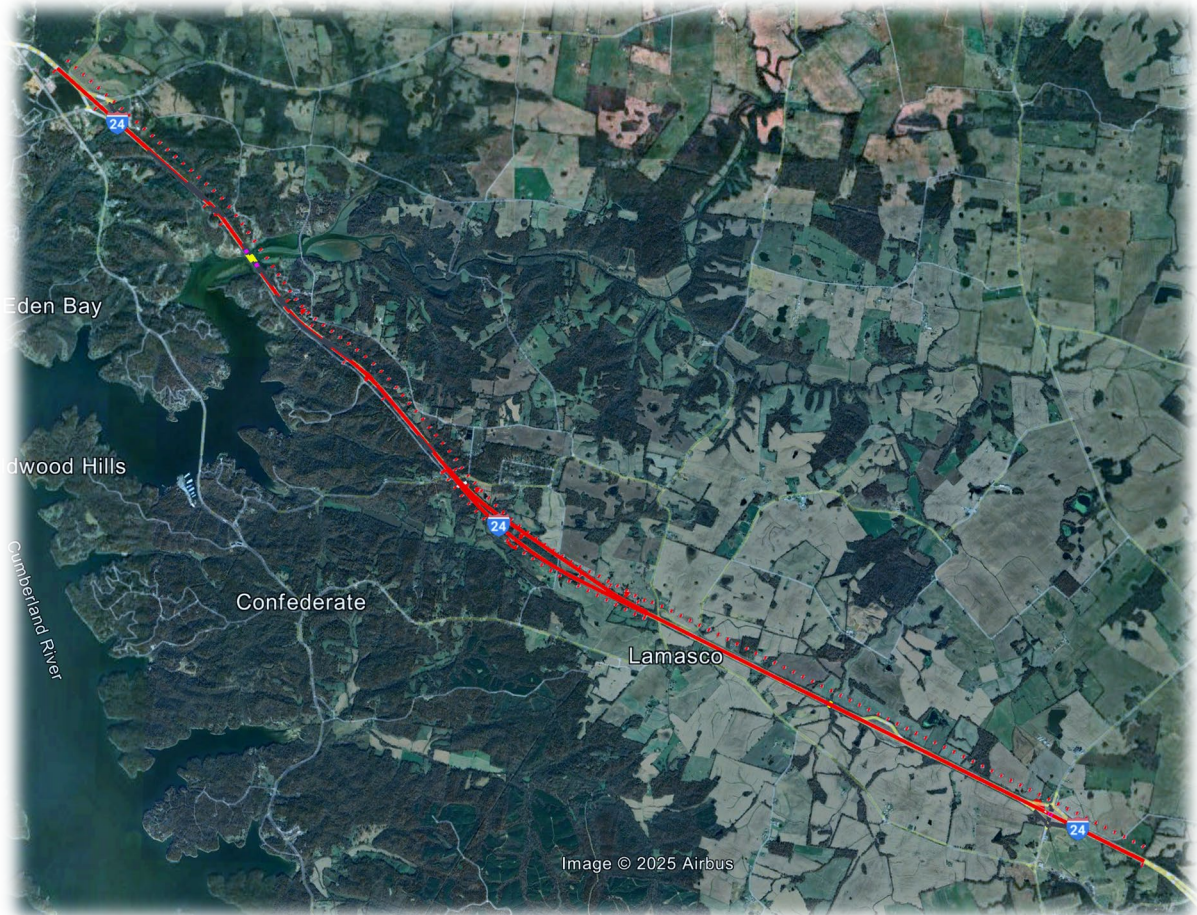




Value Study

Report - Final



I-24 | Item Nos. 1-20,010 & 2-20,062
Lyon & Caldwell Counties
Kentucky Transportation Cabinet
VE Letter Agreement No. 04

Study Dates: January 7-9, 2025

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March 28, 2025

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 of 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.

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PART

I

Value Study
Results and
Proposals








Section

1

Executive Summary

VALUE STUDY
I-24, Lyon & Caldwell Counties
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1.1 Value Study Results

VALUE STUDY RESULTS SUMMARY					
	Project Name: I-24 Lyon and Caldwell Counties				
	Project Location: Lyon and Caldwell Counties, KY				
	Client:		Kentucky Transportation Cabinet		
	Value Study Dates:		January 7-9, 2025	Original Project Cost:	
Value Study Timing:		Preliminary Design			
ACCEPTED RESULTS					
	Reliability:	Improved		Total Potential Initial Cost Avoidance:	\$4,458,000
	Operations & Maintenance:	Improved		Schedule Impact:	Maintained
	Functionality:	Improved		Return on Investment:	114:1
PROJECT OVERVIEW					
<p>This project is located on I-24 from M.P. 45.000 to M.P. 55.537, spanning through Lyon and Caldwell Counties, Kentucky. The project aims to address existing pavement base deterioration and improve roadway conditions through pavement rehabilitation strategies, including the use of asphalt or JPC pavement. The proposed profile will be raised by 1 inch for asphalt pavement and 3 inches for JPC. The project will also incorporate measures to improve drainage, including edge drains tied to centerline drainage, chemical-stabilized subgrade, and adjustments to water-prone sections with intermediate bleeders. Additionally, the project includes updates to median infrastructure, such as installing bull nose terminals at twin bridges, web walls, and U-turn deterrents. Other components of the project may involve bridge maintenance with latex overlays, ITS implementation for advanced traffic warnings, and temporary rumble strips to enhance work zone safety. The project budget is anticipated to be roughly \$50M with an anticipated letting date of April 2025.</p>					
VALUE STUDY BENEFITS			KEY ACCEPTED RECOMMENDATIONS		
<p>Given the relatively straightforward nature of the I-24 rehabilitation project, the Value Engineering (VE) team focused on validating the current design decisions while also offering professional insights into a set of preferred strategies in the areas of paving, maintenance of traffic (MOT), and construction. Utilizing the Value Methodology, the team was able to confirm the soundness of existing approaches while identifying a few additional conservative, cost-saving ideas to enhance project clarity and execution.</p> <p>The Kentucky-based VE team members, including representatives from KYTC and project consultants, developed a range of recommendations intended to refine the project's direction. These recommendations prioritize practical, conservative solutions that align with the project's goals, such as optimizing pavement rehabilitation strategies, improving MOT plans, and streamlining construction efforts.</p>			<p>9 Value Proposals were developed and 6 were accepted for intended implementation, including:</p> <ul style="list-style-type: none"> ▪ IQ-01: Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern ▪ IQ-02: Pave in echelon to eliminate the longitudinal joint ▪ IQ-09: Leave roadway elevation (top of roadway as is and excavate) ▪ AC-02: Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall <p>18 Standalone Design Comments were also identified and are included, along with the Value Proposals, in Section 2 of this report.</p>		

1.2 Value Study Background

A virtual VE workshop was conducted from January 7-9, 2025, on the project documents prepared by KYTC and WSP for the I-24 Lyon and Caldwell Counties 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 Tuesday, August 13, 2024.

1.2.1 Project Goals, Purpose, and Need

Project Goals

- **Capacity and Mobility** – Improve capacity and enhance mobility on I-24 between M.P. 45.000 and M.P. 55.537 to better accommodate through traffic and local drivers in Lyon and Caldwell Counties.
- **Safety** – Implement measures to reduce the potential for crashes, including updates to Maintenance of Traffic (MOT) strategies, drainage improvements, and installation of bull nose terminals and delineators to deter unsafe maneuvers.
- **Longevity** – Provide long-term pavement solutions by addressing current base deterioration, integrating durable materials (e.g., geogrids and chemical-stabilized subgrade), and upgrading drainage systems to mitigate future maintenance needs.
- **Constructability** – Validate straightforward and cost-effective construction strategies, ensuring clarity and minimizing complexity during project implementation.

Project Need (Higher Order Functions):

- **Extend Life Cycle** – Increase the lifespan of the roadway through strategic rehabilitation measures, durable materials, and enhanced drainage solutions to reduce the need for frequent maintenance.

Project Purpose (Basic Function):

- **Improve Quality** – Enhance the overall quality of the roadway infrastructure by addressing existing deficiencies and ensuring durable rehabilitation solutions.
- **Maintain Asset** – Preserve and protect the integrity of the I-24 corridor, ensuring it remains a vital transportation asset for the region.
- **Maintain Traffic** – Ensure continuous traffic flow during construction through effective MOT strategies, including temporary rumble strips, law enforcement presence, and pilot vehicles.
- **Accelerate Construction** – Employ efficient construction methods to minimize disruptions and complete the project within the planned

1.2.2 Workshop Objectives

- **Apply solid VM principles to review project for value (function/resources) improvements**
- **Identify opportunities for:**
 - Constructability – optimizing construction phasing and minimizing impacts during construction
 - Maintenance of Traffic (MOT) solutions
 - Reducing cost and schedule
 - Improving safety

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 WSP presented a briefing on the project to the VE team on Tuesday, January 7.
- **Function Analysis / Creativity** – Key project functions were identified and prioritized by the VE team to guide brainstorming during the Creativity Phase, including Improve Quality, Maintain Asset, Maintain Traffic, and Accelerate Construction. These functions provided the framework for generating innovative solutions. During the Creativity Phase, the VE team collaborated in a virtual environment, using an online whiteboard space to generate 33 creative ideas through individual and group brainstorming sessions, all aimed at extending the life cycle of the roadway and meeting project objectives.
- **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. The team selected ideas that helped to clarify the already sound design provided by the KYTC/WSP project team. The intent was to help provide validation on the design as well as provide clarity on the overall project strategy moving forward.
- **Presentation** - After developing the Value Proposals, the VE team presented the developed proposals to project stakeholders at the out-brief meeting on Thursday, January 9.
- **Implementation** - After receiving the Draft Report, the Project Team made preliminary decisions to “Accept” or “Reject” each Value Proposal for intended implementation into the project design. A total of six (6) Value Proposals were Accepted. These decisions are detailed in **Section 2.2** of this Final Report.

2

Section

Value Study Results
and Proposals

2.1 Introduction

The value team brainstormed 33 creative ideas, of which 9 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, 18 Constructability / 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
Value Proposals	Proposals that impact the cost of the project program or process being studied. Impact on future Life-Cycle Costs is considered where applicable.	Developed into write-ups	9
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	18

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.

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. 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	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
Improve Quality										
IQ-01	Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern	Maintained	Degraded	Maintained	Improved	\$2,121,000	-	\$2,121,000	Accept*	<i>The Project Team made the decision to accept this recommendation and will gather additional information through plan development. This would require additional work to the EB shoulder prior to switching all traffic to the EB side, which would limit the contractor’s timeframe for completion of the project. One concern is that as construction moves west where there are concrete sections that were not removed, those sections would have to be broken and seated. One option is to have intermediate completion dates and work in segments. With this recommendation, it will be essential to consider crossover locations during plan development.</i>

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Idea No.	Idea Title	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
IQ-02	Pave in echelon to eliminate the longitudinal joint	Improved	Maintained	Improved	Improved	\$0	\$3,439,000	\$3,439,000	Accept*	<i>The Project Team made the decision to accept this recommendation. There is encouragement to pave in echelon from the State Highway Engineers Office. The Project Team will encourage paving in echelon for the final surface layer and determine whether it is feasible for the base layer as well. In order for this recommendation to be executed, recommendation IQ-01 must also be utilized.</i>
IQ-07	Build full depth shoulders to allow for future maintenance of traffic	Improved	Improved	Improved	Maintained	(\$591,000)	-	(\$591,000)	Accept*	<i>The Project Team made the decision to accept this recommendation and acknowledged the benefit if it is ever needed to move traffic to the shoulder for any reason. There is a substantial amount of truck traffic (39%) along this corridor and having a full-deep shoulder would provide a great benefit for routine maintenance and eventually a longer duration for any shoulder repair.</i>
IQ-09	Leave roadway elevation (top of roadway as is and excavate)	Maintained	Maintained	Maintained	Maintained	\$1,452,000	-	\$1,452,000	Accept*	<i>The Project Team would like to accept this recommendation and has decided that this would be easier to excavate since they would be moving all traffic to the EB lanes during construction. The Project Team noted that there would not be any constructability concerns with this recommendation.</i>
Maintain Asset										
MA-04	Construct with asphalt to improve ease of maintenance	Maintained	Improved	Improved	Improved	\$0	-	\$0	Reject	<i>The Project Team made the decision to reject this recommendation since they are required to utilize an alternate pavement within the bidding process.</i>
Accelerate Construction										
AC-01	A+B bidding notes to incentivize contractor innovation to speed construction	Maintained	Maintained	Maintained	Improved	\$0	-	\$0	Accept*	<i>The Project Team would like to accept this recommendation with the understanding that more investigation will be required. They do understand that the A+B Bidding could decrease construction time and potentially eliminate a construction season. This would require set milestone completion dates.</i>

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Idea No.	Idea Title	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
AC-02	Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall	Maintained	Maintained	Improved	Maintained	\$885,000	-	\$885,000	Accept*	<i>The Project Team would like to consider this recommendation with the understanding that additional work would need to be completed to determine where the crossovers would be located throughout the project. The Project Team believes that this may require an additional crossover or two.</i>
AC-04	Reduce concrete pavement from 13" to 11"	Maintained	Maintained	Maintained	Improved	\$9,669,000	-	\$9,669,000	Reject	<i>The Project Team has made the decision to reject this recommendation due to the high percentage of truck traffic that is currently utilizing I-24 within this roadway segment. Although the previously completed segment of I-24 utilized 11" of concrete, both the truck traffic and the ADT have increased since this section was completed, therefore making the reduction in concrete thickness not a recommended alternative.</i>
General										
GE-02	Do not cement stabilize shoulders (stabilize to the rumble strip) and only update guardrail end treatments	Maintained	Maintained	Maintained	Improved	\$4,286,000	-	\$4,286,000	Reject	<i>The Project Team has made the decision to reject this recommendation due to the fact that they will try to utilize full-depth shoulders for this project.</i>

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 value 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 team identified during the preparation and performance of the VE workshop that only comment about recommended corrections of concerns found in the project documents. In addition to constructability comments, 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
IQ-03	<p>Utilize pavement fibers to increase durability</p> <p>Using pavement fibers can improve the tensile strength and crack resistance of asphalt and concrete pavements, extending their life span. For the I-24 project, this could reduce long-term maintenance and bolster the pavement’s resilience to heavy truck traffic (38% AADT).</p>
IQ-04	<p>Move outside joint beyond rumbles to reduce likelihood of issues</p> <p>Placing pavement joints outside of rumble strips addresses prior challenges where joint placement led to deterioration. This adjustment minimizes water infiltration and enhances the structural integrity of the pavement over time.</p>
IQ-05	<p>Cut intermediate bleeders in water prone sections in addition to edge drains</p> <p>Intermediate bleeders can improve water management in areas prone to pooling, complementing edge drains to reduce subgrade failure. This is particularly relevant given the need to mitigate drainage-related deterioration noted in existing sections.</p>
IQ-06	<p>Install geogrid to improve durability and possibly reduce needed thickness</p> <p>Incorporating geogrids into the subgrade could distribute loads more effectively, reducing rutting and enabling thinner pavement layers. This could be a cost-saving measure without compromising durability, particularly in high-load areas.</p>
IQ-08	<p>Offset joint from pavement markers (reflectors) to lower the likelihood of failure along the joint</p>

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Creative Idea No.	Design Comment
	Aligning joints away from reflective pavement markers reduces stress and water infiltration along the joints. This aligns with the project goal to minimize failure points and extend pavement life.
MA-01	<p>Perform latex overlay of bridges while under closure to save future bridge maintenance costs</p> <p>Applying a latex overlay during the closure phase is a proactive measure to prevent water infiltration and subsequent deterioration. This reduces future maintenance needs and extends the service life of the bridge decks, and by combining the two actions, the Cabinet saves time and money on MOT.</p>
MA-02	<p>Evaluate panel signs and replace</p> <p>Ensuring that all panel signs are up-to-date enhances traffic safety and compliance. Replacing outdated or damaged signs during construction is cost-effective and improves driver communication in high-traffic areas.</p>
MA-03	<p>Tie in edge drain to the center line drainage</p> <p>Connecting edge drains to centerline drainage improves overall water management by directing runoff efficiently, reducing water-related pavement failures in the subgrade.</p>
MA-05	<p>Use ITS for advanced warning during maintenance</p> <p>Intelligent Transportation Systems (ITS) can warn drivers of upcoming construction zones and potential delays, improving traffic flow and reducing crashes caused by sudden congestion.</p>
AC-05	<p>Use E5 in concrete pavement JPC to reduce cracking and minimize outside mainline construction</p> <p>Incorporating E5 admixtures enhances concrete durability and resistance to cracking, reducing the likelihood of costly maintenance. This also reduces the impact of construction on the surrounding environment. E5 has shown flexural strength increases in JPC pavements in northern states. This could be helpful given wet conditions and high truck traffic.</p>
AC-08	<p>Install temporary rumbles to increase awareness of upcoming construction and increase law enforcement officer presence</p> <p>Temporary rumble strips can alert drivers to changing conditions, reducing the risk of crashes near work zones. Combined with officer presence, this creates a safer environment for workers and drivers.</p>
AC-09	<p>Increase law enforcement officer hours to help enforce speed limit</p>

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Creative Idea No.	Design Comment
	Enforcing speed limits within construction zones is critical to maintaining safety. Increased officer presence can deter speeding and reduce the likelihood of accidents in these areas.
AC-10	Contractor provides a pilot vehicle to regulate speed within construction zone (55mph) A pilot vehicle guiding traffic through construction zones helps maintain consistent speeds and reduces variability, which is a common cause of rear-end collisions.
AC-11	Use PQWAS as early alerts for detours Portable Queue Warning Systems (PQWAS) provide real-time updates to drivers about detours and congestion, minimizing delays and improving safety during lane closures. PQWAS can be used at interchanges to diverge local traffic.
GE-01	Leave cable rail in place (and for crossovers) Retaining cable rail reduces costs and ensures continuous safety barriers for drivers. This approach can also speed up construction by avoiding unnecessary replacement.
GE-04	Use recycled materials or reclaimed asphalt pavement to reduce the need for new materials Utilizing recycled materials aligns with sustainability goals and reduces costs without compromising quality. This approach is practical given the large material requirements for the 10-mile stretch.
GE-06	Confirm elevation under bridges is sufficient Ensuring sufficient elevation under bridges is critical to avoiding clearance issues after profile adjustments. This is especially important with the planned 1” and 3” profile increases for asphalt and JPC, respectively.
GE-08	Verify eastbound shoulder thickness to ensure it can be used in a 1-and-1 scenario Confirming the eastbound shoulder’s capacity to handle traffic loads ensures its viability for 1+1 configurations, a key element in the project’s MOT strategy to maintain traffic flow efficiently.

2.4 Individual Value Proposals

The following pages detail the Value Proposals developed as part of the study by the value 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 value team based upon experience with similar projects and from contractor bid research conducted by the team. Where the value 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

IQ-01

Kentucky Transportation Cabinet I-24 Lyon & Caldwell Counties

TITLE	Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern				
FUNCTION	Improve Quality				
VALUE PROPOSAL SYNOPSIS:					
Reduce Eastbound Traffic to 1 lane and place 1 lane of Westbound Traffic on the East bound side. This will completely close the westbound side of the roadway allowing for full width construction.					
 Reliability	Maintained	 Functionality	Degraded	\$ Initial Cost Avoidance (Add)	
 O&M	Maintained	 Schedule Impact	Improved	\$2,121,000	
BASELINE CONCEPT:					
The existing baseline concept maintains two lanes in the eastbound direction and one lane in the westbound direction.					
VALUE PROPOSAL DESCRIPTION:					
We propose to shift westbound traffic onto the eastbound side and reduce both directions to 1 lane each.					
ADVANTAGES:			DISADVANTAGES:		
● Shorten Construction Duration			● Affects both directions of travel		
● Removes joints in stabilized roadbed			● Additional costs for cross overs		
● Eliminates shoulder replacement prior to phasing			● May require additional shoulder thickness on eastbound side		
● Allows for safer ingress and egress of work zone by workers and materials			●		
●			●		
●			●		
AVOID COST					
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost		
BASELINE CONCEPT:	\$2,910,000	\$0	\$2,910,000		
VALUE PROPOSAL DESCRIPTION:	\$789,000	\$0	\$789,000		
TOTAL (Baseline less Proposed)	\$2,121,000	\$0	\$2,121,000		

VALUE PROPOSAL

IQ-01

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern
DISCUSSION & JUSTIFICATION:	
<ul style="list-style-type: none">• Technical Considerations : There will need to be increased signage and markings to notify both directions on what is occurring. Proper visibility and communication will be key to avoid crashes and confusion.• Performance Impacts: The impacts to the final product by going to the 1:1 will allow for a better final product. It can eliminate the multiple joints with the cement stabilization, and the overall joint placement/elimination of the paving joint. Regardless of the pavement selection, a better subgrade can be constructed and compacted. It also leads to a much safer work zone for both workers and the public. there will be one or two locations for ingress into the project that can occur at the beginning and end of the work zone allowing safer merges. Otherwise, you will have a less than desirable access into the work zone which can create conflict points. Under the current design you have barrier wall sitting less than a foot from workers. This is well within the deflection of the wall and puts our workers at risk. By eliminating the phased construction, the subgrade and pavement structure (both concrete and asphalt) can be better constructed to increase durability.• Cost Considerations: While there is an increase in MOT cost due to the crossovers, the relocation of the 9T wall can go away for the phasing as currently shown.• Schedule Impacts: Impacts to the schedule would be a reduction of construction time. Phased construction would require half the roadway width be constructed• Risk Considerations: The eastbound travel lane reduction from 2 lanes to 1 lane has the potential to increase crashes due to back up. <p>(continued on next page)</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

VALUE PROPOSAL

IQ-01

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern
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DISCUSSION & JUSTIFICATION: (cont.)

Joints in the stabilized roadbed as well as phased construction of the csb and lead to improper compaction and failures that would allow water to penetrate. This is part of the issues this roadway is experiencing now (there are slabs pumping mud). If we can create a solid stabilized roadbed and get proper complete compaction through the driving lanes of the csb, we gain a much more durable roadway.

In addition, if asphalt is chosen, and it is constructed as per the current phasing plan, there isn't enough room to properly step the subgrade, base layers and surface. There is a chance the joints will somewhat align. This will lead to these joints opening up and water infiltrating the subgrade. We will be back to where we are today in a few short years.

VALUE PROPOSAL

IQ-01

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE

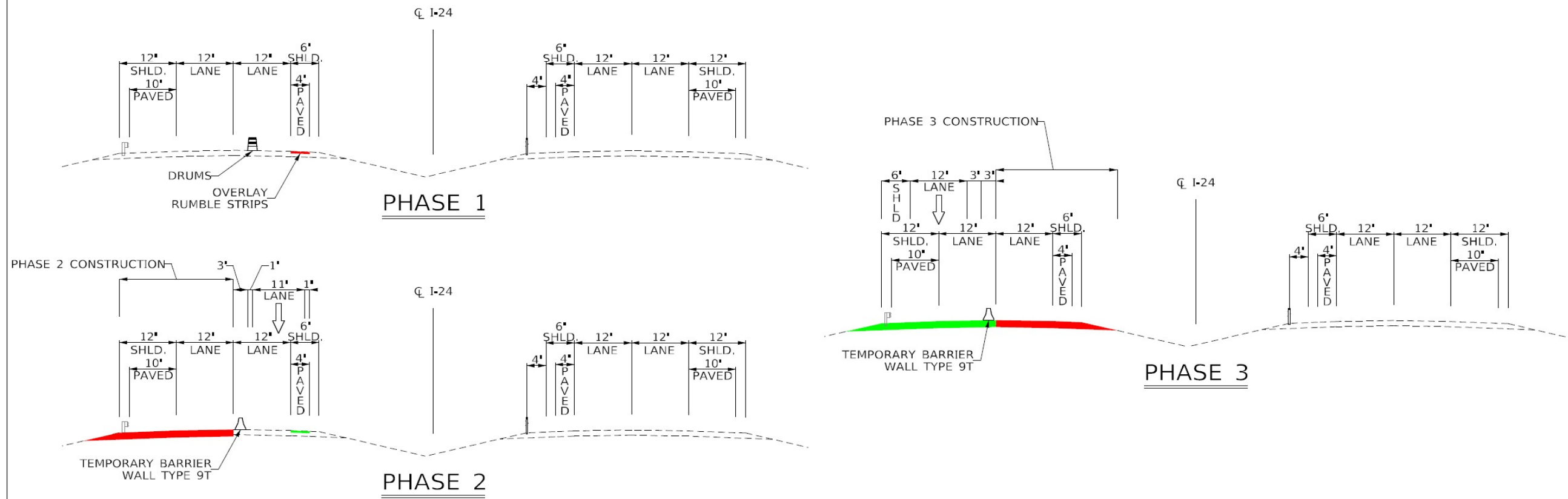
Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

MAINTENANCE OF TRAFFIC TYPICAL SECTIONS

MP 45.000 TO MP 55.537

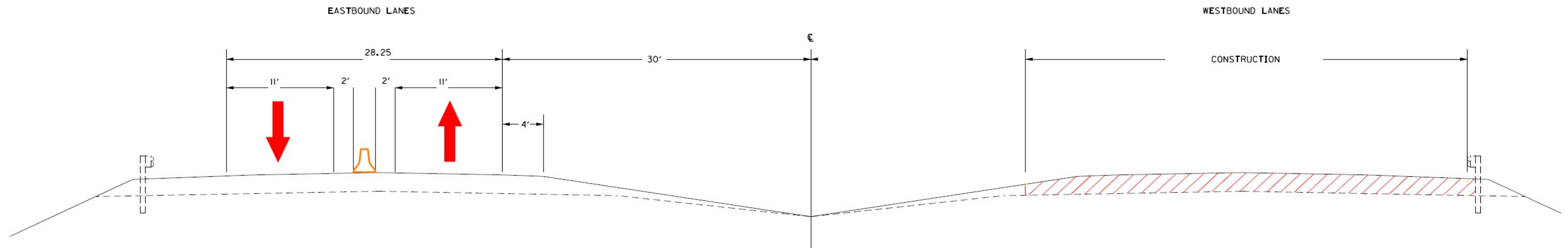
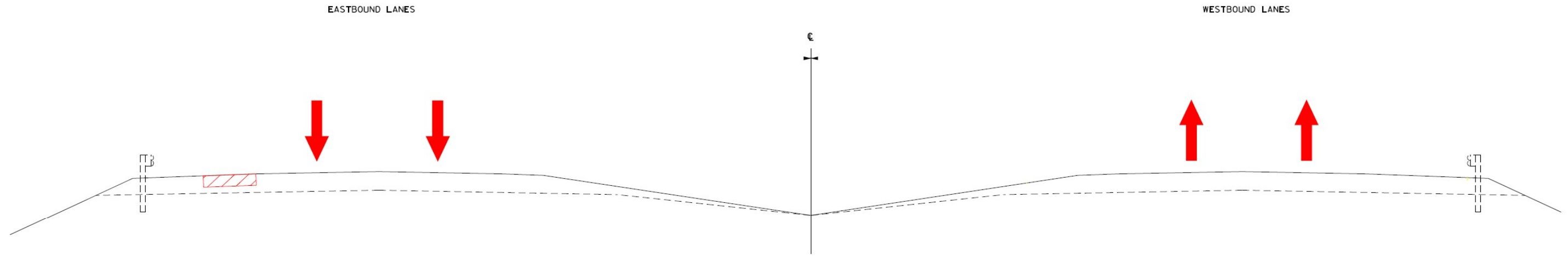
LEGEND
UNDER CONSTRUCTION █
CONSTRUCTED DURING A PREVIOUS PHASE █



VALUE PROPOSAL
IQ-01
 Kentucky Transportation Cabinet
 I-24 Lyon & Caldwell Counties

TITLE	Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

IQ-01

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties





TITLE	Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern						
Assumptions & Calculations	None noted.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Asphalt Base	Ton	0	\$115	\$0	1,000	\$115	\$114,870
Temporary Stripe	LF	0	\$1	\$0	10,000	\$1	\$8,100
Milling (rumbles)	Ton	0	\$45	\$0	5,200	\$45	\$234,000
Final surface (rumbles)	Ton	0	\$83	\$0	2,600	\$83	\$215,800
Temporary surface (rumbles)	Ton	0	\$83	\$0	2,600	\$83	\$215,800
Remove PCC Pavement	SY	23,466	\$58	\$1,361,028	0	\$58	\$0
Temp Base	Ton	15,488	\$100	\$1,548,800	0	\$100	\$0
TOTAL				\$2,910,000			\$789,000
Impact to Initial Cost (Baseline Less Proposed)							\$2,121,000
							AVOID COST

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

VALUE PROPOSAL

IQ-02

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Pave in echelon to eliminate the longitudinal joint				
FUNCTION	Improve Quality				
VALUE PROPOSAL SYNOPSIS:					
The longitudinal joint between the travel lanes is often where we begin to see our roadways fail. By eliminating this joint, we can extend the life of our pavement and reduce the maintenance cost of sealing and patching over time.					
 Reliability	Improved	 Functionality	Maintained	\$ Initial Cost Avoidance (Add)	
 O&M	Improved	 Schedule Impact	Improved	\$0	
BASELINE CONCEPT:					
The baseline concept shows constructing the pavement in multiple phases creating longitudinal joints that are not offset. This will result in less than desirable long-term issues.					
VALUE PROPOSAL DESCRIPTION:					
If the 1:1 MOT pattern is accepted as proposed in the IQ-01 report, then it allows the possibility of paving the surface (and maybe top mat of base) in echelon and eliminating this joint. This with the cement stabilized roadbed will increase the durability and longevity of this pavement.					
ADVANTAGES:			DISADVANTAGES:		
● Longer pavement life			● More complex construction scheduling		
● Minimal maintenance requirements			●		
● Smoother ride quality			●		
●			●		
●			●		
●			●		
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost		
BASELINE CONCEPT:	\$0	\$6,882,000	\$6,882,000		
VALUE PROPOSAL DESCRIPTION:	\$0	\$3,439,000	\$3,439,000		
TOTAL (Baseline less Proposed)	\$0	\$3,443,000	\$3,443,000		
AVOID COST					

VALUE PROPOSAL

IQ-02

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Pave in echelon to eliminate the longitudinal joint
DISCUSSION & JUSTIFICATION:	
<p>*Technical Considerations: Paving in echelon does require more equipment on hand, both in use and as backup. The main issue we have seen in other projects is the ability of the asphalt plant to keep up with the demand. This typically results in additional plants being on standby but has not been an issue resulting in failure.</p> <p>*Cost Considerations: There has not been a noticeable cost difference in the price of asphalt when required on previous project. In speaking with the industry, those crews would have been required to lay the asphalt, there is no additional monies unless there is a short time frame which this project isn't requiring (think weekend work that would require round the clock paving)</p> <p>*Performance Impacts: The elimination of the joint will ensure a smooth transition between lanes, no areas for the pavement to open up and pothole, and no future sealing along the longitudinal joint. We have had pavements on high volume interstates last almost 20 years and our belief is this is due in large part to no failure along the joint.</p> <p>*Schedule impacts: Construction time is reduced due to the reduction in paving shifts required.</p> <p>*Risk Considerations: Weather and asphalt plant breakdowns are among the most risky aspects of the echelon paving. Both can be mitigated easily.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

VALUE PROPOSAL

IQ-02

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Pave in echelon to eliminate the longitudinal joint
--------------	---

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL

IQ-02

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Pave in echelon to eliminate the longitudinal joint
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

IQ-02

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Pave in echelon to eliminate the longitudinal joint
--------------	---

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	Resurface with Milling	12	\$2,334,816	\$1,756,520		
2	Resurface	16			\$2,334,816	\$1,597,546
3	Resurface and Base	24	\$5,703,456	\$3,228,042		
4	Resurface	32			\$2,334,816	\$1,093,085
5	Resurface	36	\$2,334,816	\$994,155		
6	Resurface	48	\$2,334,816	\$747,919	\$2,334,816	\$747,919
7	Joint Repair	8	\$84,480	\$69,880		
8	Joint Repair	20	\$84,480	\$52,572		
9	Joint Repair	40	\$84,480	\$32,716		
10						
Total Salvage & Replacement Costs			\$12,961,344	\$6,881,805	\$7,004,448	\$3,438,551

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

SUMMARY	Baseline Present Worth	Proposed Present Worth
Total Present Worth (salvage+annual pres worth)	\$6,882,000	\$3,439,000





RESULTS (Proposed less Baseline) AVOID COST of \$3,443,000

Notes: 1) Total Present Worth is rounded to the nearest thousand dollars, 2) Initial costs are covered in the Detail sheet.
Assumptions & Calculations: Milling (35/ton) and Resurface (166/ton) = 11,616 Tons - Joint Repair \$4/lf @ 40% of ten miles - For year 24 Milling increased by XXX and 3" of class base replaced \$110/ton @ 23232 tons (23,232)

VALUE PROPOSAL

IQ-07

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Build full depth shoulders to allow for future maintenance of traffic				
FUNCTION	Improve Quality				
VALUE PROPOSAL SYNOPSIS:					
By building shoulders that can accommodate traffic, KYTC can utilize the sections in the future for MOT for normal maintenance activities and future rehabs and reconstructions.					
 Reliability	Improved	 Functionality	Improved	\$ Initial Cost Avoidance (Add)	
 O&M	Improved	 Schedule Impact	Maintained	(\$591,000)	
BASELINE CONCEPT:					
Proposed Pavement design is to thin the shoulder pavements. The Asphalt alternate reduces the thickness by 3.5" by eliminating one layer of base. The Concrete alternate reduces the pavement depth from 13" to 6".					
VALUE PROPOSAL DESCRIPTION:					
Provide future value to the roadway by thickening the shoulder pavement design to match mainline design. This will provide a durable lane for future maintenance activities, traffic volume increases and when added lanes are needed for emergency situations.					
ADVANTAGES:			DISADVANTAGES:		
● Ease of construction			● Cost increase		
● Forward thinking			●		
● Emergency preparedness			●		
● Stronger overall product			●		
●			●		
●			●		
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost		
BASELINE CONCEPT:	\$651,000	\$0	\$651,000		
VALUE PROPOSAL DESCRIPTION:	\$1,242,000	\$0	\$1,242,000		
TOTAL (Baseline less Proposed)	(\$591,000)	\$0	(\$591,000)		
ADD COST					

VALUE PROPOSAL

IQ-07

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Build full depth shoulders to allow for future maintenance of traffic
DISCUSSION & JUSTIFICATION:	
<p>Increasing the pavement thickness on the outside shoulders to match mainline thickness adds value to the project:</p> <ul style="list-style-type: none">• Projecting to future maintenance activities, which will be required on either alternate. Adding additional thickness of pavement to the shoulder will provide an adequate driving lane for use when rehabbing, repairing, patching or other activities requiring the closure of a driving lane or of the other direction.• This will provide a more durable pavement overall as all layers will be equal across the entire roadway. This will eliminate the a weak point between the driving lane and the shoulder.• This will increase overall cost as we are replacing CSB with ASPH BASE at a rate of ~\$30/ton. This is offset by the higher strength properties of the asphalt and the usefulness of this shoulder for providing an adequate driving lane.• This change should not affect the contract schedule as the CSB will have to be placed in 2 lifts, so we are replacing one lift of CSB with asphalt. The asphalt can be placed at the same rate of slightly quicker than CSB.• By increasing the strength and durability of the shoulder pavement it allows for the shoulder to be used as an auxiliary lane for emergency situations where additional lanes are needed or one of the driving lanes has to be closed. Also if this section of roadway is ever needed to be expanded due to traffic demands the should will be usable and assist with conversion to a facility with additional travel lanes.	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

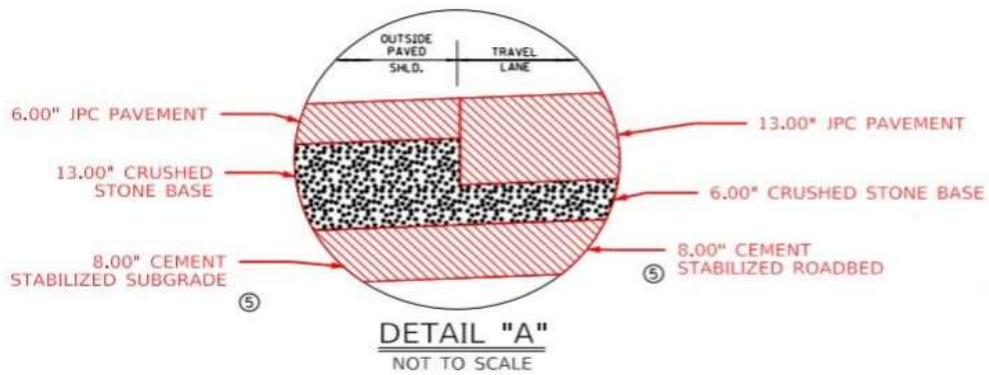
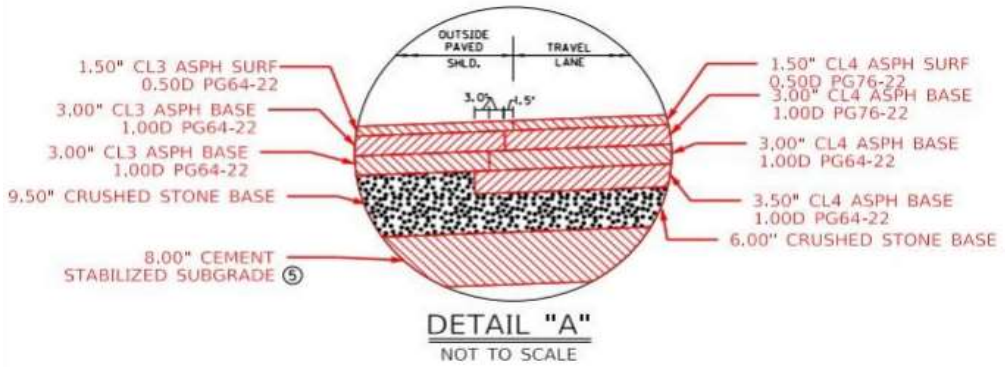
VALUE PROPOSAL

IQ-07

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Build full depth shoulders to allow for future maintenance of traffic
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SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL

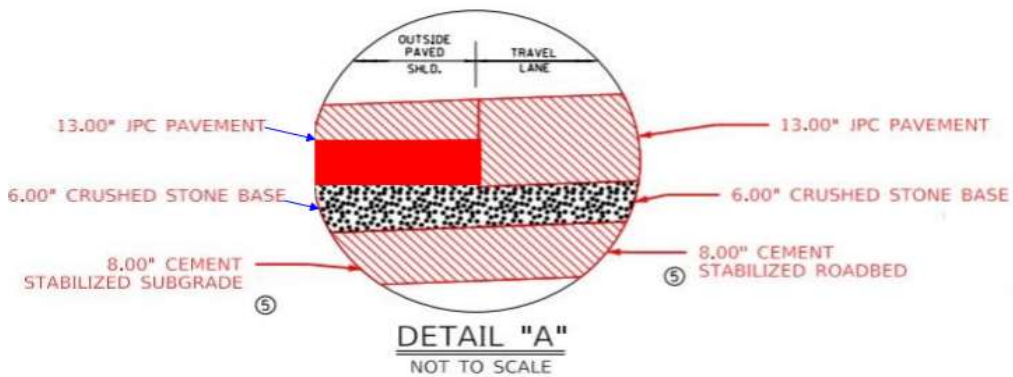
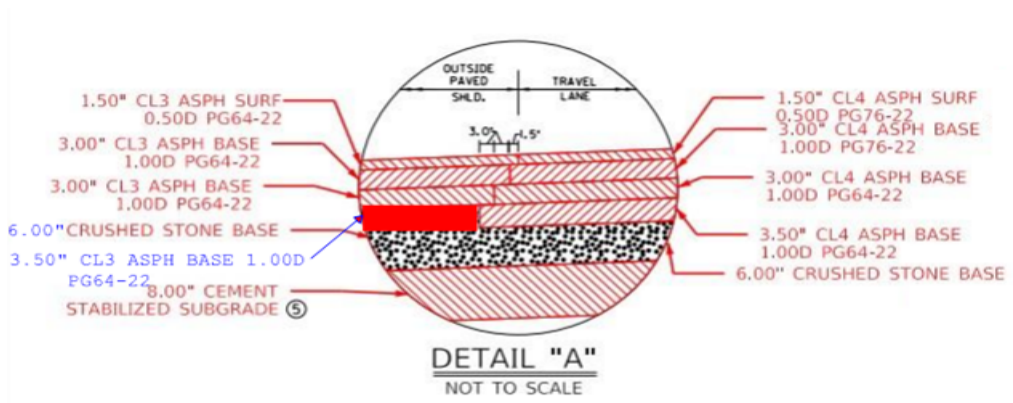
IQ-07

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Build full depth shoulders to allow for future maintenance of traffic
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

IQ-07

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Build full depth shoulders to allow for future maintenance of traffic						
Assumptions & Calculations	Bid costs based on averages of all KYTC bid prices since October 2022.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
Crushed Stone Base	ton	9,550	\$68	\$650,642	0	\$68	\$0
CL3 ASPH BASE 1.00D PG64-22	ton	0	\$110	\$0	11,293	\$110	\$1,242,230
TOTAL				\$651,000			\$1,242,000
Impact to Initial Cost (Baseline Less Proposed)							(\$591,000)





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

ADD COST

VALUE PROPOSAL

IQ-09

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Leave roadway elevation (top of roadway as is and excavate)		
FUNCTION	Improve Quality		
ASSOCIATED IDEAS	GE-07: Core existing eastbound pavement to ensure the thickness is sufficient to drive on		
VALUE PROPOSAL SYNOPSIS:			
By adjusting the excavation of the existing pavement and final grade of stabilization, the pre-construction roadway elevations and the finished elevations can be made the same with negligible costs.			
 Reliability	Maintained	 Functionality	Maintained
 O&M	Maintained	 Schedule Impact	Maintained
			\$ Initial Cost Avoidance (Add)
			\$1,452,000
BASELINE CONCEPT:			
The baseline design raises the existing roadway elevation 1" for Asphalt or 3" for JPC.			
VALUE PROPOSAL DESCRIPTION:			
The original roadway elevation can be maintained by adjusting excavation and stabilization. This allows for shoulders and safety devices to have minimal, if any, height adjustments.			
ADVANTAGES:		DISADVANTAGES:	
● No shoulder adjustments		● Near negligible increase in excavation	
● Minimal safety device adjustments		●	
● Negligible schedule impacts		●	
● No impact on bridge overpasses		●	
●		●	
●		●	
\$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	\$11,817,000	\$0	\$11,817,000
VALUE PROPOSAL DESCRIPTION:	\$10,365,000	\$0	\$10,365,000
TOTAL (Baseline less Proposed)	\$1,452,000	\$0	\$1,452,000

VALUE PROPOSAL

IQ-09

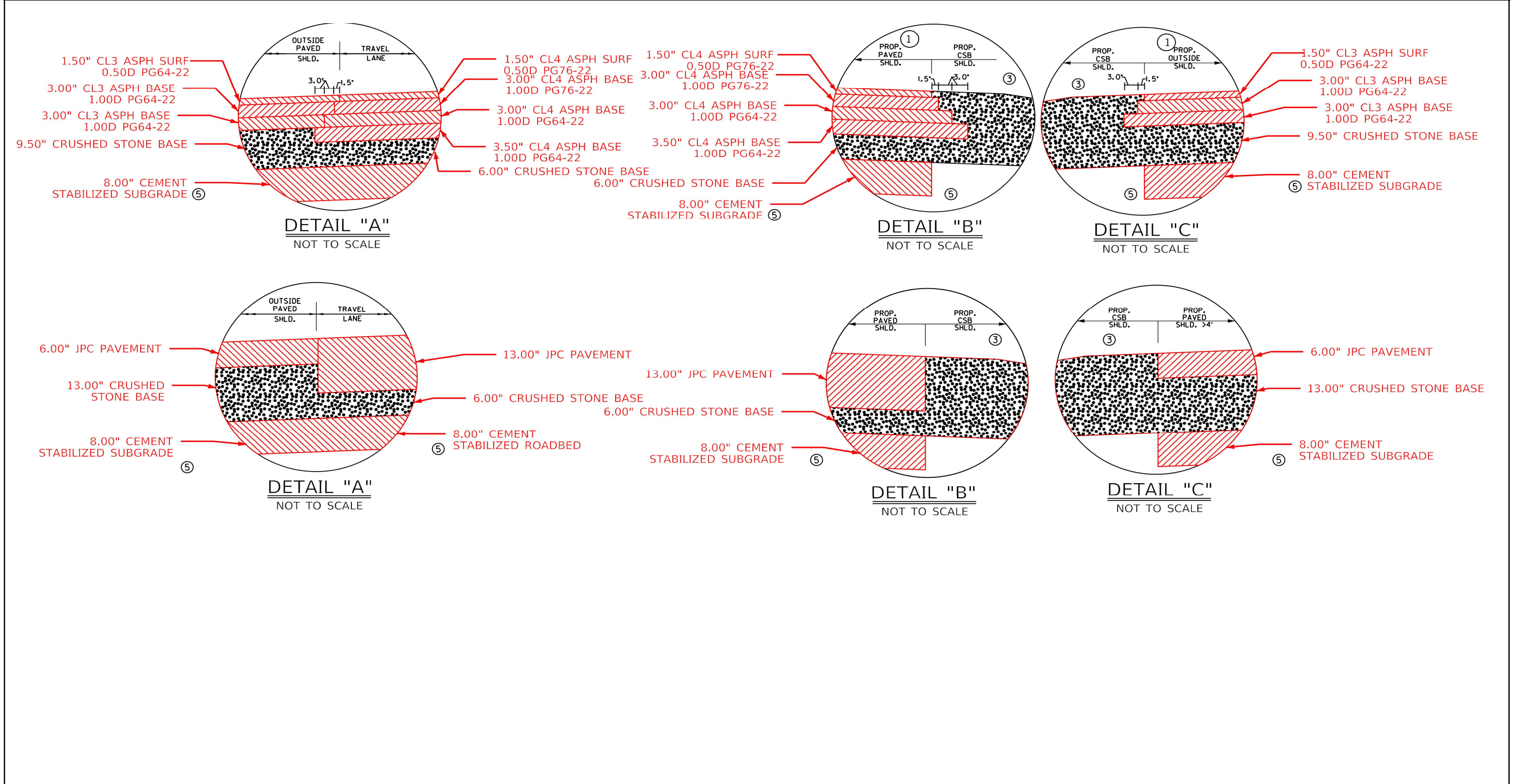
Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Leave roadway elevation (top of roadway as is and excavate)
DISCUSSION & JUSTIFICATION:	
<p>The original design removes existing PCC pavement and underlying DGA and stops at the theoretical subgrade. The reality of the situation is that the DGA and the subgrade are so intermixed at this point in roadway life, there will not be a discernible line. Therefore, the excavation depth is set at a non-existent theoretical level.</p> <p>By lowering the excavation depth based on the alternative pavement solution bid, the pre-construction roadway elevation is maintained. The notes make any excavation incidental to pavement removal anyway. It may be an advantage to allow the contractor to use the old rest areas as excess material sites and drop locations for the old PCC pavement. Including this note will level the bidding field and result in lower bid costs.</p> <p>Maintaining existing roadway elevations eliminates the need to remove and reset roadside safety devices as well as bring in slope material to correct the side slopes due to increased roadway height.</p> <p>The existing Eastbound section is 11" JPC on 12" of Cement stabilized roadbed with 8" Asphalt Shoulders.</p> <p>Another alternate is to decrease the thickness of CSB by 2" while increasing Cement Stabilization by 4" (12" total similar to adjacent section). For either pavement section, the pavement design number is maintained. With an asphalt section you eliminate some excavation and incorporate the existing DGA into the stabilization as a bonus. For a JPC section, this minimizes additional excavation while maintaining pavement structure design.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

VALUE PROPOSAL
IQ-09
 Kentucky Transportation Cabinet
 I-24 Lyon & Caldwell Counties

TITLE	Leave roadway elevation (top of roadway as is and excavate)
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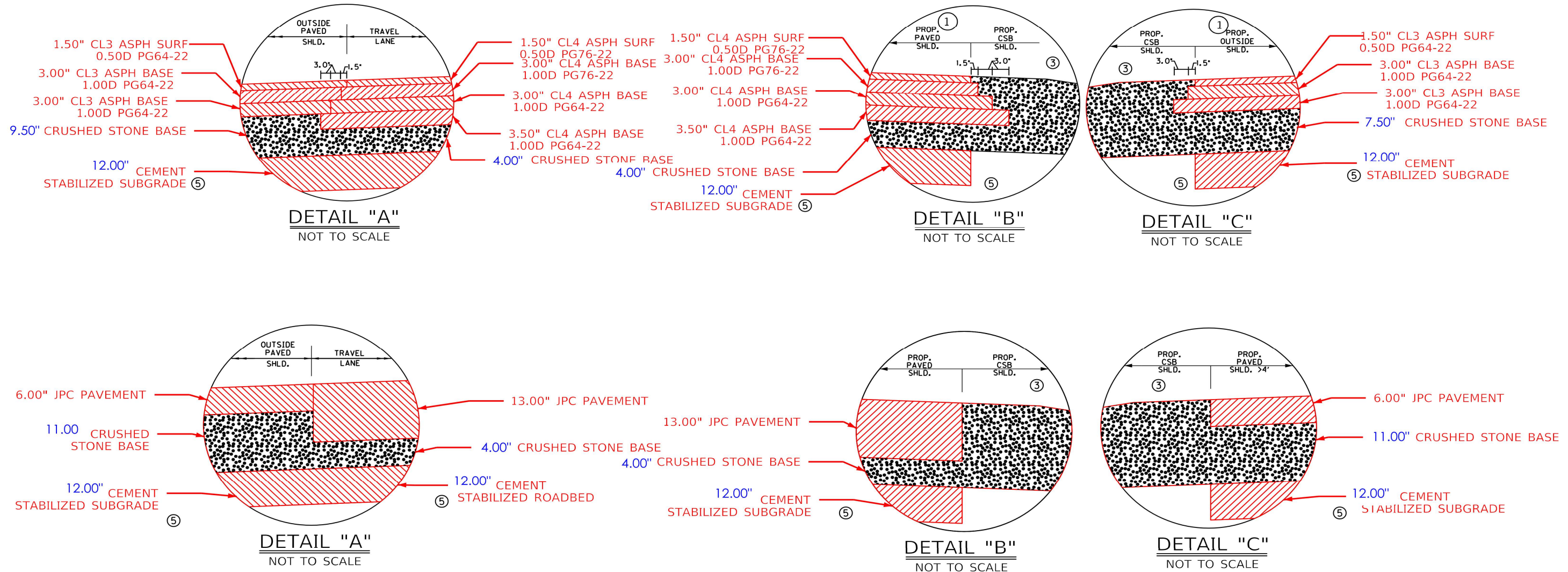
SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL
IQ-09
 Kentucky Transportation Cabinet
 I-24 Lyon & Caldwell Counties

TITLE	Leave roadway elevation (top of roadway as is and excavate)
--------------	---

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

IQ-09

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Leave roadway elevation (top of roadway as is and excavate)						
Assumptions & Calculations	Bid costs based on averages of all KYTC bid prices since October 2022.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
GUARDRAIL-STEEL W BEAM-S FACE	LF	5,525	\$52	\$287,300	0	\$5,525	\$0
CEMENT	TON	4,593	\$264	\$1,213,425	6,890	\$264	\$1,820,137
CRUSHED STONE BASE	TON	151,415	\$68	\$10,315,904	125,424	\$68	\$8,545,137
TOTAL				\$11,817,000			\$10,365,000
Impact to Initial Cost (Baseline Less Proposed)							\$1,452,000





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

AVOID COST

VALUE PROPOSAL

MA-04

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Construct with asphalt to improve ease of maintenance				
FUNCTION	Maintain Asset				
VALUE PROPOSAL SYNOPSIS:					
Utilization of asphalt rather than JPC is a cost effective letting solution and a solution that is more efficiently maintained by KYTC's current staffing and equipment.					
 Reliability	Maintained	 Functionality	Improved	\$ Initial Cost Avoidance (Add)	
 O&M	Improved	 Schedule Impact	Improved	\$0	
BASELINE CONCEPT:					
Current proposal is to bid alternate pavement designs: 13" JPC pavement vs 11" asphalt pavement.					
VALUE PROPOSAL DESCRIPTION:					
The asphalt alternate allows for ease of maintenance during the life of the pavement. Asphalt is easier to repair quickly and our maintenance personnel have greater knowledge of asphalt repair techniques over concrete. Life Cycle Costs are difficult to quantify due to lack of true numbers for specific variables. The advantage of this alternative is more that knowledge of asphalt repair is better understood and so is more likely to occur versus concrete where maintenance may be more complex and involved.					
ADVANTAGES:			DISADVANTAGES:		
● Ease of repair			● Less potential bidders		
● Speed of repair			●		
● Speed of construction			●		
●			●		
●			●		
●			●		

NO CHANGE

VALUE PROPOSAL

MA-04

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Construct with asphalt to improve ease of maintenance
DISCUSSION & JUSTIFICATION:	
<p>This idea is to eliminate the concrete alternate based on the asphalt alternate being easier to perform maintenance activities during the pavement life:</p> <ul style="list-style-type: none">• Maintenance on asphalt is easier for our personnel to perform as they more familiar with asphalt repairs and can perform the activities must faster and easier.• Concrete pavement generally requires less maintenance over the life cycle, but the required maintenance activities are often not performed and are often very costly and time consuming.	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

VALUE PROPOSAL

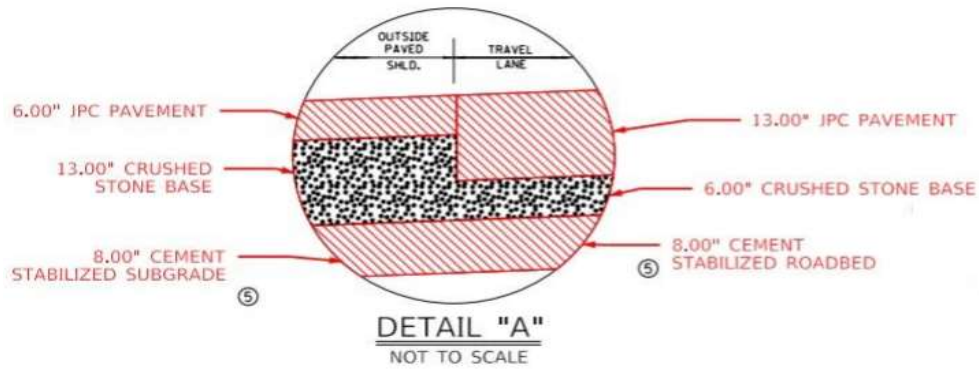
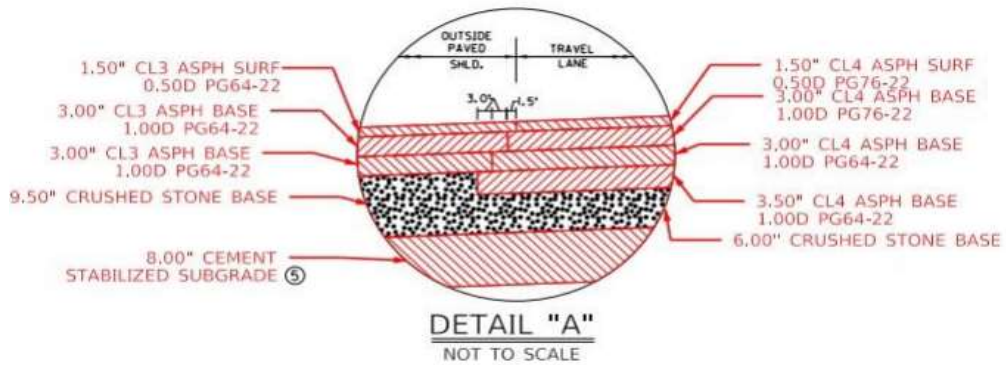
MA-04

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Construct with asphalt to improve ease of maintenance
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SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL

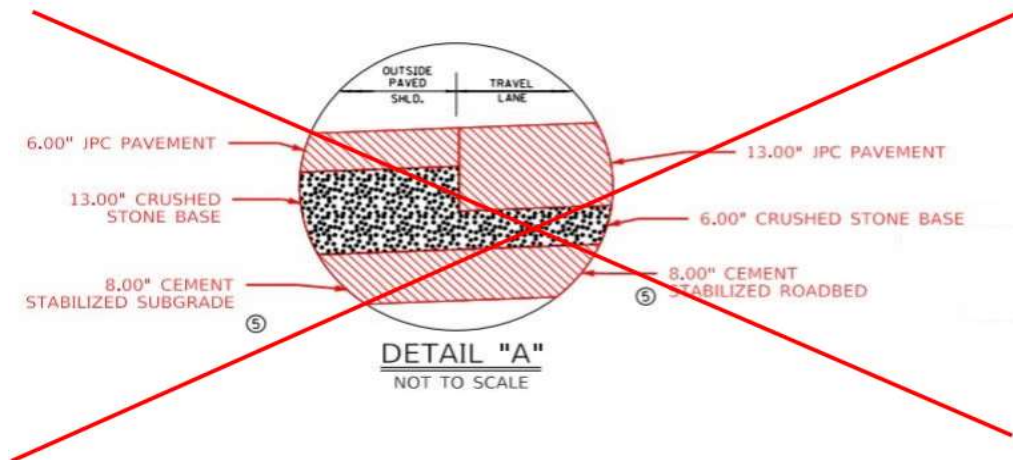
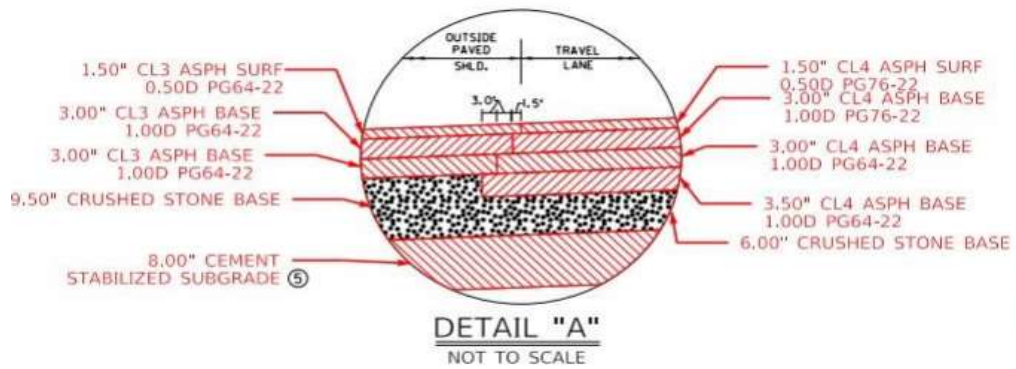
MA-04

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Construct with asphalt to improve ease of maintenance
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SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

AC-01

Kentucky Transportation Cabinet I-24 Lyon & Caldwell Counties





TITLE	A+B bidding notes to incentivize contractor innovation to speed construction				
FUNCTION	Accelerate Construction				
ASSOCIATED IDEAS	AC-03: Offer incentive /disincentive notes to monetize accelerated construction with milestones				
VALUE PROPOSAL SYNOPSIS:					
By incentivizing and monetizing the contract, the section may be completed as early as December of 2025.					
 Reliability	Maintained	 Functionality	Maintained	\$ Initial Cost Avoidance (Add)	
 O&M	Maintained	 Schedule Impact	Improved		
BASELINE CONCEPT:					
The project would be let with a normal letting schedule with a standard ultimate completion date.					
VALUE PROPOSAL DESCRIPTION:					
Utilizing alternate delivery methods, like A+B, incentive/disincentive, and milestone completion, the project will be assured to be in a safe configuration by winter, if not substantially completed in a single construction season.					
ADVANTAGES:			DISADVANTAGES:		
● Faster final delivery of project			● Increased cost		
● Safer for the traveling public			●		
● Innovative idea(s)			●		
● No "inactive closure" time			●		
●			●		
●			●		

NO CHANGE

VALUE PROPOSAL

AC-02

Kentucky Transportation Cabinet I-24 Lyon & Caldwell Counties

TITLE	Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall				
FUNCTION	Accelerate Construction				
VALUE PROPOSAL SYNOPSIS:					
By limiting active construction to 50% or 33% sections, temporary construction can reach a completed milestone that allows full capacity opened for the winter season. Additionally, this will result in a cost savings in temporary 9T barrier wall.					
 Reliability	Maintained	 Functionality	Maintained	\$ Initial Cost Avoidance (Add)	
 O&M	Improved	 Schedule Impact	Maintained	\$885,000	
BASELINE CONCEPT:					
The design as shown allows a full 10+ mile closure for the duration of the project.					
VALUE PROPOSAL DESCRIPTION:					
By restricting the contractor to actively working on only a portion of the project length with milestone completion dates, you get a safer winter condition and project savings on temporary barrier wall.					
ADVANTAGES:			DISADVANTAGES:		
● Safer construction for winter			● Slight increase in project time		
● Cost savings in temporary barrier wall			● Additional crossover construction		
● Potential crash reduction (less frustration backup)			●		
● No exposed subgrade over the winter			●		
●			●		
\$ COST SUMMARY	Initial Costs		O&M Costs		Total Life Cycle Cost
BASELINE CONCEPT:	\$4,085,000		\$0		\$4,085,000
VALUE PROPOSAL DESCRIPTION:	\$3,200,000		\$0		\$3,200,000
TOTAL (Baseline less Proposed)	\$885,000		\$0		\$885,000
AVOID COST					

VALUE PROPOSAL

AC-02

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall
DISCUSSION & JUSTIFICATION:	
<p>If the project team determines that the project should extend into a 2026 completion date, a milestone completion date should be set that states that 40% to 75% of the total length of the project should be substantially complete and open to full 2 lanes in each direction.</p> <p>This will allow for safer snow and ice maintenance and improved driving conditions for the traveling public during the statistically poor weather conditions.</p> <p>By requiring a maximum of 50% closure, the amount of temporary 9T barrier wall is reduced. The bid item for relocating the barrier wall should be added but will still result in significant cost savings. At least one additional crossover will be constructed but the saving in the reduction in the temporary barrier wall will more than make up for it.</p> <p>By limiting the duration and requiring the roadway reopened by winter, there is no subgrade exposed during the winter months leading to a better finished product.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

VALUE PROPOSAL

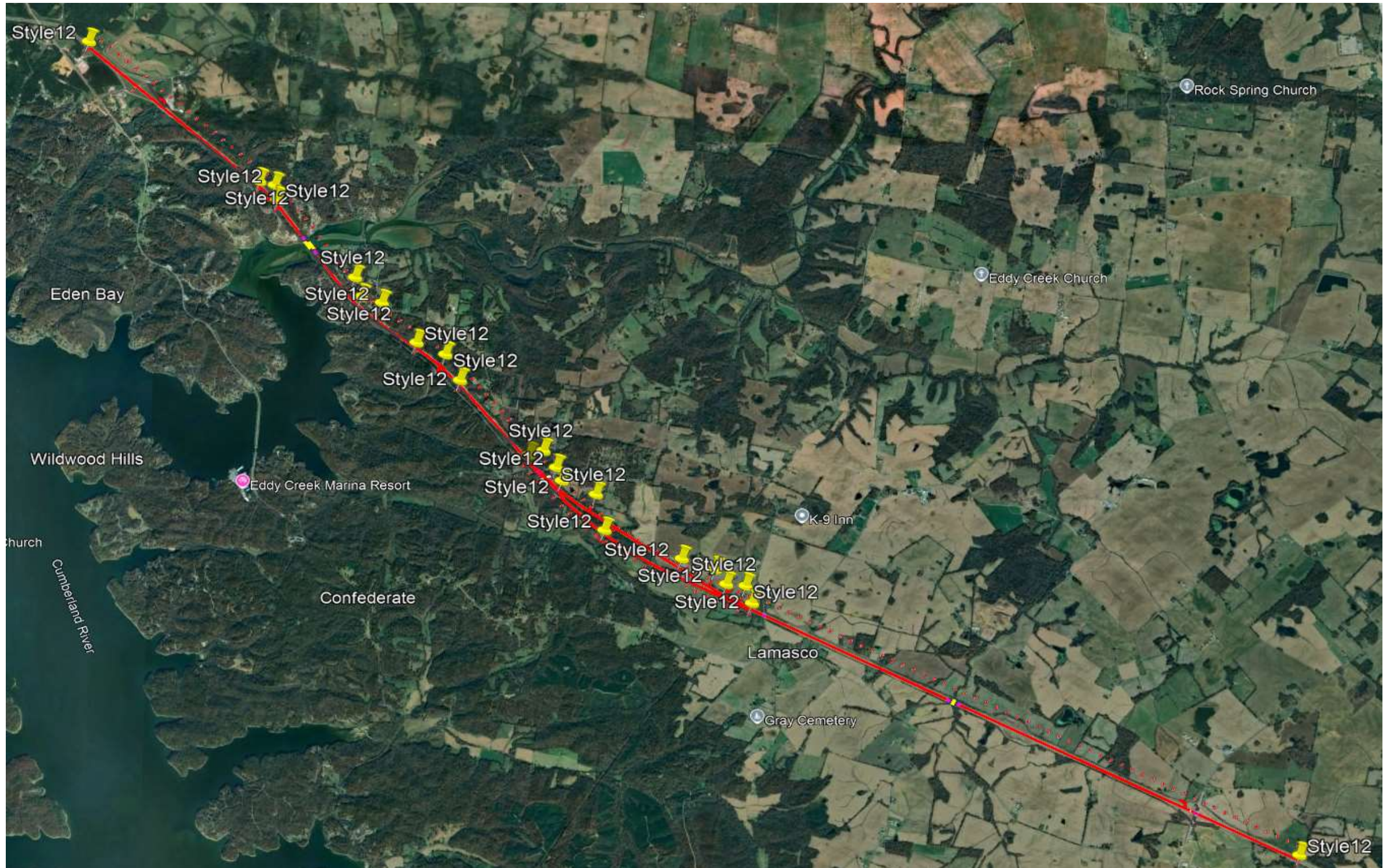
AC-02

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL

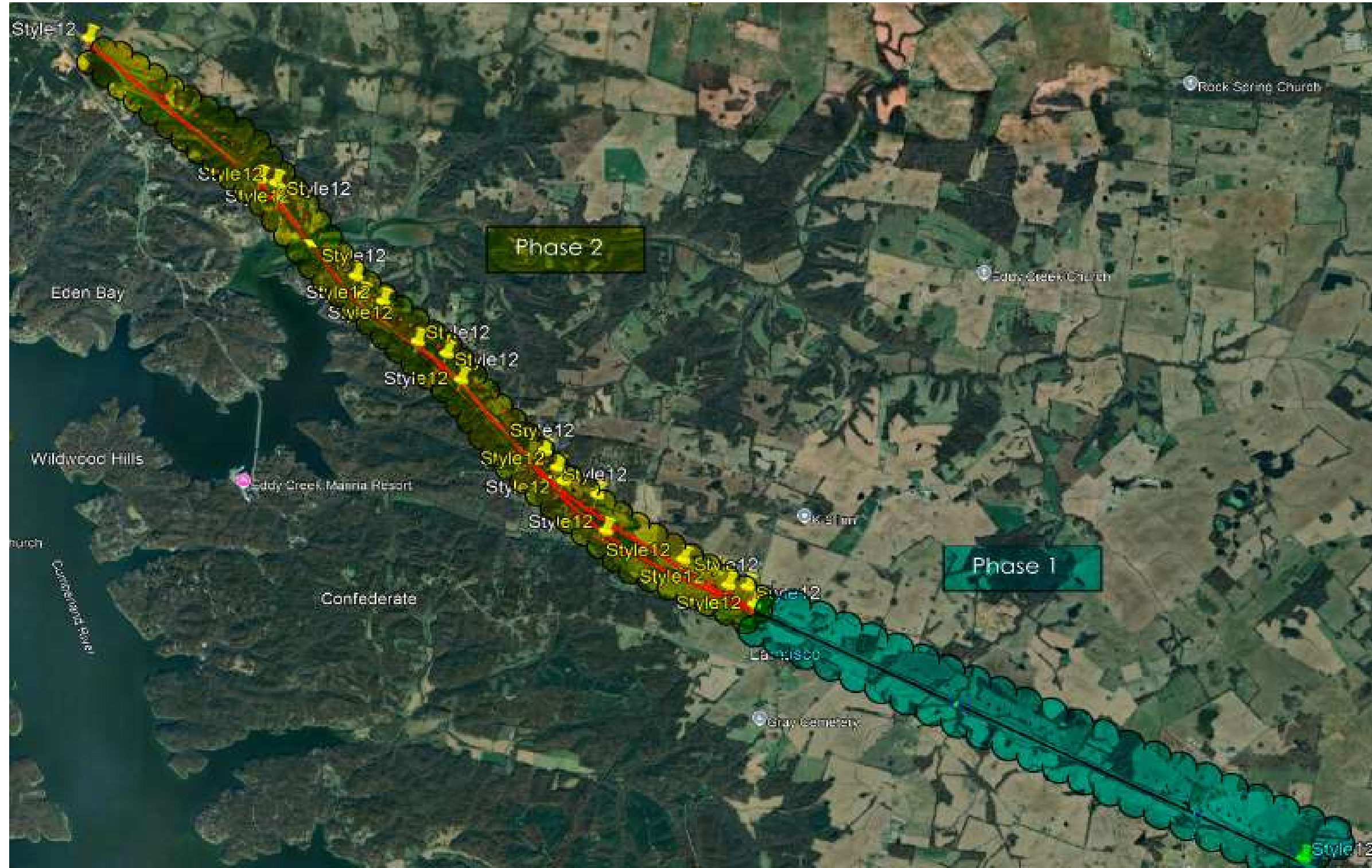
AC-02

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

AC-02

Kentucky Transportation Cabinet

I-24 Lyon & Caldwell Counties

TITLE	Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall						
Assumptions & Calculations	Bid costs based on averages of all KYTC bid prices since October 2022. Based on one 50% installation and two relocations.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
CONCRETE BARRIER WALL TY 9T	LF	55,636	\$73	\$4,085,351	27,518	\$73	\$2,020,647
RELOCATE TEMP CONC BARRIER	LF	0	\$19	\$0	55,636	\$19	\$1,057,084
CL3 ASPH BASE 1.00D PG64-22	TON	0	\$114	\$0	1,000	\$114	\$114,000
PAVE STRIPING-TEMP PAINT-6 IN	LF	0	\$1	\$0	10,000	\$1	\$8,100
TOTAL				\$4,085,000			\$3,200,000
Impact to Initial Cost (Baseline Less Proposed)							\$885,000





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

AVOID COST

VALUE PROPOSAL

AC-04

Kentucky Transportation Cabinet I-24 Lyon & Caldwell Counties

TITLE	Reduce concrete pavement from 13" to 11"				
FUNCTION	Accelerate Construction				
VALUE PROPOSAL SYNOPSIS:					
Reduction in JPC thickness would give a more cost efficient solution and the pavement thickness has been used on adjacent projects.					
 Reliability	Maintained	 Functionality	Maintained	\$ Initial Cost Avoidance (Add)	
 O&M	Maintained	 Schedule Impact	Improved	\$9,669,000	
BASELINE CONCEPT:					
Proposed pavement design for the concrete alternate is 13" of JPC pavement over 6" CSB and 8" of cement stabilized roadbed.					
VALUE PROPOSAL DESCRIPTION:					
Save cost by eliminating several cubic yards of JPC pavement by reducing the pavement design from 13 inches to 11 inches. The new design will provide adequate pavement for the expected life cycle of this roadway.					
ADVANTAGES:			DISADVANTAGES:		
● Reduce cost			● Less structure		
● Reduce time			● Life cycle		
● Less earthwork			●		
● More bridge clearance			●		
● Match other direction			●		
●			●		
\$ COST SUMMARY	Initial Costs		O&M Costs		Total Life Cycle Cost
BASELINE CONCEPT:	\$36,472,000		\$0		\$36,472,000
VALUE PROPOSAL DESCRIPTION:	\$26,803,000		\$0		\$26,803,000
TOTAL (Baseline less Proposed)	\$9,669,000		\$0		\$9,669,000
AVOID COST					

VALUE PROPOSAL

AC-04

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Reduce concrete pavement from 13" to 11"
DISCUSSION & JUSTIFICATION:	
<p>The current pavement design is for 13 inches of JPC. The previous project on EB I-24 as well as other projects on I-65 (with higher traffic) were 11 inches of JPC.</p> <ul style="list-style-type: none">• 11" PCC is acceptable for EB I-24 in this section of roadway. The same pavement thickness will work as the traffic should be the same for each direction.• The >30% truck traffic of the 20,000+ ADT is high and does require a strong pavement to provide an adequate life to the roadway. 13" JPC will provide more structure and allow for more diamond grinding of the pavement compared to 11" JPC. However, the added life is not substantial when compared to the additional cost of the extra depth.• Concrete pavement is historically longer lasting and more durable than asphalt pavements and the two should be either the same depth (or asphalt thicker) with equal subgrades based on traffic loading.• Less material needing to be placed will speed construction activities and help improve safety, as less time needed to construct is less time needed to close lanes.• The 2" less elevation will provide more clearance under the bridges and will allow for additional overlays in the future.	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

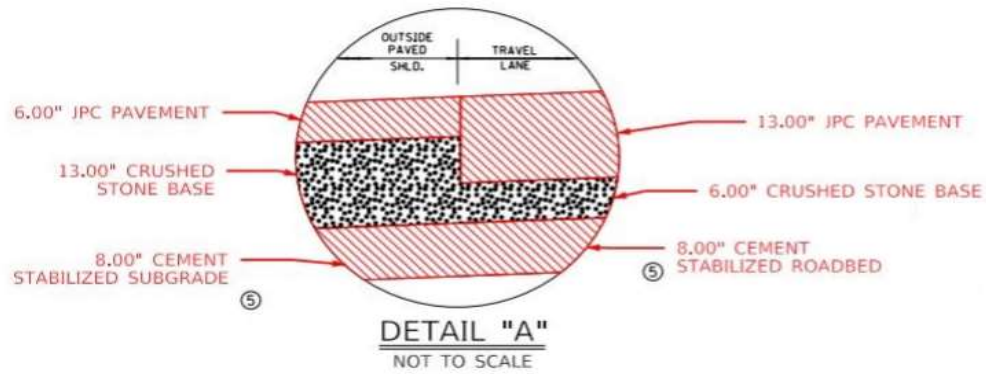
VALUE PROPOSAL

AC-04

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Reduce concrete pavement from 13" to 11"
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SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



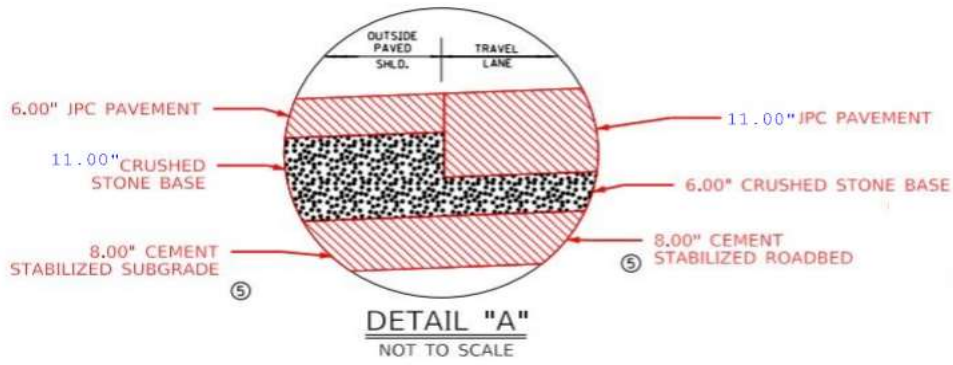
VALUE PROPOSAL

AC-04

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Reduce concrete pavement from 13" to 11"
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SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

AC-04





Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Reduce concrete pavement from 13" to 11"						
Assumptions & Calculations	Bid costs based on averages of all KYTC bid prices since October 2022.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
JPC Pavement 13"	SQYD	169,638	\$215	\$36,472,170	0	\$215	\$0
JPC Pavement 11"	SQYD	0	\$158	\$0	169,638	\$158	\$26,802,804
TOTAL				\$36,472,000			\$26,803,000
Impact to Initial Cost (Baseline Less Proposed)							\$9,669,000
Note: Total costs are rounded to the nearest thousand dollars.							AVOID COST

VALUE PROPOSAL

GE-02

Kentucky Transportation Cabinet I-24 Lyon & Caldwell Counties

TITLE	Do not cement stabilize shoulders (stabilize to the rumble strip) and only update guardrail end treatments		
FUNCTION	General		
ASSOCIATED IDEAS	GE-03: Minimize shoulder work beyond the rumbles GE-05: Reduce the amount of crushed stone base used		
VALUE PROPOSAL SYNOPSIS:			
Will drastically reduce the amount of Crushed Stone Base as well as reducing the amount of Cement Stabilized Roadbed needed. Should shorten the construction time.			
 Reliability	Maintained	 Functionality	Maintained
 O&M	Maintained	 Schedule Impact	Improved
			\$ Initial Cost Avoidance (Add)
			\$4,239,000
BASELINE CONCEPT:			
The baseline concept extends the cement stabilized roadbed to the full shoulder width on the outside. This, in turn, requires the outside shoulders to be completely rebuilt with 9.5" of CSB and requiring a new outside CSB wedge.			
VALUE PROPOSAL DESCRIPTION:			
We propose extending the stabilized roadbed to the back of the rumble strip location. There is enough DGA existing to not require any additional CSB beyond the rumble strips. This reduces the Crushed Stone Base, Cement Stabilized Roadbed (and its items), and potentially any work outside the shoulder (compliant guardrail) that would otherwise not be required to be altered.			
ADVANTAGES:		DISADVANTAGES:	
● Cost savings		● Less pavement schedule under outside shoulder	
● Schedule reduction		●	
●		●	
●		●	
●		●	
\$ COST SUMMARY		Initial Costs	O&M Costs
BASELINE CONCEPT:		\$14,058,000	\$0
VALUE PROPOSAL DESCRIPTION:		\$9,819,000	\$0
TOTAL (Baseline less Proposed)		\$4,239,000	\$0
AVOID COST			

VALUE PROPOSAL

GE-02

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

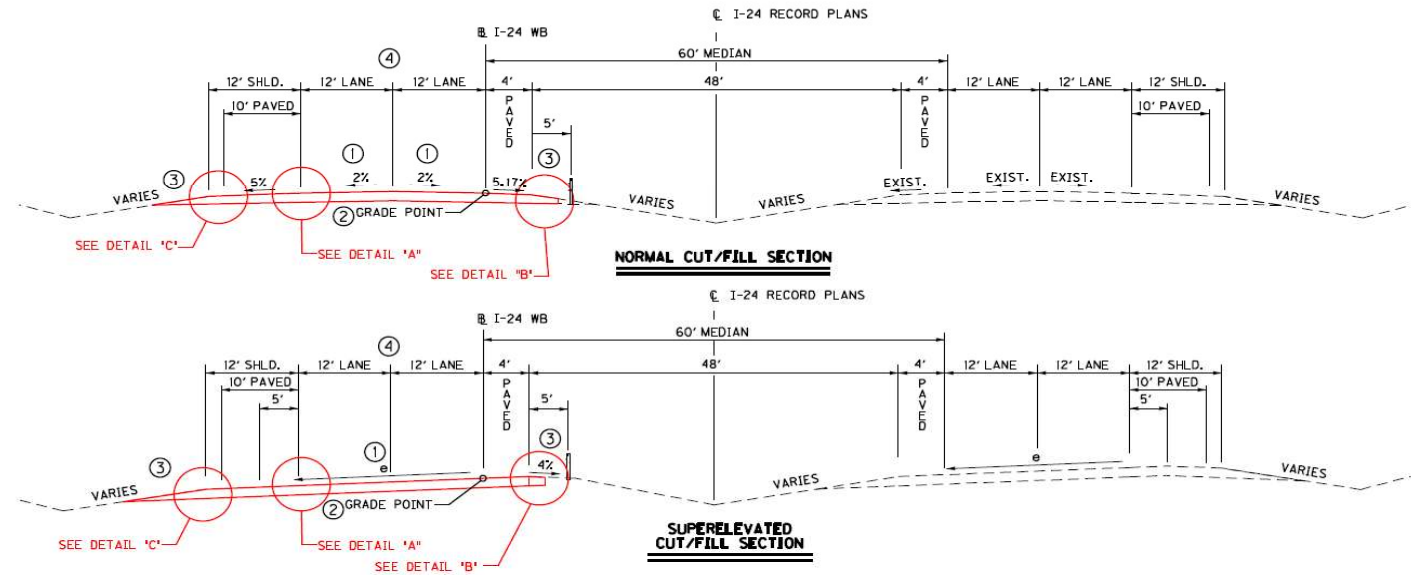
TITLE	Do not cement stabilize shoulders (stabilize to the rumble strip) and only update guardrail end treatments
DISCUSSION & JUSTIFICATION:	
<p>The existing plan is to carry the cement stabilization all the way to the edge of the 10' shoulder. While this is needed under the driving lanes, inside shoulder, and arguably to the back of the rumble strips, we can eliminate this stabilization beyond. That saves Cement stabilization over 6', but moreover it saves having to replace 9.5" of CSB for this 6' and with the asphalt typical you could eliminate the whole outside CSB wedge. The existing outside shoulder based on the 19-1064 project is 6" PCCP and 10" of DGA. There would be 9" of DGA remaining. Even if you placed full shoulder depths you would have 5-6" of remaining DGA.</p> <p>Cost impact would see approximately 20,000 tons under the shoulder disappear and approximately 30,000 tons for the outside CSB wedge. At \$70/ton this amounts to 3.5M in savings. The Cement Stabilized Roadbed is also reduced by approximately 35,000 SY. That equates to approximately \$280,000 for this bid item. This also reduces the Cement by approximately 700 tons which equates to approximately \$200,000 additional savings. Lastly, by not going beyond the edge of paved shoulder, we may be able to leave the guardrail in place that is in compliance. There appears to be approximately 5000LF of guardrail not associated with end treatments that may be able to be eliminated. This would account for approximately \$250,000 in savings. Total cost savings is approximately \$4.2M.</p> <p>Time savings equate to approximately 15% reduction in work for the CSB and the Stabilized Roadbed. Based on laying 2000 tons of CSB a day we are estimating a month of potential savings. While the CSB isn't critical path, the roadbed would be.</p> <p>If we extend it to the outside rumble, there should not be any significant impacts to the longevity of the shoulder.</p>	
OUT-BRIEF PRESENTATION COMMENTS:	
None provided.	

VALUE PROPOSAL
GE-02
 Kentucky Transportation Cabinet
 I-24 Lyon & Caldwell Counties

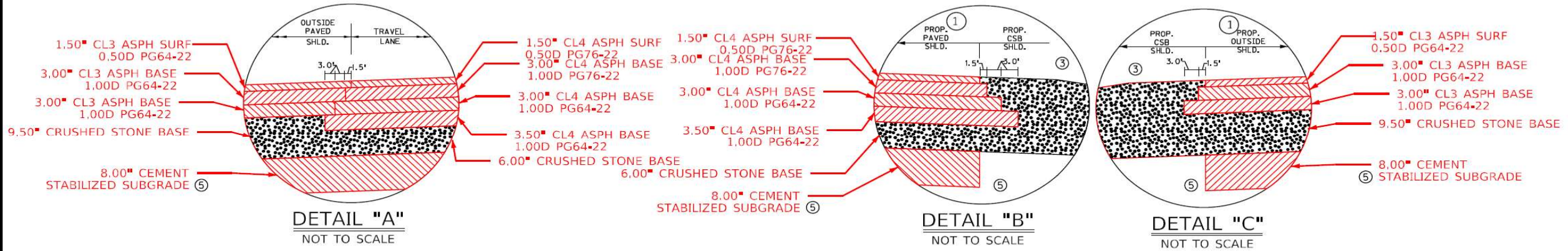
TITLE Do not cement stabilize shoulders (stabilize to the rumble strip) and only update guardrail end treatments

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

**PROPOSED TYPICAL SECTIONS
 ASPHALT ALTERNATE**



- NOTES:**
- ① MATCH EXISTING CROSS SLOPES.
 - ② PROPOSED WESTBOUND GRADE POINT TO BE RAISED 1 INCH ABOVE EXISTING WESTBOUND GRADE POINT.
 - ③ ASPHALT SEAL REQUIRED FROM OUTSIDE EDGE OF PAVED SHOULDER TO THE CONCRETE PAD FOR THE CABLE BARRIER. TWO APPLICATIONS OF THE FOLLOWING:
 ASPHALT SEAL COAT @ 2.40 LBS./SQ. YD.
 ASPHALT SEAL AGGREGATE @ 20 LBS./SQ. YD.
 - ④ EXISTING CONCRETE PAVEMENT OF WESTBOUND TRAVEL LANES AND SHOULDERS IS TO BE REMOVED AND REPLACED WITH NEW ASPHALT PAVEMENT. INCLUDES ANY REMOVAL OF UNDERLYING BASE MATERIAL NEEDED FOR PROPOSED PAVEMENT. REMOVAL OF UNDERLYING BASE MATERIAL SHALL BE INCIDENTAL TO THE REMOVAL OF THE CONCRETE.
 - ⑤ ASPHALT CURING SEAL REQUIRED OVER CEMENT STABILIZATION. TWO APPLICATIONS OF ASPHALT CURING SEAL @ 2 LBS./SQ. YD.

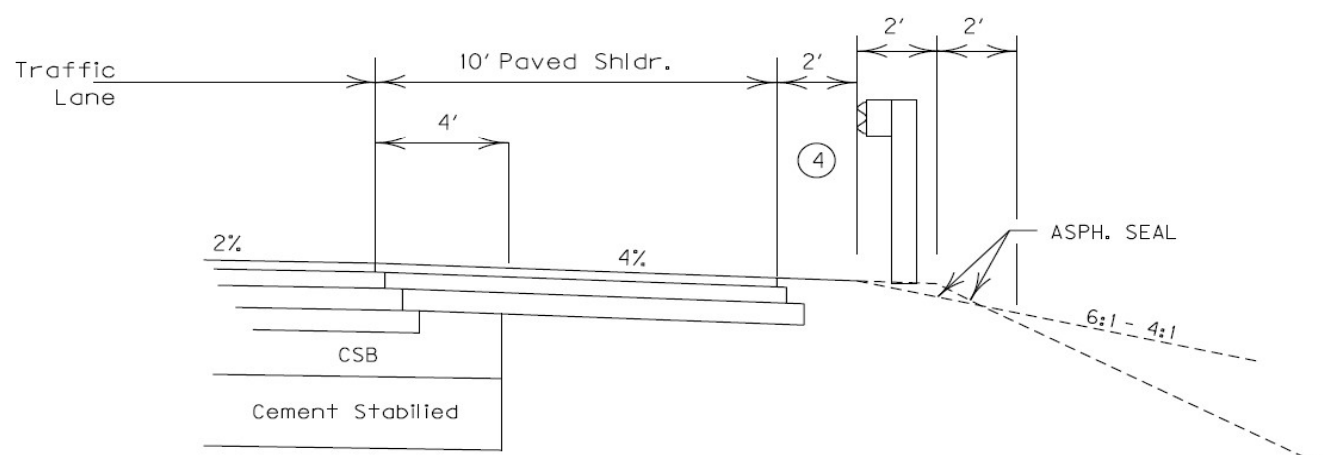
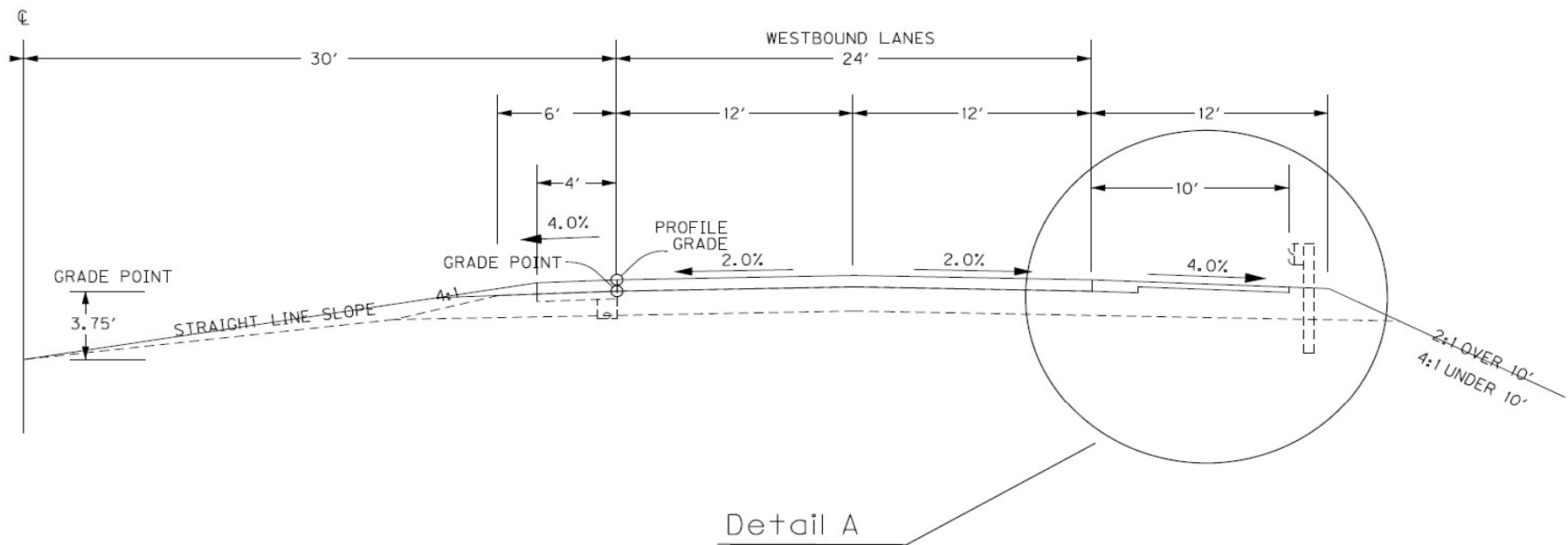


VALUE PROPOSAL
GE-02
 Kentucky Transportation Cabinet
 I-24 Lyon & Caldwell Counties

TITLE Do not cement stabilize shoulders (stabilize to the rumble strip) and only update guardrail end treatments

SKETCH/DIAGRAM: VALUE PROPOSAL

COUNTY OF	ITEM NO.	SHEET NO.
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DETAIL 'A'

SCALE: 1"=

FILE NAME: C:\USERS\WINDLANDSKTOP\VALUE ENGINEERING PROJECTS\I-24 LYON&C\GE-02 SKETCH.DGN

USER: wwindland
DATE PLOTTED: January 8, 2025

E-SHEET NAME: ---

MicroStation v8.11.5.608

VALUE PROPOSAL

GE-02

Kentucky Transportation Cabinet
I-24 Lyon & Caldwell Counties

TITLE	Do not cement stabilize shoulders (stabilize to the rumble strip) and only update guardrail end treatments						
Assumptions & Calculations	None noted.						
DESIGN ELEMENT	BASELINE CONCEPT				VALUE PROPOSAL		
Description	Unit	Qty	Unit Cost \$	TOTAL \$	Qty	Unit Cost \$	TOTAL \$
CSB	Ton	151,415	\$70	\$10,599,050	101,415	\$70	\$7,099,050
Cement Stabilized Roadbed	SY	236,282	\$8	\$1,890,256	201,282	\$8	\$1,610,256
Cement	Ton	4,593	\$285	\$1,309,005	3,893	\$285	\$1,109,505
Guardrail	LF	5,000	\$52	\$260,000	0	\$52	\$0
Asphalt curing seal	ton	473	\$891	\$421,443	421	\$891	\$375,111
TOTAL				\$14,480,000			\$10,194,000
Impact to Initial Cost (Baseline Less Proposed)							\$4,286,000

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

AVOID COST



PART

III

Appendices
Value Study
Documentation

Appendix

A

Value Study Overview

A.1 Introduction

A virtual value engineering workshop was conducted from January 7-9, 2025 on the project documents provided by KYTC and WSP for the I-24 Lyon and Caldwell Counties eastbound repair and rehabilitation project.

The Kentucky-based VE team, which consisted of consultant constructability and design experts and KYTC constructability geotechnical and maintenance experts, began the workshop process by reviewing the provided 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

The I-24 rehabilitation project aims to enhance a 10.5-mile section of interstate from milepost 45.000 to milepost 55.537 in Lyon and Caldwell Counties, Kentucky. This project is part of KYTC's statewide pavement rehabilitation initiative and represents a commitment to improving the long-term functionality, safety, and durability of this critical transportation corridor.

The primary goals of the project are to improve the quality of the roadway, preserve and maintain the existing infrastructure, ensure uninterrupted traffic flow during construction, and adopt practices to accelerate the overall construction timeline. These objectives are underpinned by a clear focus on extending the life cycle of the roadway and providing durable, long-lasting solutions for future users.

Pavement rehabilitation is central to the project. Options under consideration include both asphalt and Jointed Plain Concrete (JPC) pavement designs, with profile adjustments tailored to each material: a 1-inch increase for asphalt and a 3-inch increase for JPC. These adjustments, along with the integration of chemical-stabilized subgrades, geogrids, and E5 admixtures, are designed to reduce cracking and enhance durability, ensuring a robust and reliable roadway surface.

Drainage improvements are another critical component of the project. The installation of edge drains tied to the centerline drainage will enhance water management, while the addition of intermediate bleeders in water-prone areas will help mitigate subgrade failure. In areas near bull nose terminals, rock placement combined with chip-and-seal overlays will suppress weed growth and further improve drainage efficiency.

Traffic management during construction will be carefully planned to ensure minimal disruption to the flow of vehicles. Maintenance of Traffic (MOT) options under consideration include either a traffic crossover to allow construction on one side at a time or shifting traffic lanes without the use of crossovers.

The project is defined by key metrics and timelines. The section of I-24 under rehabilitation carries an Average Annual Daily Traffic (AADT) of 22,620 vehicles, with 38 percent of that volume being heavy

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trucks. The project budget is \$50M and construction is targeted for completion following the April 2025 letting date.

A.2.1 List of Documents Reviewed

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

	01-20010-02-20062 - I-24 Lyon and Caldwell-CL.kmz
	1-20010_2-20062 – I-24 – Lyon&Caldwell -Plan Set - 2025-01-06.pdf
	1-20010_2-20062 – I-24 – Lyon&Caldwell -Plan Set - 2025-01-06.xlsx
	201-CALDWELL-TRIGG-21-1013.pdf
	I-24 - Lyon - Caldwell County - Summary of Pre-Design Conference.pdf
	KYTC - I24 Webwall Estimate 1.pdf
	Report 072B00044L.pdf
	Report 072B00048L.pdf
	User Cost Report for 1-20010 Lyon and 2-20062 Caldwell I-24 1-WZL.pdf

A.2.2 In-brief Meeting

At the in-brief meeting on Tuesday, January 7, 2025, representatives from KYTC presented a briefing on the project to the value team. In addition to identifying the key elements of the project, the value 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 value 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.

A.2.4 Presentation

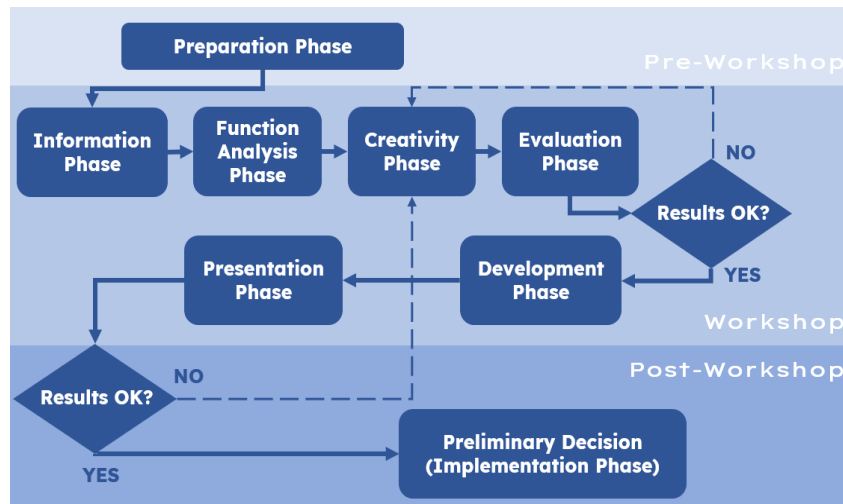
An out-brief presentation was held on Thursday, January 9, 2025. The objective of the presentation was to put forward the results of the value study. This involved a PowerPoint slide presentation to the value study stakeholders and decision makers. During the presentation, the value team highlighted 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.

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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 Team members to complete Key Issues Memos (KIM) 	<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
Phase 2: Information Phase	Analyze Information	<ul style="list-style-type: none"> Present design concept Present stakeholders' interests 	<ul style="list-style-type: none"> It brings all value study team members to a common understanding of the project,

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Value Methodology Stage / Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
	Transform Information Orient Participants	<ul style="list-style-type: none"> 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 	including its challenges and constraints <ul style="list-style-type: none"> 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
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

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Value Methodology Stage / Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
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: Value Team Participants

Name	Organization	Position
Will Nolan	Qk4	Design Construction
Jeremiah Littleton	Qk4	Constructability
Everett Wilson	KYTC	Construction Maintenance
Adam Ross	KYTC	Geotechnical/Construction
Jeff Rude, 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.

Workshop Attendee List

January 7-9, 2025									Name	Organization	Position
IBP	7		8		9		OBP				
	am	pm	am	pm	am	pm					
<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"/>	Jeff Rude, 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"/>	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"/>	Jeremiah Littleton	Qk4	Constructability
<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"/>	Will Nolan	Qk4	Design Construction
<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"/>	Adam Ross	KYTC	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"/>	Everett Wilson	KYTC	Construction Geotechnical
<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 checked="" type="checkbox"/>	Wendy Southworth	KYTC	Quality Assurance 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 checked="" type="checkbox"/>	Ross Mills	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 checked="" type="checkbox"/>	Andre Johannes	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 checked="" type="checkbox"/>	Travis Briar	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 checked="" type="checkbox"/>	Charlotte Cotton	KYTC	Section 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 checked="" type="checkbox"/>	Brad Frazier	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"/>	Paul Friedlander	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 checked="" type="checkbox"/>	Billy Garrison	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 checked="" type="checkbox"/>	Russell Krimple	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 checked="" type="checkbox"/>	Tanner Jones	WSP	
<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"/>	Jason Littleton	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 checked="" type="checkbox"/>	Dustin Turner	KYTC	

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: I-24 Lyon & Caldwell Counties
Dates/Time: January 7-9, 2024 (*times listed below*)
Study Location: Virtual // Microsoft Teams

Day 1: Tuesday, January 7, 2024; 8:00AM – 5:00PM ET

MS Teams Meeting Link: [Click here to join the meeting](#) | Meeting ID: 280 519 231 961 | Call-in #: +1 323-484-8978; 50290771#

Time	VE Activity	Participants	Comments
8:00	Welcome & Introductions	All	
8:15	Overview of Value Process (CVS Facilitator)	All	
INFORMATION PHASE			
8:45	Project Presentation by Owner/Designer	All	
10:00	Identify/Discuss: <ul style="list-style-type: none"> Project Goals VE Study Objectives VE Study Constraints Performance Attributes 	All	
11:00	Review Cost Model, Schedule, Project Risks Team Observations	VE Team	
FUNCTION ANALYSIS PHASE			
12:00	Long Break	VE Team	
1:00	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	
CREATIVE PHASE			
3:00	Brainstorm Ideas / Alternatives	VE Team	
5:00	Adjourn	VE Team	

Day 2: Wednesday, August 15, 2024; 8:00AM – 5:00PM ET

MS Teams Meeting Link: [Click here to join the meeting](#) | Meeting ID: 280 519 231 961 | Call-in #: +1 323-484-8978; 50290771#

Time	VE Activity	Participants	Comments
8:00	Check-in & Team Event	VE Team	Team-building exercise
CREATIVE/EVALUATION PHASE			
8:15	Small Group Creativity Discussions Two-step Evaluation Process Team Assignments for Development, Review Workbook Template	VE Team	
DEVELOPMENT PHASE			
9:30	Develop / Cost Alternatives	VE Team	
12:00	Long Break	VE Team	
1:00	Develop / Cost Alternatives	VE Team	
5:00	Adjourn	VE Team	

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



Day 3: Thursday, August 15, 2024; 8:00AM – 5:00PM ET

MS Teams Meeting Link: [Click here to join the meeting](#) | Meeting ID: 280 519 231 961 | Call-in #: +1 323-484-8978; 50290771#

Time	VE Study Activity	Participants	Comments
8:00	Check-in & Team Event	VE Team	Team-building exercise
DEVELOPMENT PHASE <i>(continued)</i>			
8:10	Develop / Cost Alternatives	VE Team	
10:30	Develop / Cost Alternatives (complete) Group Review of VE Alternatives Prepare Presentation	VE Team	
12:00	Long Break	VE Team	
PRESENTATION PHASE			
1:00	Review / Practice Presentation	VE Team	
2:00	Presentation of Key Findings/VE Alternatives to Stakeholders/Decision-makers	All	
3:30	Workshop Close-out Actions	VE Team	
5:00	Adjourn	VE Team	

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

B.1 Project Mind Map

As part of the Information Phase of the workshop, following the In-Brief Presentation by the project design team, the VE team members discussed the details of the project through a collaborative mind mapping exercise. The resulting mind map, pictured below in two parts, details observation and performance attributes of the project identified by the VE team.

Figure B-1: Mind Map Part 1 - Observations

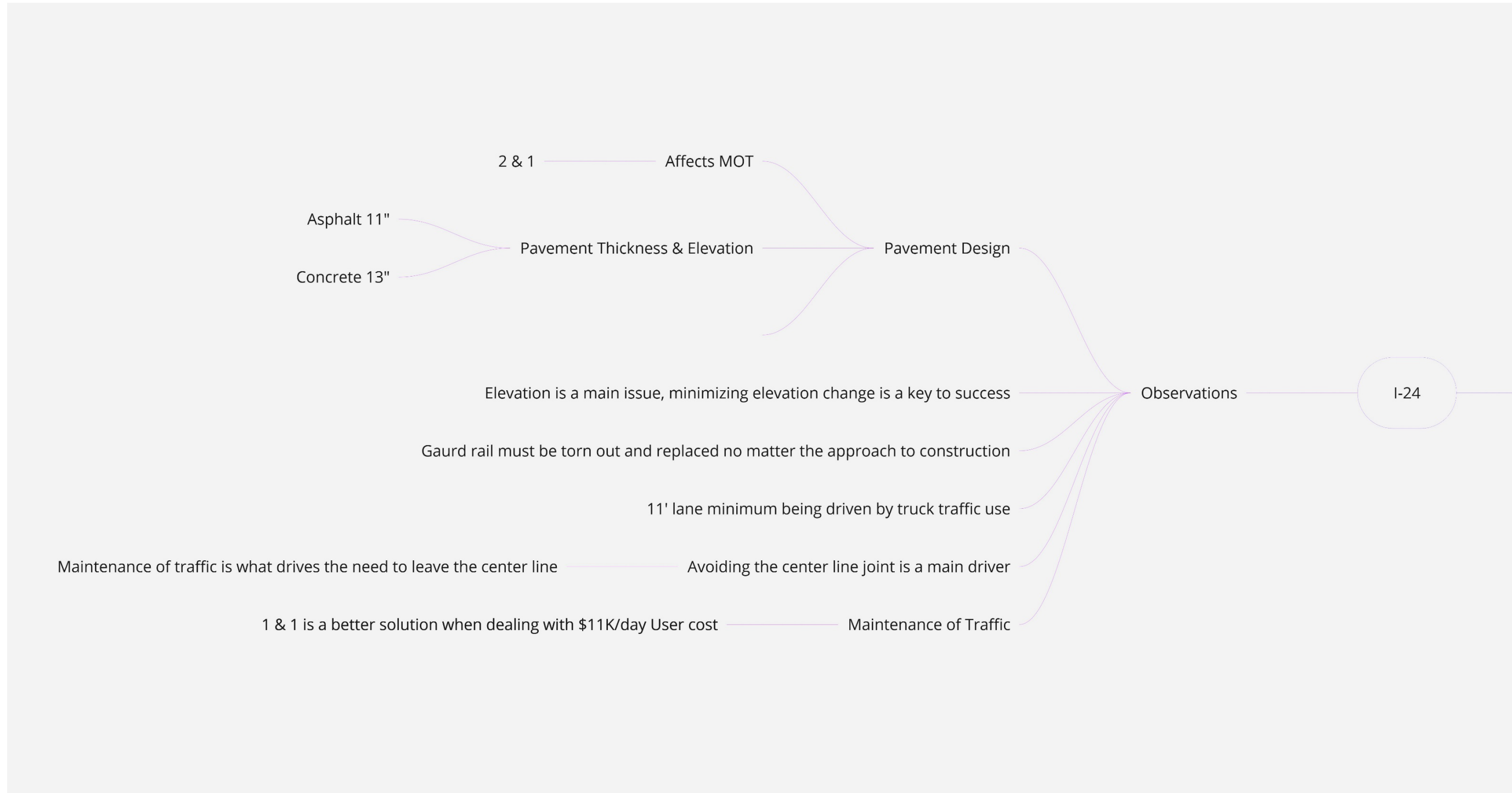
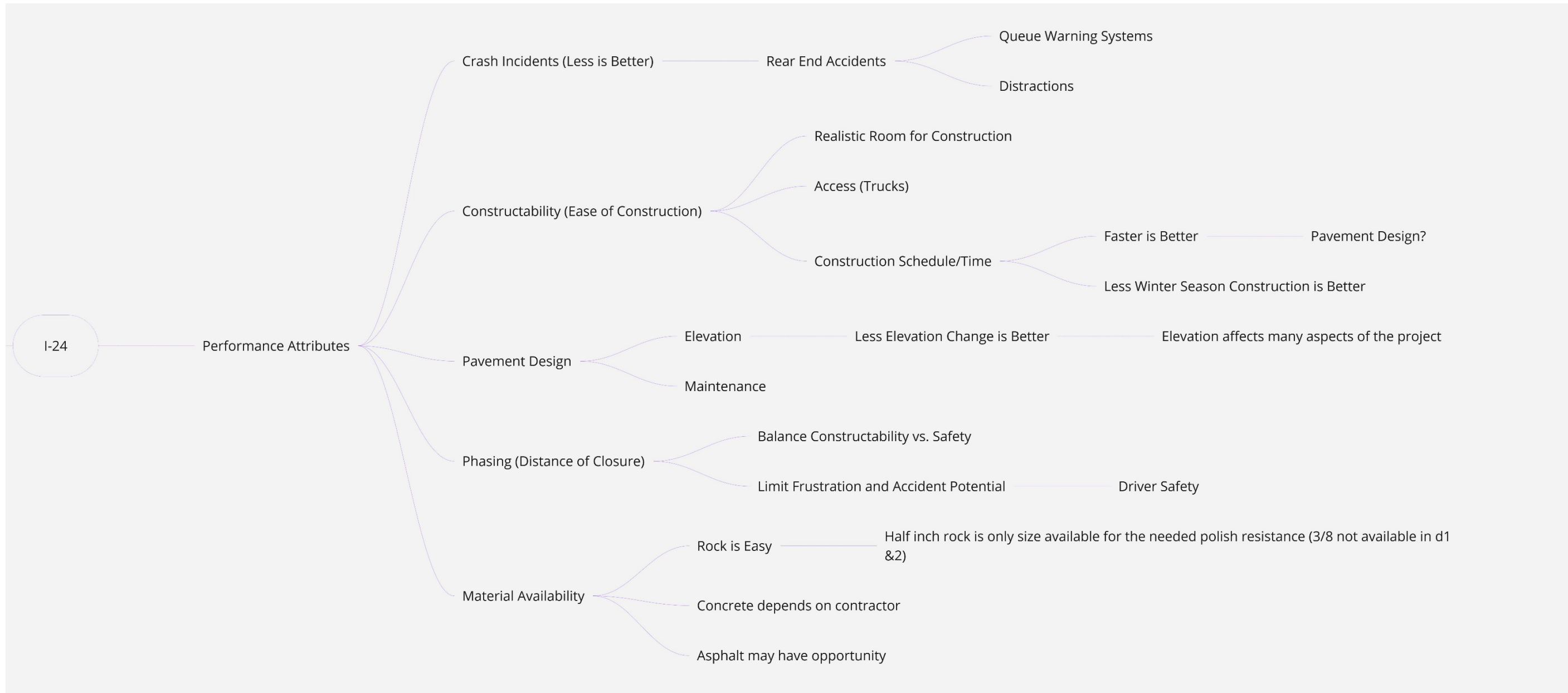


Figure B-2: Mind Map Part 2 – Performance Attributes



Appendix

C

Function Analysis

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 value 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 value 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 **“Reduce Failure-points, “Maintain Asset,”** and **“Improve Safety”** as the basic functions 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

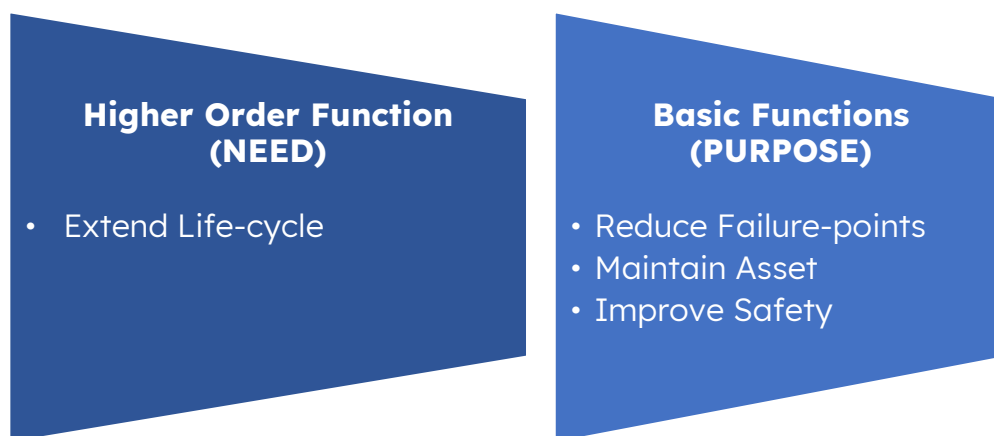
Identify Functions		Classify Functions	Prioritize Functions
Active Verb	Measurable Noun	Higher Order Basic Secondary	SELECT FOR CREATIVITY PHASE
<i>Extend</i>	<i>Life-cycle</i>	<i>Higher Order</i>	
Reduce	Failure-points	Basic	
Maintain	Asset	Basic	X
Improve	Safety	Basic	
Improve	Quality	Secondary	X
Ease	Maintenance	Secondary	
Minimize	Joints	Secondary	
Reduce	Crashes	Secondary	
Maintain	Traffic	Secondary	X
Manage	Traffic	Secondary	
Minimize	Frustration	Secondary	
Maximize	Season-utilization	Secondary	
Accelerate	Construction	Secondary	X
Simplify	Construction	Secondary	
Minimize	Construction	Secondary	
Minimize	Grade-work	Secondary	
Minimize	Elevation	Secondary	
Minimize	Clearance-loss	Secondary	
Standardize	Maintenance	Secondary	

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

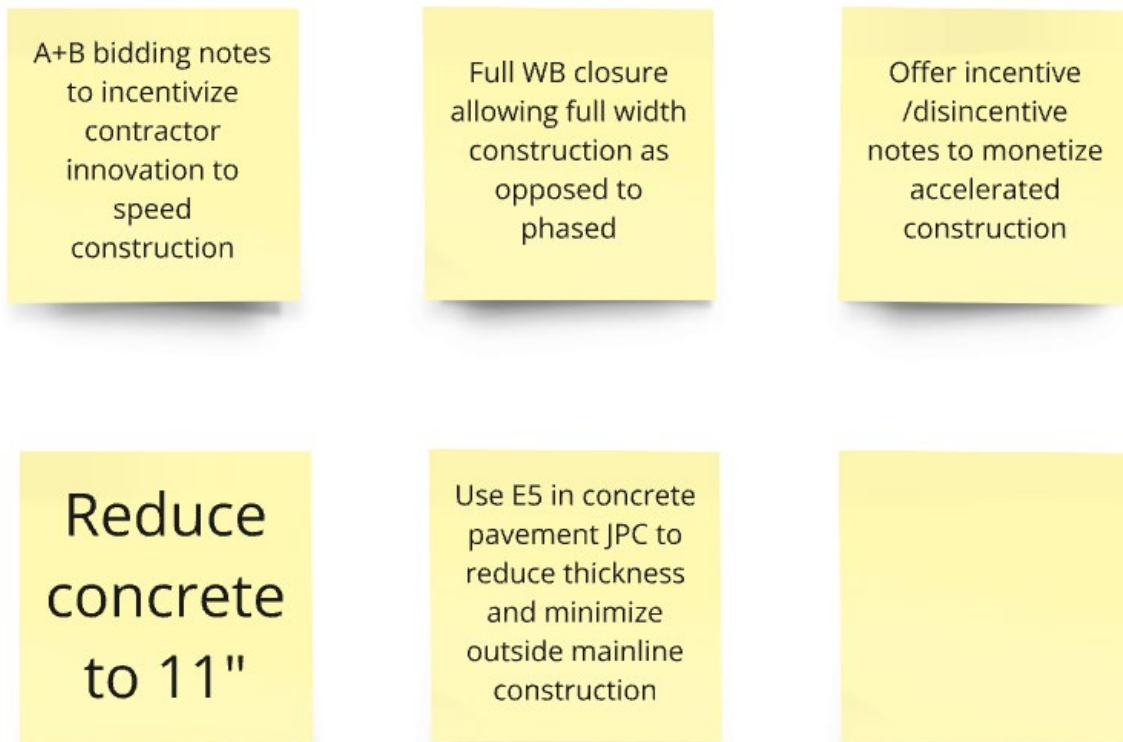
D.1 Introduction

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 value 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, 9 ideas were identified for further development into Value Proposals. In addition, 18 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 key project functions, first independently and then in groups.

Figure D-1: Sample of Miro Brainstorming Exercise for Function “Accelerate Construction”



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
Improve Quality	IQ	9	4	5
Maintain Asset	MA	5	1	4
Accelerate Construction	AC	11	3	5
General	GE	8	1	4
	Total	33	9	18

D.3 Evaluation Techniques Used

The VE team members evaluated the ideas using a two-step process. The first step, to shorten the list, identified ideas that scored as follows:

Table D-2: Evaluation Key

Score	Description
5	Great Value , meets function/performance, and avoids resources
4	Good Value , meets function/performance, and avoids or slightly increases resources
3	Moderate Value , is the function improved to the point that it overcomes the resources needed? <i>(Likely no value proposal will be prepared)</i>
2	Moderate to Poor Value , does not meet function/performance, and avoids/adds resources <i>(No value proposal will be prepared)</i>
DS	Design Suggestion , more than a DC, requires further explanation
DC	Design Comment , Stand-alone comment that needs no further explanation; a list of these will be given to the design team
ABC	Already Being Considered/Done , Included in the baseline concept
OS	Out of Scope , Not a part of this project
FF	Fatal Flaw , Violates a code or standard

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Table D-3: Rating

Value = $\frac{\text{Function Performance}}{\text{Resources}}$					
Resource	Function				
	F++	F+	F	F-	F--
R--	5	5	4	4	3
R-	5	4	4	3	2
R	4	4	3	2	2
R+	4	3	2	2	2
R++	3	2	2	2	2

Table D-4: Value Cue Key (Magnitude of Change)

Value Cue Key - Magnitude of Change	
F++ = Large increase in function F+ = Small increase in function F = No impact to function F- = Small decrease in function F-- = Large decrease in function	R-- = Large decrease in resources used R- = Small decrease in resources used R = No impact to resources used R+ = Small increase in resources used R++ = Large increase in resources used

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 value 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-5: “Scored” Creative Idea List

Idea No.*	Idea Title	Score**
**Key: P=Great to Good Value Opportunity (Value Proposal developed with cost); DS=Great to Good Value Opportunity (Value Proposal developed with no cost); X=Poor Value Opportunity (Value Proposal not developed); DC=Design Comment; ABC=Already Been Considered/Already Being Done		
Improve Quality		
IQ-01	Allow full westbound side for construction rather than phases and use a 1-and-1 traffic pattern	5
IQ-02	Pave in echelon to eliminate the longitudinal joint	5
IQ-03	Utilize pavement fibers to increase durability	DC
IQ-04	Move outside joint beyond rumbles to reduce likelihood of issues	DC
IQ-05	Cut intermediate bleeders in water prone sections in addition to edge drains	DC
IQ-06	Install geogrid to improve durability and possibly reduce needed thickness	DC

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Idea No.*	Idea Title	Score**
**Key: P=Great to Good Value Opportunity (Value Proposal developed with cost); DS=Great to Good Value Opportunity (Value Proposal developed with no cost); X=Poor Value Opportunity (Value Proposal not developed); DC=Design Comment; ABC=Already Been Considered/Already Being Done		
IQ-07	Build full depth shoulders to allow for future maintenance of traffic	5
IQ-08	Offset joint from pavement markers (reflectors) to lower the likelihood of failure along the joint	DC
IQ-09	Leave roadway elevation (top of roadway as is and excavate)	5
Maintain Asset		
MA-01	Perform latex overlay of bridges while under closure to save future bridge maintenance costs	DC
MA-02	Evaluate panel signs and replace	DC
MA-03	Tie in edge drain to the center line drainage	DC
MA-04	Construct with asphalt to improve ease of maintenance	5
MA-05	Use ITS for advanced warning during maintenance	DC
Accelerate Construction		
AC-01	A+B bidding notes to incentivize contractor innovation to speed construction	5
AC-02	Delineate work zone segments in an ideal length (two-part, 30% increments, 20% increments, etc.) to improve traffic management, allow ease of accommodating in-season construction, and reduce amount of barrier wall	5
AC-03	Offer incentive /disincentive notes to monetize accelerated construction with milestones	w/AC-01
AC-04	Reduce concrete pavement from 13" to 11"	5
AC-05	Use E5 in concrete pavement JPC to reduce cracking and minimize outside mainline construction	DC
AC-06	Close opposite lane of work to improve safety and smoothness of lane closure operations	2
AC-07	Encourage (sign and stripe) and enforce zipper merge concept and build lane closure to accommodate the concept (perform this merge further back from construction site and place Law Enforcement Officer at this point to enforce	2
AC-08	Install temporary rumbles to increase awareness of upcoming construction and increase law enforcement officer presence	DC
AC-09	Increase law enforcement officer hours to help enforce speed limit	DC
AC-10	Contractor provides a pilot vehicle to regulate speed within construction zone (55mph)	DC
AC-11	Use PQWAS as early alerts for detours	DC
General		
GE-01	Leave cable rail in place (and for crossovers)	DC
GE-02	Do not cement stabilize shoulders (stabilize to the rumble strip) and only update guardrail end treatments	5
GE-03	Minimize shoulder work beyond the rumbles	w/GE-02
GE-04	Use recycled materials or reclaimed asphalt pavement to reduce the need for new materials	DC
GE-05	Reduce the amount of crushed stone base used	w/GE-02
GE-06	Confirm elevation under bridges is sufficient	DC
GE-07	Core existing eastbound pavement to ensure the thickness is sufficient to drive on	w/IQ-09

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Idea No.*	Idea Title	Score**
**Key: P=Great to Good Value Opportunity (Value Proposal developed with cost); DS=Great to Good Value Opportunity (Value Proposal developed with no cost); X=Poor Value Opportunity (Value Proposal not developed); DC=Design Comment; ABC=Already Been Considered/Already Being Done		
GE-08	Verify eastbound shoulder thickness to ensure it can be used in a 1-and-1 scenario	DC

Appendix

E

Certification
Statement

SAVE International Value Standard Certification

Kentucky Transportation Cabinet
I-24, Lyon & Caldwell Counties (Item Nos. 1-20,010 & 2-20,062)

Value Study Dates: January 7-9, 2025

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.



Jeff Rude, CVS
CVS® No. 200704503
Facilitator