I-65 Lane Widening, Part I

Warren and Simpson County, Kentucky

Kentucky
UNBRIDLED SPIRIT

Study Date: February 14 -18, 2005

VALUE ENGINEERING STUDY

URS

for the
Kentucky
Transportation
Cabinet

I-65 Lane Widening between Tennessee State Line to Natcher Parkway

VALUE ENGINEERING STUDY for the Kentucky Transportation Cabinet

Study Date: February 14-18, 2005

Final Report

February 24, 2005

URS Corporation

EXECUTIVE SUMMARY

General

URS conducted a Value Engineering Study of the Interstate 65 widening project located in Simpson and Warren Counties, Kentucky. The topic was the preliminary line and grade submittal. The project was divided into five sections prepared by four different Engineering Design firms.

The VE team undertook the task assignment using the value engineering work plan and approach. The work plan depends on what is commonly referred to as a "bottom up" approach. With this approach, the VE Team subdivided the project into its component parts, examined the functions, purpose, and requirements of each part, and then identified alternate approaches to accomplishing the identified functions. The ideas that were generated from this process and chosen for full development as VE Team Recommendations are presented in Section 3 of this report. These recommendations are presented to all project stakeholders for judgment as to whether they should be implemented or not.

Estimate of Construction Costs and Budget

The construction cost estimates provided to the VE team indicated a total cost of construction of $130,042,045. This amount included mark-ups for overhead, profit, contingencies and engineering. The construction budget for the project will be developed as the project progresses.

Table 1. Project Cost Estimate at Preliminary Design Stage

Section 1	3.53 miles	$25,223,849
Section 2	3.18 miles	$22,446,991
Section 3	4.58 miles	$31,513,272
Section 4	3.93 miles	$24,029,439
Section 5	4.24 miles	$26,828,494
Totals	19.47 miles	$130,042,045 *

*Includes Engr and Contg

As a result of this value engineering study, should all of the VE team's recommendations be accepted for implementation, the total potential savings available to KYTC is $10,957,000 in initial cost and approximately $10,957,000 in life cycle cost.

Project Considerations

- Future 8-Lane Project. The project will widen I-65 from four lanes to six lanes from the Tennessee State line north to the Natcher Parkway. A future project is envisioned to widen I-65 to eight lanes. The designers have included design of rock cuts for full 8-lane safety. Bridges over I-65 are designed to span six lanes with 30-foot clear zone, which allows for future eight lanes with guardrail.
- Temporary Concrete Barriers The project estimate includes cost for temporary concrete barrier walls, Type 9T, to be furnished by the contractor. The five construction sections in the appropriate sequence would accommodate the use of a limited supply of KYTC stored TCBW on hand. A VE proposal addresses this issue.

Conclusion

During the speculation phase of this VE study, 13 creative ideas were identified. Nine of these ideas were developed into VE recommendations for further consideration and one design comment with no easily quantifiable cost implications, but it remains noteworthy to the results of the VE study. Some of the ideas represent changes in design approach, reconsideration of criteria, and in general, took into account the economic impact, benefits obtained, and the effect on the overall project objectives.

The following table presents a summary of the ideas developed into recommendations and design comments with cost implications where applicable. Since cost is an important issue for comparison of VE proposals, the costs presented in this report are based upon original design quantities with unit rates obtained from the original design cost estimate. Where proposed alternate designs included items not in the original scope, costs from published cost estimating databases, similar projects, and the VE team member expertise were used. The unit rates used include overhead and profit. No further mark-up is used.

SUMMARY OF RECOMMENDATIONS			
DESCRIPTION		PRESENT WORTH AMOUNTS	VE Team Selected Combo
Rec.#	Recommendation Title / Description	1st cost savings (or cost)	
	Roadway excavation		
1	Revise slopes in the cut sections from 6:1 to 4:1 to reduce excavation quantities	$562,000	X
2	Reduce heights of the benches on KY 240 to a maximum height of 3 ½ feet to 4 feet	$3,000	X
	Temporary concrete walls		
6	Use DOT furnished temporary barrier walls	$2,850,000	X
	DGA base		
7	Eliminate full depth DGA in median	$916,000	X
	Drainage blanket		
9	Use more drainage blanket, reduce asphalt base for shoulders	$1,582,000	X
	Asphalt paving		
11	Eliminate 1 ½" layer of binder on sections 3, 4, and 5	$3,061,000	X
12	Investigate need for rubblization in Section 5. Break and seat the existing 10" PCCP instead.	$102,000	X
13	Reduce shoulder widths from 12 feet to 10 feet	$1,881,000	X

Sum of VE Team Selected Combination of Recommendations: $10,957,000

SUMMARY OF DESIGN COMMENTS	
DC-8	Reduce the amount of outside wedge

Acknowledgements
The team appreciates the input and able assistance of Robert Semones and Siamak Shafaghi and all of the staff members of the Kentucky Transportation Cabinet who participated throughout the study. Without their participation, this successful value engineering study would not have been possible.

Value Engineering Study – Core Team

Name	Discipline/Role	Organization	Telephone
Joe Waits	Team Leader	URS	251-666-7184
Vibert Forsythe	Construction	KYTC	859-564-4730
Allan Frank	Bridge Design	KYTC	502-564-4560
Josh Hornbeck	Construction	KYTC	270-766-5033
Danny Jasper	Design	KYTC	502-564-3280
Robert Semones	Design	KYTC	502-564-3280
Siamak Shafaghi	Design	KYTC	502-564-3280
Bruce Newby	Recorder	URS	913-344-1000

Certification
This is to verify that the Value Engineering Study was conducted in accordance with standard Value Engineering principles and practices.

Mark Watson, PE, CVS
Value Engineering Program Manager
URS Value Engineering Service

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SECTION 1 - INTRODUCTION

This report documents the results of a value engineering study on the widening of Interstate 65 spanning from the Tennessee State line to Natcher Parkway in Warren and Simpson Counties in Kentucky. The study workshop was held at the offices of the Kentucky Transportation Cabinet (KYTC) on February 14 – 18, 2005. The study team was from KYTC and was facilitated by a Professional Engineer and Certified Value Specialist (CVS) team leader from URS. The names and telephone numbers of all participants in the study are listed in Appendix A.

The Job Plan
The study followed the value engineering methodology as endorsed by SAVE International, the professional organization of value engineers. This report does not include an explanation of standard value engineering / value analysis processes used during the workshop in development of the results presented herein. This would greatly expand the size of the report. The purpose of the report is to document only the results of the study.

Ideas and Recommendations
Part of the value engineering methodology is to generate as many ideas as practical, evaluate each idea, and then select candidates for further development only those ideas that offer added value to the project. If an idea thus selected, turns out to work in the manner expected, that idea is presented as a formal value engineering recommendation. Recommendations represent only those ides that are proven to the VE team's satisfaction.

Design Comments
Some ideas that did not make the selection for development as recommendations, were, nevertheless judged worthy of further consideration. These ideas have been written up as Design Comments and are included in Section 3.

Level of Development
Value Engineering studies are working sessions for the purpose of developing and recommending alternative approaches to a given project. As such, the results and recommendations presented are of a conceptual nature, and are not intended as a final design. Detailed feasibility assessment and final design development of any of the recommendations presented herein, should they be accepted, remain the responsibility of the designer.

Organization of the Report
The report is organized in the following outline.

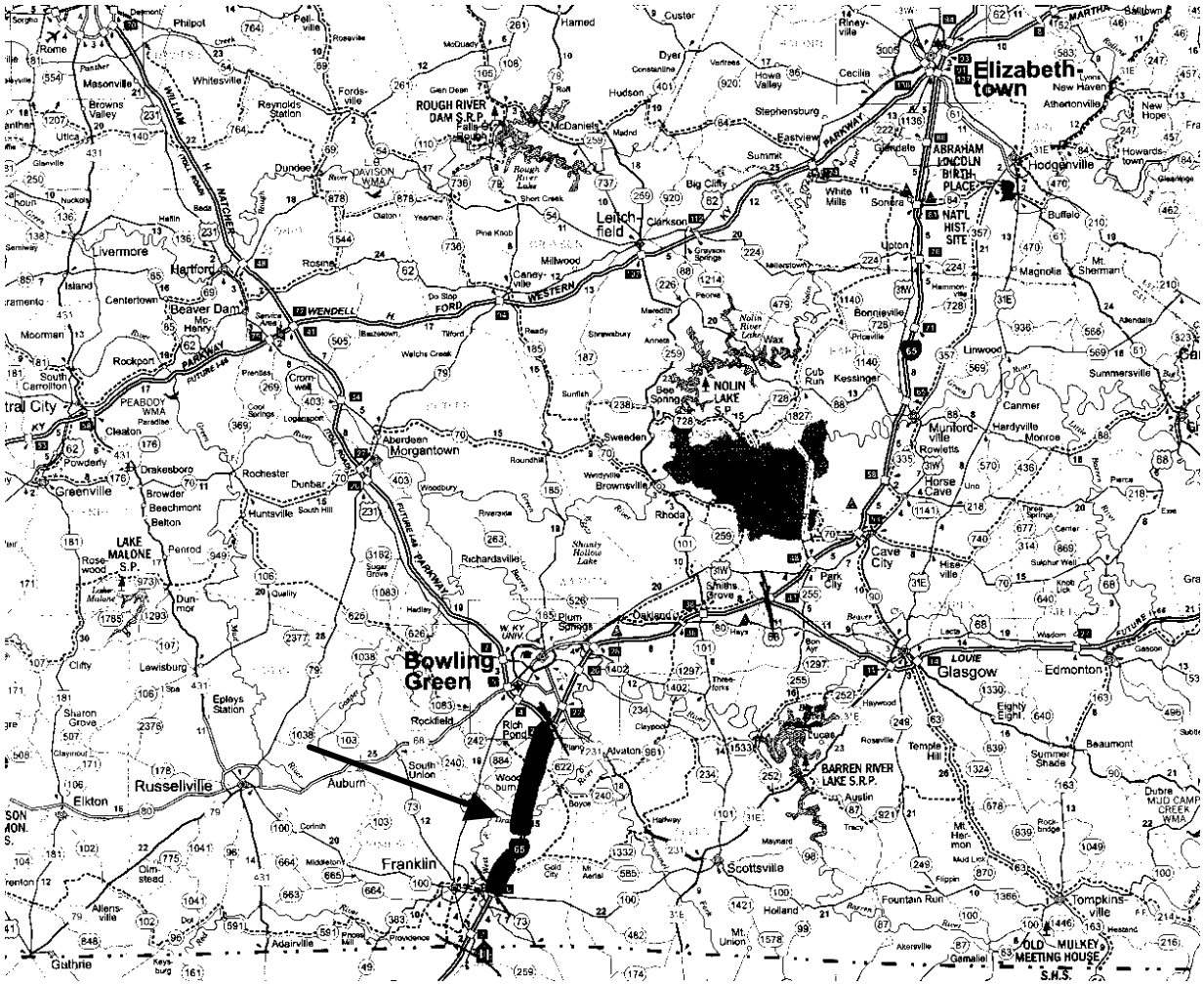
1. Introductory Information
    a. Section 1- Introduction
    b. Section 2- Project Description
2. Primary body of results……Section 3- Recommendations and Design Comments
3. Supporting documentation……Appendices

SECTION 2 – PROJECT DESCRIPTION

This project will widen I-65 from four lanes to six lanes from the Tennessee State line north to Natcher Parkway, by widening to the median, constructing a concrete median barrier and safety sideslopes on the outside shoulders. A wider shoulder in the median will also allow for safer travelling and the high median barrier will increase safety and reduce oncoming headlight glare. The existing pavement will be break and seated or rubblized and reconstructed. The mainline work will be done within the existing Right of Way. All bridges on the project will be replaced to provide adequate and safer clearance, both horizontal and vertical. The I-65 bridge and interchange ramps at US 31W will be designed to accommodate improvements being made to US 31W in a separate project. The KY 100 interchange and approach will be improved with the I-65 bridge over KY 100 to provide for increased truck traffic at this location.

Traffic will be maintained using two lanes of traffic in each direction during all heavy traffic hours of the day. The split-lane concept of traffic control will be used which requires an extra staging of traffic, but provides more recovery and escape room for through-vehicles. Crossroad traffic will be maintained by part-width construction or by detour.

A map depicting the location of the I-65 widening project is provided below.



Insert of Typical Section 1 (only found in hard copy) contains detail sections of the pavement underdrain, the median infill paving, and the specifications for grade, drain, and flexible pavement of I-65 for Simpson County.

Insert of Typical Section 2 (only found in hard copy) contains the rock cut details and median embankment specifications for Simpson County.

Insert Typical Section 3 (only found in hard copy) contains the dimensions, specifications for grade, drain, and flexible pavement, along with a detailed shoulder section for I-65 in Warren County.

SECTION 3 - VE RECOMMENDATIONS

Organization of Recommendations
This section contains the complete documentation of all recommendations to result from this study. A unique identification number marks each recommendation. The parent idea, or ideas, from which the recommendation began can be determined from the Creative Idea List located in Appendix D of this report.

Each recommendation is documented by a separate write-up that includes a description of both the original design and recommended change, a list of advantages and disadvantages, sketches where appropriate, calculations, cost estimate, and the economic impact of the recommendation on the first cost, and where applicable, the life cycle cost. The economic impact is shown in terms of savings or added cost.

Acceptance of VE Recommendations
The Summary of Recommendations table presented in the Executive Summary of this report identifies the recommendations that, in the opinion of the VE team, are the best combination of all the VE recommendations. This selection takes into account not only that the recommendations (and likewise their cost savings) are summarily additive, but also the likelihood and ease of implementing the recommendations.

While the costs savings and implementation of the recommendations is summarily additive, these recommendations should be evaluated individually to determine whether they are worthy of implementation or not. Consideration should be given to the areas within a recommendation that are acceptable and implement those parts only. Any recommendation can be accepted in whole or in part as the owner and design team see fit.

VALUE ENGINEERING RECOMMENDATION # 1

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Revise slopes in the cut sections from 6:1 to 4:1 to reduce excavation quantities.

ORIGINAL DESIGN:
Moves ditch outside of clear zone.

RECOMMENDED CHANGE:
Revise slopes in the cut sections from 6:1 to 4:1. Utilizing a 4:1 slope and keep the ditch where it is. This can be done in areas where the ditch back slope is flatter than 4:1.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$2,250,000		$2,250,000
RECOMMENDED DESIGN	$1,688,000		$1,688,000
ESTIMATED SAVINGS OR (COST)	$562,000	$0	$562,000

VALUE ENGINEERING RECOMMENDATION # 1

ADVANTAGES:

- Reduce excavation
- Reduce seeding
- Less disturbance to existing ground
- Faster construction

DISADVANTAGES:

- May decrease clear zone

JUSTIFICATION:
This recommendation reduces the excavation effort, results in less of a disturbance to the established ground cover, and can shorten the amount of time necessary to accomplish the construction.

Included **s**ketch of slopes and embankments (only found in hard copy) shows the revised cut section slope changing from 6:1 to 4:1.

VALUE ENGINEERING RECOMMENDATION # 1

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Roadway Excavation	CY	9.00	1	250,000*	$2,250,000	187,500*	$1,687,500
Subtotal					$2,250,000		$1,687,500
Mark-up**		@					
Redesign Costs							
Total					$2,250,000		$1,687,500

*Quantities are estimated. The total roadway excavation on the outside slopes for the entire project is 250,000 CY. It is estimated this can be reduced by 25% if this idea is implemented. This results in 187,500 CY of roadway excavation.

** Mark-up and contingency is included in unit pricing.

SOURCE CODE:
1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 2

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce heights of the benches on KY 240 to a maximum height of 3 ½ feet to 4 feet.

ORIGINAL DESIGN:
Benches vary in height from 6 feet to 12 feet.

RECOMMENDED CHANGE:
The benches on KY 240 should be reduced to a maximum height of 3 ½ feet to 4 feet.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$831,000		$831,000
RECOMMENDED DESIGN	$828,000		$828,000
ESTIMATED SAVINGS OR (COST)	$3,000	$0	$3,000

VALUE ENGINEERING RECOMMENDATION # 2

ADVANTAGES:

- Reduce quantities
- Increase safety
- Increase constructability

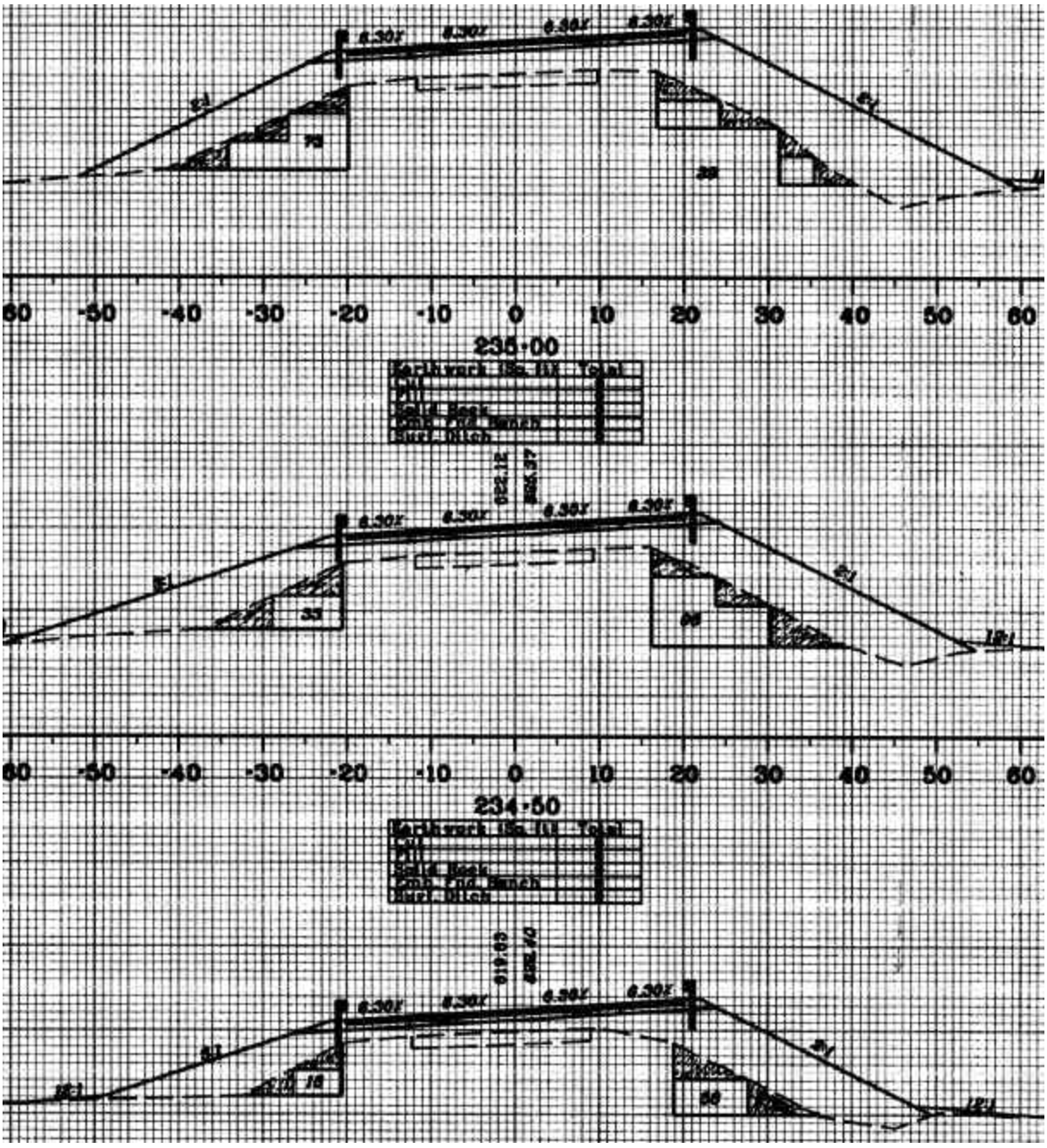
DISADVANTAGES:

- None noted

JUSTIFICATION:
The height of the benches should be reduced because it is neither safe nor practical to construct them to the height specified. A 3 ½ feet to 4 feet bench is all that is necessary to key the proposed fill into the existing embankment.

VALUE ENGINEERING RECOMMENDATION # 2

SKETCH OF ORIGINAL AND RECOMMENDED DESIGN



The attached sheet shows revised benches for stations 234+00 – 235+00. The reduction in excavation for these x-sections is 300sf (100sf average per x-section). The range of stations this applies to is 233+50 – 239+50 and 242+50 – 245+50 for a total of 900 feet.

$$\frac{900' \times 100sf}{27} = 333 \text{ C.Y.}$$

VALUE ENGINEERING RECOMMENDATION # 2

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Roadway excavation	cy	9.00	1	92,305	$830,745	91,972	$827,748
Subtotal					$830,745		$827,748
Mark-up*		@					
Redesign Costs							
Total					$830,745		$827,748

* Mark-up and contingency is included in unit pricing.

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
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4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 6

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Use DOT furnished temporary barrier walls.

ORIGINAL DESIGN:
Original design calls for the contractor(s) furnishing all required length of temporary barrier wall.

RECOMMENDED CHANGE:
Use DOT furnished temporary barrier wall, Type 9T, on the first section of this project. Should the projects be lead linearly without overlap, these barriers could be reused on other sections of the highway.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$12,911,000		$12,911,000
RECOMMENDED DESIGN	$10,061,000		$10,061,000
ESTIMATED SAVINGS OR (COST)	$2,850,000	$0	$2,850,000

VALUE ENGINEERING RECOMMENDATION # 6

ADVANTAGES:

- Immediate availability
- Uses stored materials
- Conserves resources

DISADVANTAGES:

- None noted

JUSTIFICATION:
DOT has wall available for immediate use within 20 miles of project area. Approximately 100,000 linear feet of wall is available.

VALUE ENGINEERING RECOMMENDATION # 6

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
3171	LF	51.00	1	253,160	$12,911,160	153,160	$7,811,160
DOT temp. barriers	LF	22.50	1			100,000	$2,250,000
Subtotal					$12,911,160		$10,061,160
Mark-up*		@					
Redesign Costs							
Total					$12,911,160		$10,061,160

* Mark-up and contingency is included in unit pricing.

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 7

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Eliminate full depth DGA in median.

ORIGINAL DESIGN:
Utilizes DGA to complete all embankments in median.

RECOMMENDED CHANGE:
Replace full depth DGA with soil to complete all embankments in median.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$1,297,000		$1,297,000
RECOMMENDED DESIGN	$381,000		$381,000
ESTIMATED SAVINGS OR (COST)	$916,000	$0	$916,000

VALUE ENGINEERING RECOMMENDATION # 7

ADVANTAGES:

- Reduces quantities of DGA
- Eases construction

DISADVANTAGES:

- May delay work due to weather

JUSTIFICATION:
The median is used primarily for buffering and safety. The median is not used as a driving lane, so it does not require full depth DGA. Soil will be acceptable to complete all of the embankments in the median.

VALUE ENGINEERING RECOMMENDATION # 7

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
DGA*	CY	34.00	1	38,133	$1,296,522		
Embankment in place		10.00	1			38,133	$381,330
Subtotal					$1,296,522		$381,330
Mark-up**		@					
Redesign Costs							
Total					$1,296,522		$381,330

* DGA is estimated at 2.07 cubic yards per ton.

** Mark-up and contingency is included in unit pricing.

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 9

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Use more drainage blanket and reduce the amount of asphalt base for the inside shoulders.

ORIGINAL DESIGN:
Full depth asphalt base on the inside shoulders.

RECOMMENDED CHANGE:
Substitute drainage blanket, ATDB, for the bottom 3 lifts of asphalt base on the inside shoulders.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$4,970,000		$4,970,000
RECOMMENDED DESIGN	$3,388,000		$3,388,000
ESTIMATED SAVINGS OR (COST)	$1,582,000	$0	$1,582,000

VALUE ENGINEERING RECOMMENDATION # 9

ADVANTAGES:

- Reduces base asphalt

DISADVANTAGES:

- Reduces structure strength

JUSTIFICATION:
It is not necessary to construct the inside shoulder to the same thickness of asphalt base as the driving lanes. It is proposed that the same pavement design for the outside shoulder be used for the inside shoulder. The portion of the inside shoulder that traffic will be running on should be constructed of two lifts (7") of asphalt base, but the rest of the inside shoulders can have a reduced asphalt base.

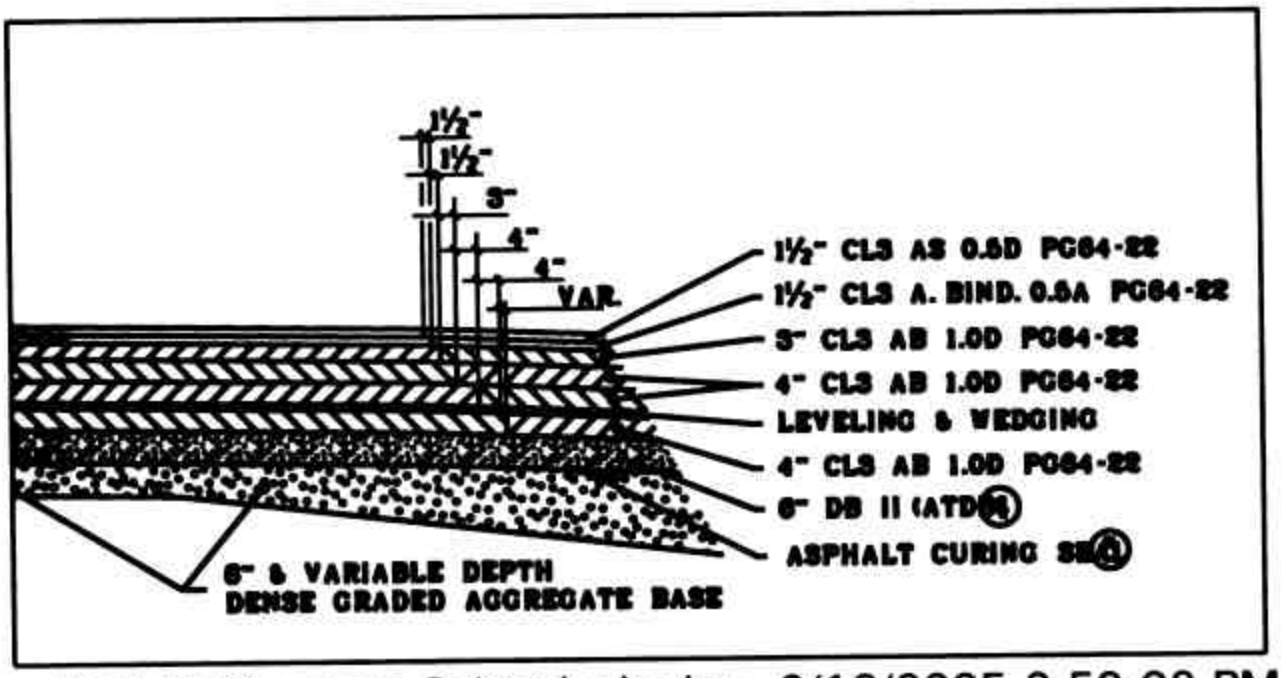
VALUE ENGINEERING RECOMMENDATION # 9

CALCULATIONS

Bottom two 4" lifts	Length of Section 3,4 & 5 (both sides)	134640	Feet	
	Width of inside shld	14	Feet	
	Area of inside shld	209440	Sq Yds	
	inside shld thickness to be changed	8	inches	
	Asphalt Base	92154	Tons	
	Unit Price	$ 40.00		Original
		$ 3,686,144.00		
	ATDB	83776	Tons	
	Unit Price	$ 30.00		Proposed
		$ 2,513,280.00		
	Savings	$ 1,172,864.00		
Top 4" lift	Length of Section 3,4 & 5 (both sides)	134640	Feet	
	Width of inside shld	9.75	Feet	
	Area of inside shld	145860	Sq Yds	
	inside shld thickness to be changed	4	inches	
	Asphalt Base	32089	Tons	
	Unit Price	$ 40.00		Original
		$ 1,283,568.00		
	ATDB	29172	Tons	
	Unit Price	$ 30.00		Proposed
		$ 875,160.00		
	Savings	$ 408,408.00		
		$ 1,172,864.00		
		$ 408,408.00		
	Total Savings	$ **1,581,272.00**		

VALUE ENGINEERING RECOMMENDATION # 9

SKETCH OF ORIGINAL DESIGN



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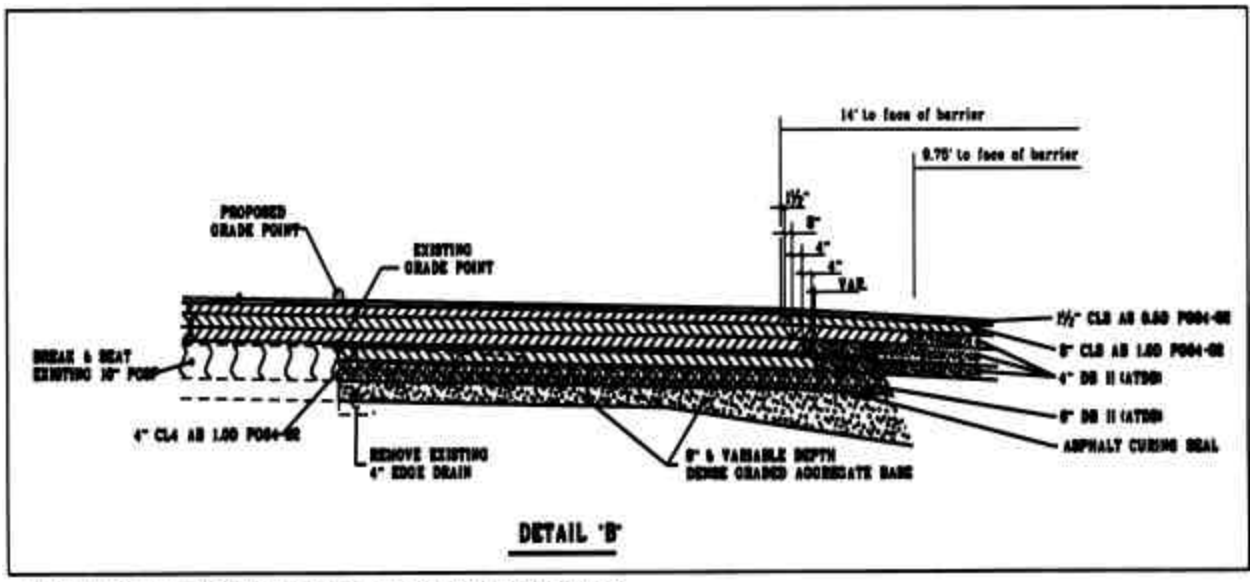
VALUE ENGINEERING RECOMMENDATION # 9

SKETCH OF RECOMMENDED DESIGN



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VALUE ENGINEERING RECOMMENDATION # 9

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
CL3 AB1.0D64-22	Ton	40.00	1	124,243	$4,969,720		
ATDB	Ton	30.00	1			112,948	$3,388,440
Subtotal					$4,969,720		$3,388,440
Mark-up*		@					
Redesign Costs							
Total					$4,969,720		$3,388,440

* Mark-up and contingency is included in unit pricing.

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 11

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Eliminate 1 ½" layer of binder on sections 3, 4, and 5.

ORIGINAL DESIGN:
The base is variable. The old lanes are 10" PCCP to be rubblized, and the new lane is DGA, drainage blanket, and 4" asphalt base. The pavement is 11" asphalt base, 1 ½" binder, and 1 ½" surface.

RECOMMENDED CHANGE:
Eliminate 1 ½" layer of binder on sections 3, 4, and 5.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$3,061,000		$3,061,000
RECOMMENDED DESIGN	$0		$0
ESTIMATED SAVINGS OR (COST)	$3,061,000	$0	$3,061,000

VALUE ENGINEERING RECOMMENDATION # 11

ADVANTAGES:

- Eliminates unnecessary work
- Not required for a good ride

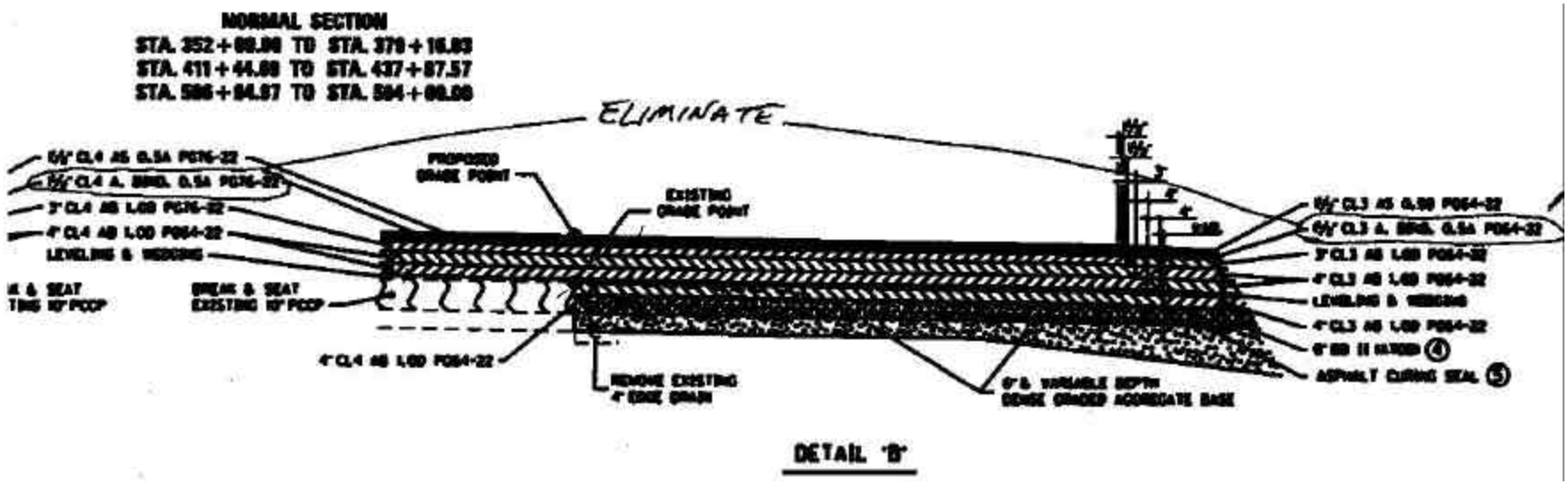
DISADVANTAGES:

- None noted

JUSTIFICATION:
Extra materials and construction of the 1 1/2" binder is not justified, because the final 1 ½" surface will provide an adequate finish and a smooth ride for motor vehicles.

VALUE ENGINEERING RECOMMENDATION # 11

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # 11

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
C12 Bind .50 64-22	Ton	40.00	1	76,520	$3,060,800		
Subtotal					$3,060,800		$0
Mark-up		@					
Redesign Costs							
Total					$3,060,800		$0

* Mark-up and contingency is included in unit pricing.

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 12

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Investigate need for rubblization in Section 5. Break and seat the existing 10" PCCP instead.

ORIGINAL DESIGN:
Rubblize the existing 10" PCCP in Section 5.

RECOMMENDED CHANGE:
Break and seat the existing 10" PCCP in Section 5.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$192,000		$192,000
RECOMMENDED DESIGN	$90,000		$90,000
ESTIMATED SAVINGS OR (COST)	$102,000	$0	$102,000

VALUE ENGINEERING RECOMMENDATION # 12

ADVANTAGES:

- Eases construction
- Reduce construction time

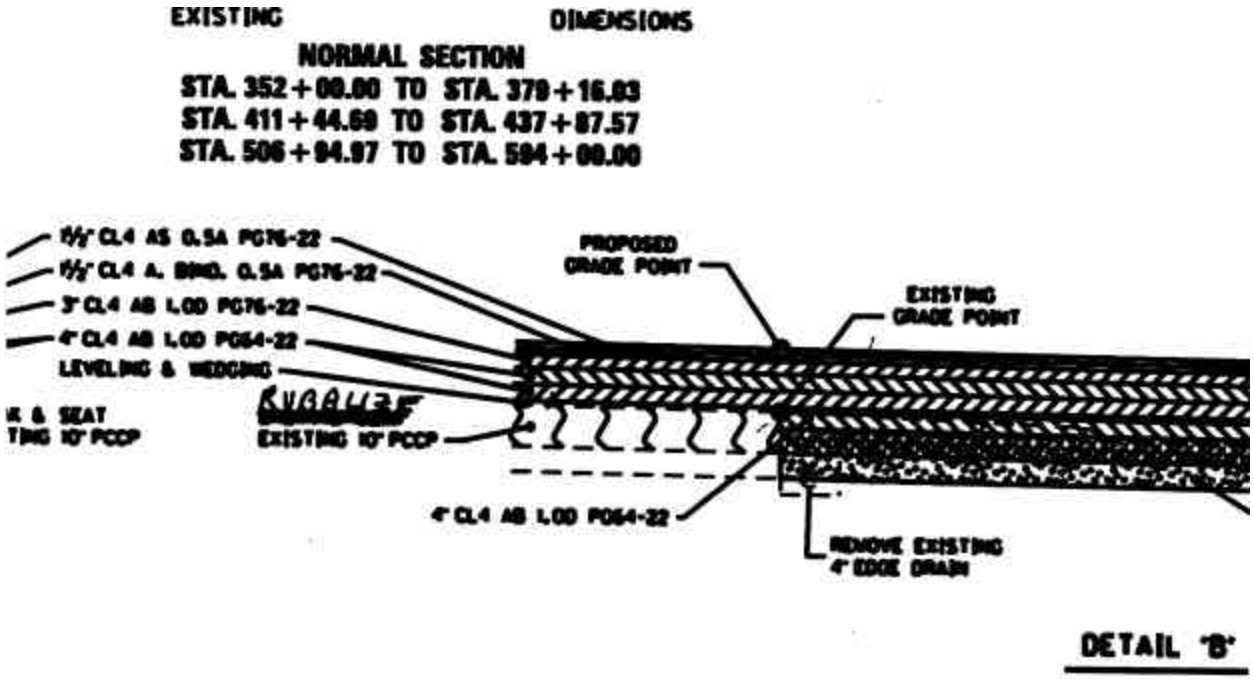
DISADVANTAGES:

- May have reflective cracks

JUSTIFICATION:
The VE team does was not given sufficient data to justify the using of the rubblization method in section 5, when the easier and faster method of break and seat would achieve acceptably comparable results.

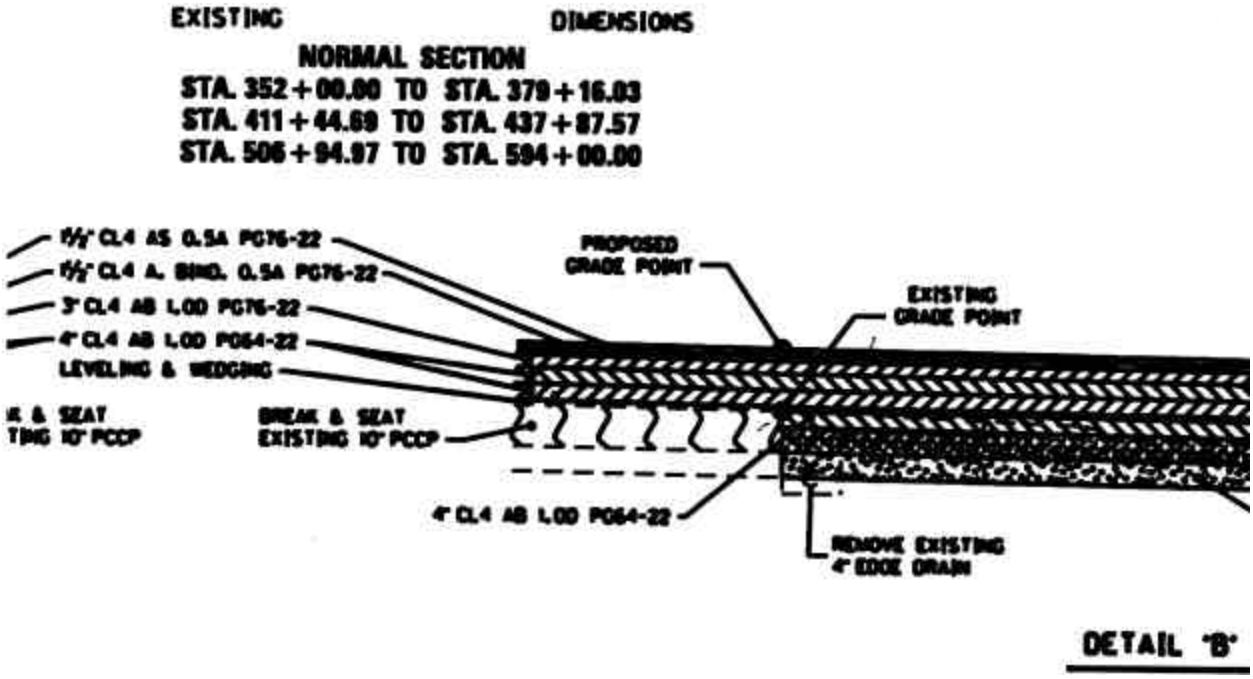
VALUE ENGINEERING RECOMMENDATION # 12

SKETCH OF ORIGINAL DESIGN



VALUE ENGINEERING RECOMMENDATION # 12

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # 12

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Rubblizing	SY	1.61	1	119,398	$192,231		
Break & Seat	SY	0.75	8			119,398	$89,549
Subtotal					$192,231		$89,549
Mark-up*		@					
Redesign Costs							
Total					$192,231		$89,549

* Mark-up and contingency is included in unit pricing.

SOURCE CODE: 1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

VALUE ENGINEERING RECOMMENDATION # 13

PROJECT: I-65 LANE WIDENING
LOCATION: SOUTH OF BOWLING GREEN, KENTUCKY
STUDY DATE: FEBRUARY 14 - FEBRUARY 18, 2005

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce outside shoulder widths from 12 feet to 10 feet.

ORIGINAL DESIGN:
The outside shoulder width is designed at 12 feet.

RECOMMENDED CHANGE:
The outside shoulder width should be changed to only 10 feet.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$9,512,000		$9,512,000
RECOMMENDED DESIGN	$7,631,000		$7,631,000
ESTIMATED SAVINGS OR (COST)	$1,881,000	$0	$1,881,000

VALUE ENGINEERING RECOMMENDATION # 13

ADVANTAGES:

- Reduces pavement necessary
- Meets AASHTO requirements
- Reduces construction time
- Reduces embankment

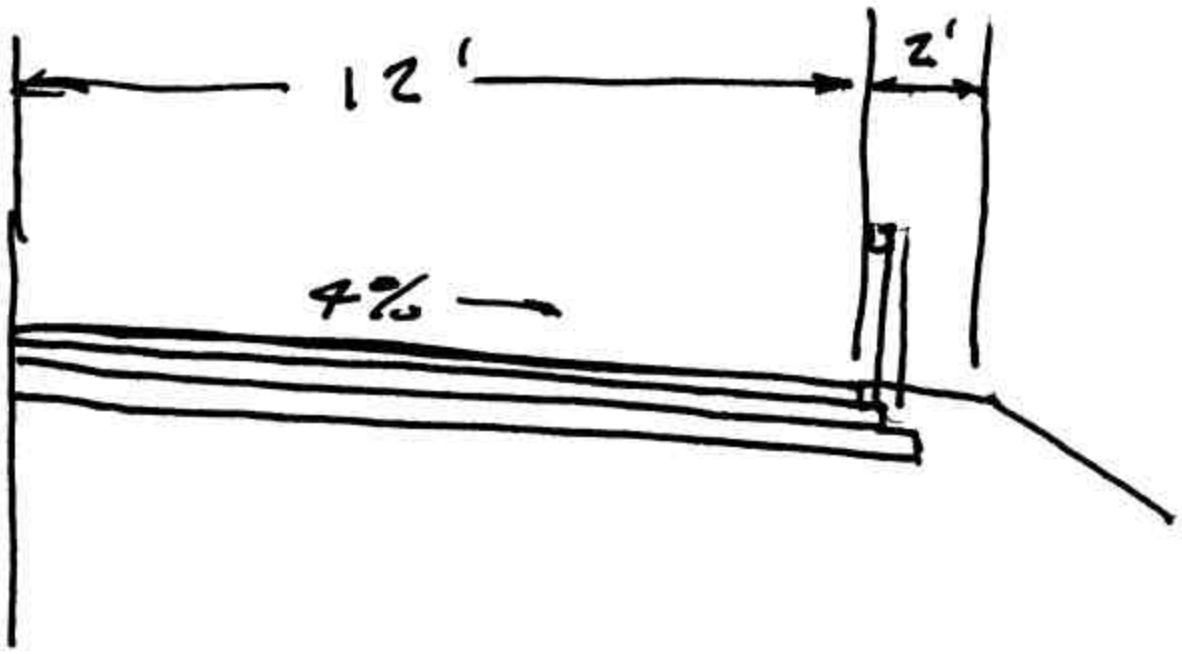
DISADVANTAGES:

- Less area for snow removal
- Less room for emergencies

JUSTIFICATION:
Other states such as Tennessee use 10-foot shoulders, so they have been successfully used before. The 10-foot width meets AASHTO criteria, which indicates the additional width is not necessary.

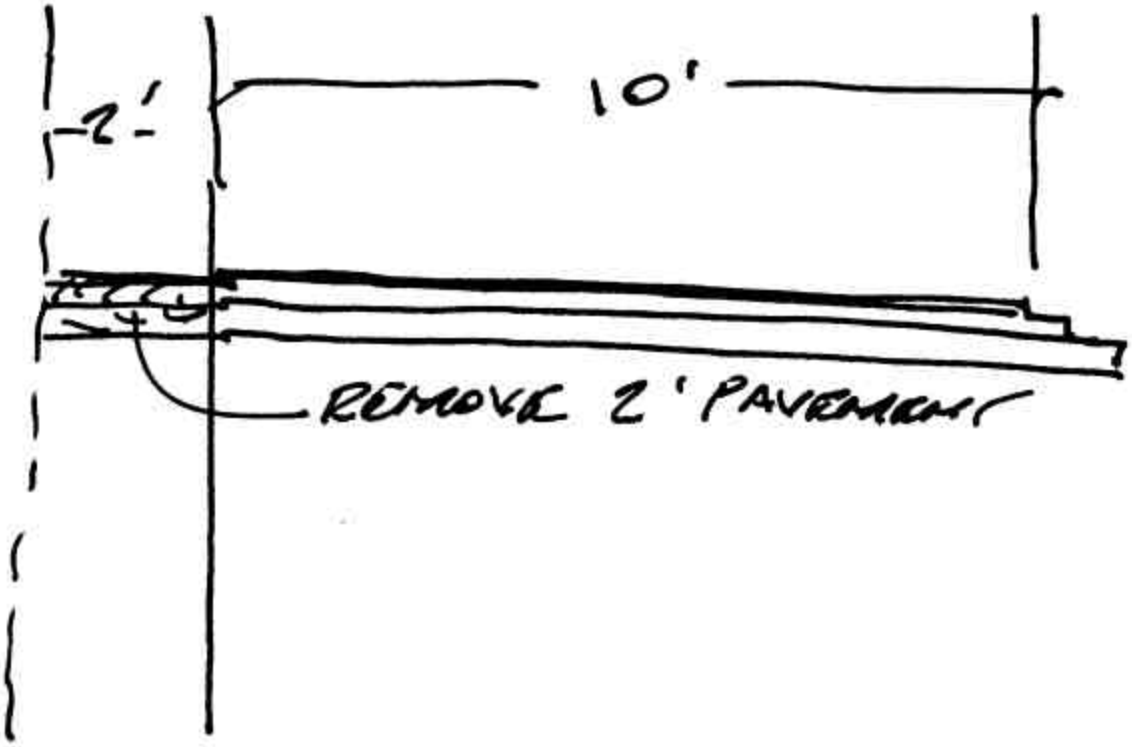
VALUE ENGINEERING RECOMMENDATION # 13

SKETCH OF ORIGINAL DESIGN



VALUE ENGINEERING RECOMMENDATION # 13

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # 13

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
1 1/2" CL3 AS 0.5 PG 64/22	Ton	40.00	1	11,895	$475,800	8,126	$325,040
1 1/2 CL# A Bind. 0.5A PG 64/22	Ton	45.00	1	11,743	$528,435	7,974	$358,830
11" CL3 AB 1.00 PG 64/22	Ton	40.00	1	115,086	$4,603,440	87,444	$3,497,760
Leveling; wedging	Ton	35.00	1	59,734	$2,090,690	58,478	$2,046,730
6" D.B. (Treated)	Ton	30.00	1	60,446	$1,813,380	46,739	$1,402,170
Subtotal					$9,511,745		$7,630,530
Mark-up		@					
Redesign Costs							
Total					$9,511,745		$7,630,530

* Mark-up and contingency is included in unit pricing.

SOURCE CODE:
1 Project Cost Estimate
2 CES Data Base
3 CACES Data Base
4 Means Estimating Manual
5 National Construction Estimator
6 Vendor List or Quote (list name / details)
7 Professional Experience (List job if applicable)
8 Other Sources (specify)

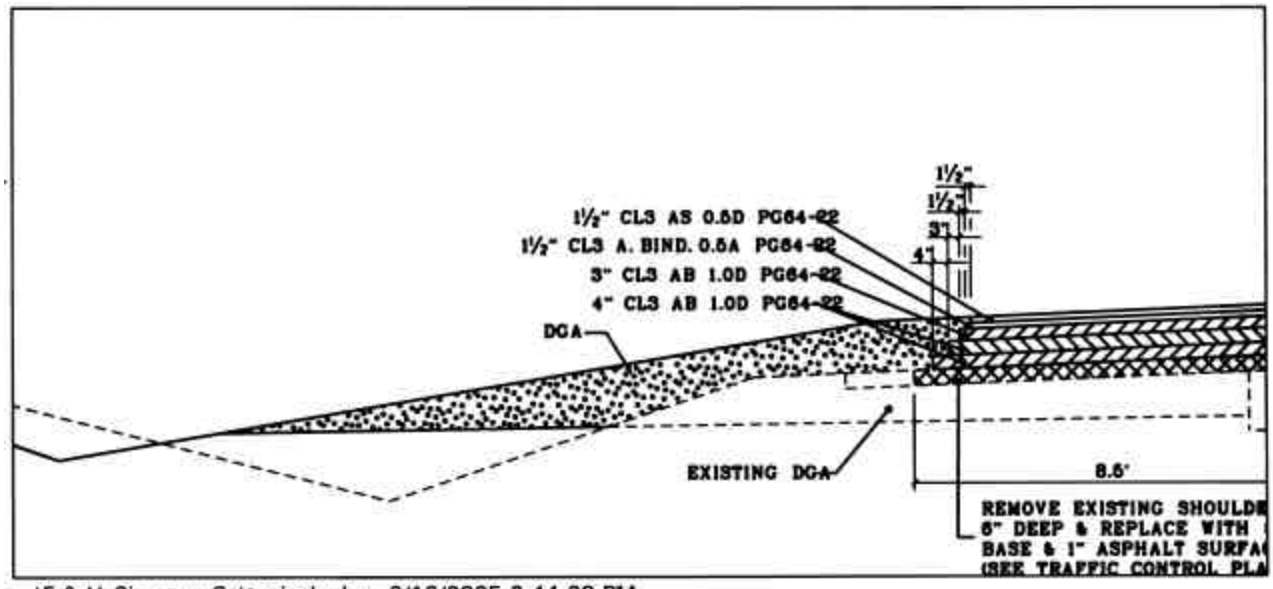
DESIGN COMMENTS

Design Comments are ideas that in the opinion of the team were good ideas, but for any number of reasons were not selected for development as VE recommendations. Design Comments can be notes to the owner or designer, a documentation of various thoughts that come up during the course of the study, a reference to possible problems, suggested items that might need further study, or questions that the owner and designer might want to explore. Some comments might relate to things of which the owner or designer is already aware. Because the study is done on a design in progress and as an independent team, the VE team may not be aware of everything intended by the owner and designer. The following comments are presented with the intent that there might be a few comments that aid the design team in some way.

VALUE ENGINEERING DESIGN COMMENT # 8

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Reduce the amount of DGA base on the outside wedge.

COMMENTARY:
Construct DGA on the outside wedge to an elevation equal to the top of the existing shoulder. This is in lieu of constructing the outside wedge to the elevation equal to the bottom of the existing DGA under the shoulder.



APPENDICES

The appendices in this report contain backup information supporting the body of the report, and the mechanics of the workshop. The following appendices are included.

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A. Study Participants A-2

B. Cost Information A-4

C. Function Analysis A-32

D. Creative Idea List and Evaluation A-34

E. Project Analysis A-36

APPENDIX A
Participants

APPENDIX A - Participants

Workshop Attendance												
Attendees				**Participation**								
				Meetings			**Study Sessions**					
Name	Organization and Address (Organization first, with complete address underneath)	Tel # and FAX. (Tel first with FAX underneath)	Role in wk shop	Intro	Mid Wk Rev	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Wallace Bennett	T.H.E. Engineering	859-263-0009	Structures	X							
Mike Bruce	Johnson, Depp & Quisenberry	270-926-1808	Design Team Manager	X							
David Depp	JDQ	859-277-3639	Structures	X							
Paul Estes, Project Manager	American Engineers, Inc	270-651-7220	Project Engineer	X							
Vibert Forsythe	KYTC – C.O – Constr	859-564-4730	VE Team	X			X	X	X	X	
Allan W. Frank	KYTC – Bridge Design	502-564-4560	VE Team	X			X	X			
Curt Hall	T.H.E. Engineering	859-263-0009	Structures	X							
Josh Hornbeck	KYTC – 04 Construction	270-766-5033	VE Team Resident Engineer	X			X	X	X	X	
Danny Jasper	KYTC CO – Design	502-564-3280	VE Team	X			X	X		X	
Robert Martin	KYTC – C.O. Design	502-564-3280	Review	X							
Bruce Newby	URS Corporation	913-344-1000	VE Technical Recorder	X			X	X	X	X	X
Robert Parks	Florence & Hutcheson	270-444-9691	Roadway	X							
Michael Robison	Skees Engineering	502-254-2344	Design Engineer	X							
Ray Robison, Jr.	Skees Engineering	502-254-2344	PM for Skees	X							
Robert Semones	KYTC CO – Design	502-564-3280	VE Team	X			X	X	X	X	X
Siamak Shafaghi	KYTC – Design	502-564-3280	VE Team	X			X	X	X	X	X
Joe Waits	URS Corporation	251-666-7184	VE Team Leader	X			X	X	X	X	X

APPENDIX B
Cost Information

APPENDIX B - Cost Information

Insert Cost Estimate

APPENDIX C
Function Analysis

APPENDIX C - Function Analysis

Function Analysis

Description	Value	Function
Roadway excavation	$378,000	Shape cross-section Establish grade
Maintain/control traffic	$1,115,000	Maintain traffic
Concrete median barrier Type 14-50	$1,254,000	Separate traffic
Temporary concrete barrier Type 9T	$2,226,150	Protect traffic Control traffic
DGA Base	$3,174,262	Fill void Establish base
Asphalt paving	$8,529,580	Carry load Prevent cracking Establish grade Minimize maintenance
Asphalt paving, milling & texturing	$2,253,000	Remove pavement
Bridge @ 178 & 85	$635,412	Span object
Bridge @ 284497	$598,849	Span object
Drainage blanket	$1,708,000	Eliminate water

APPENDIX D
Creative Idea List and Evaluation

APPENDIX D - Creative Idea List and Evaluation

List of CREATIVE IDEAS			
ID #	**Name of Idea / description**	**Develop Status**	**TM Resp.**
	Roadway excavation:		
1	Investigate slopes to reduce excavation quantities.	Develop	J. Hornbeck
2	Reduce size of benches	Develop	J. Hornbeck
	Maintain/control traffic:		
3	Investigate leaving existing barrier wall as is/ 2d stage.	Eliminate	V. Forsythe
4	Use paint in lieu of temporary tape.	Eliminate	V. Forsythe
	Concrete median barrier:		
5	Investigate 12” barrier wall in lieu of 14”	Eliminate	R. Semones D. Jasper
	Temporary concrete walls:		
6	Use DOT furnished temporary barrier walls.	Develop	V. Forsythe
	DGA Base:		
7	Eliminate full depth DGA in median	Develop	J. Hornbeck
8	Reduce the amount of outside wedge	Design comment	J. Hornbeck
	Drainage Blanket:		
9	Use more drainage blanket, reduce asphalt base for shoulders.	Develop	J. Hornbeck R. Semones
10	Use untreated drainage blanket where feasible.	Eliminate	J. Hornbeck R. Semones
	Asphalt paving:		
11	Eliminate binder	Develop	D. Jasper
12	Investigate need for rubblization in Section 5	Develop	D. Jasper
13	Reduce shoulder widths to 10 feet	Develop	D. Jasper

APPENDIX E
Analysis Phase

APPENDIX E – Analysis Phase

Analysis Phase

Roadway Excavation

1. Investigate slopes to reduce excavation quantities.
Advantages
- Reduce excavation
- Reduce seeding
- Less disturbance
- Faster construction

Disadvantages
- May decrease clear zone

Conclusion:
Continue developing idea

2. Reduce size of benches.
Advantages
- Reduce quantities
- Increase safety
- Increase constructability

Disadvantages
- None noted

Conclusion:
Continue developing idea

Maintain/control traffic

3. Investigate leaving existing barrier wall as is/2nd stage.
Advantages
- None noted

Disadvantages
- None Noted

Conclusion:
Drop idea

4. Use paint in lieu of temporary tape.
Advantages
- None noted

Disadvantages
- None noted

Conclusion:
Drop idea

Concrete median barrier

5. Investigate 12-inch barrier wall in lieu of 14 inch.
Advantages
- None noted

Disadvantages
- None noted

Conclusion:
Drop idea

Temporary Concrete Walls

6. Use DOT furnished temporary barrier walls.
Advantages
- Immediate availability
- Uses stored materials
- Conserves resources

Disadvantages
- None noted

Conclusion:
Continue developing idea

DGA Base

7. Eliminate full depth DGA in median.
Advantages
- Reduces quantities

Disadvantages
- May delay work due to weather

Conclusion:
Continue developing idea

8. Reduce the amount of outside wedge.
Advantages
- None noted

Disadvantages
- None noted

Conclusion:
Make design comment

Drainage Blanket

9. Use more drainage blanket, reduce asphalt base for shoulders.
Advantages
- Reduces base asphalt

Disadvantages
- Reduces structure strength

Conclusion:
Continue developing idea

10. Use untreated drainage blanket where feasible.
Advantages
- Reduce unit cost of materials

Disadvantages
- Reduced constructability

Conclusion:
Drop idea

Asphalt Paving

11. Eliminate binder.
Advantages
- Eliminates unnecessary work
- Not necessary for good ride

Disadvantages
- None noted

Conclusion:
Continue developing idea

12. Investigate need for rubblization in Section 5.
Advantages
- Reduce unit cost versus break/seat
- Reduce construction time

Disadvantages
- May have reflective cracks

Conclusion:
Continue developing idea

13. Reduce outside shoulder widths to 10 feet.
Advantages
- Reduces pavement
- Meets AASHTO requirements
- Reduces construction time
- Reduces embankment

Disadvantages
- Less area for snow removal
- Less room for emergencies

Conclusion:
Continue developing idea

END OF REPORT

This report was compiled and edited by:
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