VALUE ENGINEERING STUDY

OF

I-64 WIDENING AND ROADWAY REHABILITATION

ITEM NUMBER: 5-2035.10

Shelby County, Kentucky

January 15-19, 2007

Prepared by:

VE GROUP, L.L.C.

In Association With:

KENTUCKY TRANSPORTATION CABINET

VALUE ENGINEERING STUDY TEAM LEADER

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C.V.S. Registration No. 20010901

DATE

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I. EXECUTIVE SUMMARY

INTRODUCTION

This Value Engineering report summarizes the results of the Value Engineering Study performed by VE Group for the Kentucky Transportation Cabinet. The study was performed during the week of January 15-19, 2007.

The subject of the study is the widening of Interstate 64 from Milepost 38.0 and ending at Milepost 43.5.

PROJECT DESCRIPTION

This project will widen I-64 in median to provide 6-lane limited access facility from milepost 38.0 to milepost 43.5 between Louisville and Frankfort, Kentucky. In summer 2003, the scope of the project was to include the widening of all mainline and overhead structures to accommodate six lanes in one phase and the widening of the remainder of the project in another phase.

In September 2006, the Cabinet requested that Vaughn & Melton Consulting Engineers change the roadway plans to widen the entire project and bring all speed-change lanes to current guidelines. By widening to the median side, two lanes of traffic can be maintained at all times. Included in the work are replacement of existing three I-64 bridge, replacement of twin Wagon Box Structures by new I-64 Bridges, an interchange bridge, and one grade separation bridge. All of this work will be completed within existing Right of Way.

Letting is set for March 2007.

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:

- Traffic Control
- Construction Time
- Service Life
- Future Maintenance Cost
- Construction Cost
- Utility Impacts

I. EXECUTIVE SUMMARY

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:

Recommendation Number 1:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative revises the widened pavement design by using the "**Maximum Aggregate**" method of pavement design.

If this recommendation can be implemented, there is a possible savings of **$4,973,914.**

Recommendation Number 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative constructs a single 100' span bridge over the Norfolk Southern RR.

If this recommendation can be implemented, there is a possible savings of **$970,039.**

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will eliminate the two 48ft. end spans by constructing vertical end abutments with MSE walls at the clear zone.

If this recommendation can be implemented, there is a possible savings of **$59,732.**

Recommendation Number 4:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will salvage the existing wagon boxes by extending them 33' towards the median and replacing the existing outside wing walls.

If this recommendation can be implemented, there is a possible savings of **$614,614.**

Recommendation Number 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will construct roundabouts at the ramp termini and eliminating the 14' left turn lane on the bridge

If this recommendation can be implemented, there is a possible savings of **$685,845.**

Recommendation Number 6:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will eliminate some minor drainage structures in selected locations.

If this recommendation can be implemented, there is a possible savings of **$5,851.**

Recommendation Number 7:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will flatten selected 3:1 slopes to 4:1 or flatter to eliminate guardrail.

If this recommendation can be implemented, there is a possible savings of **$72,380.**

Recommendation Number 8:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will reduce the maximum height of the embankment benches from 12' to 6'.

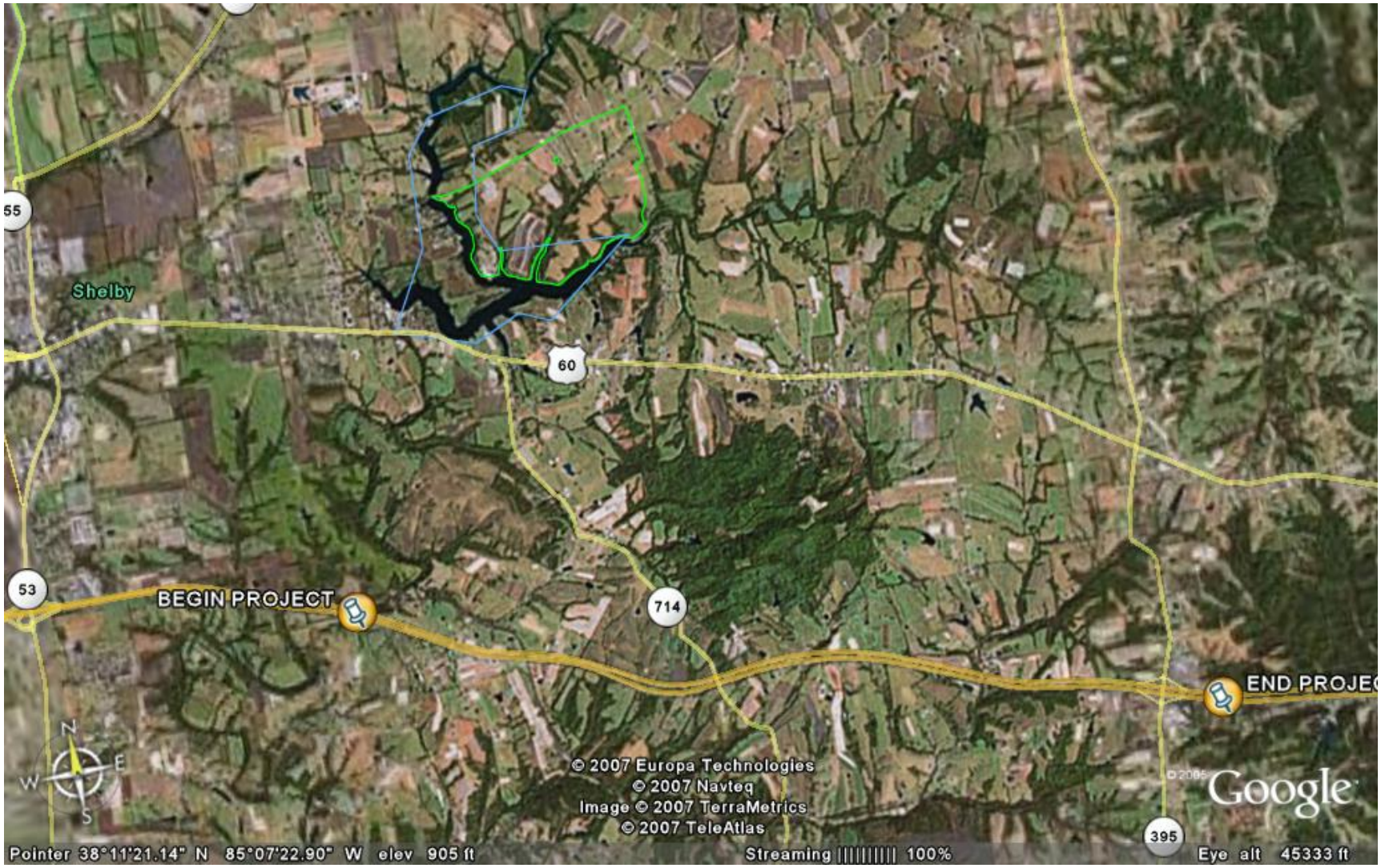
If this recommendation can be implemented, there is a possible savings of **$286,223.**

Recommendation Number 9:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will revise the MOT Phasing constructing 1-barrel without traffic.

If this recommendation can be implemented, there is a possible savings of **$3,121,531.**

II. LOCATION OF PROJECT



III. TEAM MEMBERS AND PROJECT DESCRIPTION

TEAMMEMBERS

NAME	AFFILIATION	EXPERTISE	PHONE
Tom Hartley, P.E., C.V.S.	VE Group	Team Leader	850/627-3900
Richard Elliott, P.E.	VE Group	Structures	850/627-3900
Bill Keating, P.E.	VE Group	Roadway/Construction	850/627-3900
Duncan Silver, P.E.	VE Group	Pavement/Traffic	850/627-3900
Josh Hornbeck, P.E.	KYTC – D4 Construction	Resident Engineer	270/766-5033
Leo Frank, P.E.	KYTC – CO Design	Pavement Design	502/564-3280

III. TEAM MEMBERS AND PROJECT DESCRIPTION

PROJECT DESCRIPTION

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Letting is set for March 2007.

IV. INVESTIGATION PHASE

VALUE ENGINEERING STUDY BRIEFING

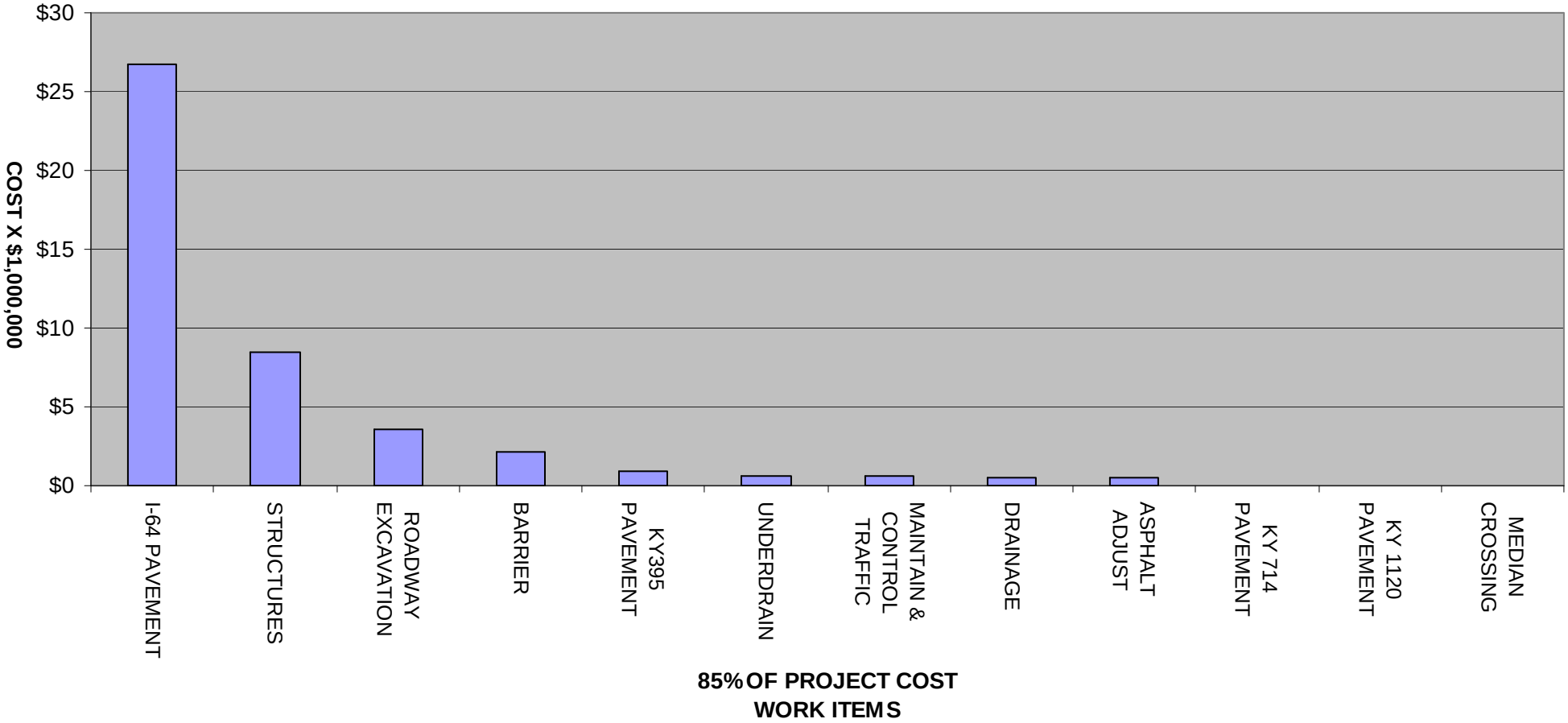
I-64 WIDENING AND ROADWAY REHABILITATION **January 15, 2007**		
NAME	**AFFILIATION**	**PHONE**
Tom Hartley, P.E., C.V.S.	VE Group	850/627-3900
Richard Elliott, P.E.	VE Group	850/627-3900
Bill Keating, P.E.	VE Group	850/627-3900
Duncan Silver, P.E.	VE Group	850/627-3900
Josh Hornbeck	KYTC – D4 Construction	270/766-5033
Leo Frank	KYTC – CO Design	502/564-3280
Clint Goodin.	Vaughn & Melton	606/248-6600
Bradley Ridnour	Vaughn & Melton	606/248-6600
Robert Semones	KYTC – Program Performance	502/564-9555
Dan Hite	KYTC – Design	502/564-3280

IV. INVESTIGATION PHASE

STUDY RESOURCES

I-64 WIDENING AND ROADWAY REHABILITATION **January 15-19, 2007**		
NAME	**AFFILIATION**	**PHONE**

PARETO CHART



IV. INVESTIGATION PHASE

FUNCTIONAL ANALYSIS WORKSHEET

I-64 WIDENING AND ROADWAY REHABILITATION

January 15-19, 2007

ITEM	FUNCT. VERB	FUNCT. NOUN	* TYPE	COST	WORTH	VALUE INDEX
Pavement	Support Increase	Vehicles Capacity	B B	$26,750,000	$21,000,000	1.27
RR Bridge	Separate	Traffic	B	$1,800,000	$1,020,000	1.76
KY 714 Bridge	Separate	Traffic	B	$884,000	$800,000	1.11
Bob Jeff Wagon Box	Separate	Traffic	B	$1,090,000	$230,000	4.74
Jeptha Creek Bridge	Separate Avoid	Traffic Obstacle	B B	$2,255,000	$1,900,000	1.19
KY 395 Interchange Bridge	Separate	Traffic	B	$1,769,000	$1,259,000	1.41
Earthwork	Set	Grades	B	$3,500,000	$3,000,000	1.67
MOT	Maintain Protect	Traffic Workers	S S	$1,800,000	$1,500,000	1.20
Guard Rail	Redirect Protect	Vehicle Obstacle	S S	$900,000	$720,000	1.25
Under drain	Convey	Runoff	S	$625,000	$625,000	1.00
Drainage	Convey	Runoff	S	$540,000	$500,000	1.08

***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.

IV. INVESTIGATION PHASE

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. RR BRIDGE

C. KY 714 BRIDGE

D. BOB JEFF ROAD WAGON BOX

E. JEPTHA CREEK BRIDGE

F. KY 395 INTERCHANGE BRIDGE

G. DRAINAGE

H. GUARDRAIL

I. EARTHWORK

J. MAINTENANCE OF TRAFFIC

V. SPECULATION PHASE

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

A. PAVEMENT

- Reconstruct pavement using Maximum Asphalt Method
- Reconstruct pavement using Maximum Aggregate Method
- Eliminate leveling and wedge layer by keeping the crown point and cross slope the same
- Widen pavement using Maximum Aggregate Method

B. RR BRIDGE

- Shorten to a single span 100’ long bridge

C. KY 714 BRIDGE

- Shorten bridge to a 2-span 289’ long bridge
- Shorten bridge to a 3-span 289’ long bridge

D. BOB JEFF ROAD WAGON BOX

- Extend wagon box into median

E. JEPTHA CREEK BRIDGE

- Construct Conspan over Jeptha creek and construct a 30’ bridge over Jeptha Creek Road

F. KY 395 INTERCHANGE BRIDGE

- Construct roundabouts at the ramp termini and reduce the width of the structure to a 2-lane bridge
- shorten bridge to a 2-span 289’ bridge
- shift alignment 11’ to allow 2-phase construction

G. DRAINAGE

- Eliminate cross drains and use slope drains/flumes

H. GUARDRAIL

- Use excess excavation material to reduce side slopes to 4:1 in selected areas

I. EARTHWORK

- Bench to maximum height of 6’**.**

J. MAINTENANCE OF TRAFFIC

- Construct 1-barrel without traffic

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 #1: ***Reconstruct I-64 pavement using the Maximum asphalt method.***

Value Engineering Alternative #2: ***Reconstruct I-64 pavement using the Maximum aggregate method.***

Value Engineering Alternative #3: ***Widen I-64 pavement using the Maximum aggregate method.***

B. RR Bridge

Value Engineering Alternative: ***Shorten bridge to a single 100' span.***

C. KY 714 Bridge

Value Engineering Alternative #1: ***Construct a 2-span, 289' bridge constructed with steel girders.***

Value Engineering Alternative #2: ***Construct a 3-span, 289' bridge constructed with steel girders.***

D. Bob Jeff Road Wagon Box Replacement

Value Engineering Alternative: ***Extend Wagon Box into median.***

E. Jeptha Creek Bridge

Value Engineering Alternative: ***Construct Conspan over Jeptha Creek and a 30' long bridge over Jeptha Creek Road.***

F. KY 395 Interchange Bridge

Value Engineering Alternative: ***Construct roundabouts at the ramp termini, construct a 2-lane bridge.***

G. Drainage

Value Engineering Alternative: ***Construct slope drains or flumes at bridge end.***

H. Guardrail

Value Engineering Alternative: ***Use excess excavation to reduce slopes to 4:1 in selected areas.***

I. Earthwork

Value Engineering Alternative: ***Bench to maximum height of 6'.***

J. MOT

Value Engineering Alternative: ***Phase the construction to allow 1-barrel to be constructed without traffic .***

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": Break & Seat existing concrete pavement, shift the crown point with wedge and leveling course (5" maximum) and overlay with 12" of structural asphalt; widen 36' to the inside with 12" of asphalt, 4" drainage blanket, and 6" DGA

Advantages

- Salvages existing pavement
- Reduces amount of cut sections

Disadvantages

- Requires wedge and leveling course
- Raises profile
- Non-uniform pavement section
- Higher cost
- Increases fill sections

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative #1: ***Reconstruct I-64 pavement using the Maximum asphalt method.***

Advantages

- Uniform pavement section
- Keeps existing profile
- No leveling & wedge course
- Reduces fill sections

Disadvantages

- No salvage of existing pavement
- Increases cut sections
- Higher cost

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES

Conclusion

DROP

Value Engineering Alternative #2: ***Reconstruct I-64 pavement using the Maximum aggregate method.***

Advantages

- Uniform pavement section
- Keeps existing profile
- No leveling & wedge course
- Reduces fill sections

Disadvantages

- No salvage of existing pavement
- Increases cut sections
- Higher cost

Conclusion

DROP

Value Engineering Alternative #3: ***Widen I-64 pavement using the Maximum aggregate method.***

Advantages

- Lower cost

Disadvantages

- Increases cut sections

Conclusion

Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

B. RR Bridge

"As Proposed": Construct a 2-span, 171' bridge over the Norfolk Southern Rail Road.

Advantages

- None apparent

Disadvantages

- Utility impact (water line)
- Unbalanced span
- More structure

Conclusion

Carry forward for further evaluation.

Value Engineering Alternative: ***Shorten bridge to a single 100' span.***

Advantages

- Less structure
- May not impact utilities
- Reduced interference with RR operations

Disadvantages

- Non-apparent

Conclusion

Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

C.

"As Proposed": Construct a 5-span, 382' long bridge over I-64.

Advantages

- Short span lengths
- Lighter crane lifts

Disadvantages

- More spans
- More structure

Conclusion
Carry forward for further evaluation.

Value Engineering Alternative: ***Construct a 2-span, 289' bridge constructed with steel girders.***

Advantages

- Fewer spans
- Shorter bridge

Disadvantages

- Longer spans
- Deeper spans
- Higher bridge material cost
- Increase roadway embankment

Conclusion
DROP

Value Engineering Alternative #2: ***Construct a 3-span, 289' bridge constructed with AASHTO girders.***

Advantages

- Fewer spans
- Shorter bridge

- Lower cost

Disadvantages

- Longer spans
- Deeper spans
- Increase roadway embankment

Conclusion

Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

D. **Bob Jeff Road Wagon Box Replacement**

As Proposed": Replace existing Wagon Boxes with twin single span 115' long bridges.

Advantages

- Wider roadway
- Longer service life

Disadvantages

- More structure
- Constructibility issues
- MOT

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative #1: Extend Wagon Box into median.

Advantages

- Less structure
- Better constructability
- Better MOT
- Lower cost

Disadvantages

- Higher maintenance cost
- May require rehab
- Shorter service life
- Narrow roadway

Conclusion

- Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

Value Engineering Alternative #1: Construct frontage road along I-64 to KY 714.

Advantages

- No structure
- Reduced construction
- Low MOT

Disadvantages

- Possible Right of Way impacts
- Environmental permits
- Increased roadway maintenance

Conclusion

- DROP

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

E. Jeptha Creek Bridge

"As Proposed": Construct 3-span 257' bridge.

Advantages

- Open spans for visual aesthetics
- Accommodates future widening of Jeptha Creek Road
- Minimal hydraulic impacts to Jeptha Creek

Disadvantages

- Increased structure

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative: ***Construct Conspan over Jeptha Creek and a 30' long bridge over Jeptha Creek Road.***

Advantages

- Less structure

Disadvantages

- Less open space for visual aesthetics
- Preclude widening of Jeptha Creek Road
- Possible environmental permit impacts
- Multi-phased MSE Wall construction
- Toe of fill slope spills outside of Right of Way
- Length of Conspan is uneconomical

Conclusion

DROP

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

F. **KY 395 Interchange Bridge**

"As Proposed": Construct a 5-span, 388'long bridge for 3-lanes of traffic over I-64.

Advantages

- No shift in horizontal alignment.

Disadvantages

- 3-phased bridge construction
- Reduces intersection site distance
- Constructibility issues
- More substructure
- More superstructure

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative: ***Construct roundabouts at the ramp termini, construct a 2-lane bridge.***

Advantages

- Less superstructure
- Less substructure
- Reduces bridge construction staging
- Better constructability
- Reduces delay
- Aesthetics

Disadvantages

- Higher bridge material costs
- Multi-phased MSE Wall construction

Conclusion

- Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

G. Drainage

"As Proposed": Construct cross drains at the RR Bridge and Jeptha Creek Bridge

Advantages

- Single outfall
- Less erosion potential

Disadvantages

- More excavation
- Requires stubbing off of pipes
- Possible roadway settlement problems
- More pipe
- MOT issues

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative: ***Construct slope drains or flumes at bridge end.***

Advantages

- Less excavation
- No stubbing off of pipes
- Less pipe
- No MOT issues

Disadvantages

- More erosion potential
- 2-outfalls

Conclusion

- Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

H. Guard Rail

"As Proposed": Install guardrail where slopes exceed 3:1.

Advantages

- Provides channelization

Disadvantages

- Places object within Clear Zone
- Higher maintenance costs

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative: ***Use excess excavation to reduce slopes to 4:1 in selected areas.***

Advantages

- Eliminates roadside hazard
- Less maintenance
- Reduces excess excavation material.

Disadvantages

- Possible impacts to drainage structures

Conclusion

- Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

I. Earthwork

"As Proposed": Construct benches with a maximum 12' height.

Advantages

- None apparent

Disadvantages

- Increases excavation quantity
- Increase risk of embankment collapse

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative: Bench to maximum height of 6'.

Advantages

- Appears to be more practical
- Reduced risk of embankment collapse
- Reduces excavation

Disadvantages

- More benches

Conclusion

- Carry forward for further evaluation.

VI. EVALUATION PHASE

B. ADVANTAGES AND DISADVANTAGES (cont'd)

J. MOT

"As Proposed": The outside shoulders in both directions will be milled and resurfaced in Phase I. Phase II Traffic in both directions will be shifted over to the resurfaced outside shoulder and outside lane to allow widening in the median. After completion of the widening, Phase III traffic in both directions will be shifted to the new pavement and the existing pavement will be cracked and seated and overlayed. Phase IV will complete the surface layer on the roadway.

Advantages

- No restriction where contractor can work with in the work zone

Disadvantages

- Longer construction time
- More relocation
- Increased exposure to workers and equipment
- Increased construction costs

Conclusion

- Carry forward for further evaluation.

Value Engineering Alternative: ***Phase the construction to allow 1-barrel to be constructed without traffic .***

Advantages

- No throw away shoulder pavement
- Reduced exposure to construction workers and equipment
- Possible reduced construction costs on the barrel that is shut down for construction

Disadvantages

- Crossovers will be required

Conclusion

- Carry forward for further evaluation.

VII. DEVELOPMENT PHASE

A. PAVEMENT

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

B. RR Bridge

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

C. KY 714 Bridge

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

D. Bob Jeff Road Wagon Box Replacement

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

E. KY 395 Interchange Bridge

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

VII. DEVELOPMENT PHASE

F. Drainage

(3) AS PROPOSED
(4) VALUE ENGINEERING ALTERNATIVE

G. Guardrail

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

H. Earthwork

(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

I. MOT

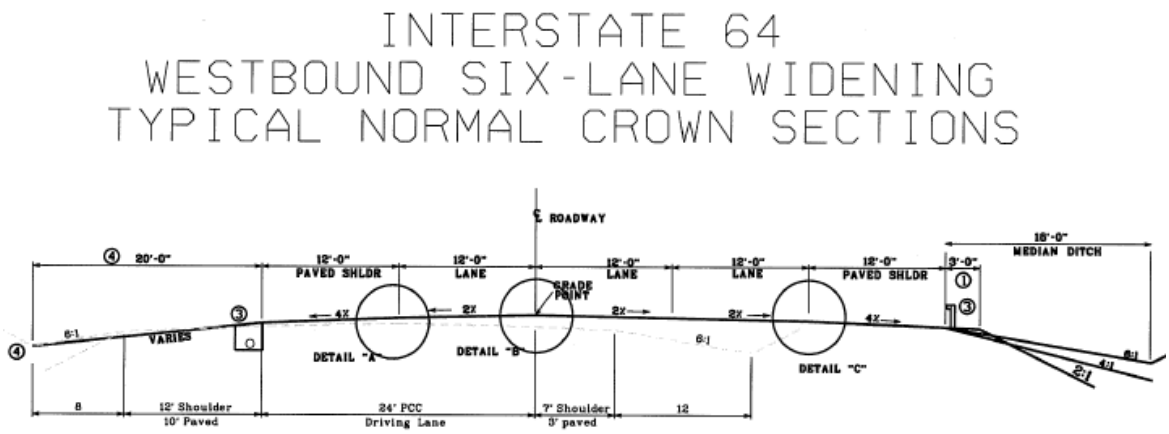
(1) AS PROPOSED
(2) VALUE ENGINEERING ALTERNATIVE

VII. DEVELOPMENT PHASE

A. PAVEMENT

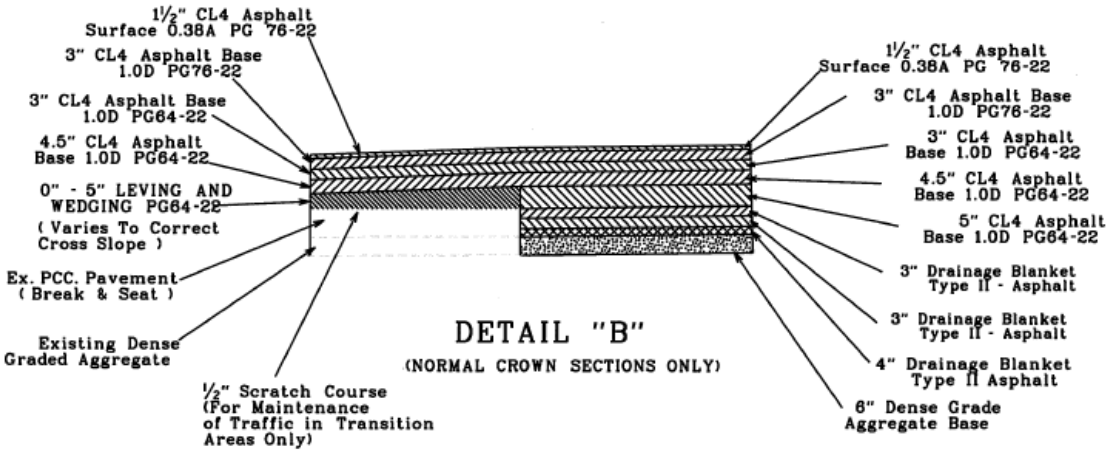
"As Proposed"

The As Proposed Typical Section for the new roadway calls for shifting the outside shoulder to the existing outside driving lane.



AS PROPOSED TYPICAL SECTION

The outside driving lane will be constructed with full depth pavement as shown below.



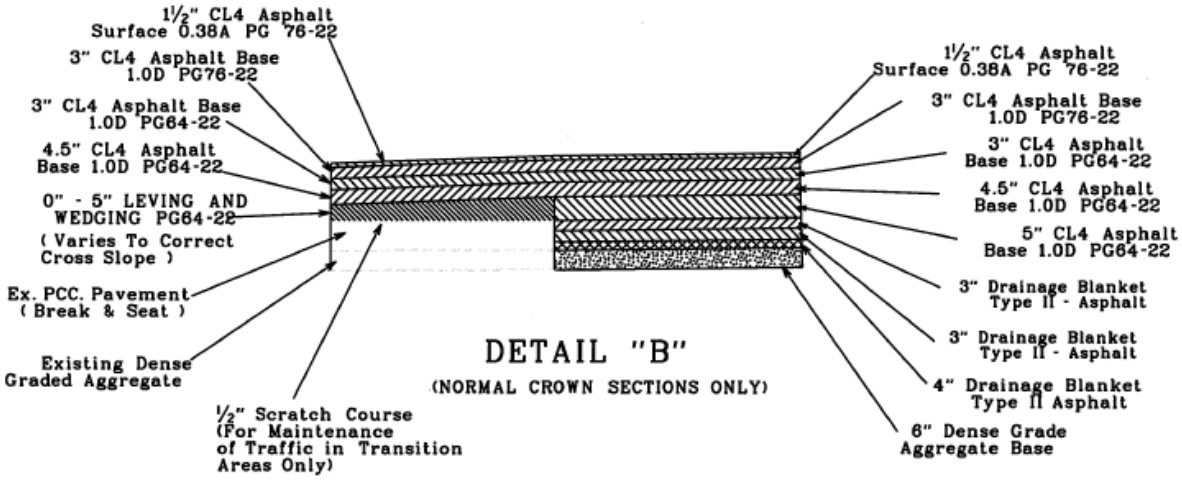
AS PROPOSED PAVEMENT DESIGN

A. PAVEMENT

"As Proposed"

The existing pavement will consist of:

- Break & Seat Existing PCC
- Overlay with:
  - 1.5" asphalt surface course
  - 10.5" of base course
  - 0.0" to 5.0" wedge and leveling course
  - 0.5" scratch course (for MOT).

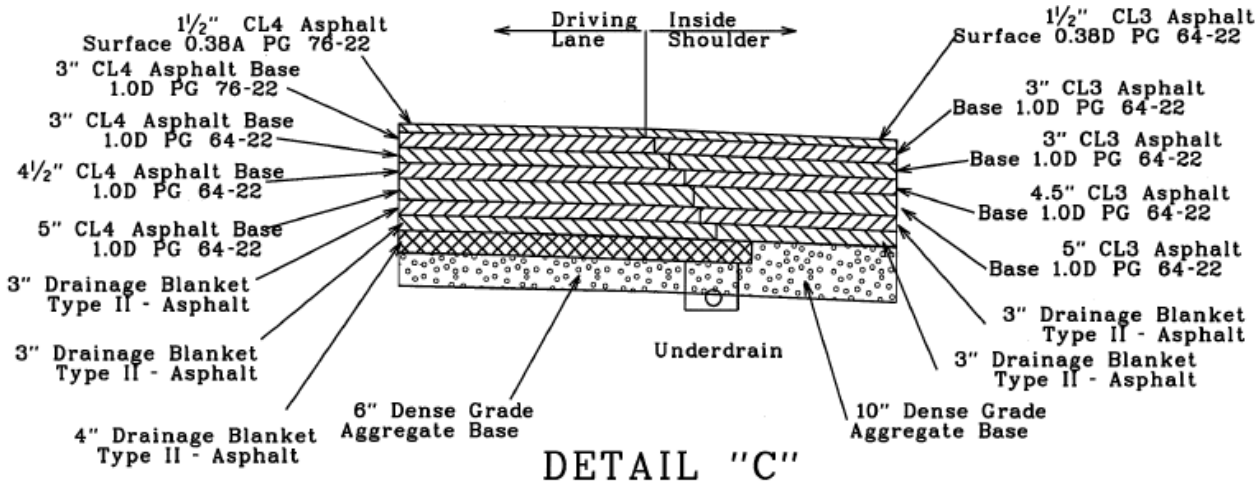


AS PROPOSED REHABILITATED PAVEMENT & OUTSIDE SHOULDER PAVEMENT

The widened pavement design was developed using the "**Maximum Asphalt**" method of pavement design and consists of:

- 1.5" of asphalt surface
- 15.5" of asphalt base
- 10.0" of asphalt treated drainage blanket
- 6.0" of DGA base.

For a total depth of pavement of 33.0"



AS PROPOSED WIDENED PAVEMENT & INSIDE SHOULDER PAVEMENT

The shoulder pavement design is:

- 1.5” of asphalt surface
- 15.5” of asphalt base
- 6.0” of asphalt treated drainage blanket
- 10.0” of DGA base.

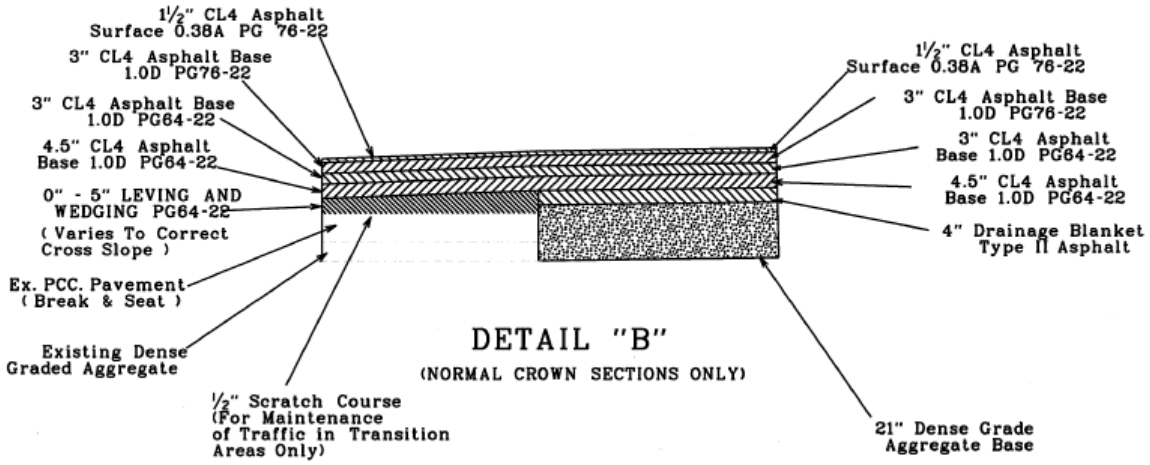
For a total depth of shoulder pavement of 33.0”

VII. DEVELOPMENT PHASE

A. PAVEMENT

Value Engineering Alternative

The VE Team recommends revising the Widened pavement design by using the "**Maximum Aggregate**" method of pavement design.



VE ALTERNATIVE REHABILITATED PAVEMENT & OUTSIDE SHOULDER DESIGN

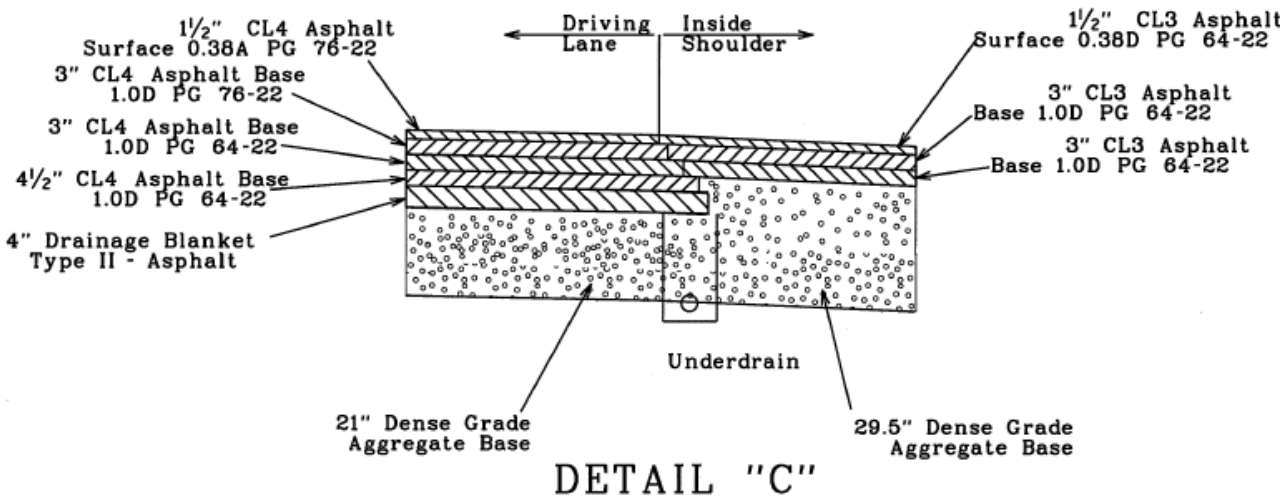
This results in the following pavement section:

- 1.5" of asphalt surface
- 10.5" of asphalt base
- 4.0" of asphalt treated drainage blanket
- 21.0" of DGA base.

16" of asphalt and 21" of aggregate base, for a total pavement depth of 37.0", which increases the depth of cut and reduces the amount of fill, which will increase the amount of excess material on the project.

A. PAVEMENT

Value Engineering Alternative



VE ALTERNATIVE SHOULDER & PAVEMENT DESIGN

The shoulder pavement design is the same as the pavement design and consists of:

- 1.5” of asphalt surface
- 6.0” of asphalt base
- 29.5” of DGA base.

7.5” of asphalt and 29.5” of aggregate base for a total shoulder pavement depth is 37.0”.

The VE Team also evaluated reconstructing the entire pavement by using the “Maximum Asphalt” and the “Maximum Aggregate” Pavement Design Methods. Both of these exceeded the estimated cost of the “As Proposed” Pavement Design and were dropped from further consideration.

PAVEMENT

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
0145 ROADWAY EXCAVATION (I-64 EB)	CY	$5.00	704,545	$3,522,725	732,645	$3,663,225
217 CL4 ASPH BASE 1.0D PG64-22	TON	$55.00	41,789	$2,298,395	41,789	$2,298,395
18 DRAINAGE BLANKET TYPE II-ASPH	TON	$42.33	98,549	$4,171,579	39,420	$1,668,649
1 DGA	TON	$14.50	61,817	$896,347	216,361	$3,137,235
SHOULDERS						
214 CL3 ASPH BASE 1.0D PG64-22 5"	TON	$48.50	95,519	$4,632,672	54,583	$2,647,276
18 DRAINAGE BLANKET TYPE II-ASPH	TON	$42.33	90,969	$3,850,714	0	$0
1 DGA	TON	$14.50	82,893	$1,201,949	150,737	$2,185,687
SUBTOTAL				**$20,574,379**		**$15,600,465**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$20,574,379**		**$15,600,465**

POSSIBLE SAVINGS: $4,973,914

VII. DEVELOPMENT PHASE

A. COST COMPARISON SHEET BACK UP CALCULATIONS

VE ALTERNATIVE QUANTITIES

Driving Lanes — Asphalt Quantity = Area*Thickness*110 lbs./SY/in of depth (115

Code	Bid Item	Unit	Thickness	Width	Area (SY)	Quantity
2107	BREAKING AND SEATING PAVEMEN	Sq Yd	---	24.00'	165,398	165,398
342	CL4 ASPH SURF 0.38A PG76-22	Ton	1.50"	36.00'	248,097	20,468
219	CL4 ASPH BASE 1.0D PG76-22	Ton	3.00"	36.25'	249,820	41,220
217	CL4 ASPH BASE 1.0D PG64-22	Ton	3.00"	36.75'	253,265	41,789
217	CL4 ASPH BASE 1.0D PG64-22	Ton	4.50"	37.25'	256,711	63,536
217	***CL4 ASPH BASE 1.0D PG64-22***	***Ton***	***0.00"***	***25.00'***	***172,289***	***0***
217	***CL4 ASPH BASE 1.0D PG64-22***	***Ton***	***0.00"***	***24.00'***	***165,398***	***0***
18	DRAINAGE BLANKET TYPE II-ASPH	Ton	4.00"	26.00'	179,181	39,420
1	DGA	Ton	21.00"	26.00'	179,181	216,361

Shoulders

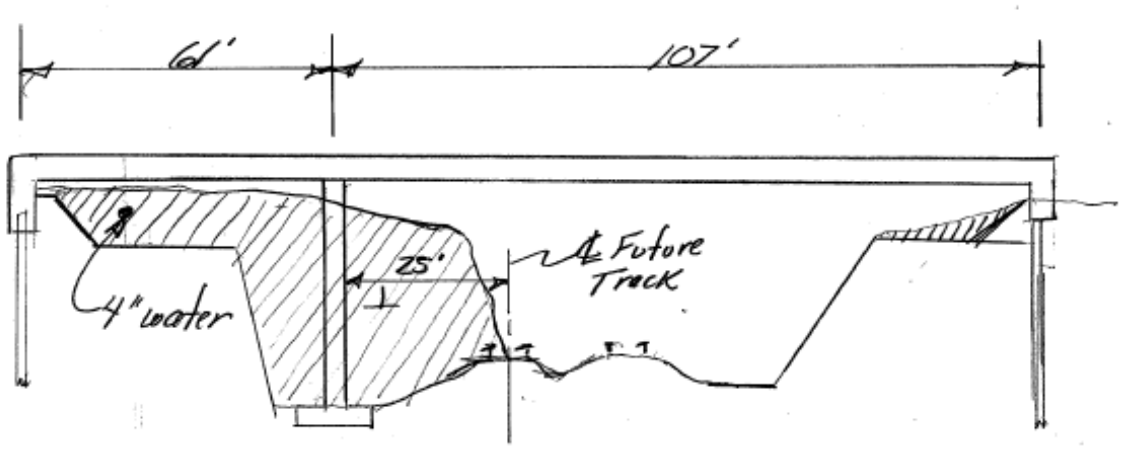
Code	Bid Item	Unit	Thickness	Width	Area (SY)	Quantity
339	CL3 ASPH SURF 0.38D PG64-22	Ton	1.50"	24.00'	165,398	13,645
214	CL3 ASPH BASE 1.0D PG64-22	Ton	3.00"	24.00'	165,398	27,291
214	CL3 ASPH BASE 1.0D PG64-22	Ton	3.00"	24.00'	165,398	27,291
214	***CL3 ASPH BASE 1.0D PG64-22***	***Ton***	***4.50"***	***24.00'***	***165,398***	***40,936***
18	DRAINAGE BLANKET TYPE II-ASPH	Ton	4.00"	12.00'	82,699	18,194
1	DGA	Ton	29.50"	12.00'	82,699	157,349
Inside	*DGA Wedge (included in DGA above)*	*Ton*	*45.50"*		*3.19*	*15,192*
Outside	*DGA Wedge (included in DGA above)*	*Ton*	*16.00"*		*0.40*	*1,879*

VII. DEVELOPMENT PHASE

B. RR BRIDGE

"As Proposed"

The proposed 2-span bridge over the Norfolk Southern RR has spans of 61ft and 107ft for a total length of 168 ft. The proposed pier is located 25ft. west of a future track. The construction of this pier will require the existing shale cut to be extended west. The abutments will be founded well beyond the face of the shale cut. The excavation near the west abutment will require the relocation of an existing 4-inch waterline.



AS PROPOSED I-64 BRIDGE OVER NORFOLK SOUTHERN RR

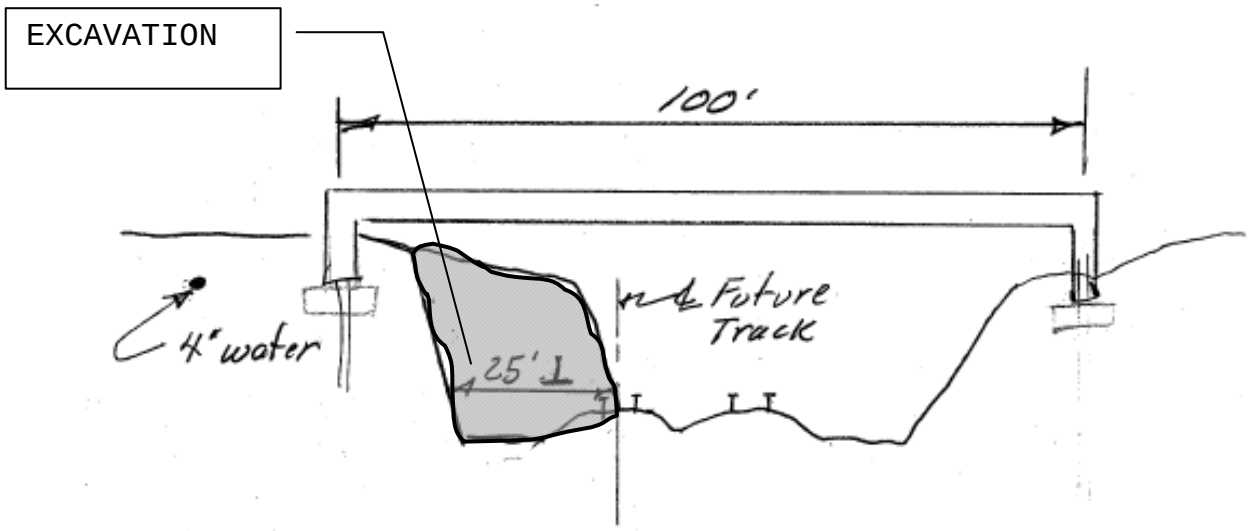
EXISTING I-64 BRIDGE OVER NORFOLK SOUTHERN RR (LOOKING NORTH)

VII. DEVELOPMENT PHASE

B. RR BRIDGE

Value Engineering Alternative

The VE recommends constructing a single 100’ span bridge. The west face of the shale will be extended west to provide 25ft. of clearance to the future track. The abutments will be located approximately 10ft. behind the face of the shale cut to provide for future weathering of the shale without jeopardizing the stability of the abutments. The VE Alternative will reduce the bridge area; eliminate the pier adjacent to the railroad tracks and eliminate the need to relocate the 4” waterline.



VE ALTERNATIVE I-64 BRIDGE OVER THE NORFOLK SOUTHER RR

I-64 BRIDGE OVER NORFOLK SOUTHERN RR

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Bridge with pier	SF	$73.16	25677.0	$1,878,529	0.0	$0
Bridge without Pier	SF	$60.00	0.0	$0	15000.0	$900,000
Excavation	CY	$15.00	2333.0	$34,995	932.0	$13,980
Roadway Pavement	SY	$70.00	0.0	$0	593.0	$41,510
Embankment	CY	$15.00	0.0	$0	1400.0	$21,000
Steel Encasement Pipe - 12" (Relocate Water Line)	LF	$103.14	320.0	$33,005	0.0	$0
SUBTOTAL				**$1,946,529**		**$976,490**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$1,946,529**		**$976,490**

POSSIBLE SAVINGS: $970,039

VII. DEVELOPMENT PHASE

B. COST COMPARISON SHEET BACK UP CALCULATIONS

PAVEMENT UNIT COST

WIDEN					**$**	**83.91**	**per sy**					**$ 9,455,098.57**
CL 4 SURF PG 76-22	1.5	110	0.0825	$ 63.83000	$	5.27	36	28170	112680.00	9,296	$	593,370.06
CL 4 BASE PG 76-22	3	110	0.165	$ 64.40275	$	10.63	36	28170	112680.00	18,592	$	1,197,388.81
CL 4 BASE PG 64-22	3	110	0.165	$ 55.00000	$	9.08	36	28170	112680.00	18,592	$	1,022,571.00
CL 4 BASE PG 64-22	4.5	110	0.2475	$ 55.00000	$	13.61	36	28170	112680.00	27,888	$	1,533,856.50
CL 4 BASE PG 64-22	5	110	0.275	$ 54.60015	$	15.02	36	28170	112680.00	30,987	$	1,691,894.85
CL 4 BASE PG 64-22	3	110	0.165	$ 51.05633	$	8.42	36	28170	112680.00	18,592	$	949,249.50
CL 4 BASE PG 64-22	3	110	0.165	$ 51.05633	$	8.42	36	28170	112680.00	18,592	$	949,249.50
DRAINAGE BLANKET	4	100	0.2	$ 42.32502	$	8.47	36	28170	112680.00	22,536	$	953,836.65
DGAB	6	115	0.35	$ 14.50000	$	5.00	36.00	28170.00	112680.00	38,875	$	563,681.70

BRIDGE WITHOUT PIER UNIT COST

On the railroad bridges, I had a copy of a detailed cost estimate based on final quantities.
The total cost for one of the bridges was $939,248. From that, I subtracted $168,952 which was the cost shown for the pier.

$939,248 - $168,952 = $770,297.

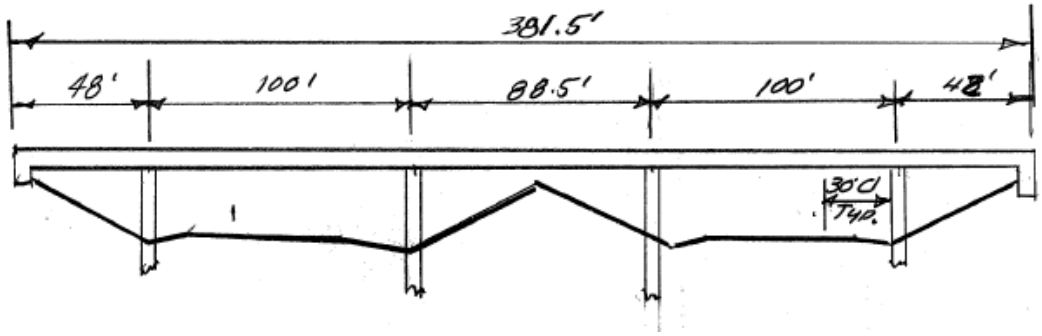
$770,297 / 171.177 ft. X 75 ft. = $60 per square foot.

VII. DEVELOPMENT PHASE

C. KY 714 BRIDGE

"As Proposed"

The proposed 381.5' long bridge will be constructed using pre-stressed girders with spans of 48'-100'-88.5'-100'-48'. The bridge deck width is 28' allowing for 2-12' lanes and 2-4' shoulders. These spans over I64 provide for a 30ft. clear zone to the face of the columns. The short end spans are unbalanced compared to the adjacent 100ft. spans.



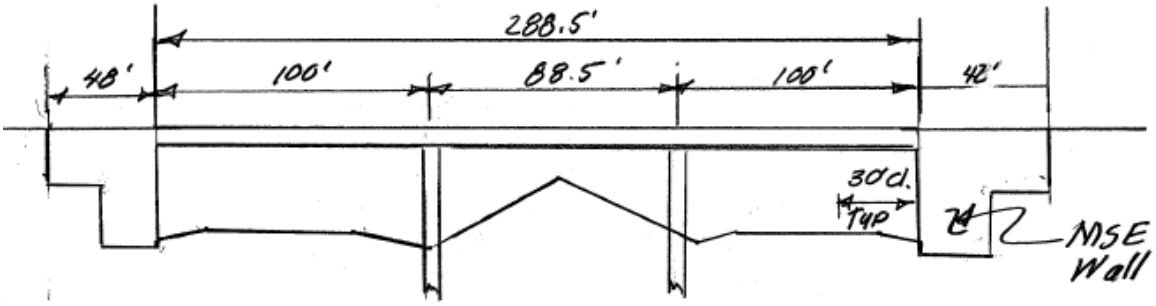
AS PROPOSED KY 714 BRIDGE OVER I-64

VII. DEVELOPMENT PHASE

C. KY 714 BRIDGE

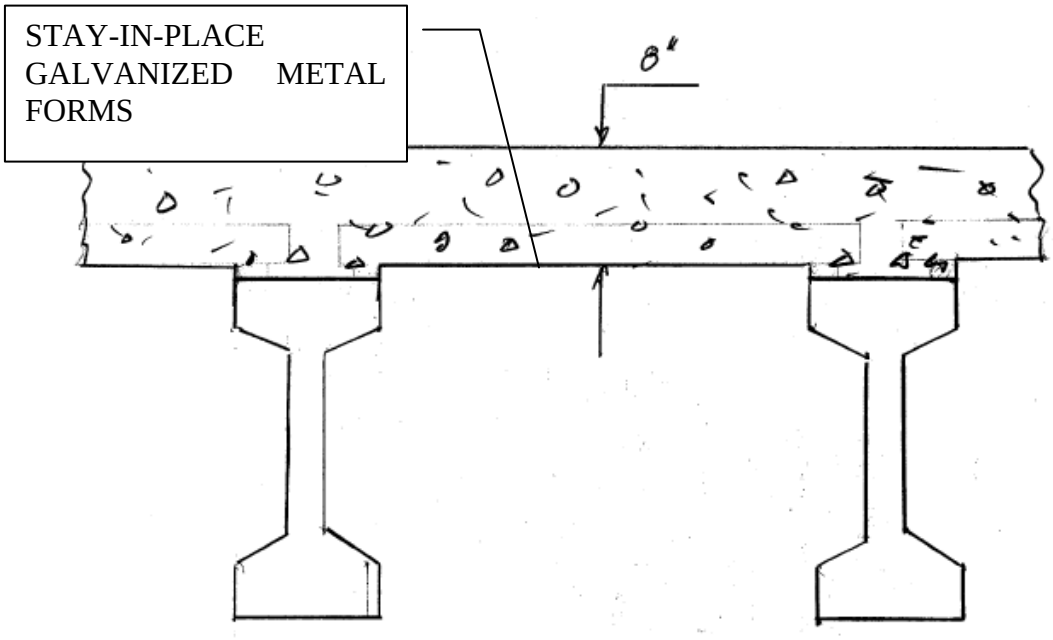
Value Engineering Alternative

The VE alternate will eliminate the two 48ft. end spans by using vertical MSE walls at the clear zone. Since this bridge will be built in one phase the MSE walls will be easier to construct and therefore will be more economical.



VE ALTERNATIVE KY 714 BRIDGE OVER I-64

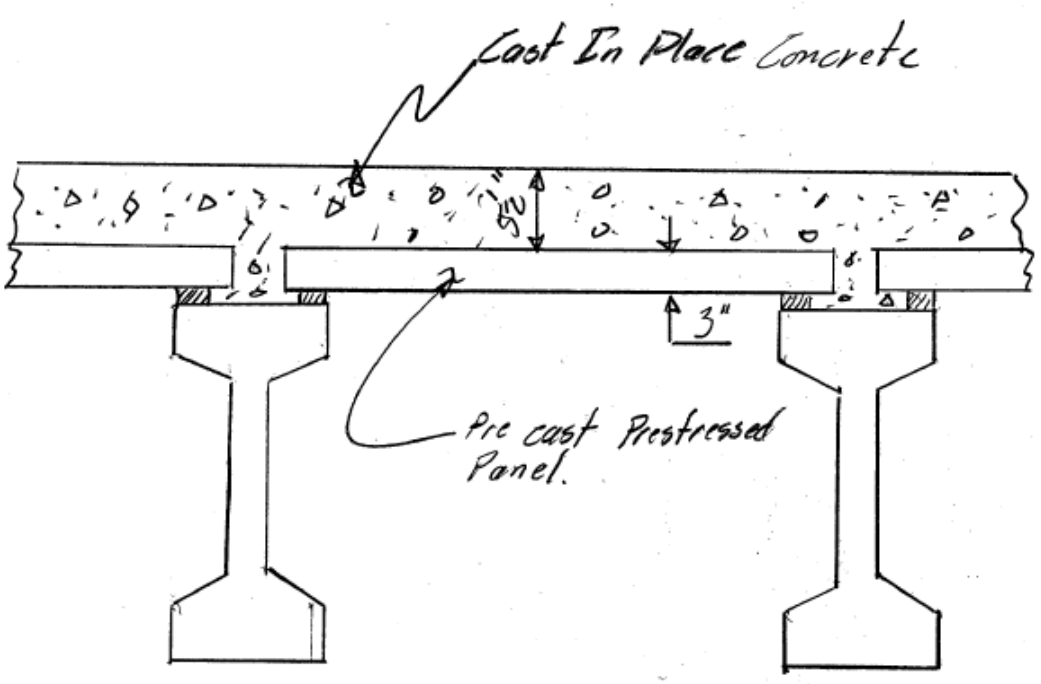
Since the MOT requires this bridge to be constructed in 60 days, any time saving procedure will be very beneficial. The plans do not require the use of stay-in-place forms for the construction of the deck. However, the general practice in Kentucky is to use galvanized corrugated metal forms.



STANDARD STAY-IN-PLACE METAL FORMS

A recent study conducted by several northern states has shown that these stay-in-place steel forms tend to separate from the bottom of the deck and trap salt water that eventually corrodes the form and the bottom deck reinforcing steel. The Kansas DOT has experienced this difficulty with several of their bridges, and in some cases, the steel panels began to fall from the bottom of the deck in about 15 years.

In order to address this problem, the VE team is proposing to use pre-cast- pre-stressed concrete deck panels to form the deck. The pre-cast pre-stressed concrete deck panels will allow the salt water to migrate through the deck and not be trapped on the top of the stay-in-place form.



PRE-CAST PRE-STRESSED PANELS

This will also provide for better visual inspection of the bottom of the deck. The use of pre-cast pre-stressed panels will probably have about the same initial cost as the steel stay-in-place forms; however, the life cycle cost, bridge maintenance, and risk to the traveling public will be reduced.

KY 714 OVER I-64

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
5 Span PS Bridge	SF	$73.00	11827.0	$863,371	0.0	$0
3 Span PS Bridge	SF	$70.20	0.0	$0	9037.0	$634,397
MSE Walls	SF	$29.00	0.0	$0	5408.0	$156,832
EARTHWORK	CY	$6.20	0.0	$0	1200.0	$7,440
Pavement	SF	$16.64	1701.2	$28,308	1999.9	$33,278
SUBTOTAL				**$891,679**		**$831,947**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$891,679**		**$831,947**

POSSIBLE SAVINGS: $59,732

VII. DEVELOPMENT PHASE

C. COST COMPARISON SHEET BACK UP CALCULATIONS

VE BRIDGE UNIT COST:

On this bridge I did not have a detailed cost estimate based on final quantities. I assumed a total cost of super structure and sub structure at $73 per square foot.

For grade separations, the substructure cost is about 25 percent of the total cost; therefore, the super structure is 73 X .75 = $54.75 per square foot.

288.5 feet X 31 feet X $54.75 = $489,656.

I estimated the cost of two abutments and two piers at $138,200.

$489,656 + $138,200 = $627,856

$627,856 / 288.5 X 31 = $70.20 per square foot

KY 714 PAVEMENT UNIT COST SY

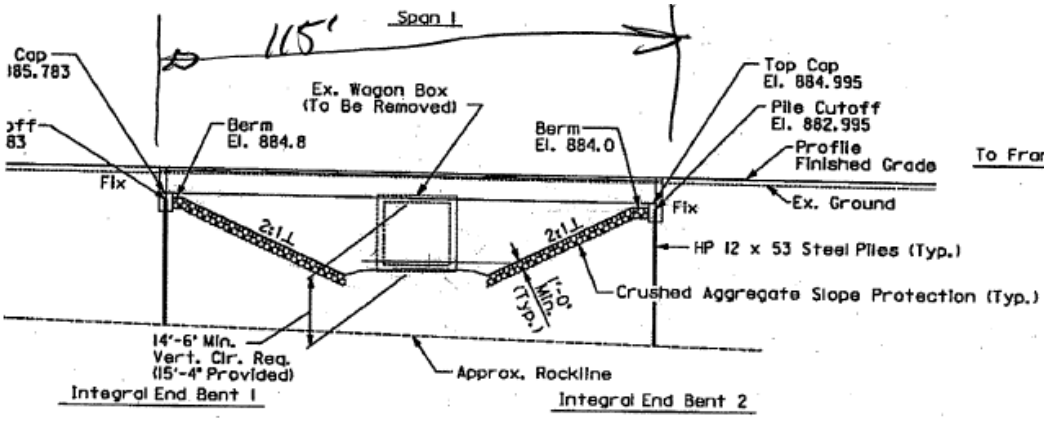
KY 714						
DGAB	$	14.50000		1,408	$	20,410.20
DGAB CRUSHED STONE	$	25.33268		-	$	-
DRAINAGE BLANKET	$	42.32502		-	$	-
ASPHALT SEAL AGGREC	$	67.90811		3	$	203.72
LEVEL - WEDGE	$	54.60015		0	$	-
SCRATCH COURSE	$	51.05633		-	$	-
CL 3 BASE PG 64-22	$	48.50000		371	$	18,005.63
CL 3 BASE PG 64-22 TRE	$	48.50000		-	$	-
CL 4 BASE PG 64-22	$	55.00000		-	$	-
CL 4 BASE PG 76-22	$	64.40275		-	$	-
EMULSIFIED ASPHALT R	$	503.16693		1	$	503.17
CL 3 SURFACE PG 64-22	$	63.50000		186	$	11,787.19
CL 4 SURFACE PG 64-22	$	63.83000		-	$	-
BREAK & SEAT	$	0.56479		-	$	-
			KY 714		$	50,909.90
	L			810		
	W			34		
	SY			3,060	$	16.64

VII. DEVELOPMENT PHASE

D. BOB JEFF ROAD WAGON BOX

"As Proposed"

The as proposed alternate is to construct an 115ft single span bridge on EB and WB I-64 over CR1120/Bob Jeff Road. The bridge deck width would be 63.33ft. These bridges will be constructed in two stages. The first stage will require the partial removal of the existing box on the median side to clear the bottom of the new girders. The "As Proposed" design will greatly increase the roadway width on Bob Jeff Road.



AS PROPOSED I-64 BRIDGE OVER BOB JEFF ROAD

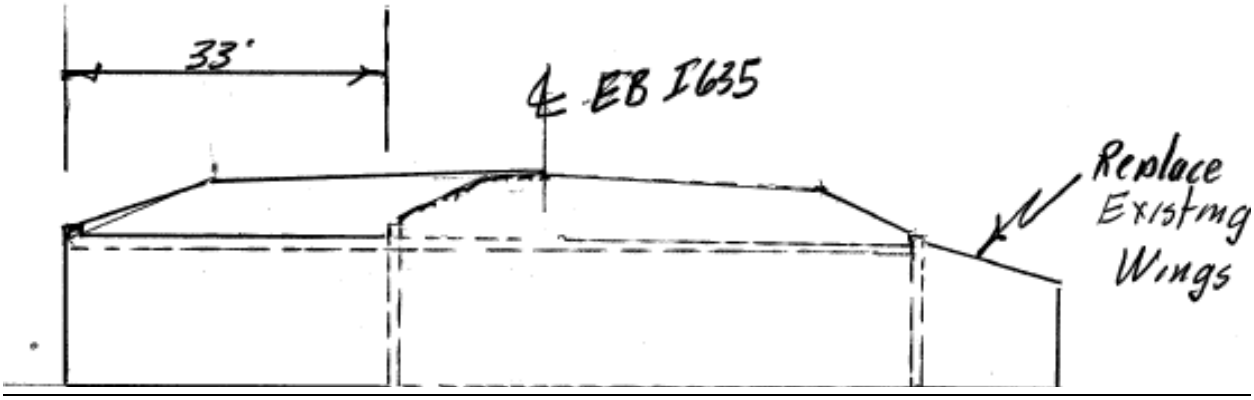
EXISTING BOB JEFF ROAD WAGON BOXES

VII. DEVELOPMENT PHASE

D. *BOB JEFF ROAD WAGON BOX*

Value Engineering Alternative

The VE Alternant recommends salvaging the existing wagon boxes by extending them 33ft.towards the median and replacing the existing outside wing walls.



EXTEND EXISTING WAGON BOX TOWARD THE MEDIAN AND REPLACE OUTSIDE WING WALLS

I-64 OVER BOB JEFF ROAD

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
2-SINGLE SPAN BRIDGES	SF	$70.00	14,566.00	$1,019,620	0.0	$0
EXTEND EXISTING RCB	SF	$144.00	0.0	$0	1,584.0	$228,096
REPLACE EXISTING WINGS	EA	$15,000.00	0.0	$0	4.0	$60,000
ADDITIONAL PAVEMENT	SY	$70.00	0.0	$0	1,533.0	$107,310
GUARD RAIL & END SECTIONS	LF	$30.00	0.0	$0	320.0	$9,600
SUBTOTAL				**$1,019,620**		**$405,006**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$1,019,620**		**$405,006**

POSSIBLE SAVINGS: $614,614

VII. DEVELOPMENT PHASE

D. COST COMPARISON SHEET BACK UP CALCULATIONS

WAGON BOX UNIT COST

On the Wagon Box - in Kansas we estimate the cost of boxes based on the cubic feet of opening. On this Box I used $9.00 per cubic foot.

16 X 24 X 33 X $9.00 per cubic foot = $114,048

$114,048 / 24 X 33 = $144 per square foot

.

I-64 PAVEMENT UNIT COST SY

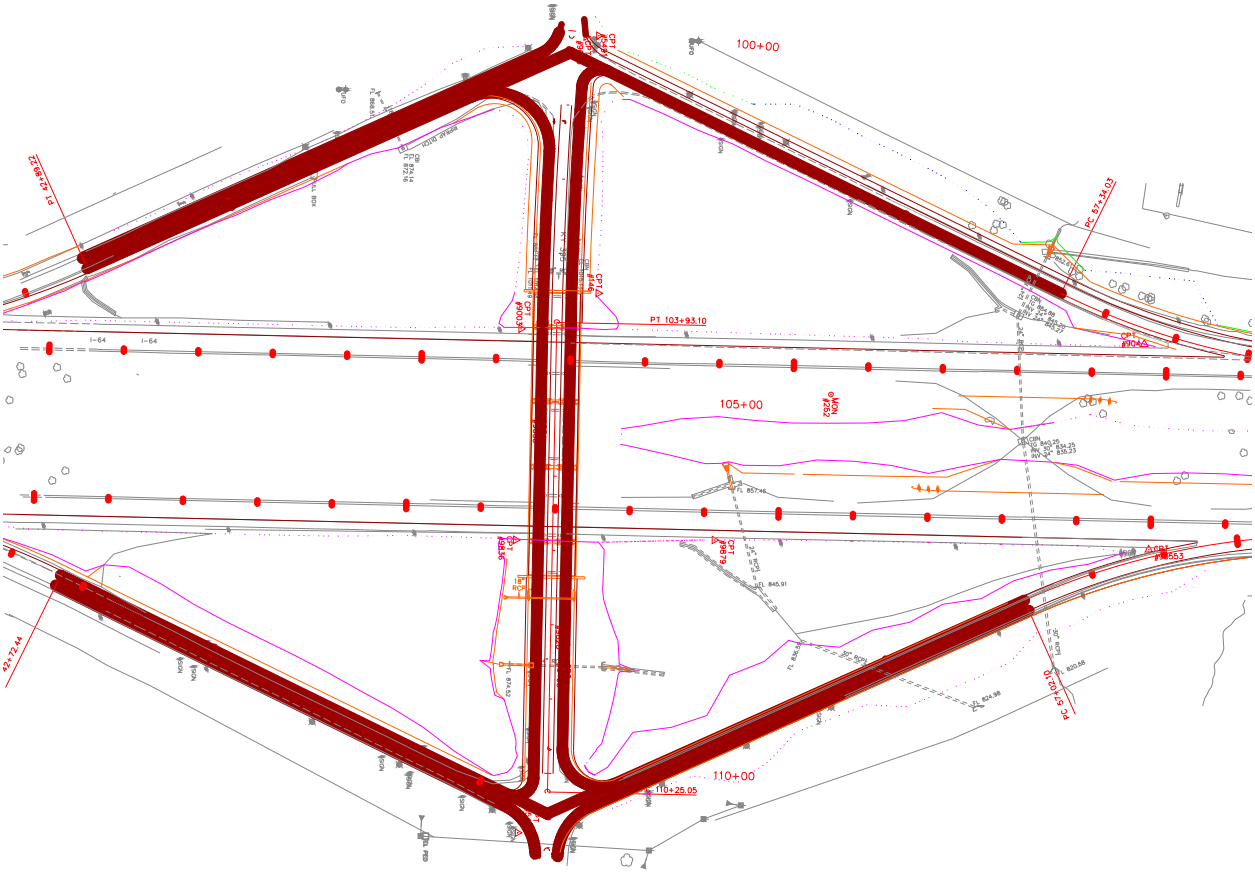
WIDEN					**$**	**83.91**	**per sy**					**$ 9,455,098.57**
CL 4 SURF PG 76-22	1.5	110	0.0825	$ 63.83000	$	5.27		36	28170	112680.00	9,296	$ 593,370.06
CL 4 BASE PG 76-22	3	110	0.165	$ 64.40275	$	10.63		36	28170	112680.00	18,592	$ 1,197,388.81
CL 4 BASE PG 64-22	3	110	0.165	$ 55.00000	$	9.08		36	28170	112680.00	18,592	$ 1,022,571.00
CL 4 BASE PG 64-22	4.5	110	0.2475	$ 55.00000	$	13.61		36	28170	112680.00	27,888	$ 1,533,856.50
CL 4 BASE PG 64-22	5	110	0.275	$ 54.60015	$	15.02		36	28170	112680.00	30,987	$ 1,691,894.85
CL 4 BASE PG 64-22	3	110	0.165	$ 51.05633	$	8.42		36	28170	112680.00	18,592	$ 949,249.50
CL 4 BASE PG 64-22	3	110	0.165	$ 51.05633	$	8.42		36	28170	112680.00	18,592	$ 949,249.50
DRAINAGE BLANKET	4	100	0.2	$ 42.32502	$	8.47		36	28170	112680.00	22,536	$ 953,836.65
DGAB	6	115	0.35	$ 14.50000	$	5.00		36.00	28170.00	112680.00	38,875	$ 563,681.70

VII. DEVELOPMENT PHASE

E. KY 395 INTERCHANGE BRIDGE

"As Proposed"

The "As Proposed" design call for replacing the existing 385' long 2-lane interchange bridge over I-64 with a new 385' long 3-lane structure with 2-12' travel lanes, a 14' left turn lane and 2-12' shoulders. It will also rehabilitate the ramp pavement on each ramp.



AS PROPOSED INTERCHANGE IMPROVEMENTS

The crossroad bridge is replaced with a new 5 span bridge. The KY 395 profile is raised to provide standard vertical clearance over the new I-64 pavement and to provide for greater beam depth of the girders that are longer than the existing bridge girders. The new KY 395 profile has a crest vertical curve with a 50 MPH Design Speed and a Stopping Sight Distance of 440 feet.

AS PROPOSED PROFILE

Although the “As Proposed” profile meets the Stopping Sight Distance criteria of 425 feet for the Design Speed, The VE Team believes that the Intersection Sight Distance criteria, as discussed in the AASHTO 2001 Policy on Geometric Design, page 654 to 669, should have been used to design the crest vertical curve at the bridge over I-64.

Because there are a lot of combination trucks using this interchange, we recommend, based upon AASHTO Exhibit 9-56 (p. 666), that an Intersection Sight Distance from the ramp termini of 860 feet be used for the design of the crest vertical curve on the KY 395 profile.

We believe that this would require raising the grade of KY 395 at the two ramp intersections, resulting in additional construction south of the eastbound ramp termini, and more complex maintenance of traffic at the ramp termini.

The crossroad bridge is three lanes wide to accommodate left turning movements from KY 395. The total bridge width is 65.5 ft.

The “As Proposed” KY 395 centerline alignment is the same as the existing KY 395 centerline alignment. The result of this is to require the new bridge over I-64 to be built in three stages in order to maintain two lanes of traffic on KY 395.

- Stage 1 constructs a 16.5 ft. width.
- Stage 2 constructs an 11.25 width of deck. (A single beam line is placed in this stage within a 16 ft. gap between the newly built section and the remainder of the existing bridge).
- Stage 3 completes the new bridge.

EXISTING KY 395 BRIDGE OVER I-64

VII. DEVELOPMENT PHASE

E. KY 395 INTERCHANGE BRIDGE

Value Engineering Alternative

The VE Team recommends constructing roundabouts at the ramp termini and eliminating the 14' left turn lane on the bridge.

VIEW OF OPERATIONAL DIAMOND INTERCHANGE WITH ROUND ABOUTS

Each round about would an outside diameter of 190' to 225' to accommodate tractor-trailer rigs in the round about.

VIEW OF TRACTOR-TRAILER OPERATING IN THE ROUND ABOUT

In order to construct the structure in 2-stages, the centerline alignment of KY 395 is shifted 11 feet in order to allow ½ new bridge over I-64 to be constructed, rather than the three stages needed for the "As Proposed" design.

The Roundabouts allow the bridge width to be reduced from 65.5 feet to 51 feet wide, because the 14-foot wide left turn lane is no longer needed.

The Roundabouts also will reduce the operating speed on KY 395 to 30 MPH, which will mean that the "As Proposed" profile meets the Intersection Sight Distance criteria and will not need to be revised.

To shift the KY 395 centerline 11 feet to the west at the I-64 bridge, the designer can change the deflection angle at PI Sta. 96+77.9 to 4º-03"-10". The resulting centerline moves the road 4 feet closer to the R/W corner at Sta. 98+50, 50 ft. Right, but that should make roadway construction on the new centerline feasible within the existing R/W. A PI at Sta. 101+54 will be 11 feet west of the existing centerline, so a left deflection at that point will result in a new centerline parallel to and 11 ft. west of the existing centerline. Going further south along the new centerline, a PI near Sta. 110+25 will meet the old centerline bearing of KY 395 south of there.

The centerline shift of 11 feet allows bridge construction Stage 1 to build a 27.5 ft. wide structure, which is wide enough to allow two lanes of traffic to be maintained on the portion constructed in Stage 1 while Stage 2 completes the new bridge.

KY 395 INTERCHANGE BRIDGE

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
BRIDGE KY 395 OVER I-64 As Proposed design	SF	$94.90	25381.0	$2,408,657	0.0	$0
BRIDGE KY 395 OVER I-64 Value Engineering design	SF	$83.95	0.0	$0	19762.5	$1,659,062
RAMP/KY395 INTERSECTION PAVEMENT	SY	$51.00	550.0	$28,050	1800.0	$91,800
SUBTOTAL				**$2,436,707**		**$1,750,862**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$2,436,707**		**$1,750,862**

POSSIBLE SAVINGS: $685,845

VII. DEVELOPMENT PHASE

E. COST COMPARISON SHEET BACK UP CALCULATIONS

KY 395						
DGAB	$	14.50000		4,372	$	63,394.00
DGAB CRUSHED STONE	$	25.33268		3,099	$	78,505.98
DRAINAGE BLANKET	$	42.32502		772	$	32,674.92
ASPHALT SEAL AGGREGATE	$	67.90811		25	$	1,697.70
LEVEL - WEDGE	$	54.60015		0	$	-
SCRATCH COURSE	$	51.05633		-	$	-
CL 3 BASE PG 64-22	$	48.50000		4,227	$	205,009.50
CL 3 BASE PG 64-22 TRENCH CAP	$	48.50000		-	$	-
CL 4 BASE PG 64-22	$	55.00000		6,382	$	351,010.00
CL 4 BASE PG 76-22	$	64.40275		1,733	$	111,609.97
EMULSIFIED ASPHALT RS-2	$	503.16693		5	$	2,515.83
CL 3 SURFACE PG 64-22	$	63.50000		570	$	36,195.00
CL 4 SURFACE PG 64-22	$	63.83000		858	$	54,766.14
BREAK & SEAT	$	0.56479		5,320	$	3,004.68
			KY 395		$	940,383.72
Area		17309.09	per sy		$	54.33

Bridge Cost Analysis

Listed below are the bridge costs I would recommend for KY 395 over I-64.

Single Stage Construction - $73.00 per sf
Two Stage Construction - $73.00 plus 15% = $83.95 per sf
Three Stage Construction - $73.00 plus 30% = $94.90 per sf

The $73 per sf for single stage construction is based on average bid prices in Kentucky. Adding 15% per stage is not "arbitrary"; it's based on my tracking bridge cost for the past 35 years.

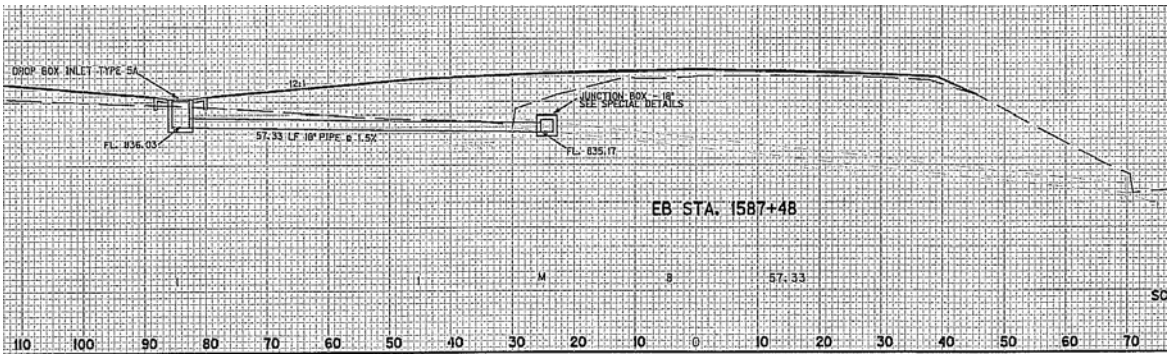
I have done a lot of two stage construction; however, only a few with three stage construction.

VII. DEVELOPMENT PHASE

F. DRAINAGE

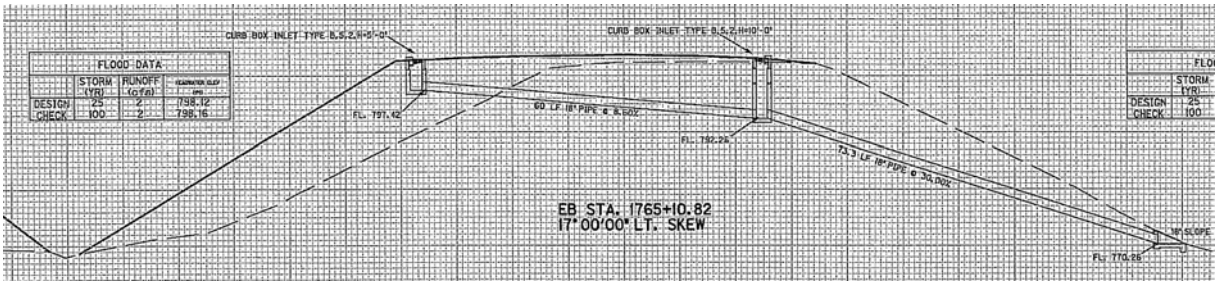
"As Proposed"

The proposed plan shows extending the existing 18" pipe at EB station 1587+48 to the median and installing a DBI type 5A to drain the surface runoff from the median.

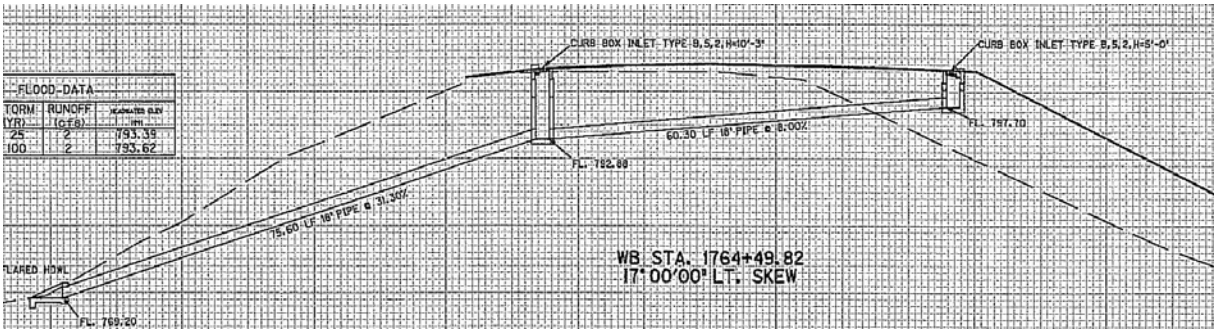


As Proposed 18" pipe at EB station 1587+48

At station 1765+10 EB and station 1764+49.82 WB is a sag vertical curve at the east end of the I-64 bridges over the Jeptha Creek. The existing drainage consists of inlets on either side of the roadway and draining to toe of slope in a 24" pipe on the WB lanes and a 15" pipe on the EB lanes. The " As Proposed" design replaces this system with new inlets on either side of the roadway an 18" pipe under the road to connect the new inlets and a slope drain to the outside of the roadway, as shown below.



AS PROPOSED STA 1765+10 EB



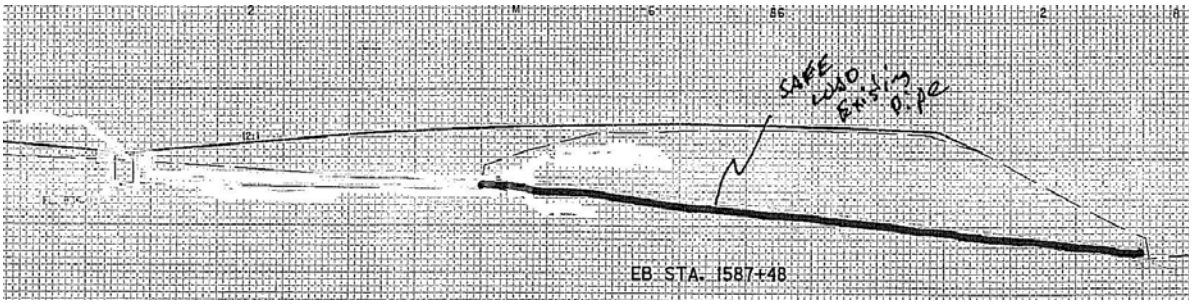
AS PROPOSED STA 1764+49.82 WB

VII. DEVELOPMENT PHASE

F. DRAINAGE

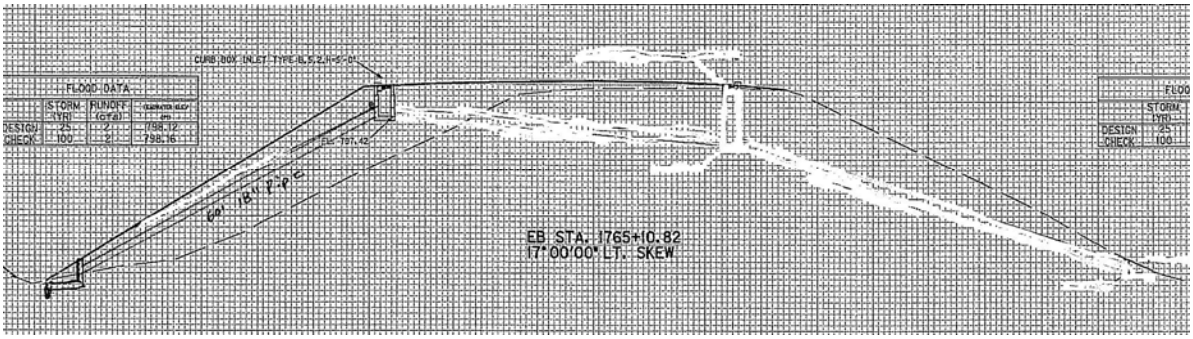
Value Engineering Alternative

The VE Team recommends safe-loading the existing pipe and to drain the surface runoff from the median over the rock cut to the railroad ditch. This proposal eliminates the need for the 18" pipe and the DBI type 5A. Since the area where the median is in a rock cut, there will not be any need for channel lining.

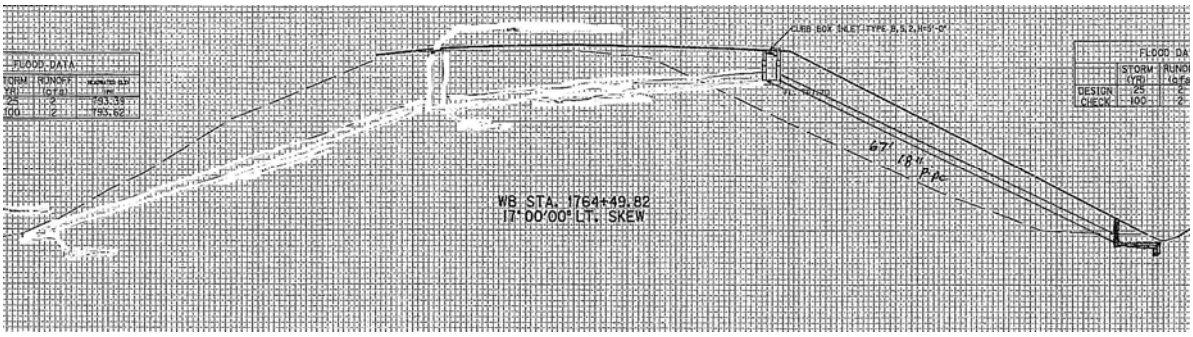


VE ALTERNATIVE STATION 1587+48

The VE Team recommends salvaging the existing outside slope drains and drain the inside drains to the median as shown below. This will eliminate removing the existing pavement in order to place the new 18" pipe under the existing pavement.



AS PROPOSED STA 1765+10 EB



AS PROPOSED STA 1764+49.82 WB

DRAINAGE

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
18" Culvert Pipe	LF	$6.46	325.3	$2,102	128.0	$827
Curb Box Inlet Type B	EA	$3,230.00	4.0	$12,920	2.0	$6,460
S & F Box Inlet - Outlet 18'	EA	$2,029.00	2.0	$4,058	4.0	$8,116
ADJUST INLET TOPS	EA	$500.00	0.0	$0	2.0	$1,000
DROP BOX INLET TYPE 5A	EA	$2,950.00	1.0	$2,950	0.0	$0
JUNCTION BOX 18"	EA	$1,473.64	1.0	$1,474	0.0	$0
SAFELOADING	CY	$191.00	0.0	$0	6.5	$1,249
SUBTOTAL				**$23,503**		**$17,652**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$23,503**		**$17,652**

POSSIBLE SAVINGS: $5,851

VII. DEVELOPMENT PHASE

F. COST COMPARISON SHEET BACK UP CALCULATIONS

100 LF 18” PIPE

18 IN PIPE

100 LF

1.77 SF

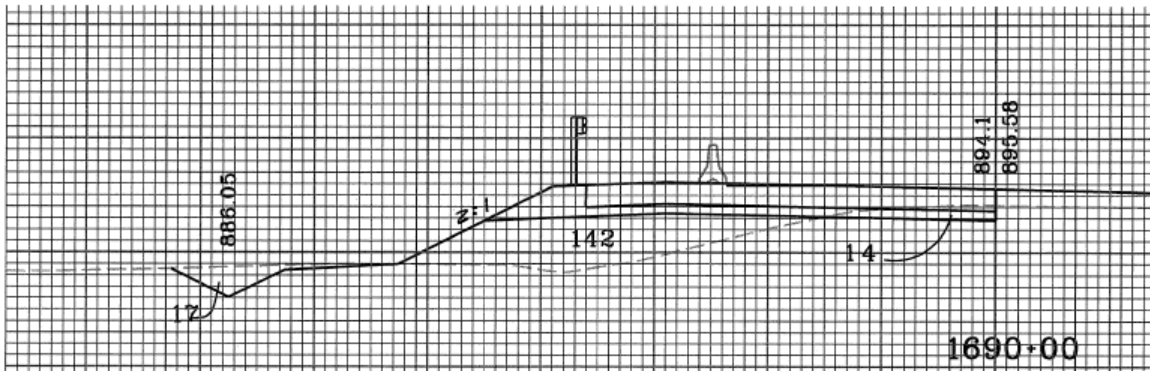
6.54 CY

VII. DEVELOPMENT PHASE

G. GUARDRAIL

"As Proposed"

The proposed plan shows placing guardrail at locations where the fill slopes exceeds 3:1.



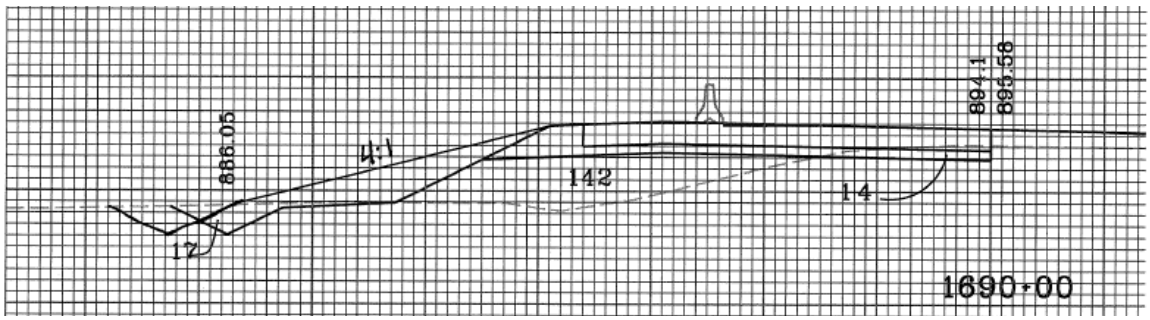
AS PROPOSED GUARDRAIL

VII. DEVELOPMENT PHASE

G. GUARDRAIL

Value Engineering Alternative

The VE proposal is to flatten selected 3:1 slopes to 4:1 or flatter. The guardrail, end treatments and pipe required by type 3 end treatments will be eliminated. The locations are from1590+00 to 1597+00 and from 1686+58 to 1703+00.



VE ALTERNATIVE REDUCING SLOPES TO 4:1 OR FLATTER

GUARD RAIL

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
Guardrail-Steel W Beam-S Face	LF	$ 17.27	4025.0	$69,512	0.0	$0
End Treatment Ty 3	Each	$ 625.00	2.0	$1,250	0.0	$0
End Treatment Ty 2A	Each	$ 522.00	1.0	$522	0.0	$0
Culvert Pipe 30"	LF	$ 74.00	35.0	$2,590	0.0	$0
Class "A" Conc	Cu Yd	$ 793.00	3.2	$2,561	0.0	$0
Steel Reinforcement	LBS	$ 1.17	244.0	$285	0.0	$0
Culvert Pipe 15"	LF	$ 106.00	300.0	$31,800	0.0	$0
Metal End Section 15"	Each	$ 689.00	1.0	$689	0.0	$0
Guardrail-Steel W Beam-D Face	LF	$ 23.30	0.0	$0	450.0	$10,485
Crash Cushion Type IX-A	Each	$ 4,864.00	0.0	$0	3.0	$14,592
Drop Box Inlet Ty 5F	Each	$ 2,985.00	0.0	$0	1.0	$2,985
Junction Box - 30"	Each	$ 2,314.00	0.0	$0	1.0	$2,314
Culvert Pipe - 30"	LF	$74.00	0.0	$0	60.0	$4,440
Br End Conn Ty A	Each	$2,014.00	0.0	$0	1.0	$2,014
GRAND TOTAL				**$109,210**		**$36,830**

POSSIBLE SAVINGS: $72,380

VII. DEVELOPMENT PHASE

G. COST COMPARISON SHEET BACK UP CALCULATIONS

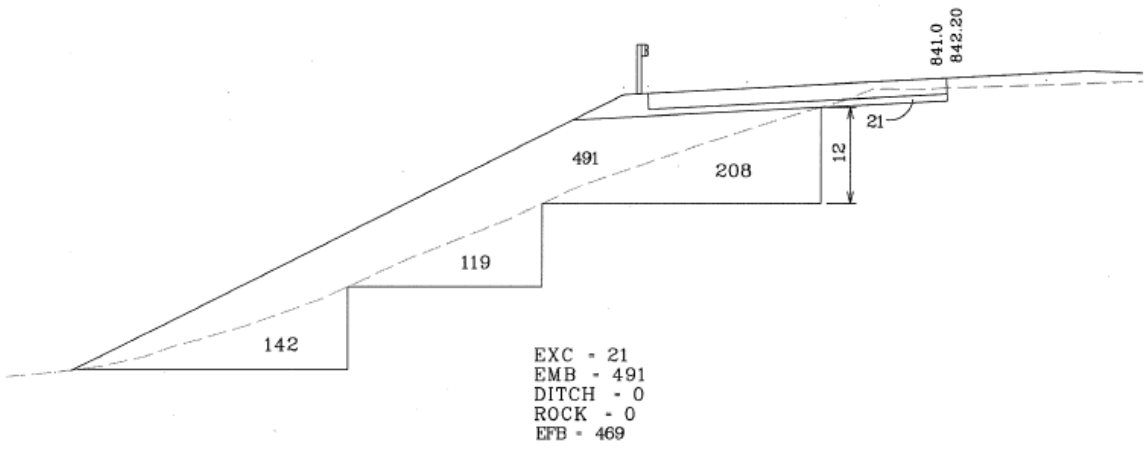
NONE

VII. DEVELOPMENT PHASE

H. EARTHWORK

"As Proposed"

The proposed plans show installing embankment benches to a height of 12'. The total quantity of embankment benching is 114,489 cubic yards.

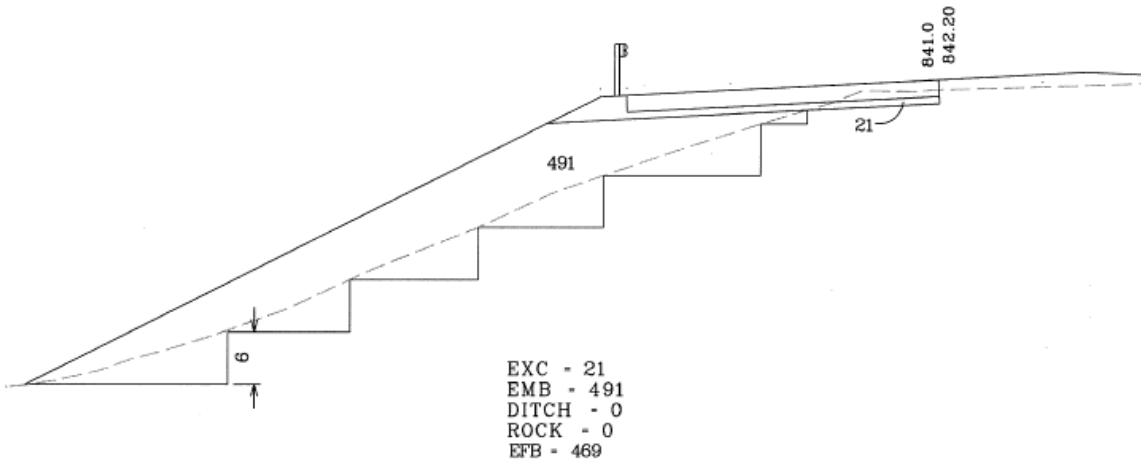


VII. DEVELOPMENT PHASE

H. EARTHWORK

Value Engineering Alternative

The VE proposal is to reduce the height of the embankment benches to 6'. By reducing the height to 6', the quantity of embankment benching can be reduced by 50% to 57,245 cubic yards.



EARTHWORK

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
ROADWAY EXCAVATION	CY	$5.00	114,489.00	$572,445	57244.5	$286,223
SUBTOTAL				**$572,445**		**$286,223**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$572,445**		**$286,223**

POSSIBLE SAVINGS: $286,223

VII. DEVELOPMENT PHASE

H. COST COMPARISON SHEET BACK UP CALCULATIONS

NONE

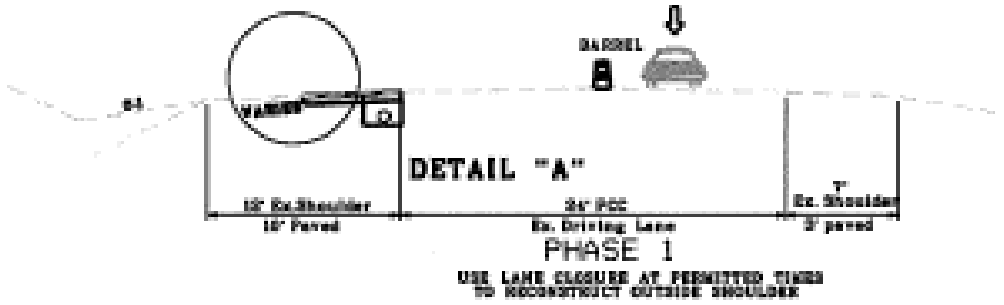
VII. DEVELOPMENT PHASE

I. MAINTENANCE OF TRAFFIC

"As Proposed"

PHASE I:

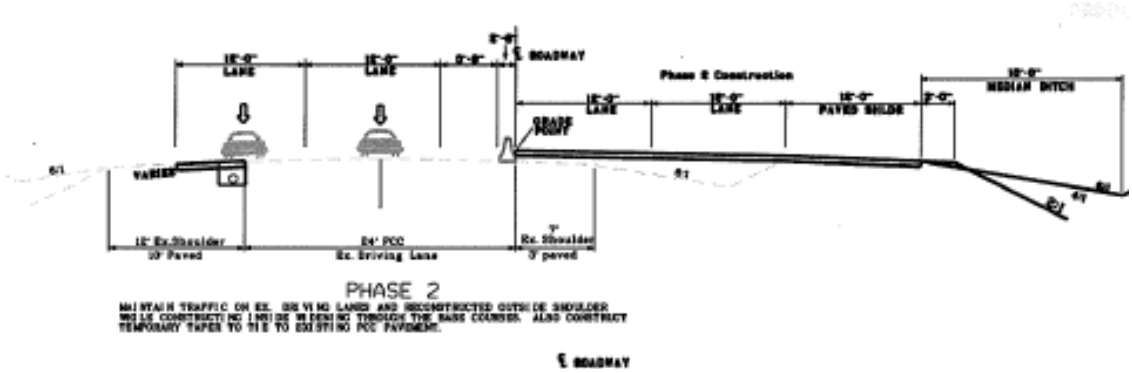
- Rebuild both EB and WB shoulders.



- Begin construction of KY 714 Bridge and KY 395 Interchange Bridge

PHASE II:

- Shift both EB and WB traffic 12 feet to the right
- Place Temporary Concrete Barrier full length of both EB and WB roadways.

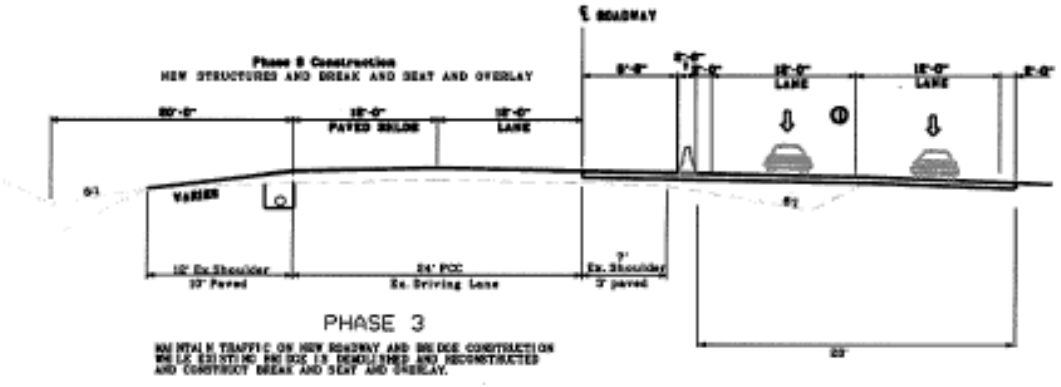


- Build median side pavement widening (36 feet wide) on both EB and WB roadways
- Complete all median re-grading.
- Build median half of both EB and WB I-64 bridges at three locations.

PHASE III:

- Shift Temporary Concrete Barrier on both EB and WB roadways.
- Shift EB traffic to the newly constructed median side of the EB roadway

- Shift WB traffic to the newly constructed median side of the WB roadway.



- Break & Seat old PCC pavement on both EB and WB roadways.
- Remove the shoulder pavement placed during Phase I on both EB and WB roadways.
- Complete building of new EB and WB pavements, (24 feet wide).
- Complete building of the second half of the I-64 bridges.

TOTAL PROJECT DURATION 17 MONTHS (500 DAYS+/-)

VII. DEVELOPMENT PHASE

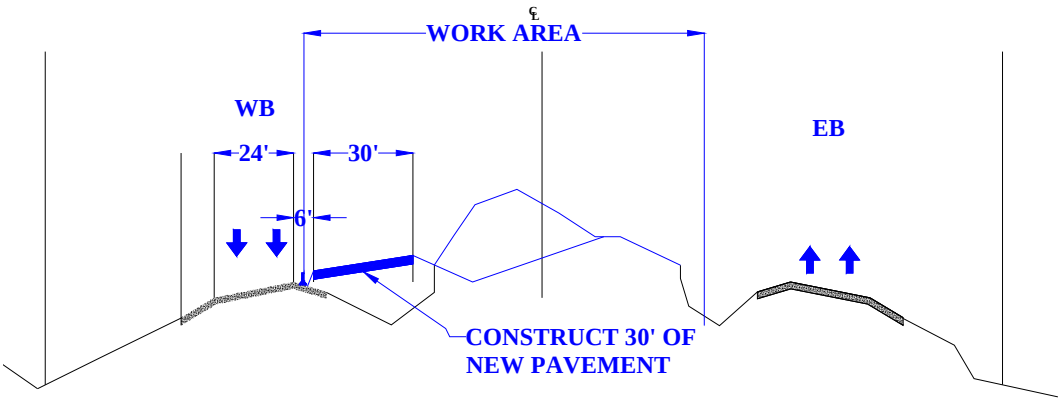
I. MAINTENANCE OF TRAFFIC

Value Engineering Alternative

The VE Team Recommends removing all the traffic from the EB Barrel of I-64 to allow better access and to reduce the exposure of the workers and their equipment from the traffic. This will also speed up construction on some of the item, which will reduce costs on material, labor and mobilizations. The VE Team's MOT Concept is as follow:

PHASE I:

- Place Temporary Concrete Barrier on the median shoulder for the full length of the WB roadway.



VE ALTERNATIVE
PHASE I MOT

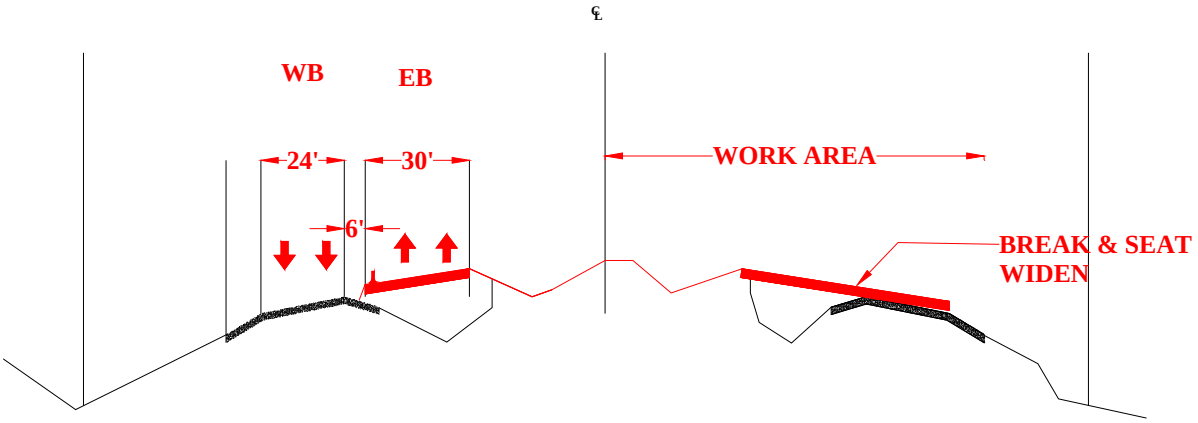
160 DAY +/-

- Build 30-foot width of the median side pavement widening on the WB roadway
- Complete all median re-grading.
- Complete KY 714 Bridge and commence work on KY 395 Bridge over I-64
- Build the median half of the WB I-64 bridges at three locations.
- Construct crossovers in the median at the western and eastern ends of the project and one single lane crossover at EB KY 395 Off Ramp.

EB roadway is untouched, and EB bridges are untouched.

PHASE II:

- Relocate Temporary Concrete Barrier to newly constructed pavement on the WB roadway.
- Shift EB traffic on to newly constructed median side portion of WB roadway.
- WB traffic remains where it was during Phase I.



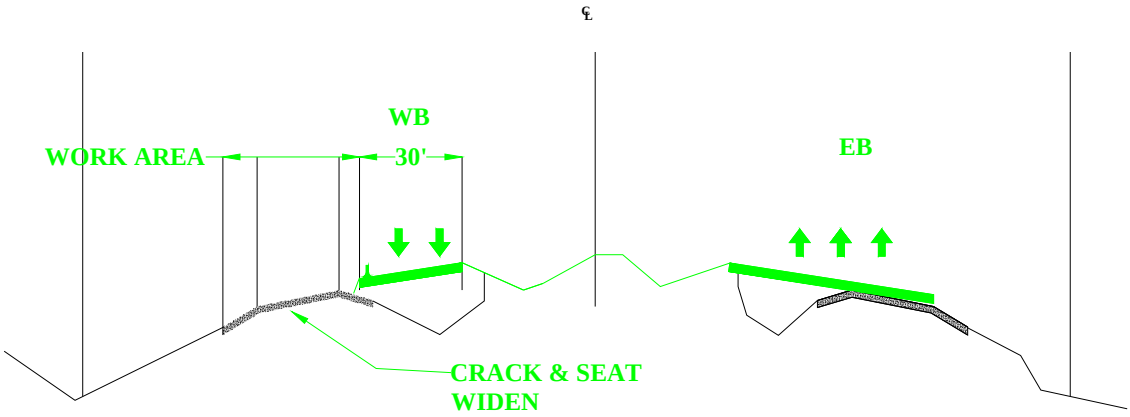
VE ALTERNATIVE
PHASE II MOT

160 DAYS +/-

- Reconstruct the entire EB roadway and EB bridges in the EB corridor cleared of all traffic. Note that the three EB I-64 bridges are constructed in a single stage.

PHASE III:

- Shift EB traffic to the newly constructed three-lane EB roadway.
- Shift WB traffic to where the EB traffic was in Phase II, (on the median side of the WB roadway which was constructed in Phase II).
- The Temporary Concrete Barrier remains where it was during Phase II.



VE ALTERNATIVE
PHASE III MOT

120 DAYS +/-

- Reconstruct the remaining outside lanes and shoulder, (28 feet) of the WB roadway.
- Complete building of the second half of the three WB I-64 bridges.

TOTAL PROJECT DURATION 14 MONTHS (420 DAYS+/-)

MAINTENANCE OF TRAFFIC

VALUE ENGINEERING ALTERNATIVE
COST COMPARISON SHEET

DESCRIPTION	UNITS	UNIT COST	PROP'D QTY.	PROP'D COST	V.E. QTY.	V.E. COST
0145 ROADWAY EXCAVATION (I-64 EB)	CY	$5.00	302,273	$1,511,365	0	$0
0145 ROADWAY EXCAVATION (I-64 EB)	CY	$4.50	0	$0	302,273	$1,360,229
0185 CONCRETE BARRIER WALL TYPE 9T	LF	$21.90	57,300	$1,254,870	28,650	$627,435
0215 RELOCATE CONC. BARRIER WALL	LS	$5,000	1	$5,000	1.0	$5,000
RAILROAD STRUCTURE (STA.1589)	LS	$939,296	1	$939,296	0.8	$751,437
JEPTHA CK/CR1107 (STA.1763)	LS	$1,310,050	1	$1,310,050	0.8	$1,048,040
BOB JEFF RD CR 1120 (STA. 1695)	LS	$568,000.00	1	$568,000	0.8	$454,400
PAVEMENT (I-64 EB)	LS	$13,361,102	1	$13,361,102	0.9	$12,024,992
OUTSIDE SHOULDER RECONSTRUCTION	LS	$783,380	1	$783,380	0.0	$0
0171 MAINTAIN & CONTROL TRAFIC	LS	$500,000	1	$500,000	0.9	$440,000
MEDIAN CROSSOVER	LS	$160,000	0	$0	2.5	$400,000
SUBTOTAL				**$20,233,063**		**$17,111,532**
MOBILIZATION (THIS IS SUB+CONTIN. X % =)		**0.0%**		$0		$0
TRAFFIC CONTROL/MOT		**0.0%**		$0		$0
CONTINGENCY		**0.0%**		$0		$0
GRAND TOTAL				**$20,233,063**		**$17,111,532**

POSSIBLE SAVINGS: $3,121,531

VII. DEVELOPMENT PHASE

I. COST COMPARISON SHEET BACK UP CALCULATIONS

Cost Estimate Assumptions:

1. The EB I-64 Bridges were assumed to be 20% less costly for the following reasons:
    a. Reduction in mobilization of men and equipment
    b. Less exposure of workers and equipment to traffic
    c. More access to the bridge
2. The EB I-64 Pavement was assumed to be 10% less costly for the following reasons.
    a. Open access to the work zone.
    b. No lost time resetting MOT
3. The Lump Sum Maintain & Control Traffic was assumed to be 10% less costly for the following reasons.
    a. Less resetting of barriers and signs
    b. Less traffic control devices to maintain
4. Median crossover pavement is 2.5 because of the single lane cross over for the KY 395 on ramp to WB I-64.

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.

Recommendation Number 1:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative revises the widened pavement design by using the "**Maximum Aggregate**" method of pavement design.

If this recommendation can be implemented, there is a possible savings of **$4,973,914.**

Recommendation Number 2:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative constructs a single 100' span bridge over the Norfolk Southern RR.

If this recommendation can be implemented, there is a possible savings of **$970,039.**

Recommendation Number 3:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will eliminate the two 48ft. end spans by constructing vertical end abutments with MSE walls at the clear zone.

If this recommendation can be implemented, there is a possible savings of **$59,732.**

Recommendation Number 4:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will salvage the existing wagon boxes by extending them 33' towards the median and replacing the existing outside wing walls.

If this recommendation can be implemented, there is a possible savings of **$614,614.**

Recommendation Number 5:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will construct roundabouts at the ramp termini and eliminating the 14' left turn lane on the bridge

If this recommendation can be implemented, there is a possible savings of **$685,845.**

Recommendation Number 6:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will eliminate some minor drainage structures in selected locations.

If this recommendation can be implemented, there is a possible savings of **$5,851.**

Recommendation Number 7:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will flatten selected 3:1 slopes to 4:1 or flatter to eliminate guardrail.

If this recommendation can be implemented, there is a possible savings of **$72,380.**

Recommendation Number 8:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will reduce the maximum height of the embankment benches from 12' to 6'.

If this recommendation can be implemented, there is a possible savings of **$286,223.**

Recommendation Number 9:

The Value Engineering Team recommends that the Value Engineering Alternative be implemented. This alternative will revise the MOT Phasing constructing 1-barrel without traffic.

If this recommendation can be implemented, there is a possible savings of **$3,121,531.**

I-64 WIDENING AND ROADWAY REHABILITATION
VALUE ENGINEERING STUDY PRESENTATION
January 19, 2007

NAME	AFFILIATION	PHONE
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Rob Harris	KYTC – D5 Construction	502/367-6411
Robert Semones	KYTC – Program Performance	502/564-9555
Dan Hite	KYTC – Design	502/564-3280
Jim Wathen	KYTC – Program Performance	502/564-4555

IX. APPENDICES