VALUE ENGINEERING STUDY
OF
I-85 FROM HAMILTON MILL ROAD, GWINNETT COUNTY
TO THE SOUTH CAROLINA STATE LINE
PROJECT NO. NH-IM-85-2(165-175)
PI NOS.
110610,110620,110630,110640,110650,110660,110670,110680,110690,110700,110170

GWINNETT, BARROW, JACKSON, BANKS, FRANKLIN, AND HART COUNTIES, GEORGIA

FEBRUARY 28 – MARCH 02, 2005

Prepared by:
Ventry Engineering, L.L.C.

In Association With:
GEORGIA DEPARTMENT OF TRANSPORTATION

VALUE ENGINEERING STUDY
TEAM LEADER

_____

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C.V.S. Registration No. 840603 (LIFE)

DATE_____

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I. EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering Study performed by Ventry Engineering for the Georgia Department of Transportation. The study was performed during the week of February 28 – March 02, 2005.

The subject of the study was the widening of I-85 from Hamilton Mill Road in Gwinnett County to the South Carolina State Line.

PROJECT DESCRIPTION

The projects consist of the widening of I-85 from Hamilton Mill Road in Gwinnett County to the South Carolina State Line. The project scope includes the addition of one lane in each direction in the median, as well as replacement and rehabilitation of various bridges throughout the project.

METHODOLOGY

The Value Engineering Team followed the basic Value Engineering procedure for conducting this type of analysis.

This process included the following phases:

1. Investigation
2. Speculation
3. Evaluation
4. Development
5. Presentation
6. Report Preparation

Evaluation criteria identified as a basis for the comparison of alternatives included the following:

- Service Life
- Maintenance of Traffic
- Maintenance Cost
- Constructability
- Remaining Life
- Construction Time
- Disruption to Traffic
- Construction Cost

RESULTS – AREAS OF FOCUS

The following Areas of Focus were analyzed by the Value Engineering Team and from these areas the following Value Engineering Alternatives were developed and are recommended for Implementation:

A. PAVEMENT

Recommendation No. 1:

The Value Engineering Team recommends that Value Engineering Alternative No. 1 be implemented. This alternative revises the typical section and uses asphalt widening and overlay.

If this recommendation can be implemented, there is a possible savings of **$225,437,278.**

If this alternative cannot be implemented, then the Value Engineering Team recommends that Value Engineering Alternative No. 2 be implemented. This alternative mills the existing asphalt down to the existing concrete and uses a bonded concrete overlay.

If this recommendation can be implemented, there is a possible savings of **$135,400,058.**

B. MULBERRY RIVER BRIDGE (Project No. NH-IM-85-2(166), PI. No. 110620)

Recommendation No. 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative jacks the existing deck and widens the existing bridge.

If this recommendation can be implemented, there is a possible savings of **$808,772**.

C. BRIDGE JACKING

Recommendation No. 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative revises the profile grades by milling the existing pavement.

If this recommendation can be implemented, there is a possible savings of **$2,670,642**.

D. MEDIAN BARRIER

Recommendation No. 4:

The Value Engineering Team recommends that Value Engineering Alternative No. 2 be implemented. This alternative uses cable barrier with a swale in the median.

If this recommendation can be implemented, there is a possible savings of **$73,838,220.**

If this alternative cannot be implemented, then the Value Engineering Team recommends that Value Engineering Alternative No. 1 be implemented. This alternative uses double face guardrail with swale in the median.

If this recommendation can be implemented, there is a possible savings of **$67,485,729.**

E. FENCING

Recommendation No. 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative utilizes and/or repairs existing fencing.

If this recommendation can be implemented, there is a possible savings of **$2,680,818.**

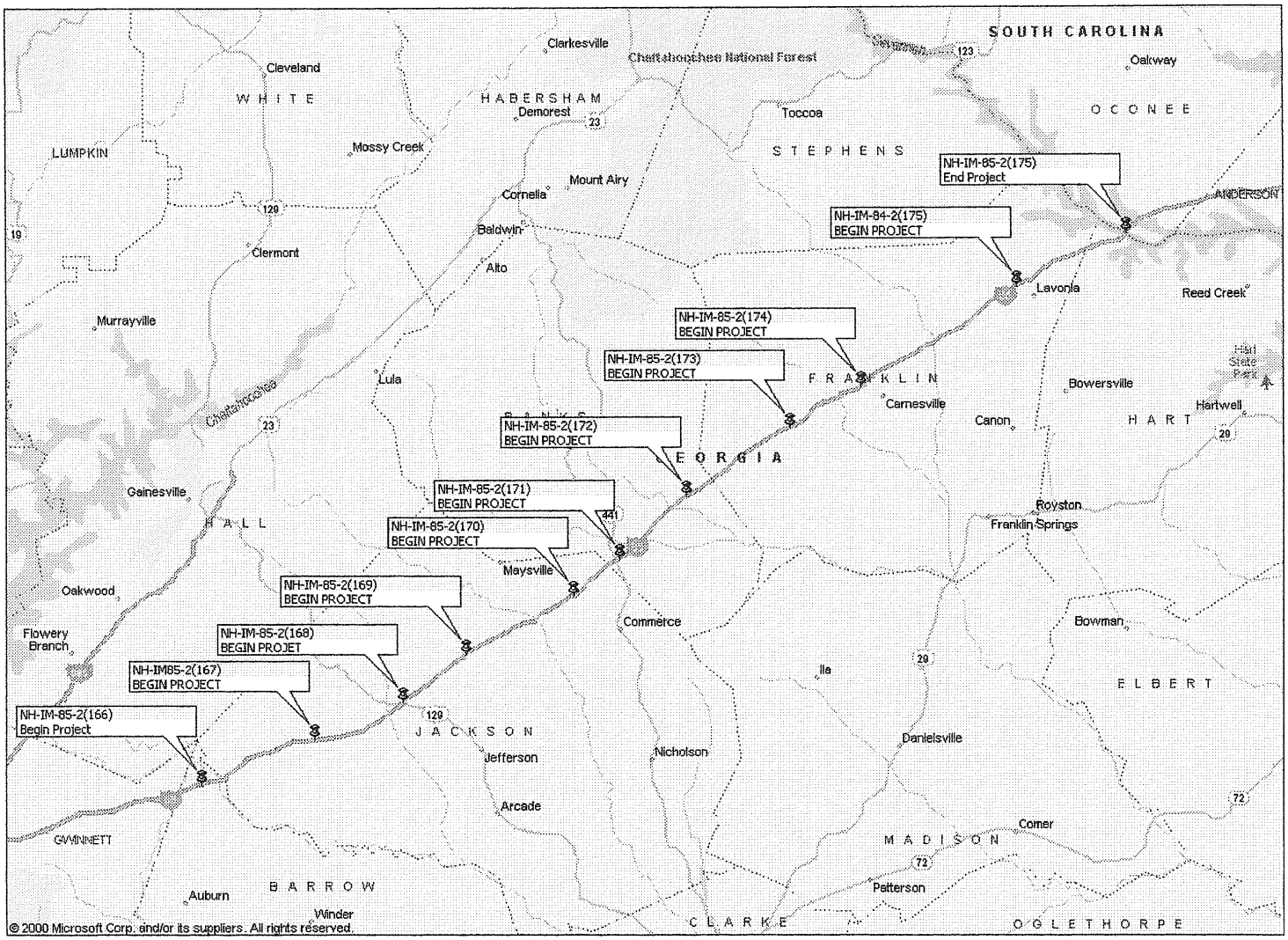
F. PROFILE

Recommendation No. 6:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative mills the existing pavement to achieve corrected K value.

If this recommendation can be implemented, there is a possible savings of **$475,365.**

II. LOCATION OF PROJECT



III. TEAM MEMBERS AND PROJECT DESCRIPTION

TEAMMEMBERS

NAME	AFFILIATION	EXPERTISE	PHONE
Bill Ventry	Ventry Engineering	Team Leader	850/627-3900
Tom Hartley	Ventry Engineering	Roadway Design/Traffic	850/627-3900
Bill Keating	Ventry Engineering	Roadway Design	850/627-3900
John Ledbetter	Ventry Engineering	Structures	850/627-3900
Bruce Nicholson	Ventry Engineering	Construction	850/627-3900
David Painter	FHWA	Pavement Engineer	404/562-3658

PROJECT DESCRIPTION

The projects consist of the widening of I-85 from Hamilton Mill Road in Gwinnett County to the South Carolina State Line. The project scope includes the addition of one lane in each direction in the median, as well as replacement and rehabilitation of various bridges throughout the project.

IV. INVESTIGATION PHASE

GA DOT- I-85 FROM HAMILTON MILL RD., TO THE SOUTH CAROLINA STATE LINE
VALUE ENGINEERING STUDY BRIEFING

FEBRUARY 28, 2005

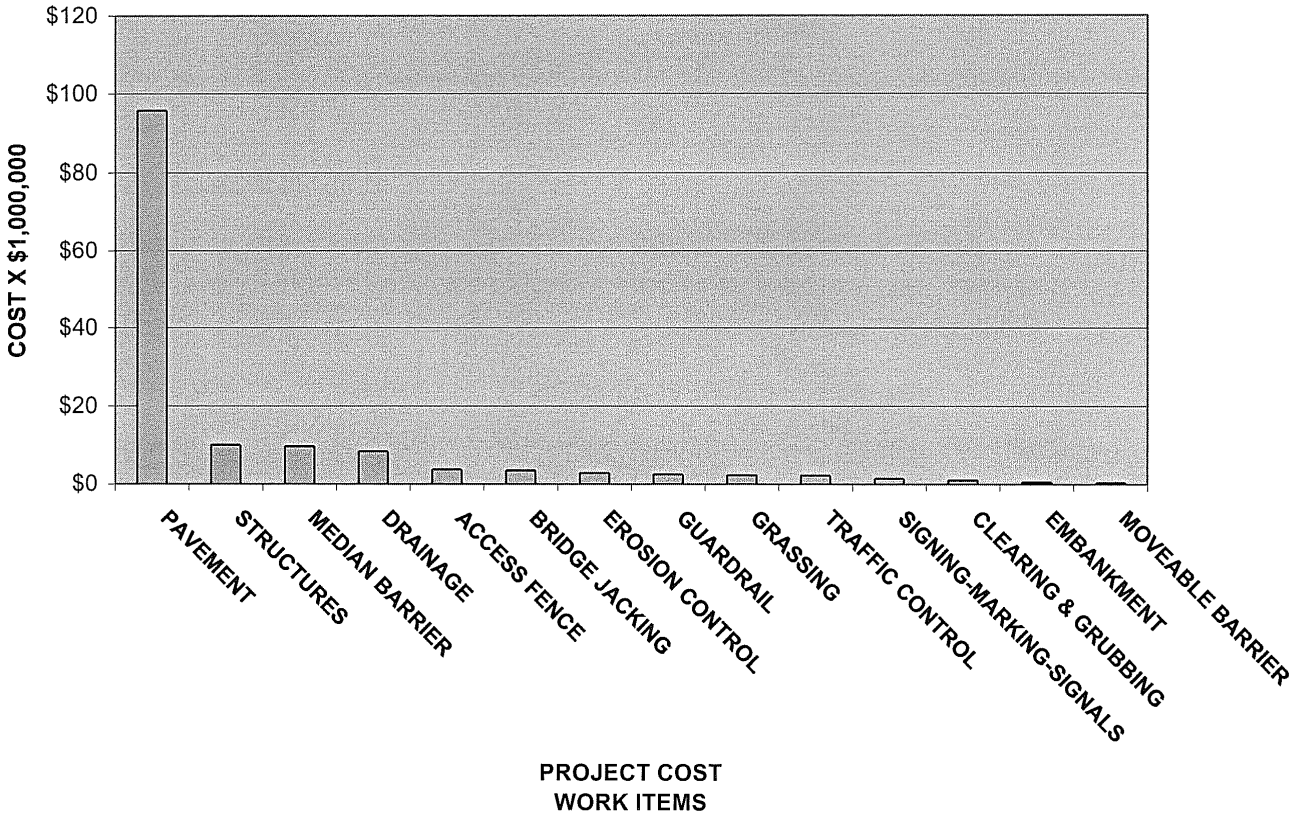
NAME	AFFILIATION	PHONE
Bill Ventry	Ventry Engineering	850/627-3900
Tom Hartley	Ventry Engineering	850/627-3900
Bill Keating	Ventry Engineering	850/627-3900
John Ledbetter	Ventry Engineering	850/627-3900
Bruce Nicholson	Ventry Engineering	850/627-3900
Joe Wheeler	GA DOT	404/657-9759
Brad McManus	GA DOT	404/656-5409
Mike Davidson	GA DOT	404/656/5409
Randy Hart	GA DOT	404/656-5306
Mike Dover	GA DOT	770/532-5528
Tim Matthews	GA DOT	404/656-5383
Ken Werho	GA DOT	404/635-8144
Lisa Favors	GA DOT	404/699-6883
Corey Carter	GA DOT	404/699-4441
Jerry Milligan	GA DOT	404/463-2575
Lisa Myers	GA DOT	404/651-7468
David Painter	FHWA	404/562-3658
Ron Morris	PBS&J	770/933-0280
Mickey Michalski	PBS&J	770/933-0280

INVESTIGATION PHASE

STUDY RESOURCES

NAME	AFFILIATION	PHONE
Lisa Myers	GA DOT	404/651-7468
Brad McManus	GA DOT	404/656-5409
Reid Matthews	GA DOT	404/635-8198
Kathy Bailey	GA DOT	404/635-8134
Phil Arena	FHWA	225/757-7612
Seve Serna	FHWA	225/757-7618
Wade Harris	GA DOT	404/656-6849
Troy Patterson	GA DOT	404/656-

PARETO CHART



INVESTIGATION PHASE

FUNCTIONAL ANALYSIS WORKSHEET
I-85 FROM HAMILTON MILL RD., TO THE SOUTH CAROLINA STATE LINE

DATE: FEBRUARY 28 – MARCH 02, 2005

ITEM	FUNCT. VERB	FUNCT. NOUN	* TYPE	COST	WORTH	VALUE INDEX
Pavement	Support	Vehicles	B	$ 215,000,000	$ 95,700,000	2.3
Bridge Replacement	Span	River	B	$ 1,400,000	$ 700,000	2.0
Bridge Widening	Increase	Capacity	S	$ 7,800,000	$ 7,800,000	1.0
Bridge Jacking	Achieve	Clearance	S	$ 3,600,000	$ 500,000	7.2
Median Barrier	Redirect	Vehicles	B	$ 9,700,000	$ 6,000,000	1.6
Drainage	Convey	Water	B	$ 8,300,000	$ 8,300,000	1.0
Fencing	Control	Access	S	$ 3,800,000	$ 0	∞
Erosion Control	Control	Erosion	S	$ 2,900,000	$ 2,900,000	1.0
Guardrail	Redirect	Vehicles	B	$ 2,600,000	$ 2,600,000	1.0
Grassing	Prevent	Erosion	S	$ 2,400,000	$ 2,400,000	1.0
Maintenance of Traffic	Maintain	Traffic	B	$ 7,300,000	$ 7,300,000	1.0
Signing	Advise	Motorist	B	$ 1,600,000	$ 1,600,000	1.0
Clearing & Grubbing	Clear	Area	B	$ 1,100,000	$ 1,100,000	1.0

***B – Basic S - Secondary**

** Note: This worksheet is a tool of the Value Engineering process and is only used for determining the areas that the Value Engineering team should focus on for possible alternatives. The column for COST indicates the approximate amount of the cost as shown in the cost estimate. The column for WORTH is an estimated cost for the lowest possible alternative that would provide the FUNCTION shown. Many times the lowest cost alternatives are not considered implementable but are used only to establish a worth for a function. A value index greater than 1.00 indicates the Value Engineering team intends to focus on this area of the project.

INVESTIGATION

The following areas have a value index greater than 1.00 on the proceeding Functional Analysis Worksheet and therefore have been identified by the Value Engineering Team as areas of focus and investigation for the Value Engineering process:

A. PAVEMENT

B. MULBERRY RIVER BRIDGE

C. BRIDGE JACKING

D. MEDIAN BARRIER

E. FENCING

F. PROFILE

V. SPECULATION PHASE

Ideas generated, utilizing the brainstorming method, for performing the functions of previously identified areas of focus.

A. PAVEMENT

- Asphalt widening and overlay.
- Revise typical section.
- Bonded concrete overlay.
- New asphalt.
- New concrete.
- Mill existing asphalt down to existing concrete.

B. MULBERRY RIVER BRIDGE

- Replace the existing deck and widen the existing bridge.

C. BRIDGE JACKING

- Revise profile grades by milling existing pavement.

D. MEDIAN BARRIER

- Double face guardrail with swale.
- Cable with swale.

E. FENCING

- Utilize and/or repair existing fencing.

F. PROFILE

- Mill existing pavement to achieve corrected K value.

VI. EVALUATION PHASE

A. ALTERNATIVES

The following alternatives were formulated during the "eliminate and combine" portion of the Evaluation Phase.

A. PAVEMENT

Value Engineering Alternative No. 1 - Revise typical section and use asphalt widening and overlay.

Value Engineering Alternative No. 2 - Mill existing asphalt down to existing concrete and use a bonded concrete overlay.

B. MULBERRY RIVER BRIDGE

Value Engineering Alternative - Replace the existing deck and widen the existing bridge.

C. BRIDGE JACKING

Value Engineering Alternative - Revise profile grades by milling existing pavement.

D. MEDIAN BARRIER

Value Engineering Alternative No. 1 - Double face guardrail with swale.

Value Engineering Alternative No. 2 – Cable barrier with swale.

E. FENCING

Value Engineering Alternative - Utilize and/or repair existing fencing.

F. PROFILE

Value Engineering Alternative - Mill existing pavement to achieve corrected K value.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES

The following Advantages and Disadvantages were developed for the Value Engineering Alternatives previously generated during the speculation phase. It also includes the Advantages and Disadvantages for the As Proposed.

A. PAVEMENT

"As Proposed" – Un-bonded concrete overlay with full depth concrete widening.

Advantages

- Utilizes the existing pavement structure.
- Long service life.
- Less frequent maintenance.

Disadvantages

- Requires buildup of outside shoulders.
- High initial construction cost.
- Ride ability/noise.

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative No. 1 - Revise typical section and use asphalt widening and overlay.

Advantages

- Utilizes the existing pavement structure.
- Shorter construction time.
- Easier staging.
- Less drainage problems.
- Lower maintenance of traffic.
- Lower initial construction cost.
- Can use ground rumble strip.
- Does not require outside additional 2 inches.

Disadvantages

- More frequent maintenance.
- Less service life.

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative No. 2 - Mill existing asphalt down to existing concrete and use a bonded concrete overlay.

Advantages

- Utilizes the existing pavement structure.
- Lower profiles.
- May eliminate bridge jackings.
- Long service life.

Disadvantages

- May be more difficult construction.
- May require under drain.
- Medium to high initial construction cost.

Conclusion
Carry forward for further evaluation.

B. MULBERRY RIVER BRIDGE

"As Proposed" – Three span, bulb "T" and type II AASHTO girders.

Advantages

- New structure.
- Longer service life.
- No bent in water.

Disadvantages

- High construction cost.
- Does not utilize the remaining life of the existing bridge which has very high rating.

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative - Jack the existing deck and widen the existing bridge.

Advantages

- Utilizes the remaining life of the existing bridge.
- Lower construction cost.
- Less construction time.
- May result in suitable shoulder for future lane.

Disadvantages

- Not as long service life as all new.

Conclusion
Carry forward for further evaluation.

C. BRIDGE JACKING

"As Proposed" – Raise the existing bridges to attain a 17' vertical clearance by jacking.

Advantages
- Meets Georgia Department of Transportation vertical clearance requirements.
- More flexibility in future.

Disadvantages
- May require right of way at crossroads.
- Difficult construction.
- High construction cost.
- High maintenance of traffic.
- Some bridges may not be good candidates for jacking.

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative - Revise profile grades by milling existing pavement.

Advantages
- Meets Georgia Department of Transportation vertical clearance requirements.
- Lower construction cost.
- Less construction time.
- Less disruption to traffic.

Disadvantages
- May require pavement replacement at some structures.

Conclusion
Carry forward for further evaluation.

D. MEDIAN BARRIER

"As Proposed" – Concrete barrier.

Advantages
- Redirects vehicle.
- Less maintenance.

Disadvantages
- High construction cost.
- Longer construction time.

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative No. 1 - Double face guardrail with swale.

Advantages

- Redirects vehicle.
- Low construction cost.
- Easier construction.
- Less construction time.

Disadvantages

- More frequent repair.

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative No. 2 – Cable barrier with swale.

Advantages

- Redirects vehicle.
- Low construction cost.
- Easier construction.
- Less construction time.

Disadvantages

- More frequent repair.

Conclusion
Carry forward for further evaluation.

E. FENCING

"As Proposed" – New fence.

Advantages

- Longer service life.
- Less maintenance.

Disadvantages

- Requires clearing of right of way.
- May have environmental impacts.

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative - Utilize and/or repair existing fencing.

Advantages

- No construction cost.
- Less environmental impacts.

Disadvantages

- None apparent.

Conclusion
Carry forward for further evaluation.

F PROFILE

"As Proposed" – Adjust profile in sag curves by raising elevations.

Advantages

- Reduces risk.

Disadvantages

- Construction cost.
- Maintenance of traffic.

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative - Mill existing pavement to achieve corrected K value.

Advantages

- May be less impact to traffic.
- May be lower cost.

Disadvantages

- None apparent.

Conclusion
Carry forward for further evaluation.

VII. DEVELOPMENT PHASE

A. PAVEMENT

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE NO.1

(3) VALUE ENGINEERING ALTERNATIVE NO.2

B. MULBERRY RIVER BRIDGE (Project No. NH-IM-85-2(166), PI. NO. 110620

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE

C. BRIDGE JACKING

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE

D. MEDIAN BARRIER

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE NO. 1

(3) VALUE ENGINEERING ALTERNATIVE NO. 2

E. FENCING

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE

F. PROFILE

(1) AS PROPOSED

(2) VALUE ENGINEERING ALTERNATIVE

G. DESIGN COMMENTS

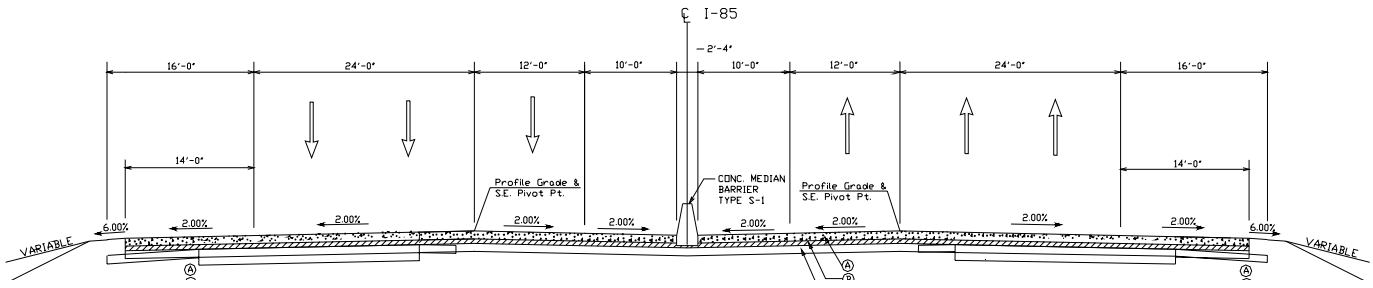
A. PAVEMENT

1. AS PROPOSED

The 10 projects included in this Value Engineering Study widen Interstate 85 from near Hamilton Mill Road to the South Carolina line. The existing roadway consists of two 12-foot lanes in each direction with 4-foot inside and 10-foot outside paved shoulders. The original construction of the Interstate some 40 years ago was non-doweled jointed concrete paving for the travel lanes. Several overlays have occurred since its original construction and the asphalt depth is estimated to be 7-10 inches. There is a short section of about 4 miles in Banks County that is still the original concrete paving.

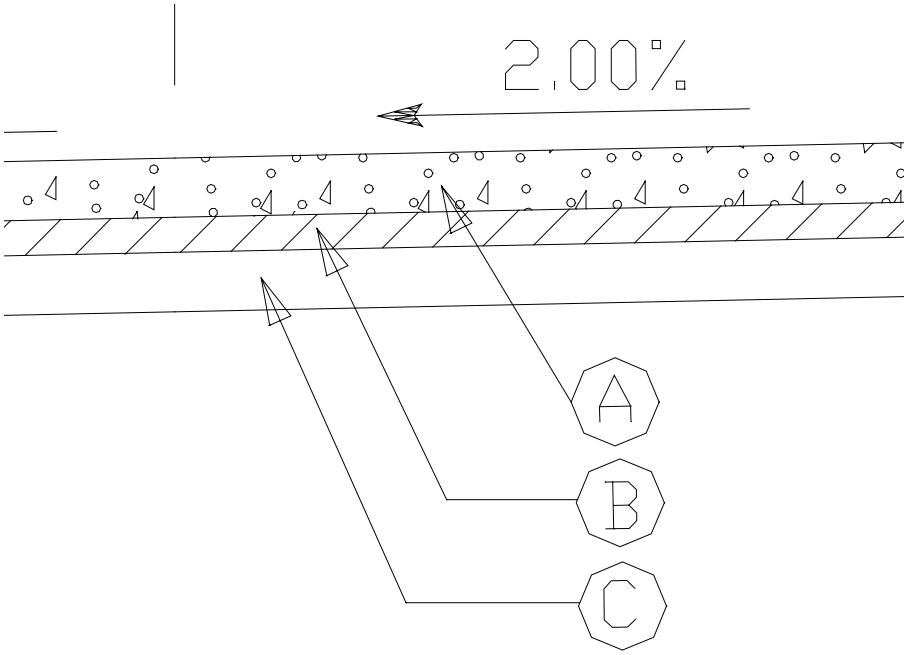
Cross slope of the existing roadway is 1/8th inch per foot. To obtain a corrected cross slope of ¼ inch per foot, the existing HMA overlay will be milled prior to the overlay. In the 4-mile PCC section in Banks County the projects add a 3 to 6 inch thick interlayer to correct cross slope, minimize reflective cracking and reduce infiltration of water.

The proposed project is to widen this 51.3 mile section to three lanes in each direction with adequate widening included to easily add a fourth lane in the future. The widening is mostly to the inside, but a portion of the existing outside shoulder is also replaced full-depth. The pavement section of the inside shoulder, lane 1 and half of lane 2 is 12-inches of graded aggregate base, topped by three inches of 19mm Superpave HMA, topped by 11" of CRC. The pavement section of half of lane 2, lane 3 and most of the 14 foot wide outside shoulder (future lane 4) incorporates the existing pavement structure. Under this concept 11" of CRC pavement and a 3-6 inch thick HMA interlayer is either added in Banks County or milled into the existing HMA overlay everywhere else.



AS PROPOSED TYPICAL SECTION

AS PROPOSED (CONT'D)



PAVEMENT MATERIAL SCHEDULE
Ⓐ CR CONC. PAVEMENT, CL HES CONC., 12 INCH
Ⓑ 25 MM SUPERPAVE MIX DESIGN LEVEL A, 330 LBS./SY
Ⓒ GRADED AGGREGATE BASE, 12 INCH

PAVEMENT SECTION

The project will be constructed in several stages. The first stage includes the construction of a new concrete barrier in the median for the entire corridor except for several short sections that add up to 6 of the 51-mile length of this project, construction of a piped median drainage system along the entire length of the corridor and construction of the new CRC pavement. In the second stage, traffic will be shifted to this new roadway and separated by temporary concrete barrier from the existing pavement. The existing HMA overlay will be milled as discussed above. In Banks County a new 3 – 6 inch thick HMA interlayer will be placed on the existing PCC pavement with appropriate joint treatments. Six to eight feet of the outside shoulder will be reconstructed along the entire corridor. Eleven inches of CRC pavement will be placed over everything.

In developing the cost of the "As Proposed" alternative prices from a comparable project to widen I-285 were used. From this analysis, the cost of the As Proposed base and paving is $301,976,000. This varies significantly from the concept and it is therefore recommended that careful development of the As Proposed cost needs to be completed.

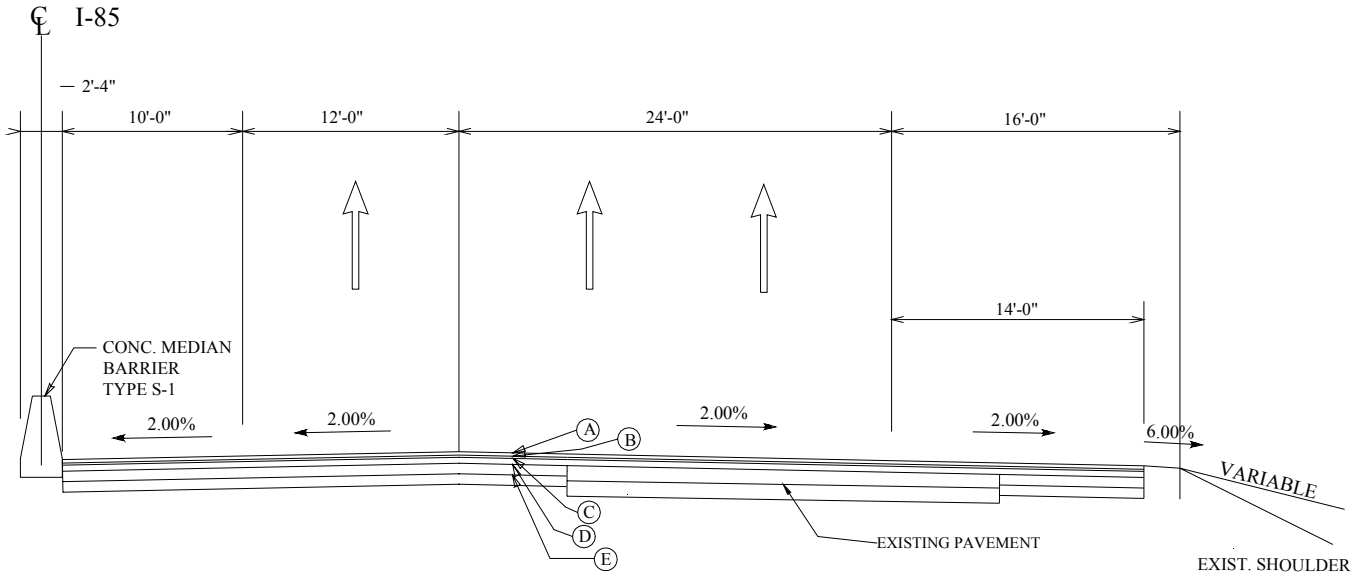
A. PAVEMENT

2. VALUE ENGINEERING ALTERNATIVE NO. 1

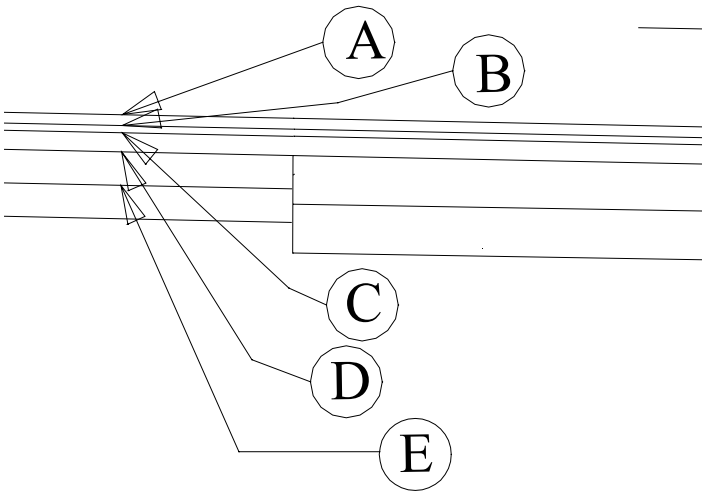
Value Engineering Alternative No. 1 to the proposed concrete overlay is to use asphalt paving for the widening and overlay of the existing roadway.

Similar to the As Proposed, the new roadway would have to be constructed in stages. The first stage will be construction of a new HMA roadway in the median area. This pavement structure includes 12" of graded aggregate base, 7" of 25 MM Superpave, 4" of 19 MM Superpave, 1 ½" of SMA, and 2 ¼" of PEM. This stage will also provide a rigid barrier along 45 of 51 miles of the corridor.

In the second stage, traffic will be shifted to this new roadway and separated by a temporary concrete barrier from the existing pavement. The existing roadway will be milled at variable depths to obtain a proper cross slope and overlaid with asphalt. This overlay will consist of 4" of 19 MM Superpave, 1 ½" of SMA and 2 ¼" of PEM. Eight feet of the outside shoulder will be reconstructed along the entire corridor which will require 12"of GAB and 7" of 25MM Superpave in addition to the 4" of 19 MM Superpave, 1 ½" of SMA and 2 ¼" of PEM. The widening in this stage will be of sufficient width to accommodate the 12-foot shoulder, which is the future fourth lane. The Value Engineering Team calculated a sufficient quantity of PEM to provide an 18" lap on the inside and outside shoulders through the entire corridor. A Typical Section follows to detail the Value Engineering Alternative.



Value Engineering Alternative No. 1 Typical Section



PAVEMENT MATERIAL SCHEDULE
Ⓐ 2.25 " PEM
Ⓑ 1.50" SMA
Ⓒ 4" 19 MM SP
Ⓓ 7.00 " 25 MM SP
Ⓔ GRADED AGGREGATE BASE, 12 INCH

PAVEMENT LAYERS

The cost for using asphalt to accomplish the proposed widening is estimated to be $132,007,000. With the additions of inflation for 3 years and a contingency of 10%, the estimated cost savings is $225,437,000.

The Value Engineering Team used the same assumptions for Life Cycle Cost Analysis (LCCA) of the Value Engineering Alternatives that were used for Life Cycle Cost Analysis of the As-Proposed alternative provided to us from Forest Park Laboratory. These include 40-year lifespan and a 3 percent discount rate. Comparison of the two Life Cycle Cost Analysis's shows that the equivalent uniform annualized cost (EUAC) of the As Proposed alternative exceeds the EUAC of Value Engineering Alternative No. 1 by 59 percent.

PAVEMENT
VALUE ENGINEERING ALTERNATIVE NO. 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
UNBONDED CONCRETE OVERLAY	CY	$235.00	1103520	$259,327,200		
19 MM SUPERPAVE, 330 LBS/SY	TN	$40.00	357540	$14,301,600		
MILLING 0" - 3"	SY	$1.10	1323520	$1,455,872		
12 INCH GAB	SY	$12.41	2166912	$26,891,378	2166912	$26,891,378
12.5 MM PEM 2 1/4"	TN	$65.69	0	$0	414127	$27,204,003
12.5 MM SMA	TN	$65.69			258426	$16,976,004
19 MM SUPERPAVE, 440 LBS/SY	TN	$40.00			689138	$27,565,520
25 MM SUPERPAVE, 770 LBS/SY	TN	$40.00			834261	$33,370,440
SUBTOTAL				**$301,976,050**		**$132,007,344**
INFLATION (5% PER YEAR FOR 3 YEARS)			5.0%	$47,712,216	5.0%	$6,600,367
E & C			10.0%	$30,197,605	12.0%	$15,840,881
GRAND TOTAL				**$379,885,871**		**$154,448,593**

POSSIBLE SAVINGS: $225,437,278

PAVEMENT
LCC UNBONDED vs. ASPHALT
COMPARISON

40 Year Life Cycle Cost Comparison

Enter the Interest Rate =3%

		AS PROPOSED CONCRETE WIDENING AND OVERLAY			VALUE ENGINEERING ALTERNATIVE NO.1 ASPHALT WIDENING AND OVERLAY
Year		**Total (000's)**	**Present Worth**	**Total (000's)**	**Worth**
0	INITIAL COST	$302,000	$302,000	$107,100	$107,100
10			$0	$42,871	$31,900
20			$0	$42,871	$23,737
25		$10,978	$5,243		$0
30			$0	$42,871	$17,662
39			$0	$42,871	$13,537
AGGREGATE PRESENT VALUE			**$307,243**		**$193,936**

A. PAVEMENT

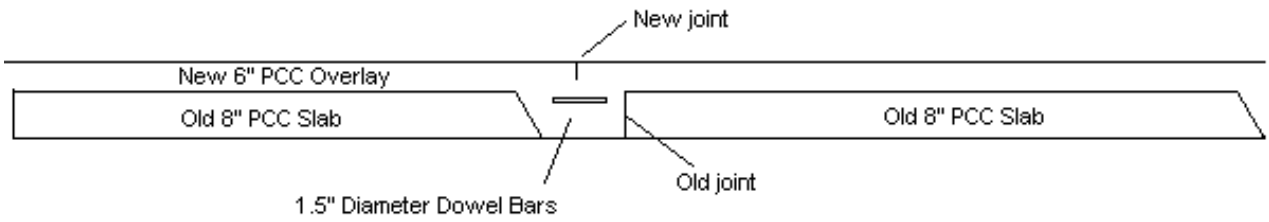
3. VALUE ENGINEERING ALTERNATIVE NO. 2

This Value Engineering Alternative to the proposed concrete overlay is to use a bonded overlay of PCC over the existing PCC pavement with RCC as the base course for the new lanes in the median.

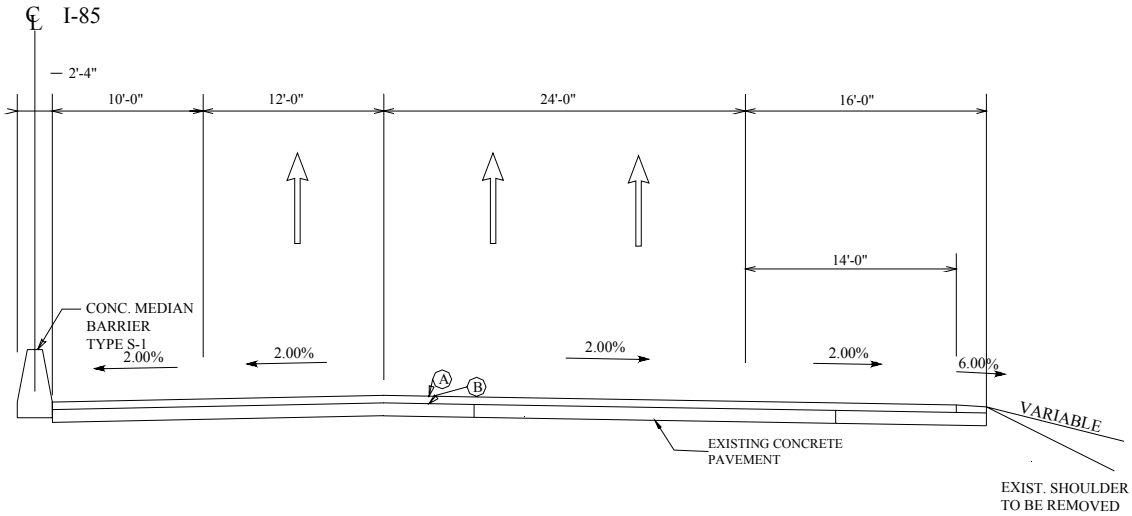
Similar to the As Proposed, the widening will have to be constructed in stages. The first stage will be construction of a new PCC roadway in the median area. This pavement structure includes 8" of RCC with a 6" overlay of PCC. This construction method should require fewer steps and should reduce the time for construction. The RCC layer will use vibrated joints prior to the compaction stage to achieve high load transfer. Joints will be sawed in the PCC overlay directly over the RCC joints. Joint spacing will be based on joint spacing of the existing concrete, which should be visible along the edge. This stage will also provide a rigid barrier along 45 of 51 miles of the corridor.

In the second stage, traffic will be shifted to this new roadway and separated by a temporary concrete barrier from the existing pavement. The existing roadway will be milled to the original jointed non-doweled 8" concrete, which is estimated to be 7 - 10 inches beneath the current PGL. A variable depth bonded concrete overlay will then be placed on the original concrete. The bonded overlay depth will be 6 to 9 inches to provide the proper cross slope. The bond will be a mechanical one with the roughened concrete surface resulting from the milling. Eight feet of 8" thick RCC will be used to reconstruct the outside shoulder of the original pavement. The bonded overlay will cover 6 of the 8 feet of RCC placed on the outside shoulder. The widening in this stage will be of sufficient width to accommodate the 14-foot shoulder, which is the future fourth lane.

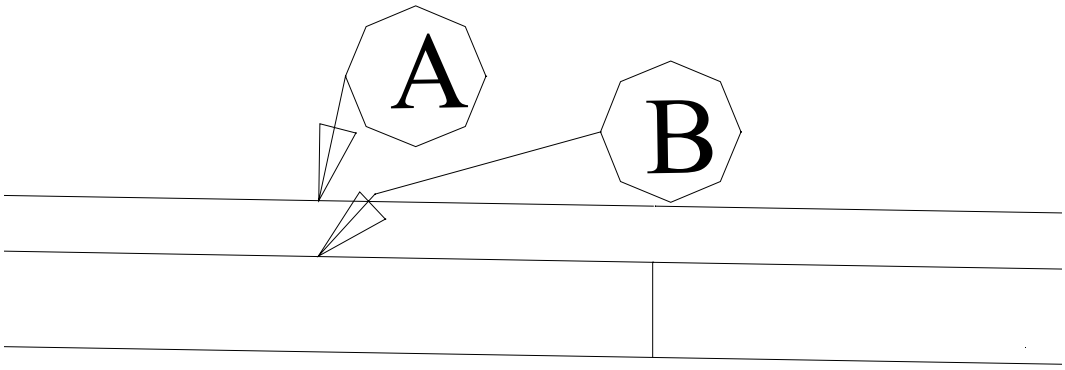
During the development of this alternative, an innovative method of treating the transverse joint was recommended. At the transverse joint a section of the old slab will be removed. This section will be 24" wide at the bottom and 30" wide at the top. One and a half inch dowel bars will be placed in the center of the proposed overlay. This new "notch" will be poured monolithically with the overlay. (See the detail below.) The cost for the dowel bars and the additional concrete required was included in the cost development.



A Typical Section follows detailing this Value Engineering Alternative.



VALUE ENGINEERING ALTERNATIVE NO. 2 TYPICAL SECTION



PAVEMENT MATERIAL SCHEDULE
Ⓐ 6.00" BONDED PCC
Ⓑ 8.00 " RCC

PAVEMENT SECTION

The cost for using bonded PCC overlay to accomplish the proposed widening is estimated to be $191,300,000. With the additions of inflation for 3 years and a contingency of 10%, the estimated cost savings is $135,400,000.

The Value Engineering Team used the same assumptions for Life Cycle Cost Analysis (LCCA) of the Value Engineering Alternatives that were used for Life Cycle Cost Analysis of the As Proposed alternative provided to us from Forest Park Laboratory. These include 40-year lifespan and a 3 percent discount rate. Comparison of the two Life Cycle Cost Analysis's shows that the Equivalent Uniform Annualized Cost (EUAC) of the As Proposed alternative exceeds the Equivalent Uniform Annualized Cost of Value Engineering Alternative No.2 by 56 percent.

PAVEMENT
VALUE ENGINEERING ALTERNATIVE NO. 2
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
UNBONDED CONCRETE OVERLAY	CY	$235.00	1103520	$259,327,200		
19 MM SUPERPAVE, 330 LBS/SY	TN	$40.00	357540	$14,301,600		
MILLING 0" - 3"	SY	$1.10	1323520	$1,455,872		
12 INCH GAB	SY	$12.41	2166912	$26,891,378		
RCC	CY	$110.00	0	$0	508288	$55,911,680
MILLING 0" - 6"	SY	$1.50			1444608	$2,166,912
BONDED PCC OVERLAY	CY	$160.00			817950	$130,872,000
REINFORCING STEEL (DOWEL BAR RETROFIT)	LB	$1.50			125334	$188,001
SLAB REMOVAL FOR DOWEL BAR RETROFIT	SY	$15.00			144324	$2,164,860
SUBTOTAL				**$301,976,050**		**$191,303,453**
INFLATION (5% PER YEAR FOR 3 YEARS)	YR	$3.00	15.8%	$47,712,216	15.8%	$30,225,946
E & C			10.0%	$30,197,605	12.0%	$22,956,414
GRAND TOTAL				**$379,885,871**		**$244,485,813**

POSSIBLE SAVINGS: $135,400,058

PAVEMENT
LCC UNBONDED VS BONDED
COMPARISON

40 Year Life Cycle Cost Comparison

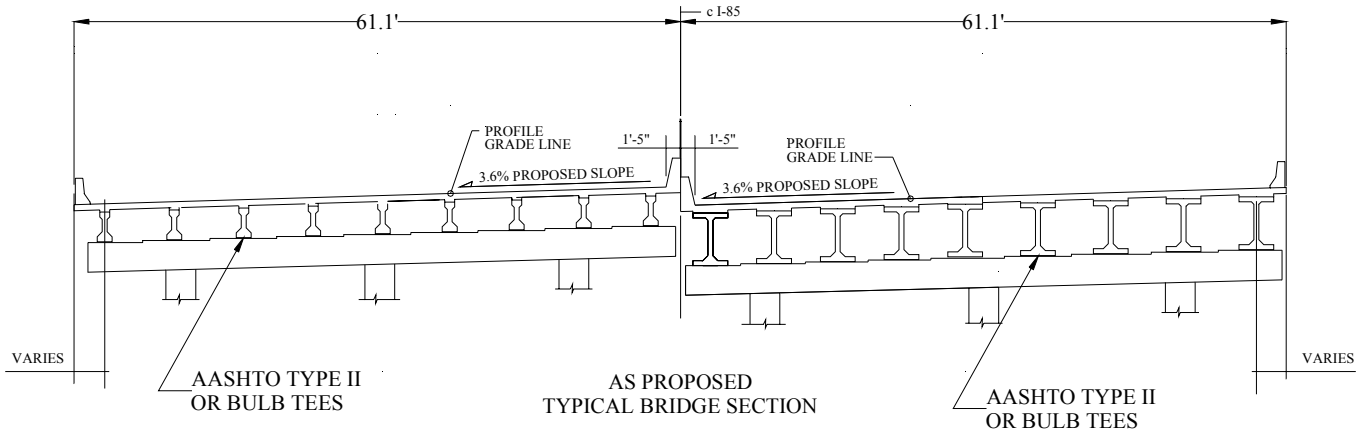
Enter the Interest Rate =3%

		AS PROPOSED CONCRETE WIDENING AND OVERLAY		VALUE ENGINEERING ALTERNATIVE NO.2 BONDED CONCRETE OVERLAY	
Year		Total (000's)	Present Worth	Total (000's)	Worth
0	INITIAL COST	$302,000	$302,000	$191,303	$191,303
25		$10,978	$5,243	$12,000	$5,731
40			$0		$0
AGGREGATE PRESENT VALUE			**$307,243**		**$197,034**

B. MULBERRY RIVER BRIDGE (Project No. NH-IM-85-2(2(166), PI. NO. 110620)

1. AS PROPOSED

The As Proposed design consists of removal of the existing 4 span, steel beam, and dual bridges over Mulberry River and construction of a new bridge. The existing dual bridges are 228 ft. in length and 45 ft. wide. The Sufficiency Rating of these bridges is 95.4. The new bridge will be 223 ft. in length and 122 ft. wide. The new bridge is a 3 span structure with span lengths of 54 ft., 115 ft., and 54 ft. The end spans are AASHTO Type II PSC beams while the center span is made up of Bulb Tee PSC beams.

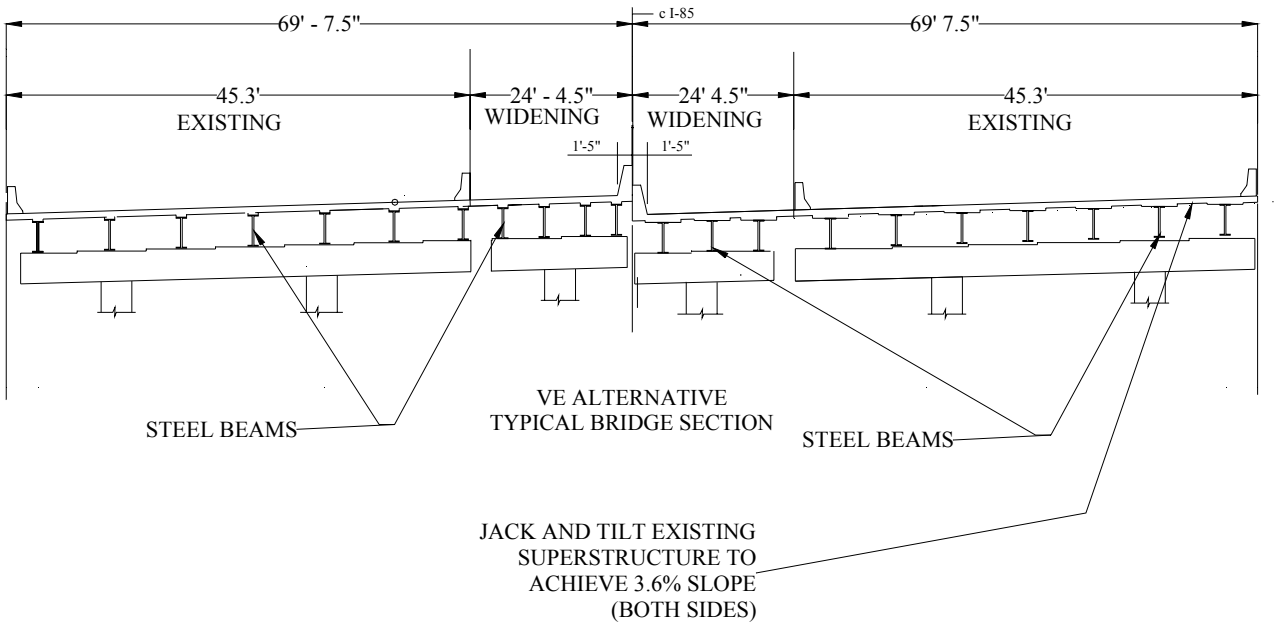


AS PROPOSED
TYPICAL BRIDGE SECTION

B. MULBERRY RIVER BRIDGE (Project No. NH-IM-85-2(2(166), PI. NO. 110620)

2. VALUE ENGINEERING ALTERNATIVE

The Value Engineering Alternative consists of retaining the existing dual bridges and widening on the inside. The total widening will be about 49 ft. and including the existing bridges the overall width will be 139.5 ft. This is approximately 17 ft. wider than the As Proposed bridge replacement. In order to provide the cross slope of 3.6% the existing bridges will have to be jacked and tilted. The Georgia Department of Transportation has experience in this method of correcting cross slope on bridges. The widening will use steel beams to match the existing superstructure.



A Life Cycle Cost Analysis of the As Proposed new bridge with a 75-year life against the Value Engineering Alternative with a remaining life of 37 years shows that the Value Engineering Alternative is more economical by $120,020.

MULBERRY RIVER BRIDGE
(Project No. NH-IM-85-2(2(166), PI. NO. 110620)
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
3 Span Bulb Tee, Type II AASHTO Girder Replacement Bridge	SF	$75.00	27206.0	$2,040,450		$0
Removal of Existing Bridges	SF	$20.00	20634.0	$412,680		
Widening	SF	$135.00		$0	11115.0	$1,500,525
Jack and Tilt Existing Superstructure	SF	$15.00		$0	20634.0	$309,510
Subtotal				**$2,453,130**		**$1,810,035**
E &C @ 10%				$245,313		$181,004
Inflation	YR	5%	3.0	$386,675		$285,307
GRAND TOTAL				**$3,085,118**		**$2,276,345**

POSSIBLE SAVINGS: $808,772

MULBERRY RIVER BRIDGE

Table 1: 75 Year Life Cycle Cost Comparison

Enter the Interest Rate =3%

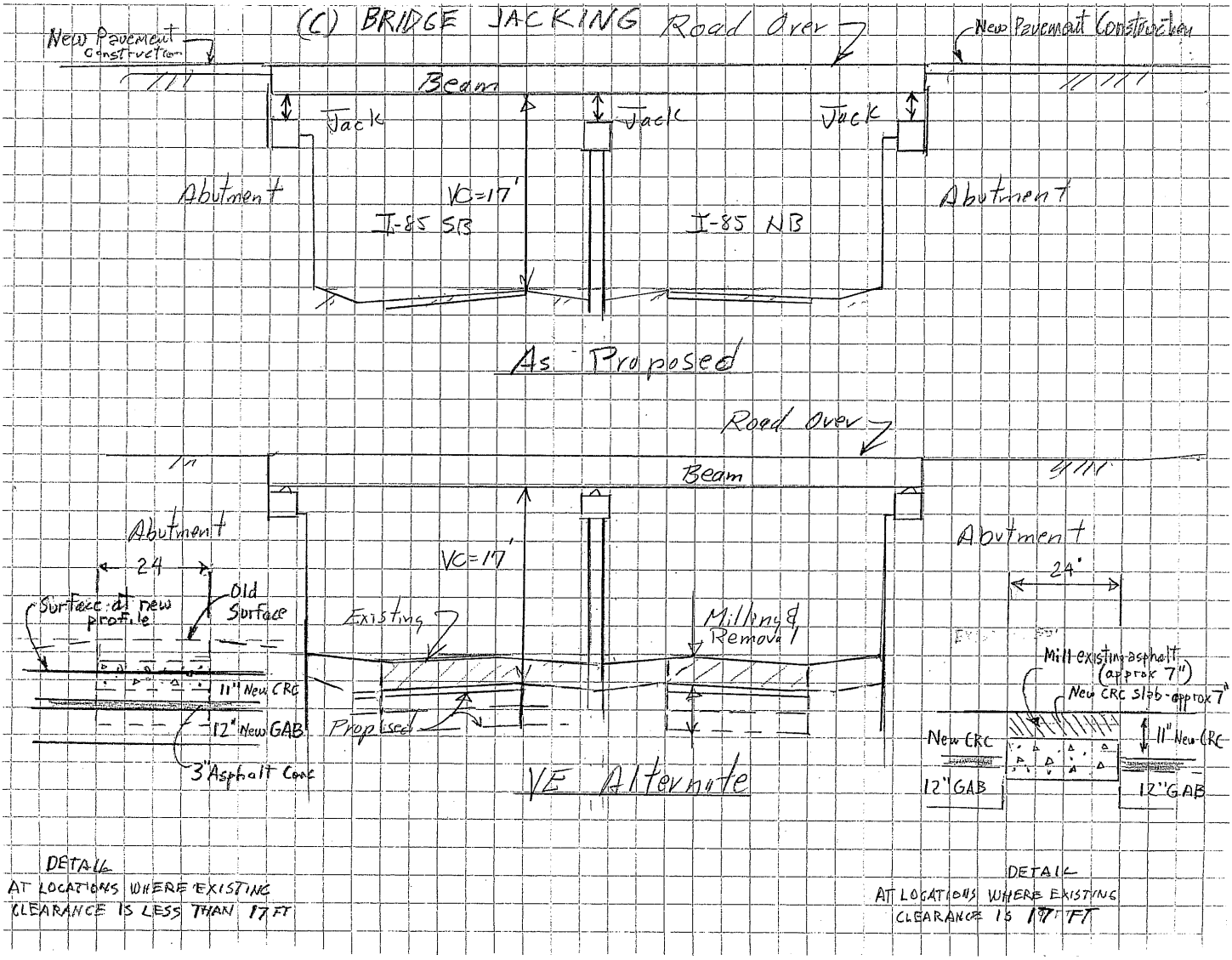
AS PROPOSED				**VALUE ENGINEERING ALTERNATIVE**			
Year		**Total**	**Present Worth**			**Total**	**Present Worth**
0		$2,453,130	-$2,453,130			$1,810,035	-$1,810,035
37		$0				$2,727,513	-$913,670
75			$0	**Salvage**		-$1,381,940	$150,556
Present Value			**-$2,453,130**				**-$2,573,150**
Life Cycle Cost Difference		**$120,020**					

C. BRIDGE JACKING

1. AS PROPOSED

There are 15 known bridge sites on I-85 where either the vertical clearance is less than the desired 17 ft., or the 11-inch CRC pavement over the existing pavement would reduce the vertical clearance to less than 17 ft. The proposed solution to providing 17 ft. vertical clearance at all necessary locations is to jack each bridge. The jacking operation will be done over I-85 and therefore will require special protection to shield I-85 vehicles from any harm. In addition, the traffic using the cross roads may suffer delays or detours. The profile of the approach roadways will have to be adjusted upward, requiring new pavement construction for hundreds of feet north and south of the existing bridges.

C. BRIDGE JACKING



C. BRIDGE JACKING

2. VALUE ENGINEERING ALTERNATIVE

The Value Engineering Alternative is to lower the profile grade under each bridge sufficient to gain the desired 17 ft. vertical clearance. Starting a downgrade 500 ft. west of the bridge site and extending it to reach a maximum depth under the bridge will accomplish this. Then, extend an upgrade to a point 500 ft east of the bridge site.

At any bridges where the existing clearance is equal to 17 ft., but the proposed 11-inch CRC pavement would require a need for jacking, simply removing all the existing asphalt overlay and changing the new CRC pavement thickness to a lesser dimension than 11 inches (say 7 inches) laid directly on the old 1963 concrete slab would provide a virtually no-cost solution.

At any bridges where the existing vertical clearance is already substandard, the lowered profile grade will require the existing asphalt to be removed for the entire 1000 ft. (approximate) surrounding the bridge, and also removing the middle 500 ft. of the old 1963 concrete slab, and new pavement in the location of the existing lanes for the central 500 ft.

At the bridge locations which already have substandard bridge clearances, the incremental cost of milling, and 1963 concrete slab removal, and the incremental cost of the new pavement over the proposed 11-inch CRC overlay is estimated to be $40,000.

BRIDGE JACKING
VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Jacking of Bridge On CR 146 Over I-85	SF	$15.00	9330.0	$139,950		
Milling Asphalt, Removing Conc. Pavement, GAB, & Sub grade	LS	$40,000.00			1.0	$40,000
Jacking of Bridge On CR 893 Over I-85	SF	$15.00	6528.0	$97,920		
Milling Asphalt, Removing Conc. Pavement, GAB, & Subgrade	LS	$40,000.00			1.0	$40,000
Jacking of Bridge On SR 332 Over I-85	SF	$15.00	10336.0	$155,040		
Jacking of Bridge on CR 229 Over I-85	SF	$15.00	8220.0	$123,300		
Jacking of Bridge on CR 250 Over I-85	SF	$15.00	7830.0	$117,450		
Jacking of Bridge On SR 82	SF	$15.00	9384.0	$140,760		
Jacking of Bridge On US 441/SR15 Over I-85	SF	$15.00	21384.0	$320,760		
Jacking of Bridge on CR 258 Over I-85	SF	$15.00	9376.0	$140,640		
Jacking of Bridge on CR 387 Over I-85	SF	$15.00	8864.0	$132,960		
Jacking of Bridge on SR 198 Over I-85	SF	$15.00	8544.0	$128,160		
Jacking of Bridge on CR 187 Over I-85	SF	$15.00	8992.0	$134,880		
Jacking of Bridge on CR 97 Over I85	SF	$15.00	7920.0	$118,800		
Jacking of Bridge on CR 383 Over I-85	SF	$15.00	9280.0	$139,200		
Subtotal				**$2,203,560**		**$80,000**
E & C			10.0%	$220,356	10.0%	$8,000
Inflation @ 3 yr			5.0%	$347,336	5.0%	$12,610
GRAND TOTAL				**$2,771,252**		**$100,610**

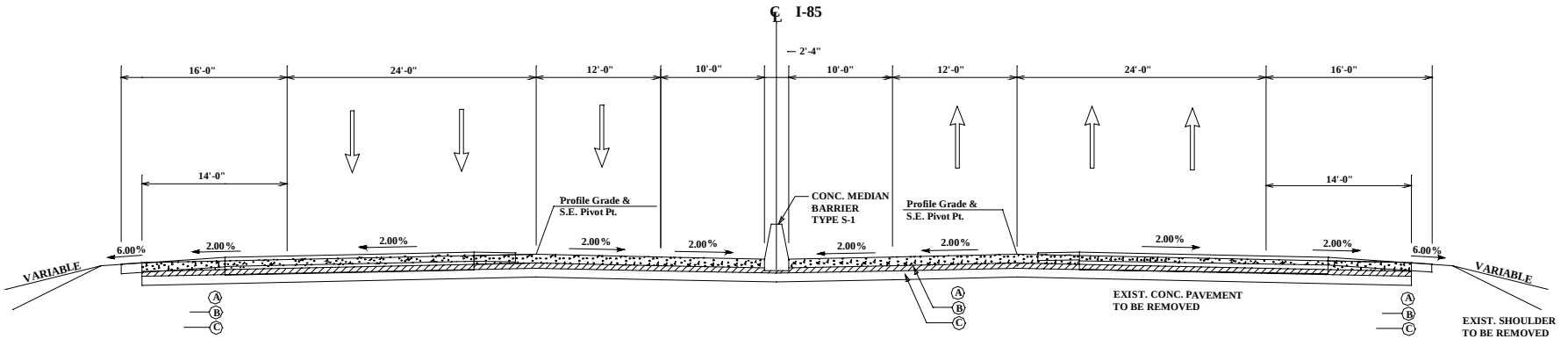
POSSIBLE SAVINGS: $2,066,982

D. MEDIAN BARRIER

1. AS PROPOSED

The As Proposed Typical Section (as shown on the following sheet) calls for a 14-ft. paved outside shoulder, 3-12-ft. travel lanes, a 10-ft. paved inside shoulder in each direction with a 2-ft. 4-inch wide concrete median barrier (Type S-1) at the centerline of construction. In addition to the pavement and barrier, $9,000,000 +/- worth of drainage improvements will be required to remove the water from the median.

This Typical will shift the existing travel lanes approximately 6 ft. towards the centerline and allow for an 8 – lane future Typical with 4 – 12-ft. lanes and a 10-ft. paved shoulder (8-ft. asphalt pavement and 2-ft. CRC pavement).



AS PROPOSED TYPICAL SECTION
WIDENING AND OVERLAY
TANGENT SECTION

PAVEMENT MATERIAL SCHEDULE
(A) CR CONC. PAVEMENT, CL HES CONC., 12 INCH
(B) 25 MM SUPERPAVE MIX DESIGN LEVEL A, 330 LBS./SY
(C) GRADED AGGREGATE BASE, 12 INCH

SLOPE CONTROLS		
SLOPE	CUT	FILL
4:1	0'-6'	6'-10'
# 2:1	OVER 6'	OVER 10'

D. MEDIAN BARRIER

2. VALUE ENGINEERING ALTERNATIVE NO. 1

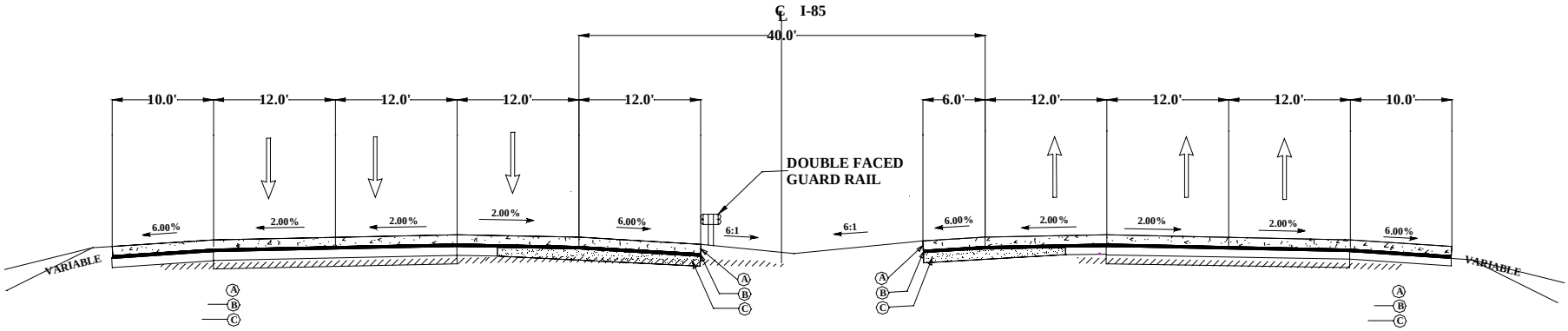
The Value Engineering Team recommends replacing the 2-ft. 4-inch wide Concrete Median Barrier (Type S-1) with double faced W – Beam guard rail that is offset 12 ft. from one of the inside travel lanes as shown on the following sheet. With the As Proposed Concrete Barrier System, both directions of travel have an obstacle (the barrier) within 10 ft. of the inside travel lane. The Value Engineering Alternative increases this obstacle distance to the travel lane to 12 ft. for one direction of travel and to 26 ft. +/- feet for the other resulting in a reduce risk for collisions with an obstacle.

This alternative provides several savings:

1. Replacing a $90/LF concrete barrier with a $20/LF guardrail.

2. Greatly reduces the amount of the closed drainage system improvements required to remove storm water from the median.

3. Reduces the amount of cross sectional pavement by 22 ft.



VE ALTERNATIVE TYPICAL SECTION
WIDENING AND OVERLAY
TANGENT SECTION

PAVEMENT MATERIAL SCHEDULE
(A) CR CONC. PAVEMENT, CL HES CONC., 12 INCH
(B) 25 MM SUPERPAVE MIX DESIGN LEVEL A, 330 LBS./SY
(C) GRADED AGGREGATE BASE, 12 INCH

SLOPE CONTROLS		
SLOPE	CUT	FILL
4:1	0'-6'	6'-10'
# 2:1	OVER 6'	OVER 10'

GUARD RAIL SYSTEM MEDIAN BARRIER
VALUE ENGINEERING ALTERNATIVE NO. 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
MEDIAN/SIDE BARRIER	LF	$92.14	239043	$22,025,422		$0
DOUBLE FACE GUARD RAIL	LF	$20.00	0	$0	239043	$4,780,860
END ANCHORAGE SYSTEM (EVERY 10,000 FT.)	EA	$1,600.00	0	$0	80	$128,000
MISCELLANEOUS ASHPHALT (UNDER GUARD RAIL)	TN	$65.69	0	$0	78884	$5,181,902
MEDIAN PAVEMENT	SF	$6.68	5258946	$35,129,759	0	$0
GRASSING	AC	$1,000.00	0	$0	121	$120,729
DRAINAGE	LS	$8,956,746.00	1	$8,956,746	25%	$2,239,187
SUBTOTAL				**$66,111,927**		**$12,450,678**
E & C			10.0%	$6,611,193	10.0%	$1,245,068
INFLATIONS	3	5%	15.8%	$10,420,893	15.8%	$1,962,538
GRAND TOTAL				**$83,144,013**		**$15,658,284**

POSSIBLE SAVINGS: $67,485,729

D. MEDIAN BARRIER

3. VALUE ENGINEERING ALTERNATIVE NO. 2

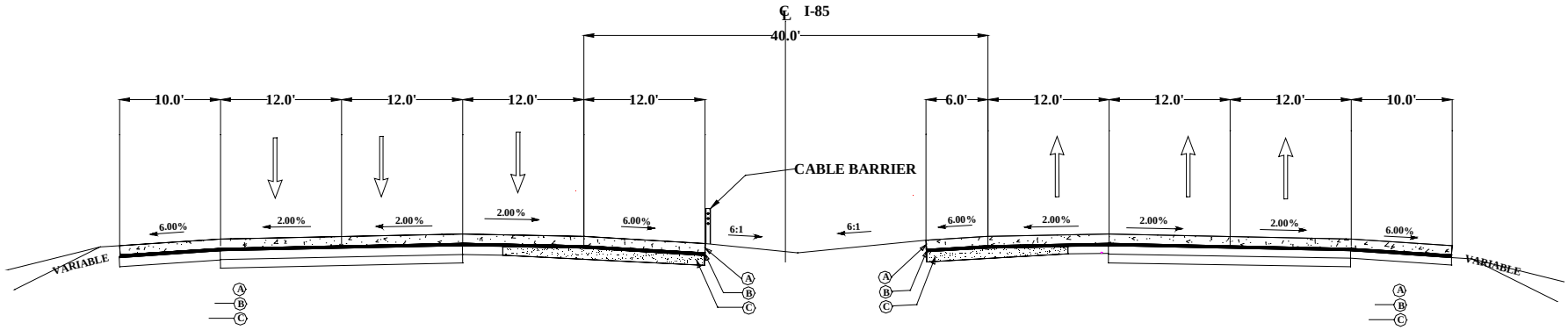
The Value Engineering Team recommends replacing the 2-ft. 4-inch wide Concrete Median Barrier (Type S-1) with a Cable Barrier System that is offset 12 ft. from one of the inside travel lanes as shown on the following sheet. With the As Proposed Concrete Barrier System, both directions of travel have an obstacle (the barrier) within 10 ft. of the inside travel lane. The Value Engineering Alternative increases this obstacle distance to the travel lane to 12 ft. for one direction of travel and to 26 ft. +/- feet for the other resulting in a reduce risk for collisions with an obstacle.

This Alternative provides several savings:

1. Replacing a $90/LF concrete barrier with a $20.50/LF Cable Barrier System.

2. Greatly reduces the amount of the closed drainage system improvements required to remove storm water from the median.

3. Reduces the amount of cross sectional pavement by 22 ft.



VE ALTERNATIVE TYPICAL SECTION
WIDENING AND OVERLAY
TANGENT SECTION

PAVEMENT MATERIAL SCHEDULE
(A) CR CONC. PAVEMENT, CL HES CONC., 12 INCH
(B) 25 MM SUPERPAVE MIX DESIGN LEVEL A, 330 LBS./SY
(C) GRADED AGGREGATE BASE, 12 INCH

SLOPE CONTROLS		
SLOPE	CUT	FILL
4:1	0'-6'	6'-10'
# 2:1	OVER 6'	OVER 10'

CABLE BARRIER SYSTEM
MEDIAN BARRIER
VALUE ENGINEERING ALTERNATIVE NO. 2
COST COMPARISON

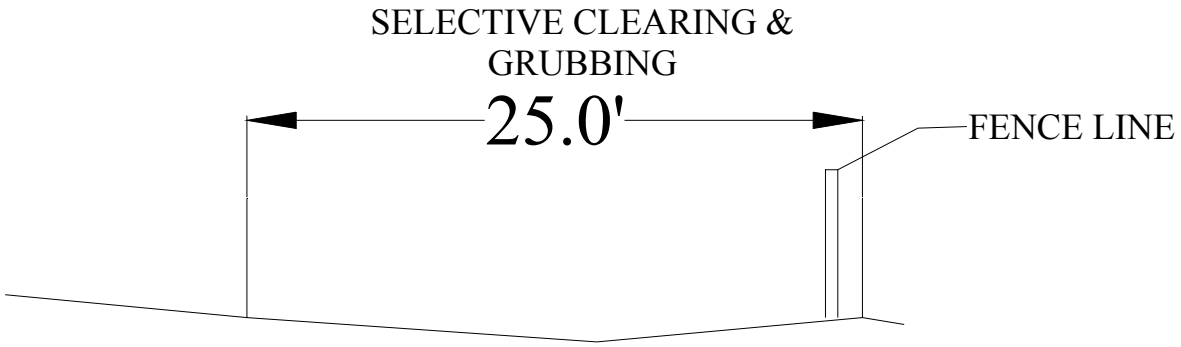
DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
MEDIAN/SIDE BARRIER	LF	$92.14	239043	$22,025,422		$0
CABLE BARRIER	LF	$20.50	0	$0	239043	$4,900,382
END ANCHORAGE SYSTEM (EVERY 10,000 FT.)	EA	$2,900.00	0	$0	48	$139,200
MEDIAN PAVEMENT	SF	$6.68	5258946	$35,129,759	0	$0
GRASSING	AC	$1,500.00	0	$0	121	$181,093
DRAINAGE	LS	$8,956,746.00	1	$8,956,746	25%	$2,239,187
SUBTOTAL				**$66,111,927**		**$7,459,861**
E & C			10.0%	$6,611,193	10.0%	$745,986
INFLATIONS	3	5%	15.8%	$10,420,893	15.8%	$1,175,861
GRAND TOTAL				**$83,144,013**		**$9,381,708**

POSSIBLE SAVINGS: $73,838,220

E. FENCING

1. AS PROPOSED

Replace Access Fence on both sides of the 51 +/- mile project. Replacing the fence will have to include Selective Clearing & Grubbing to provide an adequate work space for the fencing contractor.



E. FENCING

2. VALUE ENGINEERING ALTERNATIVE

The Value Engineering Team recommends replacing only access fence that is damaged or past its useful life (estimated to be 10%).

ELIMINATE NEW FENCING
ACCESS FENCE
VALUE ENGINEERING ALTERNATIVE NO. 1
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
FENCE	LF	$3.25	538560	$1,750,320	53856	$175,032
SELECTIVE C & G	AC	$2,000.00	309	$618,182	31	$61,818
SUBTOTAL				**$2,368,502**		**$236,850**
E & C			10.0%	$236,850	10.0%	$23,685
INFLATIONS	3	5%	15.8%	$373,335	15.8%	$37,334
GRAND TOTAL				**$2,978,687**		**$297,869**

POSSIBLE SAVINGS: $2,680,818

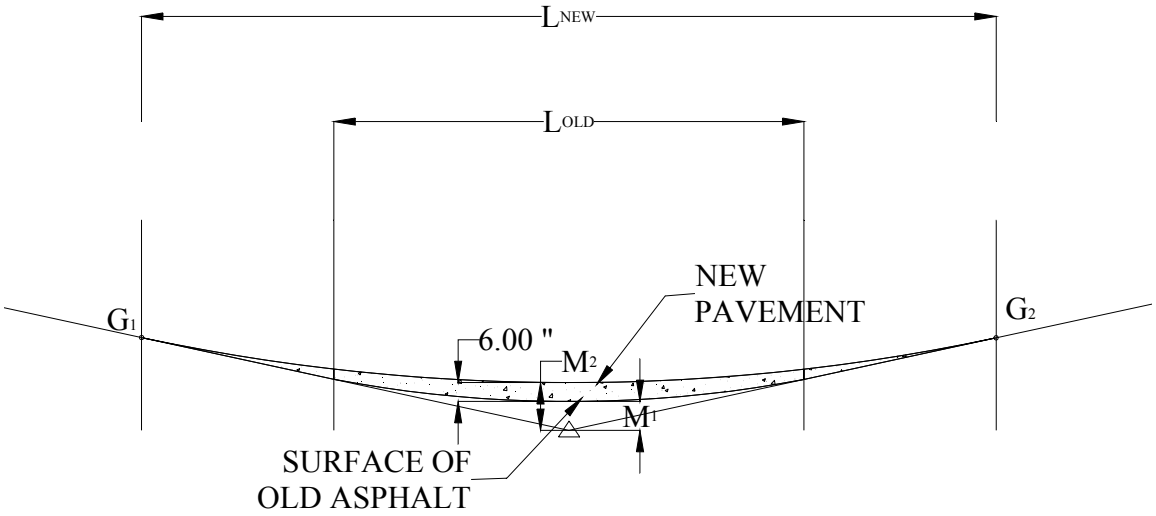
F. PROFILE

1. AS PROPOSED

"As Proposed"

Adjust the Profile at Substandard Vertical Curves by filling in a lens of Asphalt Concrete of variable depth over existing four lanes of pavement for the complete length of the new sag vertical curve.

The example below shows a sample where the proposed sag vertical curve with a K value of 181 (70 MPH) is to be superimposed upon an existing vertical curve with a K value of 140, and the result is that there is a 6-inch rise in the new profile at the sag which coincides with an assumed 6-inch thickness of existing asphalt above the existing concrete slab built in 1963. For the computation, the existing K = 140 VC length is 430 ft., and the upgraded K = 181 VC length is 550 ft.

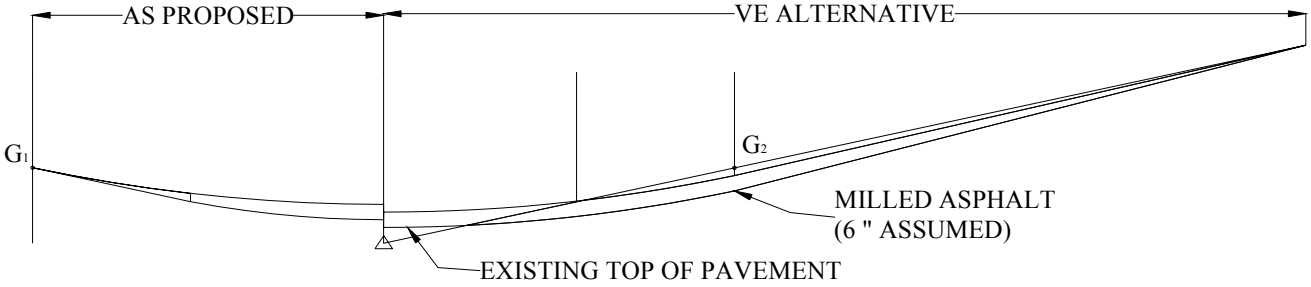


The As Proposed profile will require raising the pavement at the VPI at approximately thirty locations, and the amount to be filled varies from as little as 3 inches to as much as 2.97 ft. However, it is assumed that the difference in the materials used at each location will be virtually the same regardless of the overall depth of filling over the sag which is in excess of the 6 inches assumed to be available for milling.

F. PROFILE

2. VALUE ENGINEERING ALTERNATIVE

Mill the existing Asphalt Concrete in the vicinity of the beginning and the end of the new longer vertical curves to lay bare the old concrete slab, in order to minimize the depth of new asphalt concrete over the middle of the vertical curve at the PVI and low point.
It is assumed that there is a depth of approximately six inches of old Asphalt Concrete over the old Portland Cement concrete slab.



The majority of the approximately thirty substandard sag vertical curve locations require an asphalt concrete overlay which exceeds six inches at the point of maximum overlay (the PVI or the low point). Some of those locations need as much as two feet of asphalt concrete overlay. Nevertheless, all of the locations may benefit by milling whatever thickness of existing asphalt concrete overlay is available at any given substandard vertical curve location.

ADJUST PROFILE AT SUBSTANDARD SAG VERTICAL CURVES
VALUE ENGINEERING ALTERNATIVE
SELECTIVELY MILL EXISTING ASPHALT
COST COMPARISON SHEET FOR ONE TYPICAL SAG LOCATION

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
ASPHALT CONCRETE FILL	TON	$42.56	484	$20,599	0	$0
VARIABLE MILLING 0" TO 6"	SY	$1.50	0	$0	5333	$8,000
SUBTOTAL				**$20,599**		**$8,000**
E & C			10.0%	$2,060	10.0%	$800
INFLATION	3	5%	15.8%	$3,247	15.8%	$1,261
GRAND TOTAL				**$25,906**		**$10,060**

POSSIBLE SAVINGS FOR ONE LOCATION: $15,845

POSSIBLE SAVINGS FOR 30 LOCATIONS: $475,365

G. DESIGN COMMENTS

1. Consider Changing the item for earthwork for the I-85 corridor from in-place embankment to grading complete.

2. The project concept reports have several items that do not agree with the proposed design: i.e. the inside and outside shoulder widths have been changed.

3. A comprehensive survey of existing drainage needs to be completed to make sure that all drainage is functional and compatible with proposed construction.

4. Chain link fencing should be added to the bridge barrier on existing overpass roadway bridges.

5. Close coordination is encouraged between projects in an effort to eliminate the need for temporary pavement to shift traffic.

6. Grinding of concrete is recommended rather than tinning.

7. Grinding of concrete should be delayed in order to thoroughly remove temporary markings.

8. One quarter-inch of sacrificial concrete is recommended for the bridges for thorough removal of temporary markings. (Ride ability may also be enhanced.)

9. A *Special Provision* is needed requiring temporary raised pavement markings for staged traffic.

10. Project NH-85-2(166) has a typical section different than the other nine projects. It is recommended that this typical be changed to agree with the others.

VIII. SUMMARY OF RECOMMENDATIONS

It is the recommendation of the Value Engineering Team that the following Value Engineering Alternatives be carried into the Project Development process for further development.

A. PAVEMENT

Recommendation No. 1:

The Value Engineering Team recommends that Value Engineering Alternative No. 1 be implemented. This alternative revises the Typical Section and uses asphalt widening and overlay.

If this recommendation can be implemented, there is a possible savings of **$225,437,278.**

If this alternative cannot be implemented, then the Value Engineering Team recommends that Value Engineering Alternative No. 2 be implemented. This alternative mills the existing asphalt down to the existing concrete and uses a bonded concrete overlay.

If this recommendation can be implemented, there is a possible savings of **$135,400,058.**

B. MULBERRY RIVER BRIDGE (Project No. NH-IM-85-2(166), PI. No. 110620)

Recommendation No. 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative jacks the existing deck and widens the existing bridge.

If this recommendation can be implemented, there is a possible savings of **$808,772**.

C. BRIDGE JACKING

Recommendation No. 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative revises the profile grades by milling the existing pavement.

If this recommendation can be implemented, there is a possible savings of **$2,670,642**.

SUMMARY OF RECOMMENDATIONS (cont'd)

D. MEDIAN BARRIER

Recommendation No. 4:

The Value Engineering Team recommends that Value Engineering Alternative No. 2 be implemented. This alternative uses cable barrier with a swale in the median.

If this recommendation can be implemented, there is a possible savings of **$73,838,220.**

If this alternative cannot be implemented, then the Value Engineering Team recommends that Value Engineering Alternative No. 1 be implemented.
This alternative uses double face guardrail with swale in the median.

If this recommendation can be implemented, there is a possible savings of **$67,485,729.**

E. FENCING

Recommendation No. 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative utilizes and/or repairs existing fencing.

If this recommendation can be implemented, there is a possible savings of **$2,680,818.**

F. PROFILE

Recommendation No. 6:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative mills the existing pavement to achieve corrected K value.