URS

THE OHIO RIVER BRIDGES

OHIO RIVER BRIDGES
SECTION 4 - EAST END BRIDGE APPROACH
VALUE ENGINEERING STUDY REPORT

Study Date: December 10 - 14, 2007
Report Date: January 4, 2008

KENTUCKY TRANSPORTATION CABINET

OHIO RIVER BRIDGES
SECTION 4 – EAST END BRIDGE APPROACH

VALUE ENGINEERING STUDY
for
Kentucky Transportation Cabinet

Study Date: December 10 - 14, 2007

Final Report

January 4, 2008

URS Corporation

EXECUTIVE SUMMARY

General
URS conducted a Value Engineering Study of the Louisville Ohio River Bridges, Section 4 – East End Bridge Approach. The topic was the 40% Design Development Submission prepared for the Kentucky Transportation Cabinet (KYTC) by Lochner Associates, Inc.

The VE Team undertook the task assignment using the value engineering work plan and approach. The ideas 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.

Estimate of Construction Costs and Budget
The construction cost estimate provided to the VE Team with the project documents indicates a total construction cost of $548,000,000. This project is scheduled to be let as a design/bid/build project, thus the cost of construction will be determined on a contractor bid.

As a result of this value engineering study, should all of the VE Team's selected combination of recommendations be accepted for implementation, the total potential savings available to KYTC for this project is $120,742,000. These potentials are based upon the VE Team's cost estimates of the individual recommendations selected by the VE Team as noted on the Summary of Recommendations table below. Total cost savings realized by KYTC will be based upon the final implementation status of these VE recommendations.

Summary of VE Study Results
During the speculation phase of this VE study, 77 creative ideas were identified. 63 of these ideas were developed into VE recommendations and design comments with cost implications where applicable. Many of the ideas represent changes in design approach, reconsideration of criteria, and in some cases, modification of the project scope. In general, the idea evaluation took into account the economic impact, other 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 estimate as prepared by the design team and included in their submission to KYTC, published cost databases, and VE Team member experience.

The table also identifies the recommendations and alternatives 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 whether the cost savings or project improvement potential of the recommendations are worth the change to the project design.

SUMMARY OF RECOMMENDATIONS			
DESCRIPTION		PRESENT WORTH	
Rec #	Recommendation Title / Description	1st cost savings (or cost)	VE Selected Combo
VE-1	Utilize pervious concrete (a green methods) for storm-water capture on the hard shoulders of the tunnel portal and whenever else possible	($914,000)	X
VE-2	Utilize Design-Build in lieu of Design-Bid-Build for the entire project or at least for the tunnel section	$51,584,000	X
VE-3	Utilize Design-Build-Operate-Transfer contracting method in lieu of a Design-Bid-Build contracting method	Up to 100% of project	
VE-4	Utilize 16.5 feet of vertical clearance in lieu of 17 feet of vertical clearance on the tunnel	$767,000	X
VE-5	Utilize a 4’-36’-4’ tunnel section in lieu of an 8’-36’-10’ tunnel roadway section	$13,875,000	X
VE-6	Utilize a 5’-36’-10’ tunnel section in lieu of an 8’-36’-10’ tunnel roadway section	$4,044,000	
VE-7	Utilize one open cut and cover (reduced depth) tunnel in lieu of two deeper bored tunnels	$131,209,000	
VE-8	Utilize rock cut (reduced depth) in lieu of two deeper bored tunnels	$275,340,000	
VE-9	Modify vertical alignments south of the tunnel to increase the grade from 2.5% to 4% in order to reduce excavation	$11,969,000	X
VE-9A	Modify vertical alignments south of the tunnel to increase the grade from 2.5% to 4% and reduce clear zone from 33 ft to 12 ft to reduce excavation (combination of recommendations VE-9 and VE-10)	$13,643,000	
VE-10	Utilize a barrier wall and a 20 ft offset in lieu of a 33 ft offset in the cut section south of the tunnel	$6,124,000	
VE-11	Reduce the length of the Ramp A structure by approximately 400 ft by reducing the excavation within the rock cut before the elevated bridge abutment	$3,102,000	
VE-12	Place Ramp A on the east side of KY-841 in lieu of installing flyover to the west side	$8,931,000	X
VE-13	Revise maintenance of the traffic plan to allow excavation of the south tunnel portal rock cut, between approximate stations 50 + 00 and 106 + 00, in one phase in lieu of three phases	$4,491,000	
VE-14	Utilize normal geotechnical surface exploration techniques in lieu of the exploratory tunnel project	$21,275,000	X
VE-15	Utilize directional drilling in lieu of boring an exploratory tunnel to acquire geotechnical information	$16,100,000	
VE-16	Reduce right of way acquired in this entire project by constructing the noise barrier wall on top of the proposed retaining wall	$1,017,000	X

SUMMARY OF RECOMMENDATIONS			
DESCRIPTION		PRESENT WORTH	
Rec #	Recommendation Title / Description	1st cost savings (or cost)	VE Selected Combo
VE-17	Reduce the Harrod's Creek Bridge length from 1,470 ft to 1,200 ft by eliminating spans 1 and span 7	$11,033,000	X
VE-18	Reduce the width of Harrod's Creek Bridge by 16 ft by utilizing 4 ft shoulders (4'-36'-4') in lieu of 12 ft foot outside shoulders (12'-36'-12') on both bridges	$15,255,000	
VE-19	Utilize a sod lining in the drainage ditches in lieu of bentonite lining	$156,000	X
VE-20	Reduce width of the shared pedestrian path from 15 ft to 10 ft to meet the recommended minimum for a 2-way pedestrian path	$44,000	X
VE-21	Utilize existing ramp from KY-841 to I-71 west (station 24+42.10 to station 25+00) in lieu of replacing this section of ramp	$72,000	X
VE-22	Utilize open storage for drainage in lieu of under road storage in the Belleview area	$2,900,000	
VE-23	Utilize natural drainage system in lieu of capturing stormwater in the Belleview area	$3,360,000	
VE-24	Utilize 4:1 side slopes between station 154+00 to station 168+00 (near Belleview) in lieu of the proposed slopes to incorporate wetland area at the bottom of the slopes	$423,000	X
VE-25	Utilize steeper side slopes in combination between station 156+00 and station 168+00 (near Belleview) in lieu of a proposed side slopes through these stations	$575,000	
VE-26	Do not utilize vegetation within the interior barrier wall/median system	$510,000	X

Summary of VE Team Selected Combination $120,742,000

SUMMARY OF DESIGN COMMENTS	
DC #	Description Title
DC-27	Utilize three construction contracts in lieu of eight separate construction contracts
DC-28	Reroute KY-841 to the east of Bridgeport around all historic properties
DC-29	Utilize a toll way for the tunnel or for the entire project
DC-30	Utilize closed drainage storage in lieu of under road storage in the Belleview area
DC-31	Verify the stormwater detention basin location with respect to the Harrod's Creek (north) Bridge abutment to verify that they do not overlap
DC-32	Utilize 60 mph design speed in lieu of 70 mph design speed throughout project
DC-33	Prequalify all tunnel contractors before bidding takes place, and provide stipend to all tunnel design-build firms that submit qualified bids
DC-34	Utilize scuppers in lieu of closed pipe drainage on Ramp A and Wolf Pen Branch bridges
DC-35	Utilize the rock excavated from the cut and tunnel sections within the project in lieu of wasting material off-site in the quarry
DC-36	Utilize a uniform pavement design that includes full depth shoulders in lieu of partial depth shoulders
DC-37	Utilize landscaping that does not require irrigation at any location within the project limits to ensure plant survival
DC-38	Provide provision for temporary drainage at the south portal of the tunnel during construction
DC-39	Utilize steel plate girders and PCI beams for all structures (where applicable)
DC-40	Utilize permanent decorative accents bolted on the side of the structures in lieu of using haunched girders
DC-41	Maintain existing sludge pond in its current location and jointly use the ROW with the Louisville Water Company
DC-42	Relocate Harrod's Creek to reduce the length of the Harrod's Creek Bridge
DC-43	Utilize the existing construction contract for at least 5 years of maintenance for the landscaping of the project
DC-44	Improve River Road from US-42 to the project ROW (at least) for use during construction
DC-45	Reevaluate the 4F requirements to allow cut and cover construction of the tunnel in lieu of boring the tunnel
DC-46	Utilize security for emergency access road from the tunnel to River Road
DC-47	Tunnel uphill (north to south) in lieu of tunneling in the downhill direction, and build a temporary bridge across Harrod's Creek to transport tunnel waste material to fill site
DC-48	Utilize a belt conveyor to transfer material from the north end of the tunnel to the north side of Harrod's Creek

SUMMARY OF DESIGN COMMENTS	
DC #	Description Title
DC-49	Pending the findings of the geotechnical investigation, utilize a continuous rock face in the cut section in lieu of a bench section
DC-50	Squeeze or move the typical section so the noise wall is not directly on top of the existing 60” water line in conjunction with adjusting the typical width of the cut section
DC-51	Utilize sheet flow and eliminate the drainage ditch on the top of the slope at station 82+00 to station 107+00
DC-52	Provide taper and emergency crossovers on roadway adjacent to both ends of the tunnel to accommodate two way traffic in each bore in case of an emergency situation
DC-53	Work with TRIMARC to add a performance specification component to the existing contract to ensure the tunnel monitoring is compatible with the existing system
DC-54	Utilize agreement with the Metro Parks to maintain the multiuse path
DC-55	Utilize anti-graffiti coatings along with specific plantings in strategic locations along walls and around bridge piers
DC-56	Utilize “quiet” asphalt in the sound calculation or do not utilize “quiet” asphalt
DC-57	Consider work hour schedule exception for tunnel and for construction season
DC-58	Utilize a narrow and longer stormwater detention basin at the southern tunnel portal, which could be located and maintained between the two inside shoulders in lieu of the originally designed detention basin that requires lane closure during maintenance
DC-59	Utilize edge drains in the pavement design currently not shown on the proposed typical drawings
DC-60	Utilize a 4’-15’-6’ roadway section for Ramp A in lieu of a 6’-15’-8’ roadway section
DC-61	Roadway excavation unit price in the estimate appears to be low
DC-62	Examine the use of a full interchange with US-42 in lieu of a half interchange

Acknowledgments
A thank you is given to the staff members from the Kentucky Transportation Cabinet and the design team members from Lochner and Associates, Inc. A special thanks is also extended to Mr. Robert Semones for his assistance with the setting up of this study.

Value Engineering Study - Core Team

Name	Discipline / Role	Organization	Telephone
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Kevin Rust, PE	Construction Expert	URS	513-419-3503
Kyle Schafersman, EIT, CVS	VE Team Leader	URS	913-344-1019
Christopher Smith	Maintenance Expert	URS	502-382-6013

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

Kyle Schafersman, EIT, CVS
Value Engineering Program Manager

TABLE OF CONTENTS

SECTION 1 - INTRODUCTION

This report documents the results of a value engineering study on the Ohio River Bridge, Section 4 – East End Bridge Approach. The study workshop was held at the URS offices in Louisville, KY on December 10 - 14, 2007. The study team was from URS. Kyle Schafersman, a Certified Value Specialist (CVS) team leader from URS, facilitated the study. The names and telephone numbers of all participants in the study are listed in Appendix A.

The Job Plan
This study followed the value engineering methodology as endorsed by SAVE International, the professional organization of value engineering. This report does not include any detailed explanations of the 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 sole purpose of this report is to document the results of the study. Additional information regarding the processes used during the study can be obtained by contacting the Certified Value Specialist team leader that facilitated the study.

Ideas and Recommendations
Part of the value engineering methodology is to generate as many ideas as is practical, evaluate each idea, and then select as 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 put forth as a formal value engineering recommendation. Recommendations represent only those ideas 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 after the recommendations.

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
4. Supporting documentation……Appendices

SECTION 2 – PROJECT DESCRIPTION

Section 4 of the Louisville-Southern Indiana Ohio River Bridges Project (Project) is located in eastern Jefferson County, Kentucky, and begins on KY 841 just west of the I-71/265 interchange. Section 4 will be constructed as a six-lane, limited access highway that generally follows existing alignment of KY 841 as it approaches US 42. As the roadway approaches Wolf Pen Branch Road, the profile elevation will descend to enter twin tunnels underneath US 42 and the historic Drumanard Estate. The twin tunnels will be approximately 2000 ft long and the roadway will exit the tunnels in an approximately 40-50' deep cut section through the Shadow Wood Subdivision.

Because the Project will adversely affect historic resources in the project area, its historic context provides the first point of consideration. The period of historic significance in this area of eastern Jefferson County for which historic resources remain to physically illustrate a variety of themes, extends from the early-nineteenth through the mid-twentieth century. A variety of resources including buildings, structures, sites and landscapes exist as individual properties and in historic districts. The existing organization illustrates the area's gradual transformation over decades of occupation. A man-made pattern superimposed on the natural topography includes transportation networks, commercial clusters, individual buildings and complexes, farms, areas of designed and natural vegetation, and small scale elements such as fence lines and signing.

Northbound exit and southbound entrance ramps constructed at US 42 will maintain existing access to I-265 and KY 841 southbound. The roadway continues in a generally northwesterly direction through the northern half of the Shadow Wood Subdivision, across the back (southern) portion of the Harbor at Harrod's Creek complex, and over Harrod's Creek and River Road. On the west side of River Road, the new, elevated roadway continues between the northeast corner of the historic Belleview property and the southwest edge of the historic Rosewell property. The roadway then traverses the Ohio River floodplain, crossing the southwest corner of the Louisville Water Company's Sludge Pond No. 4 and the Transylvania Beach community before approaching the Ohio River.

As required in the Record of Decision (ROD), a topographic assessment of the Project's visibility from significant historic sites was prepared by the design team to determine screening requirements. Photographs taken from the key viewing locations toward the project aided in creating illustrations that help the community to better visualize the proposed project. The community used the illustrations to enhance their understanding of the scale, materials, and overall appearance of design elements including tunnel portals, bridges, noise barriers, retaining walls, earthen berms, lighting, grading and drainage concepts. The illustrations also help to see how various landscape concepts can be used to enhance the overall character, and minimize the amount of overall maintenance and management required in the right-of-way (ROW).

The current cost estimate projects the total construction cost of this project at $548,000,000 with well over half of this figure being attributed to the construction of the tunnel at $240,317,903 not including contingency. As a result of this tunnel, the project also includes substantial cut sections on either side resulting in almost 2,000,000 CY of wasted material.

SECTION 3 - VE RECOMMENDATIONS & DESIGN COMMENTS

Organization of Recommendations
This section contains the complete documentation of all recommendations to result from this study. Each recommendation has been marked by a unique identification number.

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.

However, this report also includes other recommendations that could enhance the value of this project. These recommendations are either mutually exclusive of the recommendations selected by the VE Team (i.e. implementing one immediately precludes the implementation of another) or they require additional design and/or evaluation prior to implementation. 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.

SECTION 3.1 – VE Team Recommendations

VALUE ENGINEERING RECOMMENDATION # VE-1

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize pervious concrete (a green methods) for storm-water capture on the hard shoulders of the tunnel portal and whenever else possible.

ORIGINAL DESIGN:
In the original design, no green technology is presently proposed for storm-water capture on this project.

RECOMMENDED CHANGE:
Use green technology such as permeable concrete on the hard shoulders south of the tunnel portal for storm-water runoff between the beginning of the project and the south portal entrance at station 106 + 00.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$985,000		$985,000
RECOMMENDED DESIGN	$1,899,000		$1,899,000
ESTIMATED SAVINGS OR (COST)	($914,000)	$0	($914,000)

VALUE ENGINEERING RECOMMENDATION # VE-1

ADVANTAGES:

- Reduction in size of the south portal storm-water treatment chamber between stations 102 + 58.5 and 105 + 84.5 due to reduction of storm-water runoff
- Mitigates suspended solids
- Reduction of the standing water at the shoulder/pavement interface
- Significant oil, grease, and petroleum products reduced
- Increase in the edge line value for the enhanced safety to the traveling public when used with the asphalt pavement to the main line

DISADVANTAGES:

- Potential need for maintenance as pervious concrete voids may get plugged with road debris and dust
- Long term durability of pervious concrete surface is unknown
- Skid properties of pervious concrete on high speed freeway shoulders is unknown
- Replacement costs are high in relation to long term maintenance

JUSTIFICATION:
Use of the green technology will reduce the required capacity for the storm-water treatment chambers and the treatment necessary within this segment of the roadway.

VALUE ENGINEERING RECOMMENDATION # VE-1

SKETCH OF RECOMMENDED DESIGN

See video demonstrations and learn more about pervious concrete at:

www.perviouspavement.org/Pervious-Pavement-Demo-Video.html

VALUE ENGINEERING RECOMMENDATION # VE-1

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Hard Shoulder Original Paving Asphalt and Base	SF	4.15	7	206,400	$856,560		
Concrete Hard Shoulder Permeable Concrete and Base	SF	8.00	7			206,400	$1,651,200
Subtotal					$856,560		$1,651,200
Contingency	@	15.00%			$128,484		$247,680
Total					$985,044		$1,898,880

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

VALUE ENGINEERING RECOMMENDATION # VE-2

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize Design-Build in lieu of Design-Bid-Build for the entire project or at least for the tunnel section.

ORIGINAL DESIGN:
The original design is a Design-Bid-Build contract. KYTC is responsible for providing all of the geotechnical information for the tunnel to the design team.

RECOMMENDED CHANGE:
The recommended change is to use one contract to cover the design and construction Design-Build. This system can also be used for the tunnel contract. Design-Build is suited to the sprayed concrete lining system which will have a number of design changes during construction. This method will place all of the geotechnical information gathering within the contractors scope.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$1,169,644,000		$1,169,644,000
RECOMMENDED DESIGN	$1,118,060,000		$1,118,060,000
ESTIMATED SAVINGS OR (COST)	$51,584,000	$0	$51,584,000

VALUE ENGINEERING RECOMMENDATION # VE-2

ADVANTAGES:

- Earlier project completion due to compressed schedule
- Reduced claims exposure
- Reduced an administrative burden
- Move accurate and earlier cost visibility
- The use of innovative technologies and techniques by the contractor
- Shared cost savings
- Eliminate interface issues, optimize schedule

DISADVANTAGES:

- Need better and earlier definitions of requirements
- Less control over the process
- Risk management strategies must be included at an earlier stage

JUSTIFICATION:
This recommendation will substantially reduce schedule and the risk of substantial cost overruns. It will also reduce costs and streamline the designs to construction coordination and design changes. For the tunnel, which will use specialist construction techniques, this is very well suited, allocating the contractor to use methods and technology for cost savings.

VALUE ENGINEERING RECOMMENDATION # VE-2

CALCULATIONS

Tunnel Design Cost	$31,000,000
Highway Design Cost	$15,000,000
Bridges Design Cost	$12,000,000
Total	$58,000,000

Assume contractor makes 5% savings on design
$2,900,000

One year early start saves KYTC and consultation savings.
Direct Cost = 25 people @ $100/hr = $5,214,000
One year early start = 4-5% savings for inflation
=$548,000,000
Assume 4% =$21,920,000

Assume 4-5 years for construction = 48 months
Assume contractor will compress schedule by 5% = 2.4 months shorter schedule

Assume total project cost $548,000,000
Or project cost = $548,000,000 / 48 month = $11,420,000 per month

So construction labor, equipment rental, maintenance, etc. costs = $11,420,000 per month

Assumed, a conservative, 60% of this monthly cost could be saved by finishing early
= $11,420,000 (assumed 14.4 month savings) x 0.6
= $6,850,000 @ 50% split (between contractor and KYTC)
= **$3,425,000 per month saved by KYTC**
= $148,000 per day saved by KTYC

Which is in addition to the following labor savings.

KYTC and consultant cost savings associated with finishing 70 calendar days early:
70 days x 50 people x $100 pr hr = **$2,000,000**

Optional daily bonus/penalty could be utilized in the following amount:
$3,425,000 (savings per month) / 70 day (expected early finish) = **48,900 per day**

VALUE ENGINEERING RECOMMENDATION # VE-2

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Reduced Design Cost (approximately 5%)							
Tunnel Design	LS		7	1	$31,000,000	1	$29,450,000
Highway Design	LS		7	1	$15,000,000	1	$14,550,000
Bridges Design	LS		7	1	$12,000,000	1	$11,400,000
Starting Construction 1 year earlier							
KYTC Costs	LS		7	1	$5,214,000		
Escalation (1-Yr @ 4%)	LS		7	1	$548,000,000	1	$526,080,000
Shortened Construction Schedule							
48 month schedule	LS		7	1	$548,000,000		
46 month schedule	LS		7			1	$536,580,000
KYTC Cost	LS		7	1	$10,430,000		
Subtotal					$1,169,644,000		$1,118,060,000
Contingency	@				$0		$0
Total					$1,169,644,000		$1,118,060,000

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

VALUE ENGINEERING RECOMMENDATION # VE-3

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize Design-Build-Operate-Transfer contracting method in lieu of a Design-Bid-Build contracting method.

ORIGINAL DESIGN:
The original design is a Design-Bid-Build contract.

RECOMMENDED CHANGE:
The VE Team recommends letting the project as a Design-Build-Operate-Transfer with a fixed concession period. Partial or full finance could be provided by the BOT consortium, with their stake in the project being recouped through tolls during the concession period. On completion of the concession, the ownership and operation of the project transfers to KYTC, or could be extended on a lease agreement if desired.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN			
RECOMMENDED DESIGN			
ESTIMATED SAVINGS OR (COST)	Up to 100% of Project		

VALUE ENGINEERING RECOMMENDATION # VE-3

ADVANTAGES:

- Earlier project completion due to compressed schedule
- Reduced claims exposure
- Reduced administrative burden up to the end of the concession period
- More accurate and earlier cost visibility
- The use of innovative technology and techniques by the contractor
- Eliminate interface issues and optimize the schedule
- Operations and maintenance and running of the project handled by consortium for concession period
- Initial cost to KYTC significantly cut (say 50%) or even eliminated (full cost concession). Greatly reduced financial exposure. Financial risk moved for KYTC, (Mayor, Governor, etc.) to financial institution. Limited or no taxpayer exposure
- Financing indirect cost (all or part) done by consortium
- Justified additional costs and cost overruns can be given as increased concession period in lieu of cash
- This type of transportation project (tunnels, bridges, and highway) is ideally suited to Design-Build-Operate-Transfer

DISADVANTAGES:

- Need better and earlier contract requirements and definitions
- Concession terms and requirements must be defined early
- Less control over Design-Build process (design changes, etc.)
- Risk Management strategies must be included at an earlier stage
- Earlier fixed conditions have greater cost implications if significant changes are required at a later stage
- Toll collection system and plaza would be required

JUSTIFICATION:
With Design- Build-Operate-Transfer, the project from KYTC's perspective can be significantly simplified. Design changes, interface requirements, and scheduling, are handled by the consortium. In addition, financing and refinancing are usually handled by the consortium with almost no taxpayer exposure. This method reduces claim exposure even more than the Design-Build method. Delays to the completion date directly affects the consortium's revenue stream, thus there is a greater incentive for prompt project completion.

VALUE ENGINEERING RECOMMENDATION # VE-3

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
This recommendation could save up to 100% of project's capital construction cost							
Subtotal					$0		$0
Contingency	@				$0		$0
Total					$0		$0

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

VALUE ENGINEERING RECOMMENDATION # VE-4

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize 16.5 feet of vertical clearance in lieu of 17 feet of vertical clearance on the tunnel.

ORIGINAL DESIGN:
The original design utilizes 17 feet of vertical clearance.

RECOMMENDED CHANGE:
The recommended change is to reduce vertical clearance to 16.5 feet and remain within recommended tolerance. An AASHTO policy on design standards for the interstate system recommends that an additional clearance be provided to accommodate for future resurfacing. Most transportation jurisdictions utilize 6 inches for this clearance rather than 12 inches.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$153,354,000		$153,354,000
RECOMMENDED DESIGN	$152,587,000		$152,587,000
ESTIMATED SAVINGS OR (COST)	$767,000	$0	$767,000

VALUE ENGINEERING RECOMMENDATION # VE-4

ADVANTAGES:

- Reduce tunnel excavated volume and materials

DISADVANTAGES:

- Reduce vertical clearance by 0.5 feet which increases the chance of a high-sided vehicular collision/impact

JUSTIFICATION:
The reduced clearance is still within the AASHTO recommended value.

VALUE ENGINEERING RECOMMENDATION # VE-4

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Excavation	LS	$99,811,216	1	1	$99,811,216		
Lining (Walls & Crown)	LS	$15,893,060	1	1	$15,893,060		
Lean Concrete	LS	$3,435,916	1	1	$3,435,916		
Canopy Tubes	LS	$13,969,244	1	1	$13,969,244		
Lining Finish	LS	$242,000	1	1	$242,000		
17' to 16.5' (0.5% reduction)							
Excavation	LS	$99,312,160	1			1	$99,312,160
Lining (Walls & Crown)	LS	$15,813,595	1			1	$15,813,595
Lean Concrete	LS	$3,418,736	1			1	$3,418,736
Canopy Tubes	LS	$13,899,398	1			1	$13,899,398
Lining Finish	LS	$240,790	1			1	$240,790
							$0
							$0
							$0
							$0
							$0
							$0
							$0
							$0
							$0
							$0
Subtotal					$133,351,436		$132,684,679
Contingency	@	15.00%			$20,002,715		$19,902,702
Total					$153,354,151		$152,587,381

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

VALUE ENGINEERING RECOMMENDATION # VE-5

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a 4'-36'-4' tunnel section in lieu of an 8'-36'-10' tunnel roadway section.

ORIGINAL DESIGN:
The original design calls for 8' inside shoulder and 10' outside shoulders.

RECOMMENDED CHANGE:
The recommended change is to reduce the inside and outside shoulders to 4' widths.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$164,629,000		$164,629,000
RECOMMENDED DESIGN	$150,753,000		$150,753,000
ESTIMATED SAVINGS OR (COST)	$13,876,000	$0	$13,876,000

VALUE ENGINEERING RECOMMENDATION # VE-5

ADVANTAGES:

- Reduce tunnel excavated volume and materials
- Reduce total out-to-out width of the freeway thereby reducing right-of-way needs and rock cut volume

DISADVANTAGES:

- Reduce the width of shoulders to make them unusable in a breakdown.
- Reduce the safety of the roadway

JUSTIFICATION:

The AASHTO "A Policy for Design Standards Interstate System" dated January 2005 states that "…because of the high cost associated with tunnels, a reduced width can be accepted...The minimum roadway width between curbs should be at least 2 feet greater than the approach traveled way…".

The geometric width suggested is taken by comparing this tunnel to a bridge longer than 200 feet where the same document states "…On long bridges, offsets to parapet, rail, or barrier shall be at least 4 feet…from the edge of the nearest traffic lane on both the left and the right."

The VE Team suggest implementing this recommendation because it meets the appropriate AASHTO standards and a substaintial cost savings will be realized. Pull off areas could be utilizied in lieu of the wider shoulders to accommodate breaksdown within the tunnel.

VALUE ENGINEERING RECOMMENDATION # VE-5

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Excavation	LS	$99,811,216	1	1	$99,811,216		
Lining (Walls & Crown)	LS	$15,893,060	1	1	$15,893,060		
Lining (Invert)	LS	$9,804,394	1	1	$9,804,394		
Lean Concrete	LS	$3,435,916	1	1	$3,435,916		
Canopy Tubes	LS	$13,969,244	1	1	$13,969,244		
Lining Finish	LS	$242,000	1	1	$242,000		
8% reduction with decrease of tunnel size to 4'-36'-4'							
Excavation	LS	$91,367,187	1			1	$91,367,187
Lining (Walls & Crown)	LS	$14,548,507	1			1	$14,548,507
Lining (Invert)	LS	$9,020,042	1			1	$9,020,042
Lean Concrete	LS	$3,145,237	1			1	$3,145,237
Canopy Tubes	LS	$12,787,446	1			1	$12,787,446
Lining Finish	LS	$221,527	1			1	$221,527
Subtotal					$143,155,830		$131,089,947
Contingency	@	15.00%			$21,473,375		$19,663,492
Total					$164,629,205		$150,753,439

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

VALUE ENGINEERING RECOMMENDATION # VE-6

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a 5'-36'-10' tunnel section in lieu of an 8'-36'-10' tunnel roadway section.

ORIGINAL DESIGN:
The original design calls for 8' inside shoulder and 10' outside shoulders within the tunnel roadway section.

RECOMMENDED CHANGE:
Utilize a 5'-36'-10' tunnel section in lieu of an 8'-36'-10' tunnel roadway section. The recommended change reduces the inside shoulders to 5' within the tunnel.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$164,629,000		$164,629,000
RECOMMENDED DESIGN	$160,585,000		$160,585,000
ESTIMATED SAVINGS OR (COST)	$4,044,000	$0	$4,044,000

VALUE ENGINEERING RECOMMENDATION # VE-6

ADVANTAGES:

- Reduce tunnel excavated volume and materials
- Reduce total out-to-out width of the freeway thereby reducing right-of-way needs and rock cut volume

DISADVANTAGES:

- Reduce the width of inside shoulders to make them unusable in a breakdown

JUSTIFICATION:

The AASHTO "A Policy for Design Standards Interstate System" dated January 2005 states that "The desirable cross section for tunnels…consists of…a 10 foot right shoulder, a 5 foot left shoulder…."

VALUE ENGINEERING RECOMMENDATION # VE-6

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Excavation	LS	$99,811,216	1	1	$99,811,216		
Lining (Walls & Crown)	LS	$15,893,060	1	1	$15,893,060		
Lining (Invert)	LS	$9,804,394	1	1	$9,804,394		
Lean Concrete	LS	$3,435,916	1	1	$3,435,916		
Canopy Tubes	LS	$13,969,244	1	1	$13,969,244		
Lining Finish	LS	$242,000	1	1	$242,000		
2% reduction with decrease of tunnel size to 5'-36'-10'							
Excavation	LS	$97,325,917	1			1	$97,325,917
Lining (Walls & Crown)	LS	$15,497,323	1			1	$15,497,323
Lining (Invert)	LS	$9,608,306	1			1	$9,608,306
Lean Concrete	LS	$3,350,361	1			1	$3,350,361
Canopy Tubes	LS	$13,621,410	1			1	$13,621,410
Lining Finish	LS	$235,974	1			1	$235,974
Subtotal					$143,155,830		$139,639,292
Contingency	@	15.00%			$21,473,375		$20,945,894
Total					$164,629,205		$160,585,185

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

VALUE ENGINEERING RECOMMENDATION # VE-7

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize one open cut and cover (reduced depth) tunnel in lieu of two deeper bored tunnels.

ORIGINAL DESIGN:
Construct 1,940 lineal foot NB and SB tunnels under the Soterion Corporation property. This property includes historically significant landscaping that the Kentucky Cabinet agreed to not disturb. These tunnels are currently proposed to utilize the "sprayed concrete lining method" for construction.

The current south portal is at station 106+10 with an invert of the tunnel at approximately elevation 503, which is an approximate average of 80' below existing ground line. The current north portal is at station 127+00 with an invert of the tunnel at elevation 460.47, which is an approximate average of 62' below existing ground line. The current tunnel length is 2,090 LF.

The highway section will reach the portals using the open-cut rock excavation. These cuts amount to an approximate volume of 1.6 million CY south of the tunnel and 250,000 CY north of the tunnel.

A separate early let contract is proposed to install an exploratory tunnel that will provide geotechnical information that will be used to complete final design of these two tunnels. This method for obtaining information is being used to avoid impacting the Soterion Corporation property.

The tunneling is required so as to not impact the Soterion Corporation property, although risks associated with underground construction do not guarantee this outcome.

VALUE ENGINEERING RECOMMENDATION # VE-7

RECOMMENDED CHANGE:
Construct a "cut and cover" tunnel from approximate station 108+00 to 125+00. This tunnel length is 1,700 LF. The proposed vertical alignment of this tunnel will substantially raise the grade.

The proposed invert at the north end ranges from elevation 550 to 560. The tunnel should travel underneath US-42, which may require grade increases to get over the final tunnel. The proposed tunnel grade will be 4% downhill to the north. Vertical curves are required at the south and north ends starting in the tunnel to flatten the grades entering and exiting the tunnel.

The proposed invert at the south end ranges from elevation 490 to 500. The portal of the tunnel will need to be far enough from the Soterion Corporation property to resolve the stream relocation and eliminate any long term impacts to that property.

This change will require permanent impacts to the Soterion Corporation property in that the existing landscaping will be removed. However, the direct property impacts will be temporary and last through construction. This change includes an unknown but substantial amount of money to restore the property after construction to a better condition. The property owners can determine the extent of what could be major improvements to the property that will respect the historical significance.

This method has been used previously at the I-64 Cochrane Tunnels beneath Cherokee Park in Louisville, KY. The park features and landscaping does not provide any indication that the cut and cover methods were used at that location.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$315,475,000		$315,475,000
RECOMMENDED DESIGN	$184,024,000		$184,024,000
ESTIMATED SAVINGS OR (COST)	$131,451,000	$0	$131,451,000

VALUE ENGINEERING RECOMMENDATION # VE-7

ADVANTAGES:

- Eliminate need for early exploratory tunnel contract
- Reduce effort required to construct tunnel
- Reduce the number of geotechnical unknowns that may arise during construction
- Substantially decrease rock excavation in the approaches to the tunnel
- Eliminate flying Ramp A over the highway
- Reduce the width of construction because of the elimination of wide center pillar and therefore median separation between NB and SB and because of reduced depth at the approaches to the tunnel
- Substantially reduces right-of-way requirements
- Reduce the need for retaining walls on each side of the highway in the deep rock cuts
- Substantially reduces the construction time for both tunnel approaches and tunnel itself
- Reduces the risks associated with tunneling as it pertains to ground subsidence and groundwater impacts
- Utilizing standard construction methods
- Moving to a less risky technique, thereby reducing potential for delay and cost increases

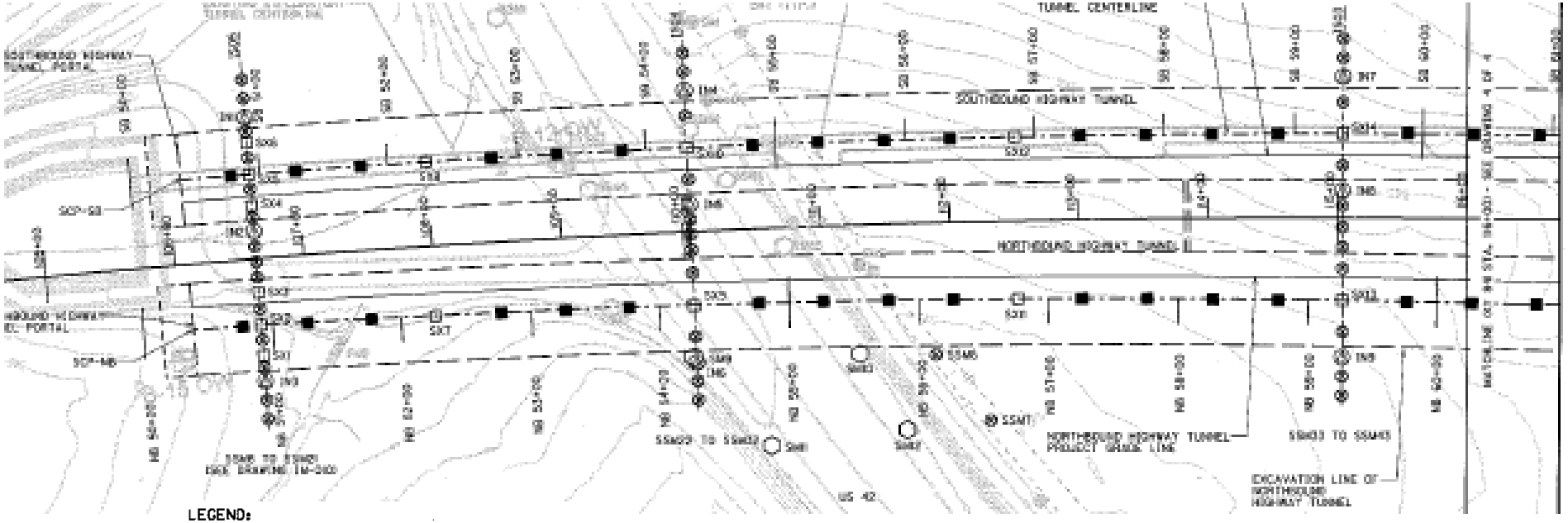
DISADVANTAGES:

- Removes historically significant landscaping
- Temporarily has significant impacts upon the Soterion Corporation property in the area of the construction easement
- Potential right-of-way condemnation at the Soterion Corporation property
- Possible violation of the Record of Decision

JUSTIFICATION:
This recommendation will substantially reduce the cost, complexity, and construction time for this project. This will also substantially change the approaches on the south and north sides of the project.

VALUE ENGINEERING RECOMMENDATION # VE-7

SKETCH OF ORIGINAL DESIGN



LEGEND:

- ⊗ SURFACE SETTLEMENT MARKER (SSM)
- ⋈ FLOW METER (FM)
- ISO1 INSTRUMENTATION FROM SURFACE LINE 01
- □ EXTENSOMETER INSTALLED FROM SURFACE
- ⏀ INCLINOMETER INSTALLED FROM SURFACE
- ■ EXTENSOMETER INSTALLED IN TUNNEL
- ⬡ SURFACE MONITORING POINT (SM)

This sketch identifies multiple components that will have to be installed on the surface above the tunnel

VALUE ENGINEERING RECOMMENDATION # VE-7

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Exploratory tunnel	LS	14,000,000	1	1	$14,000,000		
Bored tunnel	LS	185,366,574	1	1	$185,366,574		
Cut and cover tunnel	LS	78,500,000	7			1	$78,500,000
Rock exc S approach (70% decrease)	CY	30	6	1,600,000	$48,000,000	480,000	$14,400,000
Rock exc N approach (70% decrease)	CY	30	6	250,000	$7,500,000	75,000	$2,250,000
Breakdown of cut and cover tunnel							
Concrete and reinf.	CY	520	7			54,000	$28,080,000
Rock exc at tunnel	CY	30	7			275,000	$8,250,000
Misc (mob, portals, fill)	LS	12,000,000	7			1	$12,000,000
Bored tunnel MEP							
Ventilation	LS	2,123,716	7	1	$2,123,716	0.85	$1,805,159
Electrical	LS	12,864,755	1	1	$12,864,755	0.85	$10,935,042
Communication	LS	1,637,937	1	1	$1,637,937	0.85	$1,392,246
HVAC	LS	113,626	1	1	$113,626	0.85	$96,582
Central Control	LS	1,430,414	1	1	$1,430,414	0.85	$1,215,852
Site Utilities	LS	1,289,427	1	1	$1,289,427	0.85	$1,096,013
Subtotal					$274,326,449		$160,020,894
Contingency	@	15.00%			$41,148,967		$24,003,134
Total					$315,475,416		$184,024,028

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

VALUE ENGINEERING RECOMMENDATION # VE-8

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize rock cut (decreased depth) in lieu of two deeper bored tunnels.

ORIGINAL DESIGN:
Construct 1,940 lineal foot NB and SB tunnels under the Soterion Corporation property. This property includes historically significant landscaping that the Kentucky Cabinet agreed to not disturb. These tunnels are currently proposed to utilize the "sprayed concrete lining method" for construction. The current south portal is at station 106+10 with an invert of the tunnel at approximately elevation 503, which is an approximate average of 80' below existing ground line. The current north portal is at station 127+00 with an invert of the tunnel at elevation 460.47, which is an approximate average of 62' below existing ground line. The current tunnel length is 2,090 LF. The highway section will reach the portals using the open-cut rock excavation. These cuts amount to an approximate volume of 1.6 million CY south of the tunnel and 250,000 CY north of the tunnel. A separate early let contract is proposed to install an exploratory tunnel that will provide geotechnical information that will be used to complete final design of these two tunnels. This method for obtaining information is being used to avoid impacting the Soterion Corporation property. The tunneling is required so as to not impact the Soterion Corporation property, although risks associated with underground construction do not guarantee this outcome.

RECOMMENDED CHANGE:
Construct a rock cut through the Soterion Corporation property. The proposed bottom of cut at the north end ranges from elevation 550 to 560. The freeway will travel underneath US-42, which will require grade increases to get over the freeway. The proposed grade will be 4% downhill to the north. The proposed bottom of cut at the south end ranges from elevation 490 to 500. This change will require permanent impacts to the Soterion Corporation property in that the existing landscaping will be removed and that portion of the property becomes freeway. The mitigation for this work is that the Soterion Corporation property owners can determine the extent of what could be major improvements to the remainder of their property that will respect the historical significance. A portion of the money saved from building the tunnels could be used to provide major community benefits.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$315,475,000		$315,475,000
RECOMMENDED DESIGN	$40,135,000		$40,135,000
ESTIMATED SAVINGS OR (COST)	$275,340,000	$0	$275,340,000

VALUE ENGINEERING RECOMMENDATION # VE-8

ADVANTAGES:

- Eliminate need for early exploratory tunnel contract
- Reduce effort required to construct tunnel
- Reduce the number of geotechnical unknowns that may arise during construction
- Substantially decrease rock excavation in the approaches to the tunnel
- Eliminate flying Ramp A over the highway
- Reduce the width of construction because of the elimination of wide center pillar and therefore median separation between NB and SB and because of reduced depth at the approaches
- Substantially reduces right-of-way requirements
- Reduce the need for retaining walls on each side of the highway in the deep rock cuts
- Substantially reduces the construction time for tunnel approaches
- Reduces the risks associated with tunneling as it pertains to ground subsidence and groundwater impacts
- Utilizing standard construction methods
- Moving to a less risky technique, thereby reducing potential for delay and cost increases

DISADVANTAGES:

- Removes historically significant landscaping
- Permanently has significant impacts upon the Soterion Corporation property in the area of the freeway right-of-way
- Right-of-way condemnation at the Soterion Corporation property
- Possible violation of the Record of Decision
- Raising the grade of the tunnel will raise the grade of the Harrod's Creek Bridge

JUSTIFICATION:
This recommendation will substantially reduce the cost, complexity, and construction time for this project. This will also substantially change the approaches on the south and north sides of the project.

VALUE ENGINEERING RECOMMENDATION # VE-8

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Exploratory tunnel	LS	14,000,000	1	1	$14,000,000		
Bored tunnel	LS	185,366,574	1	1	$185,366,574		
Rock exc S approach (70% less)	CY	30	6	1,600,000	$48,000,000	480,000	$14,400,000
Rock exc N approach (70% less)	CY	30	6	250,000	$7,500,000	75,000	$2,250,000
Breakdown of open-cut							
Rock exc at tunnel	CY	30	7			275,000	$8,250,000
Miscellaneous rock cut costs	LS	10,000,000	7			1	$10,000,000
Bored tunnel MEP							
Ventilation	LS	2,123,716	7	1	$2,123,716		
Electrical	LS	12,864,755	1	1	$12,864,755		
Communication	LS	1,637,937	1	1	$1,637,937		
HVAC	LS	113,626	1	1	$113,626		
Central Control	LS	1,430,414	1	1	$1,430,414		
Site Utilities	LS	1,289,427	1	1	$1,289,427		
Subtotal					$274,326,449		$34,900,000
Contingency	@	15.00%			$41,148,967		$5,235,000
Total					$315,475,416		$40,135,000

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

VALUE ENGINEERING RECOMMENDATION # VE-9

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Modify vertical alignments south of the tunnel to increase the grade from 2.5% to 4% in order to reduce excavation.

ORIGINAL DESIGN:
The profile grade is 2.5% from approximately station 60 + 00 to station 106 + 00 at the tunnel.

RECOMMENDED CHANGE:
Modify vertical alignments south of the tunnel to increase the grade to 4% from 2.5% in order to reduce excavation. The 4% grade is acceptable for either a 60 mph or 70 mph design speed in this rolling terrain. The 4% grade will be controlled by the need to provide sufficient vertical clearance under the Wolf Penn Branch Road. The vertical curve at the south end of the tunnel will be located to assure that it does not affect the elevations in the tunnel.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$69,132,000		$69,132,000
RECOMMENDED DESIGN	$57,163,000		$57,163,000
ESTIMATED SAVINGS OR (COST)	$11,969,000	$0	$11,969,000

VALUE ENGINEERING RECOMMENDATION # VE-9

ADVANTAGES:

- Reduced earthwork
- Reduced retaining wall height for the length of the grade change
- Reduced wasted material
- Meets full AASHTO criteria

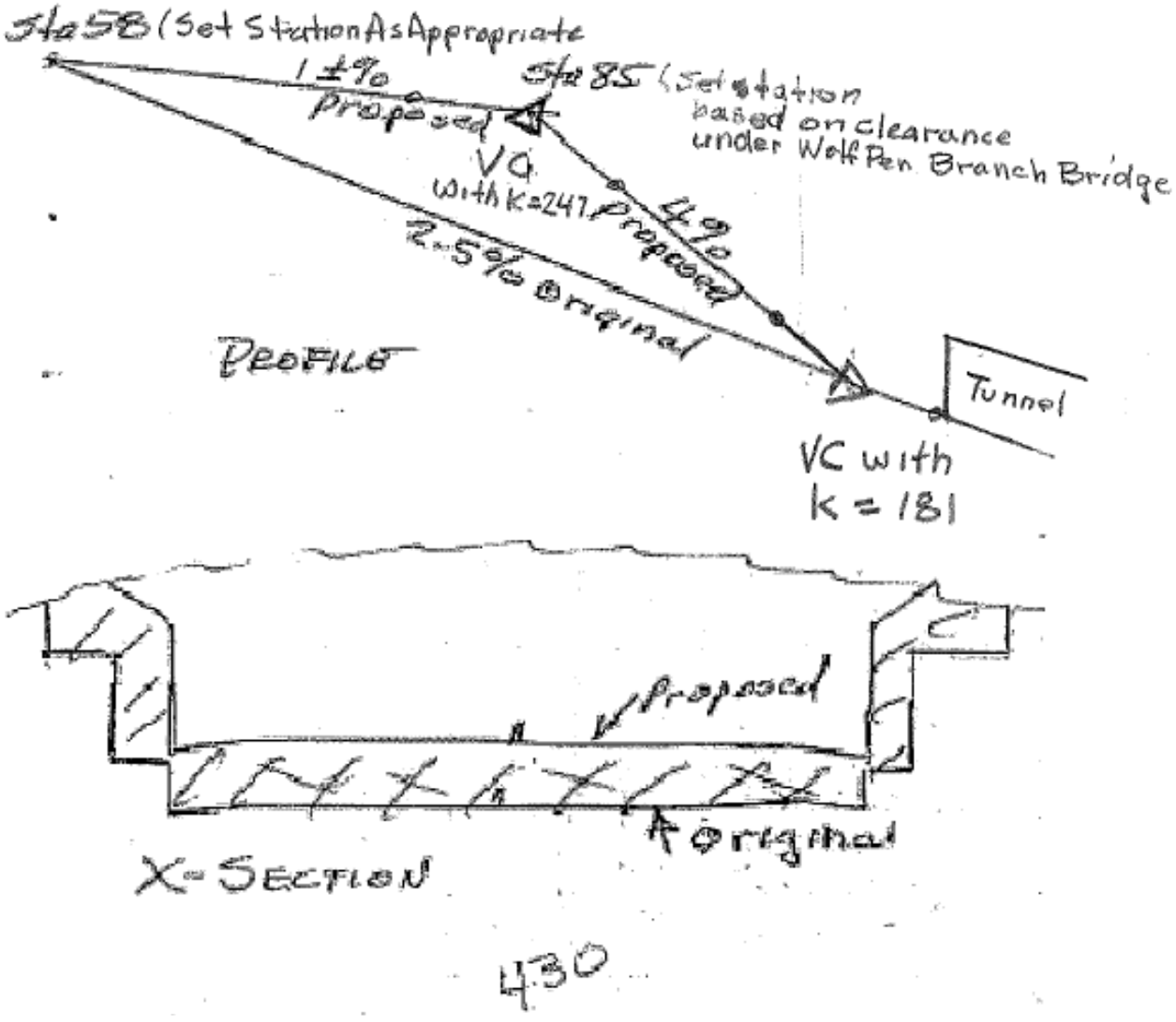
DISADVANTAGES:

- Provides steeper grade than original

JUSTIFICATION:
This recommendation provides an acceptable vertical alignment while reducing the excavation required on a project. The original design specifies wasting almost 2 million CY of excess excavation. This will also reduce the quantity and height of the retaining walls in this section.

VALUE ENGINEERING RECOMMENDATION # VE-9

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-9

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Earthwork	CY	18.00	1	2,504,000	$45,072,000	2,053,000	$36,954,000
Walls	SF	50.00	1	300,853	$15,042,650	255,053	$12,752,650
Subtotal					$60,114,650		$49,706,650
Contingency	@	15.00%			$9,017,198		$7,455,998
Total					$69,131,848		$57,162,648

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

VALUE ENGINEERING RECOMMENDATION # VE-9A

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Modify vertical alignments south of the tunnel to increase the grade from 2.5% to 4% and reduce clear zone from 33 ft to 12 ft to reduce excavation.

ORIGINAL DESIGN:
The profile grade is 2.5% from approximately station 60 + 00 to station 106 + 00 at the tunnel. The typical section and design details in the section from station 11 + 00 to station 106 + 00 has a design using a 12 ft graded shoulder and 18 ft fore-slope to a 3 ft flat bottom ditch, thus providing a 33 ft recovery area.

RECOMMENDED CHANGE:
Modify vertical alignments south of the tunnel to increase the grade to 4% from 2.5% in order to reduce excavation. The 4% grade is acceptable for either a 60 mph or 70 mph design speed in this rolling terrain. The 4% grade will be controlled by the need to provide sufficient vertical clearance under the Wolf Penn Branch Road. The vertical curve at the south end of the tunnel will be located to assure that it does not affect the elevations in the tunnel.

The VE Team recommends revising the typical section in the clear-zone by constructing a safety barrier wall at 12 ft from the edge of the traveled way. This includes providing a paved gutter behind the safety barriers. At this point the back slopes or the retaining walls are placed. After further inspection by the VE team, the concrete gutter at the New Jersey barrier is not necessary because this drainage will be handled by the roadway itself. The concrete gutters should be utilized at the bottom of the high walls.

Note: this recommendation is a combination of recommendations VE-9 and VE-10 with a revised cost estimate of implementing both simultaneously.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$120,965,000		$120,965,000
RECOMMENDED DESIGN	$107,322,000		$107,322,000
ESTIMATED SAVINGS OR (COST)	$13,643,000	$0	$13,643,000

VALUE ENGINEERING RECOMMENDATION # VE-9A

ADVANTAGES:

- Reduced earthwork and excavation
- Reduced retaining wall height for the length of the grade change
- Reduced wasted material
- Meets full AASHTO criteria
- The distance from the edge of the traveled way will be the same as on the tunnel and bridges as currently proposed
- Will reduce the additional right of way required for the project
- Will eliminate a large quantity of the retaining wall

DISADVANTAGES:

- Provides steeper grade than original
- Will not provide a typical section that is asymmetrical
- May not comply with all memorandum of agreements when it comes to aesthetic treatments
- Requires a buried drainage system

JUSTIFICATION:

This recommendation provides an acceptable vertical alignment while reducing the excavation required on a project. The original design specifies wasting almost 2 million CY of excess excavation. This will also reduce the quantity and height of the retaining walls in this section. The project has approximately 2 million cubic yards of waste. Approximately 566,000 cubic yards of this material would not have to be excavated with this revised section (451,000 CY from recommendation VE-9 and 115,000 CY from VE-10). It can also be assumed that there will be a significant reduction in the retaining walls.

VALUE ENGINEERING RECOMMENDATION # VE-9A

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Earthwork (VE-9)	CY	18.00	1	2,504,000	$45,072,000	2,053,000	$36,954,000
Earthwork (VE-10)	CY	18.00	1	2,504,000	$45,072,000	2,389,000	$43,002,000
Walls	SF	50.00	1	300,853	$15,042,650	255,053	$12,752,650
Drainage	SF	75.00	1			8,200	$615,000
Subtotal					$105,186,650		$93,323,650
Contingency	@	15.00%			$15,777,998		$13,998,548
Total					$120,964,648		$107,322,198

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

VALUE ENGINEERING RECOMMENDATION # VE-10

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a barrier wall and a 20 ft offset in lieu of a 33 ft offset in the cut section south of the tunnel.

ORIGINAL DESIGN:
The typical section and design details in the section from station 11 + 00 to station 106 + 00 has a design using a 12 ft graded shoulder and 18 ft fore-slope to a 3 ft flat bottom ditch, thus providing a 33 ft recovery area.

RECOMMENDED CHANGE:
The VE Team recommends revising the typical section in the clear-zone by constructing a safety barrier wall at 12 ft from the edge of the traveled way. This includes providing a paved gutter behind the safety barriers. At this point the back slopes or the retaining walls are placed.

After further inspection by the VE team, the concrete gutter at the New Jersey barrier is not necessary because this drainage will be handled by the roadway itself. The concrete gutters should be utilized at the bottom of the high walls.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$51,833,000		$51,833,000
RECOMMENDED DESIGN	$45,709,000		$45,709,000
ESTIMATED SAVINGS OR (COST)	$6,124,000	$0	$6,124,000

VALUE ENGINEERING RECOMMENDATION # VE-10

ADVANTAGES:

- The earthwork requested to construct the project will be reduced
- The distance from the edge of the traveled way will be the same as on the tunnel and bridges as currently proposed
- Will reduce the additional right of way required for the project
- Will eliminate a large quantity of the retaining wall

DISADVANTAGES:

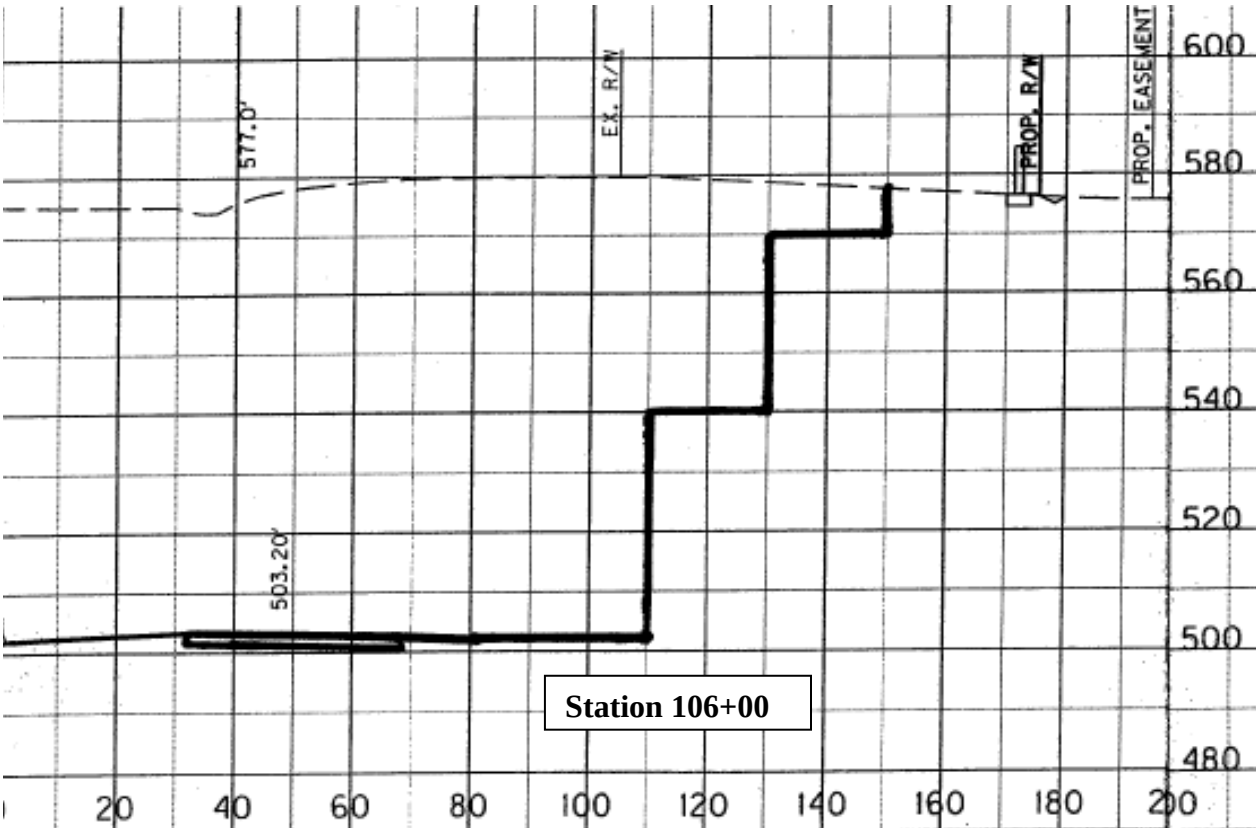
- Will not provide a typical section that is asymmetrical
- May not comply with all memorandum of agreements when it comes to aesthetic treatments
- Requires a buried drainage system

JUSTIFICATION:

The project has approximately 2 million cubic yards of waste. Approximately 330,000 cubic yards of this material would not have to be excavated with this revised section. It can also be assumed that there will be a significant reduction in the retaining walls.

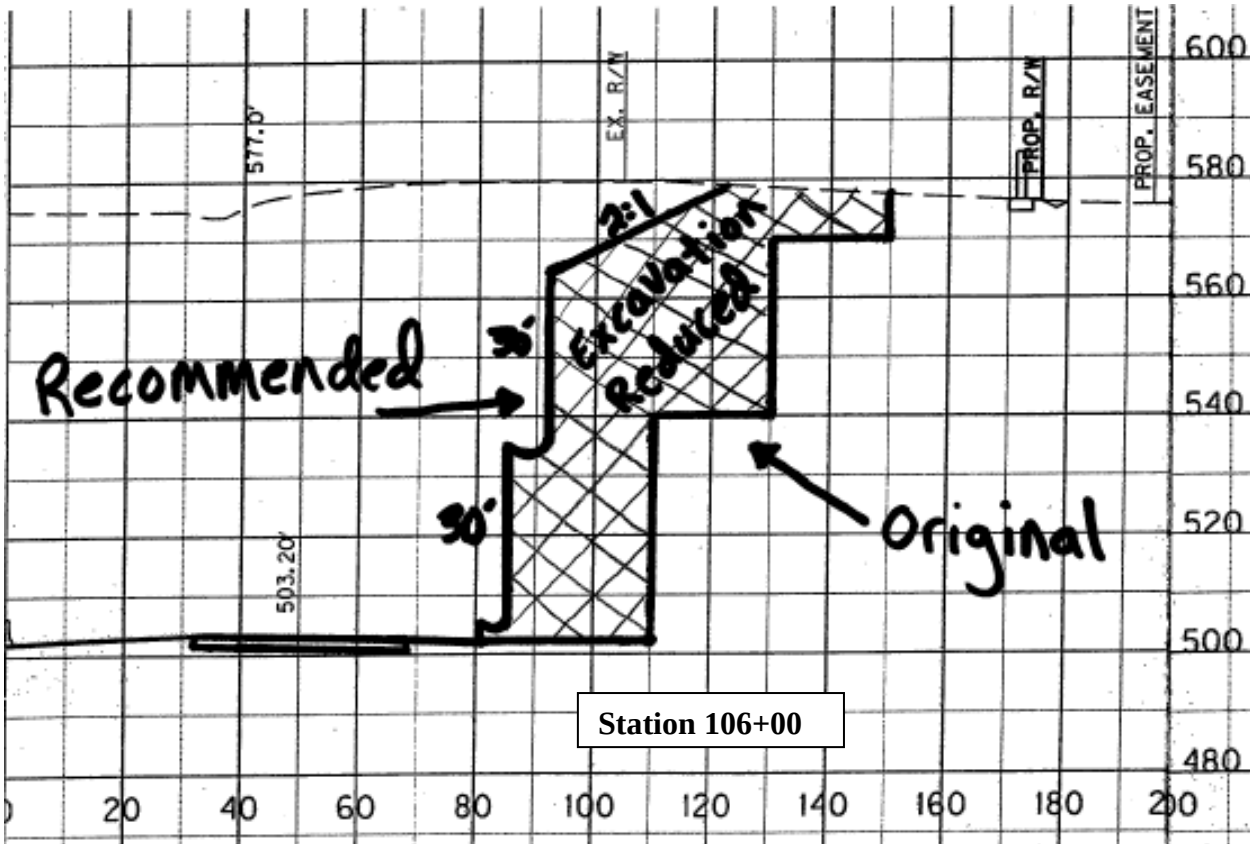
VALUE ENGINEERING RECOMMENDATION # VE-10

SKETCH OF ORIGINAL DESIGN



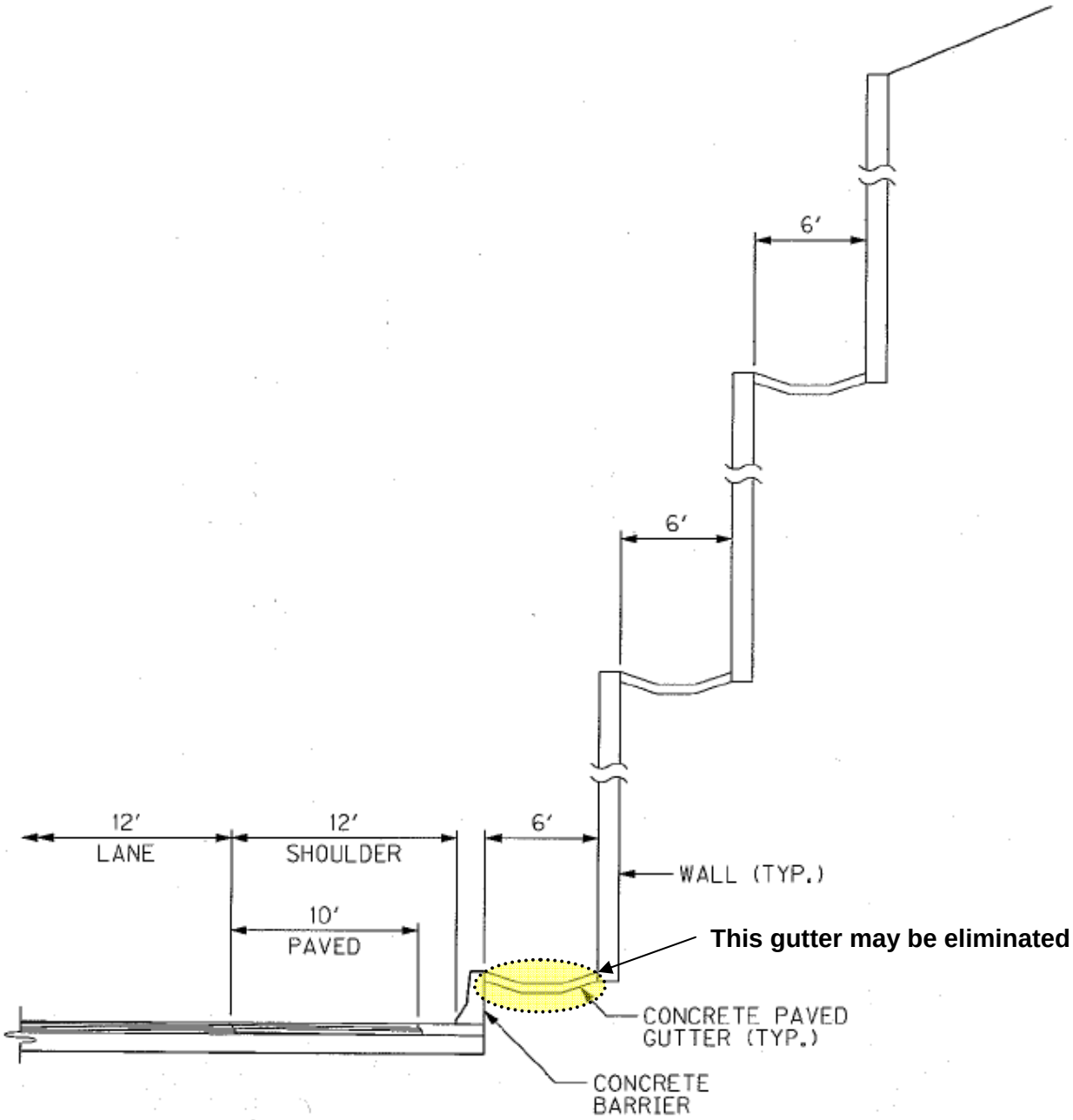
VALUE ENGINEERING RECOMMENDATION # VE-10

SKETCH OF RECOMMENDED DESIGN



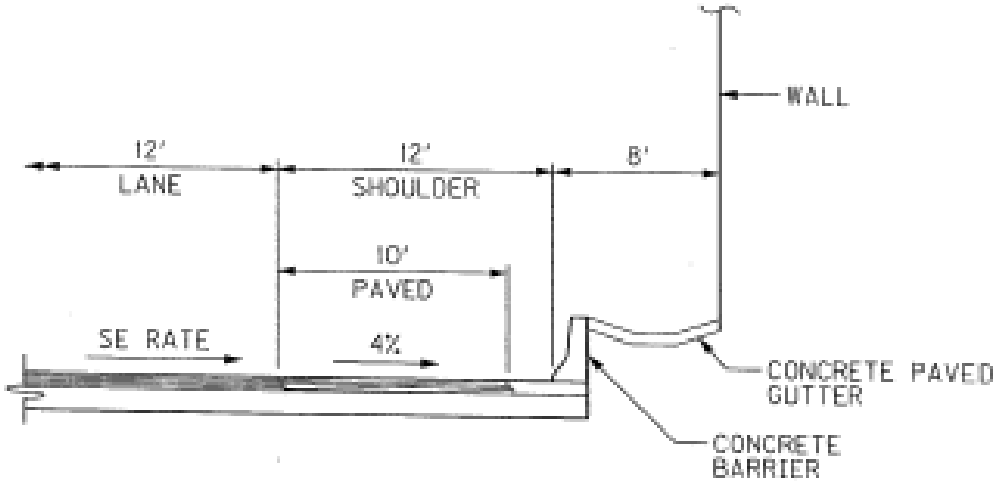
VALUE ENGINEERING RECOMMENDATION # VE-10

SKETCH OF RECOMMENDED DESIGN

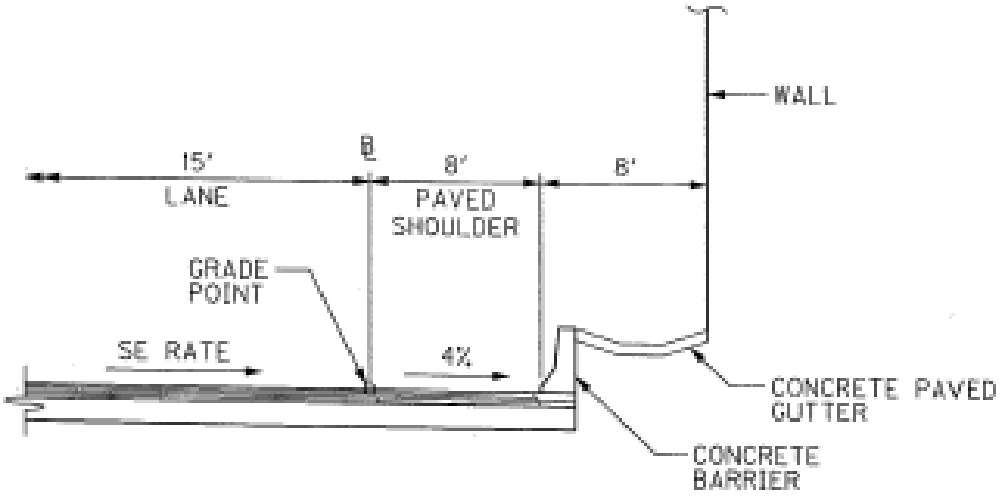


VALUE ENGINEERING RECOMMENDATION # VE-10

SKETCH OF RECOMMENDED DESIGN



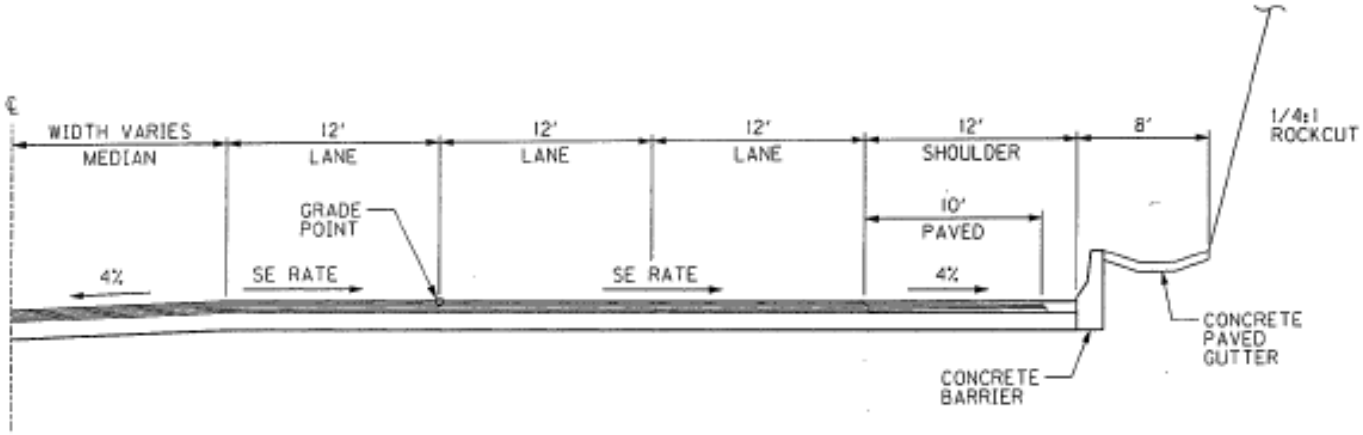
KY 841 ROCK CUT
SUPERELEVATED HALF RIGHT SECTION



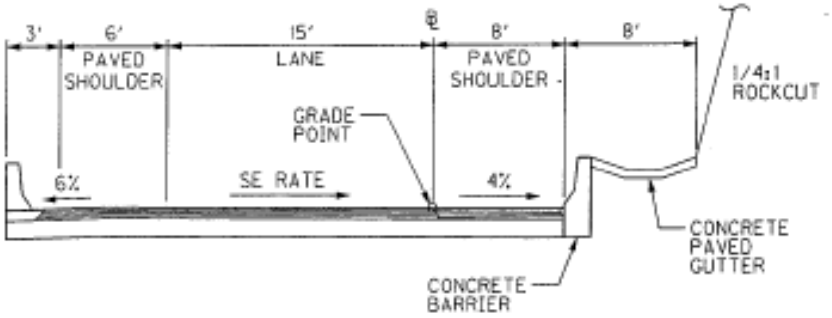
RAMP A – SUPERELEVATED RIGHT

VALUE ENGINEERING RECOMMENDATION # VE-10

SKETCH OF RECOMMENDED DESIGN



KY 841 ROCK CUT – SUPERELEVATED HALF RIGHT SECTION



RAMP A – SUPERELEVATED RIGHT

VALUE ENGINEERING RECOMMENDATION # VE-10

PHOTOGRAPH OF RECOMMENDED DESIGN

VALUE ENGINEERING RECOMMENDATION # VE-10

PHOTOGRAPH OF RECOMMENDED DESIGN

VALUE ENGINEERING RECOMMENDATION # VE-10

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Drainage	SF	75.00	1			8,200	$615,000
Roadway Excavation	CY	18.00	1	2,504,000	$45,072,000	2,174,000	$39,132,000
Subtotal					$45,072,000		$39,747,000
Contingency	@	15.00%			$6,760,800		$5,962,050
Total					$51,832,800		$45,709,050

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

VALUE ENGINEERING RECOMMENDATION # VE-11

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce the length of the Ramp A structure by approximately 400 ft by reducing the excavation within the rock cut before the elevated bridge abutment.

ORIGINAL DESIGN:
The Ramp "A" Bridge is shown to start with an abutment as station 92 + 70 (+/-). The structure continues over an excavated bench that is adjacent to the northbound lanes and outside of the 33 ft clear zone. The bridge does not encroach on the designed clear zone for the northbound KY-841 traffic and the clear zone envelope.

RECOMMENDED CHANGE:
The VE Team recommends reducing the length of the bridge by moving the abutment forward from station 92 + 70 (KY-841) - station 33 + 54 (Ramp A) to station 97 + 00 (KY-841) – station 37 + 70 (a reduction of approximately 400 ft). Do not excavate below the sub-grade until the abutment is reached. Use a closed ditch scheme and a rock bolt anchored retaining wall.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$9,262,000		$9,262,000
RECOMMENDED DESIGN	$6,160,000		$6,160,000
ESTIMATED SAVINGS OR (COST)	$3,102,000	$0	$3,102,000

VALUE ENGINEERING RECOMMENDATION # VE-11

ADVANTAGES:

- Reduce the length of the bridge
- Reduce the maintenance by reducing the length of bridge

DISADVANTAGES:

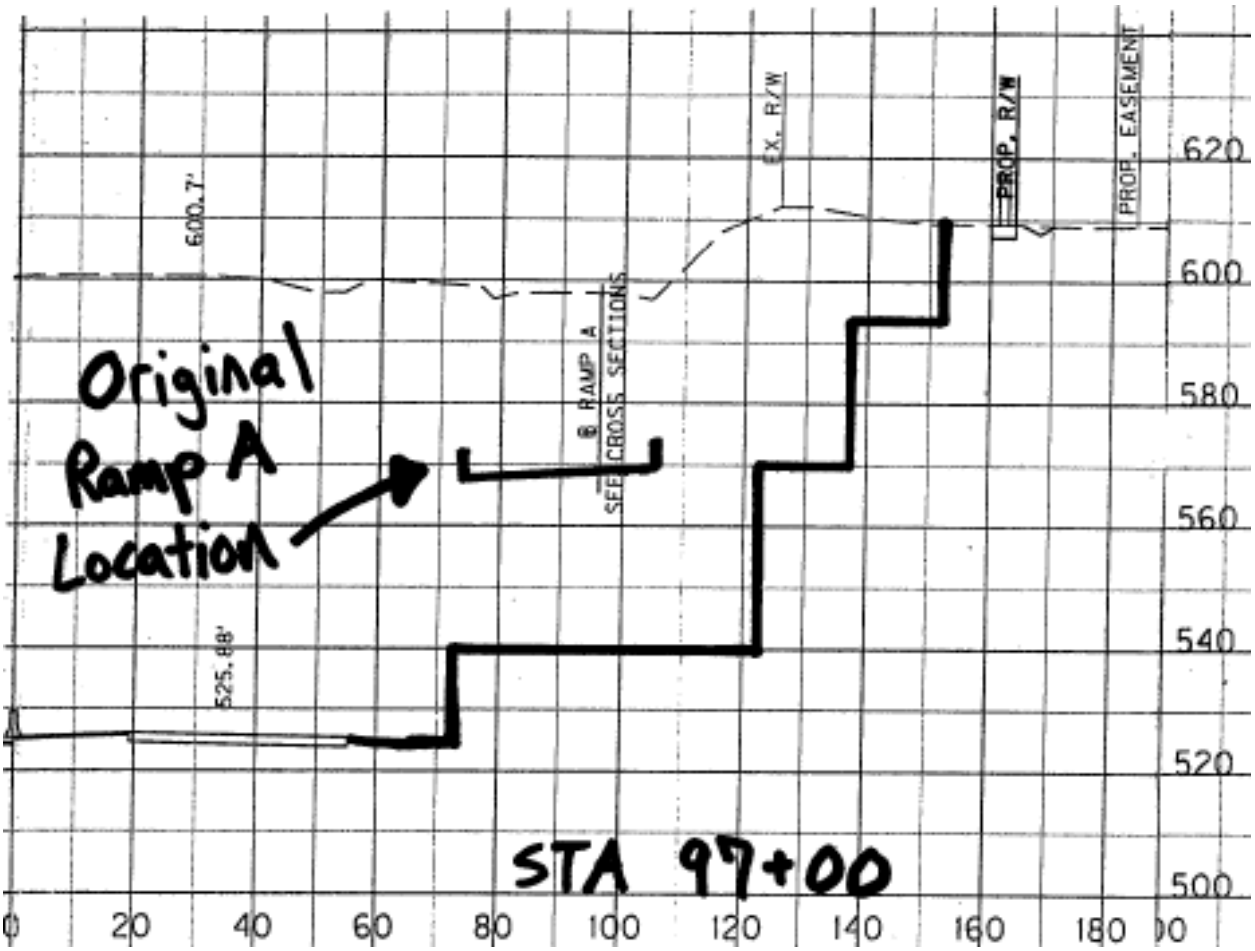
- Requires additional retaining wall

JUSTIFICATION:

This recommendation will reduce the bridge length which will reduce the bridge maintenance activities. This also reduces the maintenance inspection requirements. The excavation along the northbound lanes is tapered and the shorter bridge will be compatible with the retaining wall design already being used on the project. The original design excavates this section and specifies a bridge be built above the excavation before the structure crosses over the mainline highway. This excavation can be eliminated and the flyover ramp will function identically.

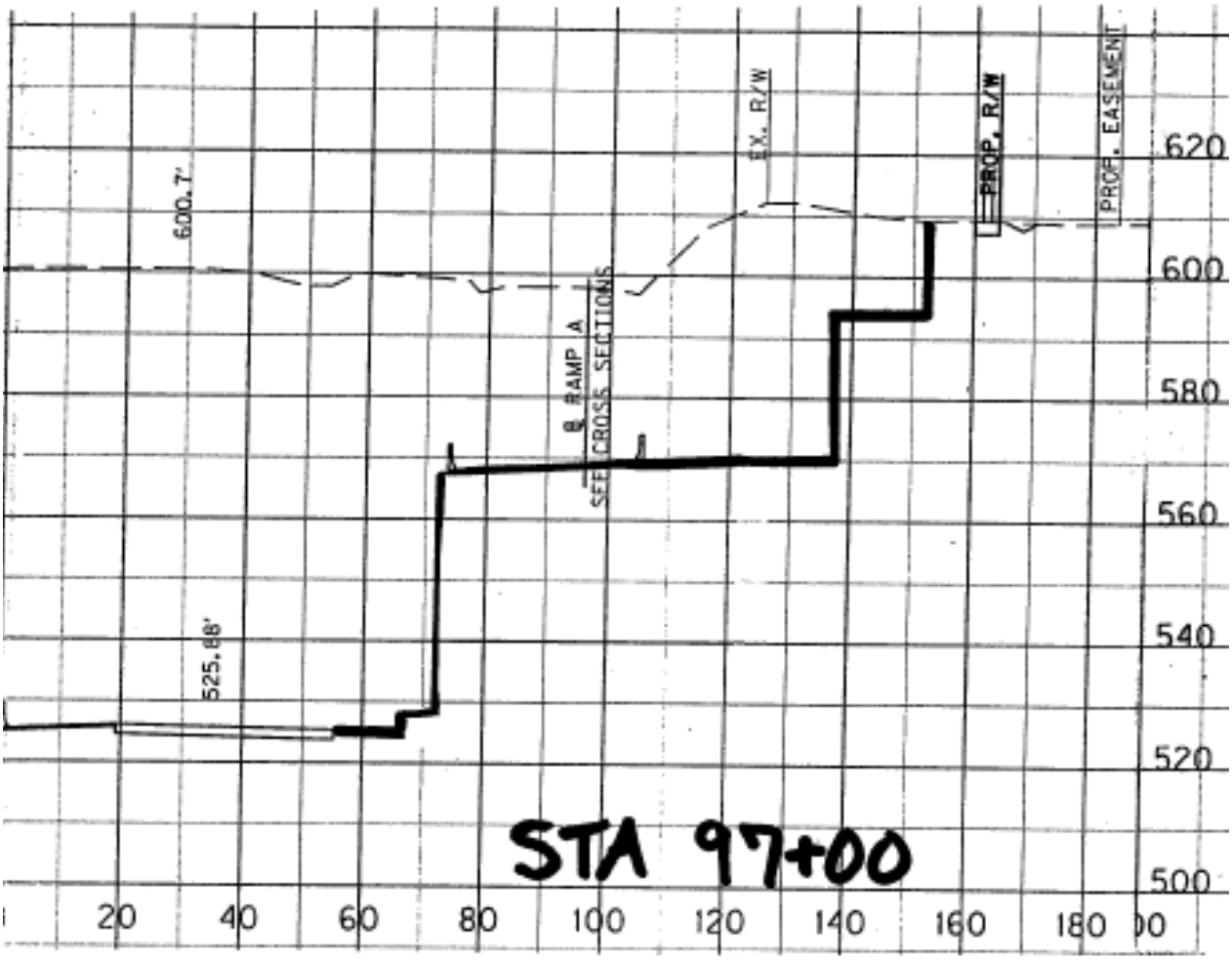
VALUE ENGINEERING RECOMMENDATION # VE-11

SKETCH OF ORIGINAL DESIGN



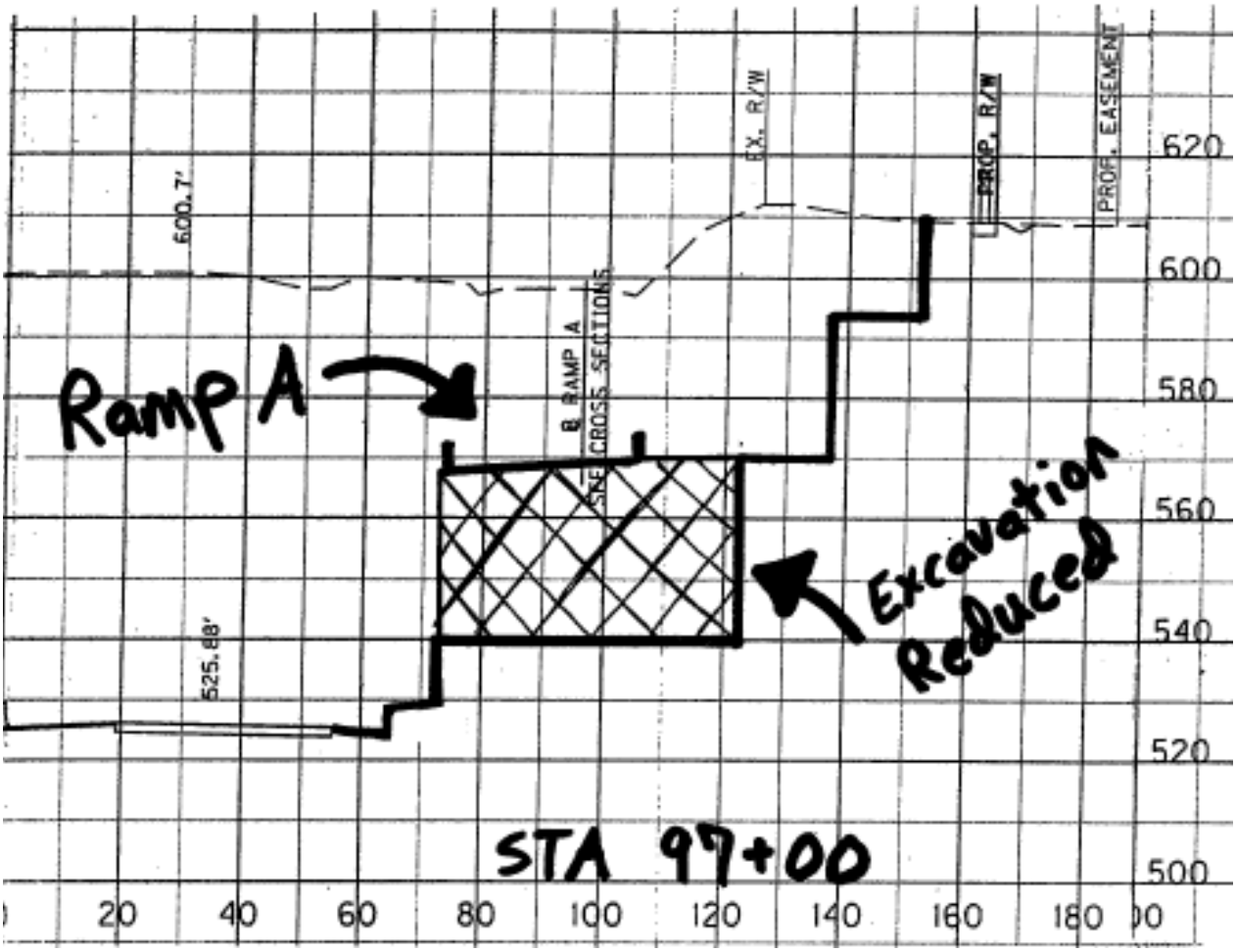
VALUE ENGINEERING RECOMMENDATION # VE-11

SKETCH OF RECOMMENDED DESIGN



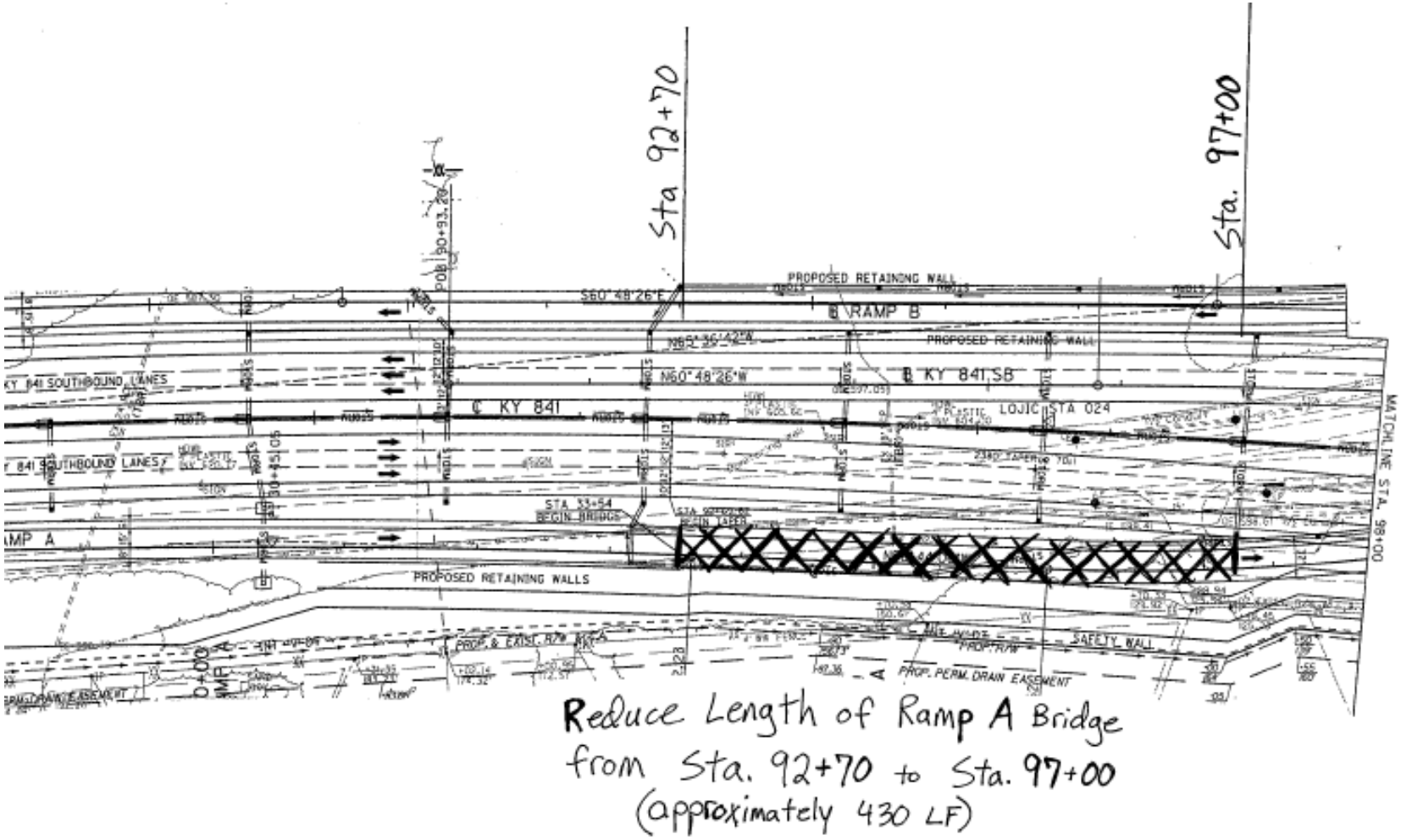
VALUE ENGINEERING RECOMMENDATION # VE-11

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-11

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-11

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Bridge Ramp station 92+70 to 97+00	SF	242.00	1	33,280	$8,053,760	20,480	$4,956,160
Additional Wall	LF	1,000.00	l			400	$400,000
Subtotal					$8,053,760		$5,356,160
Contingency	@	15.00%			$1,208,064		$803,424
Total					$9,261,824		$6,159,584

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

VALUE ENGINEERING RECOMMENDATION # VE-12

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Place Ramp "A" on the east side of KY-841 in lieu of installing the flyover to the west side.

ORIGINAL DESIGN:
Ramp "A" crosses the main line on a 946 ft bridge.

RECOMMENDED CHANGE:
Relocate Ramp "A" to the east of the main line, touching down on US-42 which is approximately 600 ft north of Ramp "B".

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$9,449,000		$9,449,000
RECOMMENDED DESIGN	$518,000		$518,000
ESTIMATED SAVINGS OR (COST)	$8,931,000	$0	$8,931,000

VALUE ENGINEERING RECOMMENDATION # VE-12

ADVANTAGES:

- Eliminates bridge
- Conforms with driver expectancy-exit ramps go off to the right and end at a one-way surface street intersection

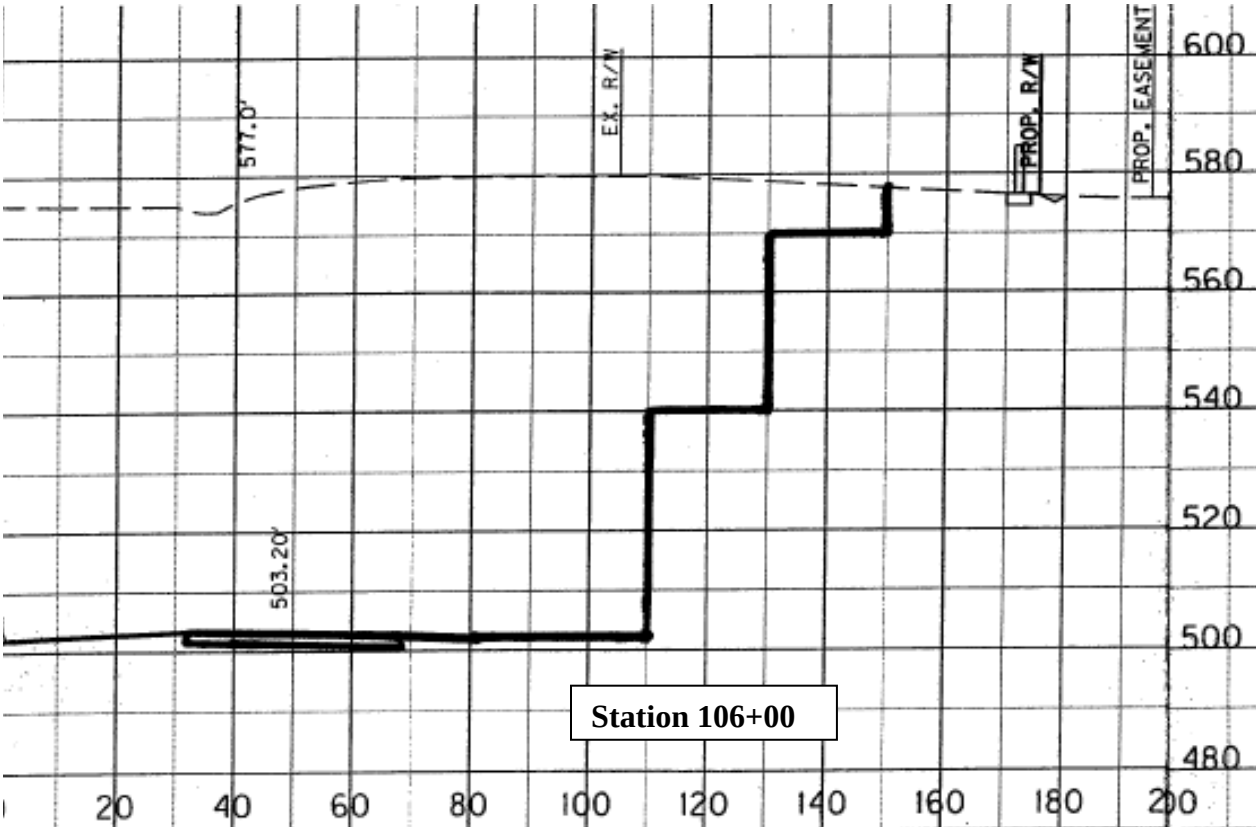
DISADVANTAGES:

- Two signalized intersections without a great amount of separation at US 42

JUSTIFICATION:
This recommendation eliminates the capitol cost and maintenance cost of a major bridge.

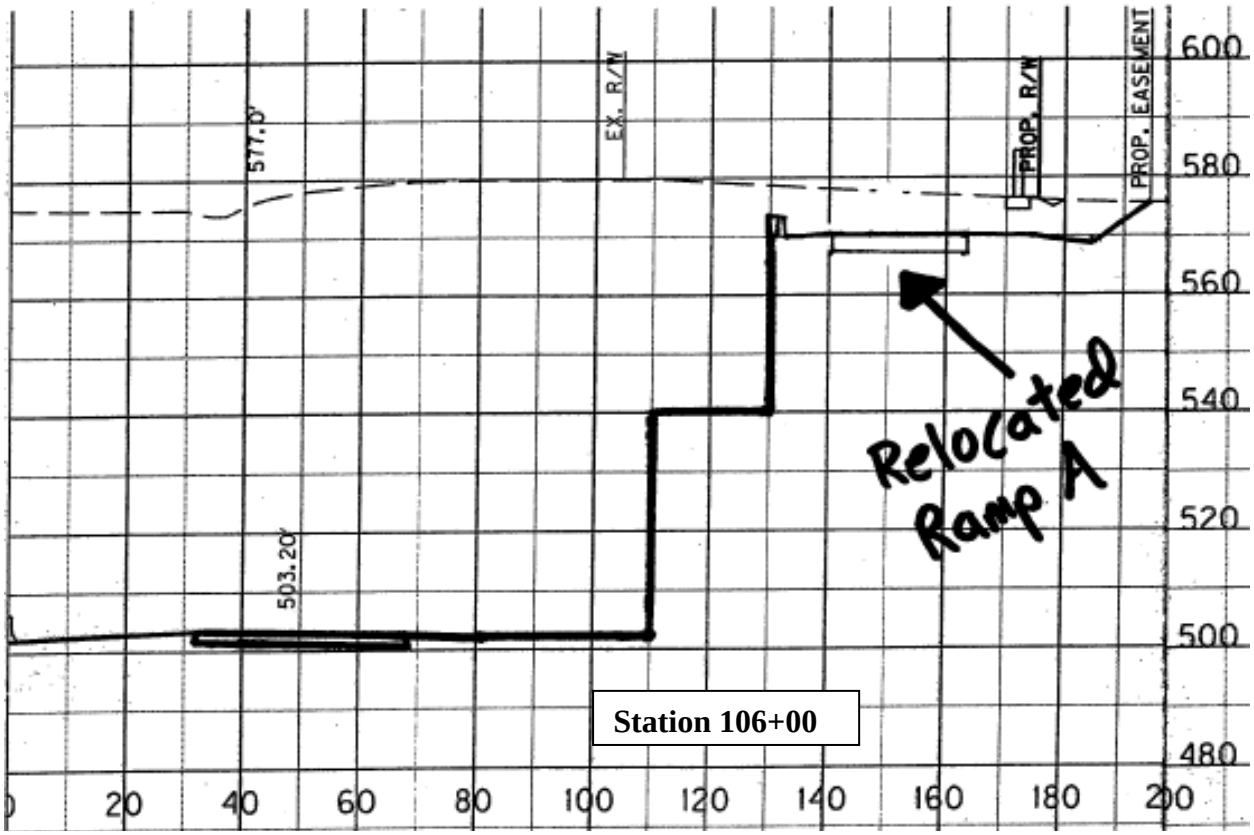
VALUE ENGINEERING RECOMMENDATION # VE-12

SKETCH OF ORIGINAL DESIGN



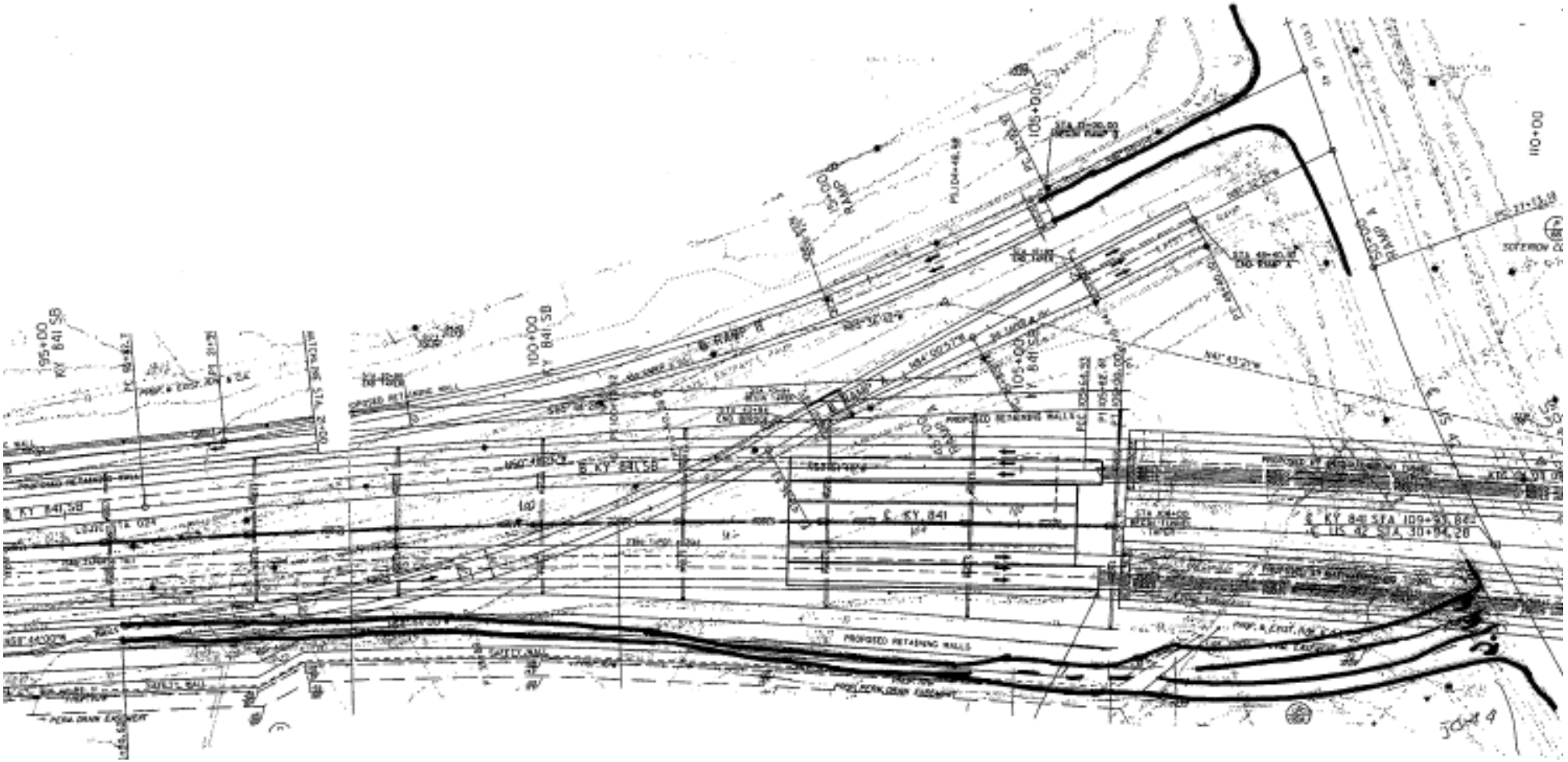
VALUE ENGINEERING RECOMMENDATION # VE-12

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-12

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-12

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Ramp "A" Bridge	SF	242.00	1	33,280	$8,053,760		
Excavation (add)	CY	18.00	1			9,315	$167,670
Pavement	TN	75.00	7	2,171	$162,825	3,766	$282,450
Subtotal					$8,216,585		$450,120
Contingency	@	15.00%			$1,232,488		$67,518
Total					$9,449,073		$517,638

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

VALUE ENGINEERING RECOMMENDATION # VE-13

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Revise maintenance of the traffic plan to allow excavation of the south tunnel portal rock cut, between approximate stations 50 + 00 and 106 + 00, in one phase in lieu of three phases.

ORIGINAL DESIGN:
The original design shows that this area is to be excavated in three phases beginning with a trench that is 70' deep and 70' wide. Wolf Pen Branch Road will be carried over the trench on a temporary bridge. Wolf Pen Branch Road is a local road that serves mostly a high end residential area.

RECOMMENDED CHANGE:
The VE Team recommends constructing the south tunnel portal rock cut in one phase by:

1. Maintain KY-841 traffic on temporary two lane pavement on the west side of the mainline between Springdale Road and the mainline work limits. This section is located between station 46 + 00 and station 106 + 00 (US-42), which is approximately 6,000 LF. Install temporary barrier between KY-841 and Springdale Road to keep through traffic out of the neighborhood.
2. Close Wolf Pen Branch Road over the proposed mainline (station 48 +50 to station 51 + 00). Maintain access to the area east of the mainline by temporarily reconnecting Spring Farm Road to KY-841. Current recommendation is a right in/right out intersection.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$29,483,000		$29,483,000
RECOMMENDED DESIGN	$24,992,000		$24,992,000
ESTIMATED SAVINGS OR (COST)	$4,491,000	$0	$4,491,000

VALUE ENGINEERING RECOMMENDATION # VE-13

ADVANTAGES:

- Reduce excavation schedule by utilizing top down means.
- Eliminate the Wolf Pen Branch Road runaround and temporary bridge.
- A stable, long term traffic pattern reduces driver confusion and the need for constant re-education

DISADVANTAGES:

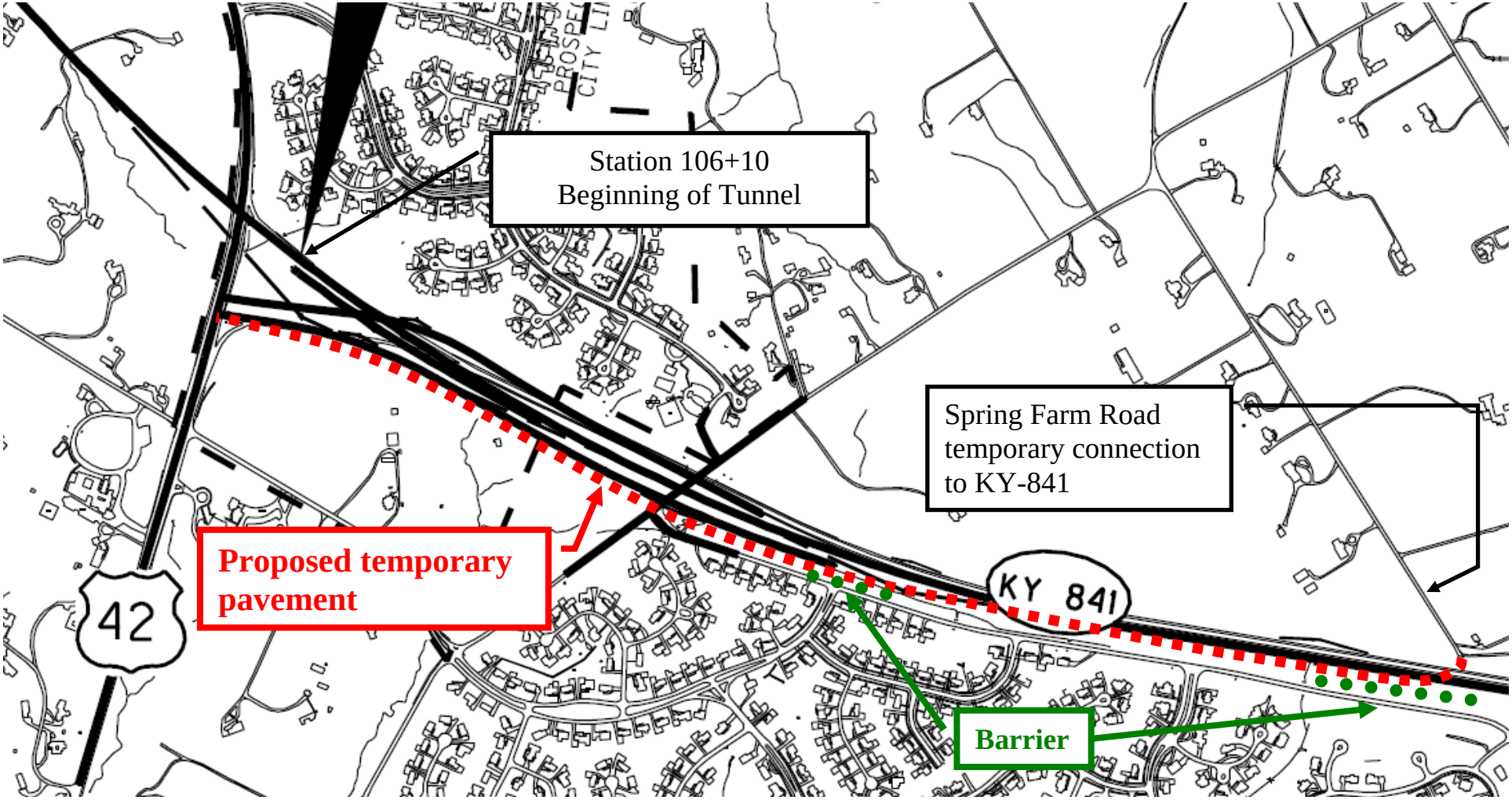
- Disconnects the residential area east of KY-841 from the signal at US-42 and Wolf Pen Branch Road

JUSTIFICATION:

Implementing this recommendation will improve the construction process by eliminating the phasing within the cut section. This section makes the south tunnel portal excavation more accessible and save time. Work the job from the north to the south and utilize uphill tunneling practices.

VALUE ENGINEERING RECOMMENDATION # VE-13

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-13

CALCULATIONS

EXCAVATION – EXISTING & PROPOSED

195 WIDE FLAT × 70 DEEP = 13,650 SF @ 106+00 & 50+00

$\left(\frac{13,650}{2}\right)$ × 5600 = 38,220,000 CF

38,220,000 / 27 = 1,413,000 CY

TEMPORARY ROADWAY

EXISTING 30+50 to 40+35

$\frac{985' \times 24}{9}$ = 2626 SY

LESS BRIDGE $\frac{112 \times 24}{9}$ = 298

2328 NET

PROPOSED:

SPRING FARM RD : $\frac{(100 \times 24)+(150 \times 12)}{9}$ = 466 SY

MAINLINE 5140 TO 106+00 = $\frac{5450 \times 24}{9}$ = 14,527

14,993

VALUE ENGINEERING RECOMMENDATION # VE-13

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Pavement Striping	MI	195.00	7	11	$2,145	3	$585
Concrete Barrier	LF	5.00	7			5,300	$26,500
Temporary Roadway	SY	34.00	1	1,164	$39,576	14,993	$509,762
Temporary Structure	LS	162,000	1	1	$162,000		
Excavation-tight	CY	18.00	1	1,413,000	$25,434,000		
Excavation	CY	15.00	7		$0	1,413,000	$21,195,000
Subtotal					$25,637,721		$21,731,847
Contingency	@	15.00%			$3,845,658		$3,259,777
Total					$29,483,379		$24,991,624

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

VALUE ENGINEERING RECOMMENDATION # VE-14

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize normal geotechnical surface exploration techniques in lieu of the exploratory tunnel project.

ORIGINAL DESIGN:
The original design is to construct an exploratory tunnel that is 12' x 12' to determine geotechnical conditions under the Soterion Corporation's property.

RECOMMENDED CHANGE:
The recommended change is to perform the normal geotechnical surface exploration techniques instead of the exploratory tunnel. Approximately 40 core holes along the length of the tunnels (20 each), will provide more geotechnical information than the exploratory tunnel, and will cost significantly less.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$21,850,000		$21,850,000
RECOMMENDED DESIGN	$575,000		$575,000
ESTIMATED SAVINGS OR (COST)	$21,275,000	$0	$21,275,000

VALUE ENGINEERING RECOMMENDATION # VE-14

ADVANTAGES:

- Eliminates the need for a separate contract for the exploratory tunnel
- Less disruption for the general public than the exploratory tunnel
- Reduction of the schedule
- Reduce material to disposal
- Very little disturbance of the natural environment
- Reduces the traffic control needs
- Provides more varied data points for the geotechnical information
- Eliminates the need to pump exploratory tunnel until the final tunnel is completed

DISADVANTAGES:

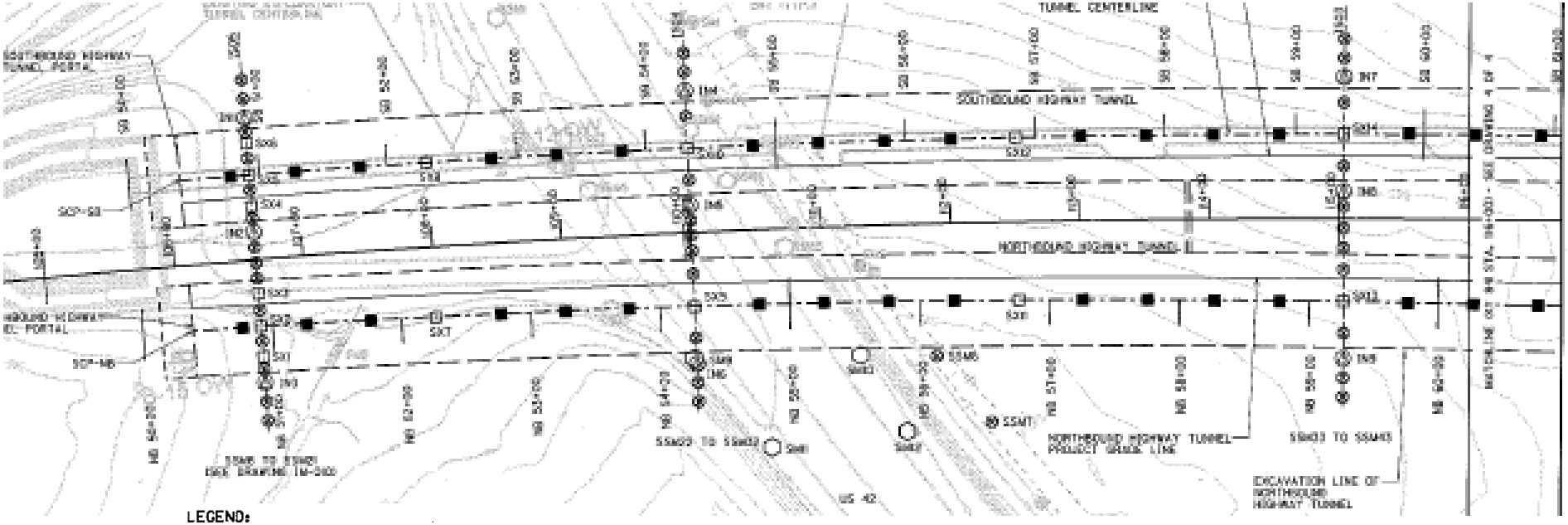
- Cannot perform the visual inspection of the actual removal of the material
- Violation of Section 4F which disturbs the historic property
- May not be able to find the exact location of the presence of groundwater

JUSTIFICATION:

The exploratory tunnel has been proven to be very expensive. It is very time consuming and only provides information for the crown of the tunnel. It also creates a lot of waste material. Sub-surface geotechnical techniques can acquire similar data and can be performed from the existing right of way. Utilizing surface exploratory techniques are much more efficient than the exploratory tunnel. The surface drilled holes, in addition to generating geotechnical data, will have magnetic sensors placed in them for future use, and the holes will be plugged to keep water out. Even with the exploratory tunnel, surface mounted sensors will be required, so some form of surface drilling will have to take place. The exploratory tunnel will have to be pumped free of water from the time it is constructed until the ultimate tunnel is constructed..

VALUE ENGINEERING RECOMMENDATION # VE-14

SKETCH OF ORIGINAL DESIGN



LEGEND:

⊗	SURFACE SETTLEMENT MARKER (SSM)
⋈	FLOW METER (FM)
ISOI	INSTRUMENTATION FROM SURFACE LINE OI
□	EXTENSOMETER INSTALLED FROM SURFACE
△	INCLINOMETER INSTALLED FROM SURFACE
■	EXTENSOMETER INSTALLED IN TUNNEL
⬡	SURFACE MONITORING POINT (SM)

This sketch identifies multiple components that will have to be installed on the surface above the tunnel

VALUE ENGINEERING RECOMMENDATION # VE-14

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Exploratory Tunnel**	LS	19,000,000	7	1	$19,000,000		
Surface Exploration Techniques	LS	500,000	7			1	$500,000
Subtotal					$19,000,000		$500,000
Contingency	@	15.00%			$2,850,000		$75,000
Total					$21,850,000		$575,000

** This estimate does not consider the fact that the exploratory tunnel project actually reduces the ultimate project by $2.5 million in cost since some of the material has been removed.

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

VALUE ENGINEERING RECOMMENDATION # VE-15

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize directional drilling in lieu of boring an exploratory tunnel to acquire geotechnical information.

ORIGINAL DESIGN:
The original design shows an exploratory tunnel (12' x 12') to determine geotechnical conditions under the Soterion Corporation's property.

RECOMMENDED CHANGE:
The recommended change is to perform Directional Drilling from the gore area in US 42 interchange and at the end of Shadow Wood Drive. Drill 4" holes, place magnetic sensors in holes, and then plug holes.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$21,850,000		$21,850,000
RECOMMENDED DESIGN	$5,750,000		$5,750,000
ESTIMATED SAVINGS OR (COST)	$16,100,000	$0	$16,100,000

VALUE ENGINEERING RECOMMENDATION # VE-15

ADVANTAGES:

- Eliminates need for separate contract for exploratory tunnel
- Less disruption of existing landscape to build pit for drilling
- Considerably reduces schedule to obtain information
- Very little material to dispose of
- Reduces traffic control needs
- Provides more data points for geotechnical information
- Eliminates need to pump exploratory tunnel until the final tunnel is completed

DISADVANTAGES:

- Cannot perform a visual inspection of actual removal of material
- May be harder to determine location of the water table

JUSTIFICATION:

The exploratory tunnel has been proven to be very expensive. It is very time consuming and only provides information for the crown of the tunnel. It also creates a lot of waste material. Directional Drilling is a technique that will work and can be performed from existing right of way. There is little waste when compared to the exploratory tunnel; the holes can have magnetic sensors placed in them for future use and the holes can be plugged to keep out water. The exploratory tunnel will have to be pumped free of water from the time it is constructed until the ultimate tunnel is constructed. Directional Drilling eliminates this need. Directional Drilling also satisfies the ROD.

Note that this estimate does not account for the $2.5 million total tunnel project cost reduction that results from boring an exploratory tunnel. This is because the mainline tunnel will have less material to be removed. The VE Team is using a cost of $80-$130 per foot of solid rock and $25-$30 per foot of soil for the directional drilling.

VALUE ENGINEERING RECOMMENDATION # VE-15

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Directional Drilling	LS	$5,000,000	7			1	$5,000,000
Exploratory Tunnel**	LS	$19,000,000	7	1	$19,000,000		
Subtotal					$19,000,000		$5,000,000
Contingency	@	15.00%			$2,850,000		$750,000
Total					$21,850,000		$5,750,000

** This estimate does not consider the fact that the exploratory tunnel project actually reduces the ultimate project by $2.5 million in cost since some of the material has been removed.

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

VALUE ENGINEERING RECOMMENDATION # VE-16

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce right of way acquired in this entire project by constructing the noise barrier wall on top of the proposed retaining wall.

ORIGINAL DESIGN:
In the original design there are fairly liberal right of way takings throughout the project, which are particularly in the areas where existing right of way is fairly wide. North of US 42, the right of way recommended is acceptable.

RECOMMENDED CHANGE:
The recommended change is to reduce right of way at the beginning of the project by pulling proposed R/W lines in closer to the disturb limits. Parcels 3 & 4 could be eliminated and the encroachment on the Louisville Water Company's 50' easement could be eliminated. Parcel 6 could be eliminated as the temporary easement shown is for the noise barrier construction and it will be constructed from the KY-841 side. Parcels 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, and 26 can be eliminated as the noise barrier wall could be constructed on top of the proposed retaining wall. Parcel 36 and 37 appear to not be affected by the construction and should be eliminated. The drainage ditch along Ramp "A" is not necessary as the VE Team feels that the sheet flow off of the existing properties is desirable. Therefore, parcels 52, 53, 54, and 64 could be eliminated. Parcels 56 and 65 are not necessary.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$1,017,000		$1,017,000
RECOMMENDED DESIGN	$0		$0
ESTIMATED SAVINGS OR (COST)	$1,017,000	$0	$1,017,000

VALUE ENGINEERING RECOMMENDATION # VE-16

ADVANTAGES:

- Eliminates 29 parcels
- Eliminates the ditch in the backyard of numerous parcels
- This will shorten the time required for R/W appraisals, negotiations, courthouse work, etc

DISADVANTAGES:

- Slightly smaller work area for contractor
- Noise wall will require weep holes to allow water to pass

JUSTIFICATION:

The right of way acquisition is one of the major expenses of a project and can be very time consuming. By eliminating approximately 20% of the parcels, expenses, and time can be minimized for the right of way acquisition phase.

VALUE ENGINEERING RECOMMENDATION # VE-16

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Appraisals	EA	500.00	7	29	$14,500		
Administrative Costs	EA	5,000.00	7	29	$145,000		
Value of Property	EA	25,000.00	7	29	$725,000		
Subtotal					$884,500		$0
Contingency	@	15.00%			$132,675		$0
Total					$1,017,175		$0

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

VALUE ENGINEERING RECOMMENDATION # VE-17

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce the Harrod's Creek Bridge length from 1,470 ft to 1,200 ft by eliminating spans 1 and span 7.

ORIGINAL DESIGN:
The original design shows the Harrod's Creek Bridges proposed as seven span bridges that are 1,470 ft in length. The proposed span arrangement for both the northbound and southbound structures are 135 ft, 225 ft, 225 ft, 300 ft, 225 ft, 225 ft, and 135 ft.

RECOMMENDED CHANGE:
Reduce the Harrod's Creek Bridge length from 1,470 ft to 1,200 ft by eliminating spans 1 and span 7.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$60,067,000		$60,067,000
RECOMMENDED DESIGN	$49,034,000		$49,034,000
ESTIMATED SAVINGS OR (COST)	$11,033,000	$0	$11,033,000

VALUE ENGINEERING RECOMMENDATION # VE-17

ADVANTAGES:

- Lengthens fill which uses some of the waste material
- Eliminates 34,020 sq. ft. of the bridge
- Allows quicker construction of both bridges
- Considerably reduces construction schedule
- Eliminates possible conflict with proposed storm water drainage storage and treatment facility
- Reduce the perpetual maintenance for 34,020 SF of bridge deck

DISADVANTAGES:

- Places fill material in the floodplain of the Ohio River's 500 year Water Surface Elevation
- Will require a CORPS of Engineer permit

JUSTIFICATION:

The Harrod's Creek bridges are a significant cost for the Section 4 project. The ways to minimize the structures' lengths or widths are the easiest to minimize these costs other than the structure types. It appears that the only need for span 1 is to keep fill out of the 500 year water surface elevation of the Ohio River. Span 7 appears to have been added for the structure balance and can be eliminated with the elimination of span 1.

VALUE ENGINEERING RECOMMENDATION # VE-17

CALCULATIONS

185,220 sq. ft. (existing bridge) ÷ 1,470 ft (length) = 126 ft width

126 ft width x 1,200 ft length = 151,200 sq. ft.

185,220 x $282 sq. ft. = $52,232,040
151,200 x $282 sq. ft. = $42,638,400

Cost Savings = $9,593,640

VALUE ENGINEERING RECOMMENDATION # VE-17

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Harrod's Creek Bridge	SF	282.00	7	185,220	$52,232,040	151,200	$42,638,400
Subtotal					$52,232,040		$42,638,400
Contingency	@	15.00%			$7,834,806		$6,395,760
Total					$60,066,846		$49,034,160

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

VALUE ENGINEERING RECOMMENDATION # VE-18

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce the width of Harrod's Creek Bridge by 16 ft through utilizing 4 ft shoulders (4'-36'-4') in lieu of 12 ft outside shoulders (12'-36'-12') on both bridges.

ORIGINAL DESIGN:
The original design shows that the Harrod's Creek bridges are proposed as 3 lane bridges in each direction with 12' inside and outside shoulders.

RECOMMENDED CHANGE:
The recommended change is to change the inside and outside shoulder widths from 12 ft to 4 ft on both bridges.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$60,067,000		$60,067,000
RECOMMENDED DESIGN	$44,812,000		$44,812,000
ESTIMATED SAVINGS OR (COST)	$15,255,000	$0	$15,255,000

VALUE ENGINEERING RECOMMENDATION # VE-18

ADVANTAGES:

- Eliminates 47,040 sq. ft. of bridge
- Allows quicker construction of both bridges
- Considerably reduces construction schedule
- Provides traffic calming with narrower typical section

DISADVANTAGES:

- Does not provide a full width shoulder to pull off or in case of an emergency
- Generally, not perceived as safe

JUSTIFICATION:

According to AASHTO's policy on Design Standards for Interstate Systems, long bridges, defined as bridges having an overall length in excess of 200 ft, may have a lesser width. On long bridges, offsets to parapet, rail, or barrier, shall be at least 4 ft measured from the edge of the nearest traffic lane on both the left and the right side. Since Harrod's Creek bridges are a significant cost for Section 4, this reduction in width should be considered.

VALUE ENGINEERING RECOMMENDATION # VE-18

CALCULATIONS

185,220 sq. ft. bridges based on 1,470 ft (length) and 126 ft (width)

16 ft of shoulder width instead of 48 ft

126 ft – 48 ft + 16 ft = 94 ft

94 ft x 1,470 ft = 138,180 sq. ft.

185,220 x $282. sq. ft. = $52,232,040
138,180 x $282 sq. ft. = $38,966,760

Cost Savings = $13,265,280

VALUE ENGINEERING RECOMMENDATION # VE-18

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Harrod's Creek Bridge	SF	282.00	7	185,220	$52,232,040	138,180	$38,966,760
Subtotal					$52,232,040		$38,966,760
Contingency	@	15.00%			$7,834,806		$5,845,014
Total					$60,066,846		$44,811,774

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

VALUE ENGINEERING RECOMMENDATION # VE-19

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a sod lining in the drainage ditches in lieu of bentonite lining.

ORIGINAL DESIGN:
The original design is to place an impermeable liner made of sodium bentonite in the top 2" of the ditches to prevent water infiltration.

RECOMMENDED CHANGE:
The recommended change is to place standard materials in the ditches such as concrete paved ditches, geo-textile fabric lined with rock, or other impermeable materials.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$340,000		$340,000
RECOMMENDED DESIGN	$184,000		$184,000
ESTIMATED SAVINGS OR (COST)	$156,000	$0	$156,000

VALUE ENGINEERING RECOMMENDATION # VE-19

ADVANTAGES:

- Eliminates the need for sodium bentonite from southwest Texas
- Reduces the construction schedule
- Eliminates a terrible maintenance issue
- Conventional and readily available materials

DISADVANTAGES:

- Not as aesthetically pleasing
- May not meet all ROD promises

JUSTIFICATION:

A bentonite lining in the ditches is going to create a terrible maintenance problem. The mowers will be getting into the material and tracking it everywhere. The first time the ditch is cleaned with a bantam, the 2" bentonite material will be removed. A combination of a filter and a rock ditch or a concrete paved ditch would allow normal ditch maintenance. Initial construction costs will be cheaper as well.

VALUE ENGINEERING RECOMMENDATION # VE-19

CALCULATIONS

Geotextile Fabric $2.20 SY = $100,000 Total
Rock = $50,000 Total

Verses

Bentonite 1,889 TON x $65 = $122,785
Trucks Hauling Bentonite = $172,872

50% Savings

VALUE ENGINEERING RECOMMENDATION # VE-19

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Geotextile Fabric	SY	2.20	7			50,000	$110,000
Rock	LS	50,000.00	7			1	$50,000
Bentonite	TN	65.00	1	1,889	$122,785		
Truck Hauling Bentonite	LS	172,872.00	1	1	$172,872		
Subtotal					$295,657		$160,000
Contingency	@	15.00%			$44,349		$24,000
Total					$340,006		$184,000

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

VALUE ENGINEERING RECOMMENDATION # VE-20

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce width of the shared pedestrian path from 15 ft to 10 ft to meet the recommended minimum for a 2-way pedestrian path.

ORIGINAL DESIGN:
The original design calls for a shared use path that varies in width from 16.5 ft to 15 ft. The path extends from River Road to the end of the project (station 187 + 00).

RECOMMENDED CHANGE:
The recommended width for a shared use path from the 1999 Guide for the Development of Bicycle Facilities is 10 ft (page 35). The VE Team recommends reducing the width of the multipurpose path to reflect this dimension.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$120,000		$120,000
RECOMMENDED DESIGN	$76,000		$76,000
ESTIMATED SAVINGS OR (COST)	$44,000	$0	$44,000

VALUE ENGINEERING RECOMMENDATION # VE-20

ADVANTAGES:

- Reduces the amount of crushed stone base
- Reduces the amount of asphalt base
- Reduces the amount of asphalt surface
- Reduces the surface area of the shared use path to maintain in the future

DISADVANTAGES:

- Will need to transition to the path on the East End bridge

JUSTIFICATION:
The current design exceeds the recommendation of the width for a shared use path. A savings of $38,600 could be realized. The final cost assumes utilizing a 10 ft path in lieu of a 16 ft path which represents a reduction of 63%.

VALUE ENGINEERING RECOMMENDATION # VE-20

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Crushed Stone Base	TN	15.71	1	980	$15,396	618	$9,709
CL3 Asphalt Base	TN	75.00	1	916	$68,700	577	$43,275
CL3 Asphalt Surface	TN	62.00	1	330	$20,460	208	$12,896
Subtotal					$104,556		$65,880
Contingency	@	15.00%			$15,683		$9,882
Total					$120,239		$75,762

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

VALUE ENGINEERING RECOMMENDATION # VE-21

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize existing ramp from KY-841 to I-71 west (station 24+42.10 to station 25+00) in lieu of replacing this section of ramp.

ORIGINAL DESIGN:
Southbound lanes and ramp to I-71 are reconstructed, but provide minimal improvements.

RECOMMENDED CHANGE:
Use existing alignment and grades on the southbound lanes and ramps to I-71 from station 24+42.10 to station 25+00. KYTC currently has a project advertised to replace this entire interchange in the future.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$72,000		$72,000
RECOMMENDED DESIGN	$0		$0
ESTIMATED SAVINGS OR (COST)	$72,000	$0	$72,000

VALUE ENGINEERING RECOMMENDATION # VE-21

ADVANTAGES:

- Makes maximum use of existing grading, pavement section, and drainage ditch
- Reduces maintenance of traffic issues and traffic control needs for KY 841 ramp to I-71 construction

DISADVANTAGES:

- The typical section will not have the same shoulder width, ditch, and slope as the proposed design. However, that's going to be the case wherever the project ends
- Does not eliminate the guard rail

JUSTIFICATION:

KYTC currently has a project advertised for design that replaces the KY-841 and I-71 interchange. Making minimal improvements to this ramp that will ultimately be torn out will result in a significant cost for a short life. This recommendation will slightly reduce the total cost of this project, and it will handle the traffic appropriately.

VALUE ENGINEERING RECOMMENDATION # VE-21

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Asphalt	TN	75.00	7	630	$47,250		
Earthwork	LS	15,000.00	7	1	$15,000		
Subtotal					$62,250		$0
Contingency	@	15.00%			$9,338		$0
Total					$71,588		$0

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

VALUE ENGINEERING RECOMMENDATION # VE-22

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize open storage for drainage in lieu of under road storage in the Belleview area.

ORIGINAL DESIGN:
Construct two storm-water treatment chambers (one between stations 151+00 to 152+64.2 and one between station 155+62.5 to station 157+26.7), beneath the roadbed proposed. The purpose is to serve as a storage location for eventual "treatment" and then discharge.

RECOMMENDED CHANGE:
Relocate storm-water treatment chambers from beneath the roadbed structure. Utilize an open treatment lagoon (drainage structure with a bentonite clay liner) located on the north side of station 159+00 near the toe of the slope above approximate elevation 460 ft.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$3,682,000		$3,682,000
RECOMMENDED DESIGN	$782,000		$782,000
ESTIMATED SAVINGS OR (COST)	$2,900,000	$0	$2,900,000

VALUE ENGINEERING RECOMMENDATION # VE-22

ADVANTAGES:

- Reduce delays to "users" of roadway during normal routine maintenance and clean up operations as a result of an accident
- Eliminate potential catastrophic collapse of the roadway due to lack of maintenance or possible explosion due to build up of grasses
- Increases volume for additional excavation/waste from project
- Enhances the safety of maintenance workers by eliminating a confused space entry, a need for specialized equipment, and a need for continuous air quality monitoring due to "chamber" design

DISADVANTAGES:

- In an emergency allow quicker access by officials and clean up contractors by having "open" air environment and a larger staging area/direction of access to speed clean up operations
- Method of "softening" or "hiding" established already can be used with recommendation
- Treatment Lagoon possible within sight of someone somewhere

JUSTIFICATION:

This recommendation enhances the safety to the traveling public along with the personnel required to maintain these treatment chambers. In the original design, any future repairs/reconstruction to the treatment chamber would cause a complete shut down of the roadway. These chambers increase the number of active systems within the corridor, which increases the likelihood of frequent maintenance visits.

VALUE ENGINEERING RECOMMENDATION # VE-22

CALCULATIONS

Length of 2 Basins Proposed and Beneath Roadways

152 + 64.2		157 + 26.7		
151 + 00.0		155 + 62.5		
164.2 ft	(+)	164.2 ft	=	328.4 LF (TOTAL) LF

Proposed

Volume

1. 328.4 ft x (8 ft tall x 20 ft wide x 4 each) = 210,176 ft³
2. 328.4 ft x (11ft height x 24 ft wide x 2 each) = 173,395 ft³

383,571 ft³

Length = 900 ft (159 + 00 to 168 + 00)

1. Depth = @ 4 ft
2. Width = @120 ft

Volume = 432, 000 ft³ (larger than proposed)

Estimate

3. Pipe Size to be determined (151 to 159) = $100 x 800 LF = 80,000
4. Bentonite Lining = 4 times current estimate
5. Landscaping = Based off of dense residential screening

VALUE ENGINEERING RECOMMENDATION # VE-22

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Water Storage Structures	LS	3,121,800	1	1	$3,121,800		
Pipe	LF	100.00	1	800	$80,000	800	$80,000
Bentonite Clay Liner	LS	400,000	1			1	$400,000
Landscaping	LS	200,000	1			1	$200,000
Subtotal					$3,201,800		$680,000
Contingency	@	15.00%			$480,270		$102,000
Total					$3,682,070		$782,000

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

VALUE ENGINEERING RECOMMENDATION # VE-23

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize natural drainage system in lieu of capturing storm-water in the Belleview area.

ORIGINAL DESIGN:
Construct a storm-water treatment system between stations 151 + 00 and 157 + 26.7. This system not only stores a 100 year storm event, but it proposes to "treat" storm-water and discharge into Harrod's Creek. The system design is located within Louisville Water Company Protection Project.

RECOMMENDED CHANGE:
Continue to allow storm-water to be collected in order to prevent discharge directly into the Louisville Water Company Wellhead Protection Project. Discharge stormwater at an accepted location so to accommodate the appropriate design year for this facility and this watershed. The gate outlet could be closed in the event of Toxic Spill or other emergency situation.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$3,590,000		$3,590,000
RECOMMENDED DESIGN	$230,000		$230,000
ESTIMATED SAVINGS OR (COST)	$3,360,000	$0	$3,360,000

VALUE ENGINEERING RECOMMENDATION # VE-23

ADVANTAGES:

- Eliminate potential catastrophic collapse of the roadway due to lack of maintenance or possible explosion due to build up of grasses
- Increases volume for additional excavation/waste from project
- Enhances the safety of maintenance workers by eliminating a confused space entry, a need for specialized equipment, and a need for continuous air quality monitoring due to “chamber” design

DISADVANTAGES:

- Quick Response is key to recommend a change

JUSTIFICATION:
Currently no storm-water system in this area has this level of “Treatment” strategy within the sited Wellhead project. The recommended method still allows for the detention of a toxic substance in the event of an accident. This recommendation is practical, and it is an acceptable alternative method.

VALUE ENGINEERING RECOMMENDATION # VE-23

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Water Storage Structures	LS	3,121,800	1	1	$3,121,800		
Gate Value	LS	200,000	7			1	$200,000
Subtotal					$3,121,800		$200,000
Contingency	@	15.00%			$468,270		$30,000
Total					$3,590,070		$230,000

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

VALUE ENGINEERING RECOMMENDATION # VE-24

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize 4:1 side slopes between station 154+00 to station 168+00 (near Belleview) in lieu of the proposed slopes to incorporate wetland area at the bottom of the slopes.

ORIGINAL DESIGN:
In the fill area, the variable side slopes are proposed ranging from 4:1 to 10:1 between stations 154+00 to 168+00 on both right and left of the main line's center line.

RECOMMENDED CHANGE:
Utilize 4:1 side slopes between stations 154+00 to station 168+00 (near Belleview) in lieu of the proposed slopes to incorporate wetland area at the bottom of the slopes. Incorporate a depression at approximate elevation 470, for wetlands near the toe of the slopes between stations 154+00 to 168+00. Also utilize wetlands in select locations right and left of the main line's center line.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$575,000		$575,000
RECOMMENDED DESIGN	$152,000		$152,000
ESTIMATED SAVINGS OR (COST)	$423,000	$0	$423,000

VALUE ENGINEERING RECOMMENDATION # VE-24

ADVANTAGES:

- Good use for excess excavation material from other areas of the project
- Produces additional wet land area along the Ohio River Area Corridor
- No change is needed in ROD because the total height of fill is not affected
- Wetland vegetation will “break up monotony of the berm”
- The ROW break points create an undulant appearance

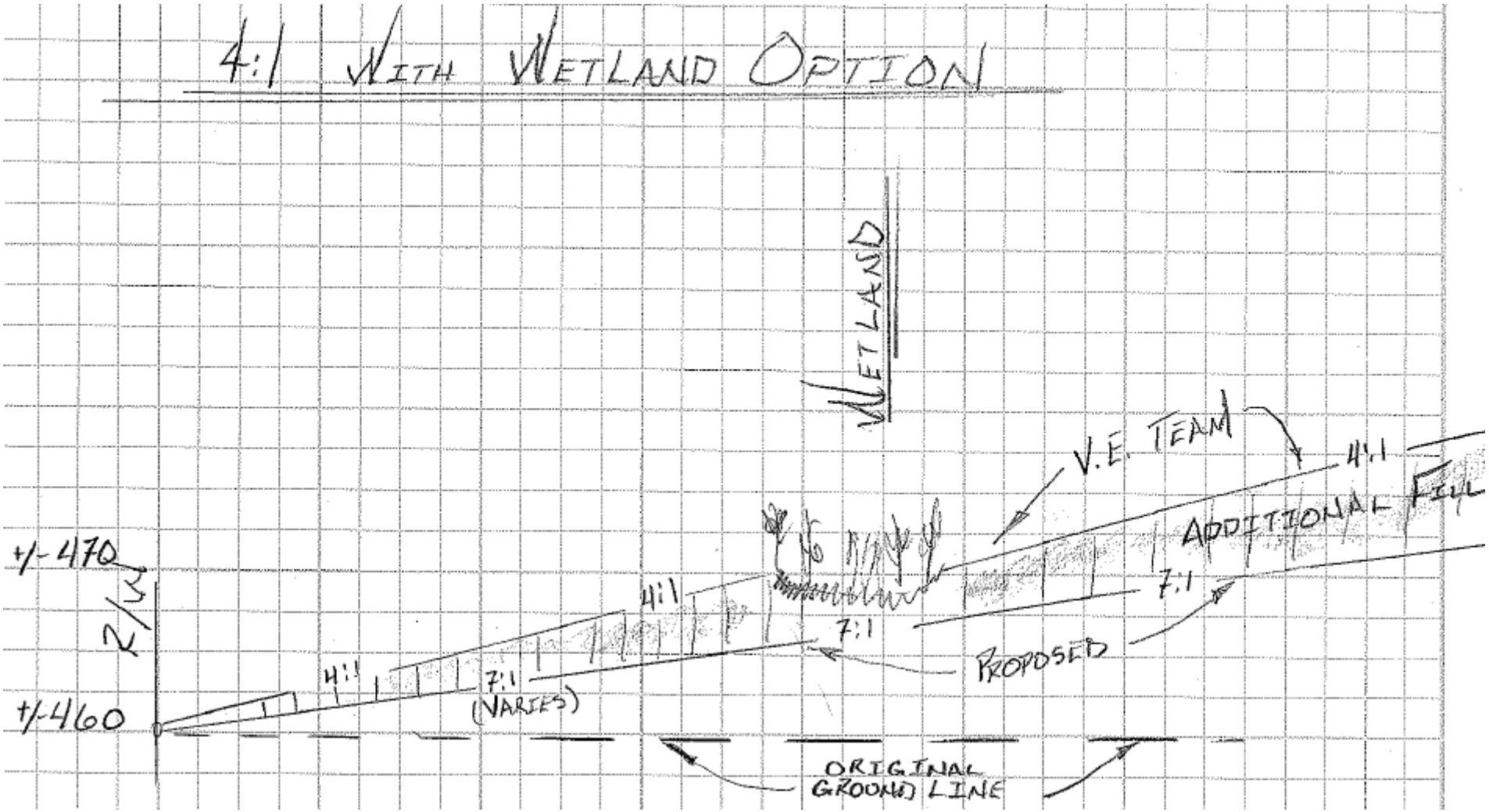
DISADVANTAGES:

- Some may perceive that the view is too much of a change to the alluvial plane

JUSTIFICATION:
Reduce the amount of material to be wasted outside of the project limits. Create wetlands in the area undergoing construction to help offset the need elsewhere in the corridor. Slope recommendation will comply with the spirit of the record of decision regarding major fills.

VALUE ENGINEERING RECOMMENDATION # VE-24

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-24

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Roadway Excavation Waste	CY	10.00	7	50,000	$500,000		
Wetland Biorention Areas	LS	13.25	1			10,000	$132,500
Subtotal					$500,000		$132,500
Contingency	@	15.00%			$75,000		$19,875
Total					$575,000		$152,375

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

VALUE ENGINEERING RECOMMENDATION # VE-25

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize steeper side slopes in combination between station 156+00 and station 168+00 (near Belleview) in lieu of a proposed side slopes through these stations.

ORIGINAL DESIGN:
In the fill area, the variable side slopes are proposed ranging from 4:1 to 10:1 between stations 154 + 00 to 168 + 00 on both right and left of the main line's center line.

RECOMMENDED CHANGE:
Adjust side slopes in variable combination (from 3:1 to 4:1), between stations 154 + 00 to 168 + 00 with variable elevation for slope break at or near toe of slopes in selected locations right and left of main line's center line.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$575,000		$575,000
RECOMMENDED DESIGN	$0		$0
ESTIMATED SAVINGS OR (COST)	$575,000	$0	$575,000

VALUE ENGINEERING RECOMMENDATION # VE-25

ADVANTAGES:

- Helps eliminate the over abundance of excavation produced elsewhere on the jobsite to be wasted
- Produce an undulating appearance that will break up monotony of the fill area
- Fill area not entirely constricted to a 3:1 ratio and raising a roadway through the alluvial plane without overall raising height of the roadway embankment

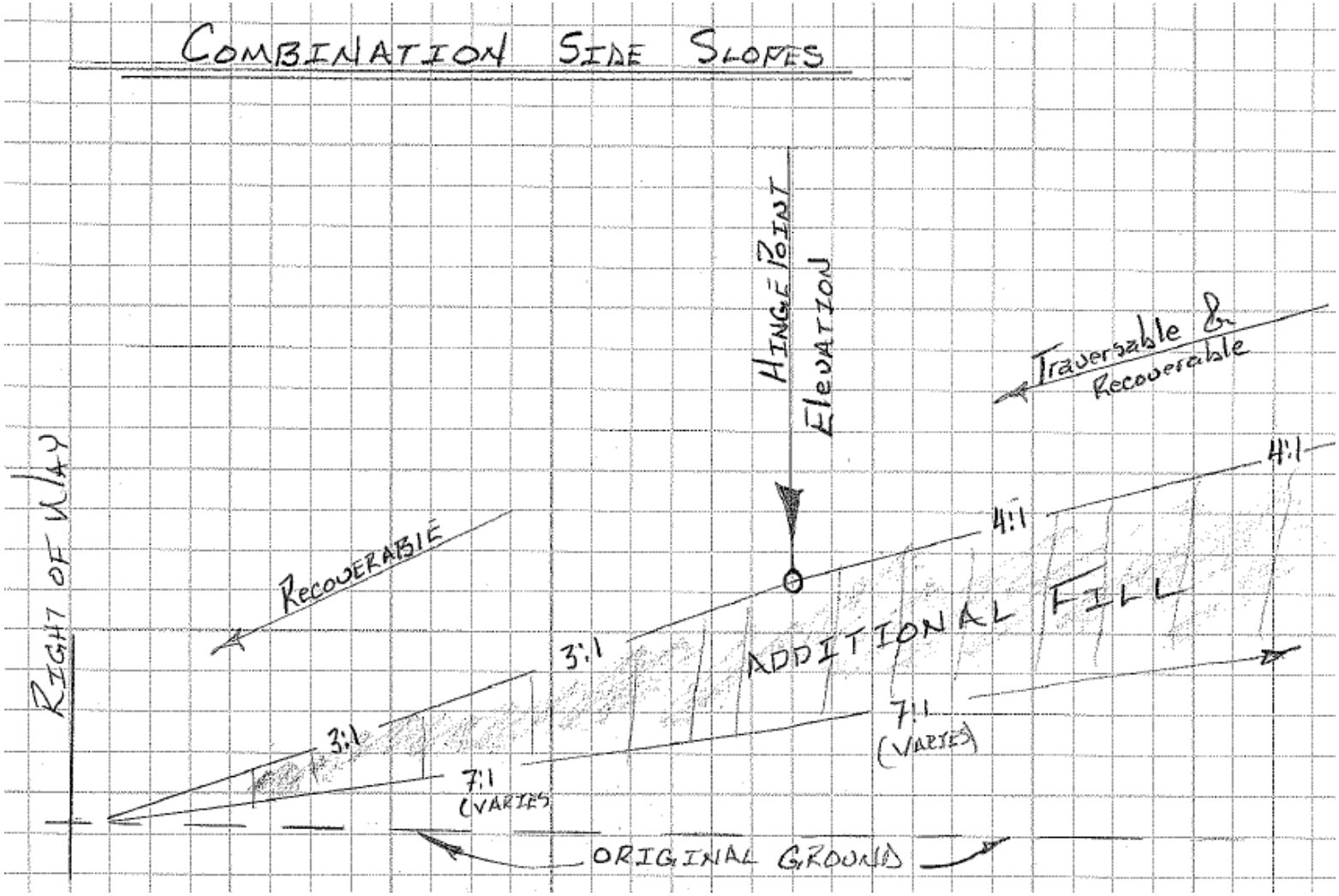
DISADVANTAGES:

- Possibly not to be perceived as undulating enough or to be constricted to a 3:1 ratio in the alluvial plane

JUSTIFICATION:
Reduce the amount of material to be wasted outside of the project limits. The slope recommendation will comply with the "spirit" of record decision, regarding major fills that are not consistent with use and elevation of a 3:1 to "other" slope ratio breakpoint.

VALUE ENGINEERING RECOMMENDATION # VE-25

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-25

CALCULATIONS

@ Roll 3:1 To 4:1 & So Forth @ Toe.

* Emb. Volume Creation:

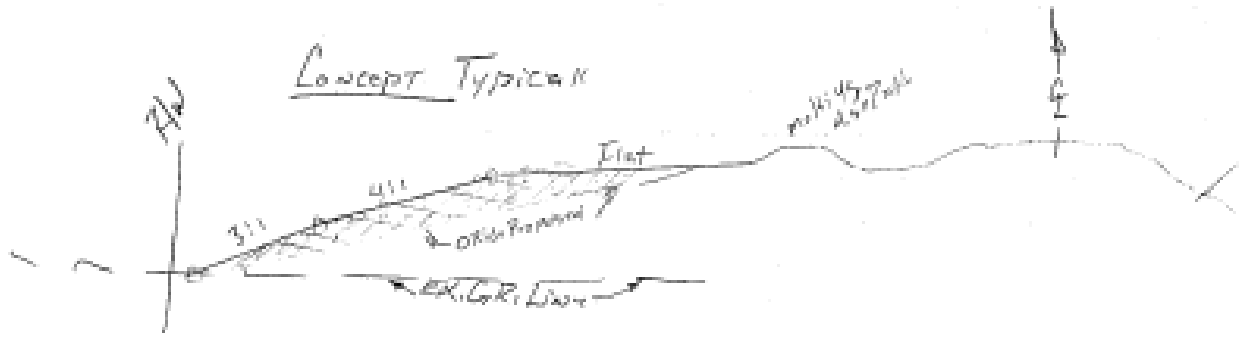
Lt. 156+00 To 168+00 = 1200'
Rt. 158+00 To 168+00 = 1000'

Average End Area Lt +/- 700 SF
3:1 To 4:1 To Flatten Rt +/- 500 SF

Lt Volume = 1200 x 700 = 840,000 Ft³
Rt " = 1000 x 500 = 500,000

= 1,340,000 / 27

= +/- 50000 C.Y.



VALUE ENGINEERING RECOMMENDATION # VE-25

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Roadway Excavation Waste	CY	10.00	7	50,000	$500,000		
Subtotal					$500,000		$0
Contingency	@	15.00%			$75,000		$0
Total					$575,000		$0

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

VALUE ENGINEERING RECOMMENDATION # VE-26

PROJECT: OHIO RIVER BRIDGES, SECTION 4 - EAST END BRIDGE APPROACH
LOCATION: LOUISVILLE, KENTUCKY
STUDY DATE: DECEMBER 10 - 14, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:
Do not utilize vegetation within the interior barrier wall/median system.

ORIGINAL DESIGN:
The original design provides vegetation within medians and adjacent to bridge piers falling at the center line of the main line and the side roadways.

RECOMMENDED CHANGE:
The VE Team recommends eliminating all vegetation within the medians and the bridge piers falling at center lines.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$510,000		$510,000
RECOMMENDED DESIGN	$0		$0
ESTIMATED SAVINGS OR (COST)	$510,000	$0	$510,000

VALUE ENGINEERING RECOMMENDATION # VE-26

ADVANTAGES:

- Reduce accidents resulting from drivers being distracted by plantings
- Reduce delays due to the lane or shoulder closures for necessary routine maintenance
- Eliminate the need for irrigation systems and associated maintenance
- Reduce exposure for maintenance crews and enhance safety to them as well as the traveling public
- Eliminate the expenditure of future resources to replace trees and plants as they outgrow their limited space or are overtaken by natural weeds
- Eliminate ponding on the pavement caused by clogged drains and grates

DISADVANTAGES:

- Public denied view of vegetation in these strips

JUSTIFICATION:

Eliminating vegetation within the critical driving areas will improve the quality and safety of the traveling public and maintainers. This will also eliminate the problems associated with vegetation affecting sight distance, storm water drainage systems, and the need to maintain the "Level of Acceptance" of visual acuity. There would likely be a life cycle cost saving associated with reducing this maintenance.

VALUE ENGINEERING RECOMMENDATION # VE-26

CALCULATIONS

- Irrigation of Median (Eliminated)

½% of Cost for landscaping
0.005 x 12,589,480 = $62,500

- Elimination of Vegetation

From Cost Estimate dated 5/14/07 (Est. Page 8 of 9) = $353,310

- Maintaining Mulching

5% of Cost for Item
0.05 x $553,910 = $27,500

VALUE ENGINEERING RECOMMENDATION # VE-26

COST ESTIMATE - FIRST COST

Cost Item	Units	$/Unit	Source Code	Original Design		Recommended Design	
				Num of Units	Total $	Num of Units	Total $
Landscaping Medians	SF	6.00	1	58,885	$353,310		
Irrigation	LS	62,500.00	7	1	$62,500		
Maintenance Mulching	LS	27,500.00	7	1	$27,500		
Subtotal					$443,310		$0
Contingency	@	15.00%			$66,497		$0
Total					$509,807		$0

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

SECTION 3.2 – VE Team 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 they may aid the design team in some way.

VALUE ENGINEERING DESIGN COMMENT # DC-27

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize three construction contracts in lieu of eight separate construction contracts.

COMMENTARY:
This comment is based upon a document titled LSIORBP Construction Section Cost Breakout (Estimated) that was provided delineating the contract into eight separate pieces.

Using the eight contracts over this 3.4 mile project presents numerous issues. First, this comment will summarize the significant issues that the VE Team notes and then discuss suggestions for separating the work:

- The coordination required between the Section 1 SB and Section 2 NB contracts from south end of the project to Wolf Pen Branch Road is problematic. Some questions that need to be asked include if they are concurrent or consecutive, how are the two sides delineated, how is drainage during construction handled, how is the permanent drainage on the SB side handled, when does the median drainage get done and when does the "hand-off" occur.
- The drainage of Sections 1 and 2 into Section 3 (Wolf Pen Branch Road to South Portal) will create coordination issues if any of these contracts are being done concurrently. The holder of the Section 3 contract will likely have issue with the water coming into their project from other sections.
- The drainage of Section 3 is a problem. It is unclear how the water that will drain from the high point at Station 22+50 will be removed from the rock cut at the South Portal? This is a significant issue until the tunnel is nearly complete when water can be transported through the tunnel to Harrods Creek.
- Material from Section 3 may need to be hauled through Sections 1 or 2, depending on where the material is being hauled. This may cause coordination issues.
- Sections 3 and 4 separate the bridge from the road pavement. From the VE Team's experience this sometimes leads to ride quality issues at the bridge ends because of the inability to make one party responsible for all components related to the ride quality.
- Access to Section 5 NB and SB tunnels is a huge issue. The VE Team is concerned that the tunnel contractor will not have full control over their access.
- The VE Team recommends elsewhere in the report to construct the tunnels from the north portals. Because of this it is recommended that Section 6 (North Portal to Harrods Creek including structure over Harrods Creek) be completed as soon as possible. This would provide unrestricted access north out of the tunnel for hauling material away from the site.
- The issue with separating Section 6 (or Section 3 if the tunnel is constructed from the South Portal) from Section 5 is most notably the reliance of the tunnel contractor upon a separate contractor to provide access before starting work. The VE Team is concerned with a scheduled delay in starting the tunnel and significant risk for unscheduled delays in starting the tunnel.
- Section 5 tunnel excavation and drainage will require access across and to Harrods Creek. The Harrods Creek Bridge is a schedule critical item if the tunnel contractor must rely on it for access to River Road. However, in order to get the tunnel started earlier a

temporary bridge across the creek is desirable. This temporary bridge for hauling may conflict with the final bridge construction.

- Section 7 (Harrods Creek structure to Ohio River approach structure) which includes the Belleview Fill is separate from all of the "cut" contracts. This is concerning. The timing, transport, and price of the "cut" material into the Belleview Fill are a problematic coordination issue.
- Section 8 (Ohio River approach structure) will require access from River Road. The bridge construction will generate significant amounts of traffic and may require a large staging area. These needs will have a major impact on the Section 7 area; therefore coordination is a major concern.
- 8 separate sections will require 8 separate staging areas. This project already has limited staging areas.

Suggested Scenario – 3 separate contracts
SECTION 1

- Section 1 would encompass the beginning of the project to the South Portal (not including actual South Portal construction) with ramp construction to US-42. This will put the major Maintenance of Traffic for this project, which is maintaining KY-841 to US-42, into a single contract. This allows the contractor to be more efficient and creative in getting the work done while always maintaining the two lanes. It will also put the responsibility for maintaining drainage into a single entity. As noted, keeping the road and excavation leading into the rock cut at the south portal drained prior to completion of the tunnel is a huge issue. This drainage issue must be addressed during design, but a general solution that can be refined by the contractor operations is recommended.
- Section 1 would also encompass the paving from the beginning of the project to the end of the project. Assuming that the road will be concrete, this would hypothetically allow the contractor to place a paving plant at the intersection of KY-841 and I-71. The paving from the South Portal to the end of project will be controlled by the completion of the tunnel, Harrods Creek Bridge, and Ohio River approach structure.
- Section 1 final completion date should lag the completion dates for the tunnel and bridges north of the tunnel. In order to minimize construction impacts at one time, we suggest lagging the start date for this Section 1 behind the Section 2 and Section 3 contracts so that work completion will coincide with completing the tunnel. We suggest that an interim completion date be included for readying the rock excavation for construction of the South Portal. This date should precede the "break-through" of the SB and NB tunnels by enough time to allow for construction of the South Portal by others.

SECTION 2 (Possibly two contracts)

- Section 2 encompasses the tunnels. The start date for this section would need to lag the start date for Section 3 because access to the North Portals would rely upon completion of the rock excavation from Harrods Creek. The tunnel work will likely be the controlling item in this project. We estimate the time to construct the tunnel at approximately 35 months.
- Section 2 could include the South and North Portal construction. However, in the interest of creating additional contracts, this work could be separated out. Coordination with the

tunnel contractor is the major concern. Ideally, the Portals would be ready at the same time as the concrete paving and roadwork is completing.

SECTION 3 (Possibly two contracts)

- Section 3 encompasses the project from the North Portal to the end of the project. This section would require the earliest start date to prepare the access to the North Portal. An interim completion date for the excavation and access to the North Portal would be required. The work would need to include temporary access across Harrods Creek to River Road. The material that is removed from that rock excavation could be used at the Belleview Fill. In order to minimize construction impacts to the surrounding properties, the aesthetic treatments at the Fill could be installed early, with consideration for hauling routes.
- Section 3 and Section 2 contracts would require significant coordination clauses to resolve the tunnel construction staging, material removal, and drainage into the project area controlled by Section 3 contractor.
- Section 3 could be broken into two sections, with the excavation from Harrods Creek to the North Portal and temporary access across Harrods Creek to River Road separated into an "early let" contract. This contract may need to include a part of the Belleview Fill to allow for waste of material to that location, although tunnel waste could be designated to this area at a later time through a coordination clause. This project would have a completion date that would coincide with the planned start of the tunnel, with some float for possible excavation delays. The "early let" would allow more time for bridge design, could be let in the very near future to prepare for tunnel work as soon as possible, and would have the benefit of providing an additional contract.
- If this "early let" contract is separate, a defined end condition and date would be required where the area of the project from the North Portal to the Belleview Fill (or River Road depending on the limits of the first contract) would be turned over to the subsequent Section 3 contractor.
- Section 3 will include bridges for Harrods Creek and Ohio River approach. The Harrods Creek bridge work would need to coordinate with the temporary access across the creek. The obvious solution is to build the temporary on one side of the right-of-way, construct the bridge on the other side; open that to construction traffic, then construct the bridge on the opposite side.

ALTERNATE MOT PHASING SCENARIO (These can be multiple contracts)

Phase 1: Build the north end, from the south tunnel portal to the East End Bridge approach. Maintenance of Traffic is minimal as most of this is on new alignment.

Phase 2: Make the cut between the south tunnel portal and station 46+00 and construct the Wolf Pen Branch Bridge. This will use the MOT plan outlined in VE-13

Phase 3: Add the northbound lanes between station 46+00 and the end of the job.

This phasing allows most of the work to be done prior to disrupting any traffic on KY-841 and work up hill as discussed above.

VALUE ENGINEERING DESIGN COMMENT # DC-28

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Reroute KY-841 to the east of Bridgeport around all historic properties.

COMMENTARY:
The existing alignment goes through the middle of the Soterion Corporation's Property which has been deemed historic. An alignment to the east that eliminates much of the subdivision along Bridgepoint Boulevard presents its own set of problems, but the VE Team feels that these problems may be solved more effectively and cheaper than the challenges posed by the Soterion Corporation's Property. Therefore, if it hasn't been looked at, it should be.

VALUE ENGINEERING DESIGN COMMENT # DC-29

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize a toll way for the tunnel or for the entire project.

COMMENTARY:

Finance the construction, operation, and maintenance of the tunnel and bridge by tolling the crossing. The methods to be considered are:

- E-Z pass
- Collect in one direction only
- Open road tolling – Toronto

The estimated costs of this project have the potential of exceeding the ability of the Kentucky Transportation Cabinet to comfortably pay for it. Tolling can partially or even fully off set these costs.

VALUE ENGINEERING DESIGN COMMENT # DC-30

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize closed drainage storage in lieu of under road storage in the Belleview area.

COMMENTARY:
The original design specifies constructing two storm-water treatment chambers (one between stations 151 + 00 to 152 + 64.2 and one between station 155 + 62.5 to station 157 + 26.7), beneath the proposed roadbed. The purpose of these stormwater chambers s are to serve as a storage location for eventual "treatment" and then discharge.

The VE Team recommends relocating the storm-water treatment chambers from beneath the road bed structure. The location could be beneath either side of the roadway, but outside of the roadway that is typical for shoulders and pavement in the side slopes between station 151 + 00 to station 159 + 00. This will enhanced safety to traveling public as well as to those mandated to maintain the treatment chambers. Future repairs/reconstruction of these chambers would cause complete shut down of the roadway.

ADVANTAGES:

- Access by emergency responders and maintenance staff would not require lane closures. Enhancing safety to all users involved in all phases of daily operations
- "Treatment" of stormwater would be more advance than existing system
- Reduced impact to travel way during catastrophic incident
- Reduced impact on highway users during cleanup operations and normal routine maintenance

Note:

The additional cost of piping associated with this recommendation will be offset by reducing the loading design of the chamber from "fill and traffic" to only "fill." It is assumed that only approximately 5 ft of fill cover is recommended in the side slope relocation.

VALUE ENGINEERING DESIGN COMMENT # DC-31

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Verify the stormwater detention basin location with respect to the Harrod's Creek (north) Bridge abutment to verify that they do not overlap.

COMMENTARY:
The design consultant needs to verify that the storm-water drainage storage and treatment facility (located from Station 151 + 00 to Station 152 + 64.2) does not conflict with Abutment # 2 of the Harrod's Creek Bridge. The centerline of Abutment # 2 is at (Station 150 + 85), which is extremely close.

VALUE ENGINEERING DESIGN COMMENT # DC-32

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize 60 mph design speed in lieu of 70 mph design speed throughout project.

COMMENTARY:
Eliminate this since it would not make a difference in the current design.

Horizontal - The current horizontal alignment is constrained by right-of-way, geography, and historical properties. The current curve will work for both design speeds, therefore changing the design speed will have no impact.

Vertical - The current vertical alignment meets 70 mph for "flat" terrain. If the terrain is defined as "rolling", then steeper grades are allowed, such as 4% even at 70 mph design speed. Therefore changing the design speed will have no impact.

VALUE ENGINEERING DESIGN COMMENT # DC-33

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Prequalify all tunnel contractors before bidding takes place, and provide stipend to all tunnel design-build firms that submit qualified bids.

COMMENTARY:
Prequalify contractors on the basis of past experience with jobs of similar size, available equipment, and management expertise. This will increase the probability that the successful bidder will be able to provide quality workmanship, and successfully complete the job with a minimum of construction and administrative problems.

Providing a stipend to the top three or four prequalified contractors will provide an incentive to make the investigative and preliminary engineering effort needed for an intelligent bid. With adequate information, bids will become more competitive. The bidders will be able to develop a feel for the job and formulate their strategies accordingly. There will be less padding for unknowns.

VALUE ENGINEERING DESIGN COMMENT # DC-34

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize scuppers in lieu of closed pipe drainage on Ramp A and Wolf Pen Branch bridges.

COMMENTARY:
The original design utilizes a closed pipe drainage system on proposed structures. In lieu of this, the VE Team recommends utilizing scupper drains that outlet from the bridge deck. The advantage will be a reduced maintenance cost and initial construction cost as well. Storage facilities could be reduced in size due to the reduced need for capacity.

The VE Team acknowledges that this comment will violate concessions made in the ROD by not capturing all of the storm water. However, by eliminating them on Ramp A and Wolf Pen Branch only, the result runoff will ultimately be collected within the originally designed system to protect the Louisville Water Wellhead project.

VALUE ENGINEERING DESIGN COMMENT # DC-35

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize the rock excavated from the cut and tunnel sections within the project in lieu of wasting material off-site in the quarry.

COMMENTARY:
Quality Rock should be utilized in the final construction of this project. Blasting operations should be conducted to produce rock size that can be utilized in landscaping, ditches, and road bed. This will further reduce the need to waste material outside of the project limits. This will contribute to the “natural” look and feel of the project.

VALUE ENGINEERING DESIGN COMMENT # DC-36

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize a uniform pavement design that includes full depth shoulders in lieu of partial depth shoulders.

COMMENTARY:
The VE Team's experience sees the benefit of utilizing full depth pavement design through the shoulder areas. User costs will far out weigh the initial construction cost when:

- Future maintenance requires lane shifting in routine operations of tunnel and bridges
- Accidents require shifting of traffic, allowing for maximum capacity through the event
- Future for maintenance and traffic control are required during resurfacing
- Future widening projects require a reduced pavement design

VALUE ENGINEERING DESIGN COMMENT # DC-37

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize landscaping that does not require irrigation at any location within the project limits to ensure plant survival.

COMMENTARY:
Basically, the landscaping plan is undeveloped at this time, but references have been made in Aesthetic Design Guideline dated October 2007. The VE Team recommends eliminating the need for irrigation by prudent selection of plant species and to reconsider planting ash. Emerald ash borer is established in neighborhood states.

Much of the landscaping on this project is located in the rock cuts, areas characterized by shallow soils, and high summertime temperatures. The selection of plants for these areas should be limited to a species which can adapt to and survive these conditions without regular intervention by the maintaining agency.

Adaptable and native plants generally cost less to establish, and the capital cost of the irrigation system will be eliminated. Operating and maintenance costs of the irrigation system will also be eliminated. This recommendation is environmental friendly by reducing ongoing energy and water use. On the down side, this recommendation will reduce the desired visual effect.

VALUE ENGINEERING DESIGN COMMENT # DC-38

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Provide provision for temporary drainage at the south portal of the tunnel during construction.

COMMENTARY:
The original design does not specify any temporary drainage at the south portal of the tunnel during construction. The bridge is scheduled to be constructed from the south end to the north end. The south portal will be located at the bottom of the 80' cut section. Since water flows down hill, during construction stormwater will collect within the tunnel. This is very problematic for tunnel construction.

The temporary drainage could be accomplished with the use of a pump or whatever other methods the contractor identifies. It is also recommended to begin the tunnel construction from the north end, so stormwater will flow downhill out of the tunnel. If the tunneling takes place from north to south, drainage from the south end of the project could be routed through the tunnel bores essentially eliminating the problem.

VALUE ENGINEERING DESIGN COMMENT # DC-39

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize steel plate girders and PCI beams for all structures (where applicable).

COMMENTARY:
Steel plate girders and PCI beams are the most economical solutions for span lengths up to 200' (160' for PCI beams). Therefore, unless span lengths dictate otherwise, the VE Team recommends their use to minimize project costs. Also, the Kentucky Transportation Cabinet's Director of Bridge Design prefers steel plate girders and PCI beam designs, which will shorten review time.

VALUE ENGINEERING DESIGN COMMENT # DC-40

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize permanent decorative accents that are bolted on the side of the structures in lieu of using haunched girders.

COMMENTARY:
Unless the span lengths on the structures exceed 200', the VE Team does not recommend using haunched girders. If the aesthetics are deemed important, then the VE Team recommends permanent decorative accents that are bolted to the structure. This has been used numerous times in Kentucky.

VALUE ENGINEERING DESIGN COMMENT # DC-41

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Maintain existing sludge pond in its current location and jointly use the ROW with the Louisville Water Company.

COMMENTARY:
The proposed design extends across an existing sludge pond which is owned by the Louisville Water Company. The proposed ROW will clip the corner of the pond; however, the proposed road is elevated by the proposed construction of a bridge with 70’ (+ or -) vertical clearance. In lieu of relocating the existing sludge pond, it would be advantageous to develop an air space agreement to leave it in place. This has precedence in District 5 with the downtown I-64 (Riverside Expressway) elevated roadway as well as the Shawnee Golf Course under I-64 near the Sherman Minton Bridge.

VALUE ENGINEERING DESIGN COMMENT # DC-42

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Relocate Harrod's Creek to reduce the length of the Harrod's Creek Bridge.

COMMENTARY:

The current plans show constructing a bridge from station 136 + 50 to station 150 + 50 to span over the Harrod's Creek and River Road. This structure is approximately 1,400 ft and consists of twin bridges with a 63 ft out to out bridge width. Using the estimated $282/SF cost from the supplied cost estimate, it is easy to calculate that for every linear foot, the bridge can be shortened and KYTC could realize a savings of $3,550 per LF. Thus, a 100 LF reduction would yield $355,000 savings. Consideration could be given to shift Harrod's Creek to possibly reduce the overall bridge length and cost.

VALUE ENGINEERING DESIGN COMMENT # DC-43

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize the existing construction contract for at least 5 years of maintenance for the landscaping of the project.

COMMENTARY:
A long term landscape contract, requiring a five year maintenance commitment has several advantages:

- Provides an incentive to the landscape contractor to provide a quality job
- Gives the maintenance agency time to build up their landscaping personnel, equipment, and skills.
- Increases the probability that the landscape plantings will be fully established by the time the maintaining agency takes over

VALUE ENGINEERING DESIGN COMMENT # DC-44

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Improve River Road from US-42 to the project ROW (at least) for use during construction.

COMMENTARY:
River Road from US-42 to the project ROW must be used for construction access. This will change the nature of the traffic along the roadway. In order to improve safety and durability of River Road the VE Team recommends road improvements to River Road.

The VE Team recommends constructing a 3 lane curb and gutter section and improving the geometrics of the intersection with US-42. We estimate the costs for this work to be approximately $3 million.

Because width constraints and community resistance may not allow for the ideal section stated above, at the very least the road must be reconstructed to handle construction traffic, the drainage must be improved, and the safety must be improved as much as possible. The VE team estimates the improvements necessary will cost approximately $1.5 to $2 million.

An extension of the improvements beyond the project ROW, or further to the west, could also be considered. This will mean additional money from that listed above.

VALUE ENGINEERING DESIGN COMMENT # DC-45

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Reevaluate the 4F requirements to allow cut and cover construction of the tunnel in lieu of boring the tunnel.

COMMENTARY:
The original design utilizes two bored tunnels under the Drumanard Estate to protect original landscape architecture designed by Frederick Law Olmstead. The cost of the tunnel on this project has escalated from $90 million to nearly $260 million. The VE Team strongly recommends utilizing a cut and cover construction technique for the tunnel. A separate VE recommendation identifies almost $170 million savings by utilizing cut and cover in lieu of boring practices.

The VE Team is under the assumption that the only reason the tunnel is requiring boring is to protect the historic (4F) landscaping of Mr. Olmstead. The VE Team recommends reevaluating the 4F requirements to allow cut and cover construction of this tunnel. After cut and cover construction is completed, the site could be redesigned by several currently renowned landscape architects. This could become a new cultural monument for the community.

The 4F guideline state that this property may not be adversely impacted if a “prudent” and “feasible” alternative exists. When this project started ($90 million tunnel), tunneling under the site was a prudent and feasible alternative to impacting this property. At $260 million dollars, the VE Team feels the tunnel is no longer a prudent alternative.

The VE Team also encourages looking at options to satisfy impacted groups in lieu of boring this tunnel. For example, a large endowment fund could be created at the University of Louisville to further the landscape architectural principles utilized by Frederick Law Olmstead. This would have a better long term benefit to the community at large, and it will further the teachings of Mr. Olmstead. It is the VE Team’s opinion that this endowment would honor him more than saving the trees on the Drumanard Estate.

Assuming FHWA approves the change, the KYTC should explore creative techniques to negotiate with the property to gain access as quick as possible for surface geotechnical exploration.

It is also recommended to acquire this site, by condemnation if necessary, to facilitate and maintain tunnel monitoring equipment. This will insure constant and secure access to the tunnel surface mounted equipment. Condemnation of the property may result in a court battle to determine fair price.

VALUE ENGINEERING DESIGN COMMENT # DC-46

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize security for emergency access road from the tunnel to River Road.

COMMENTARY:
The VE Team stresses the need for security at both ends of the emergency access road. This will reduce vandalism within the right of way and will ensure the quality of emergency response in the unlikelihood of a catastrophic terroristic episode. Necessary equipment and monitoring will be accomplished through proposed Intelligent Transportation Systems. Physical Barriers as simple as locked gates should also be utilized to enhance security.

VALUE ENGINEERING DESIGN COMMENT # DC-47

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Tunnel uphill (north to south) in lieu of tunneling in the downhill direction, and build a temporary bridge across Harrod's Creek to transport tunnel waste material to fill site.

COMMENTARY:
Uphill construction is usually considered better because of the advantages with groundwater removal. This results in an increase in face/excavation stability and tunnel muck removal. In this case, the direction is north to south.

A temporary bridge can be used to transport the tunnel waste material to the fill site north of the tunnel which is approximately 1,500 ft from the north portal. This will require an advanced acquisition of the ROW on the north side of the tunnel and fill sites.

VALUE ENGINEERING DESIGN COMMENT # DC-48

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize a belt conveyor to transfer material from the north end of the tunnel to the north side of Harrod's Creek.

COMMENTARY:
There is a restricted haul area between the north portal and the fill area between Harrod's Creek and the Ohio River. The terrain and the creek provide a challenge to the use of trucks and scrapers.

One potential method of moving this material is the use of a belt conveyor, running between station 135+00 and 150+00, a distance of 1500 feet. This technology has been in use by coal companies and quarries for many years, and by highway contractors with a need to move a significant amount of bulk materials in tight locations.

VALUE ENGINEERING DESIGN COMMENT # DC-49

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Pending the findings of the geotechnical investigation, utilize a continuous rock face in the cut section in lieu of a bench section.

COMMENTARY:
Pending definite geotechnical data, it appears with the exception of the Waldron Shale seam and the rock disintegration zone, the proposed rock cut faces can be steepened to 1/4": 1'. Out fall benches can be eliminated or the depths can be decreased between approximately stations 59+ 50 and at the beginning of the tunnel near Station 106 + 10 as well. This will reduce excavation, disposal of waste, and the cost associated with trucking.

VALUE ENGINEERING DESIGN COMMENT # DC-50

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Squeeze or move the typical section so that the noise wall is not directly on top of the existing 60” water line in conjunction with adjusting the typical width of the cut section.

COMMENTARY:
Beginning at the approximate station 58 + 50, the proposed noise barrier will end up on the top of the existing 60” water line. The two remain in conflict for the next 1,600 ft to approximate station 74 + 00. The VE Team proposes moving the noise wall (from station 58+50 to station 74+00) at least 5 ft from the edge of the top bench or to the proposed right of way line. This will eliminate the need to either relocate the waterline or have the waterline located beneath the noise wall.

VALUE ENGINEERING DESIGN COMMENT # DC-51

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize sheet flow and eliminate the drainage ditch on the top of the slope at station 82+00 to station 107+00.

COMMENTARY:
The existing design calls for an interceptor ditch behind the safety wall from station 82 + 00 to station 107 + 00. However, in many cases, this causes the need for purchasing additional ROW, and in some cases it causes additional parcels. The VE Team recommends eliminating this ditch and allowing the water to sheet flow instead. Weep holes can be placed in the safety wall or the wall can be placed slightly above the finished grade, perhaps 4".

VALUE ENGINEERING DESIGN COMMENT # DC-52

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Provide taper and emergency crossovers on roadway adjacent to both ends of the tunnel to accommodate two way traffic in each bore in case of an emergency situation.

COMMENTARY:
Some provisions are necessary to provide a method of crossing traffic over to the opposite side of the highway during emergency situations. Northbound traffic can be removed from the freeway from Ramp A. Southbound traffic will have to be diverted in Indiana.

Items to be considered:

- A gated access to the multi-use path around station 160+00, to move trapped vehicles off the roadway to River Road. The gate and any bike path bollards should be designed to be removable by first respondents on the scene.
- For longer term closures of one bore, provide a section of median outside the taper section that can be removed with operating agency equipment. Location and length should be able to accommodate a two lane crossover.

VALUE ENGINEERING DESIGN COMMENT # DC-53

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Work with TRIMARC to add performance specification component to the existing contract to ensure the tunnel monitoring is compatible with the existing system.

COMMENTARY:
Tunnel operations will be monitored remotely most likely by TRIMARC and the local 911 call center.

Work with TRIMARC and Metro Louisville to ensure video feeds, carbon monoxide, and fire alarms are displayed to the proper agencies, and that the communication equipment works with each agency.

Keep in contact with each agency as their communication standards are in flux.

VALUE ENGINEERING DESIGN COMMENT # DC-54

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize agreement with the Metro Parks to maintain the multiuse path.

COMMENTARY:
Given the limited staff and budget of the District 5 maintenance crew, it is not reasonable to expect them to keep the multiuse path swept and free from debris. Therefore, it is recommended that the KYTC enter into a memorandum of agreement with the Metro Louisville Parks Department so they will assume responsibility of the path's up keep or even ownership. Page 73 of the Guide for Development of Bicycle Facilities clearly states that "neglecting routine maintenance eventually may render bicycle facilities may become a liability to the state or community." KYTC District 5 maintenance will not have sufficient means to give proper attention to this path unless additional funding is approved.

VALUE ENGINEERING DESIGN COMMENT # DC-55

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize anti-graffiti coatings along with specific plantings in strategic locations along walls and around bridge piers.

COMMENTARY:
The VE Team sees long term benefits and cost savings associated with reducing labor equipment, maintenance, and materials to coat walls and piers to a predetermined height with an anti-graffiti coating. The VE Team recommends utilizing stiff and thorny plantings around the bridge piers and the ends of the sound walls. This should detour the common vandalism and, it will help to ensure an aesthetically pleasing project to the traveling public and those living in the adjacent properties.

VALUE ENGINEERING DESIGN COMMENT # DC-56

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize “quiet” asphalt in the sound calculation or do not utilize “quiet” asphalt.

COMMENTARY:
The use of asphalt pavement mixture to reduce tire noise is being utilized in other states in the country, (most notably Arizona). This “quiet pavement” technology should be explored further on this project if credit can be taken for the reduction noise from the road/tire interaction.

VALUE ENGINEERING DESIGN COMMENT # DC-57

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Consider work hour schedule exception for tunnel and for construction season.

COMMENTARY:
Work hours are set by the ROD as 7 am to 7 pm. These hours will not permit an optimal construction schedule, nor are they applicable to all locations on the project. Noise controls are applicable in the residential areas south of the tunnel. Equipment operation should be limited in these areas from 7 am to 9 pm.

Work within the tunnel should not affect any neighborhood. No work restrictions should be necessary. Some noise standards may be appropriate at the tunnel portals.

The area between the north tunnel portal and the river bridge is not densely populated and contains more commercial in the mix. Noise controls without restricted work hours should be sufficient in this area.

VALUE ENGINEERING DESIGN COMMENT # DC-58

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize a narrow and longer stormwater detention basin at the southern tunnel portal, which could be located and maintained between the two inside shoulders in lieu of the originally designed detention basin that requires lane closure during maintenance.

COMMENTARY:
The original design utilizes a wide foot print for the south portal storm-water treatment chamber. This extends beneath the road bed structure which is utilized by the traveling public. In lieu of this, the VE Team recommends that the chamber be made to fit beneath the median and the median shoulders. The advantages will include:

- Reduced exposure to maintenance crews within actual traveled lanes
- Reduce delays to the traveling public by maintaining open lanes.
- Reduce complete closure of the roadway in event of a catastrophic failure within the chambers of their future repair/reconstruction.

VALUE ENGINEERING DESIGN COMMENT # DC-59

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize edge drains in the pavement design currently not shown on the proposed typical drawings.

COMMENTARY:
The original design does not indicate the use of any edge drain system. This drainage system is vital to the pavement structure longevity and maintenance. The VE Team recommends these drains be added to the design.

VALUE ENGINEERING DESIGN COMMENT # DC-60

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize a 4'-15'-6' roadway section for Ramp A in lieu of a 6'-15'-8' roadway section.

COMMENTARY:
The Kentucky Transportation Cabinet's Highway Design Manual recommends that single lane ramps have a minimum pavement width of 15 ft with a 6 ft usable shoulder on the right and a 4 ft usable shoulder on the left. This agrees with Chapter 10 of AASHTO's A Policy on geometric design of highways and streets. Since Ramp A is quite expensive, the VE Team recommends going with the minimum.

VALUE ENGINEERING DESIGN COMMENT # DC-61

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Roadway excavation unit price in the estimate appears to be low.

COMMENTARY:
The VE Team understands that the rock excavation with the restrictive vibration limits is more expensive than with less restrictive vibration limits. The restrictive limits causes the number of blast holes to substantially increase, therefore the amount of labor substantially increases. This comment is substantiated by the actual price that was submitted as part of the exploratory tunnel bid, which we understand to be approximately $40 per cubic yard.

VALUE ENGINEERING DESIGN COMMENT # DC-62

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Examine the use of a full interchange with US-42 in lieu of a half interchange.

COMMENTARY:

The original design specifies a ramp (Ramp A) from KY-841 northbound to US-42 and a ramp (Ramp B) from US-42 to KY-841 southbound. There is no access from US-42 to northbound KY-841 towards Indiana. Traffic going to Indiana from US-42 will have to access KY-841 heading southbound and go through two loop ramps at I-71 to gain access to KY-841 northbound. The VE Team feels that a full interchange is something to consider again before spending a large amount of money at this location. At the VE outbriefing, it was identified that local users are already asking for a full interchange at this location. For the amount of infrastructure being proposed, the VE team recommends improving the access to Indiana. Addition of a full interchange could increase the capital cost of the project, but it will be more cost efficient constructing it with this project as apposed to retrofitting the interchange as a separate future project.

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.

CONTENTS

APPENDIX A
Participants

APPENDIX A - Participants

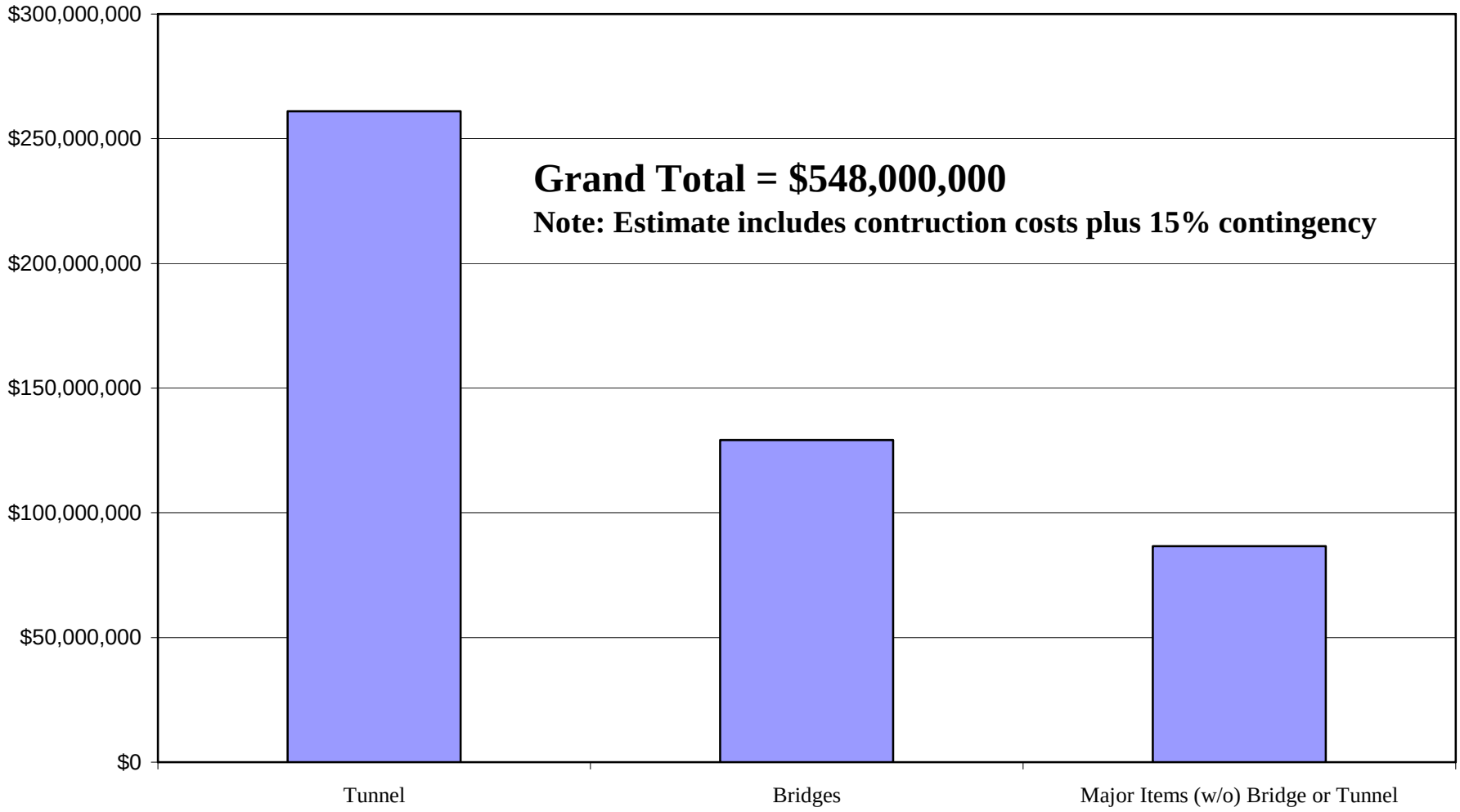
Workshop Attendance

Attendees				Participation						
				Meetings		Study Sessions				
Name	Organization and Address	Tel # and Email	Role in wk shop	Intro	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Holly Bezold	URS 36 East Seventh St. Ste. 2300 Cincinnati, OH 45202	513-307-.6270 Holly_Bezold@urscorp.com	VE Technical Recorder	X	X	X	X	X	X	X
Matt Bullock	KYTC 200 Metro St. Frankfort, KY 40622	502-367-6411 Matt.Bullock@ky.gov	KYTC Owner	X						
Greg Groves	URS 325 W Main St. Ste. 1200 Louisville, KY 40202	502-217-1509 Greg_Groves@urscorp.com	VE Design Expert	X	X	X	X	X	X	X
Mike Guter	URS 3950 Sparks Dr. SE Grand Rapids, MI 49546	616-574-8477 Mike_Guter@urscorp.com	VE Surface Transportation Expert	X	X	X	X	X	X	X
Rob Harris	CTS 305 N Hurstbourne Parkway Ste 100 Louisville, KY 40222	502-394-3841 RHarris@CTSGEC.com	Department Project Manager	X	X					
Jerry Leslie	H.W. Lochner 1040 Monarch St. Ste. 300 Lexington, KY 40513	859-224-4476 JLeslie@HWLochner.com	SDL4 Project Manager	X	X					
Christian Maguire	URS 277 West Nationwide Boulevard Columbus, OH 43215	614-464-4500 Christian_Maguire@urscorp.com	VE Tunnel Expert	X	X	X	X	X	X	X
Dick McGuinness	URS 277 West Nationwide Boulevard Columbus, OH 43215	614-464-4500 Dick_McGuinness@urscorp.com	VE Traffic Expert	X	X	X	X	X	X	X
Kim Mulder	KYTC 200 Metro St. Frankfort, KY 40622	502-564-0319 Kimberley.Mulder@ky.gov	KYTC Owner	X						
Norman Roush	URS # 4 Mission Way Ste. 201 Scott Depot, WV 25560	304-757-6642 Norman_Roush@urscorp.com	VE Geometrics Expert	X	X	X	X	X	X	X
Kevin Rust	URS 36 East Seventh St. Ste. 2300 Cincinnati, OH 45202	513-419-3503 Kevin_Rust@urscorp.com	VE Construction Expert	X	X	X	X	X	X	X
John Sacksteder	CTS 305 N Hurstbourne Parkway Ste 100 Louisville, KY 40222	502-394-3847 Jsacksteder@CTSGEC.com	CTS Project Manager		X					
Kyle Schafersman	URS 8300 College Blvd. Ste. 200 Overland Park, Kansas 66210	913-344-1019 Kyle_Schafersman@urscorp.com	VE Team Leader	X	X	X	X	X	X	X
Christopher T. Smith	URS 325 W Main St. Ste. 1200 Louisville, KY 40202	502-382-6013 aels@bellsouth.net	VE Maintenance Expert	X	X	X	X	X	X	X
Debby Taylor	H.W. Lochner 1040 Monarch St. Ste. 300 Lexington, KY 40513	859-224-4476 DTaylor@HWLochner.com	SDL4	X	X					
Jadie Tomlinson	KYTC 200 Metro St. Frankfort, KY 40622	502-564-0319 Jadie.Tomlinson@ky.gov	KYTC Owner	X	X					
Kevin Villier	CTS 305 N Hurstbourne Parkway Ste 100 Louisville, KY 40222	502-394-3855 KVillier@CTSGEC.com	KYTC Section 4 Manager	X	X					
Todd White	H.W. Lochner 1040 Monarch St. Ste. 300 Lexington, KY 40513	859-224-4476 twhite@hwlochner.com	SDL4 Project Engineer		X					

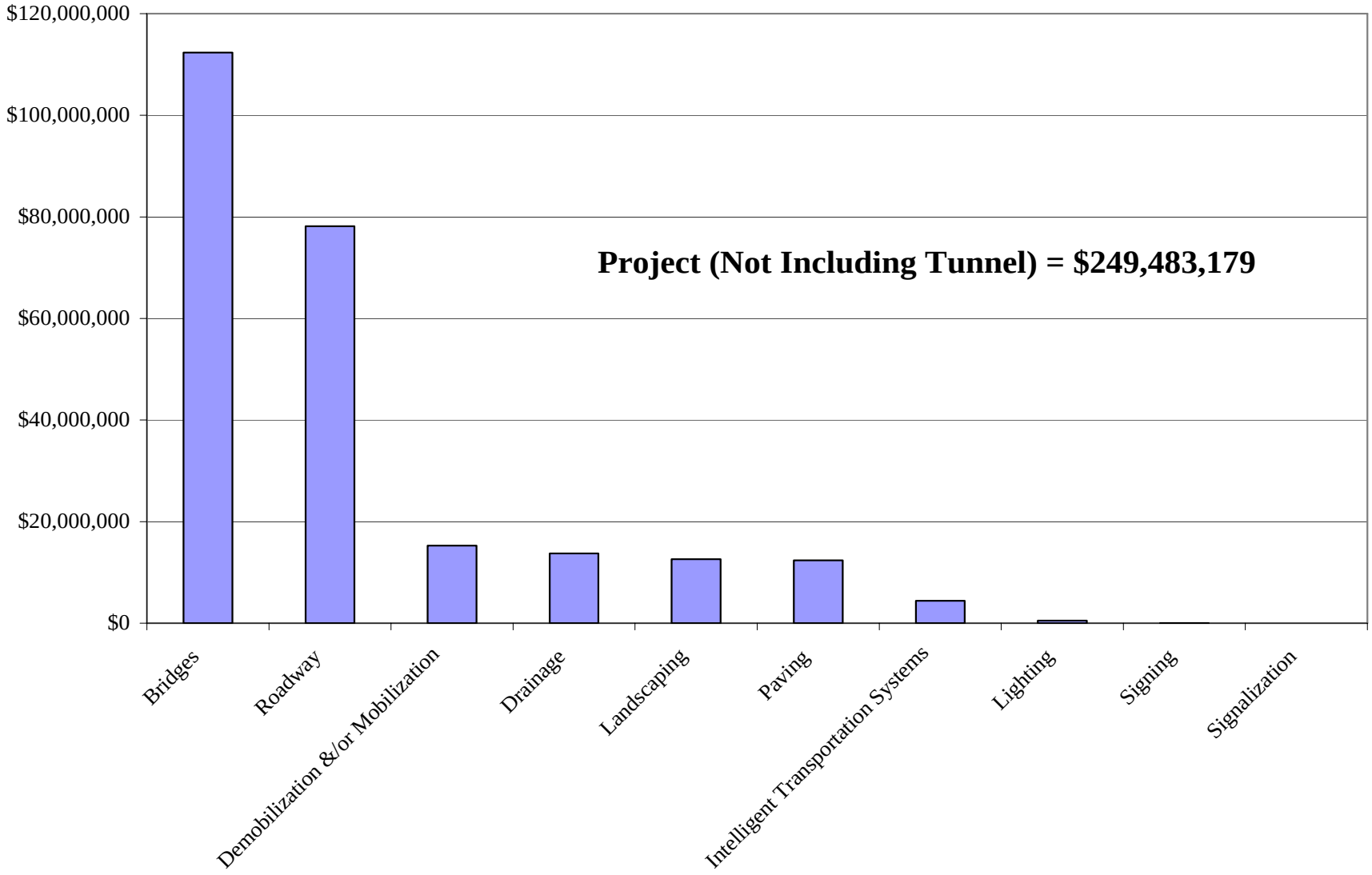
APPENDIX B
Cost Information

APPENDIX B - Cost Information

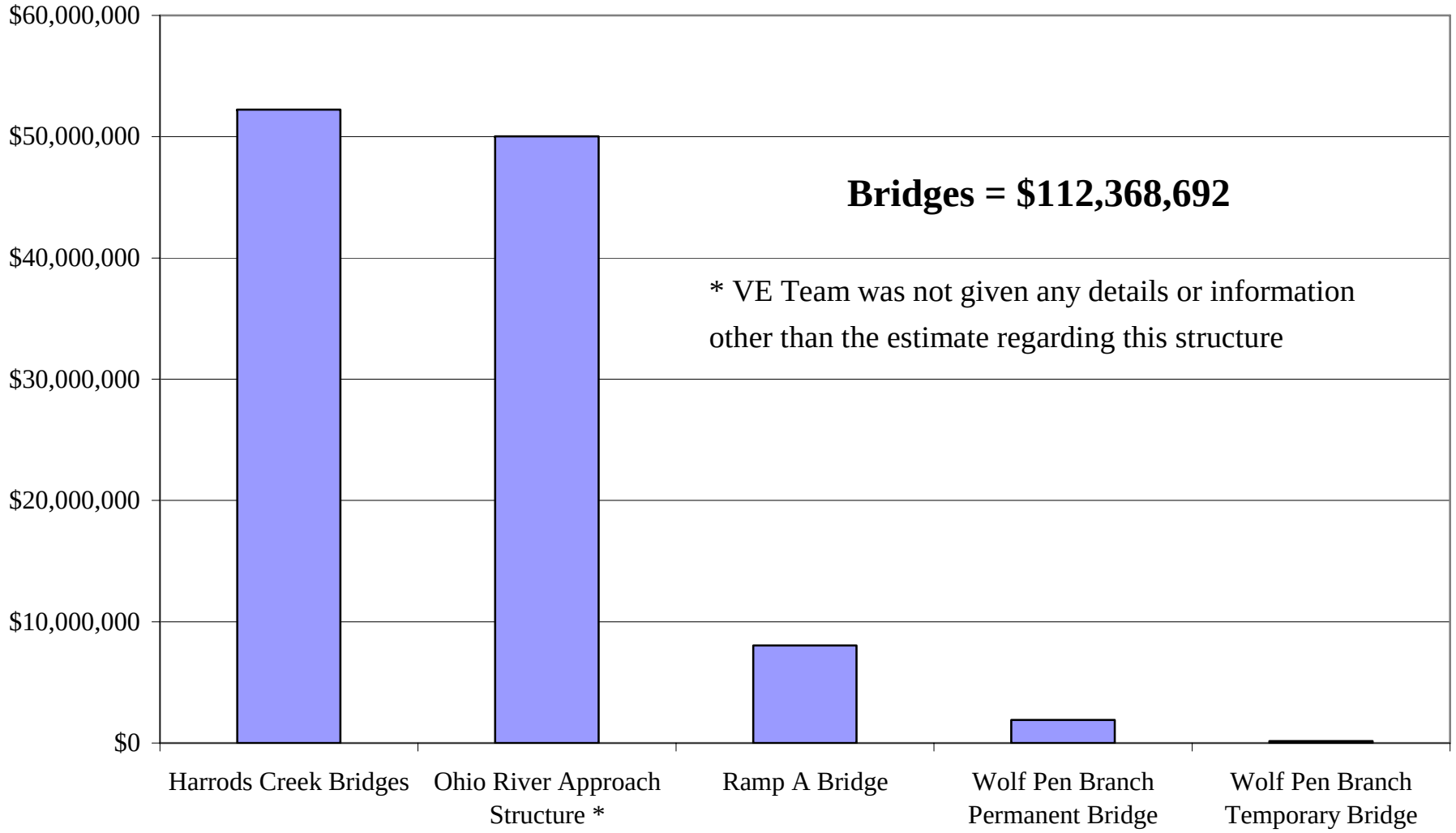
Ohio River Project, Section 4 - East End Bridge Approach
Cost Model - Total Project



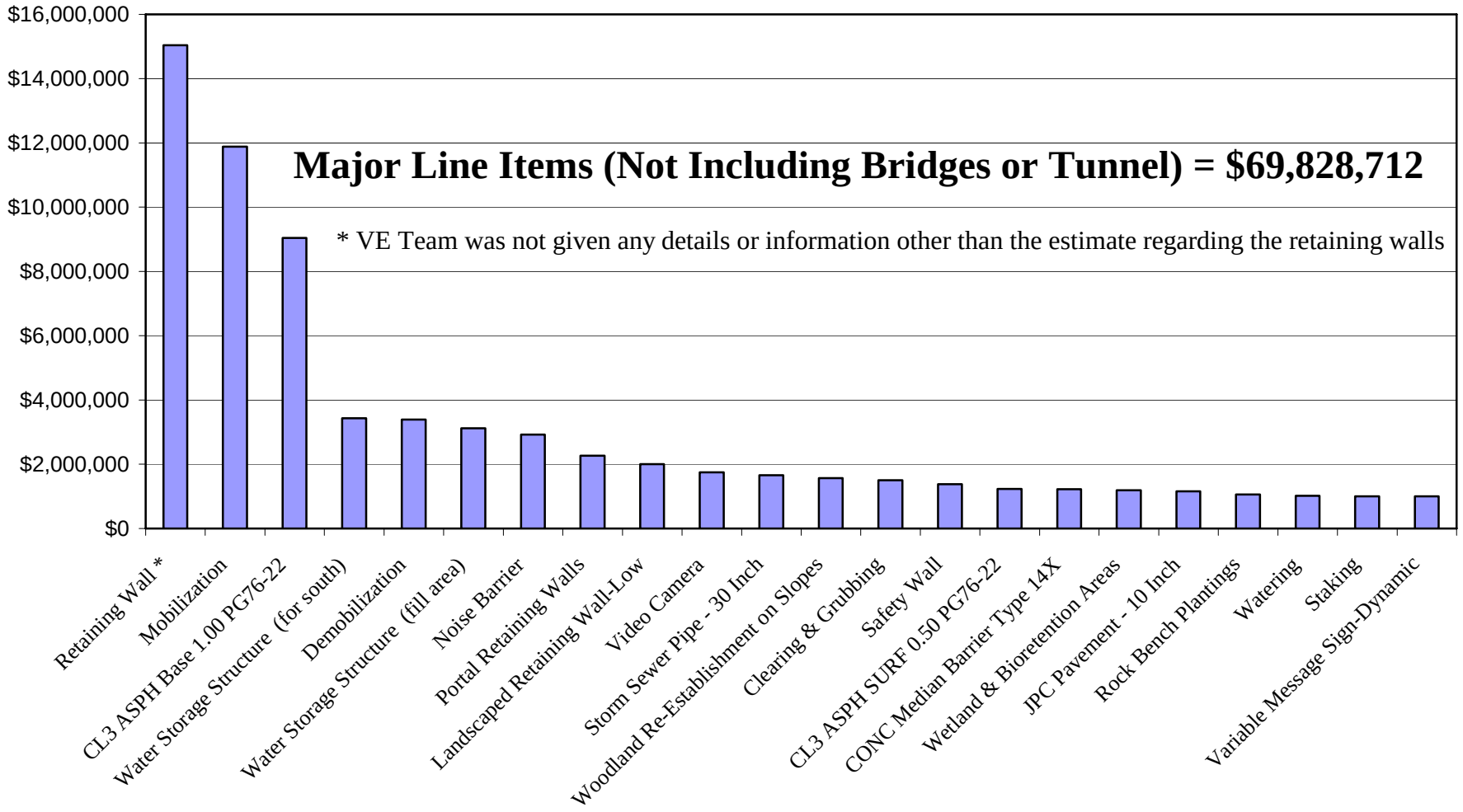
Ohio River Project, Section 4 - East End Bridge Approach
Cost Model - Project (Not Including Tunnel)



Ohio River Project, Section 4 - East End Bridge Approach
Cost Model - Bridges



Ohio River Project, Section 4 - East End Bridge Approach
Cost Model - Major Line Items (Not Including Bridges or Tunnel)



APPENDIX C
Function Analysis

APPENDIX C - Function Analysis

Function Model

Item	Function
GEOMETRICS	
Width and size of tunnel (52’ x 72’)	Accommodate full shoulders & walkways
- Inside shoulders 10’	Accommodate maintenance
- Outside shoulders 8’	Maintain traffic
- Sprayed shot-crete	Accommodate size and profile of tunnel
Height of tunnel	Support water pressure
Alignment of Ramp A	Avoid Bridgepointe
- Flyover with 290’ span	Maintain 70 mph design speed
- Skewed	
- No deceleration lane	Utilize KYTC design practice
Length of tunnel (1900’)	
Cross-section - 30’ clear zone	Accommodate future widening
- Benching (15’ benches – 20’ verticals)	Unknown geotechnical conditions
	Possibly accommodate landscape
- Back slope seam conservative (20’)	Unknown geotechnical conditions
45’-60’ separation between tunnels	Accommodate boring design
Landscape	Satisfy ROD concessions
- $12 million	
Mainline alignment	
- Follows US 40	Utilize existing ROW
- Large skew	Minimize disturbance
70 MPH design speed	Accommodate FHWA requirement
Embankment shape	Utilize existing ROW
- taking ~20 properties next to existing ROW	Shifted alignment
- 2:1 fill section outside slope	Waste material
- 2,000,000 CY of waste material	Eliminate guardrail
	Improve aesthetics
- 6:1 slope inside median	Utilize existing material
Berms near Roswell	Hide roadway
- Increase ROW width	Improve aesthetics
- Historic property	Utilize state owned property

Item	Function
TRAFFIC	
Maintain 2 lanes down KY-841 to US-42	Maintain community access
Temporary roadway	
-Wolf Pen Branch Road	Construct new bridge
	Maintain traffic
Temporary bridge	Allow Wolf Pen Branch Road to cross new construction
Material hauling	
- 2,000,000 CY waste material	Waste material
- Utilize Gene Snyder (5 miles away)	Promote urban development
	Move material out of floodplain
Future traffic capacity	Increase size of tunnel
River Road access and bridge	Utilize construction and local traffic
- needs improvement	
CONSTRUCTABILITY	
Rock cut	Lower grade to tunnel entrance
- 0'-80' depth by 230' width (1.8 M CY)	
South excavation first	
- no temporary drainage identified for rock cut	Left up to contractor
Tunnel from north	Better to tunnel uphill
	Maintain critical path
Underground sediment basins	
- Underneath 80' rock cut before tunnel	
- 120' wide by 150'-200' long by 10' deep	Increase capacity
- Located under pavement	Improve aesthetics
- 4 separate sediment basins (low spots)	Utilize gravity
- drainage lines under tunnel	
8 separate construction contracts	
- Starts south of US-42	
- North of tunnel section – unknown access	Accommodate ROD concessions
STRUCTURES	

Item	Function
Wolf Pen Branch Road	
- 2 span tall pier permanent	Utilize cost efficient
- Temporary bridge for construction	Accommodate traffic at construction
- Footpath with stone aesthetic on bridge	Improve aesthetics
- Maximize span and minimize piers	Improve aesthetics
- Exposed aggregate footpath	Improve aesthetics
- Pre-stressed concrete I-beams	Utilize cost efficient
- Stone façade on barrier	Improve aesthetics
- Wooden fence existing	Assumed replaced with noise wall
- 4% grade	
Ramp A over KY-841	
- 4 span curved plate girder	Utilize cost efficient bridge
- Taking easement for construction wall	Keep people & animals off highway
	Delineate property
- 32’ wide including shoulders	Meet standards
- 1040’ length	Accommodate skew
- 2.5% grade	
- 6’ shoulder inside; 1-15’ lane, 8’ outside	Accommodate future widening
Harrod’s Creek	
- Two 63’ wide sections	Results of tunnel separation
- 3 – 12’ lanes spans (12’ shoulders on both sides)	Utilize breakdown lane
	Improve maintenance
	Meet ideal design
- 7 spans	Maintain navigation channel
	Balance aesthetics
	Improve view from harbor
Haunched girders	Improve aesthetics
6 girders (10.5’ spacing)	Function of design
Constructability issue of this bridge	
- North end (Sta. 150+85) and storm water detention pond (Sta. 150+50)	Oversight of design
Sound walls	Accommodate ROD concessions
Approach structure	
- unknown details ($50 million)	Related to East End Cable Stay Bridge
TUNNEL	
Width and size of tunnel (52’ x 72’)	Accommodate full shoulders & walkways
- Inside shoulders 10’	Accommodate maintenance
- Outside shoulders 8’	Maintain traffic

Item	Function
- Sprayed shot-crete	Accommodate size and profile of tunnel
	More precise profile
Top side access for drilling on historic property	Install tunnel monitoring equipment
- $700,000 worth of instrumentation	Monitor tunnel stresses
- 40 - 6” holes drilled from topside of tunnel	Install tunnel monitoring sensors
- Up to 50’ deep	
Exploratory tunnel	Acquire geotechnical material
- 12’ x 12’ in keystone of finished tunnel	Identify where shale begins
- Top side tunnel monitoring equipment	Monitor tunnel conditions
Main tunnel drainage	
- Inconsistency within plans	
- 9,000 LF of mainline roadway drainage to be accepted and transmitted by tunnel drainage system	Eliminate pumping water elsewhere
Diverted small creek away from protected site	Allows for tunnel construction
Tunnel portals	
- 4 separate walls with retaining wall on each end	Access tunnel
- Landscaped and stepped portal (3:1 slope)	Improve aesthetics
Jet fan and monitors	Ventilate space
Lighting and signage	Accommodate passage
MAINTENANCE	
Access for landscaping (unknown location)	Maintain landscaping
Irrigation for landscaping	Maintain landscaping
Multiple maintenance contract	Maintain landscaping
Tunnel maintenance	
- Drainage	Channel stormwater
- Hazmat shutoff system	Contain spill
Sediment basins – Unknown, designed confined spaces, disposal undefined	Capture sediment
Ornamental fence – Aesthetic feature	Improve aesthetics

Item	Function
Different types of grass – different maintenance	Improve aesthetics
Bike paths maintenance – 1,000 LF of path that has to be maintained	Satisfy community
Security on access road limits emergency vehicle access	Secure roadway
Security to instrumental panel within tunnel	Secure equipment
Maintenance to bridge normal	Maintain bridge
Storm water pipes on bridge – problematic	Subjected to corrosion
Access to crossover taper to allow two way traffic within each tunnel bore	Maintain traffic Service tunnel
No ITS board to inform traffic of upcoming crossover	Warn pedestrians
Bentonite ditch – how do you maintain it	Improve natural aesthetics
- Trucked from Texas	Acquire material
- Extrude 2” liner within ditch	Naturalize appearance

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.**
1	Utilize one construction bidding in lieu of eight separate construction contracts	DC w/ 30	M. Guter
2	Utilize Design-Build in lieu of Design-Bid-Build for tunnel or for the entire project including the tunnel	Develop w/ 23	C. Maguire
3	Construct within existing ROW south of US-42 in lieu of taking additional ROW/easement on the east side	Develop	K. Rust
4	Utilize one open cut and cover (reduced depth) tunnel in lieu of two deeper bored tunnels	Develop	C. Maguire
5	Reroute KY-841 to the east of Bridgeport around all historic properties	DC	N. Roush
6	Utilize a toll way for the tunnel or for the entire project	DC	D. McGuinness
7	Let project as a Design-Build-Operate-Transfer contract or a Build-Operate-Transfer contract in lieu of a Design-Bid-Build contract	Develop	C. Maguire
8	Modify vertical alignments south of tunnel to increase grade to 4% from 2.5% in order to reduce excavation	Develop	N. Roush
9	Place Ramp A on the east side of KY-841 in lieu of installing flyover to the west side	Develop	D. McGuinness
10	Build 3-2 lane tunnel structures in lieu of 2-3 line tunnel structures	Eliminate	
11	Utilize 16.5’ vertical clearance in lieu of 17’ vertical clearance on the tunnel	Develop	M. Guter
12	Utilize a 4’-36’-4’ tunnel section in lieu of an 8’-36’-10’ tunnel section	Develop	G. Groves
13	Utilize a 5’-36’-10’ tunnel section in lieu of an 8’-36’-10’ tunnel section	Develop	G. Groves
14	Utilize a barrier wall and a 20’ off set in lieu of a 33’ off set in the cut section south of the tunnel (closed ditch scheme)	Develop	N. Roush
15	Utilize open storage for drainage in lieu of under road storage in the Belleview area	Develop w/ 17	C. Smith
16	Utilize natural drainage system in lieu of capturing stormwater in the Belleview area	Develop w/ 18	C. Smith
17	Utilize closed drainage storage in lieu of under road storage in the Belleview area	Develop See 15	C. Smith
18	Utilize green methods of stormwater capture wherever possible	Develop See 16	C. Smith & C. Maguire
19	Utilize surface exploration techniques in lieu of exploratory tunnel project	Develop w/ 53	K. Rust
20	Verify stormwater detention basin location with respect to the Harrod’s Creek north bridge abutment to verify they don’t overlap	DC	K. Rust
21	Reducing the Harrod’s Creek Bridge by a length of ~250’	Eliminate See 38	
22	Utilize 60 mph design speed in lieu of 70 mph design speed throughout project	Develop	G. Groves
23	Make geotechnical investigation part of the contractor’s scope of work in	See 2	C. Maguire

List of CREATIVE IDEAS			
ID #	**Name of Idea / Description**	**Develop Status**	**TM Resp.**
	lieu of exploratory tunnel (must be D-B)		
24	Provide stipend to all tunnel Design-Build firms that submit qualified bids	DC w/ 25	D. McGuinness
25	Prequalify all tunnel contractors before bidding takes place	See 24	D. McGuinness
26	Utilize scuppers in lieu of closed pipe drainage system on the bridges	DC	C. Smith
27	Utilize contractor to negotiate with Olmstead to build an at grade highway in lieu of constructing the tunnel and cut sections	Eliminate	
28	Utilize specialized tunnel boring machine in lieu of the proposed method	Eliminate	
29	Utilize temporary alignment to the west of or along Spring Dale Road and close Wolf Pen Branch Road overpass, and construct entire cut section in one phase. Utilize temporary connection between Spring Farm Road and KY-841 during construction.	Develop	D. McGuinness
30	Let tunnel contract before any other construction contract	See 1	M. Guter
31	Place the south 350’ of Ramp A in rock cut in lieu of constructing elevated bridge	Develop	N. Roush
32	Utilize 4:1 side slopes between Sta. 156 to Sta. 168 (near Belleview) in lieu of proposed slopes to incorporate wetland area at the bottom of slope	Develop	C. Smith
33	Utilize rock from operations in lieu of wasting off-site material in quarry	DC	C. Smith
34	Utilize flatter side slope between Sta.156 and Sta. 168 (near Belleview) in lieu of a proposed side slopes through these stations	Develop	C. Smith
35	Utilize uniform pavement design that include full depth shoulders in lieu of partial depth shoulders	DC	C. Smith
36	Reduce ROW acquired in this entire project	Develop	K. Rust
37	Utilize landscaping that doesn’t require irrigation at any location within the project limits to ensure plant survival	Develop	D. McGuinness
38	Reduce the Harrod’s Creek Bridge length from ~1,470’ to ~1,200’	Develop	K. Rust
39	Provide provision for temporary drainage for south portal of tunnel during construction	DC	K. Schafersman
40	Utilize public meeting describing tremendous funding and impending tax increases to construct this project	Eliminate	
41	Utilize steel plate girders and PCI beams for all structures	DC	K. Rust
42	Utilize permanent decorative accents bolted on the side of the structures in lieu of using haunched girders	DC	K. Rust
43	Relocate the river approach structure to the west of the current location	Eliminate	
44	Maintain existing sludge pond in its current location and jointly use the ROW with the Metro Sewer Department	DC	G. Groves
45	Tunnel from US-42 all the way to the Indiana side of the Ohio River (approximately 2 miles)	Eliminate	

List of CREATIVE IDEAS			
ID #	**Name of Idea / Description**	**Develop Status**	**TM Resp.**
46	Relocate Harrod's Creek to reduce the length of the Harrod's Creek Bridge	Develop w/ 52	G. Groves
47	Reduce the width of Harrod's Creek Bridge by 16' by utilizing 4' shoulders (4'-36'-4') in lieu of 12' foot outside shoulders (12'-36'-12') on both bridges	Develop	K. Rust
48	Utilize existing construction contract for at least 5 years of maintenance for the landscaping of the project	DC	D. McGuinness
49	Eliminate shared use paths from the Ohio River to River Road	Eliminate	
50	Reduce width of shared pedestrian path from 15' to 8' to meet the minimum requirement for 2-way pedestrian path	Develop	G. Groves
51	Improve River Road from US-42 to the project ROW (east side of project) and utilize for construction vehicle access	DC	M. Guter
52	Relocate Harrod's Creek and Marina Drive in order to shorten the Harrod's Creek Bridge	See 46	G. Groves
53	Utilize directional drilling in lieu of boring an exploratory tunnel to acquire geotechnical information	See 19	K. Rust
54	Make an endowment to the University to Louisville to establish a landscape architecture program in the name of Mr. Olmstead so they will allow a cut and cover tunnel then new prominent landscape architecture can be developed on that site	DC w/ 55, 56, 57	G. Groves
55	Have KYTC purchase the Olmstead property by making an offer they can't refuse	See 54	
56	Negotiate a easement lease payment program where KYTC pays Olmstead installments for the design life of the tunnel in exchange for the 4 years necessary to cut and cover construction of the tunnel as well as the limited access to site required to monitor the tunnel	See 54	
57	Utilize condemnation to purchase Olmstead property	See 54	
58	Utilize security for emergency access road from tunnel to River Road	DC	C. Smith
59	Eliminate the bike path on the approach bridge leading to the East End Bridge	Eliminate	
60	Utilize uphill (north to south) tunnel construction in lieu of downhill tunnel construction, utilize a temporary bridge across Harrod's Creek to transport material to fill site of the project, and get advanced acquisition of ROW on the north side of the tunnel	DC	C. Maguire
61	Utilize a belt to transfer material from the north end of the tunnel to the north side of Harrod's Creek	DC	D. McGuinness
62	Pending the findings of the geotechnical information, utilize a continuous rock face in the cut section in lieu of a bench sections	DC	C. Smith
63	Squeeze or move the typical section so the noise wall is not directly on top of the existing 60" water line in conjunction with adjusting the typical width of the cut section	DC	N. Roush

List of CREATIVE IDEAS			
ID #	**Name of Idea / Description**	**Develop Status**	**TM Resp.**
64	Utilize sheet flow and eliminate the drainage ditch on the top of the slope at Sta. 82+00 to Sta. 107+00	DC	N. Roush
65	Do not utilize vegetation within the interior barrier wall system	Develop	C. Smith
66	Provide taper and emergency crossovers on roadway adjacent to both sides of the tunnel to accommodate two way traffic in each bore for emergency situations	DC	D. McGuinness
67	Work with TRIMARC to add a performance specification component to the existing contract to ensure the tunnel monitoring is compatibility with the existing system	DC	D. McGuinness
68	Utilize agreement with the Metro Park Service to maintain the multiuse path	DC	G. Groves
69	Utilize a sod lining in the drainage ditches in lieu of bentonite lining	Develop	K. Rust
70	Utilize an anti-graffiti veneer on all decorative walls	DC	C. Smith
71	Utilize “quiet” asphalt in the sound calculation or do not utilize “quiet” asphalt	DC	G. Groves
72	Consider work hour schedule exception for tunnel and for construction season	DC	D. McGuinness
73	Utilize existing ramp from KY-841 to I-71 west (Sta. 20+50 to Sta. 14+50) in lieu of replacing this section of ramp	Develop	N. Roush
74	Eliminate the water/oil separator and treatment holding tank within the tunnel	Develop	C. Maguire
75	Utilize a narrow and longer stormwater detention basin at the southern tunnel portal, which could be located and maintained between the two inside shoulders in lieu of the originally designed detention basin that requires lane closure during maintenance	DC	C. Smith
76	Utilize edge drains in the pavement design currently not shown on the proposed typical drawings	DC	C. Smith
77	Ramp A is currently designed with a 15 ft lane, an 8 ft right shoulder, and a 6 ft left shoulder. Ramp A should be designed with a 15 ft lane, a 6 ft right shoulder, and a 4 ft left shoulder	DC	K. Rust

Development Status Legend:

Develop: Idea is considered by the VE Team to be a viable value enhancement possibility and is currently being developed as a VE recommendation

Eliminate: Idea was not considered to enhance the value of the project and has been eliminated from further consideration by the VE Team

DC: Idea is being developed as a Value Engineering Comment to the designers with no easily quantifiable cost associated

END OF REPORT

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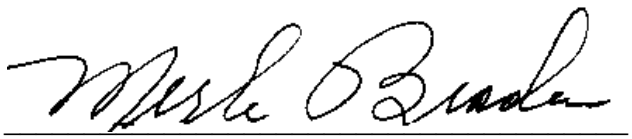

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