Value Engineering Study

US 127 FROM KY 90 TO JAMESTOWN BYPASS

CLINTON & RUSSELL COUNTY, KENTUCKY

ITEM NUMBER 8-108.00 & 8-115.10
VE STUDY NUMBER 201102

Study Date: February 28 - March 4, 2011

Kentucky Transportation Cabinet
Frankfort, Kentucky

URS

US 127 FROM KY 90 TO JAMESTOWN BYPASS
CLINTON & RUSSELL COUNTY, KENTUCKY

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VALUE ENGINEERING STUDY
for
Kentucky Transportation Cabinet
Frankfort, Kentucky

Study Date: February 28 – March 4, 2011

Final Report

May 24, 2011

URS

EXECUTIVE SUMMARY

General
URS conducted a Value Engineering (VE) study of the US 127 from KY 90 to Jamestown Bypass project in Clinton and Russell County, Kentucky. The item numbers are 8-108.00 and 8-115.10. The topic was the 30% design submission prepared by QK4 for the Kentucky Transportation Cabinet (KYTC).

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 preliminary construction cost estimate provided to the VE team with the project documents indicates a total construction cost of $125,825,009. The project also includes right-of-way (ROW) cost of $15,750,000 and utility relocation cost of $8,320,000 that were not included in the $125,825,009. This project is scheduled to be delivered as a traditional design/bid/build project, thus the cost of construction will be determined on a contractor bid.

Summary of VE Study Results
During the speculation phase of this VE study, 27 creative ideas were identified; 20 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, 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 that the cost savings of these recommendations can be added together (summarily additive), and it also considers whether the cost savings or project improvement potential are worth the change to the project design.

For this project, the VE team selected three mutually exclusive scenarios to represent a range recommendations and potential cost savings. These scenarios and cost saving potentials are comprised of a combination of individual recommendations as shown in the Summary of Recommendation table. Scenario #1 represents an estimated potential cost savings of $144,895,000 in first cost. Scenario #2 results in an estimated potential cost savings of $55,341,000 in first cost and $3,043,000 over a 20-year life cycle. Scenario #3 results in an estimated potential cost savings of $35,586,000 in first cost and $2,904,000 over a 75-year life cycle. Total cost savings realized will be based upon the final implementation status of these VE recommendations.

SUMMARY OF RECOMMENDATIONS

DESCRIPTION		PRESENT WORTH AMOUNTS			
Rec #	Recommendation Title / Description	1st cost savings (or cost)	O & M savings (or cost)	Total LCC savings (or cost)	VE Scenarios
VE-1	Revise the cost estimate to reflect a higher contingency mark-up, a higher construction engineering mark-up, stream mitigation in lieu of fees, and higher bridge unit costs	Comment		Comment	
VE-2	Utilize spot and curve improvements along US 127 in lieu of the base case design	$144,895,000		$144,895,000	1
VE-3	Utilize 1990 scoping study alignment diverted around Wolf Creek Dam in lieu of the base case design	$55,341,000	$3,043,000	$58,384,000	2
VE-4	Utilize existing US 127 alignment from KY 90 to KY 1730, and follow KY 1730 to proposed alignment 16.1	$50,609,000	$3,043,000	$53,652,000	
VE-5	Utilize design section 13 and 14 from station 330+00 to Swan Pond Road in lieu of design section 11	$33,243,000		$33,243,000	
VE-6	Utilize existing US 127 alignment from KY 90 to preferred alignment at station 285+00 in lieu of design segments 3 and 6	$16,280,000	$1,136,000	$17,416,000	
VE-7	Utilize at-grade intersection of the preferred alignment and KY 1730 in lieu of realigning and adding a flyover bridge for KY 1730	$6,293,000		$6,293,000	
VE-8	Specify partially controlled access in lieu of by-permit only access	$0		$0	3
VE-9	Reduce entire paved typical cross section from 40 ft (2-12 ft lanes, 2- 8 ft paved shoulders) to 32 ft (2-12 ft lanes, 2-4 ft shoulders), and utilize 6 ft bridge shoulders in lieu of 12 ft bridge shoulders	$11,492,000		$11,492,000	3
VE-10	Utilize 10 ft bridge shoulders in lieu of 12 ft bridge shoulders	$3,339,000		$3,339,000	
VE-11	Utilize a 4 ft usable shoulder (2 ft paved) for the truck climbing lanes in lieu of 10 ft (8 ft paved)	$3,276,000		$3,276,000	
VE-12	Introduce additional vertical curves and steepen grades to follow the existing topography more closely and reduce the amount of earthwork necessary	Comment		Comment	3
VE-13	Review the construction sections for constructability and fiscal constraints	Comment		Comment	
VE-14	Utilize culvert and embankment in lieu of Turkeypen Creek Bridge	$3,410,000	$825,000	$4,235,000	3

Comment = Design Comment with no cost savings determined

SUMMARY OF RECOMMENDATIONS

DESCRIPTION		PRESENT WORTH AMOUNTS			
Rec #	Recommendation Title / Description	1st cost savings (or cost)	O & M savings (or cost)	Total LCC savings (or cost)	VE Scenarios
VE-15	Utilize culvert and embankment in lieu of Salt Lick Creek Bridge	$7,816,000	$1,374,000	$9,190,000	3
VE-16	Utilize culvert and embankment in lieu of West Fork Creek Bridge	$2,039,000	$705,000	$2,744,000	3
VE-17	Utilize more roadway and embankment to reduce the length of the Manntown Road, B. Mann Road, and Creek Drive Bridges	$10,829,000		$10,829,000	3
VE-18	Utilize mechanically stabilized earth (MSE) or a cantilevered retaining wall (breast wall abutment) to reduce the length of the Manntown Road, B Mann Road, and Creek Drive Bridges	$9,926,000		$9,926,000	
VE-19	Utilize crushed stone base in lieu of dense grade aggregate (DGA) to improve subgrade drainage	Comment		Comment	
VE-20	Utilize geogrids to decrease the required asphalt pavement thickness	Comment		Comment	

Summary of VE Scenario #1:	**$144,895,000**	**$0**	**$144,895,000**
Summary of VE Scenario #2:	**$55,341,000**	**$3,043,000**	**$58,384,000**
Summary of VE Scenario #3:	**$35,586,000**	**$2,904,000**	**$38,490,000**

Comment = Design Comment with no cost savings determined

Acknowledgments
A thank you is given to the staff members from the Kentucky Transportation Cabinet and QK4 for their participation. Special thanks are also extended to Mr. Brent Sweger for his assistance with this study.

Value Engineering Study - Core Team

Name	Discipline / Role	Organization	Telephone
Rachel Catchings, PE	Roadway Design Engineer	KYTC	502-564-3280
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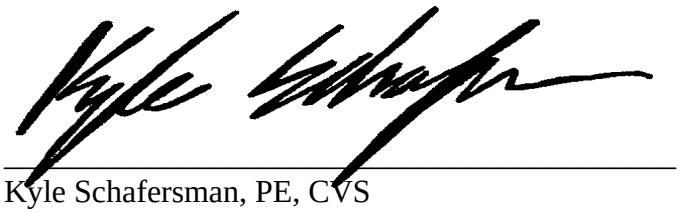
Kyle Schafersman, PE, CVS	VE Team Leader	URS	913-344-1019
Brent Sweger, PE	VE Coordinator	KYTC	502-564-3280
Mike Zwick, PE	Bridge Engineer	URS	513-419-3505

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



Kyle Schafersman, PE, CVS
Value Engineering Program Manager

TABLE OF CONTENTS

Section and Title *Page No.*

Appendices

SECTION 1 - INTRODUCTION

This report documents the results of a Value Engineering study on the US 127 from KY 90 to Jamestown Bypass project in Clinton and Russell County, Kentucky. The item number is 8-108.00 and 8-115.10. The study was held at the KYTC offices in Frankfort, KY on February 28 – March 4, 2011. The study team was from URS, KYTC, and Kentucky Transportation Center (KTC). Kyle Schafersman, a Certified Value Specialist (CVS), Professional Engineer (PE), and 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, Recommendations, and Design Comments

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. 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 owner. VE team members have not and will not sign or seal any recommendations and comments contained in this report as certifiable engineering or architectural design. These value analysis alternatives have been developed by individual VE team members and may not reflect the entire VE team's opinion.

Organization of the Report

The report is organized in the following outline.

A. Introductory Information
    Section 1- Introduction
    Section 2- Project Description
B. Primary body of results
    Section 3- Recommendations and Design Comments
C. Supporting documentation
    Appendices

SECTION 2 – PROJECT DESCRIPTION

The project corridor begins at KY 90 and continues north to the Jamestown Bypass, a distance of approximately 20 miles. The proposed Build Alternatives are on new alignment. The various alignments cross several state and local roads. Only at the southern and northern termini would the project use the existing alignment of US 127.

US 127 is a major north-south thoroughfare extending through the Commonwealth from the Kentucky-Tennessee to approximately the Kentucky-Ohio state lines. Within Clinton and Russell Counties, it begins at the state line in Static, Kentucky, and extends north 47.9 miles to the Casey County line. In the Study Area, it has two lanes with widths varying between 10 and 12 feet, narrow shoulders, and a posted speed limit of 55 miles per hour (mph). US 127 is classified in the KYTC's Functional Classification System as a Rural Principal Arterial, and on the state system as a State Primary (Other) roadway. Traffic on US 127 through the project corridor consists of heavy trucks (from 11.0% to 11.6% of the traffic volume on US 127 in Clinton County and 6.5% in Russell County), tourists, and recreational vehicles, as well as local residents and/or commuters.

The US 127 project would result in an improved section of a critical north-south highway corridor that enters Kentucky at the Kentucky-Tennessee line and exits in Covington. The *US 127 Jamestown to Tennessee* scoping study evaluated the need to improve US 127 from Albany to the south through Jamestown to the north. The study identified capacity deficiencies along the route in both cities and major geometric deficiencies throughout the entire route. The study recommended solutions that included:

- Elevating the level of service through the two communities by constructing bypasses around both.
- Linking the communities via a roadway constructed to current design standards, thereby eliminating design deficiencies and improving safety.

The Jamestown Bypass is now open to traffic and right-of-way is being purchased for the reconstruction of US 127 from KY 90 south to Tennessee, including a western bypass of Albany. The purpose and need for the current US 127 project is summarized as follows:

- To provide a key link in this important local and regional Rural Principal Arterial roadway by relocating US 127 on new alignment
- Providing a roadway having improved geometrics compared with existing US 127, which is substandard to contemporary design.
- Potential for closing US 127 over Wolf Creek Dam due to national security threat: The existing roadway crosses Wolf Creek Dam, which is operated by the United States Army Corps of Engineers (USACE) and has an average daily traffic (ADT) volume of 1,700 vehicles per day (VPD). In 1996, **USACE requested that KYTC partner with USACE to remove US 127 from the dam and relocate the roadway downstream.**

Closing the dam road without ample notice would likely leave many motorists—through travelers, commercial haulers, and local residents, alike—needing to cross the river to travel long distances to the nearest river crossings, at Burkesville (southwest) or Somerset and Burnside (northeast).

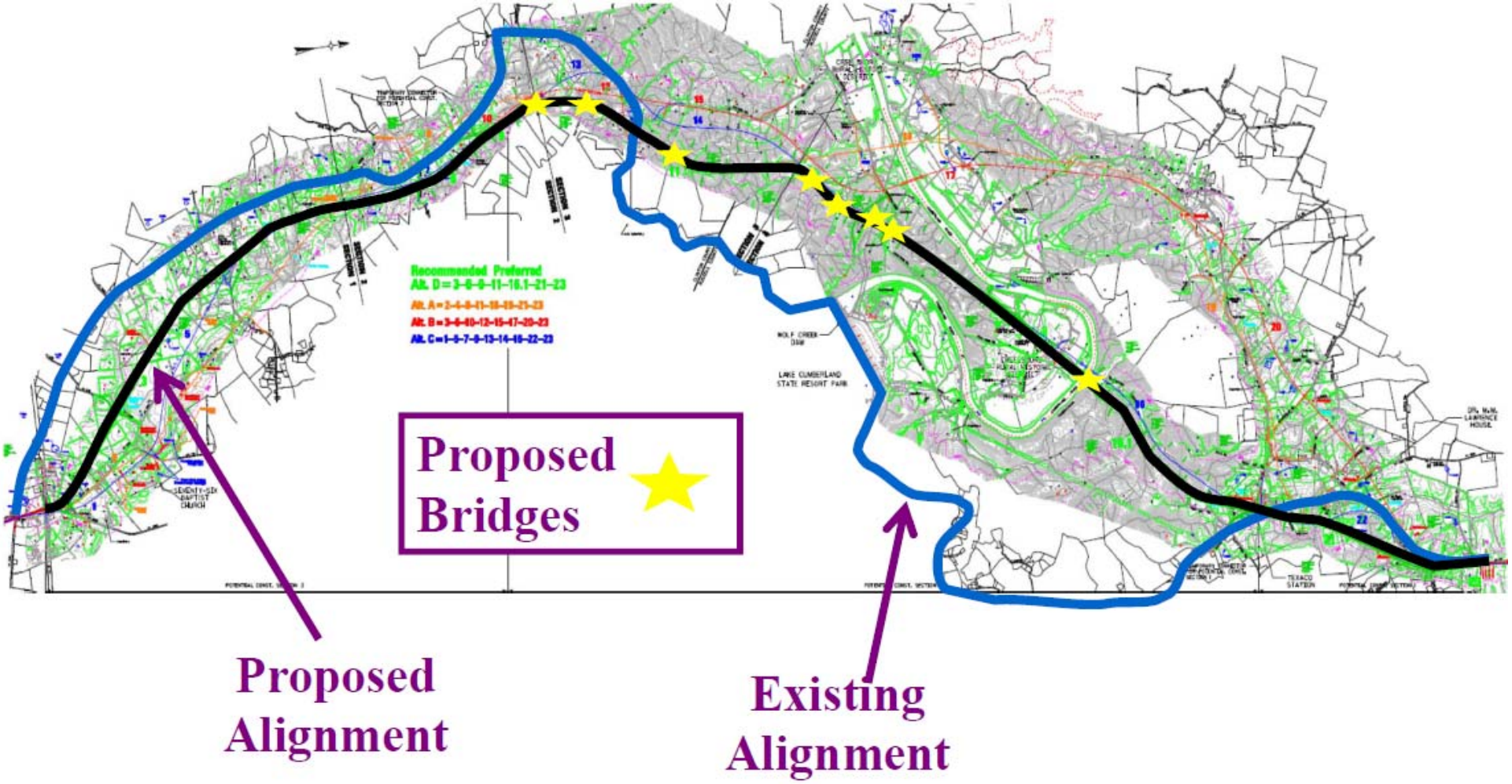
Because neither the No-Build Alternative nor rebuilding the existing road would meet the project's purpose and need, Build Alternatives on new alignment were developed. The locations of the alternatives took into

account several constraints including USACE requirements/recommendations related to the Wolf Creek Dam; aligning US 127 at KY 90 (the intersection is currently offset); historical and recreational resources (involving Section 106 and Section 4(f) issues); natural resources such as wetlands, streams, and endangered species habitat; farmland and residential/commercial impacts; and engineering constraints related to the terrain and the Cumberland River crossing.

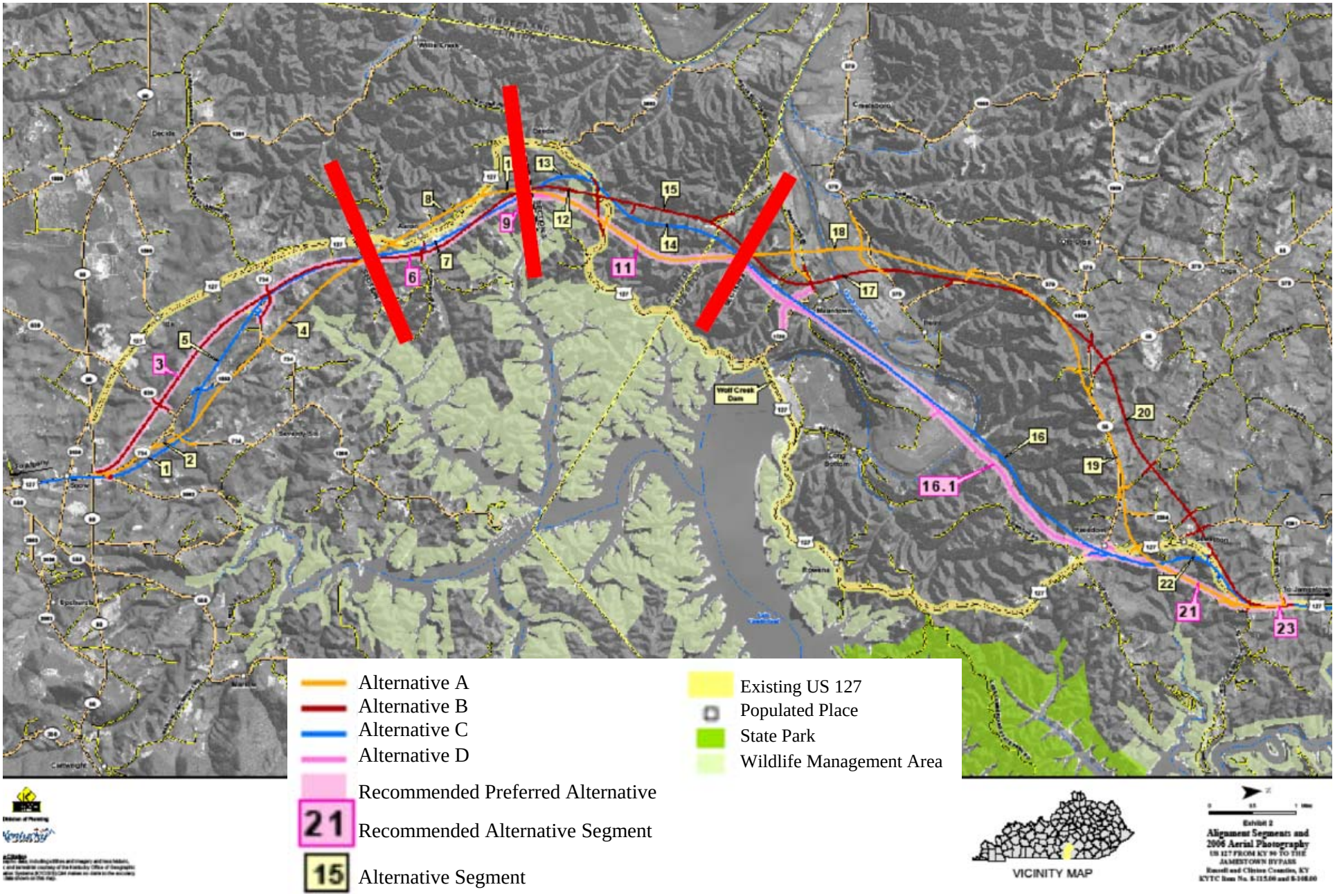
At four locations along the corridor all of the Build Alternatives intersect, in effect dividing the corridor into four sections—South, South Central, Central, and North. At various locations within the sections, two or more of the alternatives intersect each other and existing US 127 to create 23 individual segments. These unique segments were numbered 1 through 23 for ease of reference and analysis. In addition, a segment numbered 16.1 (a derivative of Segment 16) was developed as the evaluation of alternatives revealed an opportunity to retain beneficial features of the original segment (Segment 16) while avoiding/minimizing several potential impacts. The 23 segments that form 3 potential interweaving alignments within the design sections have the ability to "mix and match" segments. After extensive analysis, the preferred Build Alternative Alignment was selected as a combination of Segments 3, 6, 9, 11, 16.1, 21, and 23.

The preferred alignment is approximately 17 miles long. It is comprised of two-12 ft undivided roadway lanes with 10 ft shoulders (8 ft paved) with truck climbing lanes in specific locations. It is classified as access controlled by permit, only. There are seven new mainline bridges ranging from 754 ft to 1,444 ft in length. These bridges have a cross section of 51 ft consisting of two-12 ft lanes, two-12 ft shoulders, and two-1.5 ft barriers. There is also a bridge along KY 1730 over the mainline.

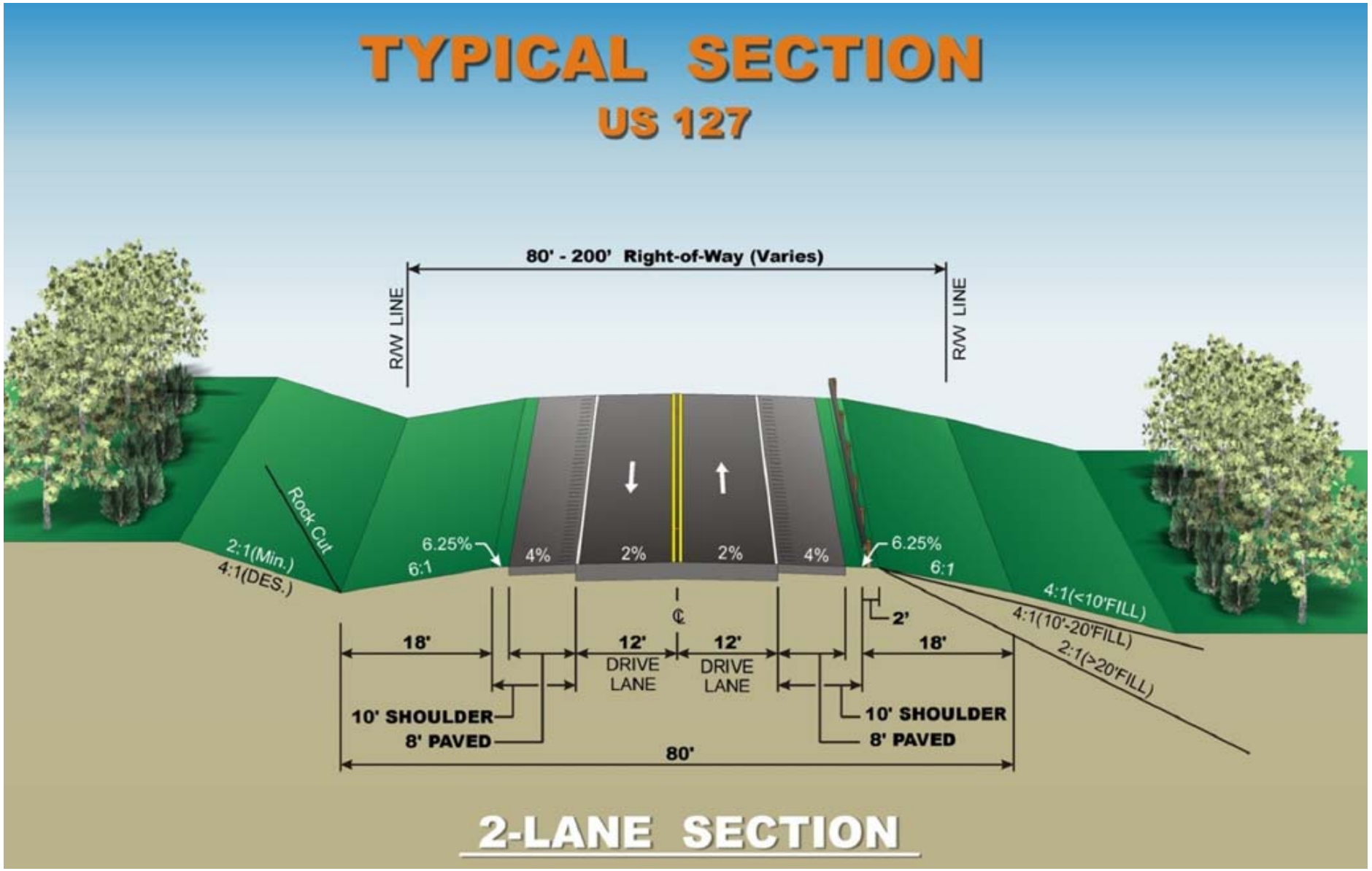
Overall Aerial Image of Existing Alignment and Proposed Alignment



Overall Aerial Image of 23 Alternative Segments and 4 Design Sections



Proposed Typical Section of US 127



SECTION 3 - VE RECOMMENDATIONS & DESIGN COMMENTS

Organization of Recommendations
This section contains the complete documentation of all recommendations that have resulted 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 and Evaluation 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,
- 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 (can be added together), 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.

Design Comments
Design Comments are ideas that in the opinion of the VE 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 # VE-1

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Revise the cost estimate to reflect a higher contingency mark-up, a higher construction engineering mark-up, stream mitigation in lieu of fees, and higher bridge unit costs.

COMMENTARY:
The VE team recommends modifying the project construction cost estimate in several ways. The original estimate is carrying a mark-up of 10% for construction engineering and contingency. At this point in the design, there are a lot of unknown conditions which propose a higher level of cost risk. The VE team recommends revising this quantity to approximately 25%. The 25% could also be broken out as separate line items of 15% construction engineering and 10% contingency.

The VE team recommends including an allowance in the cost estimate to account for stream crossing mitigation. In the US 127 Reconstruction and Relocation Environmental Assessment, on page 31 Table 9 states that Alternative D (the preferred alternative) has 58 stream crossings with approximately 30,973 LF of impacted stream. Of this 30,973 LF, 1,167 LF is perennial and 13,249.8 LF is intermittent which will likely require mitigation. This mitigation can cost up to $200/LF per which represents a potential cost of $2,883,360 for that 14,417 LF section. This item needs to be included in the cost estimate so that project executives are adequately informed of the expected

The VE team also recommends revising the unit cost of the bridges. The original design used a bridge square foot cost of $105/SF. The VE team feels this unit cost is low due to the relatively tall height of some of these bridges (up to 225 ft high). The following tables identify the original and recommended unit cost per bridge.

VALUE ENGINEERING DESIGN COMMENT # VE-1

DISCUSSION CONTINUED

Orignal Design Bridge Costs

Bridge	Station	Bridge Name	Begin Station	End Station	Length	Width	Estimated Height	Sq. Foot	Unit Cost	Total Cost
1	336+69	Turkeypen Creek	333+00	341+61	861	51	150	43,911	$105	$ 4,610,655
2	363+00	West Fork	360+26	367+79	753	51	200	38,403	$105	$ 4,032,315
3	405+68	Salt Lick Creek	400+07	414+51	1444	51	225	73,644	$105	$ 7,732,620
4	487+52	Rock Lick Creek	482+65	494+15	1150	51	70	58,650	$105	$ 6,158,250
5	507+11	Creek Drive	503+80	511+65	785	51	80	40,035	$105	$ 4,203,675
6	533+71	Manntown Road	527+65	537+65	1000	51	100	51,000	$105	$ 5,355,000
7	657+00	Cumberland River	651+60	661+00	940	51	100	47,940	$105	$ 5,033,700
8	50+00	KY 1730	48+76	51+70	294	35	30	10,290	$105	$ 1,080,450
Total								363,873	$105	$ 38,206,665

Recommended Design Bridge Costs

Bridge	Station	Bridge Name	Begin Station	End Station	Length	Width	Estimated Height	Sq. Foot	Unit Cost	Total Cost
1	336+69	Turkeypen Creek	333+00	341+61	861	51	150	43,911	$225	$ 9,879,975
2	363+00	West Fork	360+26	367+79	753	51	200	38,403	$275	$ 10,560,825
3	405+68	Salt Lick Creek	400+07	414+51	1444	51	225	73,644	$300	$ 22,093,200
4	487+52	Rock Lick Creek	482+65	494+15	1150	51	70	58,650	$150	$ 8,797,500
5	507+11	Creek Drive	503+80	511+65	785	51	80	40,035	$150	$ 6,005,250
6	533+71	Manntown Road	527+65	537+65	1000	51	100	51,000	$175	$ 8,925,000
7	657+00	Cumberland River	651+60	661+00	940	51	100	47,940	$175	$ 8,389,500
8	50+00	KY 1730	48+76	51+70	294	35	30	10,290	$125	$ 1,286,250
Total								363,873	$209	$ 75,937,500

With the implementation of the previously noted modifications to the project cost estimate, the total cost of construction, not including right-of-way or utilities, is increased from $125,825,010 to $193,022,124. This represents a modification to the cost estimate of approximately $67,197,114.

✓ VE Selected
Scenario #1

VALUE ENGINEERING RECOMMENDATION # VE-2

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize spot and curve improvements along US 127 in lieu of the base case design.

ORIGINAL DESIGN:
The original design proposes to construct a new US 127 alignment from Albany to Jamestown rerouting US 127 away from the Wolf Creek Dam and through the Creelsboro Rural Historic District.

RECOMMENDED CHANGE:
The VE team recommends the existing US 127 roadway be maintained with additional spot improvements, including between the Russell/Clinton County line and KY 1730 to address the high crash rates in that area.

ADVANTAGES:

- Does not impact the Creelsboro Historic District
- No/Minimal change in level of service over proposed alternative
- Significant reducing in construction material, labor, and duration
- Minimizes total mileage maintained by the District

DISADVANTAGES:

- Does not address national security threat of having the roadway over the dam.
- "Sub" standard design

JUSTIFICATION:
This section of US 127 carries a minimal volume (<3000 vehicles per day (VPD) on most sections) and is expected to carry less than 5000 VPD during the 2026 design year. Review of the capacity analysis and roadway geometry indicates that the existing configuration is sufficient to carry the anticipated traffic volumes during the design year. Level of Service (LOS) analysis indicates an estimated LOS of C under 2026 peak conditions, on all but one section which is expected to operate at LOS B. Existing US 127 is expected to operate at LOS B or C in the design year with the construction of the new roadway, which does not indicate a significant improvement in operations. The proposed roadway would operate at LOS B. Moreover this analysis is reflective of the ability to pass other vehicles and is not reflective of the actual travel time on the corridor, which would vary little between the two alternatives.

Moreover, the traffic forecasts were reviewed for the area to evaluate the 2.5 percent growth rate assumed in the forecast. Looking at the section of US127 north of KY 90 to KY 55, three count stations suggest a different trend. Since 2002, the corridor ranges from 0% just south of KY 55, to 1% just south of the Lake Cumberland Dam, to 2.2% just north of KY 90.

VALUE ENGINEERING RECOMMENDATION # VE-2

DISCUSSION CONTINUED

Proceeding to the north from KY 55 echoes the same change in volume as the station south if KY 55, or 0% growth. The recently constructed Jamestown bypass in Russell County has three stations since 2007 and indicates a 10 to 20% drop in volumes. No records are available before 2007 for the bypass. The Albany bypass is assigned Item Number 8-260 and has been studied since 1989 with the last report done in 2005. That report suggested a similar 2.5% growth rate. However, since 2005, station records along US127 and south of Albany suggest 0% growth rates to the Tennessee border.

Critical crash rates for the study area were reviewed as well. The Environmental Assessment (EA) identified three section representing 5 miles of the 17 mile project as having a higher than average crash rate. However, review of the crash rates presented in the Environmental Assessment document appeared to misinterpret the crash rate data. Reevaluation of the crash data and more recent crash trends only identify one section less than 1 mile in Length (Russell County US 127 from MP 0.00 to 0.923) as having a critical rate factor (CRF) greater than 1. This section has a CRF of 1.17. A summary of the actual CRFs for each section of road is presented in the following table:

From	To	Length	HMVM	Rates per HMVM*				Critical Rate	Critical Rate Factor
				Fatal Rate	Injury Rate	PDO** Rate	Total Rate		
KY 55	KY 2284	0.974	0.038	0	106.2	132.7	238.8	470.2	0.51
Lure Lodge Rd	KY 55	2.492	0.118	0	67.9	135.8	203.8	370.4	0.55
Dam Road	Lure Lodge Rd	3.085	0.086	12	81.8	175.3	257.1	392.5	0.66
KY 1730	Dam Rd	1.592	0.044	0	113.2	294.4	407.6	452.4	0.90
Clinton C/L	KY 1730	**0.923**	0.017	0	403.5	749.3	1152.7	584.8	**1.97**
KY 1590	Russell C/L	8.587	0.276	4	25.4	25.4	50.8	327.1	0.16
KY 90	KY 1590	1.95	0.055	0	0	146	146	430.4	0.34

*HMVM = hundred million vehicle miles

**PDO = property damage only

Overall the project does not represent a significant improvement in roadway capacity nor does it address a significant safety problem. It is presumed that the existing safety problem may be addressed in a much more economical manner than bypassing the 1-mile of roadway with a new 17 mile road.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$149,895,000	$0	$149,895,000
RECOMMENDED DESIGN	$5,000,000	$0	$5,000,000
ESTIMATED SAVINGS OR (COST)	$144,895,000	$0	$144,895,000

VALUE ENGINEERING RECOMMENDATION # VE-2

ADDITIONAL INFORMATION

	2006		2026 No-Build		2026 Build	
	ADT	LOS	ADT	LOS	ADT	LOS
US 127	1,800-3,100	C	3,000-5,100	C	200-2,800	B/C
Build Alt					2,100-4,300	B

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 $
US 127 Realignment Construction Cost	LS	$125,825,010	1	1	$125,825,010		
ROW costs	LS	$15,750,000	1	1	$15,750,000		
Utility costs	LS	$8,320,000	1	1	$8,320,000		
Spot and Curve Improvements	LS	$5,000,000	7			1	$5,000,000
Subtotal					$149,895,010		$5,000,000
Engr. & Contg.	@	0%			$0		$0
Total					$149,895,010		$5,000,000

SOURCE CODE: 1 Project Cost Estimate
2 KYTC 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)

✓ VE Selected
Scenario #2

VALUE ENGINEERING RECOMMENDATION # VE-3

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize the 1990 scoping study alignment diverted around Wolf Creek Dam in lieu of the base case design.

ORIGINAL DESIGN:
The original design alignment is a new, cross-country route from KY 90 (south end) to Story Lane (north end) at the new Jamestown bypass.

RECOMMENDED CHANGE:
The VE team recommends that the project team reconsider the alignment that was recommended in the 1990 Scoping Study, US 127, Jamestown to Tennessee. This alternative assumes that the project still requires that the road be diverted around the Wolf Creek Dam. The alignment follows the same basic alignment as the existing US127 from the southern termini until KY 1730, just south of the dam. From there, the VE team recommends that it would follow the KY 1730 alignment and tie into Design Section 16.1. The alignment proposed in the study meets 60 mph design speed and assumed 12 ft travel lanes and full width shoulders.

ADVANTAGES:
- Meets project purposes
- Construction cost reduced with less cut/fill and fewer bridges.
- R/W cost reduced
- Fewer environmental impacts
- No maintenance required on abandoned US127

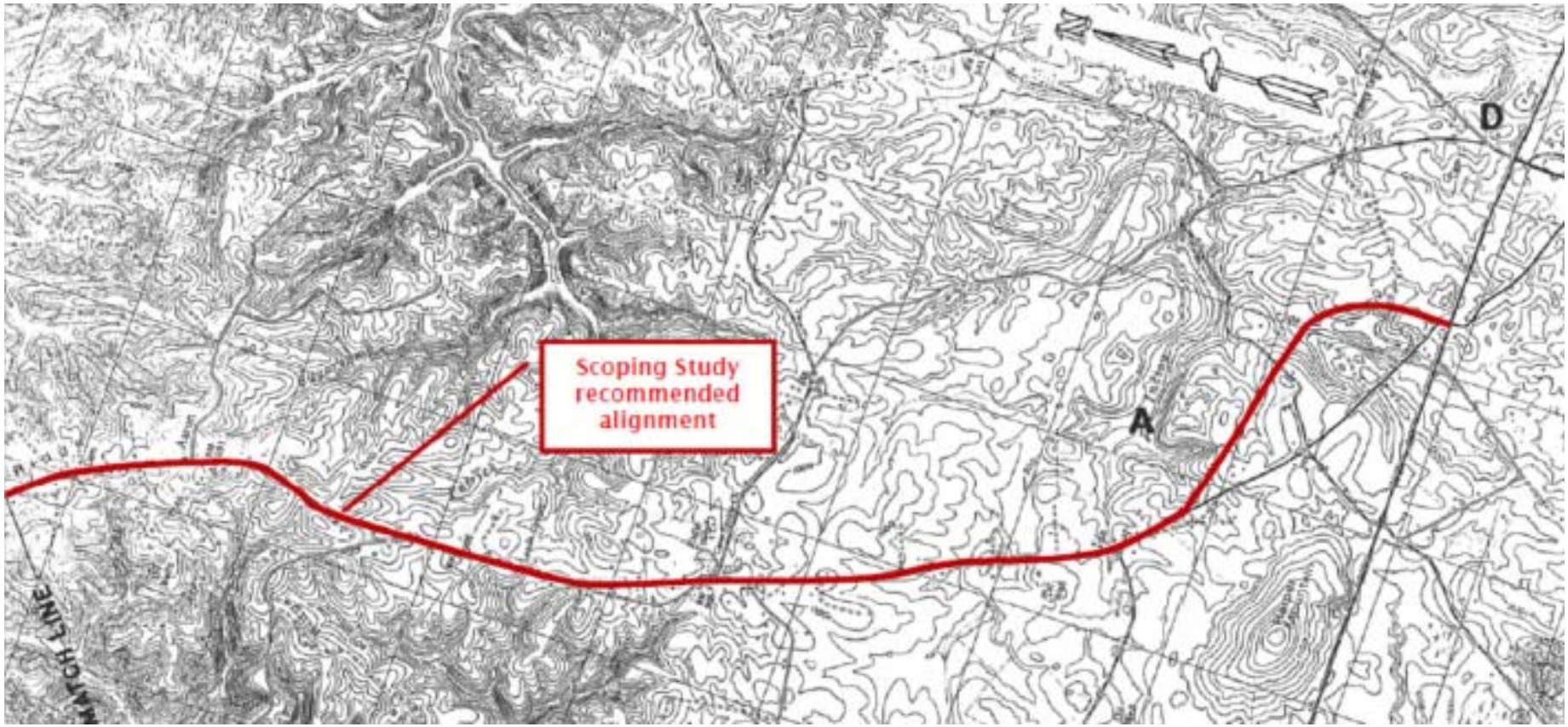
DISADVANTAGES:
- Maintenance of traffic during construction
- Revisiting the environmental assessment

JUSTIFICATION:
Although the environmental assessment considered reconstruction on the existing alignment (Alternative II, Rebuild the Existing Road), it was eliminated from "further study for reason that include failure to meet purpose and need related to removal from atop Wolf Creek Dam." However, it did not consider a combination of existing alignment and new alignment to avoid the dam. This VE alternative meets both purposes identified in Environmental Assessment: removing the principal arterial from atop the dam and improving geometrics. This alternative would reduce the cost to a level that would allow the entire project to be funded much sooner.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$86,546,000	$3,864,000	$90,410,000
RECOMMENDED DESIGN	$31,205,000	$821,000	$32,026,000
ESTIMATED SAVINGS OR (COST)	$55,341,000	$3,043,000	$58,384,000

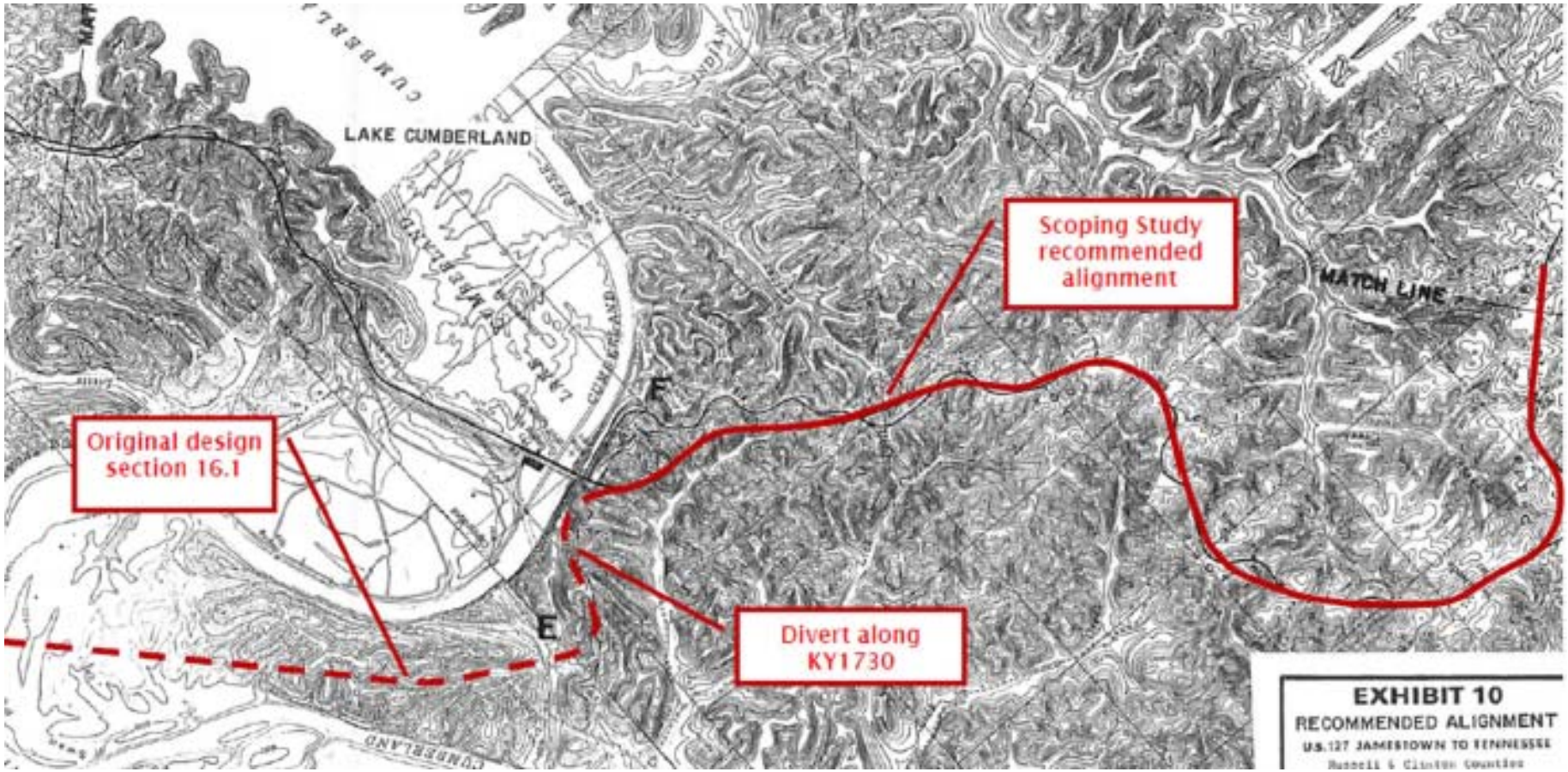
VALUE ENGINEERING RECOMMENDATION # VE-3

SKETCH OF RECOMMENDED DESIGN



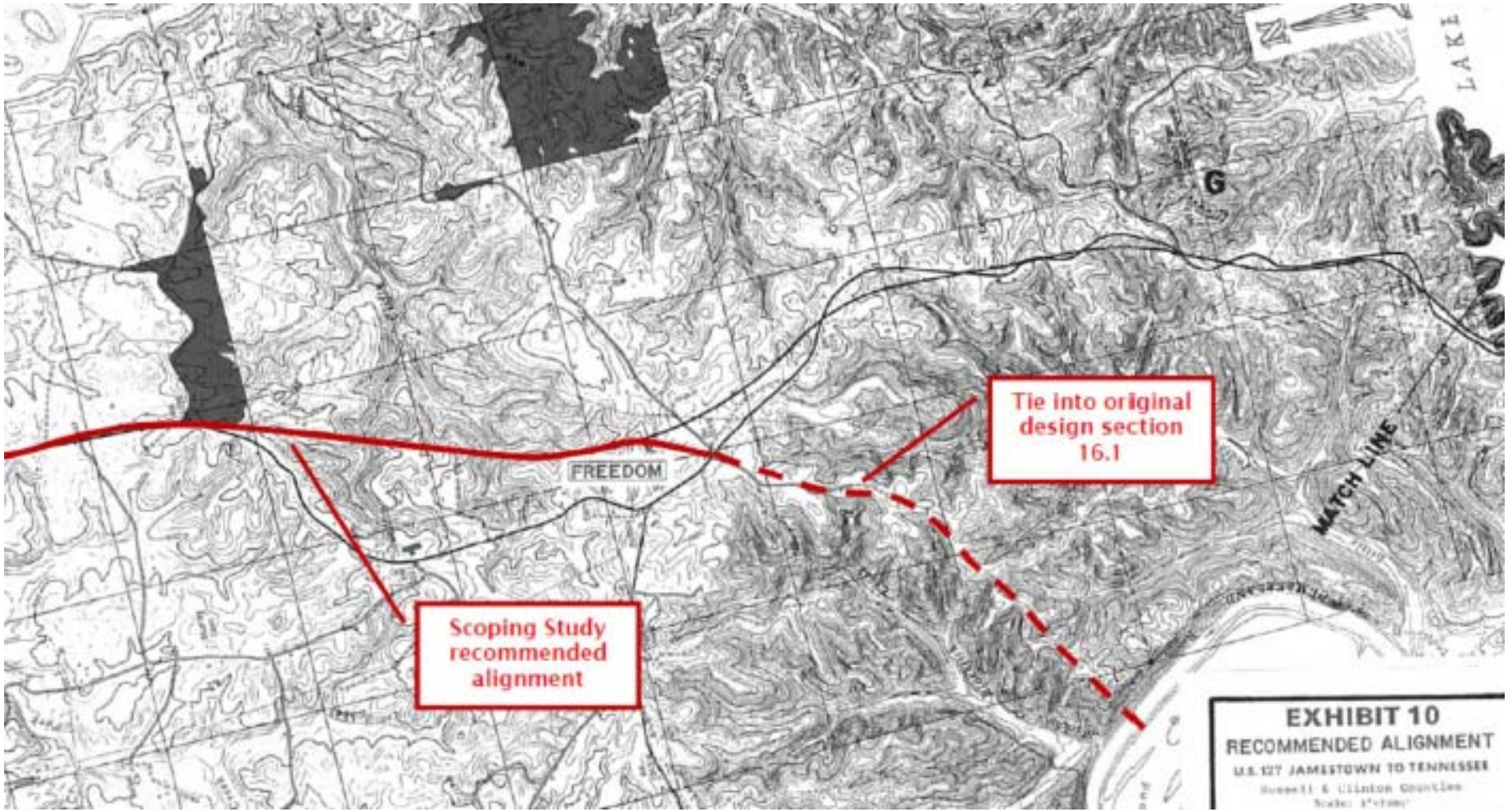
VALUE ENGINEERING RECOMMENDATION # VE-3

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-3

SKETCH OF RECOMMENDED DESIGN



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 $
Construction MP 11.0 to 18.5	mile	$3,716,532	1	3	$11,149,596		
Construction MP 11.0 to 18.5	mile	$1,114,959	1			3	$3,344,877
Construction MP 18.5 to 0.9	mile	$3,234,801	1	3.4	$10,998,323		
Construction MP 18.5 to 0.9	mile	$1,617,400	1			3.4	$5,499,160
Construction MP 8.0 to 11.0	mile	$4,253,335	1	3	$12,760,005		
Construction MP 8.0 to 11.0	mile	$2,126,667	1			3	$6,380,001
Turkeypen Creek Bridge	EA	$4,610,655	1	1	$4,610,655		
West Fork Bridge	EA	$4,036,277	1	1	$4,036,277		
Salt Creek Bridge	EA	$7,734,119	1	1	$7,734,119		
Rock Lick Creek Bridge	EA	$6,158,250	1	1	$6,158,250		
Creek, Drive Bridge	EA	$4,203,675	1	1	$4,203,675		
KY 1730 Bridge	EA	$1,081,185	1	1	$1,081,185		
Double RCBC	EA	$766,000	1	1	$766,000		
ROW	LS	$15,180,000	1	1	$15,180,000	0.8	$12,144,000
Utility Relocation	LS	$1,000,000	7			1	$1,000,000
Subtotal					$78,678,085		$28,368,038
Engr. & Contg.	@	10%			$7,867,809		$2,836,804
Total					$86,545,894		$31,204,842

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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)

Assumptions:

1. Construction Section 3 at 30%
2. Construction Section 2 without bridges at 50%
3. Construction Section 1 at 50%

VALUE ENGINEERING RECOMMENDATION # VE-3

COST ESTIMATE - LIFE CYCLE (LC) COST

PRESENT WORTH (PW) METHOD
LIFE CYCLE (LC) PERIOD (YEARS) = 20
ANNUAL PERCENTAGE RATE = 4%

Operations & Maintenance Single Expenditure	In the Yr	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Repaving	20	0.4564	$4,000,000	$1,825,548	$1,800,000	$821,497
Subtotal Single Life Cycle O&M Costs				$1,825,548		$821,497
Operations & Maintenance Annual Continuous Costs	For How Many Yrs	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Operations & Maintenance	20	13.5903	$150,000	$2,038,549		
Subtotal Annual Life Cycle Costs				$2,038,549		$0
Total Life Cycle Operations & Maintenance Costs				$3,864,000		$821,000

VALUE ENGINEERING RECOMMENDATION # VE-4

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize existing US 127 alignment from KY 90 to KY 1730, and follow KY 1730 to proposed alignment 16.1.

ORIGINAL DESIGN:
The original design specifies a relocated US 127 along the length on the corridor between Albany Bypass (KY 90) and Jamestown Bypass (US 127) which is identified as Preferred Alternative D.

RECOMMENDED CHANGE:
The VE team recommends using the existing US 127 corridor from KY 90 in Clinton County to KY 1730 in Russell County, then make an improved connection along KY 1730 to tie into a relocated US 127, identified as Segment 16.1 on the Preferred Alternative D.

ADVANTAGES:

- Reduces the amount of new right of way
- Reduce amount of new construction
- Eliminates the need for several new bridges proposed on Alternative D
- Eliminates the need to maintain the old US 127 if US 127 is relocated on new alignment
- Removes US 127 from the Wolf Creek Dam
- Does not change the Section 4f issues with the Creelsboro Rural Historic District

DISADVANTAGES:

- Would likely increase the number of property relocations
- Would require design exceptions for existing geometrics less than 60 MPH in some areas
- Would increase the amount of utility relocations
- Will require a supplemental EA to document the new alternative

JUSTIFICATION:
This recommendation is justified given the lack of identified funding for the project and a desire to make some level of improvement. Also, the existing US 127 has an ADT of approximately 3,300 and based on the material provided for the VE study, it does not appear to be a safety problem along the route.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$164,576,000	$3,864,000	$168,440,000
RECOMMENDED DESIGN	$113,967,000	$821,000	$114,788,000
ESTIMATED SAVINGS OR (COST)	$50,609,000	$3,043,000	$53,652,000

VALUE ENGINEERING RECOMMENDATION # VE-4

DISCUSSION CONTINUED

Assumptions included below:
Preferred Alternative D construction cost: $125,825,000
Project Length: 16.594 miles
Average per mile construction cost: 125,825,000 / 16.594 = $7,582,560; Say => $7.6 M / mile

Preferred Alternative D, Segment 16.1 (Station 520+00 to Station 890+00) = 37000 ft. = 7 miles

Existing US 127 in Clinton Co. (KY 90 MP 11.017) to Russell Co Line (MP 20.967) = 9.95 miles
Existing US 127 in Russell Co. (MP 0.0) to KY 1730 (MP 0.923) = 0.923 miles
Total rebuild of existing is 10.87 miles.

KY 1730 ~ 3500 ft (0.7 mile) of KY 1730 will need to be rebuilt.

Cost assumption for rebuild of US 127 is based on the cost of construction section 3 provided by the designer ($21,890,374 / 5.89 miles = $3,716,532 per mile). Based on 50% savings due to pavement reuse, reduced rock excavation, reduced embankments and other miscellaneous items, cost per mile for rebuild is: ($3,716,532 X 0.5 = $1.85 M / mile ; Say $2 M / mile)

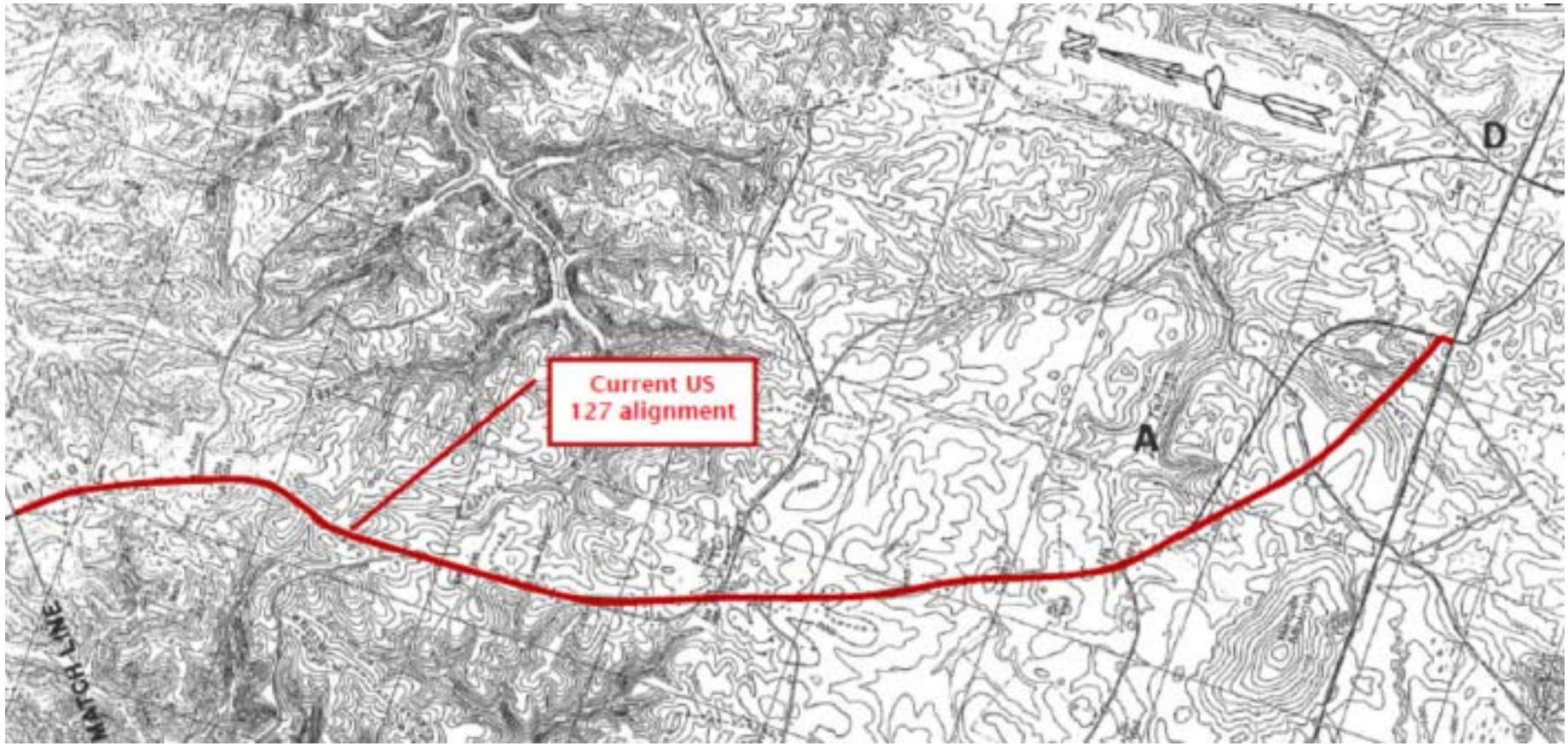
R/W costs for Alternative D: $15,750,000. Cost per mile is $15,750,000 / 16.68 = $944,245/mile; Say $1.0 M / mile. R/W costs for improvements along existing alignment will be reduced by 30%.

Utility costs for Alternative D: $8,320,000. Cost per mile is $8,320,000 / 16.68 = $498,800 / mile; Say $500,000 / mile. Utility costs for improvements along existing alignment will be increased by 100%.

NOTE: The as-builts for US 127 was reviewed however the portion of US 127 identified in Design Section 3 and 4 were not available on the archive plan website.

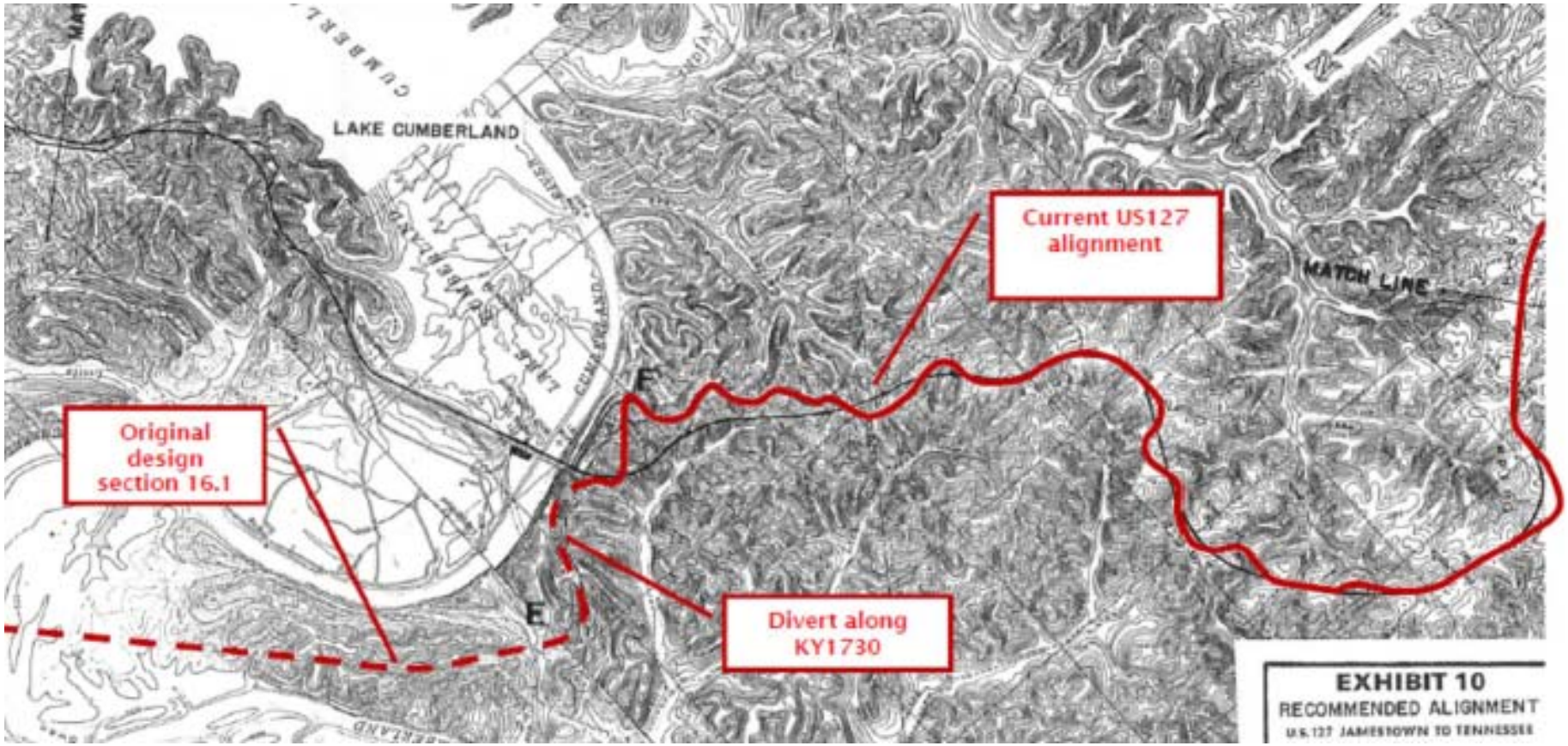
VALUE ENGINEERING RECOMMENDATION # VE-4

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-4

SKETCH OF RECOMMENDED DESIGN



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 $
Preferred Alternative D	mile	$7,600,000	1	16.6	$126,114,400	7	$53,200,000
Reconstruct existing US 127 from KY 90 to KY 1730	mile	$2,000,000	1			10.9	$21,740,000
Rebuild KY 1730	mile	$2,000,000	1			0.7	$1,400,000
ROW	LS	$15,180,000	1	1	$15,180,000	0.7	$10,626,000
Utility Relocation	LS	$8,320,000	1	1	$8,320,000	2	$16,640,000
Subtotal					$149,614,400		$103,606,000
Engr. & Contg.	@	10%			$14,961,440		$10,360,600
Total					$164,575,840		$113,966,600

SOURCE CODE: 1 Project Cost Estimate
2 KYTC 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

COST ESTIMATE - LIFE CYCLE (LC) COST

PRESENT WORTH (PW) METHOD
LIFE CYCLE (LC) PERIOD (YEARS) = 20
ANNUAL PERCENTAGE RATE = 4%

Operations & Maintenance Single Expenditure	In the Yr	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Repaving	20	0.4564	$4,000,000	$1,825,548	$1,800,000	$821,497
Subtotal Single Life Cycle O&M Costs				$1,825,548		$821,497
Operations & Maintenance Annual Continuous Costs	For How Many Yrs	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Operations & Maintenance	20	13.5903	$150,000	$2,038,549		
Subtotal Annual Life Cycle Costs				$2,038,549		$0
Total Life Cycle Operations & Maintenance Costs				$3,864,000		$821,000

VALUE ENGINEERING RECOMMENDATION # VE-5

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize design section 13 and 14 from station 330+00 to Swan Pond Road in lieu of design section 11.

ORIGINAL DESIGN:
The original design specifies the preferred alternative from station 330+00 to Swan Pond Road is design section 11. This section includes several new bridges including the West Folk Creek Bridge and the Salt Lick Creek Bridge.

RECOMMENDED CHANGE:
The VE team recommends utilizing design section 13 and 14 from station 330+00 to Swan Pond Road in lieu of design section 11. It is assumed that this alignment will not require the construction of the West Folk Creek Bridge and the Salt Lick Creek Bridge. Further hydrological analysis is required to confirm this assumption.

ADVANTAGES:
- Eliminate construction of 2 bridges
- Eliminate maintenance of 2 bridges
- Reduce construction materials
- Reduce construction duration
- Reduces LF of stream impacts

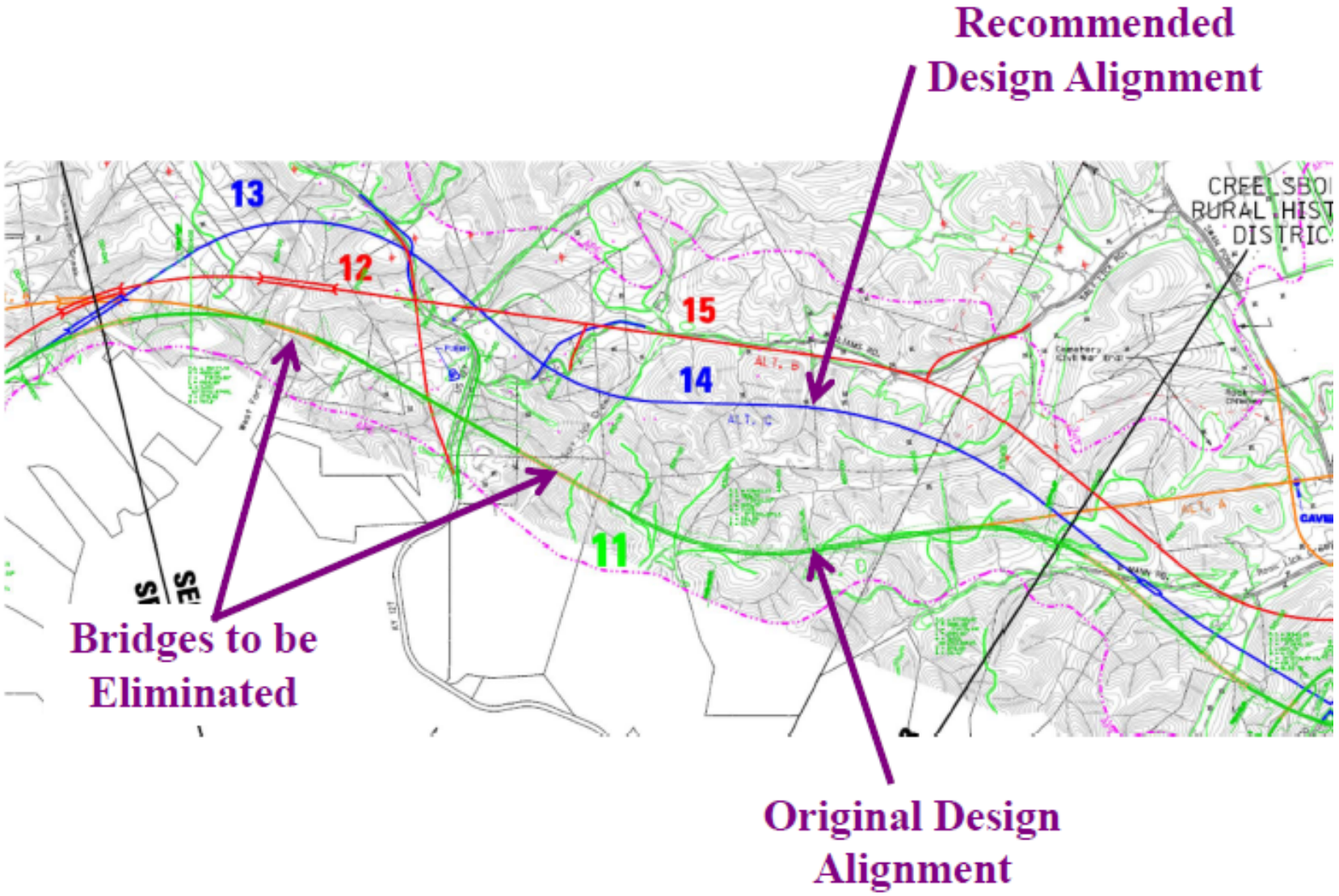
DISADVANTAGES:
- Requires ROW take of 3 residences
- Requires redesign
- Requires reconstruction of a portion of Williams Road

JUSTIFICATION:
This recommendation has the potential to reduce the number of bridges (or height of those bridges) constructed in this design section. The decision making process weighted heavily on cost for the selection of design section 11 over design section 13 – 14. The bridges are the most expensive component of this project, so if an alternate alignment could reduce the number of bridges necessary, a substantial cost savings could be realized. The VE team did not have any hydrological information available at the time of the VE study, so additional analysis will be required to confirm bridges are not necessary. Even if bridges are still required, the VE team assumes the height and length should be reduced along alignment 13 and 14 opposed to alignment 11.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$46,725,000	$0	$46,725,000
RECOMMENDED DESIGN	$13,482,000	$0	$13,482,000
ESTIMATED SAVINGS OR (COST)	$33,243,000	$0	$33,243,000

VALUE ENGINEERING RECOMMENDATION # VE-5

SKETCH OF RECOMMENDED DESIGN



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 $
West Fork Creek Bridge	EA	$10,560,825	7	1	$10,560,825		
Salt Lick Creek Bridge	EA	$22,093,200	7	1	$22,093,200		
Roadway Construction	mile	$4,590,425	1	2.14	$9,823,509	2.67	$12,256,435
Subtotal					$42,477,534		$12,256,435
Engr. & Contg.	@	10%			$4,247,753		$1,225,643
Total					$46,725,288		$13,482,078

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize existing US 127 alignment from KY 90 to preferred alignment at station 285+00 in lieu of design segments 3 and 6.

ORIGINAL DESIGN:
The original design specifies a relocated US 127 along the length on the corridor between Albany Bypass (KY 90) and Jamestown Bypass (US 127) which is identified as Preferred Alternative D.

RECOMMENDED CHANGE:
The VE team recommends using the existing US 127 corridor from KY 90 in Clinton County to Station 285+00 as shown on Alternative D. From that point forward to the Jamestown Bypass, maintain the alignment identified as Preferred Alternative D.

ADVANTAGES:

- Reduces the amount of new right of way
- Eliminates the need to maintain the old US 127 if US 127 is relocated on new alignment
- Removes US 127 from the Wolf Creek Dam
- Does not change the Section 4f issues with the Creelsboro Rural Historic District

DISADVANTAGES:

- Would likely increase the number of property relocations
- Would require design exceptions for existing vertical geometrics less than 60 MPH in some areas
- Would increase the amount of utility relocations
- Will require a supplemental EA to document the new alternative

JUSTIFICATION:
This recommendation is justified given the lack of identified funding for the project and a desire to make some level of improvement. Also, the existing US 127 has an ADT of approximately 3300. The existing horizontal alignment meets 55 MPH except for one location near Aaron which is 50 MPH. The crest vertical curves meet 55 MPH design speed however a few vertical curves are in sag condition and do not need 55 MPH for headlight sight distance. Since a crash issue in these areas was not evident from the material provided for the VE study, it does not appear to be a safety problem.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$33,781,000	$2,505,000	$36,286,000
RECOMMENDED DESIGN	$17,501,000	$1,369,000	$18,870,000
ESTIMATED SAVINGS OR (COST)	$16,280,000	$1,136,000	$17,416,000

VALUE ENGINEERING RECOMMENDATION # VE-6

DISCUSSION CONTINUED

Assumptions included below:
Preferred Alternative D – Construction Section 3: $21,890,374; Length 5.89 miles
Average per mile construction cost: 21,890,374 / 5.89 = $3,716,532; Say => $3.7 M / mile

Existing US 127 in Clinton Co. (KY 90 MP 11.017) to Station 285+00 = 5.9 miles

Cost assumption for rebuild of US 127 is based on the cost of construction section 3 provided by the designer ($21,890,374 / 5.89 miles = $3,716,532 per mile). Based on 50% savings due to pavement reuse, reduced rock excavation, reduced embankments and other miscellaneous items, cost per mile for rebuild is: ($3,716,532 X 0.5 = $1.85 M / mile ; Say $2 M / mile)

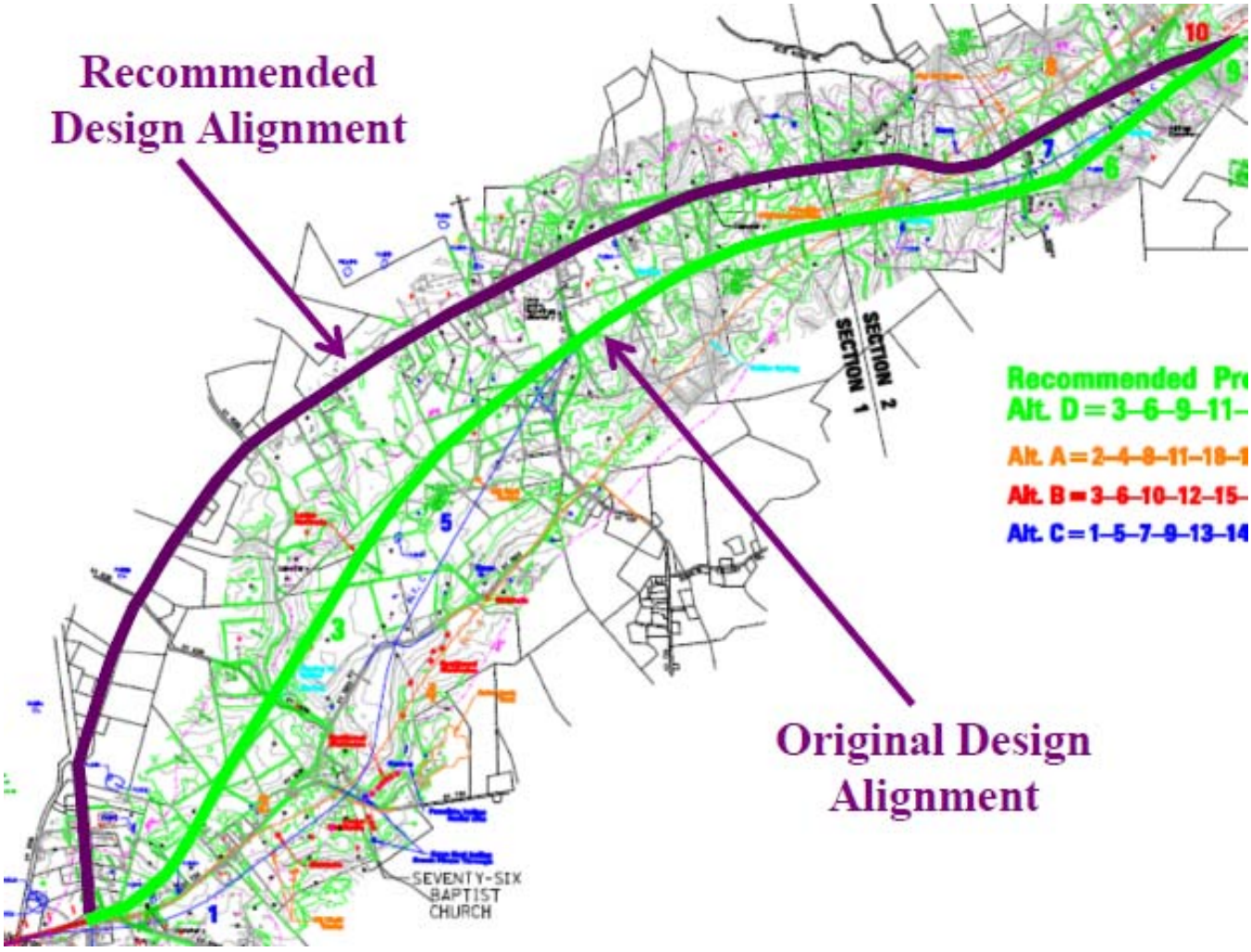
R/W costs for Alternative D: $15,750,000. Cost per mile is $15,750,000 / 16.68 = $944,245/mile; Say $1.0 M / mile. R/W costs for improvements along existing alignment will be reduced by 30%.

Utility costs for Alternative D: $8,320,000. Cost per mile is $8,320,000 / 16.68 = $498,800 / mile; Say $500,000 / mile. Utility costs for improvements along existing alignment will be increased by 100%.

NOTE: The as-builts for US 127 was reviewed however the portion of US 127 identified in Design Section 3 and 4 were not available on the archive plan website.

VALUE ENGINEERING RECOMMENDATION # VE-6

SKETCH OF RECOMMENDED DESIGN



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 $
Proposed Construction Section 3	LS	$21,890,374	1	1.0	$21,890,374		
Improve Existing Section 3	LS	$2,000,000	1			5.9	$11,780,000
ROW New Alignment	mile	$1,000,000	1	5.9	$5,870,000		
ROW along existing	mile	$700,000	1			5.9	$4,130,000
Utility Relocation New Alignment	mile	$500,000	1	5.9	$2,950,000		
Utility Relocation along existing	mile	$1,000,000	1			5.9	$5,900,000
Subtotal					$30,710,374		$15,910,000
Engr. & Contg.	@	10%			$3,071,037		$1,591,000
Total					$33,781,411		$17,501,000

SOURCE CODE: 1 Project Cost Estimate
2 KYTC 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

COST ESTIMATE - LIFE CYCLE (LC) COST

PRESENT WORTH (PW) METHOD
LIFE CYCLE (LC) PERIOD (YEARS) = 20
ANNUAL PERCENTAGE RATE = 4%

Operations & Maintenance Single Expenditure	In the Yr	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Repaving	20	0.4564	$4,000,000	$1,825,548	$3,000,000	$1,369,161
Subtotal Single Life Cycle O&M Costs				$1,825,548		$1,369,161
Operations & Maintenance Annual Continuous Costs	For How Many Yrs	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Operations & Maintenance	20	13.5903	$50,000	$679,516		
Subtotal Annual Life Cycle Costs				$679,516		$0
Total Life Cycle Operations & Maintenance Costs				$2,505,000		$1,369,000

VALUE ENGINEERING RECOMMENDATION # VE-7

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize at-grade intersection of the preferred alignment and KY 1730 in lieu of realigning and adding a flyover bridge for KY 1730.

ORIGINAL DESIGN:
The original design specifies construction of a flyover bridge along KY 1730 over the US 127 mainline at station 533+71 near Manntown Road. This flyover also included an exit ramp to facilitate traffic flow from KY 1730 to US 127 and vice versa.

RECOMMENDED CHANGE:
The VE team recommends constructing an at-grade intersection of the preferred alignment and KY 1730 in lieu of realigning and adding a flyover bridge for KY 1730.

ADVANTAGES:

- Improve access to the Manntown cemeteries from US 127
- Reduce fill necessary for flyover ramps
- Eliminates construction of flyover bridge
- Reduce construction labor, materials, and duration

DISADVANTAGES:

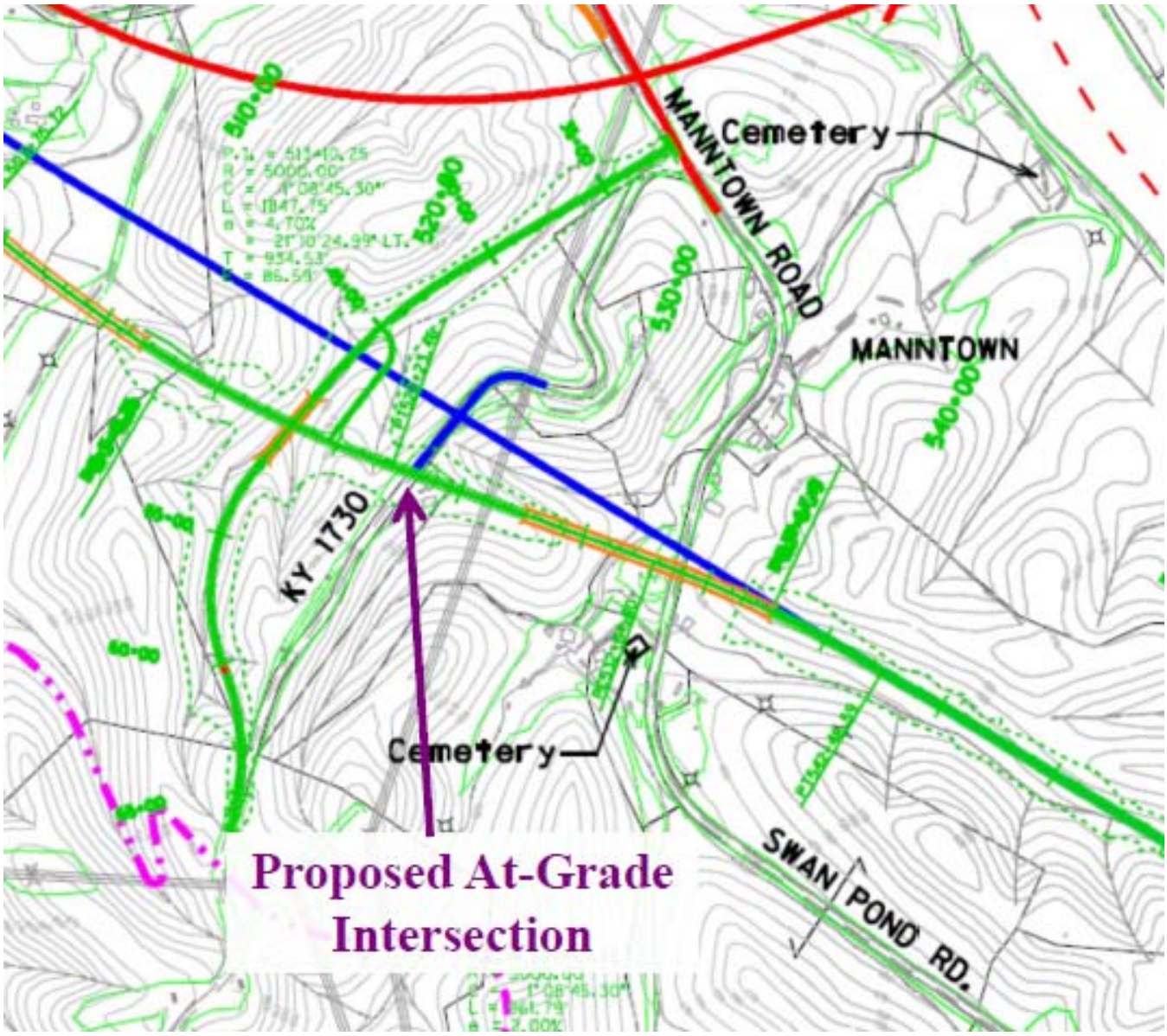
- Traffic conflict in lieu of grade separated free movement
- May lead to queuing-up of motorized traffic
- May require signalization of intersection

JUSTIFICATION:
This recommendation will allow better access to the Manntown cemeteries near this intersection which seems to be driving this variance from the proposed grade separation with the context sensitivity concerns of this region. Low projected turning and through volumes allow for a safely designed at-grade intersection.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$7,080,000	$0	$7,080,000
RECOMMENDED DESIGN	$787,000	$0	$787,000
ESTIMATED SAVINGS OR (COST)	$6,293,000	$0	$6,293,000

VALUE ENGINEERING RECOMMENDATION # VE-7

SKETCH OF RECOMMENDED DESIGN



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 $
ML Bridge @ 533+71 (Manntown Road)	LS	$5,355,000	1	1	$5,355,000		
KY 1730 Bridge over US 127	LS	$1,081,185	1	1	$1,081,185		
DGA Base	TON	$18.99	1			2,400	$45,576
Drainage Blanket - Type II - Asphalt	TON	$36.28	1			1,600	$58,048
Asphalt Base	TON	$52.00	1			3,200	$166,400
Asphalt Surface	TON	$63.00	1			400	$25,200
Asphalt Curing Seal	TON	$538.00	1			5	$2,690
Sand for Blotter	TON	$27.21	1			15	$408
Asphalt Seal Aggregate	TON	$60.13	1			25	$1,503
Emulsified Asphalt RS-2	TON	$696.86	1			3	$2,091
Roadway Excavation	CY	$3.50	1			118,200	$413,700
Subtotal					$6,436,185		$715,616
Engr. & Contg.	@	10%			$643,618		$71,562
Total					$7,079,803		$787,178

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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)

✓ VE Selected
Scenario #3

VALUE ENGINEERING RECOMMENDATION # VE-8

DESCRIPTIVE TITLE OF RECOMMENDATION:
Specify partially controlled access in lieu of by-permit only access.

ORIGINAL DESIGN:
The original design specifies that access points on the proposed roadway be granted by permit. This only requires that stopping sight distance be available to allow an access point, which given the proposed roadway geometry no restrictions would be placed on the placement of access points.

RECOMMENDED CHANGE:
The VE team recommends that the proposed roadway utilize partial control of access to limit the number and spacing of access points on the corridor. This would limit access spacing to 1,200 feet.

ADVANTAGES:
- Decreased travel time
- Decreased crashes
- Improved safety
- Increased capacity
- Increased roadway service life

DISADVANTAGES:
- May not be popular with adjacent land owners
- May require the construction of frontage roads to support development

JUSTIFICATION:
Most of the US 127 corridor through Kentucky that has been reconstructed has partial control of access to safely facilitate long distance and localized travel. Partial control of access will limit the spacing of access points to no less than 1,200 feet, whereas by-permit access can allow unlimited access points with no minimum access spacing. Decreased density of access points and increased spacing have shown to have significant reductions roadway travel time (up to 33 percent), and crash frequency (> 20 percent) and severity as well as increase roadway capacity and service life1. If topographical and/or other conditions exist that would warrant spacing below 1,200 feet, partial control permits a reduction if a traffic engineering study finds that no significant impact would be placed on the facility.

A study by the Kentucky Transportation Center, which evaluated user costs due to access point delay and safety for Kentucky's roadways, found an average user cost savings of over $36,000 per mile per year associated with controlled access plans. Based on these savings implementing partial control of access would provide over $600,000 user costs savings per year and greater than $12 million dollars over a 20 year service life. This estimate does not account for future design and construction cost savings that may be realized by the state by avoiding unnecessary widening and/or capacity improvements as a result of the improved access management.

Cost analysis is based on user cost savings per mile per year from the report referenced[1] based on the following calculation: ($950,000,000 total annual user cost savings / 26,005 total miles roadway) X 17 miles roadway X 20 years = $12.4M for a 20 year life cycle. This report is available at the following web address: http://www.ktc.uky.edu/Reports/KTC_06_16_SPR_290_05_1F.pdf

1 Kirk, A., et al. "*Quantification of the Benefits of Access Management for Kentucky*". Kentucky Transportation Center. Lexington, KY. 2006.

✓ VE Selected
Scenario #3

VALUE ENGINEERING RECOMMENDATION # VE-9

DESCRIPTIVE TITLE OF RECOMMENDATION:
Reduce entire paved typical cross section from 40 ft (2-12 ft lanes, 2- 8 ft paved shoulders) to 32 ft (2-12 ft lanes, 2-4 ft shoulders), and utilize 6 ft bridge shoulders in lieu of 12 ft bridge shoulders.

ORIGINAL DESIGN:
The original design specifies 2-12 foot lanes with 2-8 foot paved shoulders (2 foot unpaved). Bridge shoulders have been proposed 12 foot wide.

RECOMMENDED CHANGE:
The VE team recommends reducing the typical section to 2-12 foot lanes with 2-4 foot paved shoulders (2 foot unpaved). The earthwork quantities could be similarly revised, but have not been estimated here.

ADVANTAGES:
- Reduce construction materials, labor, and duration
- Simplification of asphalt bid items (for shoulder placement monolithic with lanes -
- Potential reduction in roadway footprint, pipe lengths, RCBC lengths, etc.)

DISADVANTAGES:
- Reduced width limits available shoulder for emergencies
- Inconsistent design compared to adjacent sections of US 127 (prior reconstructions)

JUSTIFICATION:
The estimate is based upon 140 lb/SY/in for asphalt items. No change in asphalt base quantity is represented because the recommended typical section would likely require paving the shoulder area monolithically with the lane. A shoulder-specific paving typical section would be infeasible given standard paver equipment limitations. DGA Base quantity was accordingly reduced. Bridge quantities and estimate rates are based upon project estimate and not reflective of other rates used for other portions of this VE study.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$63,699,000	$0	$63,699,000
RECOMMENDED DESIGN	$52,207,000	$0	$52,207,000
ESTIMATED SAVINGS OR (COST)	$11,492,000	$0	$11,492,000

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 $
Asphalt Surface	tons	$63.00	1	254,223	$16,016,049	232,417	$14,642,271
DGA Base	tons	$18.99	1	194,130	$3,686,529	176,274	$3,347,443
Total Bridge Cost	LS	$38,206,000	1	1	$38,206,000	0.77	$29,470,962
Subtotal					$57,908,578		$47,460,676
Engr. & Contg.	@	10%			$5,790,858		$4,746,068
Total					$63,699,435		$52,206,744

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize 10 ft bridge shoulders in lieu of 12 ft bridge shoulders.

ORIGINAL DESIGN:
The original design specifies 12 ft wide shoulders on all the bridge structures.

RECOMMENDED CHANGE:
The VE team recommends the bridge shoulder width be reduced to match the cross section of the typical section. The bridge parapet wall will form a 10 ft shoulder which will align with the face of guardrail on the roadway.

ADVANTAGES:

- Reduce construction labor and materials

DISADVANTAGES:

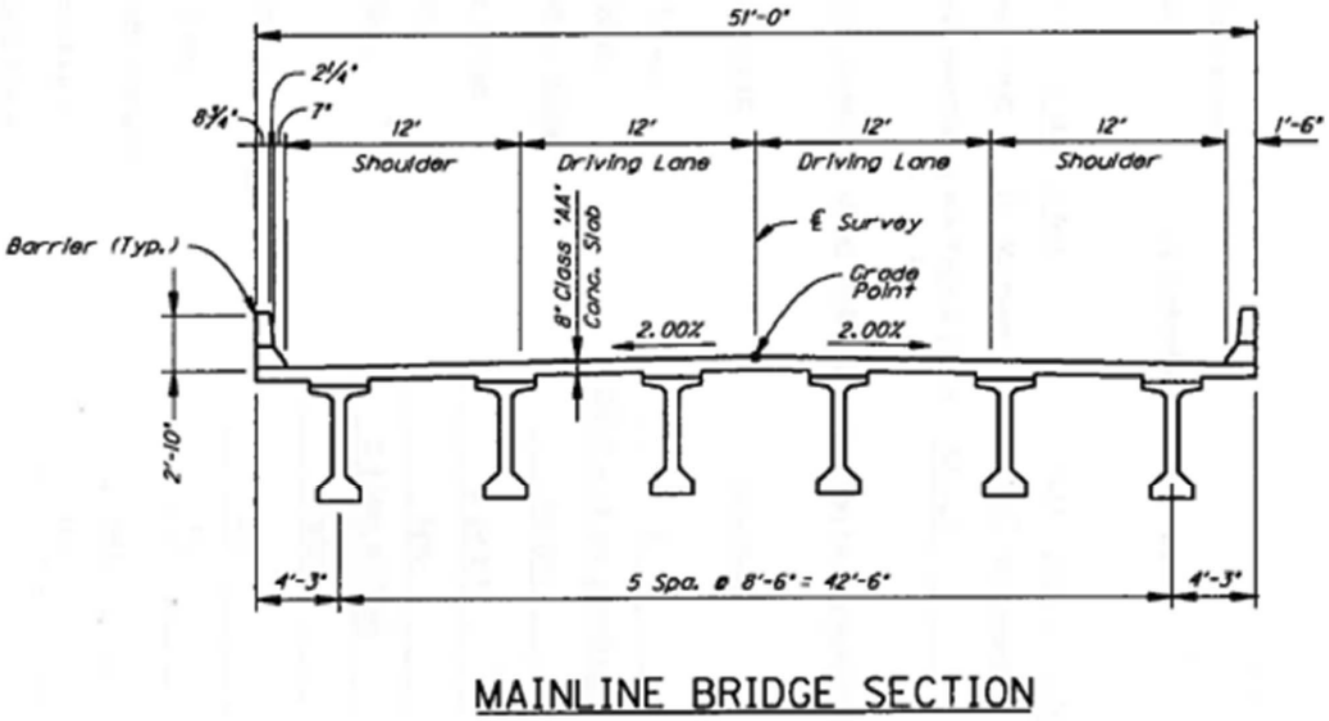
- None

JUSTIFICATION:
There is no solid benefit to making the shoulders greater than 10 ft wide. In fact, it could be argued that the bridge shoulders could be reduced to six or eight feet wide to accommodate a parked vehicle safely. The VE team assumed 7,227 ft of bridge length times 2 shoulders. With 12 ft shoulders, the bridge area equals 173,448 SF, and with 10 ft shoulders, the bridge area equals 144,540 SF.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$20,033,000	$0	$20,033,000
RECOMMENDED DESIGN	$16,694,000	$0	$16,694,000
ESTIMATED SAVINGS OR (COST)	$3,339,000	$0	$3,339,000

VALUE ENGINEERING RECOMMENDATION # VE-10

SKETCH OF ORIGINAL DESIGN



MAINLINE BRIDGE SECTION

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 $
Bridge Deck: 12 ft Shoulder	SF	$105	1	173,448	$18,212,040		
Bridge Deck: 10 ft Shoulder	SF	$105	1			144,540	$15,176,700
Subtotal					$18,212,040		$15,176,700
Engr. & Contg.	@	10%			$1,821,204		$1,517,670
Total					$20,033,244		$16,694,370

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize a 4 ft usable shoulder (2 ft paved) for the truck climbing lanes in lieu of 10 ft (8 ft paved).

ORIGINAL DESIGN:
The original design specifies using a 10 ft shoulder (8 ft paved) in areas where a truck climbing lane is being proposed. The project currently calls for 4.7 miles of truck climbing lane.

RECOMMENDED CHANGE:
The VE team recommends using a 4 ft shoulder (2 ft paved) which is the allowable for truck climbing lanes based on AASHTO standards.

ADVANTAGES:

- Reduces the amount of pavement needed
- Potentially reduces the impact on utilities
- Potentially reduces the impact on right of way

DISADVANTAGES:

- Does not provide a parking area for emergency situations along the truck climbing lanes

JUSTIFICATION:
The use of a 4 ft shoulder for a truck climbing lane is an acceptable, safe practice per AASHTO design policy and KYTC Highway Design Manual.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$4,368,000	$0	$4,368,000
RECOMMENDED DESIGN	$1,092,000	$0	$1,092,000
ESTIMATED SAVINGS OR (COST)	$3,276,000	$0	$3,276,000

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 $
8 ft Paved Shoulder (Truck climbing lane)	SF	$20	7	198,528	$3,970,560		
2 ft Paved Shoulder (Truck climbing lane)	SF	$20	7			49,632	$992,640
Subtotal					$3,970,560		$992,640
Engr. & Contg.	@	10%			$397,056		$99,264
Total					$4,367,616		$1,091,904

SOURCE CODE: 1 Project Cost Estimate
2 KYTC 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)

✓ VE Selected
Scenario #3

VALUE ENGINEERING DESIGN COMMENT # VE-12

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Introduce additional vertical curves and steepen grades to follow the existing topography more closely and reduce the amount of earthwork necessary.

COMMENTARY:
Utilize design parameters more closely as outlined in Design Executive Summary. The Design Executive Summary (DES) indicates minimum horizontal radius of 1,205 feet with overall design speed of 60 mph. Profile information indicates that proposed grades are flatter than allowable per DES details. The original design utilizes vertical grades of no greater than 3.3% throughout Design Sections 21 and 23. Proposed horizontal curves in the vicinity are 1,595 and 1,990 feet in length. A cursory review of archived plans (1941) within the vicinity of Design Section 2 found vertical grades of 6.9% and flatter. Horizontal curvature noted within the same archive plan set indicates length of (spiral) curve of the existing roadway left of proposed station 255+00 is approximately 954 feet.

Steeper vertical grades and tighter horizontal curves (more closely following existing topography) applied to similar projects have been successful in reducing overall excess excavation and therefore overall construction costs. In addition, a tighter proposed roadway footprint would reduce Right of Way phase costs and ease the maintenance of temporary access points. Shorter haul distances and lower contract bid pricing may be anticipated in association with this change. It is reasonable to expect additional savings in reduced pipe and reinforced concrete box culvert (RCBC) lengths as well.

VALUE ENGINEERING DESIGN COMMENT # VE-13

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Review the construction sections for constructability and fiscal constraints.

COMMENTARY:
One major disadvantage of any cross-country alignment is that it can't function until tied in to existing routes at either end. Accompanying that challenge is the idea that fewer project sections make larger construction funding commitments necessary at state and local levels. Given the current economic climate, the project would benefit from a close review focused on creating shorter standalone sections. This may require amending the environmental document, and delays and costs are certainly associated with that effort. The first section identified for construction phase funding will make use of state bond funds. Some impacts place constraints upon the preliminary design and final design process regardless of the funding source. The potential always exists, however, that a section having no federal level constraints could be forwarded if state level construction funding was anticipated. This is, of course, very difficult or impossible to predict.

Construction Section 3 has the most potential, within the existing Area of Potential Effect, for improvement through this review. Shorter construction sections, each tying back to a functional system, would also increase the accessibility of the route to those residing within its limits. The burden of maintaining the severed portions of any reconstructed roadway is always a concern. Shortening the length of those sections is often helpful as those sections are transferred to local (county) ownership. This recommendation, coupled with others related to alignment changes, could decrease the likelihood that the project will stall while construction funding is sought.

✓ VE Selected
Scenario #3

VALUE ENGINEERING RECOMMENDATION # VE-14

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize culvert and embankment in lieu of Turkeypen Creek Bridge.

ORIGINAL DESIGN:
The original design specifies a bridge spanning Turkeypen Creek and the associated valley. Based on preliminary recommendations the estimated bridge length is 861 feet with a 51 foot bridge width. The valley at this location is approximately 150 feet below the profile grade for US 127. Based on the required pier height for this structure the VE team revised the project team's square foot costs for the bridge to $225 per square foot from $105 per square foot to reflect the increased span lengths and complexity of constructing tall piers.

RECOMMENDED CHANGE:
The VE team recommends eliminating the bridge structure and utilizing a culvert structure and fill. While we do not have access to hydraulic data, based on a review of contours it is believed that a cast-in-place or precast culvert would be sufficient at this location. For the purposes of this VE we are assuming a twin 14 ft x 7 ft culvert.

ADVANTAGES:
- Reduce capital construction
- Reduced future maintenance

DISADVANTAGES:
- Wider ROW footprint
- Possible Hydraulic Limitations

JUSTIFICATION:
The VE team did not have access to hydraulic data for Turkeypen Creek, thus the justification for this VE proposal is dependent on the hydraulics. Based on the apparent drainage area it is reasonable to anticipate that Turkeypen Creek can be successfully passed through a culvert structure.

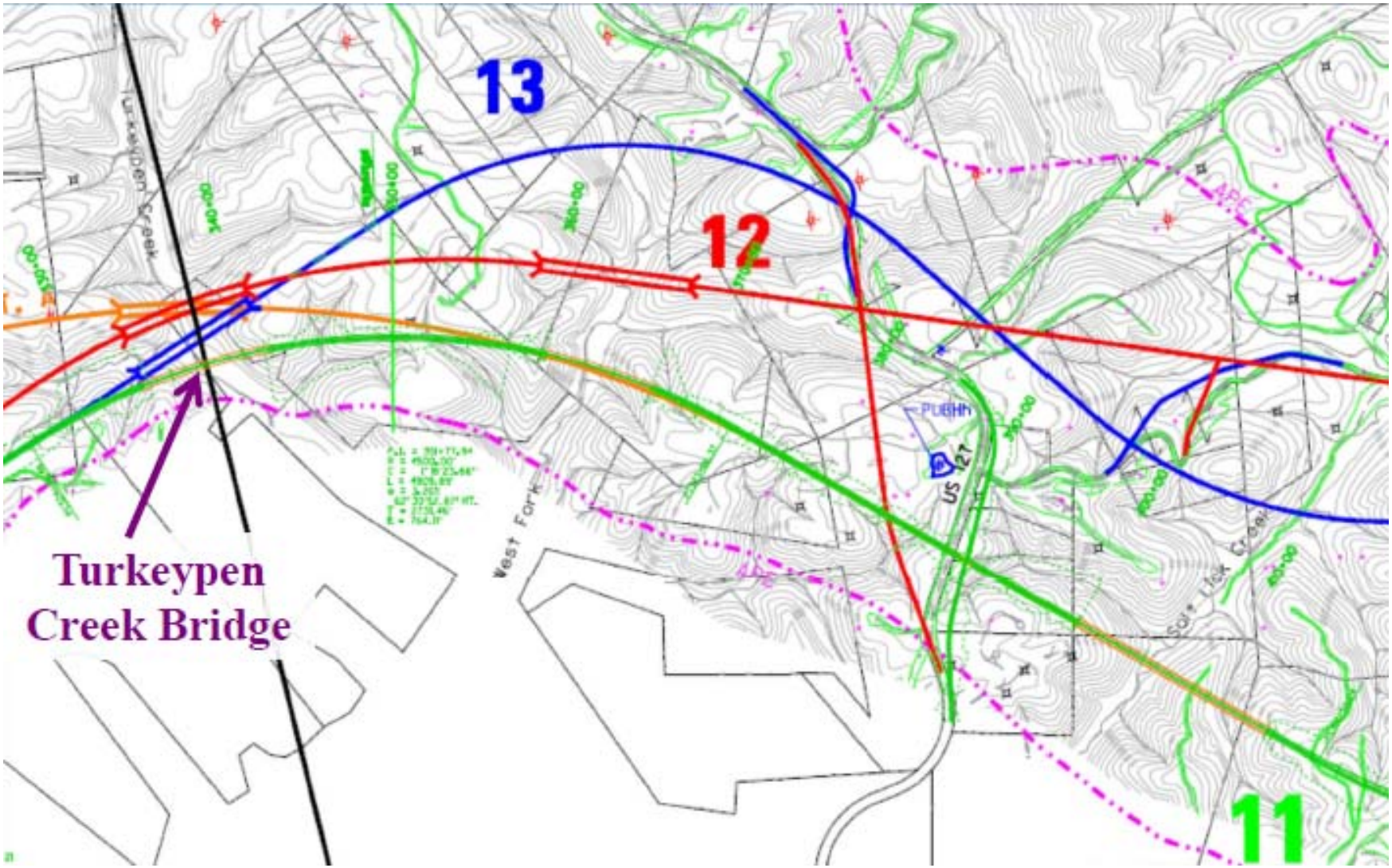
The original design estimated the bridge structure at $105 per square foot. This bridge crosses a deep valley (approximately 150 ft from profile grade) and is located in a horizontal curve. Based on these items, the VE team is of the opinion that the true cost of the bridge structure will be closer to $225 per square foot. This accounts for utilizing a longer span steel girders superstructure in lieu of precast and the added difficulty and cost of constructing tall piers in this terrain.

The revised initial construction costs are significantly reduced by eliminating the proposed structure in lieu of a culvert structure and embankment. A secondary benefit would be the elimination of future deck overlays/replacement, painting, and other bridge maintenance items. This VE proposal assumes a fill cost of $6 per square foot. While not studied as part of this recommendation, adjusting the profile to reduce the depth of fills and better balance the overall cut fill for the project would increase the benefit of this VE recommendation.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$10,868,000	$849,000	$11,717,000
RECOMMENDED DESIGN	$7,458,000	$24,000	$7,482,000
ESTIMATED SAVINGS OR (COST)	$3,410,000	$825,000	$4,235,000

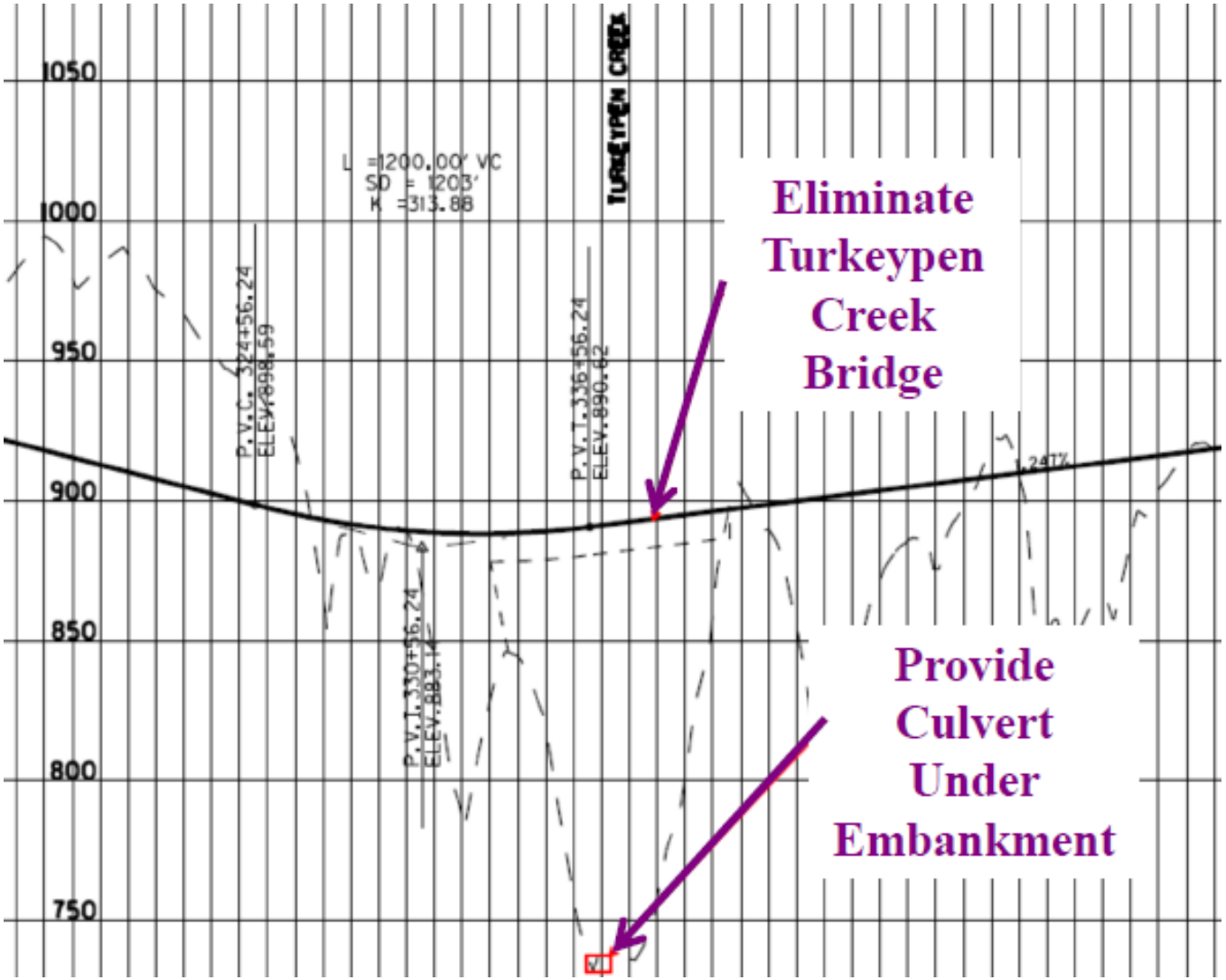
VALUE ENGINEERING RECOMMENDATION # VE-14

SKETCH OF RECOMMENDED DESIGN



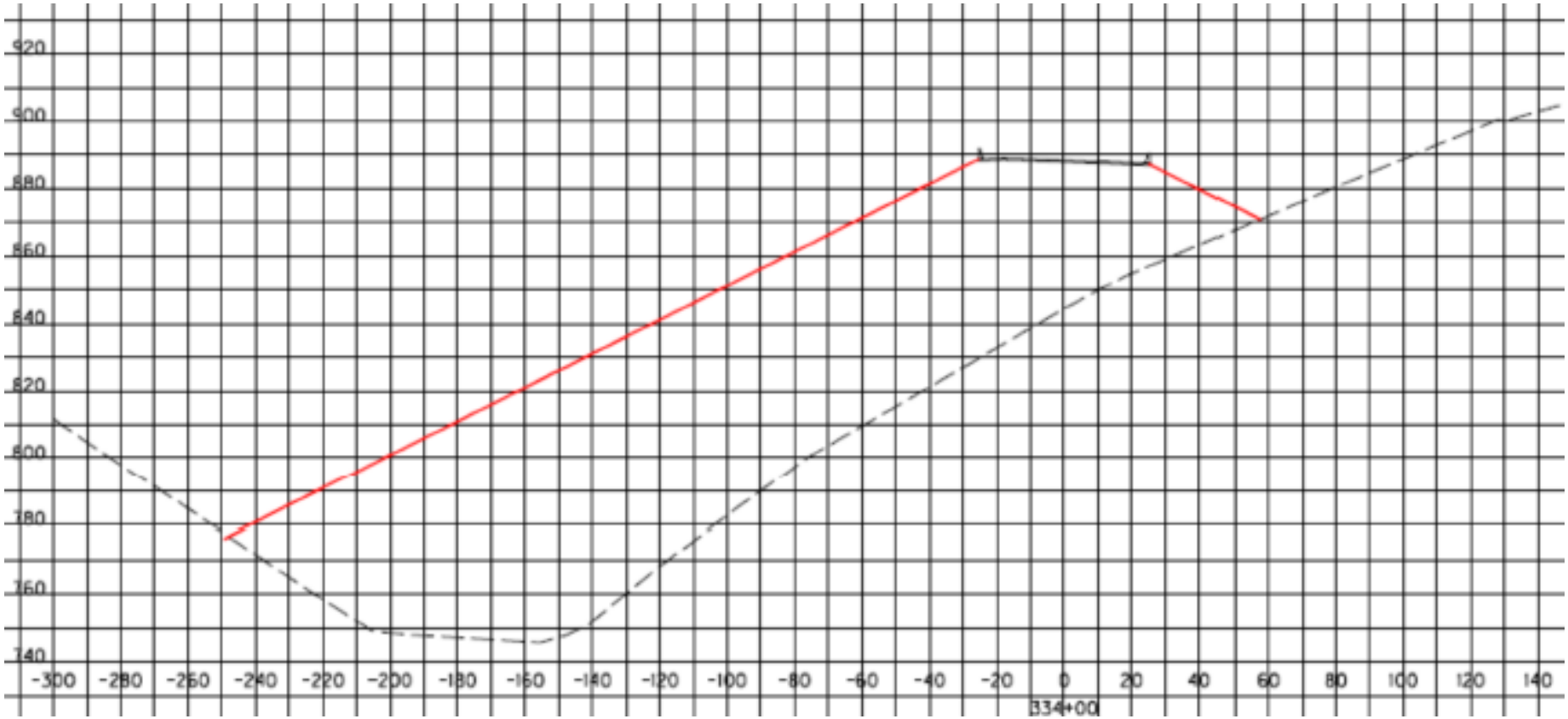
VALUE ENGINEERING RECOMMENDATION # VE-14

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-14

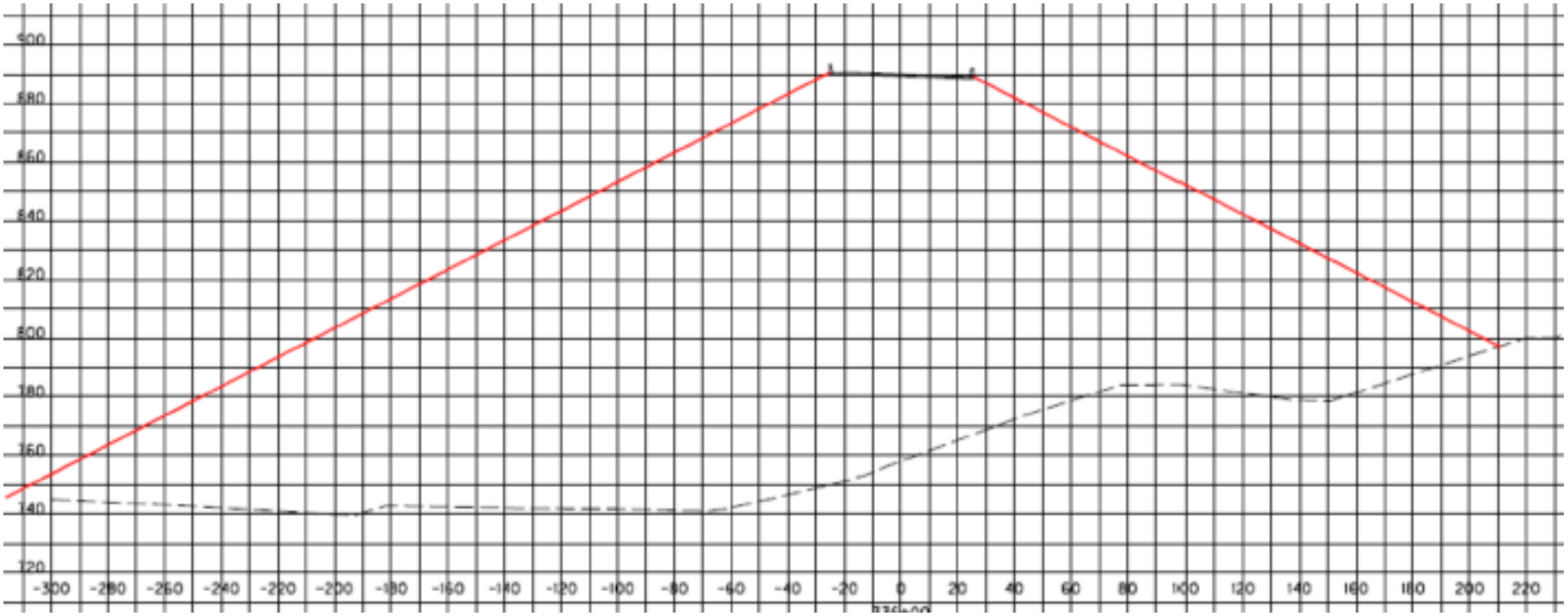
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-14

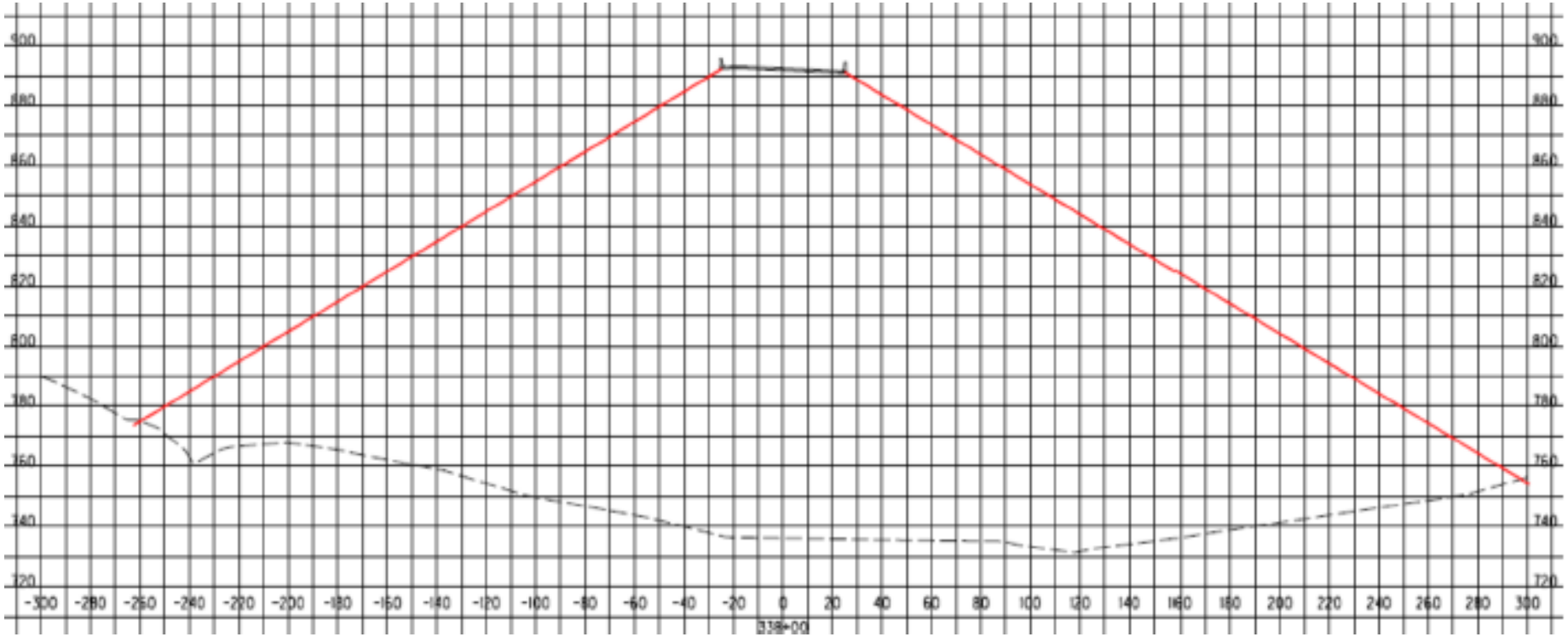
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-14

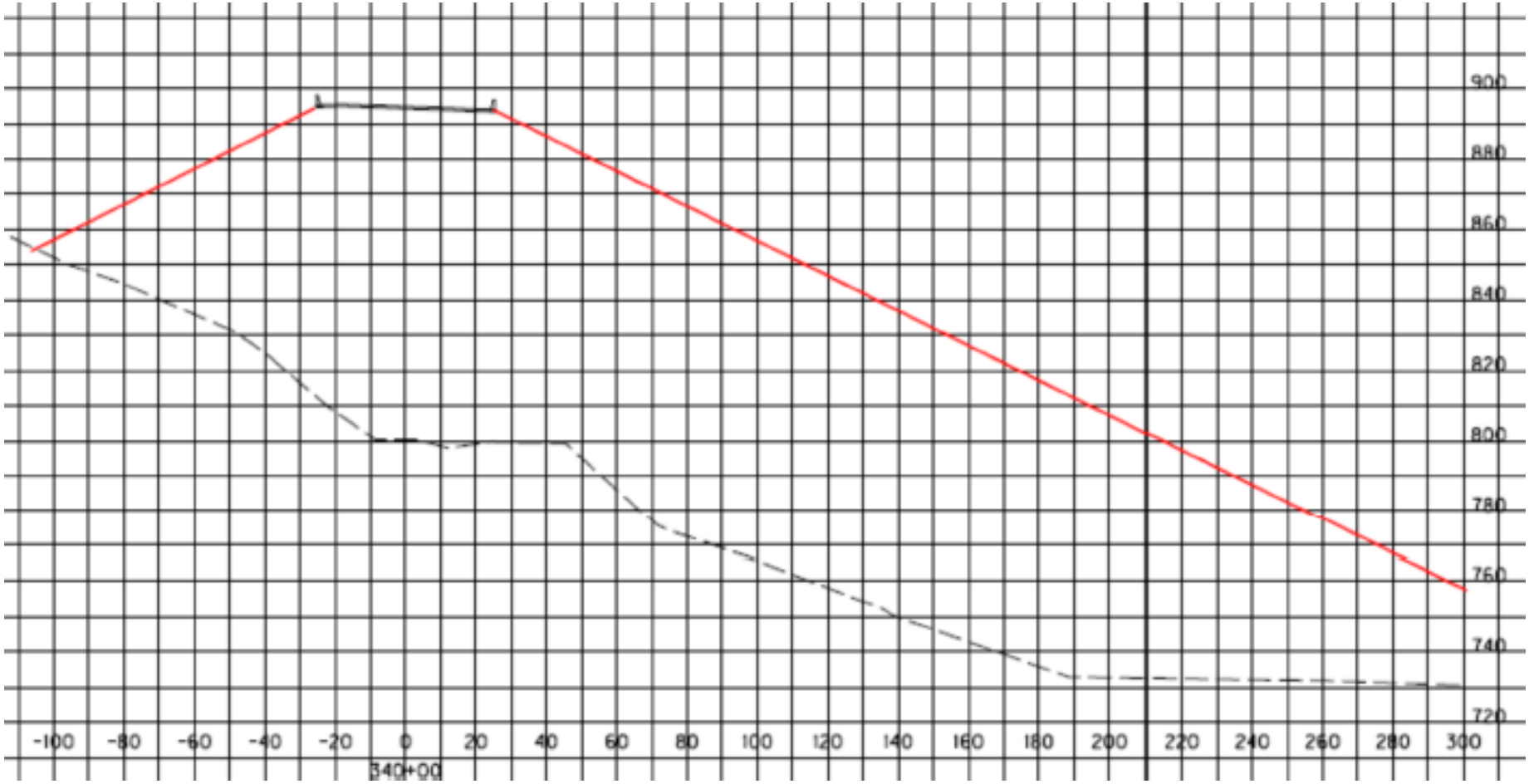
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-14

SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

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 $
Bridge	SF	$225	7	43,911	$9,879,975		
Embankment	CY	$6.00	2			905,000	$5,430,000
Culvert	LF	$2,250	1			600	$1,350,000
Subtotal					$9,879,975		$6,780,000
Engr. & Contg.	@	10%			$987,998		$678,000
Total					$10,867,973		$7,458,000

SOURCE CODE: 1 Project Cost Estimate
2 KYTC 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

COST ESTIMATE - LIFE CYCLE (LC) COST

PRESENT WORTH (PW) METHOD
LIFE CYCLE (LC) PERIOD (YEARS) = 75
ANNUAL PERCENTAGE RATE = 4%

Operations & Maintenance Single Expenditure	In the Yr	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Paint Structural Steel	25	0.3751	$550,000	$206,314		
Paint Structural Steel	50	0.1407	$550,000	$77,392		
Overlay Deck	20	0.4564	$200,000	$91,277		
New Deck	40	0.2083	$1,900,000	$395,749		
Overlay Deck	60	0.0951	$200,000	$19,012		
Subtotal Single Life Cycle O&M Costs				$789,745		$0
Operations & Maintenance Annual Continuous Costs	For How Many Yrs	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Biannual Inspections	75	23.6804	$2,500	$59,201	$1,000	$23,680
Subtotal Annual Life Cycle Costs				$59,201		$23,680
Total Life Cycle Operations & Maintenance Costs				$849,000		$24,000

✓ VE Selected
Scenario #3

VALUE ENGINEERING RECOMMENDATION # VE-15

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize culvert and embankment in lieu of Salt Lick Creek Bridge.

ORIGINAL DESIGN:
The original design specifies a bridge spanning Salt Lick Creek and the associated valley. Based on preliminary recommendations the estimated bridge length is 1,444 feet with a 51 foot bridge width. The valley at this location is approximately 225 feet below the profile grade for US 127. Based on the required pier height for this structure the VE team revised the project team's square foot costs for the bridge to $300 per square foot from $105 per square foot to reflect the increased span lengths and complexity of constructing tall piers.

RECOMMENDED CHANGE:
The VE team recommends eliminating the bridge structure and utilizing a culvert structure and fill. While we do not have access to hydraulic data, based on a review of contours it is believed that a cast-in-place or precast culvert would be sufficient at this location. For the purposes of this VE we are assuming a twin 14 ft x 7 ft culvert.

ADVANTAGES:
- Reduce Capital Construction
- Reduced future maintenance

DISADVANTAGES:
- Wider ROW footprint
- Possible Hydraulic Limitations

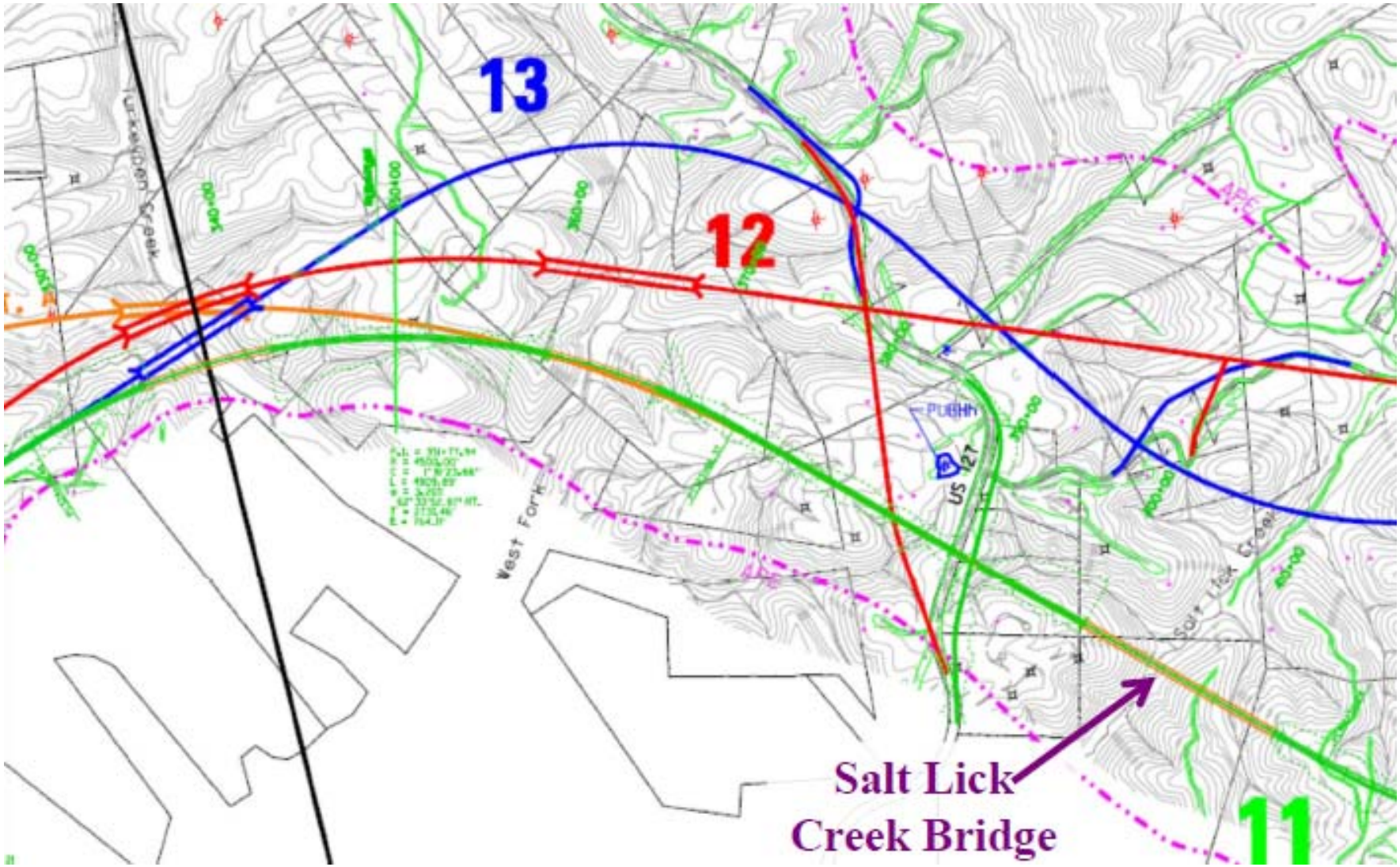
JUSTIFICATION:
The VE team did not have access to hydraulic data for Salt Lick Creek, thus the justification for this VE proposal is dependent on the hydraulics. Based on the apparent drainage area it is reasonable to anticipate that Salt Lick Creek can be successfully passed through a culvert structure. The original design estimated the bridge structure at $105 per square foot. This bridge crosses a deep valley (approximately 225 ft from profile grade) and is located in a horizontal curve. Based on these items, the VE team is of the opinion that the true cost of the bridge structure will be closer to $300 per square foot. This accounts for utilizing a longer span steel girders superstructure in lieu of precast and the increased difficulty and cost of constructing tall piers in this terrain.

The revised initial construction costs are significantly reduced by eliminating the proposed structure in lieu of a culvert structure and embankment. A secondary benefit would be the elimination of future deck overlays/replacement, painting, and other bridge maintenance items. This VE proposal assumes a fill cost of $6 per square foot. While not studied as part of this recommendation, adjusting the profile to reduce the depth of fills and better balance the overall cut fill for the project would increase the benefit of this VE recommendation.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$24,303,000	$1,398,000	$25,701,000
RECOMMENDED DESIGN	$16,487,000	$24,000	$16,511,000
ESTIMATED SAVINGS OR (COST)	$7,816,000	$1,374,000	$9,190,000

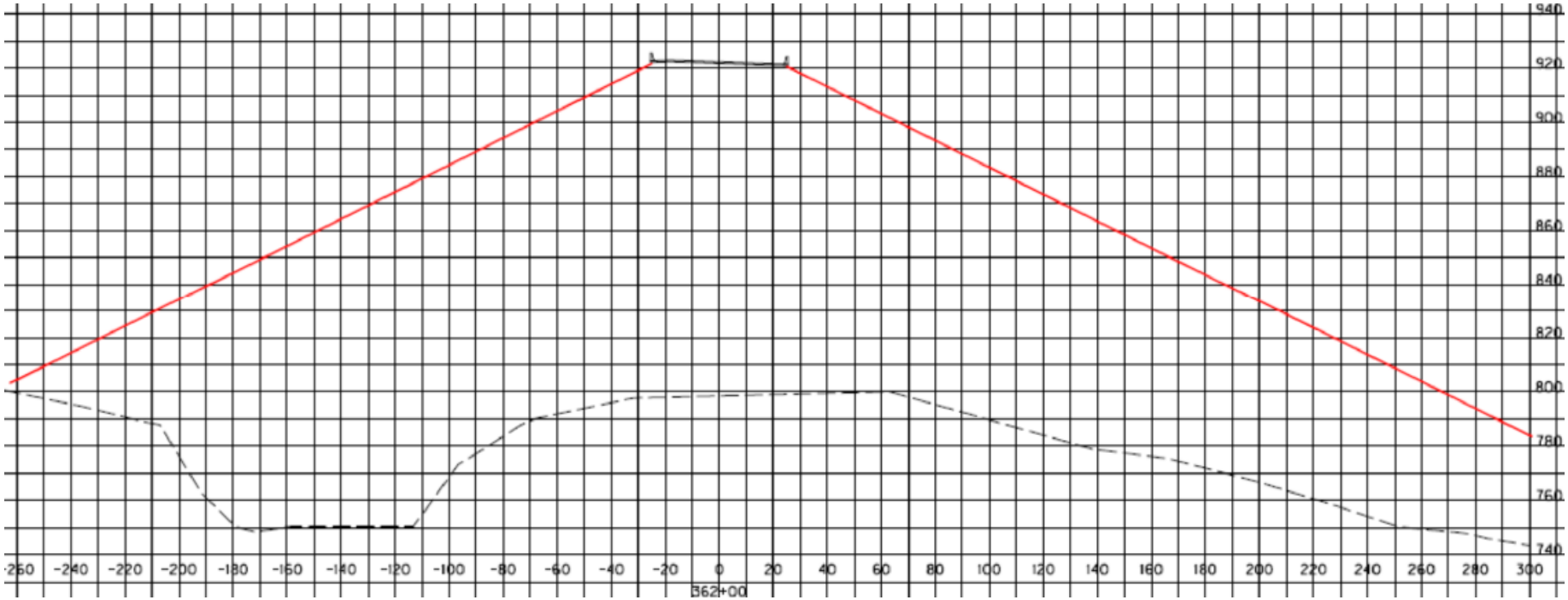
VALUE ENGINEERING RECOMMENDATION # VE-15

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-15

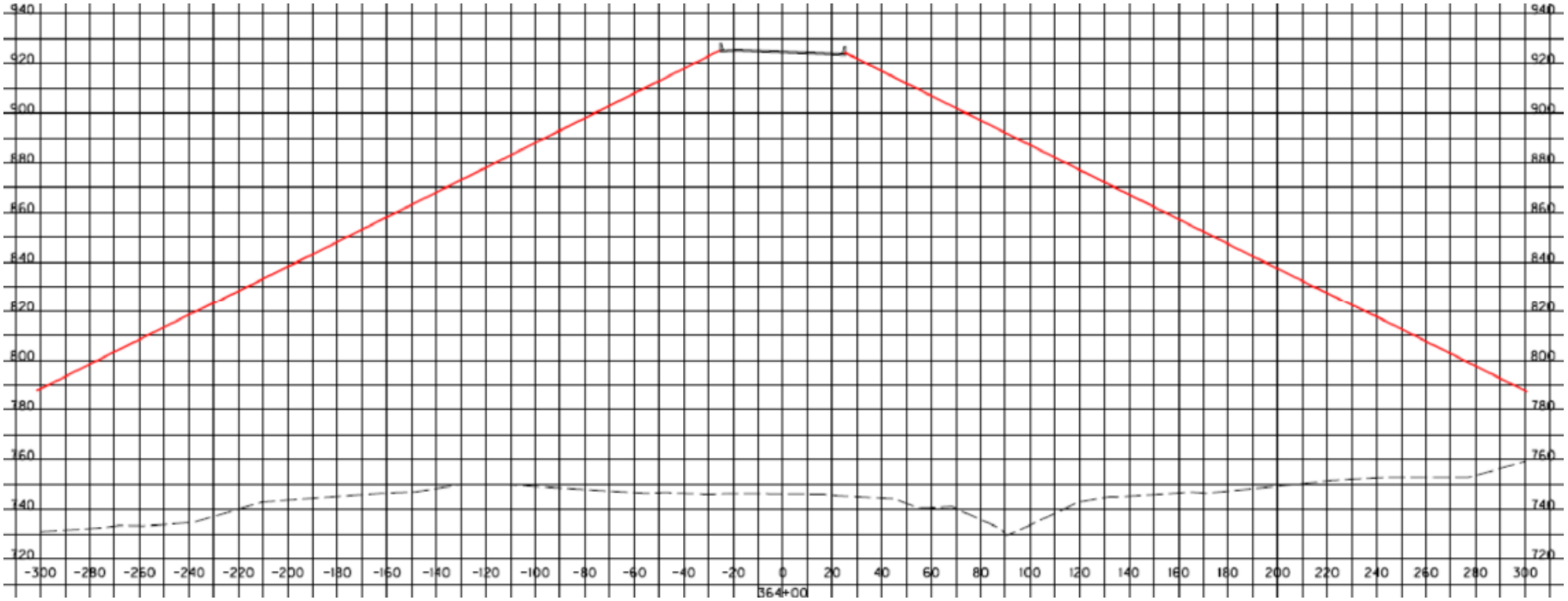
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-15

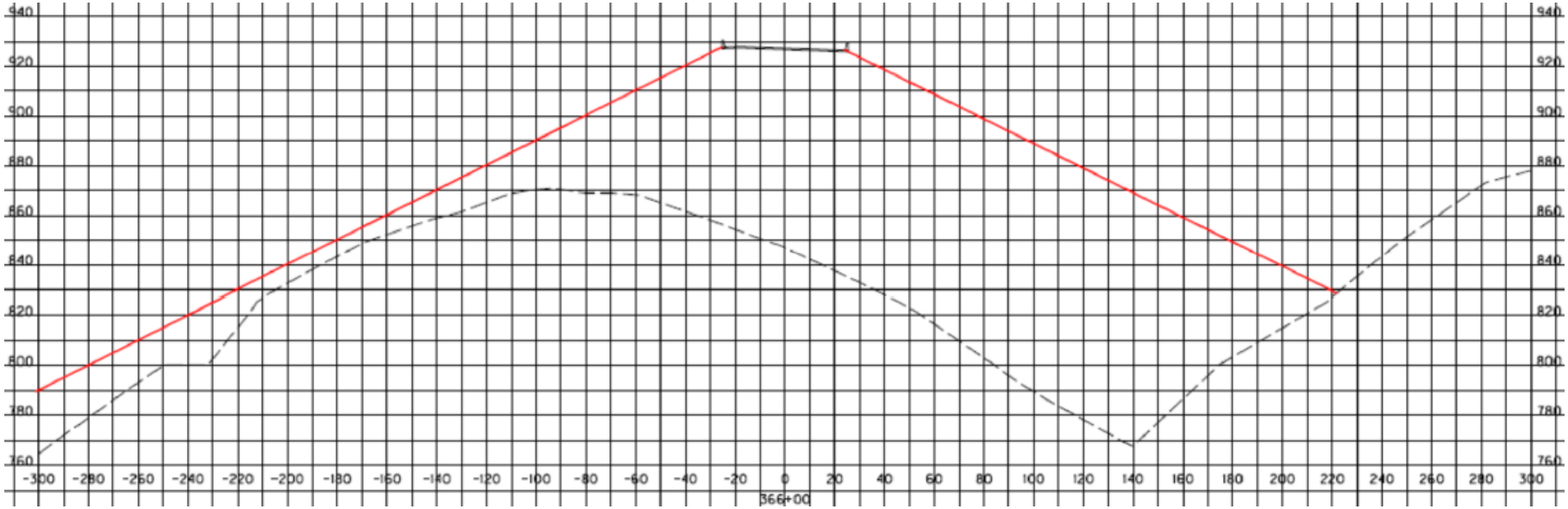
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-15

SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

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 $
Bridge	SF	$300	7	73,644	$22,093,200		
Embankment	CY	$6.00	2			2,126,000	$12,756,000
Culvert	LF	$2,250	1			900	$2,025,000
Pavement	LF	$275	1			753	$207,075
Subtotal					$22,093,200		$14,988,075
Engr. & Contg.	@	10%			$2,209,320		$1,498,808
Total					$24,302,520		$16,486,883

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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

COST ESTIMATE - LIFE CYCLE (LC) COST

PRESENT WORTH (PW) METHOD
LIFE CYCLE (LC) PERIOD (YEARS) = 75
ANNUAL PERCENTAGE RATE = 4%

Operations & Maintenance Single Expenditure	In the Yr	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Paint Structural Steel	25	0.3751	$940,000	$352,610		
Paint Structural Steel	50	0.1407	$940,000	$132,270		
Overlay Deck	20	0.4564	$340,000	$155,172		
New Deck	40	0.2083	$3,200,000	$666,525		
Overlay Deck	60	0.0951	$340,000	$32,321		
Subtotal Single Life Cycle O&M Costs				$1,338,897		$0
Operations & Maintenance Annual Continuous Costs	For How Many Yrs	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Biannual Inspections	75	23.6804	$2,500	$59,201	$1,000	$23,680
Subtotal Annual Life Cycle Costs				$59,201		$23,680
Total Life Cycle Operations & Maintenance Costs				$1,398,000		$24,000

✓ VE Selected
Scenario #3

VALUE ENGINEERING RECOMMENDATION # VE-16

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize culvert and embankment in lieu of West Fork Creek Bridge.

ORIGINAL DESIGN:
The original design specifies a bridge spanning West Fork Creek and the associated valley. Based on preliminary recommendations the estimated bridge length is 753 feet with a 51 foot bridge width. The valley at this location is approximately 200 feet below the profile grade for US 127. Based on the required pier height for this structure the VE team revised the project team's square foot costs for the bridge to $275 per square foot from $105 per square foot to reflect the increased span lengths and complexity of constructing tall piers.

RECOMMENDED CHANGE:
The VE team recommends eliminating the bridge structure and utilizing a culvert structure and fill. While we do not have access to hydraulic data, based on a review of contours it is believed that a cast-in-place or precast culvert would be sufficient at this location. For the purposes of this VE we are assuming a twin 14 ft x 7 ft culvert.

ADVANTAGES:
- Reduce capital construction
- Reduced future maintenance

DISADVANTAGES:
- Wider ROW footprint
- Possible hydraulic limitations

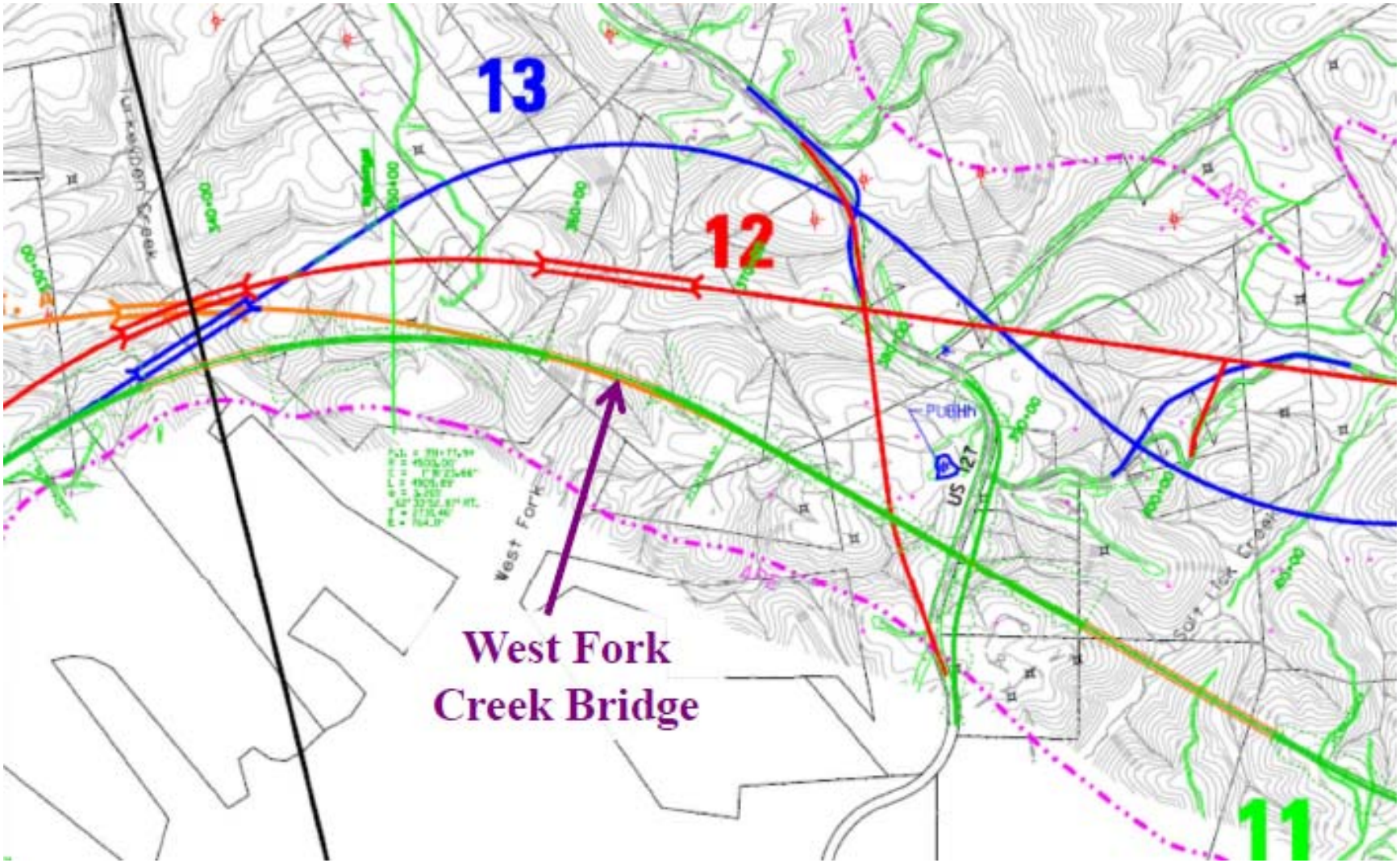
JUSTIFICATION:
The VE team did not have access to hydraulic data for West Fork Creek, thus the justification for this VE proposal is dependent on the hydraulics. Based on the apparent drainage area it is reasonable to anticipate that West Fork Creek can be successfully passed through a culvert structure. The original design estimated the bridge structure at $105 per square foot. This bridge crosses a deep valley (approximately 200 ft from profile grade) and is located in a horizontal curve. Based on these items, the VE team is of the opinion that the true cost of the bridge structure will be closer to $275 per square foot. This accounts for utilizing a longer span steel girders superstructure in lieu of precast and the increased difficulty and cost of constructing tall piers in this terrain.

The revised initial construction costs are significantly reduced by eliminating the proposed structure in lieu of a culvert structure and embankment. A secondary benefit would be the elimination of future deck overlays/replacement, painting, and other bridge maintenance items. This VE proposal assumes a fill cost of $6 per square foot. While not studied as part of this recommendation, adjusting the profile to reduce the depth of fills and better balance the overall cut fill for the project would increase the benefit of this VE recommendation.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$11,617,000	$729,000	$12,346,000
RECOMMENDED DESIGN	$9,578,000	$24,000	$9,602,000
ESTIMATED SAVINGS OR (COST)	$2,039,000	$705,000	$2,744,000

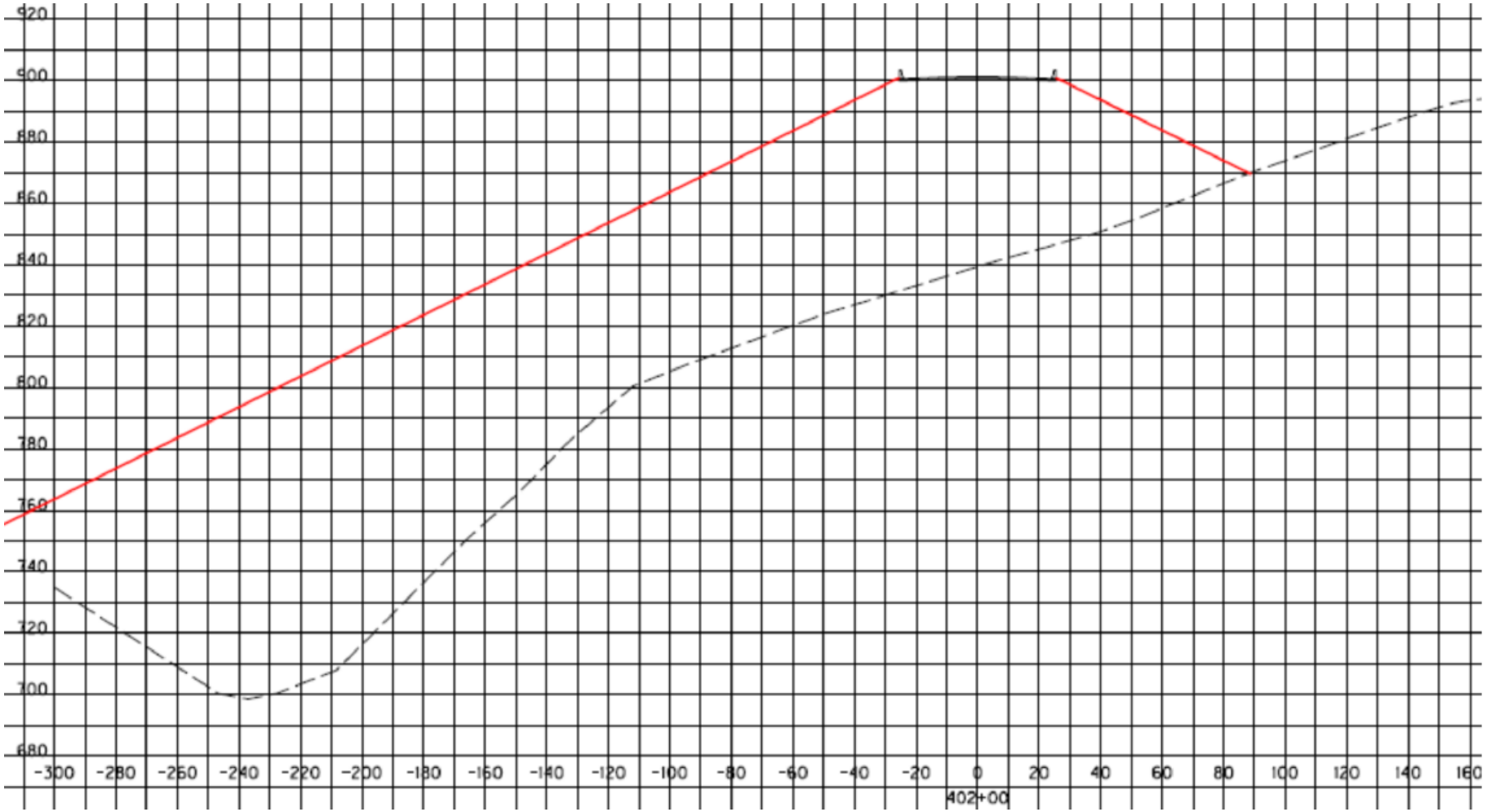
VALUE ENGINEERING RECOMMENDATION # VE-16

SKETCH OF RECOMMENDED DESIGN



VALUE ENGINEERING RECOMMENDATION # VE-16

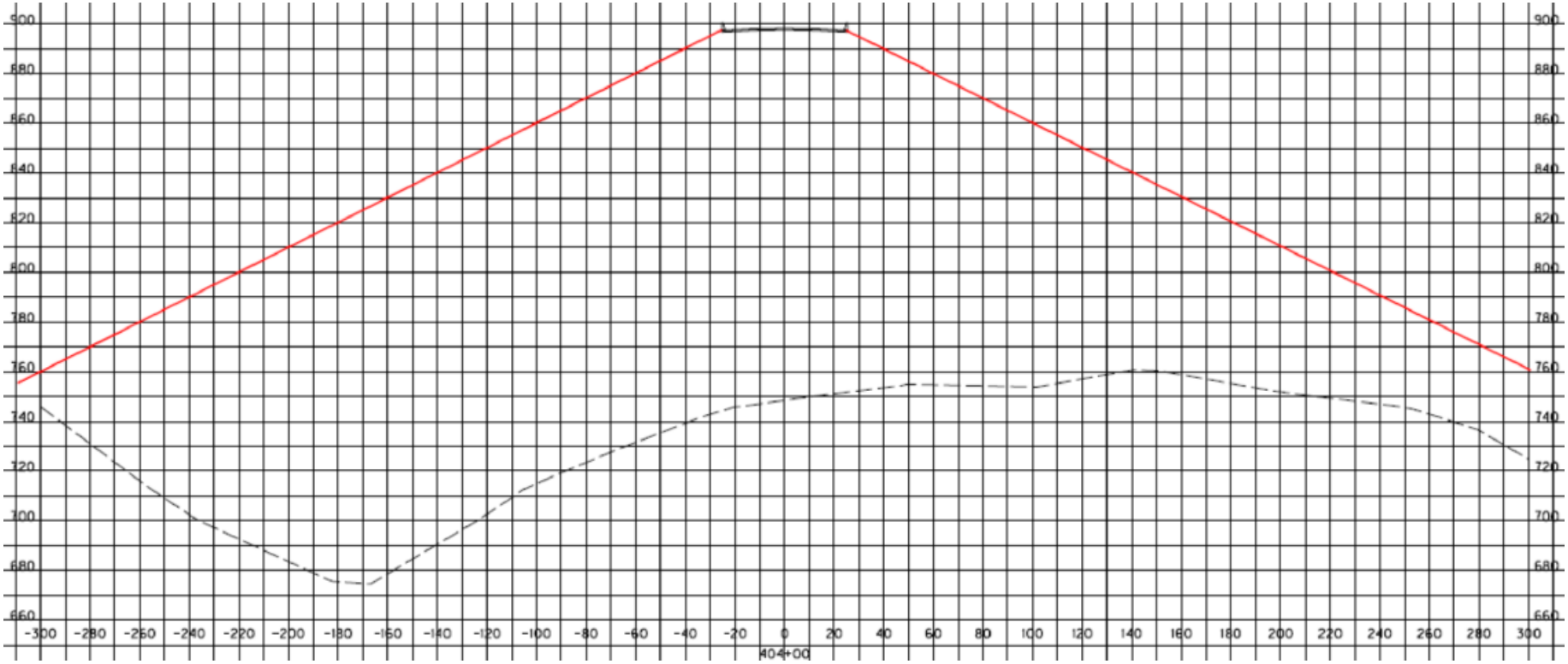
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-16

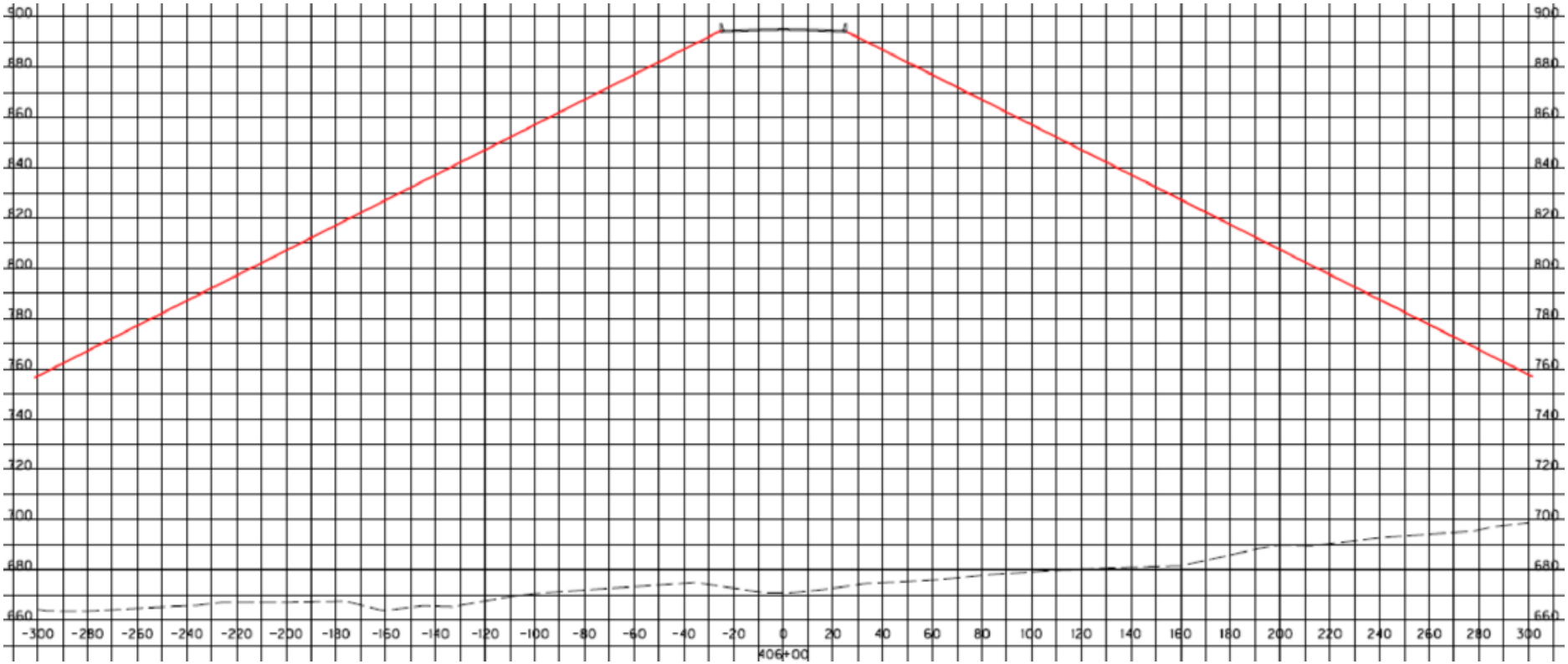
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-16

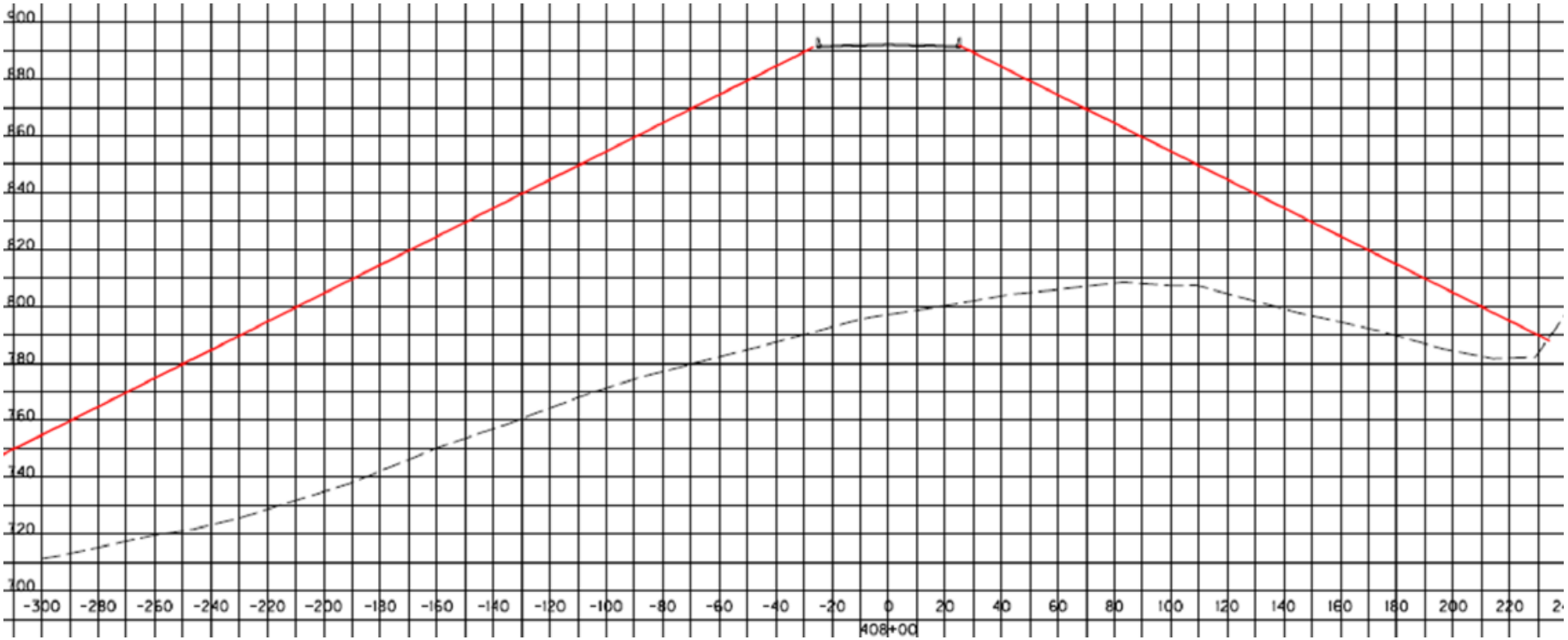
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-16

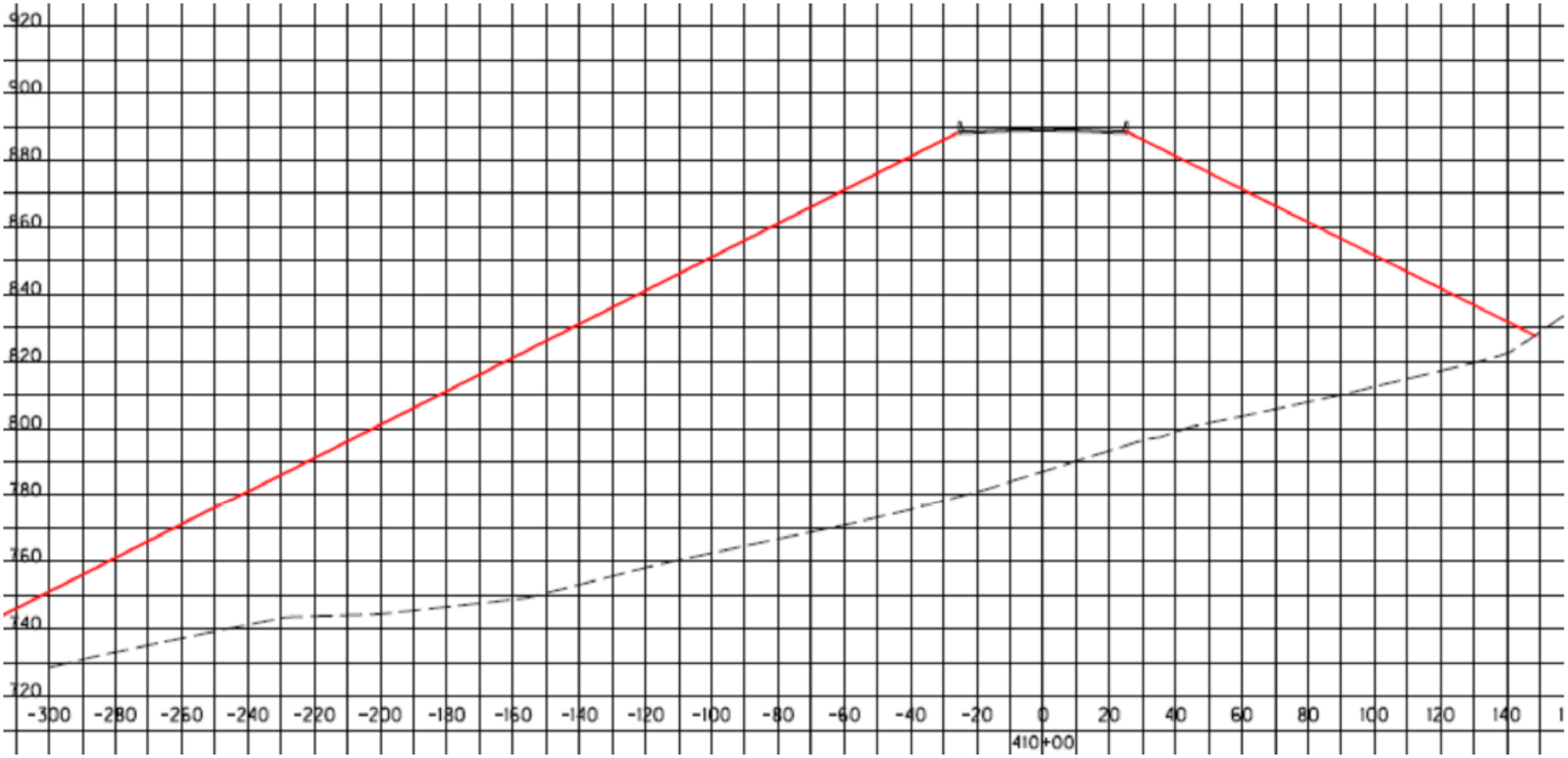
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-16

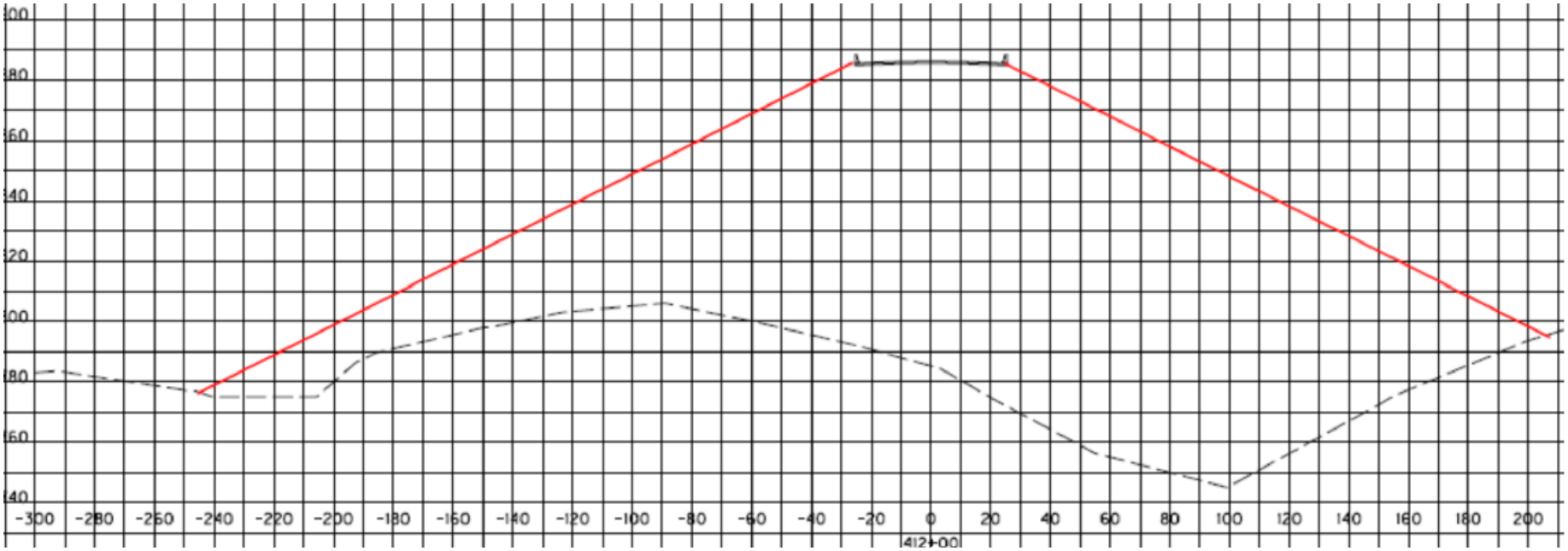
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-16

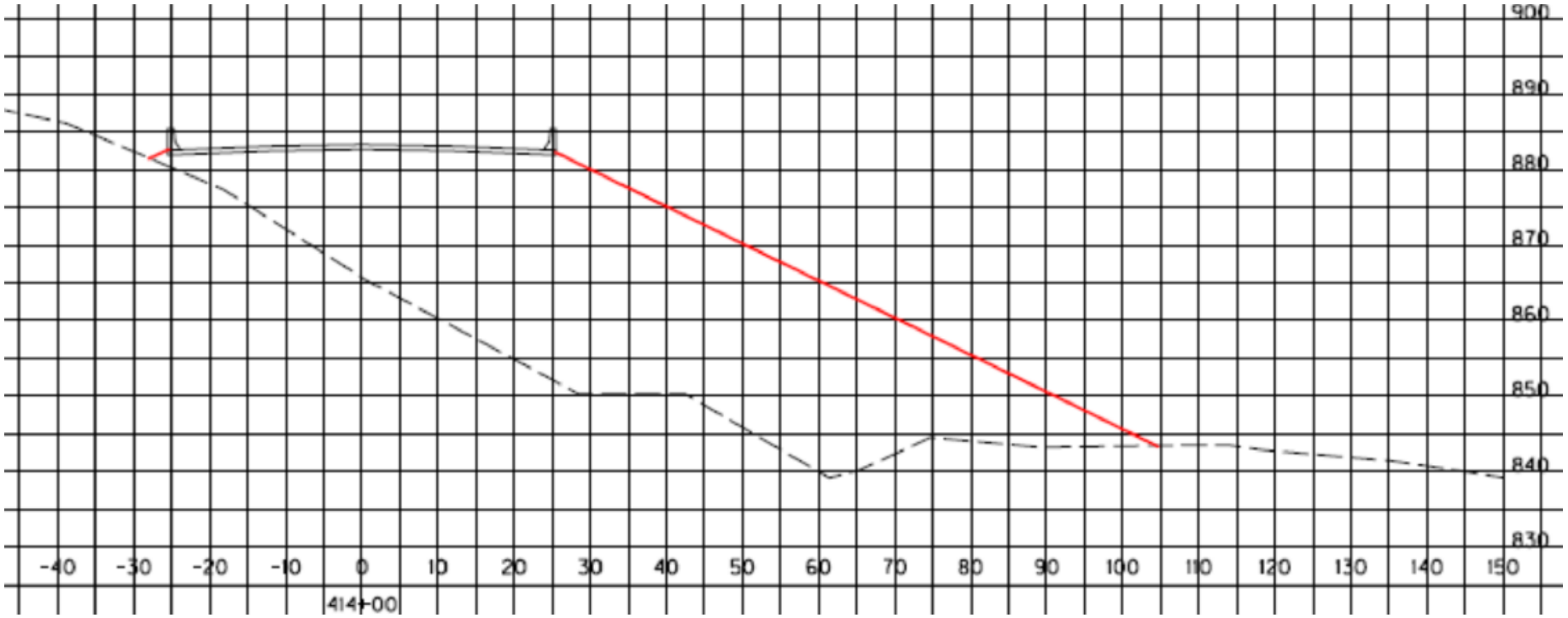
SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

VALUE ENGINEERING RECOMMENDATION # VE-16

SKETCH OF RECOMMENDED DESIGN



Proposed cross-section of recommended embankment in lieu of bridge

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 $
Bridge	SF	$275	7	38,403	$10,560,825		
Embankment	CY	$6.00	2			1,085,000	$6,510,000
Culvert	LF	$2,250	1			800	$1,800,000
Pavement	LF	$275	1			1,444	$397,100
Subtotal					$10,560,825		$8,707,100
Engr. & Contg.	@	10%			$1,056,083		$870,710
Total					$11,616,908		$9,577,810

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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

COST ESTIMATE - LIFE CYCLE (LC) COST

PRESENT WORTH (PW) METHOD
LIFE CYCLE (LC) PERIOD (YEARS) = 75
ANNUAL PERCENTAGE RATE = 4%

Operations & Maintenance Single Expenditure	In the Yr	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Paint Structural Steel	25	0.3751	$470,000	$176,305		
Paint Structural Steel	50	0.1407	$470,000	$66,135		
Overlay Deck	20	0.4564	$170,000	$77,586		
New Deck	40	0.2083	$1,600,000	$333,262		
Overlay Deck	60	0.0951	$170,000	$16,160		
Subtotal Single Life Cycle O&M Costs				$669,448		$0
Operations & Maintenance Annual Continuous Costs	For How Many Yrs	Present Worth Factor	Original Design		Recommended Design	
			Est $	PW $	Est $	PW $
Biannual Inspections	75	23.6804	$2,500	$59,201	$1,000	$23,680
Subtotal Annual Life Cycle Costs				$59,201		$23,680
Total Life Cycle Operations & Maintenance Costs				$729,000		$24,000

✓ VE Selected
Scenario #3

VALUE ENGINEERING RECOMMENDATION # VE-17

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize more roadway and embankment to reduce the length of the Manntown Road, B. Mann Road, and Creek Drive Bridges.

ORIGINAL DESIGN:
The original design provides bridges over B Mann Road / Rock Lick Creek at 1,150 ft, Creek Drive at 785 ft and Manntown Road at 1,000 ft.

RECOMMENDED CHANGE:
The VE team recommends extending the roadway and embankment on the ends of the bridge to reduce the overall bridge length. Three bridges appear to be good candidates for this modification:

- B Mann Road / Rock Lick Creek (Station 487+52) Reduce 1,150 ft bridge to 600 ft
- Creek Drive (Station 507+11) Reduce from 785 ft to 350 ft
- Manntown Road (Station 533+71) Reduce 1,000 ft bridge to 400 ft

ADVANTAGES:

- Reduce capital construction
- Reduced future maintenance

DISADVANTAGES:

- Wider ROW footprint

JUSTIFICATION:
The VE team assumed a roadway and creek bed width of approximately 100 feet at the bottom of the valleys these bridges cross. Beyond the 100 feet, 2:1 embankments would be constructed up to the abutments.

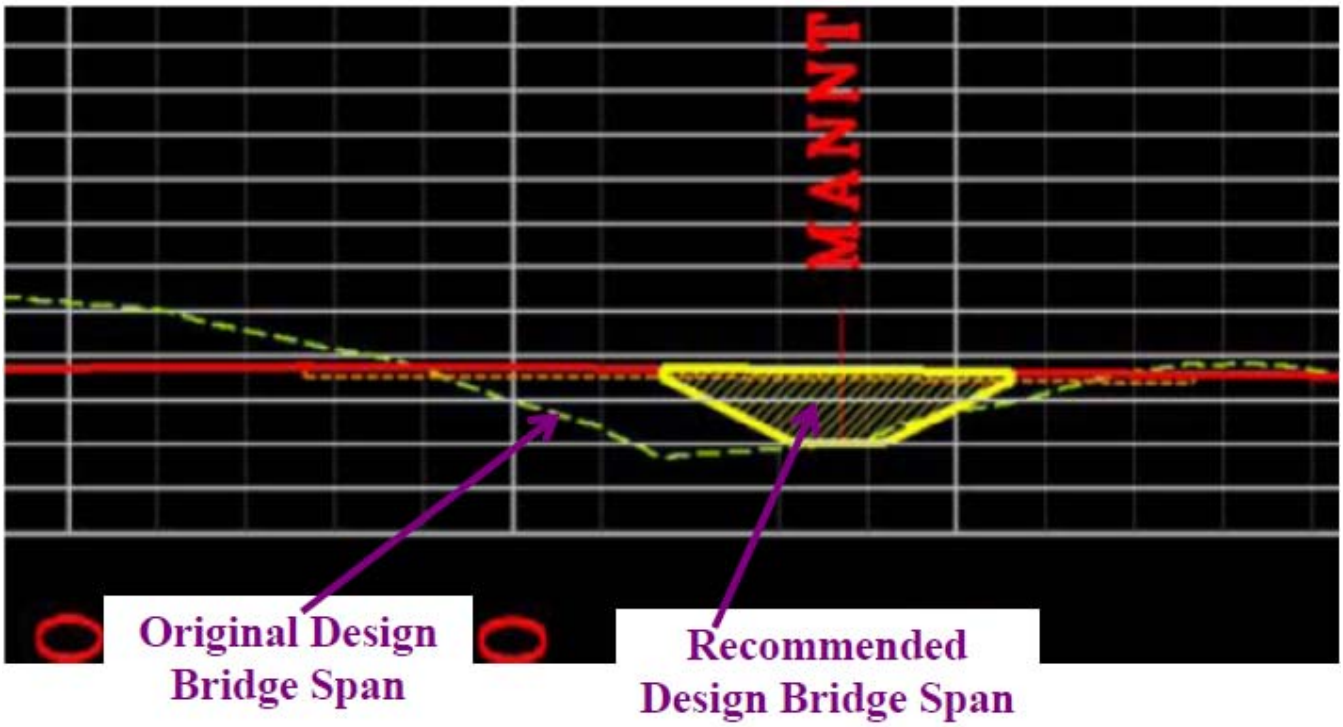
The original design estimated all the bridge structure at $105 per square foot. These bridges cross valleys that range from 50 to almost 100 feet deep. Based on the height of the required piers, the VE team is of the opinion that more realistic costs range from $150 to $175 per square foot for these bridges. Refer to the attached estimates for more detail. These increased unit costs accounts for the complexity of constructing taller piers and the associated effects on superstructure selection.

The revised initial construction costs are significantly reduced by shortening the proposed structures. No significant changes to the life cycle costs are anticipated.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$26,101,000	$0	$26,101,000
RECOMMENDED DESIGN	$15,272,000	$0	$15,272,000
ESTIMATED SAVINGS OR (COST)	$10,829,000	$0	$10,829,000

VALUE ENGINEERING RECOMMENDATION # VE-17

SKETCH OF RECOMMENDED DESIGN



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 $
Rock Lick Creek	SF	$150	7	58,650	$8,797,500	30,600	$4,590,000
Embankment	CY	$6.00	7			125,000	$750,000
Pavement	LF	$275	7			550	$151,250
Creek Drive Bridge	SF	$150	7	40,035	$6,005,250	17,850	$2,677,500
Embankment	CY	$6.00	7			100,000	$600,000
Pavement	LF	$275	7			435	$119,625
Manntown Road Bridge	SF	$175	7	51,000	$8,925,000	20,400	$3,570,000
Embankment	CY	$6.00	7			210,000	$1,260,000
Pavement	LF	$275	7			600	$165,000
Subtotal					$23,727,750		$13,883,375
Engr. & Contg.	@	10%			$2,372,775		$1,388,338
Total					$26,100,525		$15,271,713

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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

DESCRIPTIVE TITLE OF RECOMMENDATION:
Utilize mechanically stabilized earth (MSE) or a cantilevered retaining wall (breast wall abutment) to reduce the length of the Manntown Road, B Mann Road, and Creek Drive Bridges.

ORIGINAL DESIGN:
The original design provides bridges over B Mann Road / Rock Lick Creek at 1,150 ft, Creek Drive at 785 ft and Manntown Road at 1,000 ft.

RECOMMENDED CHANGE:
The VE team recommends utilizing mechanically stabilized earth (MSE) or a cantilevered retaining wall (breast wall abutment) to reduce the length of the Manntown Road, B Mann Road, and Creek Drive Bridges. The VE team assumes that the B Mann Road / Rock Lick Creek Bridge could be reduced from 1,150 ft to 600 ft. The Creek Drive Bridge could be reduced from 785 ft to 350 ft, and the Manntown Road Bridge could be reduced from 1,000 ft to 300 ft.

ADVANTAGES:
- Reduce bridge lengths
- Reduce bridge maintenance

DISADVANTAGES:
- Requires redesign

JUSTIFICATION:
This recommendation has the potential to reduce the lengths of several bridges in this project. The bridges are the most expensive component of this project, so if an alternate structural design practice could reduce the lengths of bridges necessary, a substantial cost savings could be realized. The VE team did not have any hydrological information available at the time of the VE study, so additional analysis will be required to confirm hydrological criteria is being satisfied.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$17,289,000	$0	$17,289,000
RECOMMENDED DESIGN	$7,363,000	$0	$7,363,000
ESTIMATED SAVINGS OR (COST)	$9,926,000	$0	$9,926,000

VALUE ENGINEERING RECOMMENDATION # VE-18

SKETCH OF ORIGINAL AND RECOMMENDED DESIGN

Original Design

Recommended Design

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 $
ML Bridge @ 487+52 (Rock Lick Creek)	LS	$6,158,250	1	1	$6,158,250		
ML Bridge @ 507+11 (Creek, drive)	LS	$4,203,675	1	1	$4,203,675		
ML Bridge @ 533+71 (Manntown Road)	LS	$5,355,000	1	1	$5,355,000		
ML Bridge @ 487+52 (Rock Lick Creek)	LS	$3,213,000	1			1	$3,213,000
ML Bridge @ 507+11 (Creek, drive)	LS	$1,874,250	1			1	$1,874,250
ML Bridge @ 533+71 (Manntown Road)	LS	$1,606,500	1			1	$1,606,500
Subtotal					$15,716,925		$6,693,750
Engr. & Contg.	@	10%			$1,571,693		$669,375
Total					$17,288,618		$7,363,125

SOURCE CODE:
1 Project Cost Estimate
2 KYTC 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 DESIGN COMMENT # VE-19

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize crushed stone base in lieu of dense grade aggregate (DGA) to improve subgrade drainage.

COMMENTARY:
The VE team recommends utilizing crushed stone base in lieu of dense grade aggregate (DGA). Crushed stone base provides a strong and durable base material, and it improves the subgrade drainage properties. Crushed stone base can be placed with conventional equipment. Depending on the quality of the excavated material, the project may benefit from potential availability of local material. Crushed stone base could potentially reduce or eliminate the need for more expensive natural aggregates in the pavement cross-section.

VALUE ENGINEERING DESIGN COMMENT # VE-20

DESCRIPTIVE TITLE OF DESIGN COMMENT:
Utilize geogrids to decrease the required asphalt pavement thickness.

COMMENTARY:
The use of geogrid is gaining widespread acceptance as a means to reduce costs of pavement. This is accomplished by taking advantage of the geogrid's unilateral strength which acts as a mechanically stabilized layer. This allows for less pavement thickness and therefore a reduction in paving material.

Since a pavement design has not been prepared for this project, the VE team will use an example from a recent KYTC VE Study on another project. The original design for the example project specified using a pavement design consisting of 1.25 inch asphalt surface, 8.75 inch asphalt base, 4 inch drainage blanket, and 4 inch DGA with Type IV filter fabric over 24 inch rock roadbed. The VE team recommended using Tensar TX 5 Geogrid to reduce the amount of asphalt base needed. The use of geogrid reduced the thickness of the asphalt base by 2.75 inch and increased the DGA base by 3 inch. This allowed more DGA to be used in exchange of asphalt, thus reducing the overall cost.

Installation of geogrid is fairly new to the KYTC and will require close supervision. Therefore, use of geogrid by a contractor that is unfamiliar could cause problems unless the appropriate oversight is provided by the supplier.

VALUE ENGINEERING DESIGN COMMENT # VE-20

PHOTOGRAPHS OF RECOMMENDED DESIGN

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
Study Participants

APPENDIX A – Study Participants

Workshop Attendance

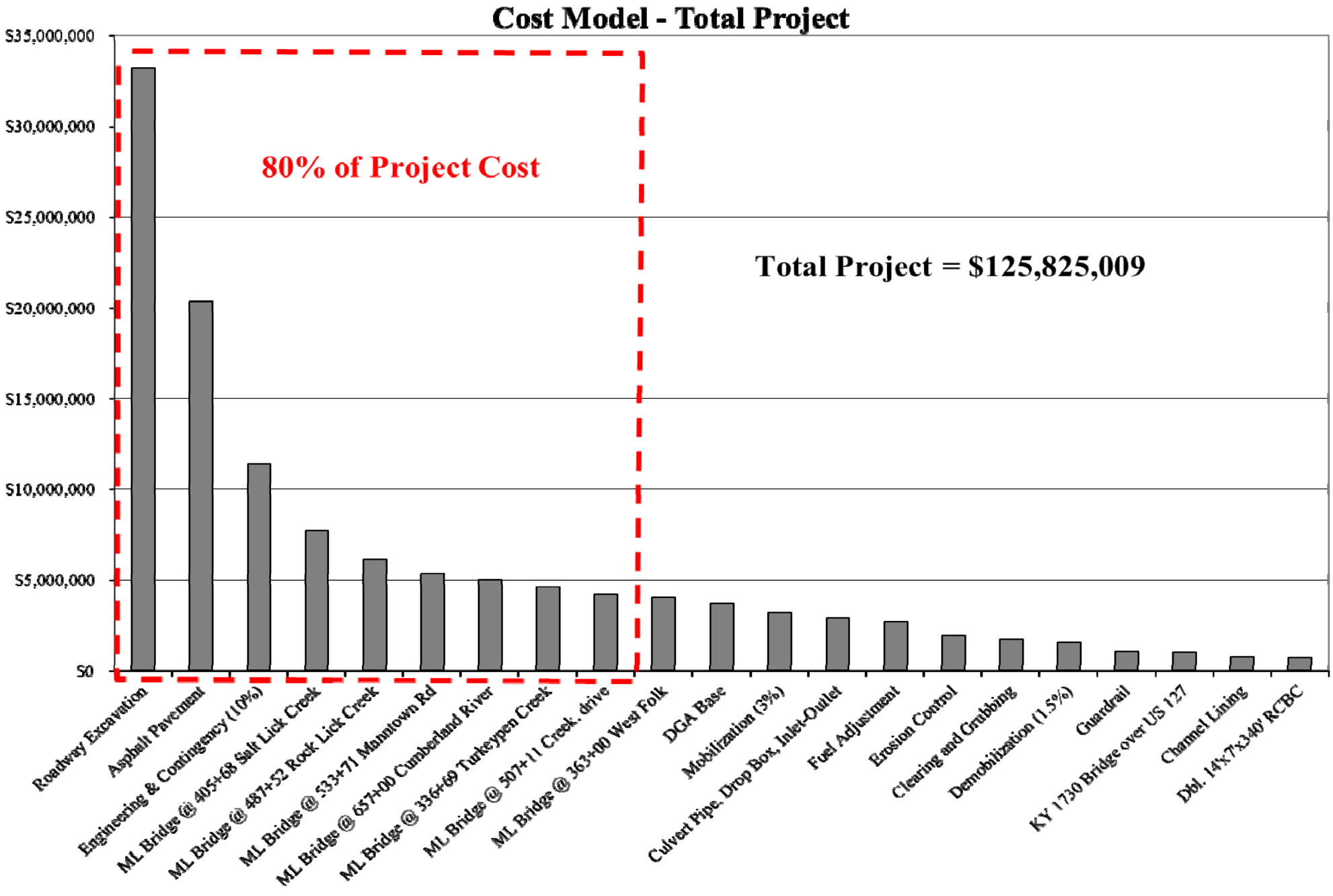
Attendees				Participation						
				Meetings		Study Sessions				
Name	**Organization and Address (Organization first, with complete address underneath)**	**Tel # and Email (Tel first with Email underneath)**	**Role in Workshop**	**Intro**	**Out Brief**	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Boday Borres	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Boday.borres@ky.gov	Owner Representative	X	X					
Marshall Carrier	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Marshall.carrier@ky.gov	Drainage		X					
Rachel Catchings	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Rachel.catchings@ky.gov	VE Team Member	X	X	X	X	X	X	X
Tom Clouse	KYTC – District 8 1660 South Highway 27 Somerset, KY 42501	606-677-4017 Tom.clouse@ky.gov	KYTC Project Manager	X	X					
Jim Gallt	Palmer Engineering 400 Shoppers Drive, P.O. Box 747 Winchester, KY 40392	859-744-1218 jgallt@palmernet.com	Design Consultant		X					
Larry Ginthum	QK4 815 West Market Street, Suite 300 Louisville, KY 40202	502-585-2222 lginthum@qk4.com	Design/NEPA Consultant	X	X					
Greg Groves	URS Corporation 325 W. Main Street, Suite 1200 Louisville, KY 40202	502-569-2301 Greg_Groves@urscorp.com	VE Roadway Designer	X	X	X	X	X	X	X
Bob Gustafson	QK4 815 West Market Street, Suite 300 Louisville, KY 40202	502-585-2222 gustafson@qk4.com	Design Consultant		X					
Taylor Kelly	QK4 815 West Market Street, Suite 300 Louisville, KY 40202	tkelly@qk4.com	Design Consultant		Via Web					
Adam Kirk	Kentucky Transportation Center 176 Raymond Building University of Kentucky Lexington, KY 40506-0281	859-257-7310 akirk@engr.uky.edu	VE Traffic Engineer	X		X	X	X	X	X
Rodney Little	KYTC – Highway Design Quality Assurance Branch	606-677-4017 Charles.Little@ky.gov	Owner Highway Design	X	X					
Phil Logsdon	KYTC 200 Mero Street Frankfort, KY 40602	502-564-7250 Phil.logsdon@ky.gov	DEA		X					

Workshop Attendance

Attendees				Participation						
				Meetings		Study Sessions				
Name	**Organization and Address (Organization first, with complete address underneath)**	**Tel # and Email (Tel first with Email underneath)**	**Role in Workshop**	**Intro**	**Out Brief**	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Bill McKinney	KYTC 200 Mero Street Frankfort, KY 40602	502-564-4560 William.mckinney@ky.gov	VE Structural Engineer	X	X	X	X	X	X	X
Peter Overmohle	AEI 65 Aberdeen Drive Glasgow, KY 42141	270-651-7220 povermohle@aei.cc	Design Consultant		X					
Kyle Schafersman	URS Corporation 8300 College Boulevard, Suite 200 Overland Park, KS 66210	913-344-1019 Kyle_Schafersman@urscorp.com	VE Team Leader	X	X	X	X	X	X	X
David Smith	QK4 815 West Market Street, Suite 300 Louisville, KY 40202	502-585-2222 dsmith@qk4.com	Design/NEPA Consultant	X						
Tom Springer	QK4 815 West Market Street, Suite 300 Louisville, KY 40202	502-585-2222 tspringer@qk4.com	Design/NEPA Consultant	X	X					
Brent Sweger	KYTC 200 Mero Street Frankfort, KY 40602	502-564-3280 Brent.Sweger@ky.gov	Owner VE Coordinator	X	X	X	X	X	X	X
Mike Zwick	URS Corporation 36 E. 7th Street, Suite 2300 Cincinnati, OH 45202	513-419-3505 Mike_Zwick@urscorp.com	VE Bridge Engineer	X	X	X	X	X	X	X

APPENDIX B
Cost Information

APPENDIX B - Cost Information


Cost Model - Total Project
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
80% of Project Cost
Total Project = $125,825,009
Roadway Excavation
Asphalt Pavement
Engineering & Contingency (10%)
ML Bridge @ 405+68 Salt Lick Creek
ML Bridge @ 487+52 Rock Lick Creek
ML Bridge @ 533+71 Manntown Rd
ML Bridge @ 657+00 Cumberland River
ML Bridge @ 336+69 Turkeypen Creek
ML Bridge @ 507+11 Creek, drive
ML Bridge @ 363+00 West Folk
DGA Base
Mobilization (5%)
Culvert Pipe, Drop Box, Inlet-Outlet
Fuel Adjustment
Erosion Control
Clearing and Grubbing
Demobilization (1.5%)
Guardrail
KY 1730 Bridge over US 127
Channel Lining
Dbl. 14'x7'x340' RCBC

APPENDIX C
Function Analysis

APPENDIX C - Function Analysis

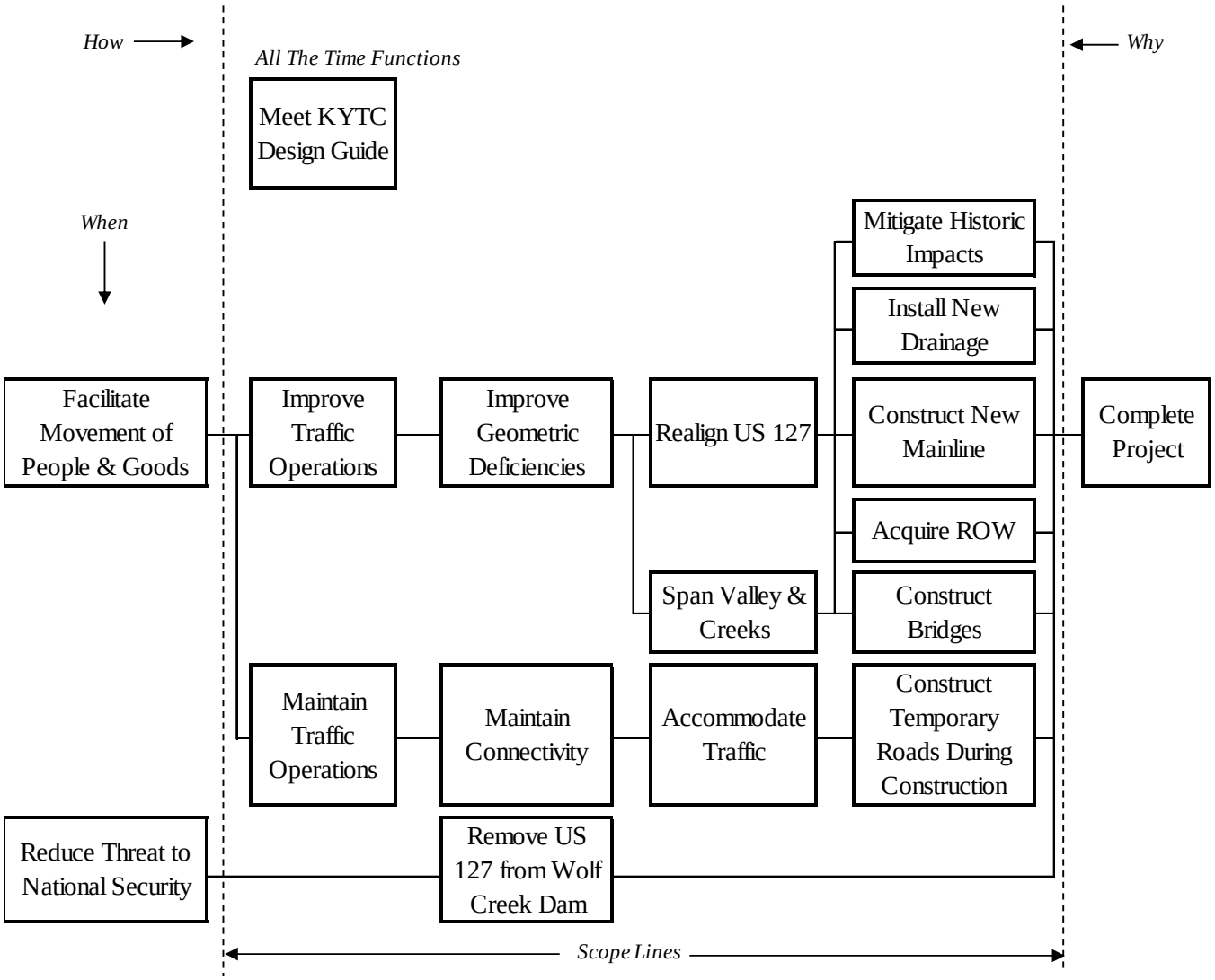
Function Model

Item	Cost	Function
Total Project	$125,825,010	Improve security Improve geometry Meet standards Support economic development
Roadway Excavation	$33,276,538	Cut rock Straighten profile Flatten vertical curve
-9,502,890 CY @ $3.50/CY		
Asphalt Pavement	$20,395,608	Support vehicles Use available material
-17 miles of new road		
-Asphalt base 254,223 Ton @ $52/Ton		
Engineering & Contingency (10%)	$11,438,637	Support construction inspection Administer contract Accounts for unknowns
-appears low (could be 25%)		
ML Bridge @ 405+68 Salt Lick Creek	$7,734,119	Span Salt Lick Creek Span valley Maintain vertical geometry
-1,444 ft x 51 ft = 73,658 SF @$105/SF		
-SF cost appears low (~$300/SF)		
ML Bridge @ 487+52 Rock Lick Creek	$6,158,250	Span B Mann Road Span Rock Lick Creek
-1,150 ft x 51 ft = 58,650 SF $105/SF		
-SF cost appears low (~$150/SF)		
ML Bridge @ 533+71 Manntown Rd	$5,355,000	Span Manntown Road Maintain Manntown Road connectivity
-1,000 ft x 51 ft = 51,000 SF $105/SF		
-SF cost appears low (~$175/SF)		
ML Bridge @ 657+00 Cumberland River	$5,033,700	Span Cumberland River Move roadway off dam
-940 ft x 51 ft = 47,940 SF $105/SF		
-SF cost appears low (~$175/SF)		

Item	Cost	Function
ML Bridge @ 336+69 Turkeypen Creek	$4,610,655	Span Turkeypen Creek Span valley Maintain vertical geometry
-861 ft x 51 ft = 43,911 SF $105/SF		
-SF cost appears low (~$225/SF)		
ML Bridge @ 507+11 Creek, drive	$4,203,675	Span Creek Maintain Creek drive continuity
-785 ft x 51 ft = 40,035 SF $105/SF		
-SF cost appears low (~$150/SF)		
ML Bridge @ 363+00 West Folk	$4,036,278	Span West Folk Creek Span valley Maintain vertical geometry
-754 ft x 51 ft = 38,441 SF $105/SF		
-SF cost appears low (~$275/SF)		
DGA Base	$3,686,529	Provides drainage Support asphalt
Mobilization (3%)	$3,205,958	Mobilize contractor labor and equipment
Culvert Pipe, Drop Box, Inlet-Outlet	$2,887,562	Convey water
Fuel Adjustment	$2,712,167	Account for fuel cost fluctuation
Erosion Control	$2,000,000	Meet permits Control erosion
Clearing and Grubbing	$1,750,000	Prepare site
Demobilization (1.5%)	$1,602,979	Demobilize contractor labor and equipment
Guardrail	$1,100,478	Keep vehicles on road
KY 1730 Bridge over US 127	$1,081,185	Maintain local connectivity
Channel Lining	$791,800	Prevent erosion
Dbl. 14 ft x 7 ft x 340 ft RCBC	$766,000	Convey water
-unknown location		
4 ft x 3 ft x 1,035 ft RCBC @ 696+30	$372,600	Convey water

Item	Cost	Function
Maintain and Control Traffic	$300,000	Maintain traffic Control traffic
4 ft x 3 ft x 795 ft RCBC @730+00	$286,200	Convey water
Staking	$200,000	Survey project area
3 ft x 3 ft x 725 ft RCBC @ 685+00	$195,750	Convey water
12 ft x 6 ft x 160 ft RCBC	$173,000	Convey water
Class A Concrete	$128,275	Construct pipe headwalls
Pavement Marker	$83,520	Notify road users
Pave. Striping - Permanent Paint	$82,000	Notify road users
Pipeline Video Inspection	$58,713	Meet standard specifications
Signs	$39,525	Notify road users
Water (for Dust Control)	$23,985	Control dust
Edge Key	$21,410	Tie to existing pavement
Steel Reinforcement	$18,114	Support pipe headwall
Fabric-Geotextile Type IV	$14,800	Stabilize soil and pipes

FAST Diagram



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	Specify partially controlled access in lieu of by-permit only access	1	A. Kirk
2	Utilize spot and curve improvements along US 127 in lieu of the base case design	2	A. Kirk
3	Utilize 1990 scoping study alignment diverted around Wolf Creek Dam in lieu the base case design	1	B. Sweger
4	Utilize existing US 127 alignment from KY 90 to KY 1730, and follow KY 1730 to proposed alignment 16.1	1	G. Groves
5	Utilize existing US 127 alignment from KY 90 to preferred alignment at station 285+00 in lieu of design segments 3 and 6	1	G. Groves
6	Utilize design section 13 and 14 from station 330+00 to Swan Pond Road in lieu of design section 11	1	G. Groves
7	Utilize 10 ft bridge shoulders in lieu of 12 ft bridge shoulders	2	B. Sweger
8	Reduce entire paved typical cross section from 40 ft (2-12 ft lanes, 2- 8 ft paved shoulders) to 32 ft (2-12 ft lanes, 2-4 ft shoulders), and utilize 6 ft bridge shoulders in lieu of 12 ft bridge shoulders	1	R. Catchings
9	At Turkeypen Creek, shift the preferred alignment to the west to eliminate the need for a bridge	3	
10	Introduce additional vertical curves and steepen grades to follow the existing topography more closely and reduce the amount of earthwork necessary	1	R. Catchings & G. Groves
11	Modify construction section 1 (design sections 21 and 23) to more closely follow the existing topography to reduce the amount of borrow material necessary	4	
12	If design section 14 is implemented, eliminate the Williams Road realignment	3	
13	Utilize culvert and embankment in lieu of Turkeypen Creek Bridge	1	M. Zwick
14	Utilize culvert and embankment in lieu of Salt Lick Creek Bridge	1	M. Zwick
15	Utilize culvert and embankment in lieu of West Fork Creek Bridge	1	M. Zwick
16	At the north end of design section 16.1 tie back into the existing alignment and eliminate design sections 21 and 23	3	
17	Utilize crushed stone base in lieu of dense grade aggregate (DGA) to facilitate subgrade drainage	DC	B. McKinney
18	Review the construction sections for constructability and cost balancing	DC	R. Catchings
19	If the existing US 127 is reused, add passing lanes	3	
20	Utilize rock road bed in lieu of lime stabilized road bed	4	
21	Utilize at-grade intersection of the preferred alignment and KY 1730 in lieu of realigning and adding a flyover KY 1730	2	B. McKinney
22	Revise the cost estimate to reflect a higher contingency mark-up, a higher construction engineering mark-up, stream mitigation in lieu of fees, and higher bridge unit costs	DC	K. Schafersman

List of Creative Ideas			
ID #	**Name of Idea / Description**	**Develop Status**	**TM Resp.**
23	Install a roundabout at KY 55 and US 127	4	
24	Utilize Tensar Geogrids to decrease the required asphalt pavement thickness	DC	K. Schafersman
25	Utilize more roadway and embankment to reduce the length of the bridges	2	M. Zwick
26	Utilize mechanically stabilized earth (MSE) or a cantilevered retaining wall (breast wall abutment) to reduce the length of the bridges	2	B. McKinney
27	Eliminate the truck climbing lanes throughout the project corridor due to low average daily traffic counts	4	

Development Status Legend:

1: Idea is considered by the VE team to be the best value enhancement possibility and is currently being developed as a VE recommendation

2: Idea is considered by the VE team to be a good value enhancement possibility and will be developed as a VE recommendation after all the “1s” have been developed

3: Idea is considered by the VE team to be of marginal value enhancement possibility and may be developed as a VE recommendation after all the “1s” and “2s” have been developed

4: 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 Design Comment to the designers with no easily quantifiable cost associated

APPENDIX E
VE Punchlist

APPENDIX E – VE Punchlist

VALUE ENGINEERING PUNCH LIST

ITEM NO. **8-108.00 & 8-115.10** PROJECT COUNTY: **Clinton & Russell** DATE OF STUDY: **2/28/2011 to 3/4/2011** **VE # 201102**

VE Alternative Number	VE Team Top Pick	Description	Activity (Y,N,UC-Date)	Implemented Life Cycle Cost Savings	Original Cost	Alternative Cost	Initial Cost Saving	Life Cycle Cost Savings (Total Present Worth)	FHWA Categories	Remarks
Alignment										
VE-2	✓-1	Utilize spot and curve improvements along US 127 in lieu of the base case design			$149,895,000	$5,000,000	$144,895,000	NA		
VE-3	✓-2	Utilize 1990 scoping study alignment diverted around Wolf Creek Dam in lieu of the base case design			$86,546,000	$31,205,000	$55,341,000	$3,043,000		
VE-4		Utilize existing US 127 alignment from KY 90 to KY 1730, and follow KY 1730 to proposed alignment 16.1			$164,576,000	$113,967,000	$50,609,000	$3,043,000		
VE-5		Utilize design section 13 and 14 from station 330+00 to Swan Pond Road in lieu of design section 11			$46,725,000	$13,482,000	$33,243,000	NA		
VE-6		Utilize existing US 127 alignment from KY 90 to preferred alignment at station 285+00 in lieu of design segments 3 and 6			$33,781,000	$17,501,000	$16,280,000	$1,136,000		
VE-7		Utilize at-grade intersection of the preferred alignment and KY 1730 in lieu of realigning and adding a flyover bridge for KY 1730			$7,080,000	$787,000	$6,293,000	NA		
Roadway										
VE-8	✓-3	Specify partially controlled access in lieu of by-permit only access			$0	$0	$0	NA		
VE-9	✓-3	Reduce entire paved typical cross section from 40 ft (2-12 ft lanes, 2- 8 ft paved shoulders) to 32 ft (2-12 ft lanes, 2-4 ft shoulders), and utilize 6 ft bridge shoulders in lieu of 12 ft bridge shoulders			$63,699,000	$52,207,000	$11,492,000	NA		
VE-10		Utilize 10 ft bridge shoulders in lieu of 12 ft bridge shoulders			$20,033,000	$16,694,000	$3,339,000	NA		
VE-11		Utilize a 4 ft usable shoulder (2 ft paved) for the truck climbing lanes in lieu of 10 ft (8 ft paved)			$4,368,000	$1,092,000	$3,276,000	NA		
VE-12	✓-3	Introduce additional vertical curves and steepen grades to follow the existing topography more closely and reduce the amount of earthwork necessary			NA	NA	NA	NA		
VE-13		Review the construction sections for constructability and fiscal constraints			NA	NA	NA	NA		
VE-19		Utilize crushed stone base in lieu of dense grade aggregate (DGA) to improve subgrade drainage			NA	NA	NA	NA		
VE-20		Utilize geogrids to decrease the required asphalt pavement thickness			NA	NA	NA	NA		
Structures										
VE-14	✓-3	Utilize culvert and embankment in lieu of Turkeypen Creek Bridge			$10,868,000	$7,458,000	$3,410,000	$825,000		
VE-15	✓-3	Utilize culvert and embankment in lieu of Salt Lick Creek Bridge			$24,303,000	$16,487,000	$7,816,000	$1,374,000		
VE-16	✓-3	Utilize culvert and embankment in lieu of West Fork Creek Bridge			$11,617,000	$9,578,000	$2,039,000	$705,000		
VE-17	✓-3	Utilize more roadway and embankment to reduce the length of the Manntown Road, B Mann Road, and Creek Drive Bridges			$26,101,000	$15,272,000	$10,829,000	NA		
VE-18		Utilize mechanically stabilized earth (MSE) or a cantilevered retaining wall (breast wall abutment) to reduce the length of the Manntown Road, B Mann Road, and Creek Drive Bridges			$17,289,000	$7,363,000	$9,926,000	NA		
Other										
VE-1		Revise the cost estimate to reflect a higher contingency mark-up, a higher construction engineering mark-up, stream mitigation in lieu of fees, and higher bridge unit costs			NA	NA	NA	NA		
					Saf 0	Ops 0	Env 0	Con 0	Oth 0	

END OF REPORT

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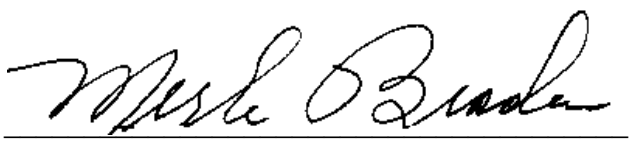

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