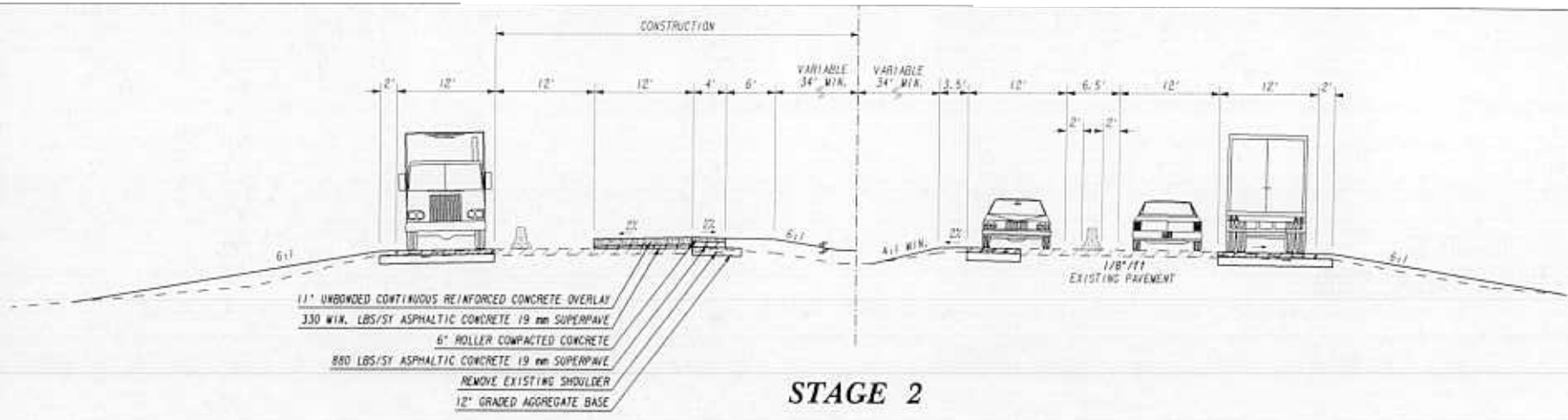
1. SHIFT TWO LANES OF TRAFFIC ACCROSS
2. CONSTRUCT 12' INSIDE TRAVEL LANE.
3. CONSTRUCT 4' INSIDE SHOULDER AND SLOPE

CONSTRUCTION



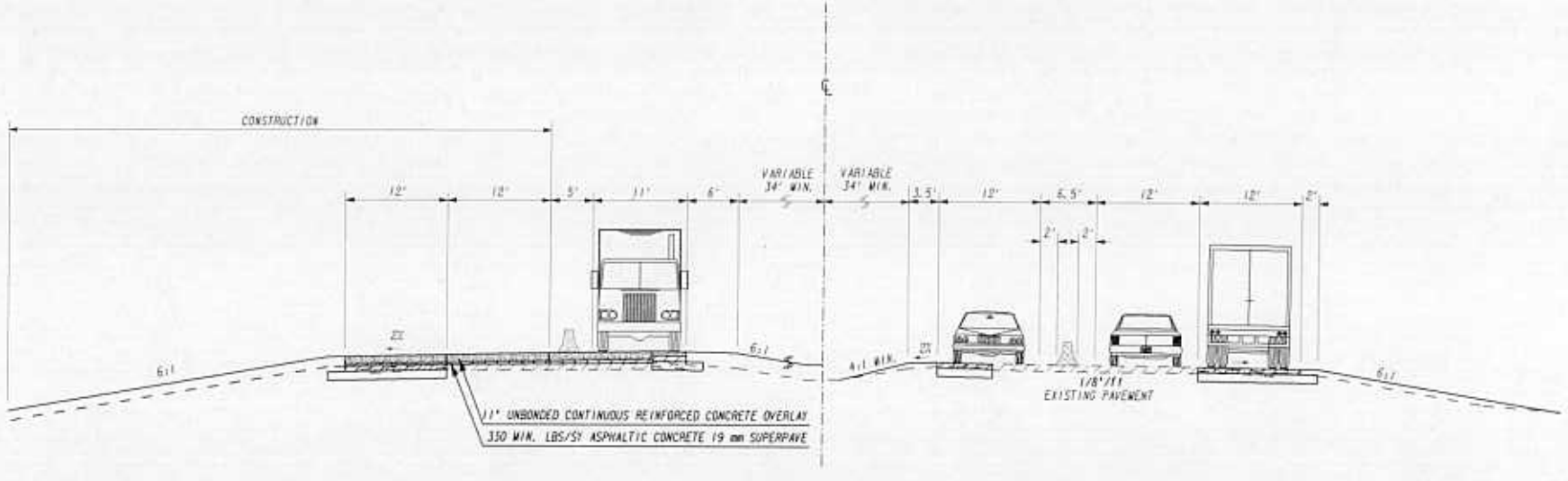
STAGE 5

1. SHIFT ONE LANE OF TRAFFIC.
2. CONSTRUCT 12' OUTSIDE TRAVEL LANE.
3. CONSTRUCT 12' OUTSIDE SHOULDER AND SLOPE.



STAGE 2

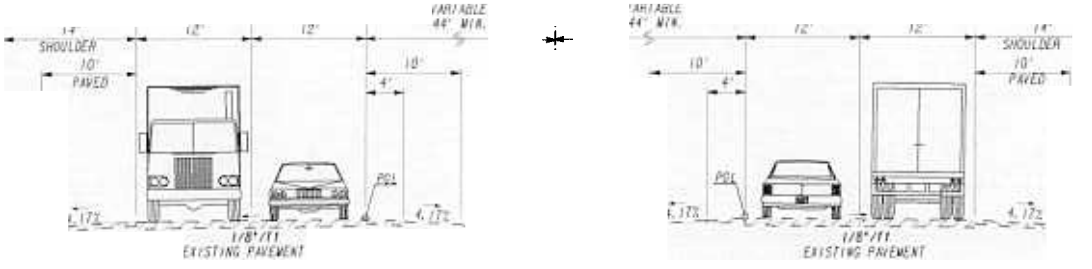
1. SHIFT ONE LANE OF TRAFFIC ACCROSS TO MAINTAIN TWO LANES OF TRAFFIC ON EXISTING PAVEMENT.
2. CONSTRUCT 12' INSIDE TRAVEL LANE.
3. CONSTRUCT 4' INSIDE SHOULDER AND SLOPE.



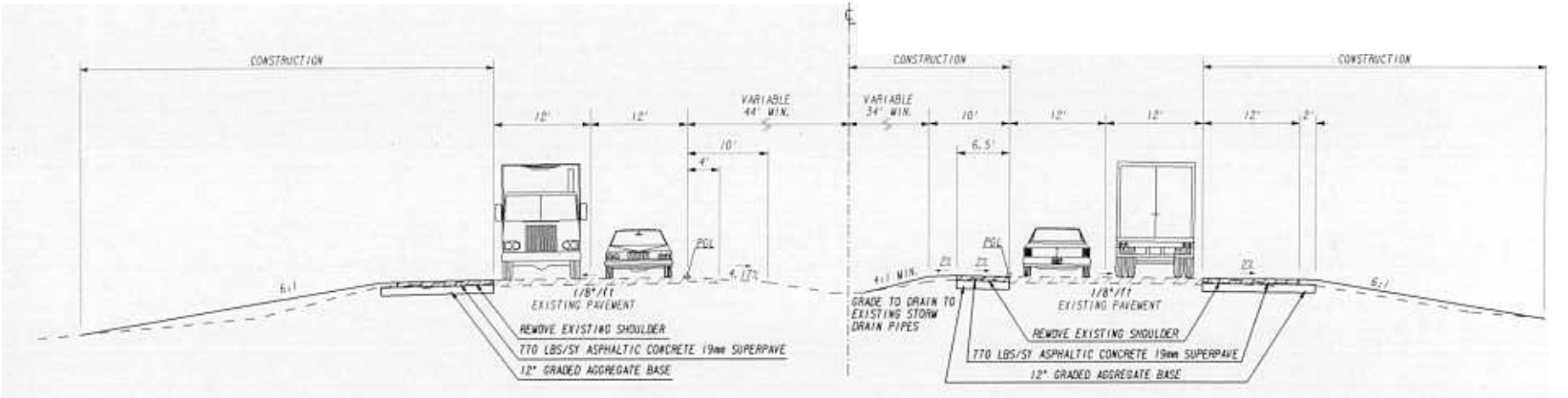
STAGE 3

1. SHIFT ONE LANE OF TRAFFIC.
2. CONSTRUCT 12' OUTSIDE TRAVEL LANE.
3. CONSTRUCT 12' OUTSIDE SHOULDER AND SLOPE.

STATE	PROJECT NUMBER	SHEET NO.
GA.	CSNHS-M002-0019661	

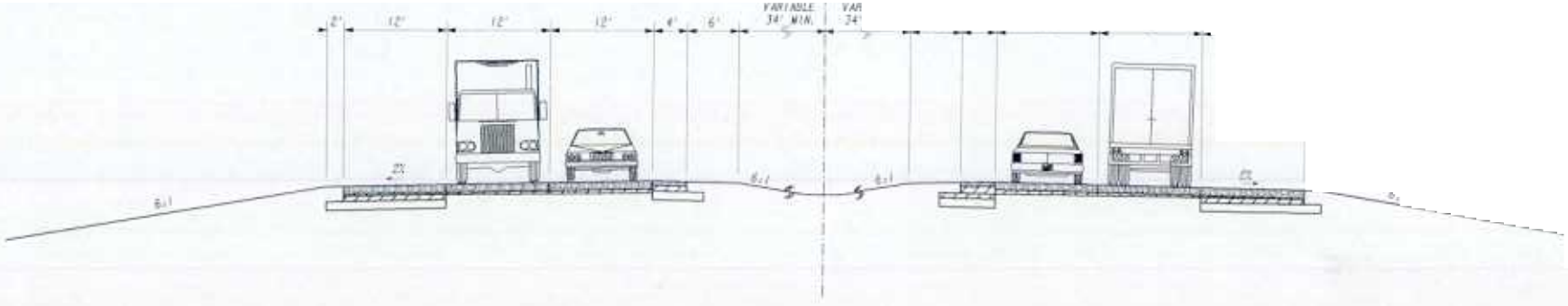


EXISTING 4–LANE SECTION



STAGE 1

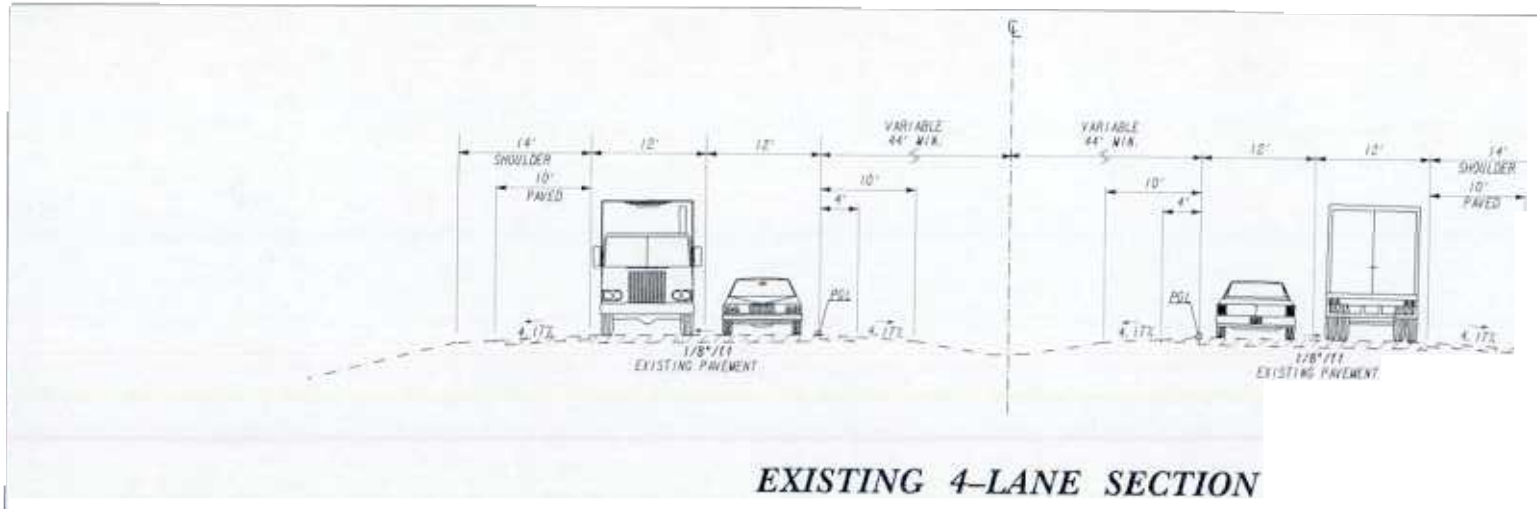
1. MAINTAIN TWO LANES OF TRAFFIC ON EXISTING PAVEMENT.
2. CONSTRUCT 12' OUTSIDE SHOULDER AND SLOPE ON BOTH DIRECTIONS (SEPARATE PHASES).
3. CONSTRUCT 6.5' TEMPORARY PAVEMENT AT INSIDE SHOULDER.



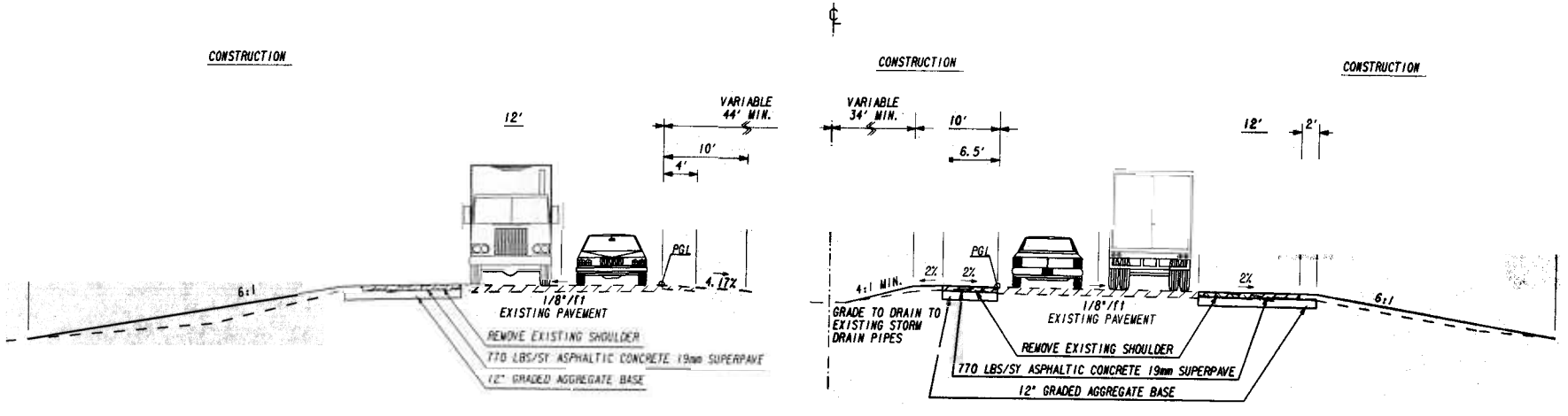
STAGE 6

1. RESTORE NORMAL TRAFFIC FLOW

STATE	PROJECT NUMBER
GA.	CSNHS-M002-0019

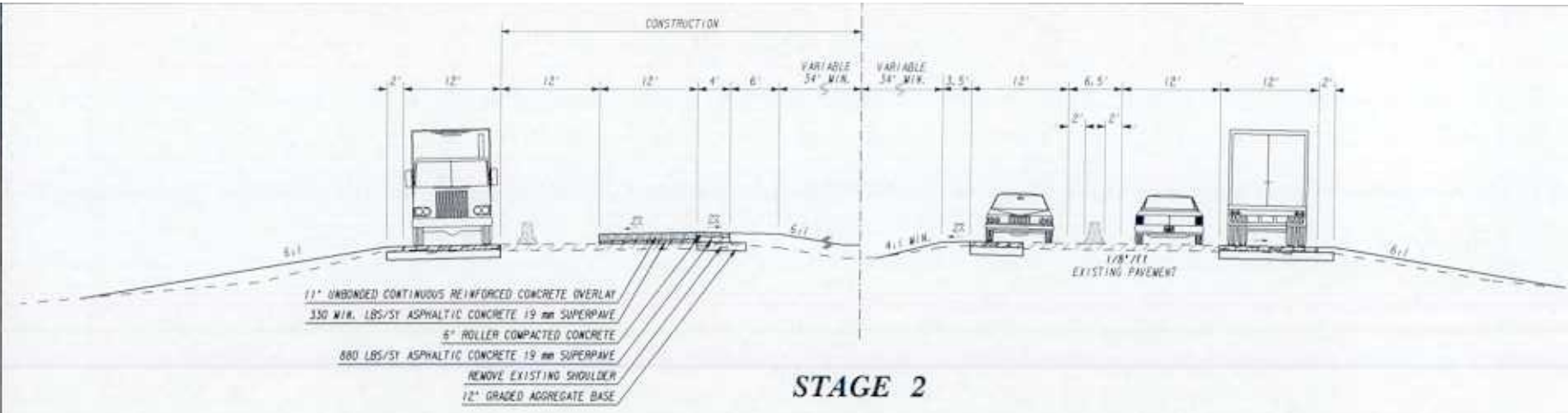


EXISTING 4-LANE SECTION



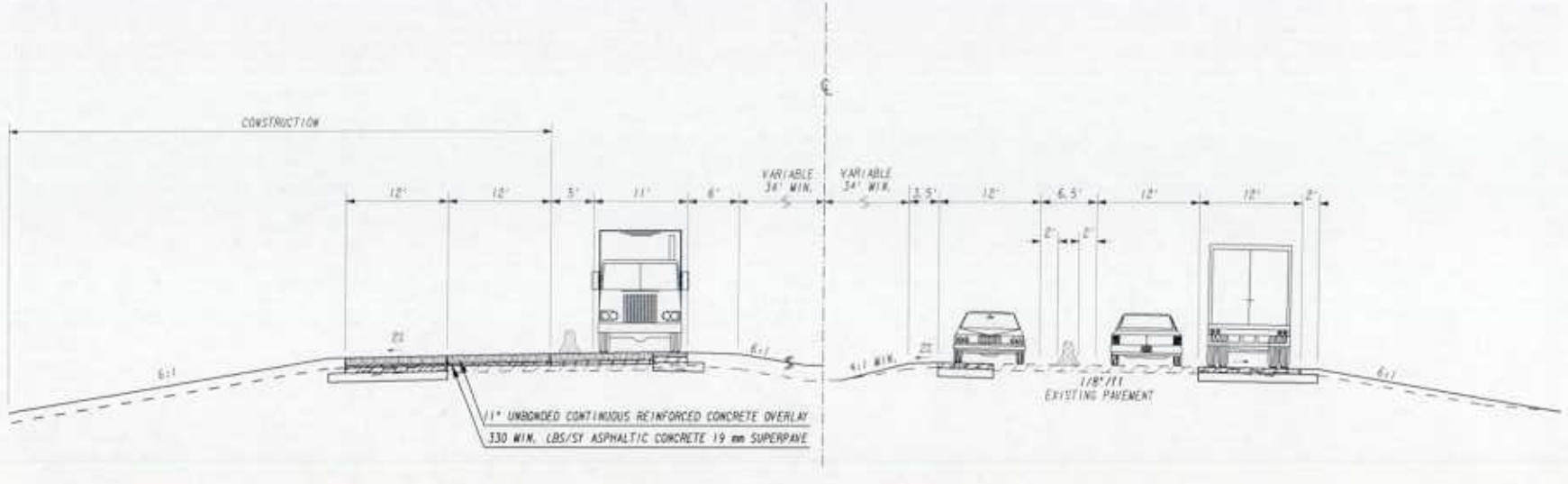
STAGE 1

1. MAINTAIN TWO LANES OF TRAFFIC ON EXISTING PAVEMENT.
2. CONSTRUCT 12' OUTSIDE SHOULDER AND SLOPE ON BOTH DIRECTIONS (SEPARATE PHASES).
3. CONSTRUCT 6.5' TEMPORARY PAVEMENT AT INSIDE SHOULDER.



STAGE 2

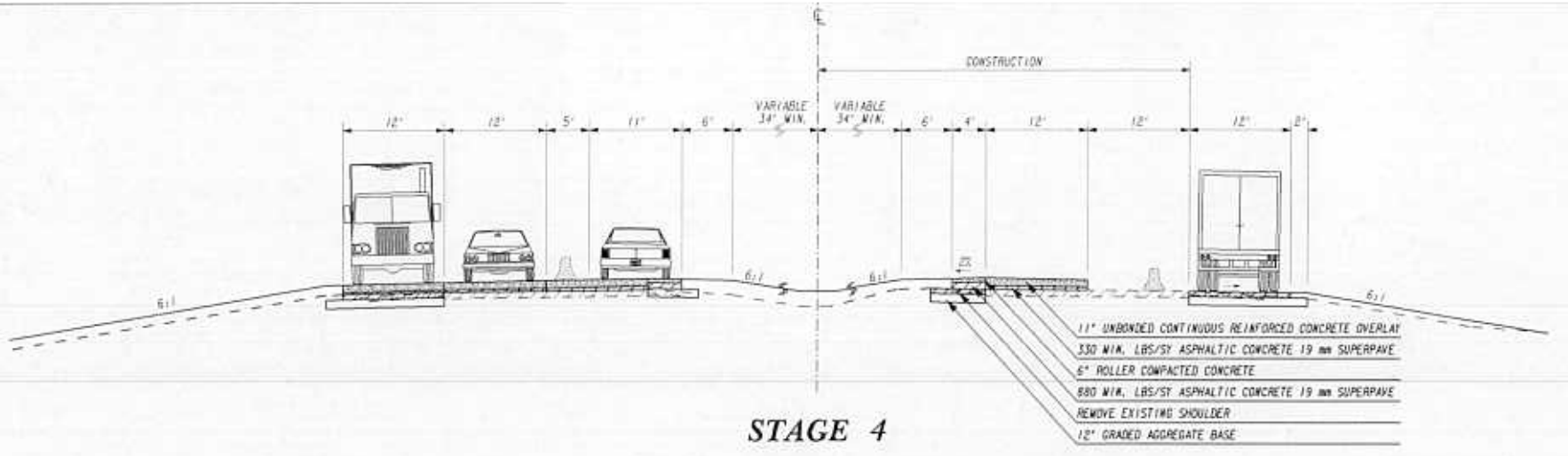
1. SHIFT ONE LANE OF TRAFFIC ACCROSS TO MAINTAIN TWO LANES OF TRAFFIC ON EXISTING PAVEMENT.
2. CONSTRUCT 12' INSIDE TRAVEL LANE.
3. CONSTRUCT 4' INSIDE SHOULDER AND SLOPE.



STAGE 3

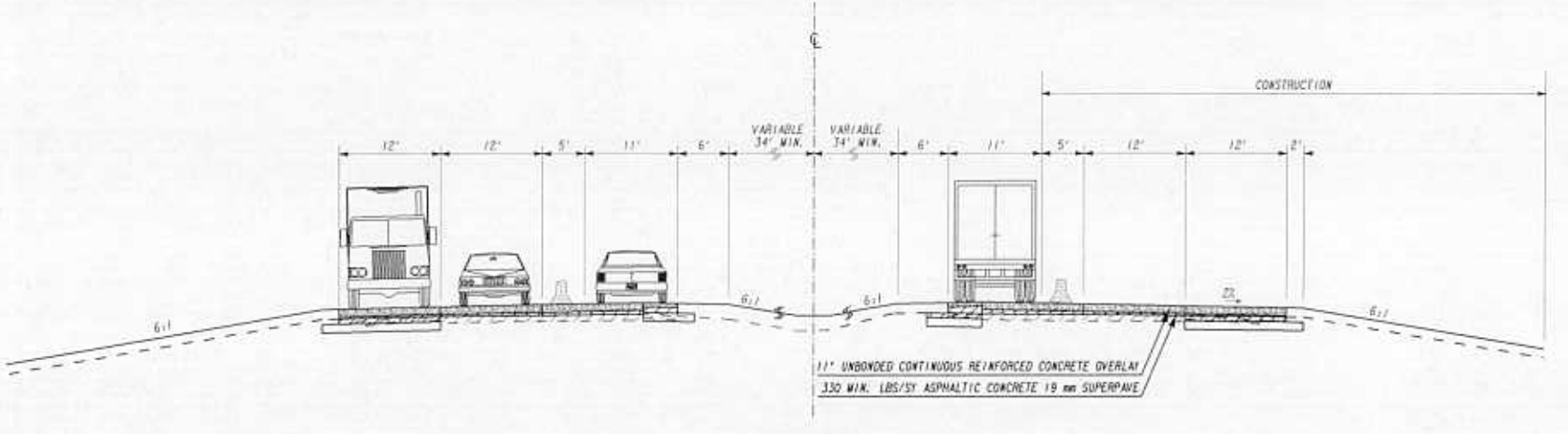
1. SHIFT ONE LANE OF TRAFFIC.
2. CONSTRUCT 12' OUTSIDE TRAVEL LANE.
3. CONSTRUCT 12' OUTSIDE SHOULDER AND SLOPE.

STATE	PROJECT NUMBER	NO.
GA.	CSNHS-M002-0019661	



STAGE 4

1. SHIFT TWO LANES OF TRAFFIC ACCROSS
2. CONSTRUCT 12' INSIDE TRAVEL LANE.
3. CONSTRUCT 4' INSIDE SHOULDER AND SLOPE.



STAGE 5

1. SHIFT ONE LANE OF TRAFFIC.
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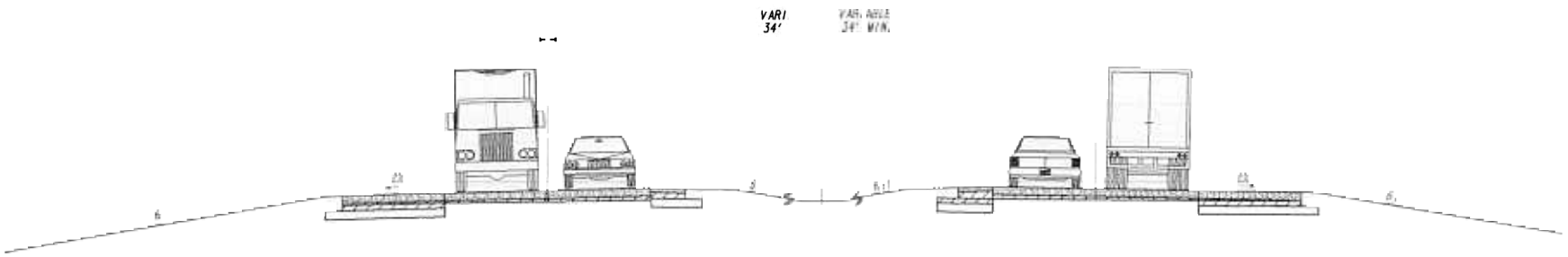

STAGE 6

'AF'

STATE	PROJECT NUMBE
GA.	CSNHS-M002-0019

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
- 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 two-day effort. 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* of I-20 from the Georgia-Alabama state line to SR 61, Haralson and Carroll Counties P.I. No. M002966, prepared by the Department of Transportation, State of Georgia, undated; and
- *Project Concept Report* for the Project Number CSNHS-M002-00(966), County: Haralson, Carroll, P. I. No. M002966, prepared by the Department of Transportation, State of Georgia, Office of Urban Design, Federal Route Number: I-75; State Route Number: SR 401; undated.

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 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 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 highly-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 *Study Results* section of the report.

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 so this phase was not conducted. 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 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
William N.Craig, AVS	VE Facilitator	Lewis & Zimmerman Associates, Inc.

OWNER'S/DESIGNER'S PRESENTATION

Representatives from the Georgia Department of Transportation administration presented an overview of the project on Thursday, February 17, 2005. 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, February 18, 2005 to GDOT. However, copies of the draft *Summary of Potential Cost Savings* worksheets were provided for interim use by GDOT.

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

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT: CSNHS-M002-00(966), P. I. Number M 002966 Haralson and Carroll Counties *Concept Development*		Date: **February 17 – 18 2005**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Klint Rommel em: klint.rommel@dot.state.ga.gov	Georgia Department of Transportation (GDOT) OEL	ph: 404-699-4415 fx:
Kerry Bonner em: kerry.bonner@dot.state.ga.us	GDOT, District Construction Asst. District Construction Engineer	ph: 770-387-3614 fx:
Andy Casey em: andy.casey@dot.state.ga.us	GDOT – Road Design Design Group Manager	ph: 404-656-5406 fx:
Lonnie Jones em: lonnie.jones@dot.state.ga.us	GDOT Construction	ph: 404-656-5306 fx:
Lisa L. Myers em: lisa.myers@dot.state.ga.us	GDOT, General Office (GO) Design Review Engineer Manager	ph: 404-651-7468 fx: 404-463-6131
E. Reid Mathews em: reid.mathews@dot.state.ga.us	GDOT, Office of Maintenance Statewide Maintenance Project Coordinator	ph: 404-635-8198 fx: 404-635-8172
A. J. Jubran em: abdallah.jubran@dot.state.ga.us	GDOT, Office of Materials and Research	ph: 404-363-7582 fx: 404-363-7684
Kenny Beckworth em: kenny.beckworth@dot.state.ga.us	GDOT, District 6, Office of Construction Assistant District Construction Engineer	ph: 770-387-3609 fx: 770-387-3653
Stan Limmiatis em: stan.limmiatis@dot.state.ga.us	GDOT O T S & D	ph: 404-635-8754 fx: 404-562-3607
Curtis Grovner em: curtis.grovner@dot.state.ga.us	GDOT	ph: 404-635-8734 fx:
Steven King em: gobaranec@delonhampton.com	GDOT – Road Design Transportation Engineer Associate	ph: fx:

VALUE ENGINEERING ATTENDEES

MEETING PARTICIPANTS

PROJECT: **CSNHS-M002-00(965), P. I. Number M002965** **Cobb, Cherokee, and Bartow Counties** ***Concept Development***		Date: **February 17 – 18 2005**
NAME & E-MAIL (PLEASE PRINT)	**ORGANIZATION/TITLE**	**PHONE/FAX**
Jessica L. Granell em: jessica.granell@fhwa.dot.gov	FHWA, Georgia Division Transportation Engineer	ph: 404-562-3644 fx: 404-562-3703
Floyd Moore em: floyd.moore@fhwa.dot.gov	FHWA, Georgia Division Transportation Engineer	ph: 404-562-3654 fx: 404-562-3703
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
William N. Craig, AVS em: bcraig@cox-internet.com	Lewis & Zimmerman Associates, Inc. VE Facilitator	ph: 936-632-8368 fx:
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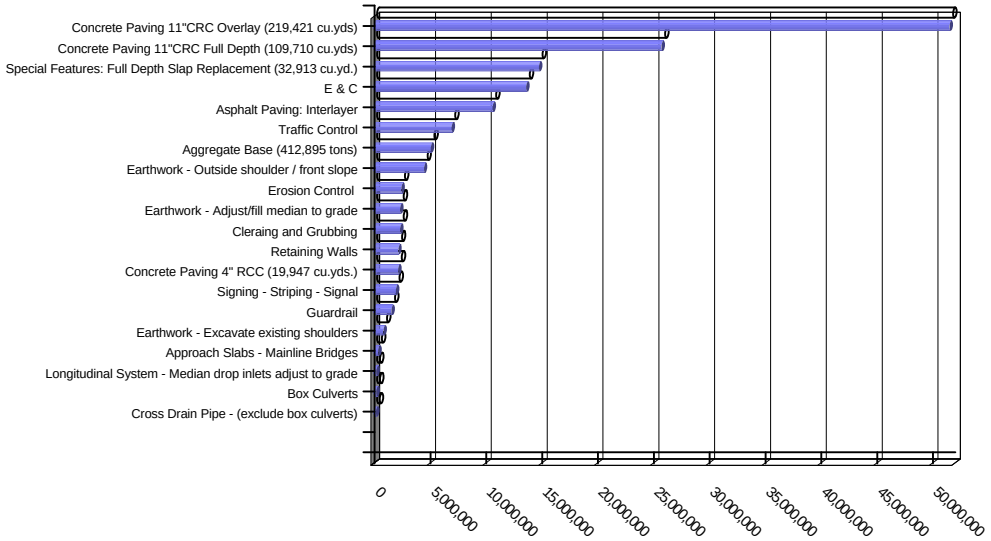
COST HISTOGRAM

PROJECT: **CSNHS-M002-00(966), P. I. Number M 002966**
Haralson and Carroll Counties ***Concept***
Development

TOTAL PROJECT	COST	PERCENTAGE	CUMM. PERCENTAGE
Concrete Paving 11"CRC Overlay (219,421 cu.yds)	51,563,935	34.27%	34.27%
Concrete Paving 11"CRC Full Depth (109,710 cu.yds)	25,781,850	17.13%	51.40%
Special Features: Full Depth Slap Replacement (32,913 cu.yd.)	14,810,850	9.84%	61.25%
E & C	13,669,580	9.08%	70.33%
Asphalt Paving: Interlayer	10,663,440	7.09%	77.42%
Traffic Control	7,000,000	4.65%	82.07%
Aggregate Base (412,895 tons)	5,124,027	3.41%	85.48%
Earthwork - Outside shoulder / front slope	4,511,780	3.00%	88.48%
Erosion Control	2,500,000	1.66%	90.14%
Earthwork - Adjust/fill median to grade	2,380,950	1.58%	91.72%
Cleraing and Grubbing	2,380,000	1.58%	93.30%
Retaining Walls	2,220,000	1.48%	94.78%
Concrete Paving 4" RCC (19,947 cu.yds.)	2,194,170	1.46%	96.24%
Signing - Striping - Signal	2,000,000	1.33%	97.56%
Guardrail	1,600,000	1.06%	98.63%
Earthwork - Excavate existing shoulders	881,950	0.59%	99.21%
Approach Slabs - Mainline Bridges	425,000	0.28%	99.50%
Longitudinal System - Median drop inlets adjust to grade	267,850	0.18%	99.67%
Box Culverts	265,000	0.18%	99.85%
Cross Drain Pipe - (exclude box culverts)	225,000	0.15%	100.00%
TOTAL	**$ 150,465,382**		



Costs in graph are not marked-up.

FUNCTION ANALYSIS

Function analysis was performed to: (1) define the requirements for each project element, and (2) ensure a complete and thorough understanding by the VE team of the basic function(s) needed to attain a given requirement. 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 functions as: Extend (Roadway) Life, and Replace Pavement with required secondary functions of Maintaining (Traffic) Flow, Upgrading Guard Rails, Isolating (Work) Zones and Maintaining (Traffic) Separation.

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(966), P. I. Number M 002966** SHEET NO.: 1 of 1
Haralson and Carroll Counties
Concept Development

NO.	IDEA DESCRIPTION	RATING
1	Stage all traffic to one side except at bridges	4
2	Stage all traffic to one side – Widen at bridges on one side to keep from shifting traffic back and forth.	3
3	Replace the entire section of I-20 with full-depth pavement design	4
4	Use either full-depth replacement design or CRC overlay design at specific areas	4
5	Add an additional lane by widening to the inside	2
6	Use “barn roof” side slopes to avoid extending bridge culverts and box culverts	5
7	Use asphalt in lieu of concrete	1
8	Rehab existing pavement (partial slab replacement)	2
9	Employ single lane traffic in each direction with contra-flow	3
10	Slope temporary shoulders toward the median	3
11	Use 4:1 slopes in the median *(Combined with No 12)*	
12	Use 4:1 slopes on the outside shoulder	DS
13	Add under-drains at sags and wet areas	DS
14	Restrict trucks from traveling on any temporary pavement	2
15	Use modified pavement design for the 18 miles of pavement between the two three-mile sections at either end where the pavement is most severely degraded	4

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