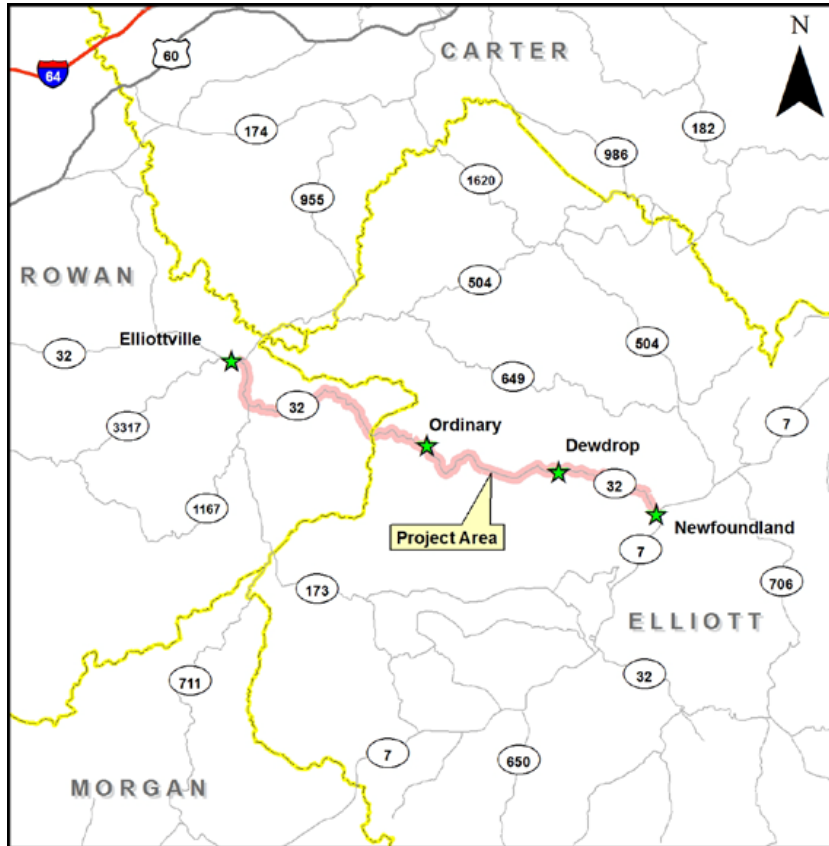




Value Study

Report - Final



KY 32 Reconstruction (Eastern & Western Sections | Item Nos. 9-192.01 & 9-192.03)

Elliott County
Kentucky Transportation Cabinet
VE No. 202304

Study Dates: November 27-30, 2023

Contact: **Ryan Elliott, EdD, PE, CVS**

CVS No. 202001001
Office Phone (602) 493-1947
Cellular Phone (850) 865-3056



January 5, 2024

Disclaimer

The information contained in this report summarizes the professional opinions of the Value Team members offered during the Value Study. These opinions were based on the information provided to the Value Team at the time of the Study. This information may develop further as the project continues, and new data may become available after this report is submitted. Evaluation on how this new information may affect the value proposals and findings contained in this report must be considered when using its content to judge their feasibility or any decisions are made about them.

This report was prepared by:



RHA, LLC

TeamRHA.com

6677 W Thunderbird Rd K183,
Glendale, AZ 85306
Office 602.493.1947
fax 602.275.2972

Table of Contents

PART I - Value Study Results and Proposals

Section 1: Executive Summary

1.1 Value Study Results	1
1.2 Value Study Background	2
1.2.1 Project Goals, Purpose and Need	2
1.2.2 Workshop Objectives	2
1.2.3 Value Study Highlights	2

Section 2: Value Study Results and Proposals

2.1 Introduction	4
2.2 Table of Value Proposals - Preliminary Determination	5
2.3 Design Comments	8
2.4 Individual Value Proposals	9
Value Proposal ES-01	10
Value Proposal ES-03	16
Value Proposal ES-05	22
Value Proposal CS-01	27
Value Proposal CS-03	33
Value Proposal LM-01	39
Value Proposal LM-03	43
Value Proposal SL-02	49
Value Proposal SL-04	55
Value Proposal PV-02	61
Value Proposal RE-01	67
Value Proposal IF-01	73
Value Proposal IF-02	79

Table of Contents (cont.)

PART II - Appendices - Value Study Documentation

Appendix A: Value Study Overview

A.1 Introduction	A-1
A.2 Project Overview	A-1
A.2.1 List of Documents Reviewed	A-2
A.2.2 In-brief Meeting	A-2
A.2.3 Site Visit	A-2
A.2.4 Presentation	A-2
A.3 VM Process	A-3
A.4 Participants	A-5
A.4.1 Attendance Records	A-5
A.5 Agenda	A-6

Appendix B: Project Analysis

B.1 Cost Model	B-1
B.2 Cost Estimate Update	B-2
B.3 Performance Criteria	B-4

Appendix C: Function Analysis

C.1 Introduction	C-1
C.2 Random Function Identification	C-1

Appendix D: Idea List and Idea Evaluation

D.1 Introduction	D-1
D.2 Summary of Outcomes	D-2
D.3 Evaluation Techniques Used	D-2
D.4 List of Scored Ideas Organized by Function	D-3

Table of Contents (cont.)

PART II - Appendices - Value Study Documentation (cont.)

Appendix E: Certification Statement

SAVE International Value Standard Certification	E-1
---	-----

List of Tables

Table 2-1: Classification of Brainstormed Ideas into Value Proposals	4
Table 2-2: Table of Value Proposals - Preliminary Determination	5
Table 2-3: Design Comments	8
Table A-1: The VM Job Plan	A-3
Table A-2: VE Team Participants	A-5
Table B-1: Cost Model Data Table (Without 10% Contingency Applied)	B-1
Table B-2: Updated VE Team Estimate Summary	B-2
Table B-3: List of Performance Criteria	B-4
Table C-1: Random Function Identification Worksheet for Project	C-1
Table D-1: Summary of Ideas Brainstormed (by Function)	D-2
Table D-2: "Scored" Creative Idea List	D-3

List of Figures

Figure A-1: The VM Process	A-3
Figure C-1: Function Analysis and Purpose & Need	C-3
Figure D-1: Sample of Miro Brainstorming Exercise	D-1
Figure D-2: Preliminary Evaluation	D-2



PART

I

Value Study
Results and
Proposals

Section








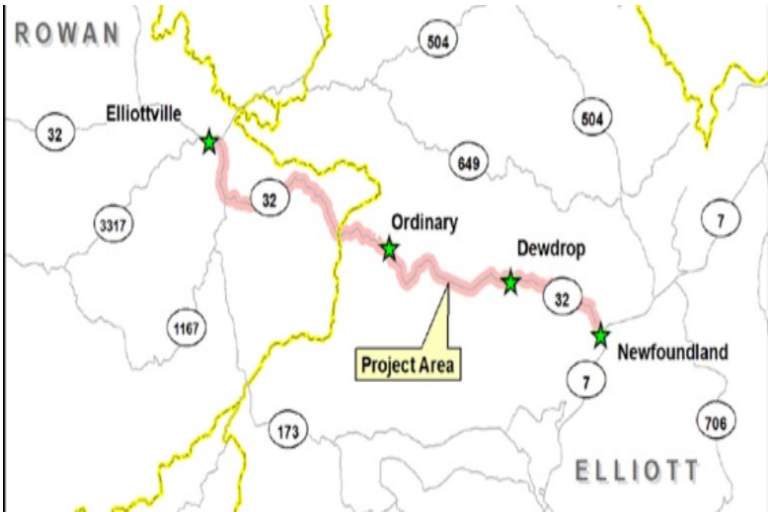
1

Executive Summary

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

1.1 Value Study Results

VALUE STUDY RESULTS SUMMARY					
	Project Name: KY 32 Reconstruction (Eastern & Western Sections)				
	Project Location: Elliott County, KY				
	Client: Kentucky Transportation Cabinet				
	Value Study Dates: November 27-30, 2023	Value Study Timing: Design Development	Original Project Cost:	\$48.3M	
ACCEPTED RESULTS					
	Reliability:	Improved		Total Potential Initial Cost Avoidance:	\$2,767,000
	Operations & Maintenance:	Improved		Schedule Impact:	Maintained
	Functionality:	Improved		Return on Investment:	44:1
PROJECT OVERVIEW					
<i>(Excerpted from the Environmental Assessment document provided by KYTC and dated May 2023)</i>					
<p>The current KY 32 facility was constructed in the 1930s and has substandard geometry (alignments, passing opportunities and sight distances, pavement and shoulder widths, etc.) along most of its 13.7-mile-long corridor. The road is a primary east-west roadway in Elliott and Rowan counties, and provides connectivity among residential areas, the county seats, health services, educational institutions, and economic activity centers.</p> <p>This project will provide a roadway with improved geometry in order to decrease travel times, provide a safer and more comfortable driving experience, improve regional and local connectivity, and preserve and enhance the scenic viewsheds in the project area that are a key element in local tourism.</p>					
VALUE STUDY BENEFITS			KEY RECOMMENDATIONS		
<p>While the VE team was able to pursue cost savings through suggested changes, the real focus of the team members was to enhance the project quality and performance utilizing the Value Methodology. The value alternatives are offered as creative contributions to the design effort.</p> <p>The Kentucky-based VE team members, including some who live locally to the project area and utilize the existing KY 32 facility daily, identified 33 creative ideas intended to help guarantee the delivery of a roadway with improved geometry that best meets the project goals identified by KYTC. In all cases, the focus was to search for opportunities that will enhance the functionality of the project to support KYTC's design effort.</p>			<p>13 Value Proposals were developed. Key accepted recommendations include:</p> <ul style="list-style-type: none"> ▪ LM-01: Create plans for stockpiling and separating both durable and nondurable shale/sandstone ▪ SL-02: "Use reinforcement fibers in top layer of base and surface to reduce pavement design ▪ IF-01: Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance <p>11 Standalone Quality Review Comments were also identified.</p>		

1.2 Value Study Background

A virtual VE workshop was conducted on November 27-30, 2023 on the project documents prepared by KYTC and AECOM for the KY 32 Reconstruction (Eastern and Western Sections) Project. The following value study background includes discussion on project goals, project purpose and need, constraints, value study objectives, and value study highlights.

The project goals, purpose and need and the workshop objectives were identified and discussed during the in-brief presentation given by the project team to the VE team members on Monday, November 27, 2023.

1.2.1 Project Goals, Purpose, and Need

- **Project Goals:**
 - **Safety** (top stakeholder/public concern) – Reduce the potential for crashes
 - **Travel Time** – Address the issue of current travel speeds being lower than posted speed limit due to substandard alignments, short sight and stopping distances, narrow lanes, limited shoulder pavement, etc.
 - **Scenic Vistas** – Preserve and enhance viewsheds (key element in local tourism)
 - **Improved Regional Connectivity** (hospital, tourism, cemeteries, etc.)
 - **Maneuverability** – Provide geometry that better accommodates large trucks, which currently do not use KY 32
 - **Overall Roadway Aesthetics** – Utilize and enhance the natural beauty of the roadway to improve the driver and area resident experience
- **Project Need (Higher Order Functions):** Improve Safety, Decrease Travel-time, Improve Regional-connectivity, Generate Opportunities
- **Project Purpose (Basic Function):** Improve Alignment

1.2.2 Workshop Objectives

- Apply solid VM principles to review project for value (function/resources) improvements
- Identify opportunities from the Pareto cost model for:
 - Constructability – maintenance of traffic; minimizing impacts during construction
 - Promoting economic opportunities in the project area (tourism, etc.)
 - Meeting the project goals

1.2.3 Value Study Highlights

Key information was discovered during the various phases of the value methodology, including:

- **Preparation** – After reviewing the project documentation, each VE team member prepared a Key Issue Memo identifying observations, preliminary VE opportunities, risks, questions for the design team, and RFIs. These documents were shared among the entire value team prior to the workshop.
- **Information** – Representatives from KYTC and AECOM provided an in-brief, going over significant project details with the VE team. A recording of the in-brief presentation and discussions can be found at the following link: <https://shorturl.at/ajpAZ>
- **Function Analysis / Creativity** – Key project functions were identified and prioritized by the VE team and utilized for brainstorming ideas in Creativity, including Improve Emergency-access, Limit Waste, Change Surface, Stabilize Load, Reduce Erosion, and Enhance Safety. During the

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
Kentucky Transportation Cabinet
Item Nos. 9-192.01 and 9-192.03

Creativity Phase, the VE team generated 33 creative ideas by brainstorming individually and as groups in a collaborative online whiteboard space.

- **Evaluation** – The VE team did a simple, preliminary evaluation of ideas by assigning proposed categories to each idea in groups. The entire team then refined the preliminary scores by discussing each idea to reach a consensus.
- **Presentation** - After developing the value proposals, the VE team presented the developed proposals to project stakeholders at the out-brief meeting. A recording of the out-brief presentation and discussions can be found at the following link: <https://shorturl.at/grBEW>
- **Implementation** – Following delivery of the draft VE report, KYTC reviewed the value proposals and provided comments for each one indicating decisions to accept an idea for further consideration or reject it. These preliminary decisions are documented in Section 2.2 of this final report.

2

Section

Value Study Results
and Proposals

2.1 Introduction

The VE team brainstormed 33 creative ideas, of which 13 ideas were identified for further development as Value Proposals (avoid cost or add cost). Their detailed development information can be found under “**Individual Value Proposals**” later in this Section.

Also, 11 new Design Comments were prepared and listed in this Section so they can be considered in the next phase of design development. The following table tallies and describes each category.

Table 2-1: Classification of Brainstormed Ideas into Value Proposals

Proposal Type	Description	Development Status in this Report	Number of Proposals
Quantitative Value Proposals	Proposals that impact the initial or first cost of the project program or process being studied. Impact on future Life-Cycle Costs is considered where applicable.	Developed into write-ups	13
Design Suggestions	Proposals that either do not have any cost impact or whose cost impacts have not been quantified. Impact on future Life-Cycle Costs is not factored.	Developed into write-ups	0
Design Comments	Recommendations derived from observations made during the value team’s review of the project documents and/or during Creativity phase and scored as a “DC” during Evaluation phase. Examples are errors, omissions, estimate or schedule corrections, and document quality issues.	No write-up is needed	11

It is important to reiterate that the definition of value is as follows:

$$\text{Value} = \frac{\text{Function}}{\text{Resources}}$$

Understanding Function is key in the evaluation and later recommendation of an idea to become a Value Proposal or Design Suggestion. By definition, a Value Proposal is expected to impact the initial cost of the project being studied (noted as the “Resources” denominator in the formula), and it is expected to improve some elements of the project performance (the numerator, “Function”), therefore improving the value of the project.

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
 Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

2.2 Table of Value Proposals – Preliminary Determination

The table on the following pages lists all proposals that were developed as part of the value study. Please note that both quantitative proposals (reduce the initial cost of the project) and qualitative proposals (add initial cost or do not have cost impact) are included in the table. The table includes:

- Idea Number
- Idea Title
- An assessment of how the idea impacts Reliability, Functionality, and Schedule (Improved, Maintained, Degraded)
- Initial Cost Avoidance (Cost Addition)
- O&M Cost Avoidance (Cost Addition)
- Total Life Cycle Cost Avoidance (Cost Addition)
- **Preliminary Decision**
 - **KEY:**
 - **A (Accept):** any proposal that is accepted in part or in full. The concept is “intent to integrate;” it is possible that the proposal ultimately is not feasible and is not implemented in later design.
 - **R (Reject):** any proposal that is 100% rejected.

Table 2-2: Table of Value Proposals – Preliminary Determination

Idea No.	Idea Title	Score	Reliability (Impact on the robustness and service life of the value study subject)	Functionality (Impact on the performance and/or quality of the value study subject)	O&M (Impact on the robustness and service life of the value study subject)	Schedule Impact	Initial Cost Avoidance / (Cost Addition)	O&M Cost Avoidance / (Cost Addition)	Total Life Cycle Cost Avoidance / (Cost Addition)	Preliminary Decision: Accept or Reject	Preliminary Decision Rationale**
Enhance Safety											
ES-01	Provide enhanced signage and striping for pedestrians and bicyclists		Maintained	Improved	Maintained	Maintained	(\$15,000)	-	(\$15,000)	Accept	Project team will consult with Keith Lovan, KYTC bicycle/pedestrian coordinator, to evaluate best practices for signage and striping.
ES-03	Utilize LED lighting to improve night visibility at rural intersections		Improved	Improved	Maintained	Maintained	(\$1,000,000)	(\$17,000)	(\$1,017,000)	Reject	Past experience has shown that unwarranted lighting will not be approved.
ES-05	Utilize shoulder widths to install turn lanes at intersections without increasing total pavement width		Improved	Improved	Maintained	Maintained	(\$927,000)	-	(\$927,000)	Reject	Reject due to safety concerns: lack of deceleration and storage).
Change Surface											
CS-01	Reduce the shoulder width to 6' shoulders (4' paved)		Maintained	Maintained	Improved	Maintained	\$1,001,000	-	\$1,001,000	Reject	Bicycles/pedestrians will be using the shoulders and the proposal would also affect the earthwork balance.

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
 Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

Idea No.	Idea Title	Score	Reliability (Impact on the robustness and service life of the value study subject)	Functionality (Impact on the performance and/or quality of the value study subject)	O&M (Impact on the robustness and service life of the value study subject)	Schedule Impact	Initial Cost Avoidance / (Cost Addition)	O&M Cost Avoidance / (Cost Addition)	Total Life Cycle Cost Avoidance / (Cost Addition)	Preliminary Decision: Accept or Reject	Preliminary Decision Rationale**
CS-03	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)		Maintained	Maintained	Maintained	Maintained	\$247,000	-	\$247,000	Reject	Right-of-way is being purchased; affects earthwork, drainage, etc.
Limit Waste											
LM-01	Create plans for stockpiling and separating both durable and nondurable shale/sandstone		Maintained	Improved	Maintained	Maintained	(\$124,000)	-	(\$124,000)	Accept	Implement if possible - will review chemical stabilization and coordinate with geotech to implement these changes.
LM-03	Use 7' posts and trim 1' of slope of fills behind guardrail		Maintained	Maintained	Maintained	Maintained	\$82,000	-	\$82,000	Reject	The slope was a requirement at the time of design. Changing to a current 3.4' slope would be preferred over this proposal, but that change may affect ditches.
Stabilize Load											
SL-02	Use reinforcement fibers in top layer of base and surface to reduce pavement design		Improved	Maintained	Degraded	Maintained	\$2,767,000	-	\$2,767,000	Accept	Will consult with Pavement Branch about the cost/constructability-to-benefit ratio of reinforcement fibers and implement their suggestions.
SL-04	Use geogrid to reinforce the subgrade		Improved	Maintained	Improved	Maintained	\$3,008,000	-	\$3,008,000	Reject	Chemical stabilization is better for constructability. Certain geogrids are equivalent to 2' of rock roadbed and would create difficulty in curved areas and impact earthwork.
Prevent Contamination											
PV-02	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds		Maintained	Maintained	Maintained	Maintained	(\$100,000)	-	(\$100,000)	Accept	Will coordinate with the appropriate offices to determine the correct seed mix and application rate.

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
 Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

Idea No.	Idea Title	Score	Reliability (Impact on the robustness and service life of the value study subject)	Functionality (Impact on the performance and/or quality of the value study subject)	O&M (Impact on the robustness and service life of the value study subject)	Schedule Impact	Initial Cost Avoidance / (Cost Addition)	O&M Cost Avoidance / (Cost Addition)	Total Life Cycle Cost Avoidance / (Cost Addition)	Preliminary Decision: Accept or Reject	Preliminary Decision Rationale**
Reduce Erosion											
RE-01	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion		Maintained	Improved	Maintained	Maintained	(\$300,000)	-	(\$300,000)	Accept	Will evaluate opportunities to improve vistas/viewsheds, etc.
Improve Flow											
IF-01	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance		Improved	Improved	Improved	Maintained	(\$743,000)	-	(\$743,000)	Accept	The 6'x6' culverts would be better for maintenance - will continue discussion with PD&P to evaluate maintenance benefit versus initial cost.
IF-02	Increase culvert size to encourage wildlife movement to reduce collisions		Maintained	Improved	Improved	Maintained	(\$743,000)	-	(\$743,000)	Accept	If IF-01 is implemented, this would be a secondary benefit. Would implement if grant funding is available.

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

2.3 Design Comments

Design Comments represent another category of recommendations as a result of the review of the project documents and subsequent Key Issue Memos (KIM), work that was accomplished by the VE team in preparation for the workshop. In addition, during the brainstorming process (Creativity Phase), some ideas were later determined (Evaluation Phase) to be categorized as Design Comments and are included on the list below. These comments may be considered in the next phase of design development.

The table on the following pages summarizes all those findings the VE team identified during the preparation and performance of the VE workshop that only comment about recommended corrections of concerns found in the project documents. Items such as errors, omissions, schedule corrections, estimate corrections, or document quality issues are examples of the elements listed in the following table and should be considered self-explanatory and do not require a formal response to accept or reject.

Table 2-3: Design Comments

Creative Idea No.	Design Comment
ES-02	Utilize enhanced striping to warn of intersections, crossings, curves, and discourage speeding
ES-04	Enhance reflectivity in curves and limited visibility areas
ES-06	Provide lighting at scenic vistas to dissuade nefarious activity
LM-04	Break down and use nondurable shale as outer shell embankment material in nonstructural areas
SL-03	Allow chemical stabilization in addition to or in lieu of rock roadbed
SL-05	If rock roadbed is eliminated, reduce cuts and utilize existing rocks from the cuts to increase the slopes of the fills
SS-01	Utilize excavated stone in toe of slopes and steepen fill to reduce excavation
IT-02	Include scenic driving elements/tourism designations (i.e. signage, guardrail, lighting, striping, landscaping, paving, etc.) to encourage tourist use of scenic vistas
MI-01	Update verbiage in plans to "Class I" and "Class II" Geotextile Fabric in lieu of "Type I" and "Type IV" to reflect current terminology
MI-02	Remove seeding cost from estimate as it included in the erosion blanket cost (ref. KYTC spec 212.04.07)
MI-03	Eliminate Scenic Vistaway and associated infrastructure in future project

2.4 Individual Value Proposals

The following pages detail the Value Proposals developed as part of the study by the VE team and include the following information:





- Unique Identifying Number (XX-##)
- Creative Idea Title
- Function Identification
- Associated Ideas, if applicable
- Value Proposal Synopsis – A brief statement summarizing the proposal’s value proposition
- Cost Avoidance – Estimated cost avoidance or cost add (a positive number indicates a reduction in cost and a negative number indicates an increase in cost)
- Schedule Savings – Time savings anticipated to result from the proposal
- Qualitative Benefits (improved, maintained, degraded)
 - Reliability – Impact on the robustness and service life of the value study subject
 - Operations & Maintenance – Impact on future and long-term operations and maintenance related to the value study subject
 - Functionality – Impact on the performance and/or quality of the value study subject
- Baseline Concept Description – Brief description of the baseline concept that would be changed by the relevant value proposal
- Value Proposal Description – Brief summary of the value proposal relative to the baseline concept
- Advantages and Disadvantages – Bulleted list of potential benefits and drawbacks of the value proposal
- Discussion and Justification – Detailed justification, including technical considerations, cost considerations, schedule impacts, risk considerations, project management considerations, stakeholder acceptance, implementation considerations
- Review Comments – Addresses any review comments or feedback received during the mid-point review and/or out-brief meetings
- Sketches and Diagrams – To assist the reader in visualizing how the proposal differs from the baseline concept
- Cost Estimates – Supports cost avoidance / cost add, including any assumptions and calculations

The costs used are those provided by the VE team based upon experience with similar projects. The VE team’s updated cost estimate (detailed in Appendix B) was used for baseline costs. Where the VE team has offered alternate costs, they are provided for information only, reflective of the short duration of the value study, and should be evaluated by KYTC. Value Proposals are provided for their evaluation and implementation exclusively by KYTC.

VALUE PROPOSAL

ES-01

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Provide enhanced signage and striping for pedestrians and bicyclists				
FUNCTION	Enhance Safety				
VALUE PROPOSAL SYNOPSIS:					
This value proposal is to provide enhanced signage and striping for pedestrians and bicyclists. Providing access for bicyclists is one way of meeting the project goal of enhancing tourism and highlighting the beautiful scenic vistas along the corridor.					
 Reliability	Maintained	 Functionality	Improved	\$ Initial Cost Avoidance (Add)	
 O&M	Maintained	 Schedule Impact	Maintained	(\$15,000)	
BASELINE CONCEPT:					
The baseline is to provide standard striping and signing.					
VALUE PROPOSAL DESCRIPTION:					
The value proposal is to provide enhanced signage and striping for bicycle use.					
ADVANTAGES:			DISADVANTAGES:		
● Provides safer access for bicycles			● May increase bicycle traffic on mainline		
● Increases tourism			● Bicyclists may feel uncomfortable riding on the shoulder		
● Provides designated area for bicyclists			This project is short in length and would have ● limited use without being combined with an overall plan		
● Improves wayfinding			●		
● Takes advantage of the scenic vistas			●		
● Will not look like a typical rural road			●		
ADDITIONAL COST SUMMARY					
\$	COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost	
	BASELINE CONCEPT:	\$25,000	\$0	\$25,000	
	VALUE PROPOSAL DESCRIPTION:	\$40,000	\$0	\$40,000	
	TOTAL (Baseline less Proposed)	(\$15,000)	\$0	(\$15,000)	
ADD COST					

VALUE PROPOSAL

ES-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Provide enhanced signage and striping for pedestrians and bicyclists
DISCUSSION & JUSTIFICATION:	
<p>The intent of this proposal is to enhance signing and striping for bicyclists and pedestrians. The proposal adds value to the project by encouraging bicyclists to utilize the facility. If this concept is implemented along the entire corridor, this facility could become a tourist destination. This project has the unique opportunity to make KY 32 Elliott County's first bicycle corridor! By utilizing existing pavement design, additional striping and signing could create a fantastic bike path through this scenic area.</p> <p>There would be little additional cost to implement. The additional cost would include signing and striping for a bicycle facility.</p> <p>There would be no impact to the schedule as this activity is standard to roadway construction.</p> <p>It does not appear that Elliott County has a bicycle plan, but Rowan County does, and Rowan County's plan includes KY 32 as a bicycle corridor. The Project Team should consider coordinating with the adjacent counties to implement a KY 32 bicycle corridor for the region to enhance regional connectivity.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

ES-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Provide enhanced signage and striping for pedestrians and bicyclists	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Improved
Justification for Impact Score	Safety increased for bicyclist and pedestrians.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Improved
Justification for Impact Score	Allowing safe bicycle access will provide more opportunities for viewing the scenic vistas and viewsheds.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Improved
Justification for Impact Score	Allowing safe bicycle access will provide more opportunities for viewing the scenic vistas and viewsheds.	

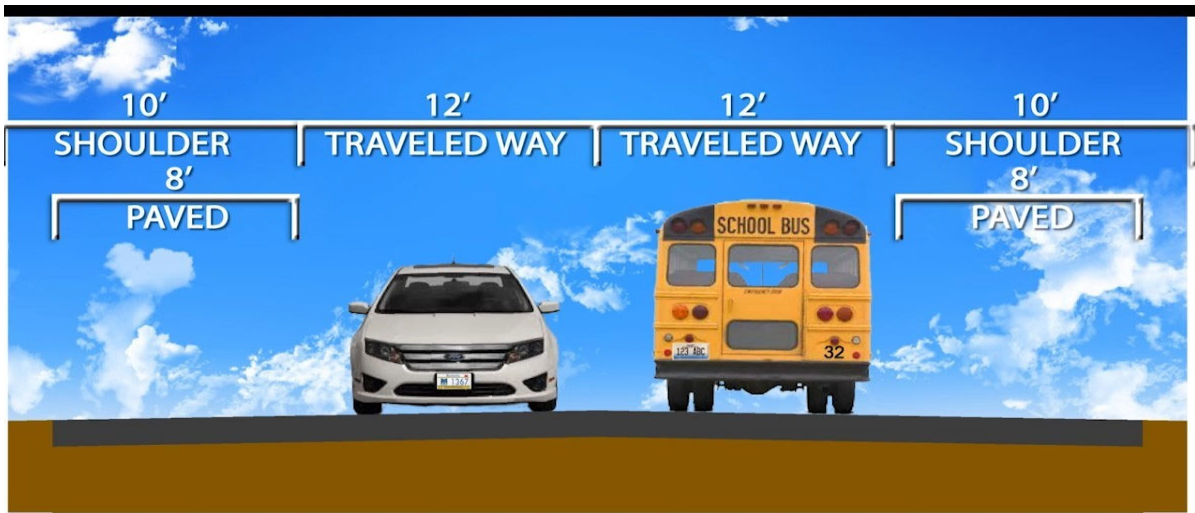
VALUE PROPOSAL

ES-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Provide enhanced signage and striping for pedestrians and bicyclists
--------------	--

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



**TYPICAL SECTION
KY 32**

VALUE PROPOSAL

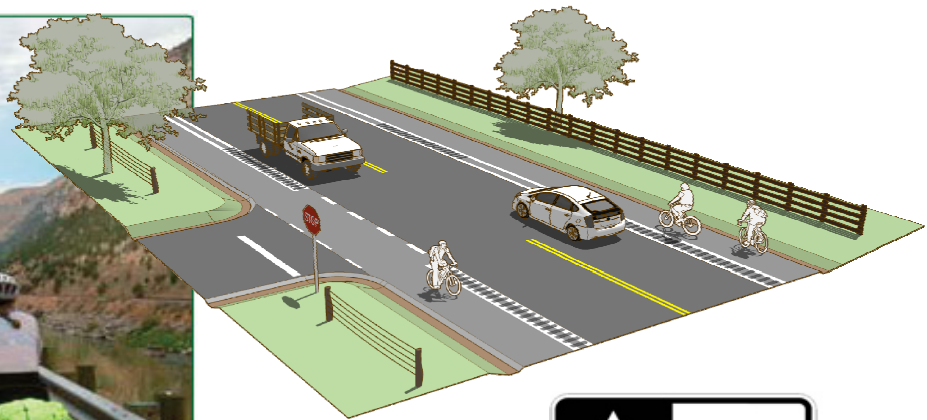
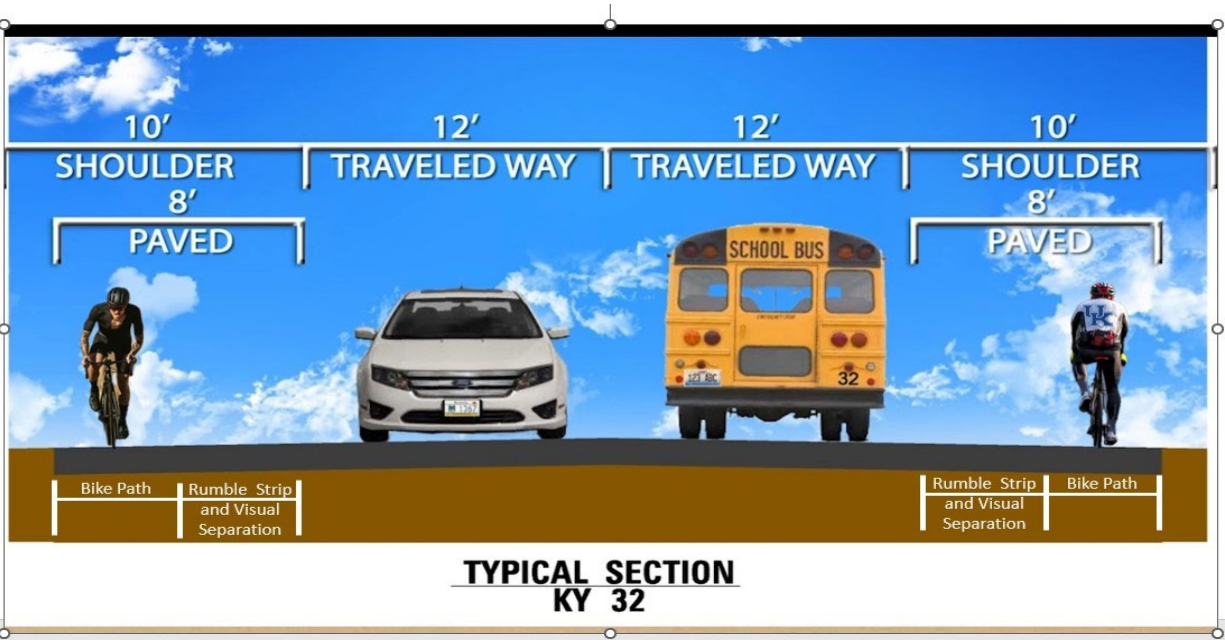
ES-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE

Provide enhanced signage and striping for pedestrians and bicyclists

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

ES-01





Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Provide enhanced signage and striping for pedestrians and bicyclists						
Assumptions & Calculations	Unit prices from Estimator software.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Striping	LF	150,542	\$0.16	\$24,711	246,516	\$0.16	\$40,429
TOTAL				\$25,000			\$40,000
Impact to Initial Cost (Baseline Less Proposed)							(\$15,000)
Note: Total costs are rounded to the nearest thousand dollars.							ADD COST

VALUE PROPOSAL

ES-03

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Utilize LED lighting to improve night visibility at rural intersections		
FUNCTION	Enhance Safety		
VALUE PROPOSAL SYNOPSIS:			
Using LED lighting for this rural project would improve safety at intersections and possibly in areas where there are potential driving hazards based on research. LED lights have long-term cost savings associated with electricity and maintenance ease.			
 Reliability	Improved	 Functionality	Improved
 O&M	Maintained	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			(\$1,000,000)
BASELINE CONCEPT:			
It is unclear if there are existing plans to use LED lighting at intersections or other parts of the project.			
VALUE PROPOSAL DESCRIPTION:			
The value is high with the introduction of safety lighting at intersections and other higher hazard areas. The addition of LED lighting would improve safety by reducing the potential for crashes, which supports the project's Purpose and Need statement. In addition, the lighting can be designed so as not to be too intrusive or overbearing, avoiding impacts to the local viewshed and keeping costs at a minimum.			
ADVANTAGES:		DISADVANTAGES:	
● Improves safety		● Adds initial cost	
● High benefit-to-cost ratio		● Masts/poles can be unsightly	
● Enhances visibility		● Potential for unwanted light pollution	
● Low maintenance		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY		Initial Costs	O&M Costs
		\$0	\$0
BASELINE CONCEPT:		\$0	\$0
VALUE PROPOSAL DESCRIPTION:		\$1,000,000	\$17,000
TOTAL (Baseline less Proposed)		(\$1,000,000)	(\$17,000)
			ADD COST

VALUE PROPOSAL

ES-03

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Utilize LED lighting to improve night visibility at rural intersections
DISCUSSION & JUSTIFICATION:	
<p>Research conducted by the Minnesota Department of Transportation (MnDOT) has determined that installing lighting at rural intersections that meets specific criteria can reduce crashes during darkness. At rural intersections, research has suggested that increasing horizontal illuminance by 1 lux reduced the nighttime crash rate by 20 percent, while a 1-lux increase in horizontal illuminance at previously unlit intersections reduced the rate of nighttime crashes by 94 percent.</p> <p>A benefit-cost analysis indicated that the crash reduction benefits associated with installing street lighting at rural intersections outweigh the costs by a 15:1 ratio.</p> <p>LED technologies consume about 50 percent less electricity and have longer life spans compared to traditional lighting. Additionally, the use of LED lighting reduces the amount of time that maintenance crews need to be on the road for maintenance. Academic and DOT research shows these improvements work and should be implemented in rural areas.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

ES-03

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Utilize LED lighting to improve night visibility at rural intersections	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Improved
Justification for Impact Score	Additional lighting at rural intersections improves safety.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

ES-03

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Utilize LED lighting to improve night visibility at rural intersections
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL

Minnesota DOT's Research:

<https://www.lrrb.org/pdf/200635.pdf>

<https://highways.dot.gov/sites/fhwa.dot.gov/files/2023-03/Minnesota%20Department%20of%20Transportation%27s%20Street%20Lighting%20at%20Rural%20Intersections.pdf>



VALUE PROPOSAL

ES-03

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Utilize LED lighting to improve night visibility at rural intersections						
Assumptions & Calculations	None noted.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
LED lighting	EA				20	\$50,000	\$1,000,000
TOTAL				\$0			\$1,000,000
Impact to Initial Cost (Baseline Less Proposed)							(\$1,000,000)

Note: Total costs are rounded to the nearest thousand dollars.

ADD COST

VALUE PROPOSAL

ES-03

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Utilize LED lighting to improve night visibility at rural intersections
--------------	---

Assumptions			
Interest/Discount Rate(%):	2.4%		Economic Life (yrs): 50

LIFE CYCLE COST ANALYSIS						
Salvage & Replacement Costs			Baseline Concept		Value Proposal	
Item	Description	Yr	Est Cost	Pres Worth	Est Cost	Pres Worth
1	Bulbs/Fixtures				\$10,000	\$10,000
2						
3						
4						
5						
6						
7						
8						
9						
10						
Total Salvage & Replacement Costs			\$0	\$0	\$10,000	\$10,000

Annual Costs (pres worth calculated over 50 yrs)		Baseline Concept		Value Proposal	
Item	Description	Est Cost	Pres Worth	Est Cost	Pres Worth
1	Replacement bulbs			\$250	\$7,234
2					
3					
4					
5					
Total Annual Costs		\$0	\$0	\$250	\$7,234

SUMMARY	Baseline Present Worth	Proposed Present Worth
Total Present Worth (salvage+annual pres worth)	\$0	\$17,000
RESULTS (Proposed less Baseline)	ADD COST of \$17,000	





Notes: 1) Total Present Worth is rounded to the nearest thousand dollars, 2) Initial costs are covered in the Detail sheet.

Assumptions & Calculations: Any assumptions made or support calculations that were developed to support the

VALUE PROPOSAL

ES-05

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Utilize shoulder widths to install turn lanes at intersections without increasing total pavement width		
FUNCTION	Enhance Safety		
VALUE PROPOSAL SYNOPSIS:			
The proposal is to utilize the existing shoulder widths to provide left and right turn lanes at 10 intersections along the project corridor.			
 Reliability	Improved	 Functionality	Improved
 O&M	Maintained	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			(\$927,000)
BASELINE CONCEPT:			
The baseline plans have two through lanes typical for the length of the project. This has a potential to slow through traffic and contribute to rear end collisions.			
VALUE PROPOSAL DESCRIPTION:			
To facilitate safe through traffic opportunities for turning movements, the VE team proposes adding additional full-depth asphalt at intersections to create left and right turn lanes. The proposal is to replace 7.5" of crushed stone base from the shoulder thickness and replace it with the full-depth pavement design of CL2 Asph Base 1.00D for a length of 660' before and after the intersection. This enables the creation of left and right turn lanes without increasing roadway surface width. The shoulder becomes a safer alternative for turning and through traffic movements.			
ADVANTAGES:		DISADVANTAGES:	
● Allows continuous through movement		● Increases asphalt thickness at intersections	
● Improves safety of turning movements		●	
●		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	\$360,000	\$0	\$360,000
VALUE PROPOSAL DESCRIPTION:	\$1,287,000	\$0	\$1,287,000
TOTAL (Baseline less Proposed)	(\$927,000)	\$0	(\$927,000)
			ADD COST

VALUE PROPOSAL

ES-05

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Utilize shoulder widths to install turn lanes at intersections without increasing total pavement width
DISCUSSION & JUSTIFICATION:	
<p>This proposal increases initial cost while reducing future maintenance costs.</p> <p>With the existing design, users will drive on the shoulder to pass a vehicle making a left turn or users will drive on the shoulder to make a right turn. This will cause accelerated deterioration and base failure to the shoulders at these locations. By increasing the pavement depths, future maintenance concerns are greatly reduced.</p> <p>There are negligible additions to project schedule.</p> <p>This will create increased safety for minimal asphalt base and striping cost increases.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

ES-05

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Utilize shoulder widths to install turn lanes at intersections without increasing total pavement width	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Improved
Justification for Impact Score	Safer turn and through movements.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Improved
Justification for Impact Score	Through traffic travel is not impacted by turn movements.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Improved
Justification for Impact Score	Creates a wider area of pavement structure to accommodate over tracking.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

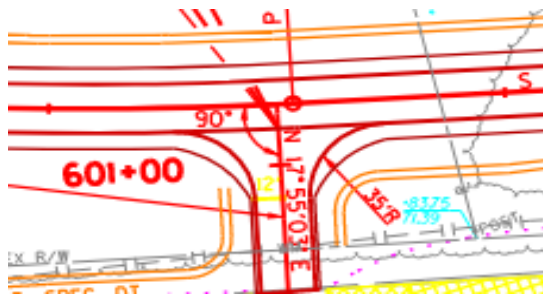
ES-05

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

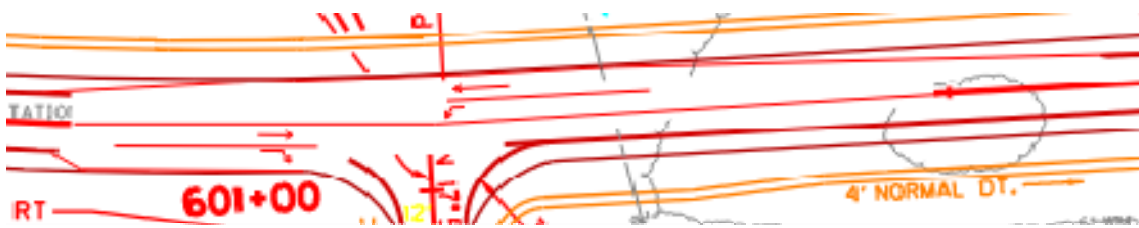
TITLE	Utilize shoulder widths to install turn lanes at intersections without increasing total pavement width
--------------	--

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

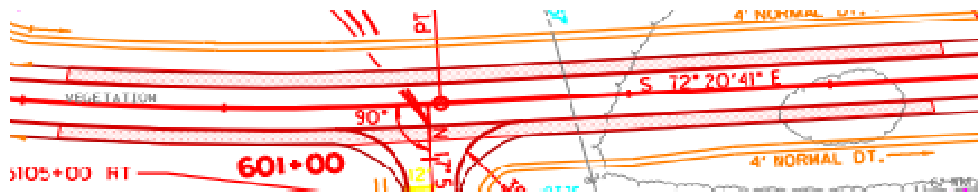
Before:



After:



Increased area of pavement:



n.t.s.

VALUE PROPOSAL

ES-05

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03





TITLE	Utilize shoulder widths to install turn lanes at intersections without increasing total pavement width						
Assumptions & Calculations	Estimating 10 locations with 660ft of additional shoulder depth on both sides of the intersections. Unit prices from Estimator software.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Crushed Stone Base	Ton	15,200	\$24	\$360,240			
CL2 Asph Base 1.00D	Ton				15,000	\$85	\$1,275,000
Perm Stripe - W	LF				15,000	\$0.17	\$2,550
Perm Stripe - Y	LF				15,000	\$0.17	\$2,550
Thermo Arrow - Straight	EA				20	\$160	\$3,200
Thermo Arrow - Curve	EA				20	\$160	\$3,200
TOTAL				\$360,000			\$1,287,000
Impact to Initial Cost (Baseline Less Proposed)							(\$927,000)
							ADD COST

Note: Total costs are rounded to the nearest thousand dollars.

VALUE PROPOSAL

CS-01

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the shoulder width to 6' shoulders (4' paved)		
FUNCTION	Change Surface		
ASSOCIATED IDEAS	PV-03: Limit the pavement width to reduce the runoff		
VALUE PROPOSAL SYNOPSIS:			
This proposal is to reduce shoulders from 10' to 6'. This will reduce cost and meets current design standards for this type of facility.			
 Reliability	Maintained	 Functionality	Maintained
 O&M	Improved	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			\$1,001,000
BASELINE CONCEPT:			
The baseline typical section is 10' shoulders (8' paved).			
VALUE PROPOSAL DESCRIPTION:			
The value proposal is a reduced shoulder width to 6' with 4' paved			
ADVANTAGES:		DISADVANTAGES:	
● Reduction in pavement quantity		● Limits the use of the shoulder for bicyclists	
● Minimal impact to vehicle operations		● Limits the ability for emergency pull offs	
●		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY		Initial Costs	O&M Costs
BASELINE CONCEPT:		\$45,398,000	\$0
VALUE PROPOSAL DESCRIPTION:		\$44,397,000	\$0
TOTAL (Baseline less Proposed)		\$1,001,000	\$0
AVOID COST			

VALUE PROPOSAL

CS-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the shoulder width to 6' shoulders (4' paved)
DISCUSSION & JUSTIFICATION:	
<p>The primary purpose of the shoulder along this section of highway is to provide a recoverable area for the roadway departure and the occasional emergency parking.</p> <p>The proposal is to provide a 6-foot shoulder that will include 4-feet of pavement. The area with pavement will help with long-term stability of the travel lane structure, limit the raveling of the edge of pavement, provide adequate space for a rumble strip, and give a recoverable area on the pavement should a driver drift out of the travel lane.</p> <p>This alternative will have little impact on project safety performances compared to the proposed design. The Highway Safety manual references an approximate CMF of 1.0 for both a 10-foot shoulder and a 6-foot shoulder. A detailed IHSDM study should be done to detail the safety differences between a 10' and 6' shoulder.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

CS-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Reduce the shoulder width to 6' shoulders (4' paved)	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

CS-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the shoulder width to 6' shoulders (4' paved)
--------------	--

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

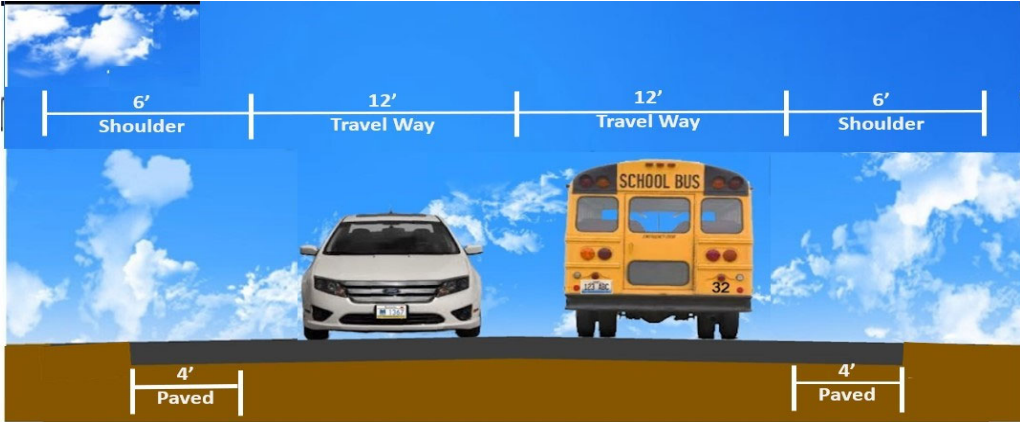


**TYPICAL SECTION
KY 32**

VALUE PROPOSAL

CS-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the shoulder width to 6' shoulders (4' paved)
SKETCH/DIAGRAM: VALUE PROPOSAL	
 <p>TYPICAL SECTION KY 32</p>	

VALUE PROPOSAL

CS-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)





Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the shoulder width to 6' shoulders (4' paved)						
Assumptions & Calculations	Cut sections were left similar while fill sections only were adjusted. CSB is increased to make up the difference in the reduction of Asphalt Base and Surface. All unit costs came from Estimator Software.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Roadway Excavation	CY	5,903,942	\$5.50	\$32,471,681	5,846,758	\$5.50	\$32,157,169
Granular Embankment	CY	88,285	\$30.00	\$2,648,550	84,285	\$30.00	\$2,528,550
CL2 Asph Base	Ton	74,098	\$85.00	\$6,298,330	74,098	\$85.00	\$6,298,330
Crushed Stone Base	Ton	128,327	\$23.70	\$3,041,350	110,819	\$23.70	\$2,626,410
CL2 Asph Surf	Ton	12,030	\$78.00	\$938,340	10,083	\$78.00	\$786,474
TOTAL				\$45,398,000			\$44,397,000
Impact to Initial Cost (Baseline Less Proposed)							\$1,001,000
Note: Total costs are rounded to the nearest thousand dollars.							AVOID COST

VALUE PROPOSAL

CS-03

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)		
FUNCTION	Change Surface		
ASSOCIATED IDEAS	PV-03: Limit the pavement width to reduce the runoff		
VALUE PROPOSAL SYNOPSIS:			
The value proposal is to reduce the travelway in each direction to 11 feet. This will save money with no impact to operations.			
 Reliability	Maintained	 Functionality	Maintained
 O&M	Maintained	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			\$247,000
BASELINE CONCEPT:			
The baseline concept is providing a 12' wide travelway.			
VALUE PROPOSAL DESCRIPTION:			
The proposal is to reduce the width of the travelway from 12' to 11'.			
ADVANTAGES:		DISADVANTAGES:	
● Reduces earthwork		● Potential for a marginal increase in collision frequency	
● Reduces pavement quantity		●	
● Meets design criteria		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY		Initial Costs	O&M Costs
BASELINE CONCEPT:		\$45,398,000	\$0
VALUE PROPOSAL DESCRIPTION:		\$45,151,000	\$0
TOTAL (Baseline less Proposed)		\$247,000	\$0
AVOID COST			

VALUE PROPOSAL

CS-03

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)
DISCUSSION & JUSTIFICATION:	
<p>The baseline condition proposes to construct 2 - 12 foot lanes for the KY 32 mainline pavement.</p> <p>The value proposal is to decrease lane width from 12 feet to 11 feet for the mainline.</p> <p>There are no perceived impacts to constructability, maintenance of traffic, project schedule, or design schedule. There will be a reduction in earthwork. There is a minor savings to long term maintenance due to decreased asphalt resurfacing needs.</p> <p>The VE team recommends perform a detailed IHSDM analysis to determine predicted safety impacts.</p> <p>Utilizing a standard 11' lane width has minimal negative affect on traffic patterns, while providing a cost-effective template. If anything, the 11' lanes will act to calm traffic to the design speed of 55MPH.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

CS-03

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

CS-03

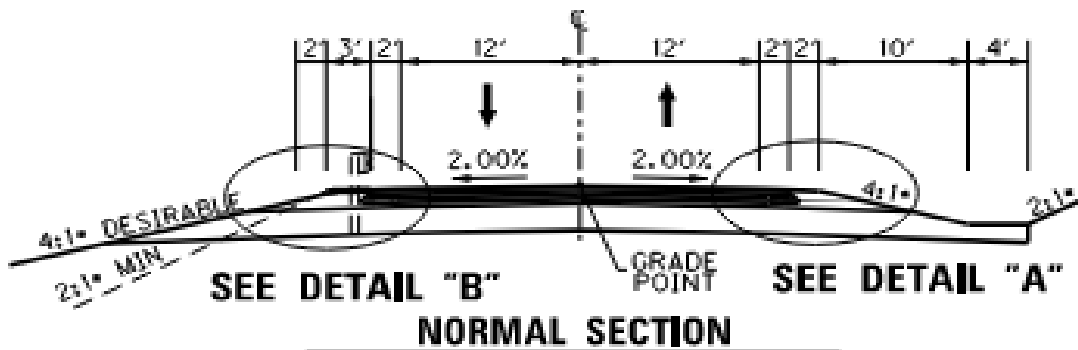
Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

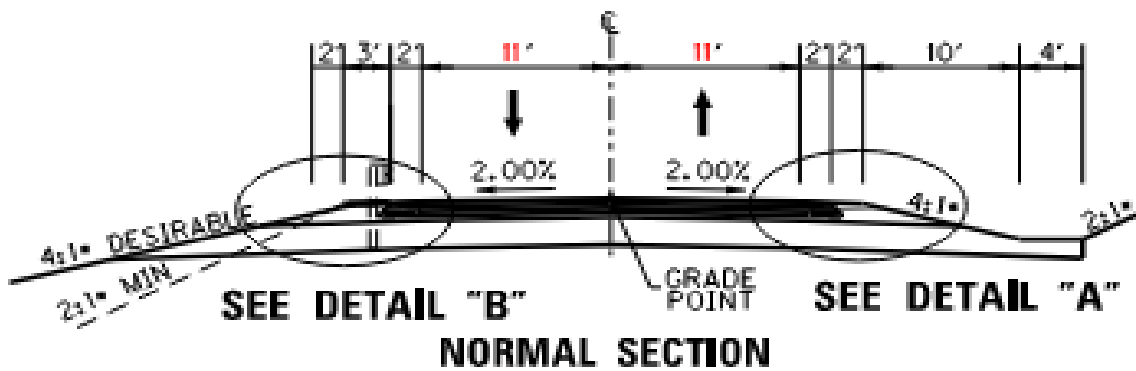
Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)
--------------	--

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



Before



After

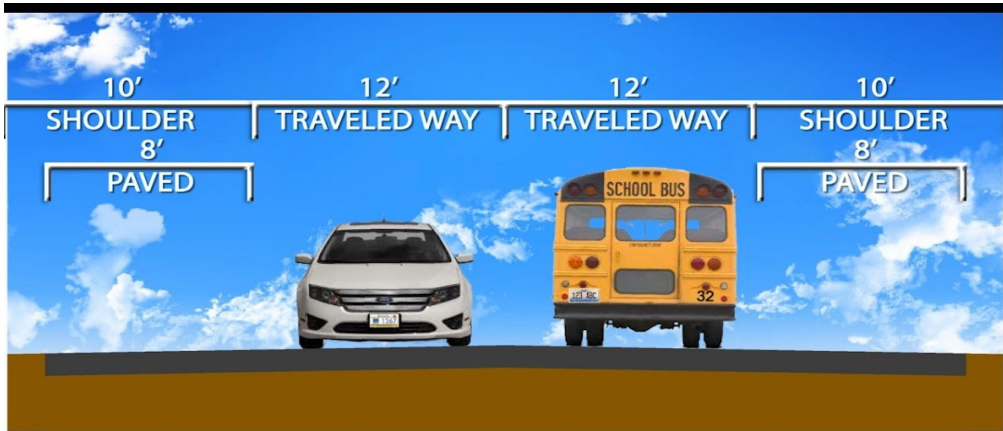
VALUE PROPOSAL

CS-03

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)
--------------	--

SKETCH/DIAGRAM: VALUE PROPOSAL



**TYPICAL SECTION
KY 32**

Before



After

**TYPICAL SECTION
KY 32**

VALUE PROPOSAL

CS-03





Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)						
Assumptions & Calculations	Costs are generated by the Estimator Software.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Roadway Excavation	CY	5,903,942	\$5.50	\$32,471,681	5,875,350	\$5.50	\$32,314,425
Granular Embankment	CY	88,285	\$30.00	\$2,648,550	86,285	\$30.00	\$2,588,550
CL2 Asph Base	Ton	74,098	\$85.00	\$6,298,330	73,822	\$85.00	\$6,274,870
Crushed Stone Base	Ton	128,327	\$23.70	\$3,041,350	128,200	\$23.70	\$3,038,340
CL2 Asph Surf	Ton	12,030	\$78.00	\$938,340	11,990	\$78.00	\$935,220
TOTAL				\$45,398,000			\$45,151,000
Impact to Initial Cost (Baseline Less Proposed)							\$247,000
Note: Total costs are rounded to the nearest thousand dollars.							AVOID COST

VALUE PROPOSAL

LM-01

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Create plans for stockpiling and separating both durable and nondurable shale/sandstone		
FUNCTION	Limit Waste		
VALUE PROPOSAL SYNOPSIS:			
Stockpiling and separating nondurable shale/sandstone from excavations and blasting operations would allow for the use of the nondurable materials on embankments or other nonstructural areas. This is a good idea because contractors will be able to utilize most of the excavated durable stone without the concern of nondurable materials within the excavated rock matrix.			
 Reliability	Maintained	 Functionality	Improved
 O&M	Maintained	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			\$124,000
BASELINE CONCEPT:			
Plans for separating the nondurable materials from the durable materials were not found when reviewing available documents.			
VALUE PROPOSAL DESCRIPTION:			
Separating the nondurable materials from the durable materials through a phased excavation plan will allow for contractors to effectively place durable stone within the embankments and reduce waste by using nondurable materials on the embankment shells and other nonstructural areas.			
ADVANTAGES:		DISADVANTAGES:	
● Reduces waste of good material		● More expensive excavation	
● Reduces contamination		● Increases inspection	
●		● May require more geotechnical data (more rock core drilling)	
●		●	
●		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY		Initial Costs	O&M Costs
BASELINE CONCEPT:		\$3,584,000	\$0
VALUE PROPOSAL DESCRIPTION:		\$3,460,000	\$0
TOTAL (Baseline less Proposed)		\$124,000	\$0
AVOID COST			

VALUE PROPOSAL

LM-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Create plans for stockpiling and separating both durable and nondurable shale/sandstone
DISCUSSION & JUSTIFICATION:	
<p>Separating and stockpiling nondurable shale/sandstone and durable shale/sandstone from the excavation and blasting operations will provide significant savings. The need for importing off site materials will be significantly reduced if this practice is implemented effectively.</p> <p>This will also reduce risk considerations when the materials are separated and better defined as durable and nondurable materials.</p> <p>The nondurable shale may be utilized as fill when it is broken down, wetted and added into the soil matrix for fill placement in accordance with Section 206.0302 D of the Kentucky Standard Specifications.</p> <p>The schedule may be impacted by separating the materials through a phased excavation and blasting program.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
<p>It was noted during the out-brief presentation that this proposal could be done via a special note. The VE team was asked to find an example of this process being implemented successfully on a previous project for KYTC's reference, and the VE team is currently working to source this information.</p>	

VALUE PROPOSAL

LM-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Create plans for stockpiling and separating both durable and nondurable shale/sandstone
--------------	---

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

LM-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

Item Nos. 9-192.01 and 9-192.03





TITLE	Create plans for stockpiling and separating both durable and nondurable shale/sandstone						
Assumptions & Calculations	Assuming an increase of 15% bid cost for additional blast methods and equipment for rock sorting and segregation. It is assumed a 10% reduction in Granular Embankment with this proposal.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Roadway Excavation	CY	170,000	\$5.50	\$935,000	170,000	\$6.33	\$1,076,100
Granular Embankment	CY	88,285	\$30	\$2,648,550	79,457	\$30	\$2,383,695
TOTAL				\$3,584,000			\$3,460,000
Impact to Initial Cost (Baseline Less Proposed)							\$124,000
							AVOID COST

Note: Total costs are rounded to the nearest thousand dollars.

VALUE PROPOSAL

LM-03

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Use 7' posts and trim 1' of slope of fills behind guardrail			
FUNCTION	Limit Waste			
VALUE PROPOSAL SYNOPSIS:				
By narrowing the template, the volume of rock needed for the rock platforms are reduced, therefore reducing overall excavation need.				
 Reliability	Maintained	 Functionality	Maintained	\$ Initial Cost Avoidance (Add)
 O&M	Maintained	 Schedule Impact	Maintained	
BASELINE CONCEPT:				
Current design utilizes 6' rail with 2' fill behind the post.				
VALUE PROPOSAL DESCRIPTION:				
The proposal would eliminate 1' of fill behind the post by using 7' rail posts instead. This 2' elimination of template width would eliminate a lot of need for rock from the cuts.				
ADVANTAGES:			DISADVANTAGES:	
● Eliminates excavation			● Increases rail installation cost	
● Excellent cost/benefit ratio			●	
●			●	
●			●	
●			●	
●			●	
\$ COST SUMMARY		Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:		\$35,905,000	\$0	\$35,905,000
VALUE PROPOSAL DESCRIPTION:		\$35,823,000	\$0	\$35,823,000
TOTAL (Baseline less Proposed)		\$82,000	\$0	\$82,000
				AVOID COST

VALUE PROPOSAL

LM-03

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Use 7' posts and trim 1' of slope of fills behind guardrail
DISCUSSION & JUSTIFICATION:	
<p>By reducing the fill template by 2', all improvements of geometrics, aesthetics, safety, and other aspects are maintained while reducing the need to generate durable, non-friable rock for the rock platforms. The reduction in need for rock translates to a large reduction in dirt overburden, which in turn translates to a substantial savings without compromising slope factors of safety or geometric design.</p> <p>The disadvantage is a slight increase in cost for rail installation and future increased cost of guardrail reinstallation when struck. These costs are dwarfed by the savings generated.</p> <p>This proposal would reduce cut and fill, thereby improving the project schedule by elimination of time-consuming work. Fill needed would be reduced by approximately 0.74CY per foot of fill height, per foot of centerline.</p> <p>There are no risk increases compared to the baseline plans and road users will not realize a reduction of service or final product.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

LM-03

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Use 7' posts and trim 1' of slope of fills behind guardrail
--------------	---

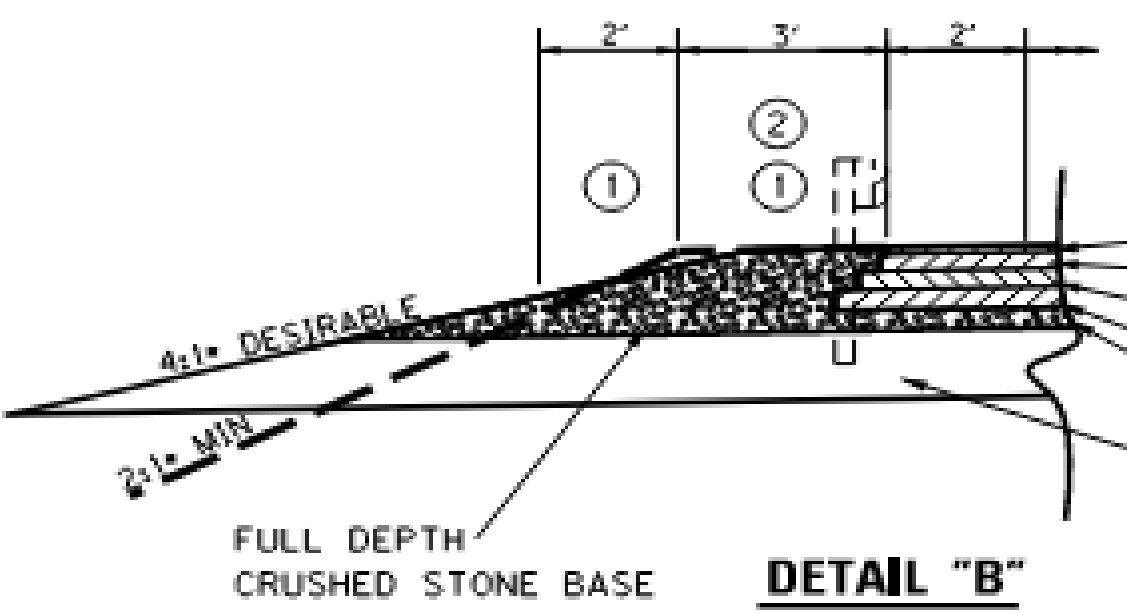
IMPACT TO PERFORMANCE

Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

LM-03

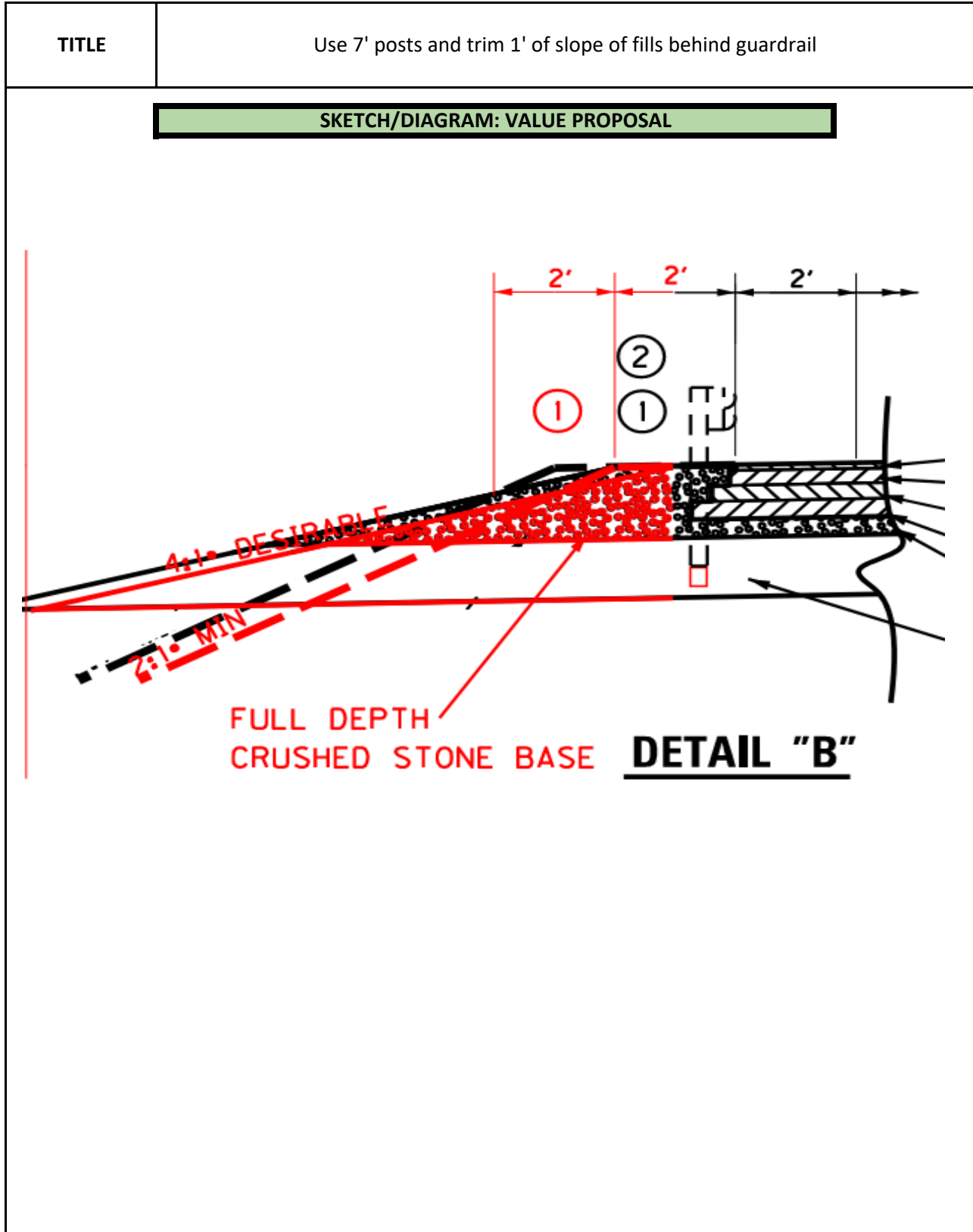
Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Use 7' posts and trim 1' of slope of fills behind guardrail
SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT	
 <p>The diagram illustrates a cross-section of a guardrail installation. A vertical post is shown with a 7-foot spacing between posts. On either side of the post, there is a 2-foot trim area. Behind the post, there is a 3-foot fill area. The fill has a 4:1 desirable slope and a 2:1 minimum slope. A full depth crushed stone base is shown under the fill. The diagram is labeled "DETAIL B".</p>	

VALUE PROPOSAL

LM-03

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03



VALUE PROPOSAL

LM-03





Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Use 7' posts and trim 1' of slope of fills behind guardrail						
Assumptions & Calculations	None noted.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Roadway Excavation	CY	5,903,942	\$5.50	\$32,471,681	5,875,350	\$5.50	\$32,314,425
GUARDRAIL-STEEL W BEAM-S FACE	LF	27,050	\$29.00	\$784,450			
G/R STEEL W BEAM-S FACE (7 FT POST)	LF				27,050	\$34.00	\$919,700
Granular Embankment	CY	88,285	\$30	\$2,648,550	86,285	\$30	\$2,588,550
TOTAL				\$35,905,000			\$35,823,000
Impact to Initial Cost (Baseline Less Proposed)							\$82,000
Note: Total costs are rounded to the nearest thousand dollars.							AVOID COST

VALUE PROPOSAL

SL-02

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Use reinforcement fibers in top layer of base and surface to reduce pavement design		
FUNCTION	Stabilize Load		
VALUE PROPOSAL SYNOPSIS:			
The use of reinforcement fibers in asphalt base and surface layers will increase pavement performance through cracking and rut resistance, increased fatigue life, increased strength and toughness, and will improve the service life of an asphalt mix.			
 Reliability	Improved	 Functionality	Maintained
 O&M	Degraded	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			\$2,767,000
BASELINE CONCEPT:			
Reinforcement fibers are not included in the current asphalt design mixes.			
VALUE PROPOSAL DESCRIPTION:			
Including reinforcement fibers into the design asphalt mixes will improve the durability and strength of the asphalt, reducing the maintenance costs over time.			
ADVANTAGES:		DISADVANTAGES:	
● Asphalt pavement thicknesses may be reduced with reinforcement fibers		● This is another QA/QC component for the pavement engineers	
● Improves the design lifespan of the asphalt pavement		● The product adds roughly \$10 per ton to material costs	
● Long term savings		●	
● Better overall finished product		●	
● Stronger asphalt surface		●	
●		●	
●		●	
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	\$9,340,000	\$0	\$9,340,000
VALUE PROPOSAL DESCRIPTION:	\$6,573,000	\$0	\$6,573,000
TOTAL (Baseline less Proposed)	\$2,767,000	\$0	\$2,767,000
			AVOID COST

VALUE PROPOSAL

SL-02

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

Item Nos. 9-192.01 and 9-192.03

TITLE	Use reinforcement fibers in top layer of base and surface to reduce pavement design
DISCUSSION & JUSTIFICATION:	
<p>The use of reinforcement fiber in asphalt base and surface designs will increase the design life of the pavement through an increase in strength, durability, reduction of cracking and fatigue stresses. Moreover, it reduces the amount of asphalt required for the same structural capacity of an asphalt mix without Kevlar fibers.</p> <p>Based on some Kevlar fiber manufacturers' research, adding the fibers increases the crack resistance by as much as 50 percent and rut resistances as much as 15 percent. Including the fibers into the mix does not affect the project schedule and only increases the cost of the asphalt about \$10 per ton.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

SL-02

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Use reinforcement fibers in top layer of base and surface to reduce pavement design
--------------	---

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

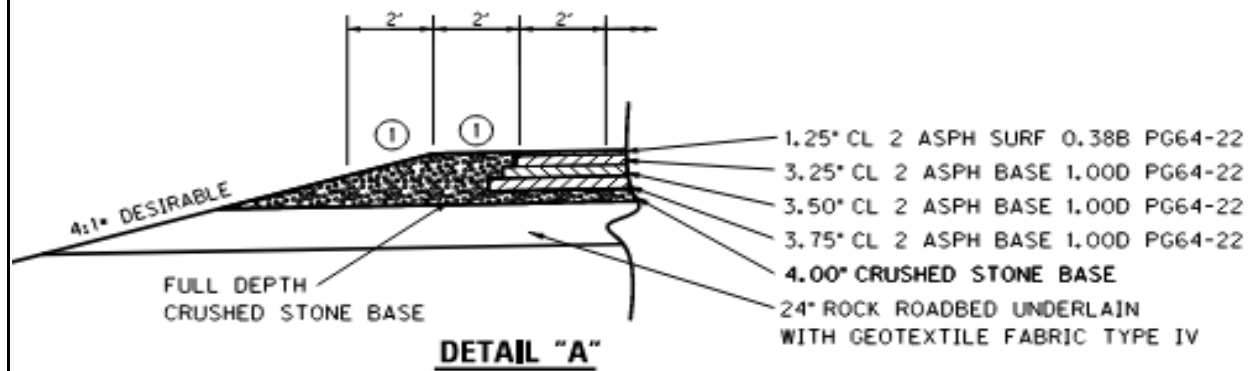
VALUE PROPOSAL

SL-02

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Use reinforcement fibers in top layer of base and surface to reduce pavement design
--------------	---

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



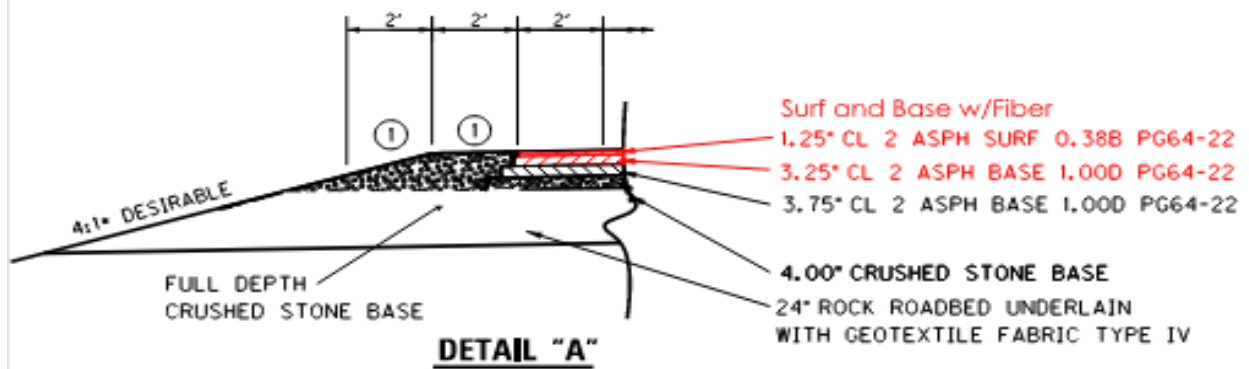
VALUE PROPOSAL

SL-02

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Use reinforcement fibers in top layer of base and surface to reduce pavement design
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

SL-02

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Use reinforcement fibers in top layer of base and surface to reduce pavement design						
Assumptions & Calculations	Kevlar fiber will increase the pavement strenght. A reduction of 33% of pavement structure can be saved when it is utilized. Costs are based on Estimator Software						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
CL2 asph Base 1.00D PG64-22	Ton	74,098	\$85.00	\$6,298,330	49,646	\$85.00	\$4,219,881
Fiber added	Ton				49,646	\$10.00	\$496,460
Crushed Stone Base	Ton	128,327	\$23.70	\$3,041,350	78,327	\$23.70	\$1,856,350
TOTAL				\$9,340,000			\$6,573,000
Impact to Initial Cost (Baseline Less Proposed)							\$2,767,000





Note: Total costs are rounded to the nearest thousand dollars.

AVOID COST

VALUE PROPOSAL

SL-04

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Use geogrid to reinforce the subgrade			
FUNCTION	Stabilize Load			
VALUE PROPOSAL SYNOPSIS:				
Geogrid is a synthetic material used to reinforce soils through apertures that allow aggregate to set through and provide confinement and interlock. The use of geogrid will further stabilize the subgrade soils, provide a more uniform course for aggregate base placement and displaces loads applied to the roadway over a larger area.				
 Reliability	Improved	 Functionality	Maintained	\$ Initial Cost Avoidance (Add)
 O&M	Improved	 Schedule Impact	Maintained	
BASELINE CONCEPT:				
Geogrid was not included in the baseline concept.				
VALUE PROPOSAL DESCRIPTION:				
Place geogrid over the geotextile fabric and then place the gravel backfill over the geogrid. Place geogrid on subgrade prior to aggregate placement along the proposed roadway.				
ADVANTAGES:			DISADVANTAGES:	
● Improves subgrade stabilization			● Increases project costs if asphalt and aggregate thicknesses are not reduced	
● May allow for reduced pavement and aggregate thicknesses			● Geogrid aperture sizes must conform to available aggregate gradations	
● Reduces differential settlement of roadways			●	
●			●	
●			●	
●			●	
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost	
BASELINE CONCEPT:	\$9,340,000	\$0	\$9,340,000	
VALUE PROPOSAL DESCRIPTION:	\$6,332,000	\$0	\$6,332,000	
TOTAL (Baseline less Proposed)	\$3,008,000	\$0	\$3,008,000	
AVOID COST				

VALUE PROPOSAL

SL-04

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Use geogrid to reinforce the subgrade
DISCUSSION & JUSTIFICATION:	
<p>Geogrids are used in roadway construction to reinforce paved roads and aggregate roadways through providing tensile strength and holding soils and aggregate together. In some cases, geogrids may reduce pavement thicknesses up by to a third without impacting performance.</p> <p>Some geogrid applications include installing geogrid above the subgrade to more effectively distribute traffic loading and prevent the subgrade from rutting; this improves the roadway stability and maintenance costs. Geogrid may also be used to stabilize embankments and assist in preventing the migration of aggregate into soft soil subgrades.</p> <p>Geogrid placement should be in accordance with Section 304 of the Kentucky Standard Specifications. Placing geogrid beneath the roadway subgrade does not significantly impact project schedule, reduces roadway deformation risks, and allows for a reduction in pavement thicknesses with the same capacity.</p> <p>The most significant technical consideration for the geogrid placement is choosing the correct geogrid aperture size for the planned aggregate gradations; geogrid manufacturers provide specifications for the various types of geogrid aperture dimensions that specify the required aggregate gradation/sizes to effectively interlock the aggregate into the geogrid without migrating through it.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
<p>During the out-brief, it was noted by Adam Ross with KYTC that District 9 has utilized geogrid reinforcement on previous projects and that it has been successful overall. He noted that there have been some construction issues and suggested issuing a special note to ensure correct installation of the geogrid, and said that while this may reduce the cost savings presented by the VE team, the savings would still be significant.</p>	

VALUE PROPOSAL

SL-04

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Use geogrid to reinforce the subgrade
--------------	---------------------------------------

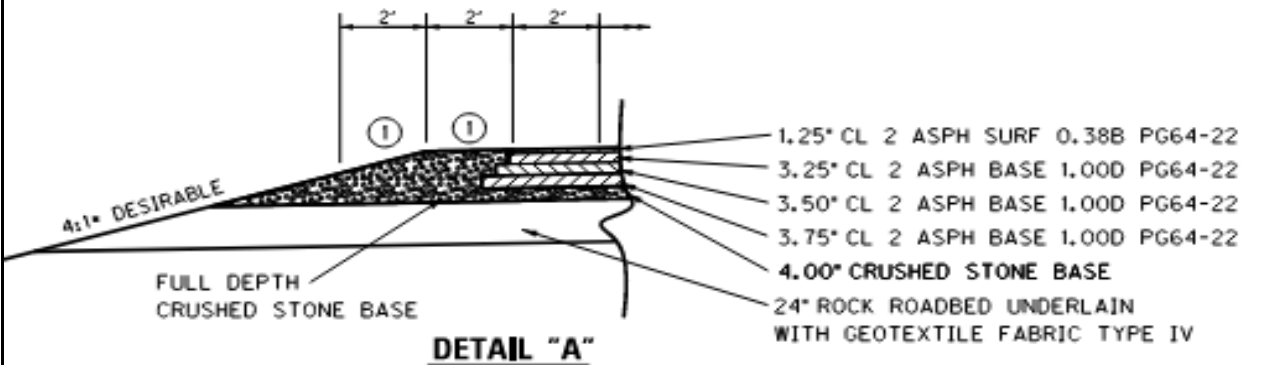
IMPACT TO PERFORMANCE

Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

SL-04

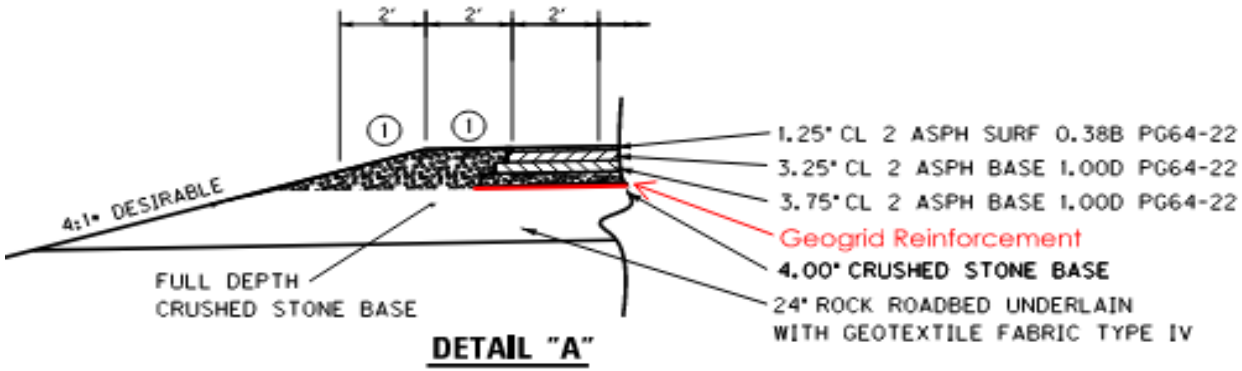
Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Use geogrid to reinforce the subgrade
SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT	
 <p data-bbox="227 861 389 913">4:1* DESIRABLE</p> <p data-bbox="316 955 584 1008">FULL DEPTH CRUSHED STONE BASE</p> <p data-bbox="592 1018 763 1050">DETAIL "A"</p> <p data-bbox="933 808 1404 1029">1.25" CL 2 ASPH SURF 0.388 PG64-22 3.25" CL 2 ASPH BASE 1.000 PG64-22 3.50" CL 2 ASPH BASE 1.000 PG64-22 3.75" CL 2 ASPH BASE 1.000 PG64-22 4.00" CRUSHED STONE BASE 24" ROCK ROADBED UNDERLAIN WITH GEOTEXTILE FABRIC TYPE IV</p>	

VALUE PROPOSAL

SL-04

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Use geogrid to reinforce the subgrade
<p data-bbox="370 415 1263 464" style="text-align: center;">SKETCH/DIAGRAM: VALUE PROPOSAL</p>  <p data-bbox="235 856 402 913">4:1* DESIRABLE</p> <p data-bbox="331 947 594 1003">FULL DEPTH CRUSHED STONE BASE</p> <p data-bbox="602 1010 769 1045" style="text-align: center;"><u>DETAIL "A"</u></p> <p data-bbox="511 682 824 718" style="text-align: center;">2' 2' 2'</p> <p data-bbox="544 808 576 850">① ①</p> <p data-bbox="943 800 1414 1024">1.25" CL 2 ASPH SURF 0.38B PG64-22 3.25" CL 2 ASPH BASE 1.00D PG64-22 3.75" CL 2 ASPH BASE 1.00D PG64-22 Geogrid Reinforcement 4.00" CRUSHED STONE BASE 24" ROCK ROADBED UNDERLAIN WITH GEOTEXTILE FABRIC TYPE IV</p>	

VALUE PROPOSAL

SL-04

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Use geogrid to reinforce the subgrade						
Assumptions & Calculations	Geogrid will increase the pavement strength. A reduction of 33% of pavement structure can be saved when it is utilized. Cost based on Estimator Software						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
CL2 asph Base 1.00D PG64-22	Ton	74,098	\$85.00	\$6,298,330	49,646	\$85.00	\$4,219,881
Geogrid	SY				73,219	\$3.50	\$256,267
Crushed Stone Base	Ton	128,327	\$24	\$3,041,350	78,327	\$23.70	\$1,856,350
TOTAL				\$9,340,000			\$6,332,000
Impact to Initial Cost (Baseline Less Proposed)							\$3,008,000





Note: Total costs are rounded to the nearest thousand dollars.

AVOID COST

VALUE PROPOSAL

PV-02

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds		
FUNCTION	Prevent Contamination		
VALUE PROPOSAL SYNOPSIS:			
The use of native grasses and plants could be used to enhance the local vistas and serve as a value to promote the local ecological environment. These minor improvements could yield a significant benefit to the existing vistas and would help promote erosion control. In addition, use of existing rock cuts or stamped concrete could be used for retaining walls for additional aesthetic value.			
 Reliability	Maintained	 Functionality	Maintained
 O&M	Maintained	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			(\$100,000)
BASELINE CONCEPT:			
Base condition is that typical erosion control practices would be used with traditional methods of seeding.			
VALUE PROPOSAL DESCRIPTION:			
The overall upside and value is limitless. The benefits far outweigh any disadvantages due to the value it adds to a project without impacting the existing design. Aesthetics would be improved while also providing a net benefit to the local environment with pollination.			
ADVANTAGES:		DISADVANTAGES:	
● Easy to implement		● Potential for additional maintenance considerations (depending on plant species)	
● Easy to maintain		●	
● Enhances aesthetics		●	
● Benefits the environment		●	
● Low costs		●	
● Enhances erosion control measures		●	
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	\$100,000	\$20,000	\$120,000
VALUE PROPOSAL DESCRIPTION:	\$200,000	\$20,000	\$220,000
TOTAL (Baseline less Proposed)	(\$100,000)	\$0	(\$100,000)
			ADD COST

VALUE PROPOSAL

PV-02

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

Item Nos. 9-192.01 and 9-192.03

TITLE	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds
DISCUSSION & JUSTIFICATION:	
<p>KYTC currently manages 100 of these roadside plots, blanketing approximately 200 acres across the state with mostly native plants, flowers, and grasses. These showy areas do more than provide beauty for passing commuters; they also provide declining pollinator populations with much-needed nutrients and habitat.</p> <p>KYTC's Pollinator Habitat Zone program aims to provide natural nutrients for all pollinators, including various insects, bees, and butterflies, especially the monarch butterfly, a species threatened with extinction. The host plant for monarchs is milkweed, which KYTC additionally plants in butterfly way stations at welcome centers, rest areas, and other sites.</p> <p>While honey bees are critical to the agriculture industry (providing \$27 billion to the agriculture economy annually), various other pollinators such as monarchs, bats, and native solitary bees are also extremely important (contributing \$6 billion annually).</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

PV-02

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds
--------------	--

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Improved
Justification for Impact Score	The use of native grasses and plants could be used to enhance the local vistas and help promote erosion control.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Improved
Justification for Impact Score	The addition of native grasses and plants will enhance the driver experience.	

VALUE PROPOSAL

PV-02

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds
--------------	--

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



<https://www.kynativeplants.com/post/kentucky-native-plants-landscaping>

<https://www.kyfb.com/federation/newsroom/pollinators-make-a-beeline-for-roadside-wildflower-plots/>

VALUE PROPOSAL

PV-02

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds
--------------	--

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

PV-02





Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds						
Assumptions & Calculations	None noted.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Grasses/plants	LS	1	\$100,000	\$100,000	1	\$200,000	\$200,000
TOTAL				\$100,000			\$200,000
Impact to Initial Cost (Baseline Less Proposed)							(\$100,000)
Note: Total costs are rounded to the nearest thousand dollars.							ADD COST

VALUE PROPOSAL

RE-01

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion				
FUNCTION	Reduce Erosion				
VALUE PROPOSAL SYNOPSIS:					
Adding elements of landscape architecture in the project would improve on the roadway design that helps promote the natural vistas. Adding these elements, where it makes sense, is a small element that would add beauty to the driving experience as well as improve the viewshed from those living next to the improved road. These elements would also help with erosion control.					
 Reliability	Maintained	 Functionality	Improved	\$ Initial Cost Avoidance (Add)	
 O&M	Maintained	 Schedule Impact	Maintained		
BASELINE CONCEPT:					
Base conditions are unknown because final design has not been completed; however, standard practices for any beautification will leave this task with plenty of opportunity to improve.					
VALUE PROPOSAL DESCRIPTION:					
The value has a two-fold benefit: aesthetics and erosion control. The value of adding landscaping treatments to a project improves the aesthetics for the driver and the people living in the area. Additionally, by improving erosion control the project will maintain water quality for the local waterways and prevent degradation of the roadway.					
ADVANTAGES:			DISADVANTAGES:		
● Beautification of the roadway			● Potential maintenance issue if too successful		
● Enhances the vistas/viewshed			● Additional costs		
● Low cost for the added value			● Will take several years to gain benefits		
● Low maintenance			● Wildlife and nature may curtail the life cycle		
● Protection from erosion			● Winter months may not improve the aesthetics		
● Promotes use of the corridor			●		
● May replace other erosion control measures for cost savings or no additional costs			●		
\$ COST SUMMARY		Initial Costs	O&M Costs	Total Life Cycle Cost	
BASELINE CONCEPT:		\$1,000,000	\$50,000	\$1,050,000	
VALUE PROPOSAL DESCRIPTION:		\$1,300,000	\$50,000	\$1,350,000	
TOTAL (Baseline less Proposed)		(\$300,000)	\$0	(\$300,000)	
ADD COST					

VALUE PROPOSAL

RE-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion
DISCUSSION & JUSTIFICATION:	
<p>The design team would need to bring on a Landscape Architect to determine where and how this could be implemented.</p> <p>The idea is not to use it through the entire corridor but in those areas that makes the most sense based on design/erosion control and aesthetic value. For example, the areas where the vistas are most prominent will likely have the least amount of landscape not to impact any views.</p> <p>Public Involvement would also be necessary to ensure buy-in on proposed concepts.</p> <p>Incorporating these elements into the project will not likely impact overall design and scheduling.</p> <p>The upfront costs are the biggest consideration; however, long-term benefits will be experienced while maintenance issues should be minimal. Landscaping would likely replace traditional erosion control measures for potential savings or at no additional costs.</p> <p>During final design, engineers should maximize the use of natural features such as trees and rock cuts to promote the natural landscape. Lastly, erosion control measures could also include the use of decorative rock walls instead of rock baskets or concrete walls.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

RE-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Improved
Justification for Impact Score	Additional landscaping measures would only enhance the aesthetics of the roadway and improve the driving experience.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Improved
Justification for Impact Score	Additional landscaping measures would only enhance the aesthetics of the roadway and improve the driving experience. In addition, the property owners would benefit from these aesthetic improvements.	

VALUE PROPOSAL

RE-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion
--------------	--

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL

RE-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion
--------------	--

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

RE-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion						
Assumptions & Calculations	None noted.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Materials	LS	1	\$700,000	\$700,000	1	\$1,000,000	\$1,000,000
Labor	LS	1	\$250,000	\$250,000	1	\$250,000	\$250,000
Maintenance	LS	1	\$50,000	\$50,000	1	\$50,000	\$50,000
TOTAL				\$1,000,000			\$1,300,000
Impact to Initial Cost (Baseline Less Proposed)							(\$300,000)





Note: Total costs are rounded to the nearest thousand dollars.

ADD COST

VALUE PROPOSAL

IF-01

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance		
FUNCTION	Improve Flow		
VALUE PROPOSAL SYNOPSIS:			
For life cycle cost and ease of maintenance, we recommend using a larger 6'x6' culvert. Requiring a 6'x6' culvert in locations discourages precast culverts under large fills, which may separate during settlement.			
 Reliability	Improved	 Functionality	Improved
 O&M	Improved	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			(\$743,000)
BASELINE CONCEPT:			
The current culvert design includes 4'x4' RCBC.			
VALUE PROPOSAL DESCRIPTION:			
Contractors prefer to build a 6'x6' culvert. Also, a 6'x6' culvert will better facilitate future maintenance of the structures, as maintenance crews can clean debris out of a 6'x6' culvert much more easily. Larger culverts are less likely to become stopped up and cause flooding and saturation of large fills. Hydraulically, the VE team does not see an issue with the baseline 4'x4' RCBC designs, but strongly recommends increasing the size, as the increased ease of maintaining the larger structures is significant.			
ADVANTAGES:		DISADVANTAGES:	
● Greatly improves ease of long-term maintenance		● Requires slight increase in initial cost	
● Discourages precast culverts		●	
● Improves drainage		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY		Initial Costs	O&M Costs
BASELINE CONCEPT:		\$2,145,000	\$0
VALUE PROPOSAL DESCRIPTION:		\$2,888,000	\$0
TOTAL (Baseline less Proposed)		(\$743,000)	\$0

VALUE PROPOSAL

IF-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance
DISCUSSION & JUSTIFICATION:	
<ul style="list-style-type: none">• Technical Considerations: The design of the 6'x6' culvert is similar to the planned 4'x4' with only a slight increase in material.• Performance Impacts: Larger culverts are easier to construct, maintain, and receive better bid prices per square foot opening. As you can see in the sketches on the following pages, a typical skid steer can fit and scoop out the 6'x6' culvert, whereas the 4'x4' must be cleaned by hand.• Cost Considerations: Increased initial costs are offset by savings in future maintenance cost reductions and improved operability.	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

IF-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Maintained
Justification for Impact Score	No impact to performance.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

IF-01

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance
--------------	---

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



4' X 4' RCBC Section

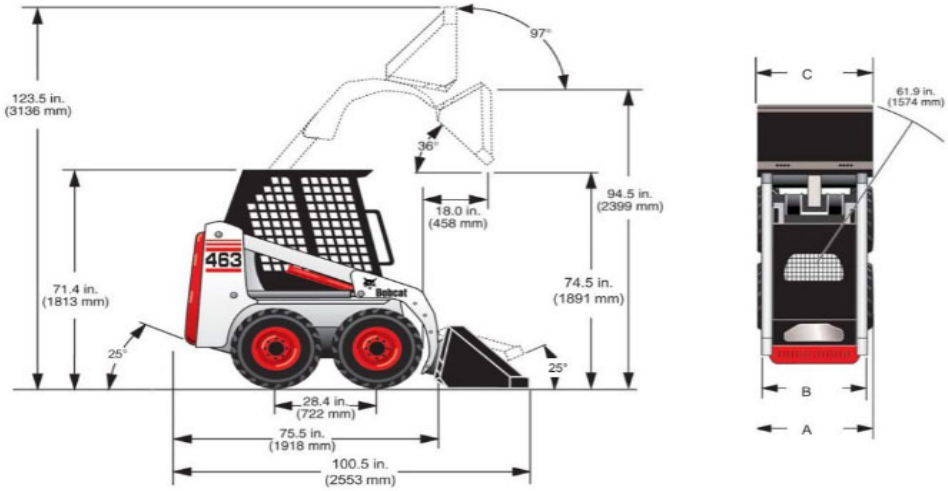
VALUE PROPOSAL

IF-01

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL



Angle of Departure	25°	
Carry Position	8.14" (207 mm)	
Dump Angle @ Maximum Height	34°	
Dump Height with Standard Bucket	74.5" (1891 mm)	
Dump Reach @ Maximum Height	18.5" (470 mm)	
Ground Clearance	5.5" (140 mm)	
Height to Bucket Hinge Pin	94.5" (2399 mm)	
Height with Operator Cab	71.4" (1814 mm)	
Length without Attachment	75.5" (1918 mm)	
Length with Standard Bucket	100.5" (2553 mm)	
Operating Height	123.3" (3132 mm)	
Rollback @ Carry Position	25°	
Rollback Fully Raised		
@ Maximum Height	97°	
Wheelbase	28.4" (722 mm)	
Turning Radius		
with Standard Bucket	61.3" (1557 mm)	
A) Width (over tires)		
23 x 5.70-12	35.4" (900 mm)	
23 x 8.50-12	43.3" (1100 mm)	
B) Wheel Tread		
23 x 5.70-12	29.6" (752 mm)	
23 x 8.50-12	35.5" (902 mm)	
C) Width (over bucket)		
36" Bucket	36.0" (914 mm)	
44" Bucket	44.5" (1130 mm)	

6' X 6' RCBC Section

VALUE PROPOSAL

IF-01

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

Item Nos. 9-192.01 and 9-192.03

TITLE	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance						
Assumptions & Calculations	Unit prices from Estimator software.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
4x4 RCBC	LF	1,650	\$1,300	\$2,145,000			
6x6 RCBC	LF				1,650	\$1,750	\$2,887,500
TOTAL				\$2,145,000			\$2,888,000
Impact to Initial Cost (Baseline Less Proposed)							(\$743,000)
Note: Total costs are rounded to the nearest thousand dollars.							ADD COST

VALUE PROPOSAL

IF-02

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Increase culvert size to encourage wildlife movement to reduce collisions		
FUNCTION	Improve Flow		
VALUE PROPOSAL SYNOPSIS:			
Many accidents on KY 32 occur because of wildlife road crossings. By increasing culvert size, there is an improved chance wildlife will use these "alternate routes" rather than entering traffic.			
Reliability	Maintained	Functionality	Improved
O&M	Improved	Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			(\$743,000)
BASELINE CONCEPT:			
The current plans utilize standard pipe sizes and 4'x4' culverts.			
VALUE PROPOSAL DESCRIPTION:			
By increasing the culvert sizes, culverts can be utilized for wildlife crossing in order to improve safety, reduce deer strikes and other animal collisions, and protect local wildlife. The VE team believes that increasing the culvert size is an important consideration for maintenance reasons alone (see value proposal IF-01), so this proposal is to seize the opportunity to simultaneously enhance safety as an added benefit for little additional cost.			
ADVANTAGES:		DISADVANTAGES:	
● Reduces crashes		● Increases initial structure and fencing cost	
● Reduces maintenance costs		● Requires additional studies to determine efficient locations	
● Increases user satisfaction		●	
● Preservation of wildlife		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY		Initial Costs	O&M Costs
BASELINE CONCEPT:		\$2,145,000	\$0
VALUE PROPOSAL DESCRIPTION:		\$2,888,000	\$0
TOTAL (Baseline less Proposed)		(\$743,000)	\$0

VALUE PROPOSAL

IF-02

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Increase culvert size to encourage wildlife movement to reduce collisions
DISCUSSION & JUSTIFICATION:	
<ul style="list-style-type: none">• Technical Considerations: Because the VE team believes that increasing the culvert size would greatly improve the ease of future maintenance (see value proposal IF-01) and provide significant value for that reason alone, the project design team has a great opportunity to enhance safety and protect wildlife at the same time as addressing the maintenance issue for little or no additional cost. The most effective culvert size to accommodate local wildlife will need to be determined.• Performance Impacts: Refer to value proposal IF-01 for traditional considerations to increasing structure size. While the vast majority of deer strikes do not involve serious injury, according to the Insurance Institute for Highway Safety (IIHS), in the 10-year period from 2012-2021, almost 1,900 people were killed in crashes involving animals, including 44 fatalities here in Kentucky. Further, consider that if even a 5% reduction in wildlife collisions results from the use of culverts as wildlife crossings, 2 human lives will have been saved.• Cost Considerations: Currently, there are funding sources that would accommodate such wildlife considerations without increasing traditional project expenses. Additional fencing costs will be required to encourage wildlife to use the crossings. The Insurance Agency at AAA statistics indicate that across Kentucky, the average claim for an animal strike in 2022 was more than \$6,000 – up more than 50% in just five years. Kyle Poat, chief engineer at the Transportation Cabinet office, warned Kentucky motorists that driving during twilight hours in the fall deer-vehicle collision season could be “especially hazardous.” According to the Northern Kentucky Tribune citing Poat, deer tend to be on the move around sunrise and sunset, which is also the time of day when a motorist can easily miss a deer moving among the shadows. The period between October and November accounts for about half of the annual more than 3,000 car accidents involving deer. 5% reduction x 3,000 accidents x \$6,000 per accident = \$900,000 saved \$1 Million reduction in property damage and lives saved. Why not try it?	
OUT-BRIEF PRESENTATION COMMENTS:	
None noted.	

VALUE PROPOSAL

IF-02

Kentucky Transportation Cabinet

KY 32 Reconstruction (Eastern & Western Sections)

TITLE	Increase culvert size to encourage wildlife movement to reduce collisions	
IMPACT TO PERFORMANCE		
Performance Attribute	Definition	Score
Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.	Improved
Justification for Impact Score	Elimination of even one deer strike is a significant safety win.	
Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.	Maintained
Justification for Impact Score	No impact to performance.	
Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.	Maintained
Justification for Impact Score	No impact to performance.	
Regional Connectivity	Improved regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.	Maintained
Justification for Impact Score	No impact to performance.	
Maneuverability	Improved maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.	Maintained
Justification for Impact Score	No impact to performance.	
Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.	Maintained
Justification for Impact Score	No impact to performance.	

VALUE PROPOSAL

IF-02

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Increase culvert size to encourage wildlife movement to reduce collisions
--------------	---

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL

IF-02

Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
Item Nos. 9-192.01 and 9-192.03

TITLE	Increase culvert size to encourage wildlife movement to reduce collisions
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

IF-02

Kentucky Transportation Cabinet
 KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

TITLE	Increase culvert size to encourage wildlife movement to reduce collisions						
Assumptions & Calculations	There is a potential for this to be a no-cost proposal based on the availability of additional funding sources. Costs shown are generated from the Estimator Software.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
4x4 RCBC	LF	1,650	\$1,300	\$2,145,000			
6x6 RCBC	LF				1,650	\$1,750	\$2,887,500
TOTAL				\$2,145,000			\$2,888,000
Impact to Initial Cost (Baseline Less Proposed)							(\$743,000)
Note: Total costs are rounded to the nearest thousand dollars.							ADD COST



PART

III

Appendices
Value Study
Documentation

Appendix

A

Value Study Overview

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
Kentucky Transportation Cabinet
Item Nos. 9-192.01 and 9-192.03

A.1 Introduction

A virtual value engineering workshop was conducted from November 27-30, 2023 on the project documents provided by KYTC for the KY 32 Reconstruction (Eastern and Western Sections) project.

The Kentucky-based VE team, which consisted of a roadway geometrics expert, a constructability expert, and geotechnical and environmental engineers, began the workshop process by reviewing the project documents and receiving the in-brief presentation. Throughout the workshop process, the VE team searched for opportunities to contribute quantitative and qualitative suggestions and improvements that would improve the value of this project through improved function. The alternatives developed by the VE team are offered as creative contributions to the design effort that has brought the project to this point.

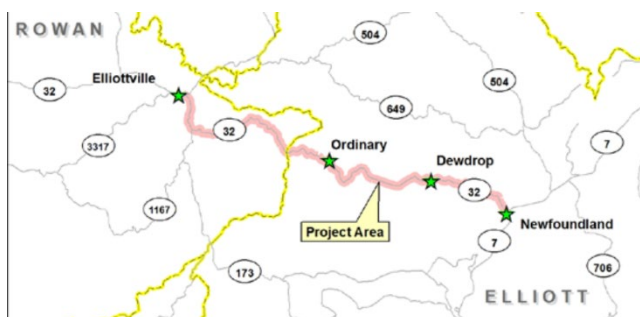
The Appendices in this report document the process the VE team followed to identify and develop the value proposals presented in Section 2.

A.2 Project Overview

(Excerpted from the Environmental Assessment provided by KYTC and dated May 2013)

Purpose: To provide a roadway with improved geometry compared with existing

Need: The current KY 32 facility was constructed in the 1930s and has substandard geometry along most of its 13.7-mile-long corridor. The road is a primary east-west roadway in Elliott and Rowan counties, and provides connectivity among residential areas, the county seats, health services, educational institutions, and economic activity centers.



The project area's topography is characterized by rolling terrain, with steep hills and valleys. KY 32 is constructed along a ridgetop and has numerous hills and curves. The existing conditions along the roadway corridor include:








- Substandard horizontal and vertical alignments (i. e., steep slopes and sharp curves) throughout the corridor.
- Few opportunities to pass, and insufficient passing sight distance along 91% of its length.
- Narrow, asphalt pavement (9- to 11-foot-wide lane widths) throughout.
- Narrow (2- to 3-foot-wide) unpaved shoulders throughout most of the corridor.
- Predominant posted speed of 55 miles per hour (MPH) that is reduced to 25, 35, or 45 mph at multiple locations.

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
Kentucky Transportation Cabinet
Item Nos. 9-192.01 and 9-192.03












A.2.1 List of Documents Reviewed

The following list of documents were available to the VE team to develop their understanding of the project and establish project purpose and need, workshop objectives, and constraints.

A preliminary set of project documents was provided to the VE team prior to the start of the workshop and were used in the team’s project review:

 9-192.01 KY 32 B&W Half Size Cross Sections.pdf	 9-192.01 KY 32 RW Rev-1 Combined Set 6-17-22.pdf
 9-192.01 KY 32 B&W Half Size Plans.pdf	 9-192.01 KY 32 Sections Rev-1 Combined Set 6-17-22.pdf
 9-192.01 KY 32 Color Half Size Cross Sections.pdf	
 9-192.01 KY 32 Color Half Size Plans.pdf	
 9-192.01 KY 32 JI Estimate.pdf	

Additional documents were made available throughout the course of the workshop:

 9-192.XX 2017-2022 CRASH data.xlsx	
 KY 32 October 2 2013 Final VO Ver01.mp4	 FONSI, Permits
 KY 32 PL&G Pro-Con Matrix.xlsx	 KMZ Files
 KY 32 PL&G Typical.pdf	 Appendix B - Public Hearing Comment Forms Received.pdf
 KY 32 Timeline - publicconsumptionforKYTCWEBSITE_Optimized.pdf	 Appendix C - ACC since Public Hearing.pdf
 Rowan - Elliott, KY 32 VE.docx	 KY 32 Environmental Assessment (Signed 6-27-13).pdf

A.2.2 In-brief Meeting

At the in-brief meeting on Monday, November 27, 2023, representatives from KYTC and the project design team presented a briefing on the project to the VE team. In addition to identifying the key elements of the project, the VE and project design teams discussed the workshop objectives (the focus of the value study) and overall project goals. The goals and objectives are listed in Section 1 of this report.

A.2.3 Site Visit

While the VE team was not able to visit the project site, the in-brief presentation given by the design team representatives provided valuable context on the condition of the site. The video shown during the in-brief, which was originally presented during public hearings on the project, was singularly beneficial in giving the VE team a better understanding of all aspects of the project.

A.2.4 Presentation

An out-brief presentation was held on Thursday, November 30, 2023. The objective of the presentation was to put forward the results of the value study. This involved a PowerPoint slide presentation to the value study stakeholders and decision makers. During the presentation, the VE team highlighted aspects of value proposals, providing an opportunity for discussion and/or clarification of the concepts presented. This report has been created to document the value study in greater detail.

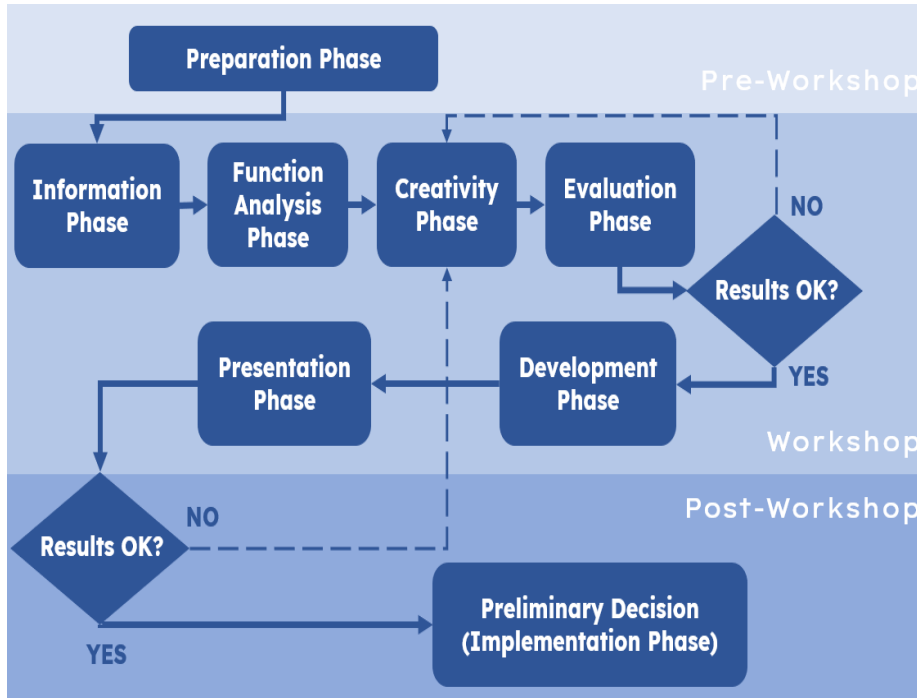
VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

A.3 VM Process

The value methodology (Synonyms: value analysis, value engineering, and value management) is a function-oriented, systematic, team approach to add customer value to a program, facility, system, or service. Improvements like performance, quality, initial and life cycle cost are paramount in the value methodology.

Figure A-1: The VM Process



The workshop was conducted in accordance with the methodology as established by SAVE International, the value society, and was structured using the Value Methodology as outlined as follows:

Table A-1: The VM Job Plan

Value Methodology Stage / Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
Phase 1: Preparation Phase	Identify Subject Identify Goals Define Value Organize Effort	<ul style="list-style-type: none"> Identify the study project Identify roles and responsibilities Define study scope, goals, and objectives Select team leader Conduct pre-study meeting Select value study team members Identify stakeholders, decision-makers, and technical reviewers Obtain time commitment Identify data collection Select study dates Determine study logistics, agenda Collect and distribute data Perform technology dry-run for a virtual workshop Send team primer to value study team 	<ul style="list-style-type: none"> Fosters understanding of value study priorities Defines and manages expectations Organizes the value study Offers a thorough review of the project Tests meeting platform and virtual tools to maximize engagement and collaboration Primes the team for the value workshop

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
Item Nos. 9-192.01 and 9-192.03

Value Methodology Stage / Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
		<ul style="list-style-type: none"> Team members to complete Key Issues Memos (KIM) 	
Phase 2: Information Phase	Analyze Information Transform Information Orient Participants	<ul style="list-style-type: none"> Present design concept Present stakeholders' interests Review project issues and objectives Discuss deviation from design standards Define project performance metrics Discuss problems the project must solve; identify issues the design may not address Visit project site / virtual site tour 	<ul style="list-style-type: none"> It brings all value study team members to a common understanding of the project, including its challenges and constraints Establishes the benchmark for which to identify alternatives Gains a real-world perspective of the project and builds the foundation for function analysis
Phase 3: Function Analysis Phase	Define Functions Allocate Resources Allocate Performance Prioritize Functions	<ul style="list-style-type: none"> Identify and classify functions Apply cost and risk relative to performance Prioritize functions Select specific functions for study 	<ul style="list-style-type: none"> Provides a comprehensive understanding by focusing on what the project does rather than what it is Identifies what the project must do to satisfy needs and objectives Focuses on functions with the greatest opportunity for project improvements
Phase 4: Creativity Phase	Generate Ideas	<ul style="list-style-type: none"> Brainstorm to generate performance-focused ideas for alternative ways to perform functions Discuss, build on and clarify ideas 	<ul style="list-style-type: none"> The value team develops a broad array of ideas that provides a wide variety of possible alternative components or methods to improve project value
Phase 5: Evaluation Phase	Evaluate Ideas Select Ideas	<ul style="list-style-type: none"> Eliminate obvious "fatal flaw" ideas Score ideas based on meeting performance criteria, value key and project/study goals Discuss conflicting rankings, further clarify ideas and determine final rankings Discuss ideas with client and decision-makers (midpoint review) Assign alternatives for the development phase 	<ul style="list-style-type: none"> Prioritizes ideas for development, focusing on those with the highest potential for performance improvement and cost savings Determine value: performance/cost Focuses team's effort to develop alternatives that best meet client study objectives
Phase 6: Development Phase	Transform Ideas Develop Information	<ul style="list-style-type: none"> Validate and refine idea concepts Compare to the original design concept Define implementation considerations Prepare sketches and calculations Measure performance Estimate costs, life-cycle cost benefits/costs 	<ul style="list-style-type: none"> Provides a side-by-side comparison of baseline and alternative—concepts, initial costs, life-cycle costs, sketches, performance metrics

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

Value Methodology Stage / Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
Phase 7: Presentation Phase	Present Information Propose Change	<ul style="list-style-type: none"> • Present developed ideas to client, designers, decision-makers, stakeholders • Document feedback • Produce draft report 	<ul style="list-style-type: none"> • Ensures management and other key stakeholders understand the rationale of the value alternatives and design suggestions
Phase 8: Implementation Phase	Implement Change Manage Change Realize Value	<ul style="list-style-type: none"> • Document process and study findings • Develop and distribute VE study summary report • Review study summary report • Assess alternatives for acceptance • Prepare draft implementation dispositions • Resolve conditionally accepted alternatives • Develop an implementation plan with the project manager • Project manager sign-off on VE implementation plan • Final presentation of study results 	<ul style="list-style-type: none"> • Involves those who will implement and increases the likelihood of implementation • Improves the actual value of the project

A.4 Participants

Table A-2: VE Team Participants

Name	Organization	Position
Jerry Leslie	AEI	Roadway Geometrics
Jacob Cowan	AEI	Geotechnical
Chris Blevins	Palmer	Environmental
Jeremiah Littleton	Qk4	Constructability
Katy Stewart	KYTC	Quality Assurance Branch Manager
Ryan Elliott, EdD, PE, CVS	RHA	Team Leader
Natalie Goings, VMA	RHA	Technical Assistant

A.4.1 Attendance Records

The following page details the attendance of all participants during the workshop, including the in-brief and out-brief presentation meetings.

VALUE STUDY
Kentucky Transportation Cabinet
KY 32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03

Workshop Attendee List

November 27-30, 2023										Name	Organization	Position
IBP	27		28		29		30		OBP			
	am	pm	am	pm	am	pm	am	pm				
										VE Team Members (Full Time)		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Ryan Elliott, CVS	RHA	Team Leader
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Natalie Goings, VMA	RHA	Workshop Assistant
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Jerry Leslie	AEI	Roadway Geometrics
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Jacob Cowan	AEI	Geotechnical
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Chris Blevins	Palmer	Environmental
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Jeremiah Littleton	Qk4	Constructability
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Katy Stewart	KYTC	Quality Assurance Branch Manager
										Stakeholder Attendees (In-Brief & Out-Brief)		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Mitch Thomas	AECOM	Project Manager - Consultant
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Darrin Eldridge	KYTC District 9	Project Manager
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Karen Mynhier	KYTC District 9	Environmental Coordinator
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Adam Ross	KYTC	Branch Manager - Geotech Services
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Austin Holbrook	KYTC	Geotechnical - Support & Review Branch
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Randy Turner	KYTC	Highway Design - Location Engineer
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Austin Mineer	KYTC	EIT - Project Development
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Erik Scott	KYTC	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Blake Jones	KYTC District 9	Design & Planning Supervisor
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Talya Caudill	KYTC	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Jordan Taliaferro	AECOM	Roadway Design Team
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Steve Gunnell	KYTC District 9	Chief District Engineer
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Michael Read	KYTC District 9	Planning & Design
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Tim Layson	KYTC	Director of Highway Design
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Greg Groves	AECOM	Project Principal
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Chadwick Collins	AECOM	Roadway Group
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	John Keeton	AECOM	Project Engineer
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Patrick Perry	KYTC	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Kyle Bidwell	KYTC	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Brad Eldridge	FHWA	VE Coordinator

A.5 Agenda

A copy of the agenda used for the value study, noting the time allocated to each one of the Value Methodology Job Plan phases, is included on the following pages.

Value Engineering (VE) Workshop Agenda



Project Name: Kentucky Transportation Cabinet
 SR32 Reconstruction (Eastern & Western Sections)
 Item Nos. 9-192.01 and 9-192.03
VE Workshop

Dates: November 27 – 30, 2023 (see detailed times below)

Study Location: Virtual

Day 1: Monday, November 27, 9:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 1: [CLICK HERE](#) -or- Call-in: +1 323-484-8978
 Access Code: 934 601 233#

Time EST	VE Activity	Participants	Comments
9:00	Welcome & Introductions Brief Overview of Value Engineering Process & VE Agenda Review (CVS Facilitator)	All	
INFORMATION PHASE			
9:20	Project Overview, Presentation & Virtual Site Tour (KYTC Project Manager, Consultant Design Lead/s)	All	
10:30	Short Break		
10:45	Identify/Review: <ul style="list-style-type: none"> ▪ Project Goals ▪ VE Study Objectives (Focus of VE Study) ▪ VE Study Constraints ▪ Identify, Define & Rank Performance Attributes 	All	
12:00	Conclusion of In-brief meeting / Long Break		
1:00	Discuss Team Observations, Project Risks Review Cost Model, Schedule, Other	VE Team	
FUNCTION ANALYSIS PHASE			
2:00	Function Identification of Project Elements <ul style="list-style-type: none"> ▪ Identify/Classify Project Functions ▪ Apply Risks/Resources to Functions ▪ Select Specific Functions for Study 	VE Team	
3:00	Short Break		
CREATIVITY PHASE			
3:15	Brainstorm Ideas / Alternatives		
5:00	Adjourn		

All: Decision-makers, Design Team, Stakeholders, VE Team (Shaded rows)
 VE Team: Subject Matter Experts and others serving as full-time VE Team members

Value Engineering (VE) Workshop Agenda



Day 2: Tuesday, November 28, 8:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 1: [CLICK HERE](#)

-or-

Call-in:

+1 323-484-8978

Access Code:

934 601 233#

Time EST	VE Activity	Participants	Comments
8:00	Check-in	VE Team	
CREATIVITY PHASE - continued			
8:05	Brainstorm Ideas / Alternatives	VE Team	
10:00	Short Break		
10:15	Brainstorm Ideas / Alternatives	VE Team	
12:00	Long Break		
EVALUATION PHASE			
1:00	Evaluation of Ideas – Team Assignments for Development	VE Team	
3:00	Short Break		
DEVELOPMENT PHASE			
3:15	Review Workbook Template & Process Flow Develop / Cost Alternatives	VE Team	
5:00	Adjourn		

Day 3: Wednesday, November 29, 8:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 1: [CLICK HERE](#)

-or-

Call-in:

+1 323-484-8978

Access Code:

934 601 233#

Time EST	VE Study Activity	Participants	Comments
8:00	Check-in	VE Team	
DEVELOPMENT PHASE - continued			
8:05	Develop / Cost Alternatives	VE Team	
9:45	Develop / Cost Alternatives	VE Team	
10:30	Check-in	VE Team	
12:00	Long Break		
1:00	Develop / Cost Alternatives	VE Team	
4:30	Check-in Alternatives to Present	VE Team	
5:00	Adjourn		

All: Decision-makers, Design Team, Stakeholders, VE Team (Shaded rows)

VE Team: Subject Matter Experts and others serving as full-time VE Team members

Value Engineering (VE) Workshop Agenda



Day 4: Thursday, November 30, 8:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 1: [CLICK HERE](#) -or-

Call-in: +1 323-484-8978

Access Code: 934 601 233#

Time EST	VE Study Activity	Participants	Comments
8:00	Check-in	VE Team	
DEVELOPMENT PHASE - continued			
8:05	Develop / Cost Alternatives - Complete	VE Team	
10:30	Check-in Practice Presentation	VE Team	
12:00	Long Break		
1:00	Peer Review Workbooks	VE Team	
PRESENTATION PHASE			
2:00	Presentation of Key Finding/VE Alternatives to Stakeholders/Decision-makers	All	
3:30	Peer Review Workbooks - Complete Workshop Close-out	VE Team	
5:00	Adjourn		

All: Decision-makers, Design Team, Stakeholders, VE Team (Shaded rows)
 VE Team: Subject Matter Experts and others serving as full-time VE Team members

B

Appendix

Project Analysis

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
 Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

B.1 Cost Model

A Pareto cost model was prepared for the project using the highest cost items (items over \$900k) from the original cost estimate provided by KYTC dated 01/12/2017.

The Pareto Concept: Typically, 80% of the total cost of a project is due to 20% of the elements of that project. Focusing on that 20% achieves the greatest impact in cost reduction and value improvement.

How to read the Cost Model Data Table: In the Cost Model Data Table, the project elements are sorted from largest down to smallest with a cumulative percentage; all project items above the 80% mark represent approximately 80% of the total project cost.

The Pareto cost model provided the VE team with valuable insights into the largest cost drivers in the estimate, and these line items were later used to brainstorm project functions (detailed in Appendix C of this report).

Table B-1: Cost Model Data Table (Without 10% Contingency Applied)

Description	Estimated Cost	% Total	% Cumulative
Roadway Excavation	\$17,711,826.00	46.93%	46.93%
CL2 Asphalt Base	\$5,557,350.00	14.72%	61.65%
Crushed Stone Base	\$3,208,175.00	8.50%	70.15%
Erosion Control Blanket	\$2,346,786.00	6.22%	76.37%
Granular Embankment	\$2,207,125.00	5.85%	82.22%
Fuel Adjustment	\$2,085,645.00	5.53%	87.74%
Channel Lining Class 3	\$1,406,475.00	3.73%	91.47%
Mobilization	\$1,260,158.06	3.34%	94.81%
4'x4' RCBC	\$997,200.00	2.64%	97.45%
CL2 Asphalt Surface	\$962,400.00	2.55%	100.00%
Total	\$37,743,140.06	100.00%	

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)
 Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

B.2 Cost Estimate Update

The VE team updated the cost estimate provided by KYTC dated 01/12/2017 to better reflect current prices. The table below compares a summary of the updated estimate to the baseline:

Table B-2: Updated VE Team Estimate Summary

	Baseline Estimate	Updated VE Team Estimate
Base Date:	01/12/17	11/28/23
Contingency:	10%	10%
PAVING	\$9.9M	\$10.5M
ROADWAY	\$29.9M	\$58.4M
DRAINAGE	\$2.2M	\$2.1M
MOB/DEMOB	\$1.9M	\$4.6M
TOTAL	\$48.3M	\$83.1M

The full updated estimate is included on the following pages.

Estimate

Estimated Cost:\$75,552,683.81

Contingency: 10.00%

Estimated Total: \$83,107,952.19

Base Date: 11/28/23

Spec Year: 08

Unit System: E

Work Type: ASPHALT SURFACE WITH GRADE & DRAIN

Highway Type: STATE

Urban/Rural Type: RURAL

Season: SPRING

County: ELLIOTT

Latitude of Midpoint: 380839

Longitude of Midpoint: 890853

District: 09

Federal Project Number: FD52 103 0032 016-022

State Project Number:

Prepared by System Administrator

Estimate:

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					

Group 0001: Paving

0002	00003	128,327.000	TON	\$23.70008	\$3,041,360.17
CRUSHED STONE BASE					
0003	00020	2,500.000	TON	\$18.26182	\$45,654.55
TRAFFIC BOUND BASE					
0004	00100	814.000	TON	\$81.16708	\$66,070.00
ASPHALT SEAL AGGREGATE					
0005	00103	102.000	TON	\$610.37016	\$62,257.76
ASPHALT SEAL COAT					
0006	00190	147.000	TON	\$103.75498	\$15,251.98
LEVELING & WEDGING PG64-22					
0007	00212	74,098.000	TON	\$85.00000	\$6,298,330.00
CL2 ASPH BASE 1.00D PG64-22					
0009	00307	12,030.000	TON	\$78.00000	\$938,340.00
CL2 ASPH SURF 0.38B PG64-22					

Total for Group 0001:\$10,467,264.46

Group 0002: Roadway

0010	00071	232.000	TON	\$49.77267	\$11,547.26
CRUSHED AGGREGATE SIZE NO 57					
0021	02014	44.000	EACH	\$182.01749	\$8,008.77
BARRICADE-TYPE III					
0022	02091	14,370.000	SQYD	\$5.98367	\$85,985.34
REMOVE PAVEMENT					
0024	02159	16,610.000	LF	\$0.15930	\$2,645.97
TEMP DITCH					
0025	02160	8,300.000	LF	\$0.02453	\$203.60
CLEAN TEMP DITCH					
0026	02200	5,903,942.000	CUYD	\$5.50000	\$32,471,681.00
ROADWAY EXCAVATION					
0027	02223	88,285.000	CUYD	\$30.00000	\$2,648,550.00
GRANULAR EMBANKMENT					
0028	02242	6,343.000	MGAL	\$0.19308	\$1,224.71
WATER					

Estimate:

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0031	02351	27,050.000	LF	\$29.02455	\$785,114.08
GUARDRAIL-STEEL W BEAM-S FACE					
0032	02360	58.000	EACH	\$82.00000	\$4,756.00
GUARDRAIL TERMINAL SECTION NO 1					
0033	02367	33.000	EACH	\$3,591.96406	\$118,534.81
GUARDRAIL END TREATMENT TYPE 1					
0034	02371	16.000	EACH	\$1,538.89884	\$24,622.38
GUARDRAIL END TREATMENT TYPE 7					
0035	02381	7,705.000	LF	\$2.09395	\$16,133.88
REMOVE GUARDRAIL					
0036	02391	4.000	EACH	\$2,850.00000	\$11,400.00
GUARDRAIL END TREATMENT TYPE 4A					
0037	02397	2,500.000	LF	\$12.43334	\$31,083.35
TEMP GUARDRAIL					
0038	02429	357.000	EACH	\$125.00000	\$44,625.00
RIGHT-OF-WAY MONUMENT TYPE 1					
0039	02431	357.000	EACH	\$150.00000	\$53,550.00
WITNESS R/W MONUMENT TYPE 2					
0040	02475	4.000	EACH	\$2,500.00000	\$10,000.00
PLUG WATER WELL					
0041	02484	40,185.000	TON	\$29.00000	\$1,165,365.00
CHANNEL LINING CLASS III					
0042	02545	1.000	LS	\$190,000.00000	\$190,000.00
CLEARING AND GRUBBING					
0043	02562	630.000	SQFT	\$11.46850	\$7,225.16
TEMPORARY SIGNS					
0045	02585	628.000	LF	\$17.74741	\$11,145.37
EDGE KEY					
0046	02602	39,500.000	SQYD	\$2.25590	\$89,108.05
FABRIC-GEOTEXTILE CLASS 1					
0047	02603	331,346.000	SQYD	\$3.50000	\$1,159,711.00
FABRIC-GEOTEXTILE CLASS 2					
0049	02650	1.000	LS	\$250,000.00000	\$250,000.00
MAINTAIN & CONTROL TRAFFIC					

Estimate:

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0050	02671	8.000	EACH	\$4,199.38500	\$33,595.08
PORTABLE CHANGEABLE MESSAGE SIGN					
0051	02690	2.000	CUYD	\$599.71438	\$1,199.43
SAFELOADING					
0052	02696	60,974.000	LF	\$0.13601	\$8,293.07
SHOULDER RUMBLE STRIPS					
0053	02701	17,697.000	LF	\$1.75329	\$31,027.97
TEMP SILT FENCE					
0054	02703	131.000	EACH	\$75.10511	\$9,838.77
SILT TRAP TYPE A					
0055	02704	307.000	EACH	\$77.88774	\$23,911.54
SILT TRAP TYPE B					
0056	02705	307.000	EACH	\$52.56283	\$16,136.79
SILT TRAP TYPE C					
0057	02706	786.000	EACH	\$65.00000	\$51,090.00
CLEAN SILT TRAP TYPE A					
0058	02707	1,842.000	EACH	\$65.00000	\$119,730.00
CLEAN SILT TRAP TYPE B					
0059	02708	1,842.000	EACH	\$65.00000	\$119,730.00
CLEAN SILT TRAP TYPE C					
0060	02711	700.000	CUYD	\$25.00000	\$17,500.00
SEDIMENTATION BASIN					
0061	02712	4,200.000	CUYD	\$10.00000	\$42,000.00
CLEAN SEDIMENTATION BASIN					
0062	02726	1.000	LS	\$250,000.00000	\$250,000.00
STAKING					
0064	02731	1.000	LS	\$150,000.00000	\$150,000.00
REMOVE STRUCTURE					
0066	05950	1,173,393.000	SQYD	\$8.50000	\$9,973,840.50
EROSION CONTROL BLANKET					
0067	05952	990,623.000	SQYD	\$0.14650	\$145,126.27
TEMP MULCH					
0068	05953	742,967.000	SQYD	\$0.13907	\$103,324.42
TEMP SEEDING AND PROTECTION					

Estimate:

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0069	05963 INITIAL FERTILIZER	47.000	TON	\$986.46544	\$46,363.88
0070	05964 MAINTENANCE FERTILIZER	77.000	TON	\$1,550.00000	\$119,350.00
0073	05992 AGRICULTURAL LIMESTONE	864.000	TON	\$77.64066	\$67,081.53
0074	06510 PAVE STRIPING-TEMP PAINT-4 IN	5,000.000	LF	\$0.11372	\$568.60
0075	06514 PAVE STRIPING-PERM PAINT-4 IN	150,542.000	LF	\$0.16415	\$24,711.47
0076	06568 PAVE MARKING-THERMO STOP BAR-24IN	487.000	LF	\$10.24821	\$4,990.88
0077	06591 PAVEMENT MARKER TYPE V-BY	384.000	EACH	\$55.00000	\$21,120.00
0079	10020NS FUEL ADJUSTMENT	2,100,000.000	DOLL	\$1.00000	\$2,100,000.00
0082	10030NS ASPHALT ADJUSTMENT	350,000.000	DOLL	\$1.00000	\$350,000.00
0083	20458ES403 CENTERLINE RUMBLE STRIPS	31,866.000	LF	\$0.15146	\$4,826.42
0084	20550ND SAWCUT PAVEMENT	3,133.000	LF	\$2.57353	\$8,062.87
0085	20667ED PNEUMATIC BACKSTOWING	500.000	TON	\$250.00000	\$125,000.00
0086	22664EN WATER BLASTING EXISTING STRIPE	5,000.000	LF	\$0.36348	\$1,817.40
0087	23274EN11F TURF REINFORCEMENT MAT 1	42,688.000	SQYD	\$10.00000	\$426,880.00
0088	20166ES810 TEMPORARY PIPE	98.000	LF	\$89.96231	\$8,816.31
0089	08018 RETAINING WALL	40,000.000	SQFT	\$120.00000	\$4,800,000.00

Total for Group 0002:\$58,408,153.93

Group 0003: Drainage

Estimate:

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0090	00078	21.000	TON	\$73.03041	\$1,533.64
CRUSHED AGGREGATE SIZE NO 2					
0091	00440	223.000	LF	\$108.75214	\$24,251.73
ENTRANCE PIPE-15 IN					
0092	00441	438.000	LF	\$79.87416	\$34,984.88
ENTRANCE PIPE-18 IN					
0093	00443	261.000	LF	\$103.67417	\$27,058.96
ENTRANCE PIPE-24 IN					
0094	00462	192.000	LF	\$163.30087	\$31,353.77
CULVERT PIPE-18 IN					
0095	00464	1,884.000	LF	\$177.35276	\$334,132.60
CULVERT PIPE-24 IN					
0096	00466	717.000	LF	\$146.54027	\$105,069.37
CULVERT PIPE-30 IN					
0097	00468	520.000	LF	\$162.25128	\$84,370.67
CULVERT PIPE-36 IN					
0098	00469	855.000	LF	\$280.00000	\$239,400.00
CULVERT PIPE-42 IN					
0099	00470	642.000	LF	\$279.42412	\$179,390.29
CULVERT PIPE-48 IN					
0101	00524	104.000	LF	\$147.07515	\$15,295.82
STORM SEWER PIPE-24 IN					
0102	01001	10,798.000	LF	\$8.62326	\$93,113.96
PERFORATED PIPE-6 IN					
0103	01011	5,896.000	LF	\$26.00000	\$153,296.00
NON-PERFORATED PIPE-6 IN					
0104	01021	2.000	EACH	\$696.00000	\$1,392.00
PERF PIPE HEADWALL TY 1-6 IN					
0105	01025	9.000	EACH	\$645.00000	\$5,805.00
PERF PIPE HEADWALL TY 2-6 IN					
0106	01029	10.000	EACH	\$930.00000	\$9,300.00
PERF PIPE HEADWALL TY 3-6 IN					
0107	01208	11.000	EACH	\$2,129.41759	\$23,423.59
PIPE CULVERT HEADWALL-24 IN					

Estimate:

<u>Line #</u>	<u>Item Number</u>	<u>Quantity</u>	<u>Units</u>	<u>Unit Price</u>	<u>Extension</u>
<u>Description</u>					
<u>Supplemental Description</u>					
0108	01210 PIPE CULVERT HEADWALL-30 IN	4.000	EACH	\$2,616.09372	\$10,464.37
0109	01212 PIPE CULVERT HEADWALL-36 IN	5.000	EACH	\$2,955.87295	\$14,779.36
0110	01214 PIPE CULVERT HEADWALL-42 IN	8.000	EACH	\$6,100.00000	\$48,800.00
0111	01216 PIPE CULVERT HEADWALL-48 IN	8.000	EACH	\$4,085.41250	\$32,683.30
0112	01433 SLOPED BOX OUTLET TYPE 1-18 IN	6.000	EACH	\$2,147.02548	\$12,882.15
0113	01434 SLOPED BOX OUTLET TYPE 1-24 IN	16.000	EACH	\$3,700.00000	\$59,200.00
0114	01452 S & F BOX INLET-OUTLET-30 IN	6.000	EACH	\$6,064.47206	\$36,386.83
0115	01453 S & F BOX INLET-OUTLET-36 IN	1.000	EACH	\$9,116.65246	\$9,116.65
0116	01490 DROP BOX INLET TYPE 1	1.000	EACH	\$3,605.81115	\$3,605.81
0117	01514 DROP BOX INLET TYPE 5E	1.000	EACH	\$7,550.00000	\$7,550.00
0120	02607 FABRIC-GEOTEXTILE CLASS 2 FOR PIPE	12,254.000	SQYD	\$2.00000	\$24,508.00
0121	22581EN ENTRANCE PIPE-36 IN	296.000	LF	\$145.00000	\$42,920.00
0123	24694ED BOX CULVERT	1,000.000	LF	\$400.00000	\$400,000.00

Total for Group 0003:\$2,066,068.75

Group 0004: Mobilization & Demobilization

0124	02568 MOBILIZATION	1.000	LS	\$3,547,074.35700	\$3,547,074.36
0125	02569 DEMOBILIZATION	1.000	LS	\$1,064,122.30710	\$1,064,122.31

Total for Group 0004:\$4,611,196.67

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

B.3 Performance Criteria

During the in-brief meeting, the project team and VE team reviewed and discussed the project goals identified in the Environmental Assessment provided by KYTC and dated May 2013. The VE team used these goals, along with additional goals identified by the project team at the in-brief and the VE team during subsequent discussion, as performance criteria. These criteria were used as a tool to evaluate and develop ideas during the Evaluation and Development Phases of the workshop. Table B-2 presents the list and description of these criteria.

Table B-3: List of Performance Criteria

LIST OF CRITERIA	#	Criteria:	Description:
	A	Safety	Top stakeholder/public concern. Improved geometry would contribute to a solution to safety problems by reducing the potential for crashes.
	B	Travel Time	Travel speed is currently below the posted speed limits on KY 32 due to the road's substandard horizontal and vertical alignments, short sight and stopping distances, narrow driving lanes and limited shoulder pavement, and low design speeds in some locations. Benefits to efficient travel within the corridor would include reducing traffic on local roads, particularly KY 173, by attracting traffic to the improved KY 32.
	C	Scenic Vistas	As KY 32 is a ridgetop road, in certain locations the viewsheds from the road extend many miles to the horizon. The preservation and enhancement of viewsheds are seen as a value to the citizens and stakeholders, and a key element in local tourism.
	D	Regional Connectivity	Improves regional connectivity for efficient access to hospitals, tourism spots, cemeteries, etc.
	E	Maneuverability	Improves maneuverability to accommodate large trucks, which cannot use the existing KY 32 facility.
	F	Overall Roadway Aesthetics	Utilizes and enhances the natural beauty of the roadway to improve the driver and area resident experience.

Appendix

C

Function Analysis

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

C.1 Introduction

Function analysis is the heart of the Value Methodology (VM). It is the primary activity that separates VM from all other “improvement” programs. The objective of this phase is to ensure the entire VE team agrees upon the purposes for the project elements. Furthermore, this phase assists with identifying the most beneficial areas for continuing study.

C.2 Random Function Identification

The VE team identified the functions of the project using active verbs and measurable nouns. This process allowed the VE team to truly understand the functions associated with the project.

Functions were identified and prioritized using the previously identified risks, Pareto cost model, and the team members’ expertise. The VE team identified **“Improve Alignment”** as the basic function of the project. The Function Analysis Worksheet (Table C-1) is shown for the project and reflects the complete list of functions.

Table C-1: Random Function Identification Worksheet for Project

Identify Functions		Classify Functions	Prioritize Functions
Active Verb	Measurable Noun	Higher-Order Basic Secondary	SELECT FOR CREATIVITY PHASE
Project			
<i>Improve</i>	<i>Safety</i>	<i>Higher-Order</i>	
<i>Decrease</i>	<i>Travel-time</i>	<i>Higher-Order</i>	
<i>Improve</i>	<i>Regional-connectivity</i>	<i>Higher-Order</i>	
<i>Generate</i>	<i>Opportunities</i>	<i>Higher-Order</i>	
Improve	Alignment	Basic	
Improve	Traffic	Secondary	
Attract	Tourism	Secondary	
Change	Condition	Secondary	
Enhance	Safety	Secondary	YES
Improve	Performance	Secondary	
Reduce	Length	Secondary	
Connect	Communities	Secondary	
Improve	Surface	Secondary	
Improve	Emergency-access	Secondary	YES
Maintain	Population	Secondary	
Roadway Excavation			
Change	Surface	Secondary	YES
Create	Access	Secondary	
Procure	Material	Secondary	
Remove	Material	Secondary	
Minimize	Grade	Secondary	

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

Identify Functions		Classify Functions	Prioritize Functions
Active Verb	Measurable Noun	Higher-Order Basic Secondary	SELECT FOR CREATIVITY PHASE
Limit	Waste	Secondary	YES
CL2 Asphalt Base			
Reduce	Width	Secondary	
Increase	Structure	Secondary	
Create	Material	Secondary	
Stabilize	Load	Secondary	YES
Improve	Capacity	Secondary	
Crushed Stone Base			
Increase	Volume	Secondary	YES
Distribute	Load	Secondary	
Increase	Uniformity	Secondary	
Erosion Control Blanket			
Prevent	Contamination	Secondary	YES
Protect	Environment	Secondary	
Stabilize	Seedbed	Secondary	
Decrease	Movement	Secondary	
Granular Embankment			
Stabilize	Slope	Secondary	YES
Reduce	Erosion	Secondary	YES
Improve	Working-platform	Secondary	
Increase	Stability	Secondary	
Channel Lining Class 3			
Armor	Slopes	Secondary	
Prevent	Scour	Secondary	
Stabilize	Embankment	Secondary	
Repel	Corrosion	Secondary	
4'x4' RCBC			
Improve	Flow	Secondary	YES
Guide	Drainage	Secondary	
CL2 Asphalt Surface			
Seal	Pavement	Secondary	
Improve	Traction	Secondary	YES
Protect	Road-bed	Secondary	
Improve	Comfort	Secondary	
Minimize	Sound	Secondary	

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

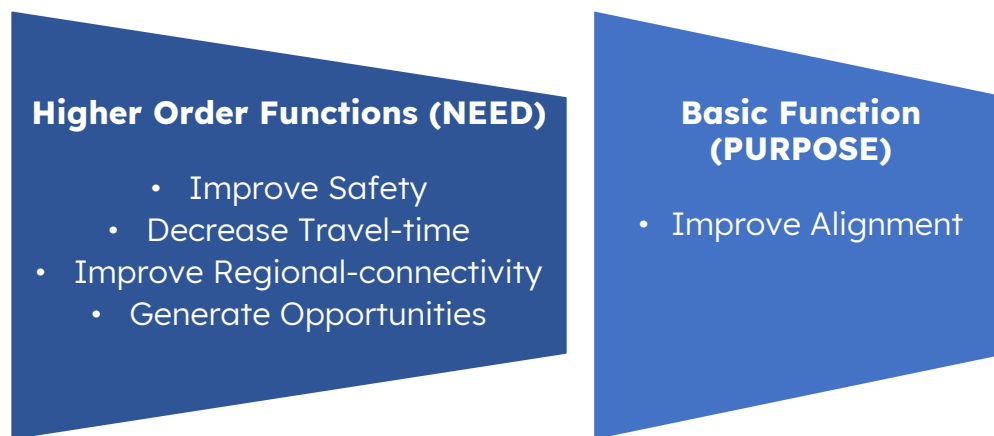
Kentucky Transportation Cabinet
Item Nos. 9-192.01 and 9-192.03

The definitions of the classifications are:

- **Higher Order Function:** The specific goals or needs for which the basic function exists and is outside the scope of the subject under study. [NEED]
- **Basic Function:** The specific purpose(s) for which a project exists and answers the question, “what must it do?” [PURPOSE]
- **Secondary Function:** A function that supports the basic function or required secondary functions and results from the specific design approach to achieve the basic function.

Please note that the Basic and Higher-Order functions relate directly to the project’s Purpose and Need as illustrated in Figure C-1.

Figure C-1: Function Analysis and Purpose & Need



Appendix

D

Idea List and
Evaluation

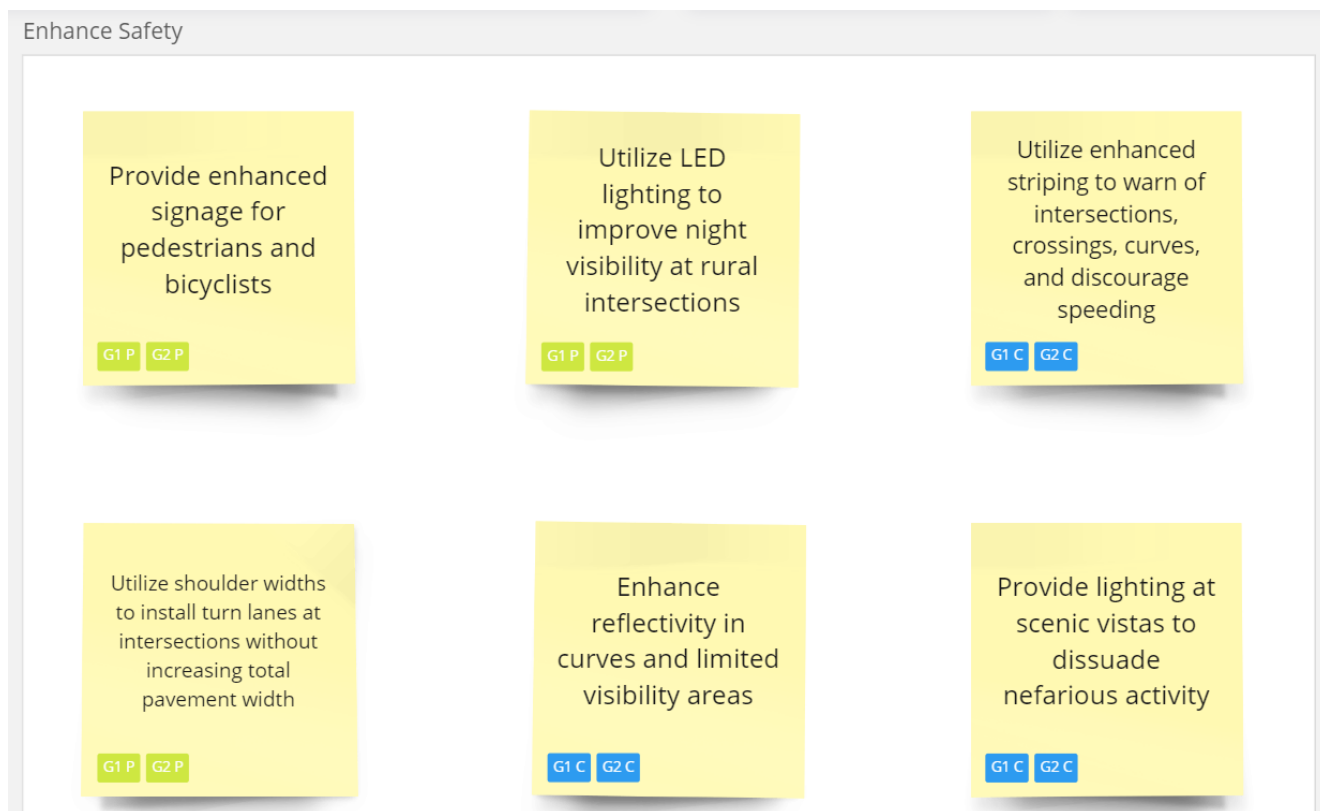
D.1 Introduction

The objective of the Creativity Phase is to generate a large quantity of ideas on alternate ways to perform each function selected for study. It uses common brainstorming techniques, including ideation that is unconstrained by habit, tradition, negative attitudes, assumed restrictions, and specific criteria. No judgment takes place during this phase of the study, though ideas are discussed for clarification purposes.

What makes the Creativity Phase of the value methodology successful is for the VE team not to conceive ways to design a project, but to develop a variety of ways to perform the functions selected for study.

The VE team brainstormed 33 ideas. Of these, 13 ideas were identified for further development into Value Proposals. In addition, 11 standalone Design Comments were identified during the value study to be considered in the next phase of design development. The VE team members brainstormed creative ideas in a collaborative virtual whiteboard space on Miro where ideas were brainstormed on “sticky notes” under each project function, first independently and then in groups.

Figure D-1: Sample of Miro Brainstorming Exercise for Function “Enhance Safety”



VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

D.2 Summary of Outcomes

The table below summarizes by function the total number of ideas brainstormed and developed as either Value Proposals or Design Suggestions.

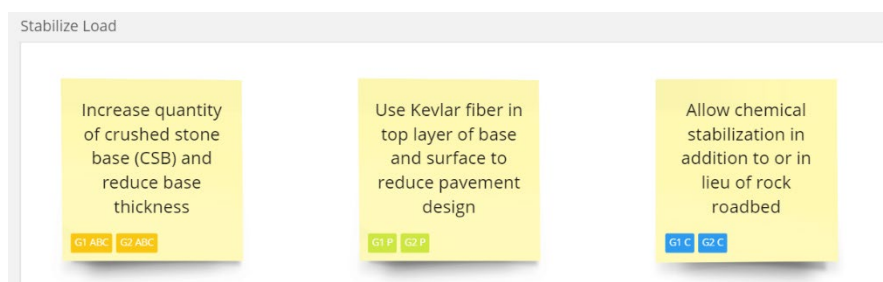
Table D-1: Summary of Ideas Brainstormed (by Function)

Function / Focus Area	Abbreviation	Total Number of Ideas Brainstormed	Total Number of Value Proposals Developed (Costed)	Total Number of Design Comments
Enhance Safety	ES	6	3	3
Improve Emergency-access	IEA	1	0	0
Change Surface	CS	3	2	0
Limit Waste	LM	5	2	1
Stabilize Load	SL	5	2	2
Increase Volume	IV	1	0	0
Prevent Contamination	PV	3	1	0
Stabilize Slope	SS	1	0	1
Reduce Erosion	RE	1	1	0
Improve Flow	IF	2	2	0
Improve Traction	IT	2	0	1
Miscellaneous	MI	3	0	3
	Total	33	13	11

D.3 Evaluation Techniques Used

The ideas were evaluated using a two-step process. The first step involved the VE team reviewing the ideas in Miro in teams and assigning a preliminary score of Comment (“C”), Proposal (“P”), Do Not Pursue (“X”), or Already Being Considered (“ABC”) to each idea.

Figure D-2: Preliminary Evaluation



VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

This served to shorten the list by identifying consensus regarding whether each idea should be considered further. The preliminary scores used in this first step are as follows:

- **Comment (“C”)** – Idea should be considered as a possible standalone Design Comment
- **Proposal (“P”)** – Idea may add value and should be considered as a possible Value Proposal
- **Do Not Pursue (“X”)** – Idea is not feasible or does not add value and should not be pursued further
- **Already Being Considered (“ABC”)** – Idea has already been evaluated by the project design team or is included in the baseline design

In the second step of evaluation, the VE team reviewed and discussed the ideas in terms of value to refine their decisions by reaching a group consensus. Then, each idea that had been earmarked for development with a score of “P” was assigned to a Subject Matter Expert.

D.4 List of Scored Ideas Organized by Function

The list of scored ideas is shown on the following pages. During the Creativity and Evaluation Phases of the workshop, all VE team members were actively engaged in the brainstorming and evaluation of ideas. During the Evaluation Phase, some ideas were combined with others and are designated as such by the nomenclature “w/” (with another idea).

Table D-2: “Scored” Creative Idea List

Idea No.*	Idea Title	Score**
**Key: P=Great to Good Value Opportunity (Value Proposal developed with cost); X=Poor Value Opportunity (Value Proposal not developed); DC=Design Comment; ABC=Already Been Considered/Already Being Done		
Enhance Safety		
ES-01	Provide enhanced signage and striping for pedestrians and bicyclists	P
ES-02	Utilize enhanced striping to warn of intersections, crossings, curves, and discourage speeding	DC
ES-03	Utilize LED lighting to improve night visibility at rural intersections	P
ES-04	Enhance reflectivity in curves and limited visibility areas	DC
ES-05	Utilize shoulder widths to install turn lanes at intersections without increasing total pavement width	P
ES-06	Provide lighting at scenic vistas to dissuade nefarious activity	DC
Improve Emergency-access		
IEA-01	Widen or improve access/secondary roads to emergency services	ABC
Change Surface		
CS-01	Reduce the shoulder width to 6' shoulders (4' paved)	P
CS-02	Switch from a "B" stone in the surface to a "D" stone but modify the geometry of curves	X
CS-03	Reduce the pavement width to 11' and maintain 10' shoulders (8' paved, 2' unpaved)	P
Limit Waste		
LM-01	Create plans for stockpiling and separating both durable and nondurable shale/sandstone	P
LM-02	Build ultimate fill (sta2015+00 forward) as an overflow for excess material rather than purchase off-site waste area	ABC
LM-03	Use 7' posts and trim 1' of slope of fills behind guardrail	P

VALUE STUDY
KY 32 Reconstruction (Eastern and Western Sections)

Kentucky Transportation Cabinet
 Item Nos. 9-192.01 and 9-192.03

Idea No.*	Idea Title	Score**
**Key: P=Great to Good Value Opportunity (Value Proposal developed with cost); X=Poor Value Opportunity (Value Proposal not developed); DC=Design Comment; ABC=Already Been Considered/Already Being Done		
LM-04	Break down and use nondurable shale as outer shell embankment material in nonstructural areas	DC
LM-05	If unable to limit waste, create areas for potential development, pullover, and passing	ABC
Stabilize Load		
SL-01	Increase quantity of crushed stone base (CSB) and reduce base thickness	ABC
SL-02	Use reinforcement fibers in top layer of base and surface to reduce pavement design	P
SL-03	Allow chemical stabilization in addition to or in lieu of rock roadbed	DC
SL-04	Use geogrid to reinforce the subgrade	P
SL-05	If rock roadbed is eliminated, reduce cuts and utilize existing rocks from the cuts to increase the slopes of the fills	DC
Increase Volume		
IV-01	Increase design speed to 65 mph and utilize access control to limit access points along corridor	X
Prevent Contamination		
PV-01	Create small intermediate benches for ditches to slow sheet flow	ABC
PV-02	Plant native grasses and plants to help stabilize and encourage pollination and improve the vistas/viewsheds	P
PV-03	Limit the pavement width to reduce the runoff	w/CS-01; CS-03
Stabilize Slope		
SS-01	Utilize excavated stone in toe of slopes and steepen fill to reduce excavation	DC
Reduce Erosion		
RE-01	Increase the use of landscape architecture to complement the vistas/viewsheds, improve the driver experience, and reduce erosion	P
Improve Flow		
IF-01	Increase the culvert sizes to 6'x6' in lieu of 4'x4' for ease of future maintenance	P
IF-02	Increase culvert size to encourage wildlife movement to reduce collisions	P
Improve Traction		
IT-01	Utilize friction pavement on curves along the corridor	ABC
IT-02	Include scenic driving elements/tourism designations (i.e. signage, guardrail, lighting, striping, landscaping, paving, etc.) to encourage tourist use of scenic vistas	DC
Miscellaneous		
MI-01	Update verbiage in plans to "Class I" and "Class II" Geotextile Fabric in lieu of "Type I" and "Type IV" to reflect current terminology	DC
MI-02	Remove seeding cost from estimate as it included in the erosion blanket cost (ref. KYTC spec 212.04.07)	DC
MI-03	Eliminate Scenic Vistaway and associated infrastructure in future project	DC

Appendix

E

Certification
Statement

SAVE International Value Standard Certification

Kentucky Transportation Cabinet
KY 32 Reconstruction (Item Nos. 9-192.01 & 9-192.03)

Value Study Dates: November 27-30, 2023

The undersigned Certified Value Specialist (CVS) facilitator (along with any participating co-facilitators) attests that the Value Study was facilitated in accordance with the SAVE International® Standards of Conduct.



Ryan Elliott, EdD, PE, CVS

CVS® No. 202001001

Facilitator



Natalie Goings, VMA

VMA® No. 202209041

Co-Facilitator