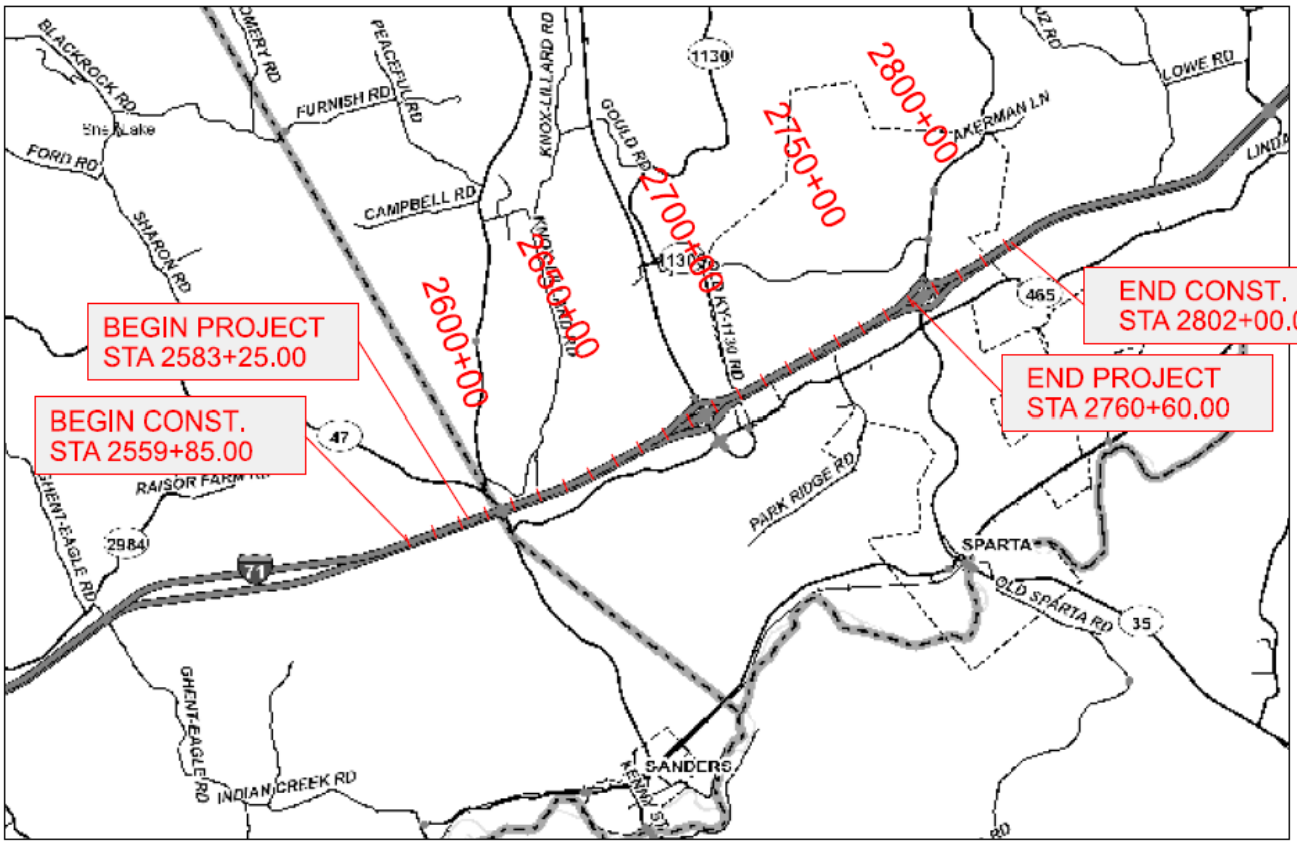
KENTUCKY TRANSPORTATION CABINET

Value Study

Report – Final



I-71 | Item No. 6-20,021.00

Gallatin County

Kentucky Transportation Cabinet

VE Letter Agreement No. 03

Study Dates: August 13-15, 2024

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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

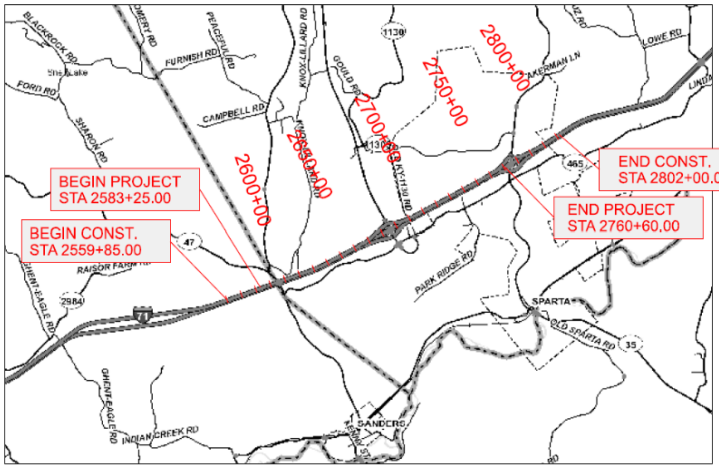
1.1 Value Study Results

VALUE STUDY RESULTS SUMMARY				
Project Name: I-71, Gallatin County (Item No. 6-20021.00)				
Project Location: Gallatin County, KY				
Client:	Kentucky Transportation Cabinet			
Value Study Dates:	August 13-15, 2024	**Original Project Cost:**	$53.1M	
Value Study Timing:	Pre-Final Design			

ACCEPTED RESULTS					
	Reliability:	Improved		**Total Potential Initial Cost Avoidance:**	$971K
	Operations & Maintenance:	Improved		**Schedule Impact:**	Maintained
	Functionality:	Improved		**Return on Investment:**	26:1

PROJECT OVERVIEW

(Excerpted from the Design Executive Summary document provided by KYTC and Stantec, dated August 2023)



This project is located on I-71 (M.P. 53.29 to M.P. 56.58) predominantly in the southwest region of Gallatin County, Kentucky with a small section extending into the northeast region of Carroll County, Kentucky. The project proposes to address existing pavement base deterioration with deep milling, breaking and seating of the underlying concrete pavement, and overlaying with asphalt pavement to a proposed target grade of 4.5" above existing grade point. The project also proposes to widen this section of I-71 towards the inside to create a flush median with concrete median barrier wall and three lanes of traffic in each direction in the vicinity of the Kentucky Speedway and the KY 1039 and KY 35 interchanges. The I-71 bridges over KY 47 will be replaced with a new, single span bridge with a typical section matching the median widening proposed.

VALUE STUDY BENEFITS

While the VE team was able to pursue cost savings through suggested changes, the real focus of the team members was to focus on ways to improve the biddability and constructability of the project utilizing the Value Methodology. The value alternatives are offered as creative contributions to the design and contracting efforts.

The Kentucky-based VE team members, including representatives from KYTC, identified 51 creative ideas intended to help guarantee the delivery of a roadway with improved capacity that best meets the project goals identified by KYTC.

In all cases, the focus was to search for opportunities that will enhance the functionality of the project to support KYTC's design effort.

KEY ACCEPTED RECOMMENDATIONS

5 Value Proposals were accepted with the intent to implement into the project design:

- MR-01: Extend asphalt under concrete wedge curb to prevent cracking
- IB-02: Update time constraints to allow for more realistic construction requirements
- IB-04: Switch to 1.0" base throughout
- MC-08 Option C: Crack suppression layer
- MC-10: Reuse cable for cable barrier replacement

21 Standalone Design Comments were also identified and are included, along with the Value Proposals, in **Section 2** of this report.

1.2 Value Study Background

A virtual VE workshop was conducted from August 13-15, 2024, on the project documents prepared by KYTC and Stantec for the I-71, Gallatin County 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** – Increase capacity and improve mobility on I-71 near the KY 1039 and KY 35 traffic interchanges to serve both through traffic and local drivers traveling to and from Sparta and Glencoe
  - **Safety** – Reduce the potential for crashes
  - **Longevity** – Take steps now to provide long-term solutions for surface cracks, etc.
- **Project Need (Higher Order Functions):** Meet Demand, Enhance Safety, Improve Mobility, Increase Opportunity
- **Project Purpose (Basic Function):** Improve Capacity

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 Stantec presented a briefing on the project to the VE team on Tuesday, August 13.
- **Function Analysis / Creativity** – Key project functions were identified and prioritized by the VE team and utilized for brainstorming ideas in Creativity, including Meet Requirements, Improve Biddability, Minimize Cost, Maintain Traffic, and Enhance Longevity. During the Creativity Phase, the VE team generated 51 creative ideas by brainstorming individually and as groups in a collaborative online whiteboard space.
- **Evaluation** – The VE team did a simple, preliminary evaluation of ideas by assigning proposed categories to each idea in groups. The entire team then refined the preliminary scores by discussing each idea to reach a consensus.

- **Presentation** - After developing the Value Proposals, the VE team presented the developed proposals to project stakeholders at the out-brief meeting on Thursday, August 15.
- **Implementation** – Following delivery of the draft report, the project team reviewed the Value Proposals and made preliminary decisions to "Accept" or "Reject" each one for intended implementation into the project design. Five Value Proposals were accepted with a combined potential initial cost avoidance of $971K. These preliminary decisions and their justifications are documented in **Section 2.2** of this final report.

Section

2

Value Study Results and Proposals

2.1 Introduction

The value team brainstormed 51 creative ideas, of which 12 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, 21 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	12
Constructability & 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	21

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**
Meet Requirements										
MR-01	Extend asphalt under concrete wedge curb to prevent cracking	Improved	Improved	Improved	Maintained	($17,000)		($17,000)	Accept	*The Project Team would like to implement this recommendation, they will work through the design plans to provide notes for the contractor.*
Improve Biddability										
IB-02	Update time constraints to allow for more realistic construction requirements, i.e. lane closures for bridge removal and beam setting	Maintained	Maintained	Maintained	Maintained	$200,000		$200,000	Accept	*The Project Team would like to implement this recommendation. There is an acceptable detour route for US 42 to allow the contractor to close the road for 2 weekends to allow for bridge removal and setting of the beams. The Project Team decided that the closure would be okay for local traffic but a little more difficult for truck traffic. Maintenance of Traffic to be noted as such in the design plans for the contractor.*

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**
IB-04	Switch to 1.0" base throughout	Improved	Improved	Maintained	Maintained	$734,000		$734,000	Accept	*The Project Team would like to implement this recommendation. Because of the amount of Level and Wedging the 1.0" base will work for this project. There are not many instances where they are at grade and also have locations where the roadway crown is being shifted. This should be a fairly simple change to the design plans. This may prompt several questions from the contractors bidding this project on how to handle this change. The Project Team noted that with the 1.0" base the minimum thickness would be 3.0". They will add a note that the 1.0" base can be used as directed by the engineer.*
Minimize Cost										
MC-01	Adjust fill slopes behind guardrail to eliminate backslope cuts	Maintained	Maintained	Maintained	Improved	$279,000		$279,000	Reject	*The Project Team noted that there were only a few spots there this could be achieved and that the earthwork calculations from the VE study were different than what they had. The Project Team rejected this recommendation since the benefit was smaller than the amount of work required to adjust the design plans.*
MC-02	Remove 4-inch DGA layer	Maintained	Maintained	Maintained	Improved	$863,000		$863,000	Reject	*The Project Team rejected this recommendation because the Highway Design Manual and the Pavement Design Policy indicate that a 4" DGA layer should be utilized.*
MC-08	Use fibers in asphalt to improve functionality	Improved	Improved	Maintained	Maintained					

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**
	OPTION A: FIBER					($495,000)	$790,000	$295,000	Reject	*Although the Project Team rejected this recommendation, they did see the benefit of adding the fiber but noted that there was major concern that the existing concrete pavement would not get broken adequately when the Break and Seat was completed.*
	OPTION B: GEOCOMPOSITE					($1,961,000)	$790,000	($1,171,000)	Reject	*The Project Team rejected this recommendation. They believe the Break and Seat with accomplish the same outcome by helping with the reflective cracking.*
	OPTION C: CRACK SUPPRESSION LAYER					($1,445,000)	$790,000	($655,000)	Accept	*The Project Team will look into this recommendation. They believe that if use Modified Rubblization for the breaking of the existing concrete this Option will work. Will require the addition of a special note for rubblization.*
MC-10	Reuse cable for cable barrier replacement	Maintained	Maintained	Maintained	Maintained	$37,000		$37,000	Accept	*The Project Team would like to implement this recommendation and will note to remove and reuse the cable barrier along this project.*
MC-11	Install guardrail to eliminate any earthwork to the outside, tie down at 2:1	Maintained	Maintained	Maintained	Improved	$389,000		$389,000	Reject	*The Project Team rejected this recommendation since adding a roadside hazard is not in the best interest of the traveling public and the side slope work would be required anyway in order to improve the drainage of the roadway.*
MC-12	Use metal end sections or mitered ends on pipes to reduce head wall costs	Maintained	Maintained	Maintained	Maintained	$2,000		$2,000	Reject	*The Project Team rejected this recommendation due to the increase cost of design changes. They felt the additional design costs would be more than the benefit received.*

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**
MC-13	Instead of milling to concrete, saw and excavate and cement stabilize for improved pavement performance	Maintained	Improved	Improved	Degraded	($3,051,000)		($3,051,000)	Reject	*The Project Team rejected this recommendation due to the added time constraint to get the design plans changed for the scheduled letting date. This recommendation would require substantial changes to the plans.*
Maintain Traffic										
MT-04	Use contraflow traffic to allow surface to be paved in echelon	Improved	Improved	Improved	Maintained	$0	$972,000	$972,000	Reject	*The Project Team rejected this recommendation due to the complications of directing traffic through the interchanges with the existing barrier wall. The Consultant Team did review this recommendation in more detail.*
Enhance Longevity										
EL-01	Change cement modified layer from 8″ to 12″	Improved	Improved	Improved	Maintained	$1,489,000	$441,000	$1,930,000	Reject	*The Project Team rejected this recommendation due to the fact that the existing pavement design is adequate for its intended purpose.*

2.3 Constructability / 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
IS-01	Cut the top of the hills to reduce fill at sag
MR-02	Change crash wall ties from grout to epoxy
MR-03	Evaluate overhead sign supports (OHSS) for re-use
MR-04	Evaluate median boxes for extra weight of single-slope median barrier (SSMB)
IB-01	KYTC should keep maintenance function
IB-05	Modify note to allow elimination of rumble strips just ahead of work completion
MC-05	Allow non-tracking tack as an asphalt seal coat
MC-07	Split the wall with concrete board and place 2 half walls rather than asymmetric wall
MT-01	Reduce lane widths in MOT phases to allow for more space behind barrier wall
MT-02	Reduce shoulder widths in MOT to allow for constructability (Phases 1B, 1D, 2)
MT-06	Safe load pipes and bore and jack pipes
PA-02	Account for drainage ponding in phasing 1B, 1C, and 1D
IS-02	Close shoulders 2 miles before project to give visual cue of entering a work zone
IS-03	Use orange for WZ striping
EL-03	Use echelon paving in each phase
EL-04	Seal concrete deck
EL-05	Completely rubblize concrete pavement not just break and seat

Creative Idea No.	Design Comment
MI-01	Avoid making widened layer so small that paver cannot lay
MI-04	Cut the median wall short of bend at ends and use "permanent temporary" 9T to match up to next phase
MI-06	Allow excavation waste in gore areas
MI-07	Ensure there is adequate room behind the temporary 9T wall

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

MR-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Extend asphalt under concrete wedge curb to prevent cracking
FUNCTION	**Meet Requirements**

VALUE PROPOSAL SYNOPSIS:

Place concrete wedge curb on asphalt to improve longevity and operation of the curb.

Reliability	**Improved**	**Functionality**	**Improved**	**$ Initial Cost Avoidance (Add)**
O&M	**Improved**	**Schedule Impact**	**Maintained**	**($17,000)**

BASELINE CONCEPT:

The baseline proposal shown in detail K on sheet R2F shows the concrete wedge curb placed on rock shoulder wedge.

VALUE PROPOSAL DESCRIPTION:

Extend the asphalt under the concrete wedge curb. This will provide stability and improved longevity of the concrete curb.

ADVANTAGES:	**DISADVANTAGES:**
● Better stability for curb	● Additional asphalt cost
● Erosion prevention of the rock layer	●
● Prevents cracking and breaking of curb	●
●	●
●	●
●	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$1,433,000	$0	$1,433,000
VALUE PROPOSAL DESCRIPTION:	$1,450,000	$0	$1,450,000
TOTAL (Baseline less Proposed)	($17,000)	$0	($17,000)
			ADD COST

VALUE PROPOSAL

MR-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Extend asphalt under concrete wedge curb to prevent cracking

DISCUSSION & JUSTIFICATION:

• Technical Considerations
The asphalt wedge curb and associated dowel bars are not fixed by sitting on a rock pavement wedge. In order to properly set the dowels and curb, the curb should be placed on asphalt.

• Performance Impacts
The curb sitting on asphalt will lengthen the service life of the curb. The dowels will be fixed to the pavement and prevent less movement to provide less chance of future breakage.

• Cost Considerations
Additional asphalt will need to be placed to the guardrail post to place the curb on.

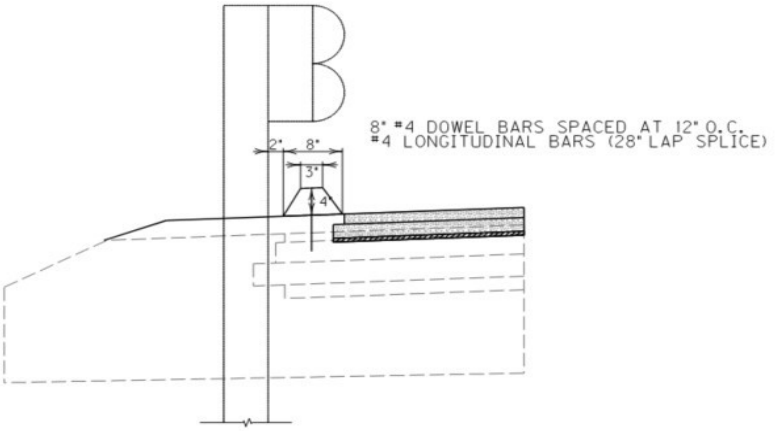
• Schedule Impacts
No schedule impacts should be anticipated.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

TITLE	Extend asphalt under concrete wedge curb to prevent cracking

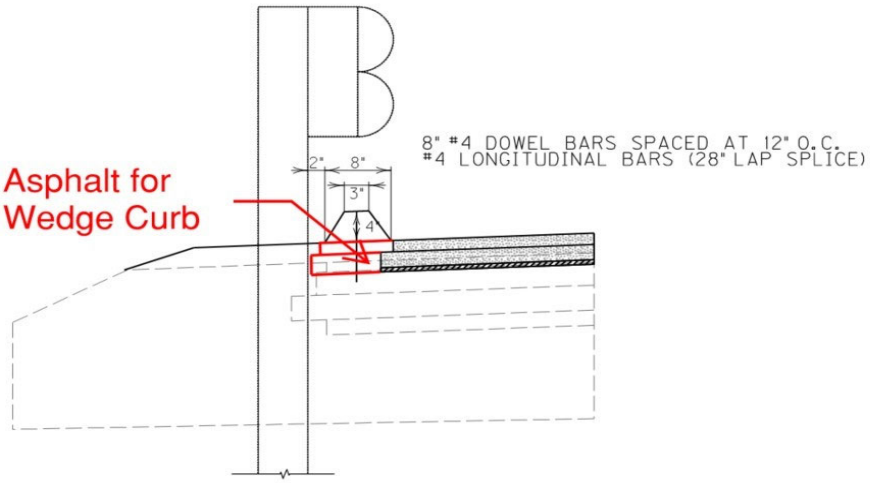
SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



CONCRETE WEDGE CURB DETAIL

TITLE	Extend asphalt under concrete wedge curb to prevent cracking

SKETCH/DIAGRAM: VALUE PROPOSAL



CONCRETE WEDGE CURB DETAIL

VALUE PROPOSAL

MR-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Extend asphalt under concrete wedge curb to prevent cracking
Assumptions & Calculations	Asphalt estimated at 110 lbs/sqyd-in Pricing based on AUB and provided estimate

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
CL3 ASPH Base 0.75D PG 64-22 (Carroll)	Tons	267	$95	$25,365	281	$95	$26,733
CL3 ASPH Surf 0.38D PG 64-22 (Carroll)	Tons	1,280	$100	$128,000	1,288	$100	$128,800
CL3 ASPH Base 0.75D PG 64-22 (Gallatin)	Tons	3,278	$95	$311,410	3,365	$95	$319,675
CL3 ASPH Surf 0.38D PG 64-22 (Gallatin)	Tons	9,357	$100	$935,700	9,409	$100	$940,900
CL3 ASPH Surf 0.38D PG 64-22 (Ramps B)	Tons	128	$100	$12,800	132	$100	$13,200
CL3 ASPH Surf 0.38D PG 64-22 (Ramp C)	Tons	202	$100	$20,200	204	$100	$20,400
TOTAL				$1,433,000			$1,450,000
Impact to Initial Cost (Baseline Less Proposed)							**($17,000)**

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

ADD COST

VALUE PROPOSAL

IB-02

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Update time constraints to allow for more realistic construction requirements, i.e. lane closures for bridge removal and beam setting
FUNCTION	**Improve Biddability**
ASSOCIATED IDEAS	RR-01: Create a detour up and around US 42 so KY 47 can stay closed (22 miles) MT-05: Allow KY 47 to be closed for weekend for bridge removal and add detours

VALUE PROPOSAL SYNOPSIS:

Modify proposed time constraints on KY 47 and I-71 to remove and minimize contractor risk from the MOT bid item.

Reliability	**Maintained**	**Functionality**	**Maintained**	**$ Initial Cost Avoidance (Add)**
O&M	**Maintained**	**Schedule Impact**	**Maintained**	**$200,000**

BASELINE CONCEPT:

Restrict KY 47 to 1 - 10 hour closure per phase for bridge removal. Restrict lane closures on I-71 to 1.5 miles.

VALUE PROPOSAL DESCRIPTION:

Allow 2 weekend closures of KY 47 utilizing US 42 during removal phase for removal and beam setting. Allow single lane closures with flagging on KY 47 for removal of substructure.

ADVANTAGES:	**DISADVANTAGES:**
● Provides detours for the public	● More impact occurences to the public
● Would allow some day work for demolition and improve worker safety	● Lengthy detour
● Reduces MOT price	●
● Increases public safety	●
●	●
●	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$1,000,000	$0	$1,000,000
VALUE PROPOSAL DESCRIPTION:	$800,000	$0	$800,000
TOTAL (Baseline less Proposed)	$200,000	$0	$200,000

AVOID COST

VALUE PROPOSAL

IB-02

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Update time constraints to allow for more realistic construction requirements, i.e. lane closures for bridge removal and beam setting

DISCUSSION & JUSTIFICATION:

The existing plans on page R53 has some stringent restrictions such as note Z stating that the entire bridge over KY 47 would need to be removed over the course of 10 hours. This is a removal of a 5 beam bridge. The contractor faces $10,000 per hour for every hour left in place.

Closing 47 and routing traffic to 42 via 1039 is a difference of approximately 10 miles. Allowing 2 weekend closures per phase for bridge removal and beam setting will greatly reduce the risk to the contractor. Allowing a night time closure for pouring the deck would allow increased safety for the deck pour and a better product by allowing the pump truck to set up on KY 47.

Allow 47 to be reduced to 1 lane with flagging operations during non-peak hours for substructure removal of the bridge.

Additional closure requirements restrict rumble strips to 1 mile at a time. Reword to require milled lengths to be repaved prior to opening in phase 1A. If the contractor can do 2 or 3 miles and get that opened back up before the time restrictions that should be allowed.

• The bridge demolition and beam setting should not be on the critical path. If so, something is wrong with the schedule. No impact.

• Risk is minimized to the contractor and should be reflected in the bid.

• Public Involvement Plan will need to be well detailed for local users.

Cost estimation based off one additional shift for removal (10 hr) and 1 shift for setting (10 hr). 20 hrs at 10,000/hr penalty should result in 200,000 risk taken out for the bridge alone.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

VALUE PROPOSAL

IB-02

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Update time constraints to allow for more realistic construction requirements, i.e. lane closures for bridge removal and beam setting
Assumptions & Calculations	Price based on an anticipated 2 days to remove the structure and one day to set the beams. Based on the LD note, the contractor will bid 20 hours of LD into his proposal to accomplish this which is 200,000

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
MOT (Gallatin)	LS	1	$500,000	$500,000	1	$300,000	$300,000
MOT (Carrol)	LS	1	$500,000	$500,000	1	$500,000	$500,000
TOTAL				$1,000,000			$800,000
						Impact to Initial Cost (Baseline Less Proposed)	**$200,000**

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

AVOID COST

VALUE PROPOSAL

IB-04

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Switch to 1.0" base throughout
FUNCTION	**Improve Biddability**
ASSOCIATED IDEAS	IB-06: Reduce asphalt bid items MC-03: Change 0.75" base to 1.0" base

VALUE PROPOSAL SYNOPSIS:

This replacement of a very rarely used and more costly asphalt type with a less expensive, more widely used product will reduce cost and improve constructability.

Reliability	**Improved**	**Functionality**	**Improved**	**$ Initial Cost Avoidance (Add)**	
O&M	**Maintained**	**Schedule Impact**	**Maintained**	**$734,000**	

BASELINE CONCEPT:

The baseline design includes the use of a 0.75 ASPH BASE bid item.

VALUE PROPOSAL DESCRIPTION:

Change all 0.75 ASPH BASE bid items to 1.0 ASPH BASE bid items and adjust lift thickness to match asphalt layer warrants. Replacing an expensive, rarely used asphalt base type with a lower-cost, more readily available type will reduce costs and material availability.

ADVANTAGES:	**DISADVANTAGES:**
● More common, readily available material	● Possibly increases use of level and wedge
● Improves constructability	●
● Consistent material across project	●
●	●
●	●
●	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$3,524,000	$0	$3,524,000
VALUE PROPOSAL DESCRIPTION:	$2,790,000	$0	$2,790,000
TOTAL (Baseline less Proposed)	$734,000	$0	$734,000

AVOID COST

VALUE PROPOSAL

IB-04

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Switch to 1.0" base throughout

DISCUSSION & JUSTIFICATION:

* Technical Considerations: Overall usage rates of differing ASPH BASE types were considered. The use of 1.0 BASE far exceeds the 0.75 BASE. Adjusting the layer thicknesses to match required warrants will improve compaction and durability. Some adjustments will be required to other layers to match standards and fit in the required template.

*Performance Impacts: The larger aggregate used in 1.0 BASE will provide a greater durability and wear resistance than the smaller 0.75 aggregate. Using a consistent material across the entire project will provide more uniformity in the mix, product placement, and should extend pavement life.

*Cost Considerations: Adjustments to the layer thicknesses may increase total asphalt used in some locations and reduce it in others. Any additional cost will be offset by the use of a lower cost (more readily available) product. Using 0.75 BASE will increase risk to contractor since as it is not produced regularly, it will have a higher chance for error in production. With less risk and increased total quantities of commonly used 1.0 Base, the bid price should decrease slightly.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

TITLE	Switch to 1.0" base throughout

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

Paving the 0.75 ASPH BASE layer

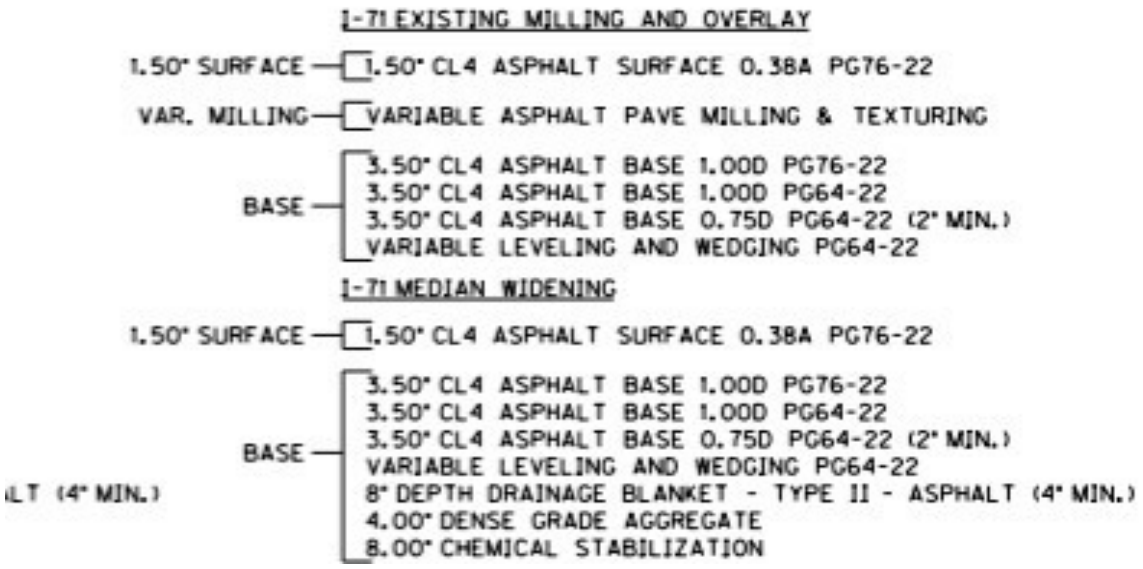
TITLE	Switch to 1.0" base throughout

SKETCH/DIAGRAM: VALUE PROPOSAL

Paving with 1.0 BASE

TITLE	Switch to 1.0" base throughout

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



Current total of 10.5" of ASPH BASE required. 2" min for 0.75 doesn't match warrent of 2.25" min.

TITLE	Switch to 1.0" base throughout

SKETCH/DIAGRAM: VALUE PROPOSAL

I-71 EXISTING MILLING AND OVERLAY:

1.5" CL4 ASPH SURF 0.38A PG76-22

VARIABLE ASPH PAVE MILLING & TEXTURING

3.0" CL4 ASPH BASE 1.00D PG76-22
3.0" CL4 ASPH BASE 1.00D PG64-22
4.5" CL4 ASPH BASE 1.00D PG64-22 (3.0" MIN)
VARIABLE LEVELING AND WEDGING PG64-22

I-71 MEDIAN WIDENING

1.5" CL4 ASPH SURF 0.38A PG76-22

3.0" CL4 ASPH BASE 1.00D PG76-22
3.0" CL4 ASPH BASE 1.00D PG64-22
4.5" CL4 ASPH BASE 1.00D PG64-22 (3.0" MIN)
VARIABLE LEVELING AND WEDGING PG64-22
8.0" DRAINAGE BLANKET TYPE II ASPH (4.0" MIN)
4.0" DGA
8.0" CHEMICAL STABILIZATION

Pavement changed to match warrents for depth requirements and use only 1.00D base.

VALUE PROPOSAL

IB-04

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Switch to 1.0" base throughout
Assumptions & Calculations	Costs based on KYTC Average unit Bid Prices (year 2023)

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
CL4 ASPH BASE 0.75D PG 64-22	TON	28,169	$110	$3,098,590			
CL4 ASPH BASE 1.00D PG 64-22	TON				28,169	$84	$2,369,858
CL3 ASPH BASE 0.75D PG64-22	TON	3,545	$120	$425,400			
CL3 ASPH BASE 1.00D PG64-22	TON				3,545	$118	$419,763
TOTAL				$3,524,000			$2,790,000
Impact to Initial Cost (Baseline Less Proposed)							**$734,000**

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

AVOID COST

VALUE PROPOSAL

MC-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Adjust fill slopes behind guardrail to eliminate backslope cuts
FUNCTION	**Minimize Cost**
ASSOCIATED IDEAS	OP-02: Eliminate small cuts MI-02: Go to 2:1 behind rail

VALUE PROPOSAL SYNOPSIS:

Tighten up slopes from 6:1 to 2:1 behind guardrail to eliminate excavation in this area.

Reliability	**Maintained**	**Functionality**	**Maintained**	**$ Initial Cost Avoidance (Add)**
O&M	**Maintained**	**Schedule Impact**	**Improved**	**$279,000**

BASELINE CONCEPT:

The existing slopes behind guardrail are shown to be 6:1, resulting in cut slopes.

VALUE PROPOSAL DESCRIPTION:

Eliminate cuts behind guardrail areas by placing 2:1 slopes in these areas.

ADVANTAGES:	DISADVANTAGES:
● Reduces earthwork cost	● None apparent
● Faster construction schedule	●
● Reduces chance of slope disturbance issues	●
●	●
●	●
●	●

$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	$2,892,000	$0	$2,892,000
VALUE PROPOSAL DESCRIPTION:	$2,613,000	$0	$2,613,000
TOTAL (Baseline less Proposed)	$279,000	$0	$279,000

AVOID COST

VALUE PROPOSAL

MC-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Adjust fill slopes behind guardrail to eliminate backslope cuts

DISCUSSION & JUSTIFICATION:

The 6:1 slopes were placed in order to try to obtain clear zone. In areas where guardrail is present, a clear zone is not required due to protection. Utilizing 2:1 slopes in lieu of 6:1 will allow these fill slopes to be minimized and the cut slopes to be eliminated.

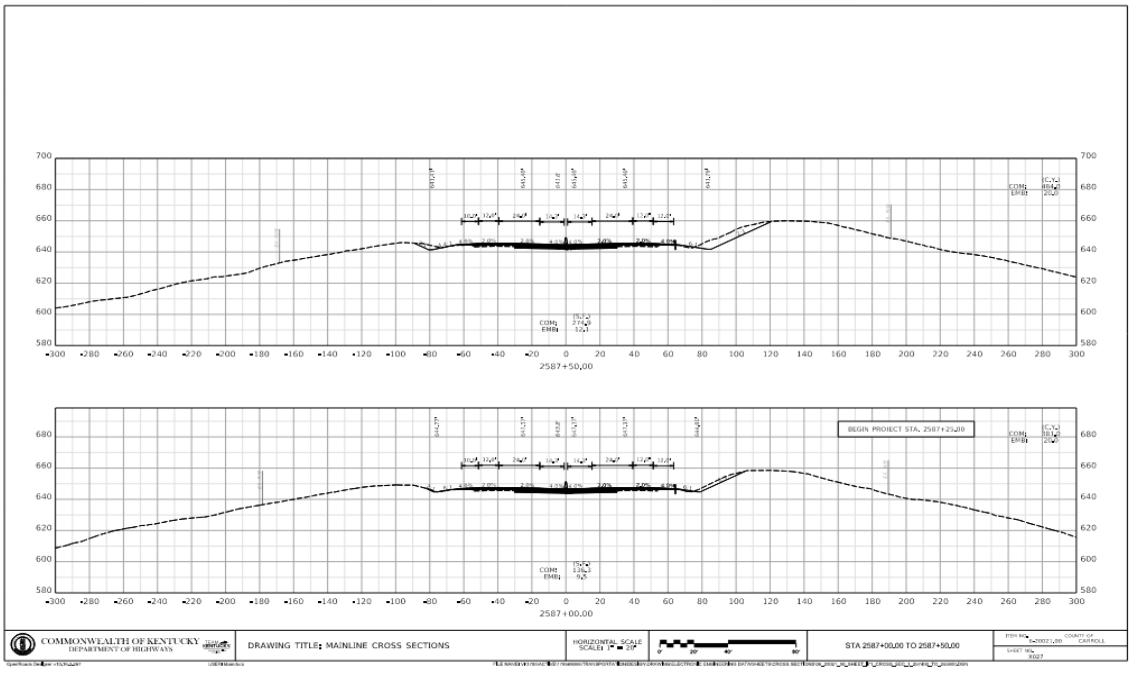
There are approximately 50 cross sections (roughly 2500 LF) where earthwork could be eliminated behind guardrail.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

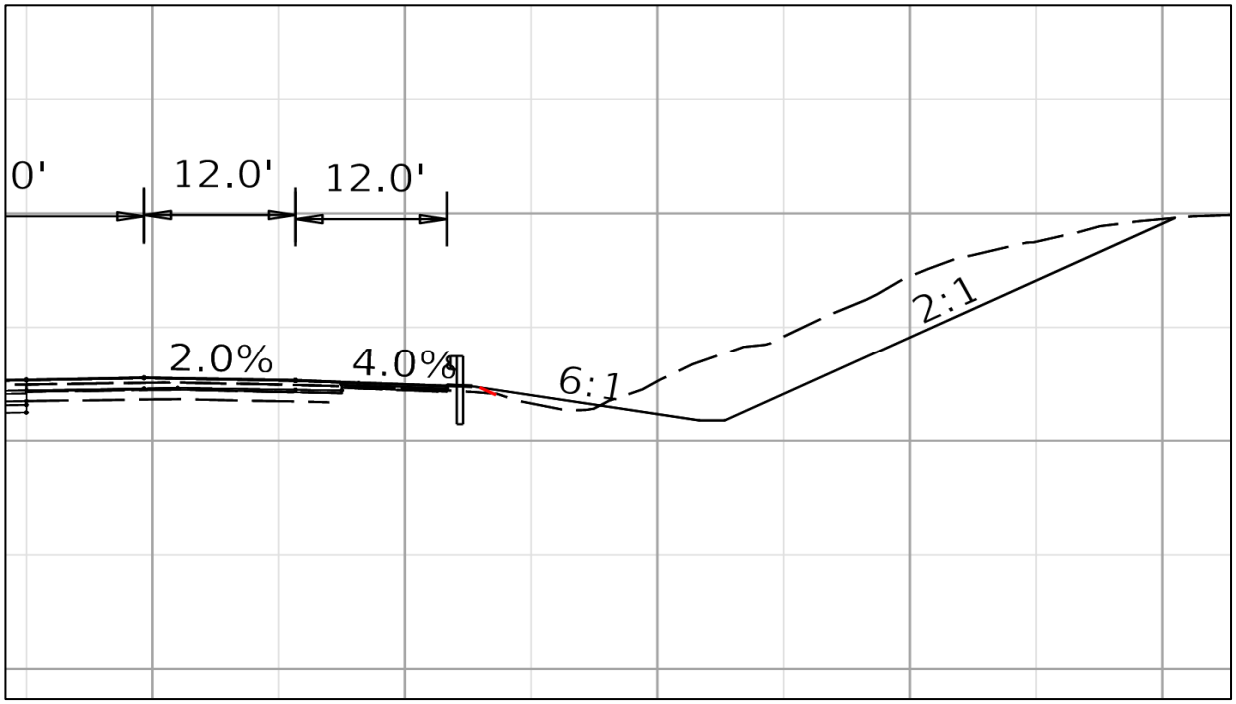
TITLE	Adjust fill slopes behind guardrail to eliminate backslope cuts

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



TITLE	Adjust fill slopes behind guardrail to eliminate backslope cuts

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

MC-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Adjust fill slopes behind guardrail to eliminate backslope cuts
Assumptions & Calculations	Costs based on KYTC AUB.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Roadway Excavation	CY	102,567	$28	$2,892,389	93,307	$28	$2,612,596
TOTAL				$2,892,000			$2,613,000
						Impact to Initial Cost (Baseline Less Proposed)	**$279,000**

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

AVOID COST

VALUE PROPOSAL

MC-02

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Remove 4-inch DGA layer
FUNCTION	**Minimize Cost**

VALUE PROPOSAL SYNOPSIS:

Remove the 4-inch DGA layer on top of the chemically stabilized subgrade. This proposal would also remove the asphalt curing seal on top of the DGA.

Reliability	**Maintained**	**Functionality**	**Maintained**	**$ Initial Cost Avoidance (Add)**
O&M	**Maintained**	**Schedule Impact**	**Improved**	**$863,000**

BASELINE CONCEPT:

The current design includes placing a 4-inch DGA course on top of the chemically stabilized subgrade with asphalt curing seal.

VALUE PROPOSAL DESCRIPTION:

Remove the 4-inch DGA layer on top of the chemically stabilized subgrade. This proposal would also remove the asphalt curing seal on top of the DGA. The DGA provides no significant structure to the pavement and does not benefit drainage. The asphalt curing seal can be removed with or without the DGA layer. It is not typical to place curing seal on DGA.

ADVANTAGES:	DISADVANTAGES:
● Reduces cost	● Contractor will need to maintain grade tolerances
● Reduces schedule	●
● Prevents overrun of quantities	●
●	●
●	●
●	●

$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	$1,003,000	$0	$1,003,000
VALUE PROPOSAL DESCRIPTION:	$140,000	$0	$140,000
TOTAL (Baseline less Proposed)	$863,000	$0	$863,000

AVOID COST

VALUE PROPOSAL

MC-02

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Remove 4-inch DGA layer

DISCUSSION & JUSTIFICATION:

Remove the 4-inch DGA layer on top of the chemically stabilized subgrade. This proposal would also remove the asphalt curing seal on top of the DGA. This design has proven very effective in Jefferson County. Asphalt treated drainage blanket was placed on top of cement stabilized subgrade in both asphalt and JPC applications and has not lead to any issues from the contractor or pavement performance.

The second layer of asphalt curing seal may be removed from the project. It is not a standard construction practice to apply asphalt curing seal or tack on top of rock base.

• The performance of the pavement layer will remain the same. There is an adequate layer of ATDB to promote drainage and load distribution.

• This proposal carries considerable cost savings.

• The schedule impact of this proposal should be positive. It take a considerable amount of time to place 30,000 tons of DGA base.

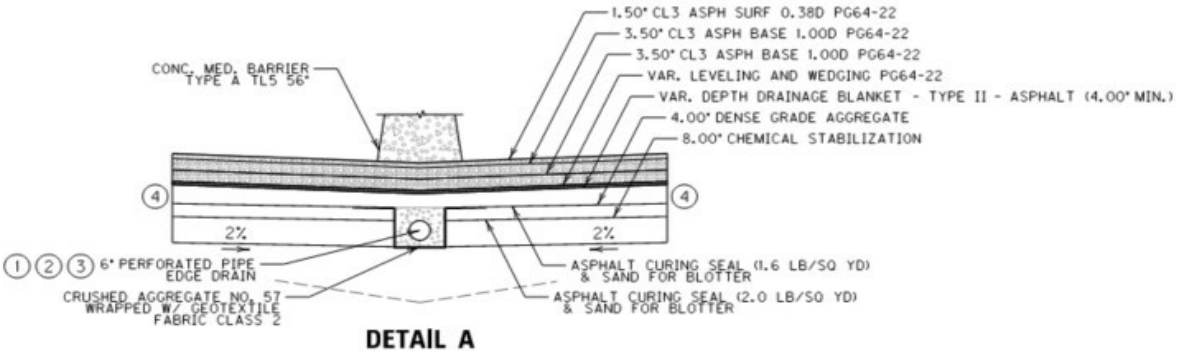
• There are 2 alternatives that may be considered separately from this proposal:
- The top of the cement stabilization could be raised by the depth of the DGA layer. This would result in additional savings.
- The second alternative is to change the cement stabilization from 8-inches to 12-inches. Additional cement stabilization carries a lower cost value compared to DGA. This is shown in a separate proposal (EL-01).

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

TITLE	Remove 4-inch DGA layer

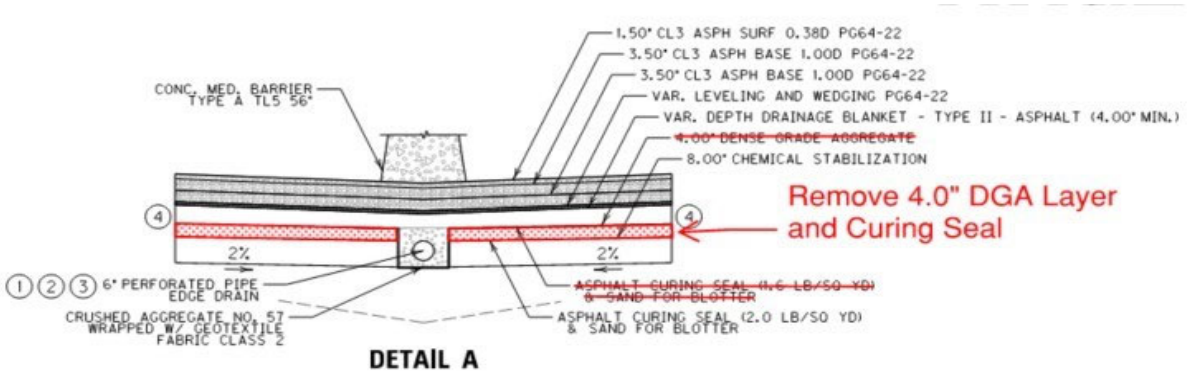
SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



DETAIL A

TITLE	Remove 4-inch DGA layer

SKETCH/DIAGRAM: VALUE PROPOSAL



DETAIL A

VALUE PROPOSAL

MC-02

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Remove 4-inch DGA layer
Assumptions & Calculations	DGA estimated at 115 lbs/SY-in Asphalt Curing Seal estimated at 1.6 lbs/SY-in Costs obtained from estimate submitted by KYTC.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
DGA Base (Carroll)	Tons	5,066	$28	$142,963	246	$28	$6,888
Asphalt Curing Seal (Carroll)	Tons	38	$791	$30,058	21	$791	$16,611
DGA Base (Gallatin)	Tons	24,288	$28	$680,064	1,159	$28	$32,452
Asphalt Curing Seal (Gallatin)	Tons	190	$791	$150,290	106	$791	$83,846
TOTAL				$1,003,000			$140,000
						Impact to Initial Cost (Baseline Less Proposed)	**$863,000**

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

AVOID COST

VALUE PROPOSAL

MC-08

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use fibers in asphalt to improve functionality
FUNCTION	**Minimize Cost**
ASSOCIATED IDEAS	EL-02: Add fibers to PG 76 pavement layers, and/or add grid or reflective cracking layer underneath

VALUE PROPOSAL SYNOPSIS:

Increase the durability, reduce crack propagation and increase the life expectancy of the asphalt pavement.

				$ OPTION A COST ADD	$ OPTION B COST ADD	$ OPTION C COST ADD
Reliability	**Improved**	**Functionality**	**Improved**			
O&M	**Improved**	**Schedule Impact**	**Maintained**	**($495,000)**	**($1,961,000)**	**($1,445,000)**

BASELINE CONCEPT:

The current design does not include fiber reinforcement.

VALUE PROPOSAL DESCRIPTION:

Increase the flexural strength of the asphalt mixture with the addition of aramid fibers and/or geocomposite reinforcement. Decrease the propagation of reflective cracks with the use of a new layer specificaly formulated to supress crack propagation. Reduce life cycle costs of the pavement via use of fiber, Geocomposite reinforcement and/or reflective cracking inhibator layer.

ADVANTAGES:	DISADVANTAGES:
● Less maintainence costs	● Higher initial cost
● Stronger more durable material	● Added construction activity (grid/rc layer)
● Reduction in cracking	●
● Longer pavement life	●

$ COST SUMMARY OPTION A: FIBER	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	$0	$1,305,000	$1,305,000
VALUE PROPOSAL DESCRIPTION:	$495,000	$515,000	$1,010,000
TOTAL (Baseline less Proposed)	($495,000)	$790,000	$295,000
			AVOID COST

$ COST SUMMARY OPTION B: GEOCOMPOSITE	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	$0	$1,305,000	$1,305,000
VALUE PROPOSAL DESCRIPTION:	$1,961,000	$515,000	$2,476,000
TOTAL (Baseline less Proposed)	($1,961,000)	$790,000	($1,171,000)
			ADD COST

$ COST SUMMARY OPTION C: CRACK SUPPRESSION LAYER	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	$1,840,000	$1,305,000	$3,145,000
VALUE PROPOSAL DESCRIPTION:	$3,285,000	$515,000	$3,800,000
TOTAL (Baseline less Proposed)	($1,445,000)	$790,000	($655,000)
			ADD COST

VALUE PROPOSAL

MC-08

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use fibers in asphalt to improve functionality

DISCUSSION & JUSTIFICATION:

*Technical Considerations: Positive history of increased durability of pavements with fibers added or when geocomposite reinforcement have been used. History of slower and much less total reflective cracking. propagation on projects with the crack suppression layer, fibers added and when geocomposites were used.

**Constructability: Fibers is high, with just need to be added to mix at plant.
Geocomposite is low due to process of placing layer with some hand work. Crack suppression layer is high, just need to place an additional layer of special mix.

* Cost Considerations: Initial cost will be higher as adding additional items to pavement design. Life cycle cost should provide overall savings with longer pavement life, less maintenance costs, and less cracking.

* Performance Impacts: Pavement life will be increased with the increase in flexural strength provided by the fibers and/or geocomposite or via the prevention of crack propagation by the crack suppression layer. Several projects with these additives have shown extended life and durability.

*Risk Considerations: Use of geocomposites and fibers is common enough that most if not all contractors have experience using or installing them on projects so no additional risk should be considered. The crack suppression layer has only been used on a couple of projects and might be considered a risk by contractors not accustomed to using it. Also, the CS layer has more weather limitations that might increase risk.

*Outside-the-box consideration: Reduce the total asphalt base thickness with the use of fiber and/or geocomposite reinforcement. Based on the performance of past projects consideration for reduction in pavement thickness to reduce total cost. Consider a reduction in asphalt base from 10.5" to 10.0".

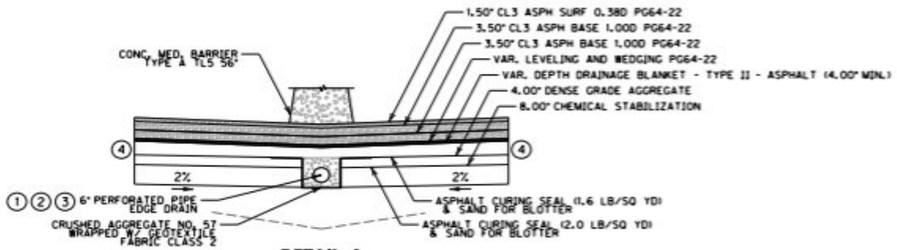
OUT-BRIEF PRESENTATION COMMENTS:

None noted.

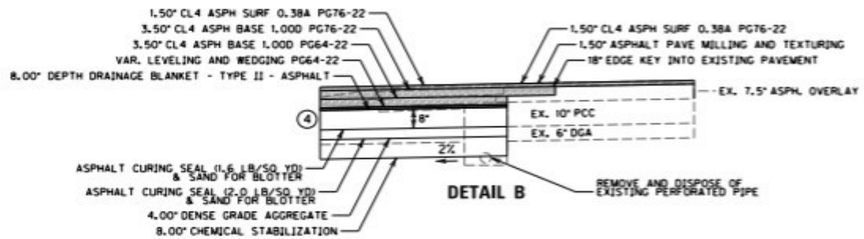
TITLE	Use fibers in asphalt to improve functionality

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

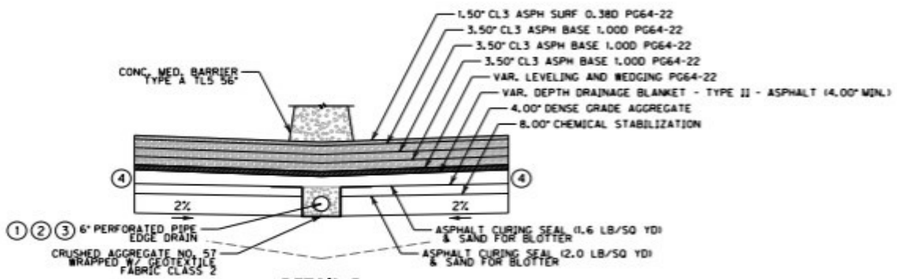
TYPICAL SECTIONS DETAILS



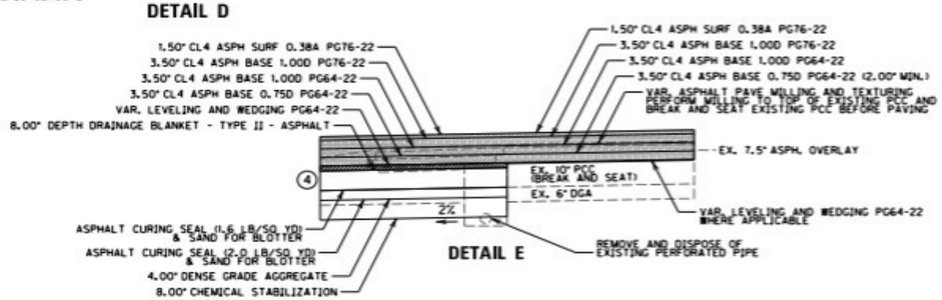
DETAIL A



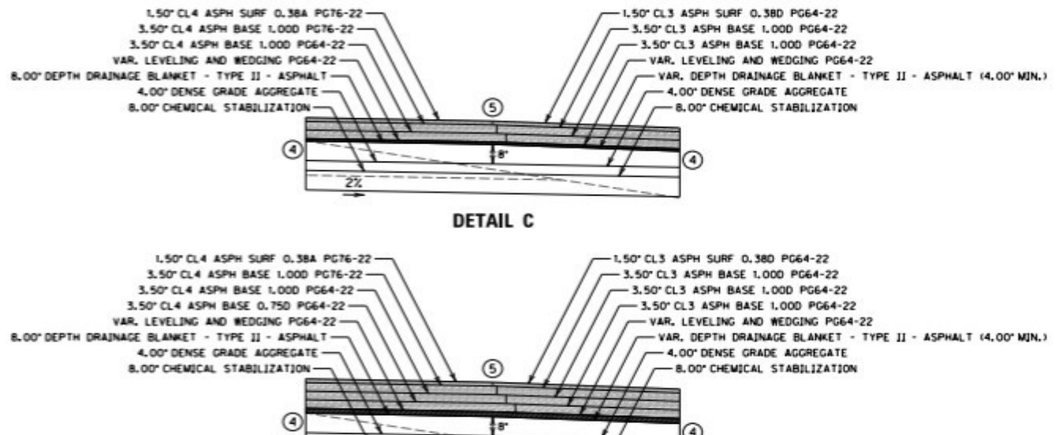
DETAIL B



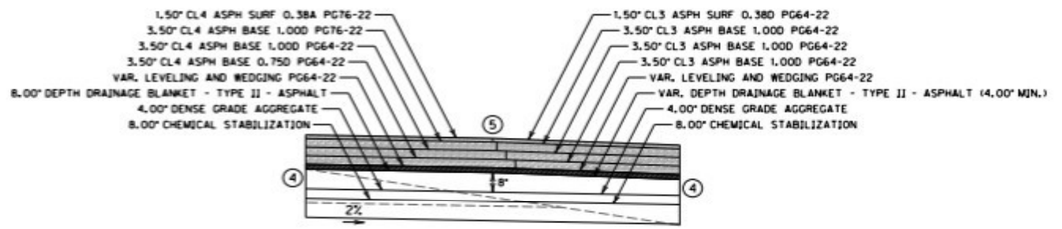
DETAIL D



DETAIL E



DETAIL C



DETAIL F

1. DRAIN TO THE STORM SEWER SYSTEM
2. MINIMUM 2" BETWEEN PERFORATED PIPE AND BOTTOM OF TRENCH
3. TRENCHING, FABRIC GEOTEXTILE CLASS 2, EMBANKMENT, EXCAVATION, STEEL PINS, AND CRUSHED AGGREGATE SIZE NO. 57 SHALL BE CONSIDERED INCIDENTAL TO THE UNIT PRICE FOR BID ITEM, "PERFORATED PIPE - 6IN".
4. DRAINAGE BLANKET MINIMUM DEPTH - 4 INCHES. DRAINAGE BLANKET, DENSE GRADE AGGREGATE, AND STABILIZED LAYERS SLOPED AT 2% TOWARDS CENTERLINE TO ENSURE POSITIVE DRAINAGE. INCREASE DRAINAGE BLANKET DEPTH ON HIGH SIDE OF SUPERELEVATION IN THE MEDIAN.
5. STEP PAVEMENT COURSES OUT THICKNESS OF LAYER.

VALUE PROPOSAL

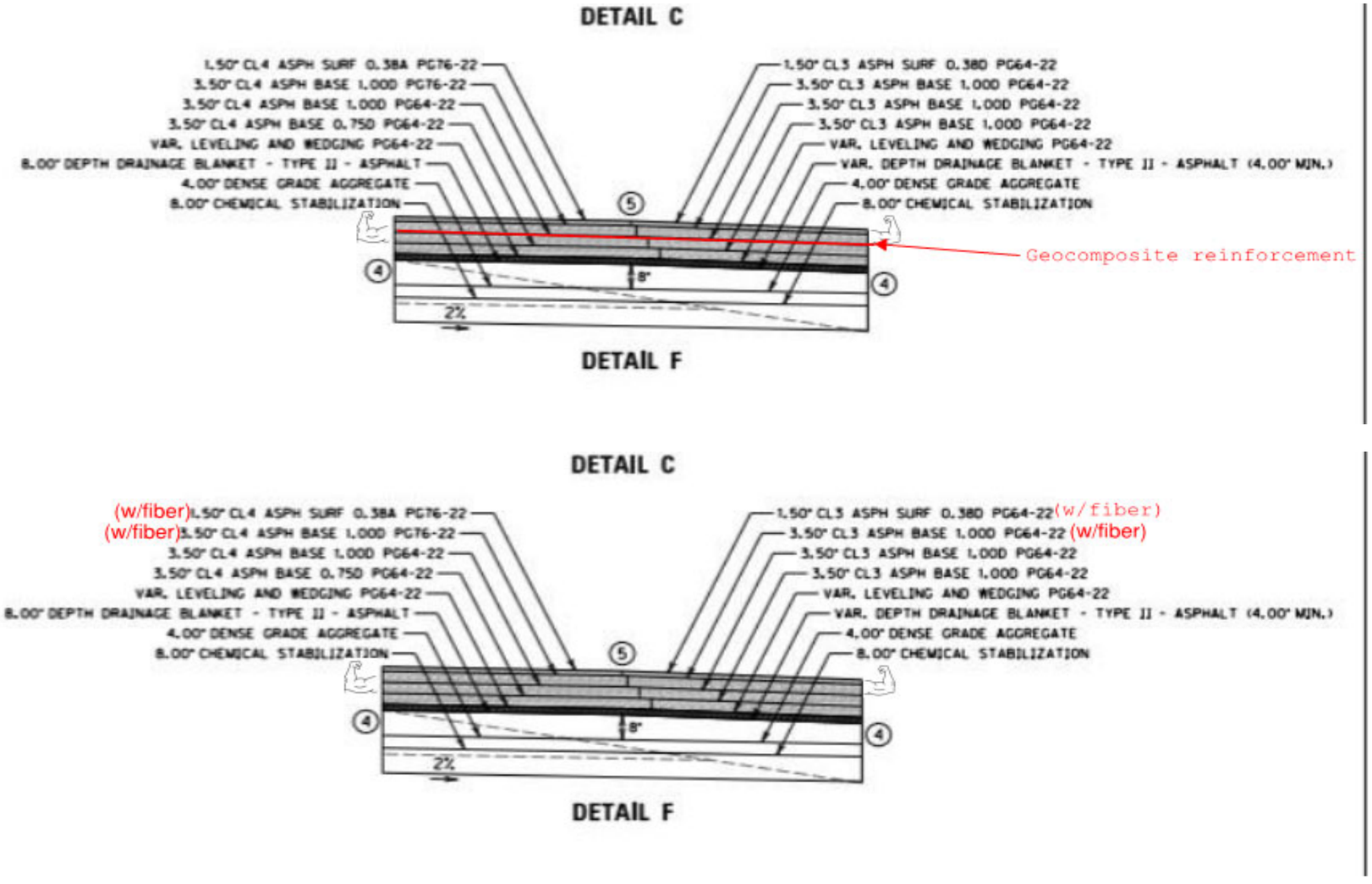
MC-08

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use fibers in asphalt to improve functionality

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

MC-08

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use fibers in asphalt to improve functionality
Assumptions & Calculations	OPTION A: FIBER Costs were from average unit bid prices (2023) or from bidx.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Fiber	ton				49,459	$10	$494,590
TOTAL				$0			$495,000
						Impact to Initial Cost (Baseline Less Proposed)	**($495,000)**

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

ADD COST

VALUE PROPOSAL

MC-08

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use fibers in asphalt to improve functionality
Assumptions & Calculations	OPTION B: GEOCOMPOSITE Costs were from average unit bid prices(2023) or from bidx.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Geocomposite reinforcement for asphalt	SQYD				199,120	$10	$1,961,332
TOTAL				$0			$1,961,000
Impact to Initial Cost (Baseline Less Proposed)							**($1,961,000)**

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

ADD COST

VALUE PROPOSAL

MC-08

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use fibers in asphalt to improve functionality
Assumptions & Calculations	OPTION C: CRACK SUPPRESSION LAYER Costs were from average unit bid prices(2023) or from bidx. Reduction of asphalt only for crack suppression layer.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
crack suppressive layer	TON				21,903	$150	$3,285,450
CL3 ASPH BASE 1.00D PG64-22	TON	21,903	$84	$1,839,852			
TOTAL				$1,840,000			$3,285,000
						Impact to Initial Cost (Baseline Less Proposed)	**($1,445,000)**

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

ADD COST

VALUE PROPOSAL

MC-08

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use fibers in asphalt to improve functionality

Assumptions				
Interest/Discount Rate(%):	**2.4%**		**Economic Life (yrs):**	12

LIFE CYCLE COST ANALYSIS

Salvage & Replacement Costs			**Baseline Concept**		**Value Proposal**	
Item	**Description**	**Yr**	**Est Cost**	**Pres Worth**	**Est Cost**	**Pres Worth**
1	Joint/Crack Seal	4	$125,000	$113,687		
2	Joint/Crack Seal	6	$125,000	$108,420		
3	Joint/Crack Seal	8	$125,000	$103,398	$31,250	$25,849
4	Joint/Crack Seal	10	$125,000	$98,608	$62,500	$49,304
5	Pothole Repair/Patching	5	$150,000	$133,227	$75,000	$66,613
6	Pothole Repair/Patching	7	$150,000	$127,055	$75,000	$63,527
7	Base Failure Repair	8	$750,000	$620,385	$375,000	$310,193
8						
9						
10						
Total Salvage & Replacement Costs			**$1,550,000**	**$1,304,779**	**$618,750**	**$515,487**

Annual Costs (pres worth calculated over 12 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)	**$1,305,000**	**$515,000**
RESULTS (Proposed less Baseline)	**AVOID COST of $790,000**	

Notes: 1) Total Present Worth is rounded to the nearest thousand dollars, 2) Initial costs are covered in the Detail sheet.
Assumptions & Calculations: Any assumptions made or support calculations that were developed to support the quantities used in the LCC should be included.

VALUE PROPOSAL

MC-10

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Reuse cable for cable barrier replacement
FUNCTION	**Minimize Cost**
ASSOCIATED IDEAS	MI-05: Reuse cable rail rope

VALUE PROPOSAL SYNOPSIS:

Rather than discarding the cable rail wire rope and posts, the VE team recommends changing the item to a remove and reinstall to reduce costs.

Reliability	**Maintained**	**Functionality**	**Maintained**	**$ Initial Cost Avoidance (Add)**
O&M	**Maintained**	**Schedule Impact**	**Maintained**	**$37,000**

BASELINE CONCEPT:

The current design concept is to remove the cable guardrail system and install a new cable guardrail system.

VALUE PROPOSAL DESCRIPTION:

By reusing the wire rope and posts from the existing cable rail system, the integrity and functionality of the cable guardrail system is maintained while reducing costs. The KYTC engineer will have the ability to select the existing components that are deemed fit for reuse. There may even be enough to maintain a stockpile for future requirements.

ADVANTAGES:	**DISADVANTAGES:**
● Functionality maintained	● No shiny new components
● Reduced Cost	● Engineer inspecton of existing cables
●	●
●	●
●	●
●	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$181,000	$0	$181,000
VALUE PROPOSAL DESCRIPTION:	$144,000	$0	$144,000
TOTAL (Baseline less Proposed)	$37,000	$0	$37,000

AVOID COST

VALUE PROPOSAL

MC-10

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Reuse cable for cable barrier replacement

DISCUSSION & JUSTIFICATION:

• Performance Impacts
Durability and longevity of the cable rail system is equal to existing. There is no difference in reusing it versus leaving in place.

• Cost Considerations
This will result in a reduced project cost overall.

• Schedule Impacts
None apparent.

• Risk Considerations
None apparent.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

TITLE	Reuse cable for cable barrier replacement

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

TITLE	Reuse cable for cable barrier replacement

SKETCH/DIAGRAM: VALUE PROPOSAL

VALUE PROPOSAL

MC-10

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Reuse cable for cable barrier replacement
Assumptions & Calculations	Cost were based on KYTC AUBP and recent bid regional bid data since 2022

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
High Tension Cable Rope Barrier System	LF	1,630	$25	$41,435			
Cable Barrier System Remove and Restore	LS				1	$16,000	$16,000
Remove Cable Barrier System	LF	19,923	$7	$139,461	18,293	$7	$128,051
TOTAL				$181,000			$144,000
						Impact to Initial Cost (Baseline Less Proposed)	**$37,000**

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

AVOID COST

VALUE PROPOSAL

MC-11

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Install guardrail to eliminate any earthwork to the outside, tie down at 2:1
FUNCTION	**Minimize Cost**

VALUE PROPOSAL SYNOPSIS:

Eliminate all cut and fill beyond existing roadway by installing guardrail in areas where earthwork is being performed.

Reliability	**Maintained**	**Functionality**	**Maintained**	**$ Initial Cost Avoidance (Add)**
O&M	**Maintained**	**Schedule Impact**	**Improved**	**$389,000**

BASELINE CONCEPT:

Create clear zone (CZ) of 30' by using 6:1 slopes from edge of pavement. Tie back with a 2:1 cut backslope.

VALUE PROPOSAL DESCRIPTION:

Install guardrail in the larger cut areas to eliminate substantial cut slopes by allowing the use of 2:1 fill slopes in lieu of 6:1.

ADVANTAGES:	**DISADVANTAGES:**
● Improves construction schedule	● Adds guardrail and crash cushions
● Eliminates earthwork cut outside the existing roadway	● Additional maintenance costs for rail
● Allows more flexibility for ditch repair maintenance	●
● Saves cost	●
●	●
●	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$2,892,000	$0	$2,892,000
VALUE PROPOSAL DESCRIPTION:	$2,503,000	$0	$2,503,000
TOTAL (Baseline less Proposed)	$389,000	$0	$389,000

AVOID COST

VALUE PROPOSAL

MC-11

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Install guardrail to eliminate any earthwork to the outside, tie down at 2:1

DISCUSSION & JUSTIFICATION:

There are significant cuts beginning at station 2618+00 and ending at 2628+50 in order to obtain clear zone. By installing guardrail, the need to obtain the clear zone would be eliminated. There are two other areas where the savings may be smaller but by installing guardrail and eliminating the earthwork,the project duration for that phase should be able to be reduced. These locations are 2584+00 to 2588+00 as well as 2607+00 to 2612+50.

In addition to installing guardrail at these locations, the VE team believes there are several areas where the existing backslopes meet the CZ (i.e. 2636+00 area) without having to change to a 6:1 and push out the earthwork. These savings have not been reflected, but the team believes there could be substantial savings by adjusting the cross sections to eliminate any unnecessary earthwork.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

VALUE PROPOSAL

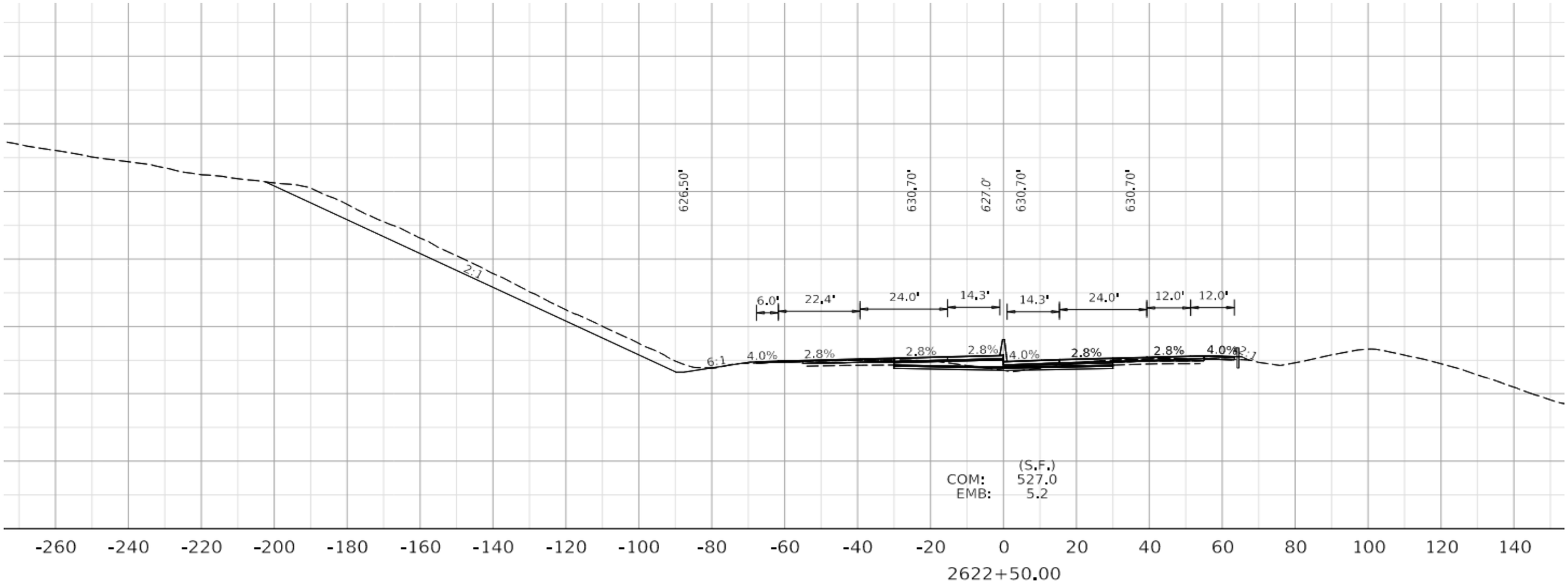
MC-11

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Install guardrail to eliminate any earthwork to the outside, tie down at 2:1

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



VALUE PROPOSAL

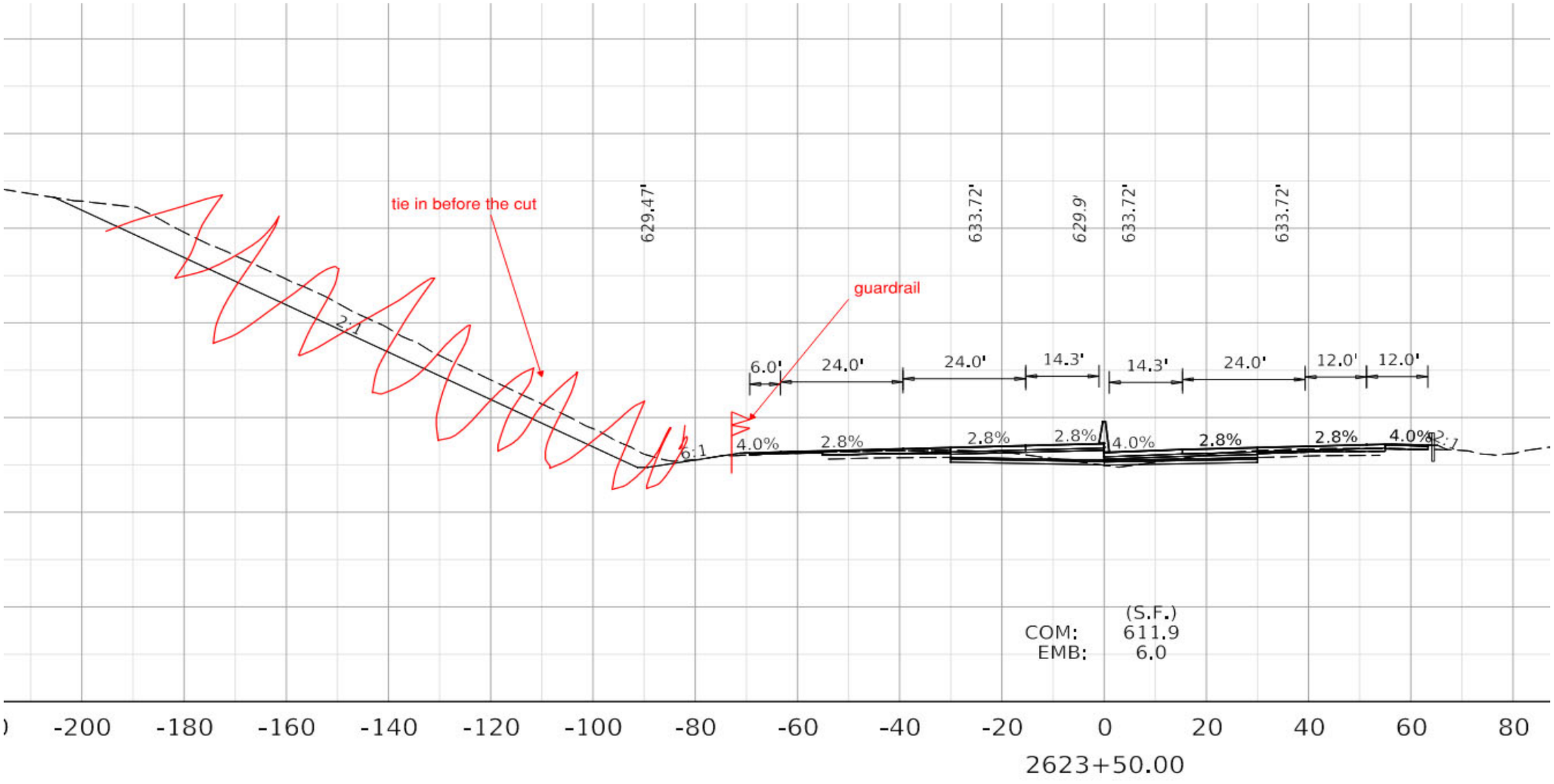
MC-11

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Install guardrail to eliminate any earthwork to the outside, tie down at 2:1

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

MC-11

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Install guardrail to eliminate any earthwork to the outside, tie down at 2:1
Assumptions & Calculations	Costs based on provided estimates.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Roadway Excavation	CY	102,567	$28	$2,892,389	86,467	$28	$2,421,076
Guardrail 7' post	LF	0	$0	$0	2,000	$36	$72,800
End Treatment Type 1	EACH	0	$0	$0	2	$4,374	$8,748
TOTAL				$2,892,000			$2,503,000
Impact to Initial Cost (Baseline Less Proposed)							**$389,000**

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

AVOID COST

VALUE PROPOSAL

MC-12

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use metal end sections or mitered ends on pipes to reduce head wall costs
FUNCTION	**Minimize Cost**

VALUE PROPOSAL SYNOPSIS:

By exchanging concrete headwalls and end sections for metal end sections or mitered ends on pipes, functionality intended in design is maintained while costs are reduced.

Reliability	**Maintained**	**Functionality**	**Maintained**	**$ Initial Cost Avoidance (Add)**	
O&M	**Maintained**	**Schedule Impact**	**Maintained**	**$2,000**	

BASELINE CONCEPT:

Use of traditional precast headwalls and slope flared end sections.

VALUE PROPOSAL DESCRIPTION:

Replace precast concrete with preformed metal end sections or mitered pipe headwalls.

ADVANTAGES:	**DISADVANTAGES:**
● Improves constructability	● Lacks the "belt and suspenders" feel
● Reduces cost	●
●	●
●	●
●	●
●	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$51,000	$0	$51,000
VALUE PROPOSAL DESCRIPTION:	$49,000	$0	$49,000
TOTAL (Baseline less Proposed)	$2,000	$0	$2,000

AVOID COST

VALUE PROPOSAL

MC-12

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use metal end sections or mitered ends on pipes to reduce head wall costs

DISCUSSION & JUSTIFICATION:

• Performance Impacts
Similar performance and longevity, but with better constructability.

• Cost Considerations
Provides a more economic option.

• Schedule Impacts
Potentially reduces lead times and fabrication delays.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

VALUE PROPOSAL

MC-12

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use metal end sections or mitered ends on pipes to reduce head wall costs
Assumptions & Calculations	Bid prices based on KYTC AUBP and bid tab data from the region since 2022.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Pipe Culvert Headwall 18"	EA	7	$2,418	$16,926			
Pipe Culvert Headwall 24"	EA	10	$2,981	$29,810			
S&F inlet-Outlet 24"	EA	1	$4,649	$4,649			
METAL END SECTION TY 3-18 IN	EA				7	$2,586	$18,102
METAL END SECTION TY 3-24 IN	EA				11	$2,775	$30,525
TOTAL				$51,000			$49,000
Impact to Initial Cost (Baseline Less Proposed)							**$2,000**

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

AVOID COST

VALUE PROPOSAL

MC-13

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Instead of milling to concrete, saw and excavate and cement stabilize for improved pavement performance
FUNCTION	**Minimize Cost**

VALUE PROPOSAL SYNOPSIS:

Remove and replace existing JPC with cement modified subgrade. This would improve overall project drainage and uncertainity with the existing JPC. The removal would be based on roadway excavation instead of milling. The proposal could also remove large amounts of level and wedge quantities.

Reliability	**Maintained**	**Functionality**	**Improved**	**$ Initial Cost Avoidance (Add)**
O&M	**Improved**	**Schedule Impact**	**Degraded**	**($3,051,000)**

BASELINE CONCEPT:

Mill the existing pavement (approx 7.5-in) down to existing concrete, break and seat, and build back pavement section.

VALUE PROPOSAL DESCRIPTION:

Remove the existing aspahlt and concrete and replace existing with more suitable materials. This would allow the existing concrete to be removed and prevent any future maintance issues arising from the existing concrete.

ADVANTAGES:	**DISADVANTAGES:**
● Vertical curves could be redesigned to limit level and wedge quantities	● Additonal cost
● Removes deteriorated concrete layer	● Additional cement stabilization and drainage blanket quantities
● Improves subgrade	● Additional design cost and time
● Improves drainage across section	●
● Limits future maintenace by leaving unknown base under JPC	●
● Removes the fixed grade	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$9,560,000	$0	$9,560,000
VALUE PROPOSAL DESCRIPTION:	$12,611,000	$0	$12,611,000
TOTAL (Baseline less Proposed)	($3,051,000)	$0	($3,051,000)
			ADD COST

VALUE PROPOSAL

MC-13

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Instead of milling to concrete, saw and excavate and cement stabilize for improved pavement performance

DISCUSSION & JUSTIFICATION:

This proposal would have several benefits to KYTC. The existing concrete provides a fixed grade that can not be lowered where needed. By removing the existing JPC, the grade could be adjusted in areas. By adjusting the grades, the amount of project level and wedge quantities could be dramatically reduced. The soils and conditions under existing JPC have always been an unknown in projects. Many base failures that have shown through I-71 appear to begin in the layer below the JPC. This proposal would allow a defined subgrade to be created and provide better drainage to the pavement section.

• The soils shown in the geotechnical pages are among some of the worst in KY. The soils and rock layers degrade rapidly when exposed to moisture creating an unstable layer as roadway base. Chemical stabilization will help stabilize the soils.

• Pavement performance criteria has shown that roads built on stabilized bases have outperformed roads in which stabilization did not occur. The amount of extensive rehabilitation is significantly lowered reducing costs for years to come.

• The initial comparison shows an increase in cost. This does not take into account future rehabilitation and paving savings that could be achieved.

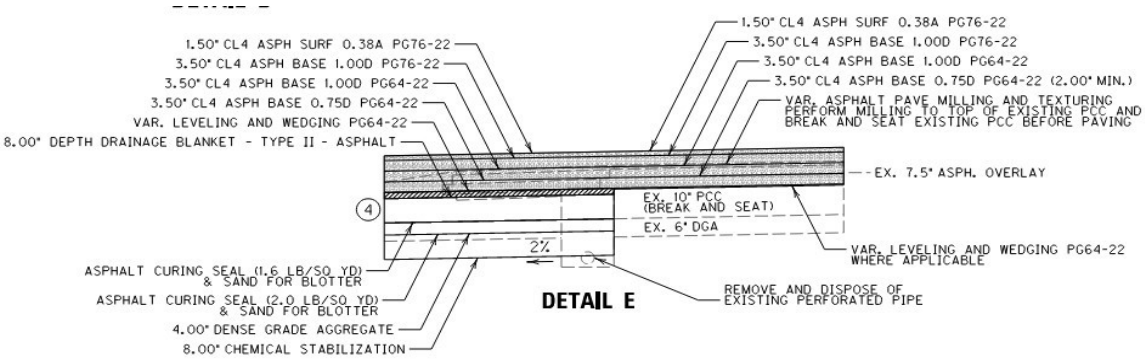
• The design schedule would be impacted by making these changes. The construction schedule could remain the same. With fall soon arriving, a very small amount of work would be impacted this year.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

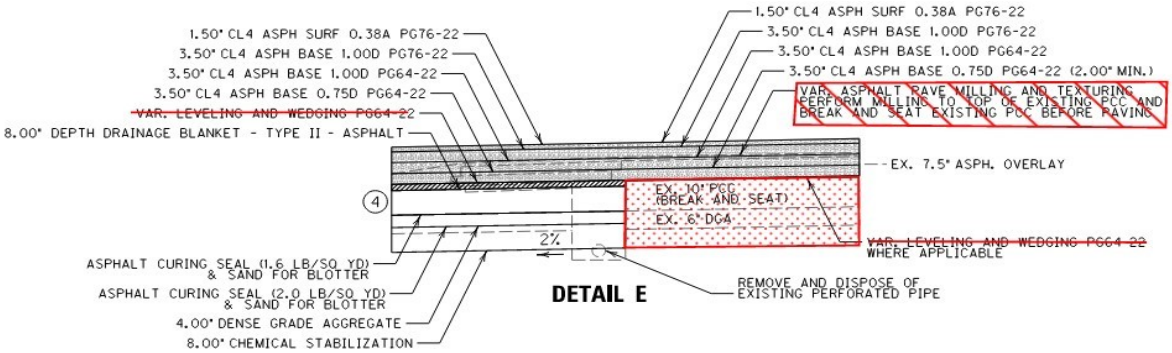
TITLE	Instead of milling to concrete, saw and excavate and cement stabilize for improved pavement performance

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



TITLE	Instead of milling to concrete, saw and excavate and cement stabilize for improved pavement performance

SKETCH/DIAGRAM: VALUE PROPOSAL



Removal quantities can be added to **Roadway Excavation.**
Level and Wedge would not be required to even up the sections.

VALUE PROPOSAL

MC-13

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Instead of milling to concrete, saw and excavate and cement stabilize for improved pavement performance
Assumptions & Calculations	Quantity estimates were completed using conversions found in plan set Costs were based on AUB and provided estimate

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Milling and Texture(Carroll)	Tons	3,930	$25	$98,250	1,470	$25	$36,750
Break and Seat Conc (Carroll)	SQ YD	5,965	$2	$11,930	0	$2	$0
Level and Wedge PG64-22 (Carroll)	Tons	2,437	$85	$207,145	132	$85	$11,220
Roadway Excavation (Carroll)	CU YD	10,224	$18	$184,032	14,538	$18	$261,684
8-in Chemical Stabilization (Carroll)	SQ YD	20,956	$4	$83,824	26,921	$4	$107,684
Asphalt Curing Seal (Carroll)	Tons	21	$791	$16,611	27	$791	$21,357
Cement (Carroll)	Tons	461	$245	$112,945	592	$245	$145,040
8-in Drainage Blanket (Asphalt Treated) Carroll	Tons	7,292	$78	$568,776	9,678	$78	$754,884
Milling and Texture(Gallatin)	Tons	44,705	$25	$1,117,625	8,570	$25	$214,250
Break and Seat Conc (Gallatin)	SQ YD	87,601	$2	$144,542	0	$2	$0
Roadway Excavation (Gallatin)	CU YD	90,993	$18	$1,637,874	154,358	$18	$2,778,444
Level and Wedge PG64-22 (Gallatin)	Tons	17,933	$85	$1,524,305	9,727	$85	$826,795
8-in Chemical Stabilization (Gallatin)	SQ YD	74,601	$4	$298,404	162,202	$4	$648,808
Asphalt Curing Seal (Gallatin)	Tons	106	$791	$83,846	163	$791	$128,933
Cement (Gallatin)	Tons	1,642	$245	$402,290	3,569	$245	$874,405
8-in Drainage Blanket (Asphalt Treated) Gallatin	Tons	39,325	$78	$3,067,350	74,366	$78	$5,800,548
TOTAL				$9,560,000			$12,611,000
						Impact to Initial Cost (Baseline Less Proposed)	**($3,051,000)**

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

ADD COST

VALUE PROPOSAL

MT-04

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use contraflow traffic to allow surface to be paved in echelon
FUNCTION	**Maintain Traffic**

VALUE PROPOSAL SYNOPSIS:

Slight modification in MOT to provide a much more durable longer lasting pavement. Paving in echelon reduces weak spots in the asphalt mat and improves lifetime performance and better ride quality.

Reliability	**Improved**	**Functionality**	**Improved**	**$ Initial Cost Avoidance (Add)**	
O&M	**Improved**	**Schedule Impact**	**Maintained**	**$0**	

BASELINE CONCEPT:

The current design does not use echelon paving.

VALUE PROPOSAL DESCRIPTION:

Change MOT to move all traffic to one side of the barrier wall to pave in echelon all lanes on the other side of the wall. Eliminate the cold joint between asphalt surface layers via use of paving in echelon.

ADVANTAGES:	DISADVANTAGES:
● More durable pavement joints	● Traffic not able to use exit to KY 1039
● Longer lasting pavement	● More complex construction scheduling
● Less maintenance	●
● Smoother ride quality	●
● Better compaction	●
●	●

$ COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE CONCEPT:	$0	$1,723,000	$1,723,000
VALUE PROPOSAL DESCRIPTION:	$0	$751,000	$751,000
TOTAL (Baseline less Proposed)	$0	$972,000	$972,000

AVOID COST

VALUE PROPOSAL

MT-04

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use contraflow traffic to allow surface to be paved in echelon

DISCUSSION & JUSTIFICATION:

*Technical Considerations: Need for more equipment and scheduling with asphalt plant. Improved ride quality and pavement longevity from experience with other past projects. With some creative use of barrels and striping the exit closure can be limited to a weekend.

*Cost Considerations: Slightly more complex and potentailly more man power needed per day, but faster operation, so cost should be about the same.

*Performance Impacts: Longevity of the better constructed joints reduces future maintenance costs. Raveling and other deteriation of construction joints between pavement lanes is a major contributer to pavements requiring patching, repair or rehabilitation. PAIKY discusses how to roll a better joint each year at the winter school.

*Schedule impacts: This increases the complexity of scheduling paving operations, but speeds up the paving process. So the individual day is more complex but less days are needed.

*Risk Considerations: Delays with transporting asphalt to the site such as plant breakdown or trucks stuck in traffic can impact the overall quality of the asphalt mat, but not much more than during normal one lane at a time paving.

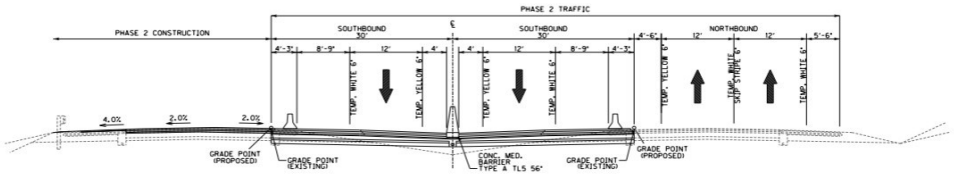
OUT-BRIEF PRESENTATION COMMENTS:

None noted.

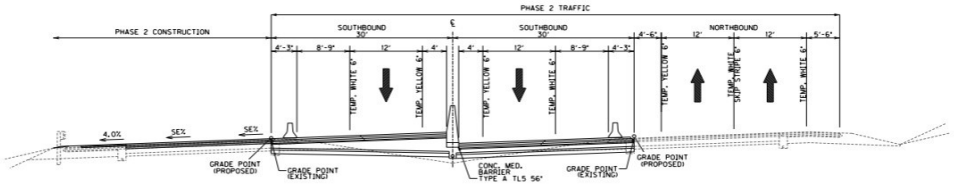
TITLE	Use contraflow traffic to allow surface to be paved in echelon

SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT

TYPICAL SECTIONS
MAINTENANCE OF TRAFFIC
PHASE 2



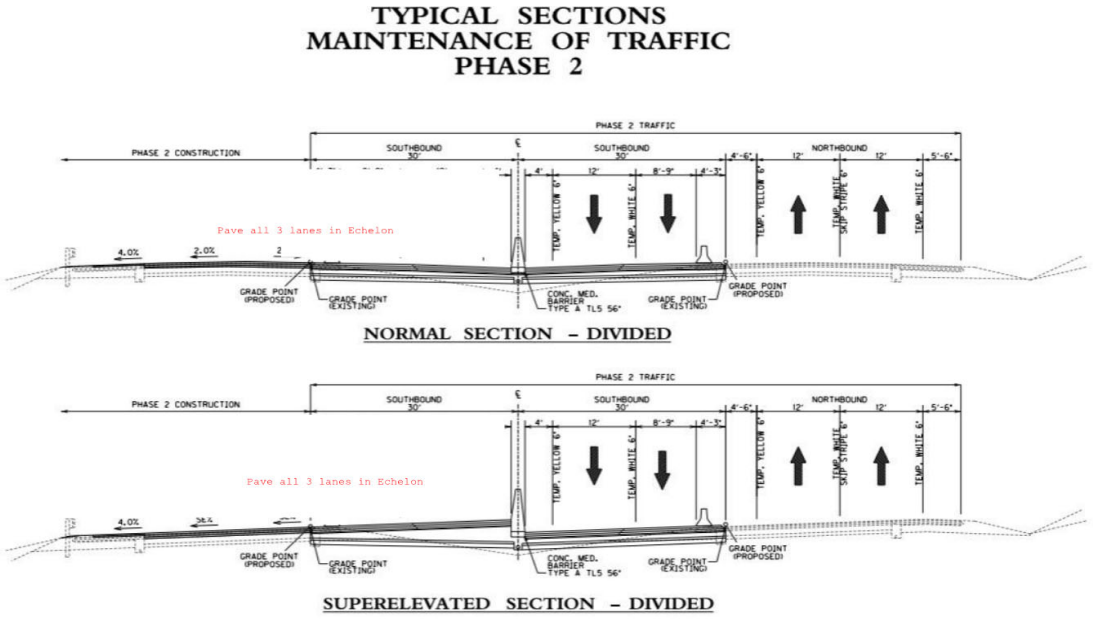
NORMAL SECTION – DIVIDED



SUPERELEVATED SECTION – DIVIDED

TITLE	Use contraflow traffic to allow surface to be paved in echelon

SKETCH/DIAGRAM: VALUE PROPOSAL



VALUE PROPOSAL

MT-04

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use contraflow traffic to allow surface to be paved in echelon
Assumptions & Calculations	Our assumption is that increased labor and equipment costs are balanced out by reduced construction time.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
See "assumptions and calculations" above.							
TOTAL				$0			$0
						Impact to Initial Cost (Baseline Less Proposed)	**$0**

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

NO CHANGE

VALUE PROPOSAL

MT-04

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Use contraflow traffic to allow surface to be paved in echelon

Assumptions				
Interest/Discount Rate(%):	**2.4%**		**Economic Life (yrs):**	12

LIFE CYCLE COST ANALYSIS

Salvage & Replacement Costs			**Baseline Concept**		**Value Proposal**	
Item	**Description**	**Yr**	**Est Cost**	**Pres Worth**	**Est Cost**	**Pres Worth**
1	Joint/Crack Seal	4	$125,000	$113,687		
2	Joint/Crack Seal	6	$125,000	$108,420		
3	Joint Replacement	8	$1,500,000	$1,240,771	$750,000	$620,385
4	Pothole Repair/Patching	5	$150,000	$133,227	$75,000	$66,613
5	Pothole Repair/Patching	7	$150,000	$127,055	$75,000	$63,527
6						
7						
8						
9						
10						
Total Salvage & Replacement Costs			**$2,050,000**	**$1,723,160**	**$900,000**	**$750,526**

Annual Costs (pres worth calculated over 12 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	**$1,723,000**	**$751,000**
RESULTS (Proposed less Baseline)	**AVOID COST of $972,000**	

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

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

VALUE PROPOSAL

EL-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Change cement modified layer from 8" to 12"
FUNCTION	**Enhance Longevity**

VALUE PROPOSAL SYNOPSIS:

Increase the cement modified subgrade from 8" thickness to 12" thickness.

Reliability	**Improved**	**Functionality**	**Improved**	**$ Initial Cost Avoidance (Add)**	
O&M	**Improved**	**Schedule Impact**	**Maintained**	**$1,489,000**	

BASELINE CONCEPT:

The current design calls for 8" cement modified subgrade.

VALUE PROPOSAL DESCRIPTION:

By increasing the cement modified subgrade from 8" to 12", KYTC can increase functionality and reduce life cycle costs.

ADVANTAGES:	**DISADVANTAGES:**
● Increased functionality	● Increased cement quantity
● Decreased hot mix asphalt	●
● Reduced future maintenance	●
● Same production costs to do the work	●
●	●
●	●

$ COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE CONCEPT:	$16,582,000	$881,000	$17,463,000
VALUE PROPOSAL DESCRIPTION:	$15,093,000	$440,000	$15,533,000
TOTAL (Baseline less Proposed)	$1,489,000	$441,000	$1,930,000
			AVOID COST

VALUE PROPOSAL

EL-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Change cement modified layer from 8" to 12"

DISCUSSION & JUSTIFICATION:

• Performance Impacts
Increasing the depth of the cement stabilized roadbed has benifits to long-term durability and reduced future maintenance costs, while having negligable impacts on constructability or schedule.

• Cost Considerations
There would be an increased cost of cement that would be offset by reduction of asphalt base thickness.

• Schedule Impacts
None apparent.

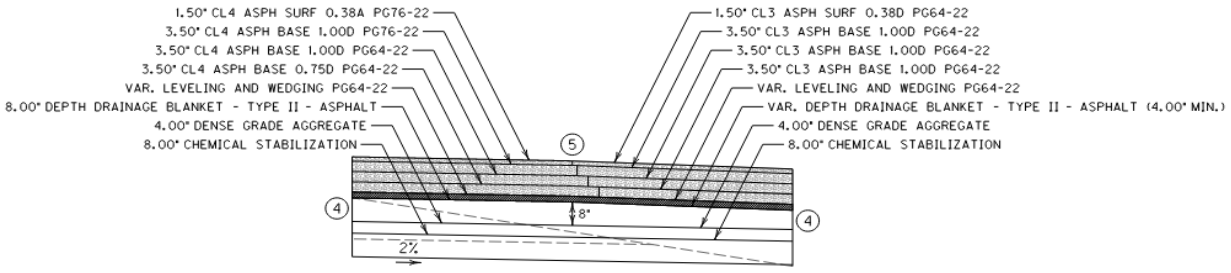
• Risk Considerations
Risk would be reduced in soft saturated soils by building a stronger subgrade.

OUT-BRIEF PRESENTATION COMMENTS:

None noted.

TITLE	Change cement modified layer from 8" to 12"

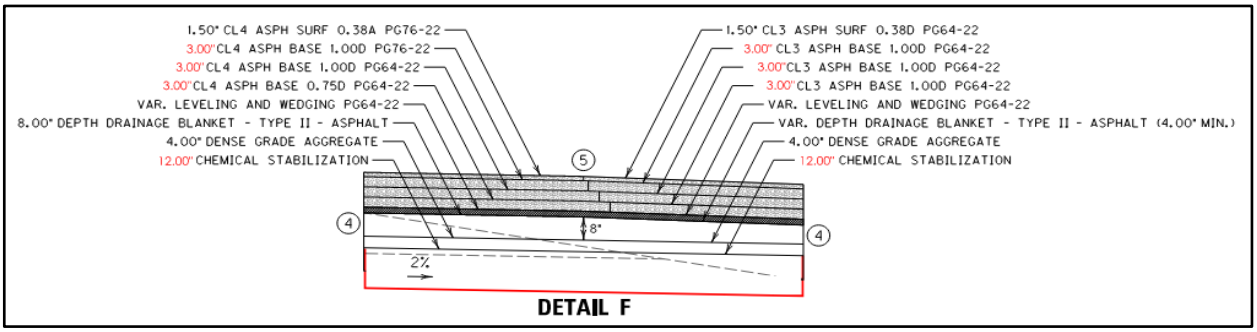
SKETCH/DIAGRAM: BASELINE DESIGN CONCEPT



DETAIL F

TITLE	Change cement modified layer from 8" to 12"

SKETCH/DIAGRAM: VALUE PROPOSAL



DETAIL F

VALUE PROPOSAL

EL-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Change cement modified layer from 8" to 12"
Assumptions & Calculations	Asphalt estimated at 110#/SY IN for Mainline. Unit bid prices pulled from updated estimate using KYTC AUBP and regional bid prices since 2022.

DESIGN ELEMENT	**BASELINE CONCEPT**				**VALUE PROPOSAL**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Cement	TON	2,103	$244	$514,015	2,797	$244	$682,468
CL3 Asph Base 1.0 64-22	TON	33,963	$118	$4,021,559	29,111	$118	$3,447,034
CL4 Asph Base 1.0 64-22 **(NOTE: Check this quantity)**	TON	69,725	$92	$6,429,342	64,962	$92	$5,990,146
CL4 Asph Base 1.0 76-22	TON	31,043	$81	$2,518,519	26,608	$81	$2,158,707
CL4 Asph Base 0.75 64-22	TON	28,169	$110	$3,098,590	25,584	$110	$2,814,240
TOTAL				$16,582,000			$15,093,000
						Impact to Initial Cost (Baseline Less Proposed)	**$1,489,000**

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

AVOID COST

VALUE PROPOSAL

EL-01

Kentucky Transportation Cabinet

I-71 Gallatin County

TITLE	Change cement modified layer from 8" to 12"

Assumptions				
Interest/Discount Rate(%):	**2.4%**		**Economic Life (yrs):**	12

LIFE CYCLE COST ANALYSIS

Salvage & Replacement Costs			**Baseline Concept**		**Value Proposal**	
Item	**Description**	**Yr**	**Est Cost**	**Pres Worth**	**Est Cost**	**Pres Worth**
1	Pothole Repair/Patching	5	$150,000	$133,227	$75,000	$66,613
2	Pothole Repair/Patching	7	$150,000	$127,055	$75,000	$63,527
3	Base Failure Repair	8	$750,000	$620,385	$375,000	$310,193
4						
5						
6						
7						
8						
9						
10						
Total Salvage & Replacement Costs			**$1,050,000**	**$880,667**	**$525,000**	**$440,334**

Annual Costs (pres worth calculated over 12 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)	**$881,000**	**$440,000**
RESULTS (Proposed less Baseline)	**AVOID COST of $441,000**	

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

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

KENTUCKY TRANSPORTATION CABINET

PART II

Appendices

Value Study Documentation

Appendix

A

Value Study Overview

A.1 Introduction

A virtual value engineering workshop was conducted from August 13-15, 2024 on the project documents provided by KYTC and Stantec for the I-71, Gallatin County project.

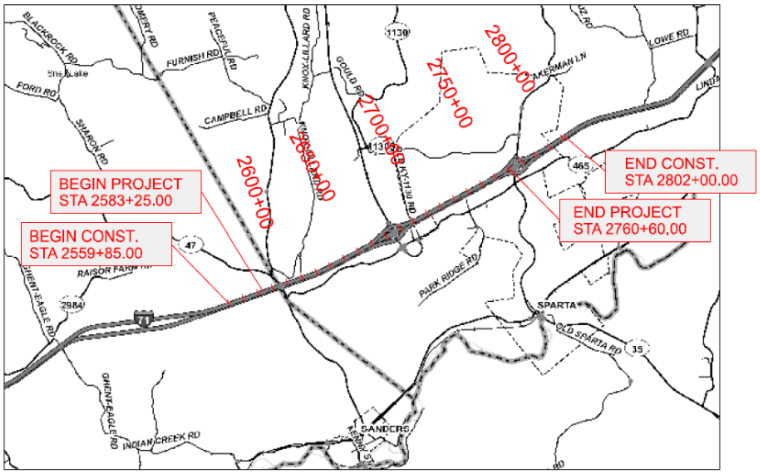
The Kentucky-based VE team, which consisted of consultant constructability experts and KYTC geotechnical engineers, began the workshop process by reviewing the provided project documents and receiving the in-brief presentation. Throughout the workshop process, the VE team searched for opportunities to 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

(Excerpted from the Design Executive Summary document provided by KYTC and Stantec, dated August 2023)

The purpose of the project is to improve mobility along I-71 in the vicinity of the KY 1039 and KY 35 interchanges, both of which serve as exits to the Kentucky Speedway. This project will serve through traffic on I-71, as well as local users traveling to and from the Sparta and Glencoe areas.



The project needs include:

1. To improve capacity on I-71 in the vicinity of the KY 1039 and KY 35 interchanges to meet existing and forecasted traffic demand.
    - I-71 serves as a primary freight corridor.
    - Exit 55 at KY 1039 and exit 57 at KY 35 both serve as primary entry routes to the Kentucky Speedway, a major special events facility located between the two exits. Although the Kentucky Speedway is no longer a hub for NASCAR races, the Speedway website indicates that it is available for other special events including music festivals, trade shows, national and regional motor sport events, and other events. It is capable of providing parking for 20,000 people. When major racing events occurred, traffic congestion was an issue on I-71 and the exits at KY 10339 and KY 35.
    - Figure 5 of the Traffic Forecast Report revision dated January 23, 2024 and provided in Appendix A indicates an approximately 57.5 to 59.6 percent increase in the AADT between 2023 and 2050 [57.5% North section, 57.6% Middle section, and 59.6% South section].
2. To improve deficiencies in the I-71 roadway pavement structure.

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.

- Estimate files
- 06_20021_00_Estimate_Total.pdf
- 06_20021_00_Roadway_Cross_Sections_Signed.pdf
- 06_20021_00_Roadway_Plan_Set_Signed.pdf
- 06_20021_00_Signing_Striping.pdf
- 2024_04_18_inspection_meeting_minutes -draft- WITH COMMENTS.docx
- 6-20,021 - Pavement Design Email.pdf
- Gallatin Co. I-71 DES 06-20021.pdf
- I_71_fixed_completion_date_note.pdf
- I-71 Gallatin County MPs 53.4-56.673 GPR-Core Data .docx
- REVISED KMZ_8_13_24__06_20021_00_gallatin_carroll_I71.kmz
- S28868-I71-KY47-20240425 (S1 Final).pdf

A.2.2 In-brief Meeting

At the in-brief meeting on Tuesday, August 13, 2024, representatives from KYTC and Stantec 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.

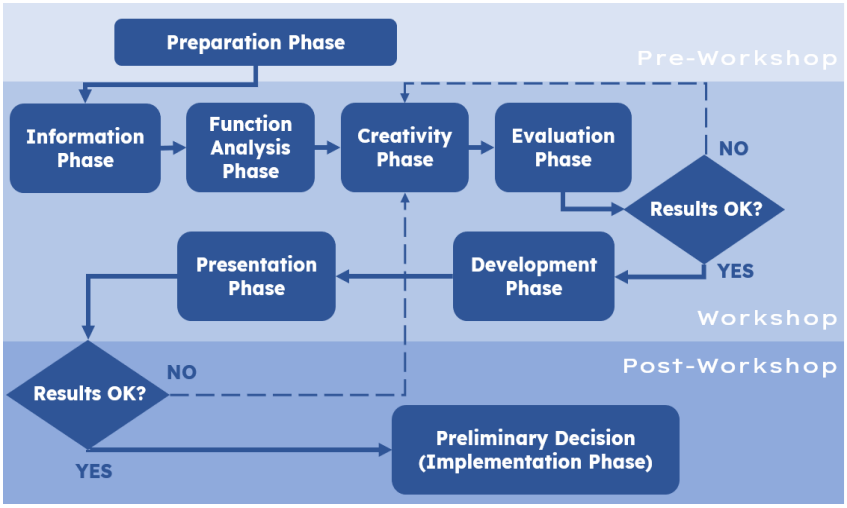
A.2.4 Presentation

An out-brief presentation was held on Thursday, August 15, 2024. 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.

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	• 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)	• 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	• Present design concept • Present stakeholders' interests • Review project issues and objectives	• It brings all value study team members to a common understanding of the project,

Value Methodology Stage / Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
	Transform Information Orient Participants	• 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 • 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	• Identify and classify functions • Apply cost and risk relative to performance • Prioritize functions • Select specific functions for study	• 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	• Brainstorm to generate performance-focused ideas for alternative ways to perform functions • Discuss, build on and clarify ideas	• 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	• 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	• 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	• 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	• 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	• Present developed ideas to client, designers, decision-makers, stakeholders • Document feedback • Produce draft report	• Ensures management and other key stakeholders understand the rationale of the value alternatives and design suggestions
Phase 8: Implementation Phase	Implement Change Manage Change	• Document process and study findings • Develop and distribute VE study summary report • Review study summary report	• Involves those who will implement and increases the likelihood of implementation • Improves the actual value of the project

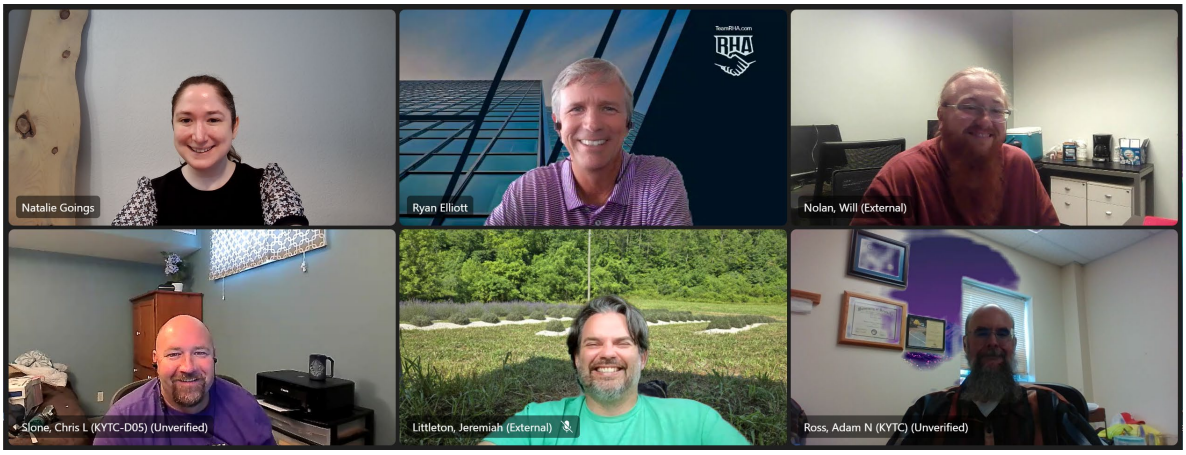
Value Methodology Stage / Phase	VM Phase Functions Achieved	Objectives of this Phase	Outcomes of this Phase
	Realize Value	• Assess alternatives for acceptance • Prepare draft implementation dispositions • Resolve conditionally accepted alternatives • Develop an implementation plan with the project manager • Project manager sign-off on VE implementation plan • Final presentation of study results	

A.4 Participants

Table A-2: Value Team Participants

Name	Organization	Position
Will Nolan	Qk4	Constructability
Jeremiah Littleton	Qk4	Constructability
Chris Slone	KYTC	Geotechnical/Construction
Adam Ross	KYTC	Geotechnical/Construction
Ryan Elliott, EdD, PE, CVS	RHA	Team Leader
Natalie Goings, VMA	RHA	Technical Assistant

Figure A-2: VE Team Members



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

13-15 August 2024								Name	Organization	Position
IBP	13		14		14		OBP			
	am	pm	am	pm	am	pm				
								VE Team Members (Full Time)		
☑	☑	☑	☑	☑	☑	☑	☑	Ryan Elliott, EdD, PE, CVS	RHA	Team Leader
☑	☑	☑	☑	☑	☑	☑	☑	Natalie Goings, VMA	RHA	Workshop Assistant
☑	☑	☑	☑	☑	☑	☑	☑	Jeremiah Littleton	QK4	Constructability
☑	☑	☑	☑	☑	☑	☑	☑	Will Nolan	QK4	Construction
☑	☑	☑	☑	☑	☑	☑	☑	Chris Slone	KYTC	Construction/Geotechnical
☑	☑	☑	☑	☑	☑	☑	☑	Adam Ross	KYTC	Geotechnical/Construction
								Stakeholder Attendees (In-Brief and Out-Brief)		
☑	☐	☐	☐	☐	☐	☐	☑	Wendy Southworth	KYTC	Quality Assurance Branch Manager
☑	☐	☐	☐	☐	☐	☐	☑	Andre Johannes	KYTC	Division of Highway Design
☑	☐	☐	☐	☐	☐	☐	☑	Mike Bezold	KYTC	Branch Manager - Project Development
☑	☐	☐	☐	☐	☐	☐	☑	Ross Mills	KYTC	Central Office Design - PM
☑	☐	☐	☐	☐	☐	☐	☑	Glenn Hardin	Stantec	Design Team
☑	☐	☐	☐	☐	☐	☐	☑	Tim Layson	KYTC	Division of Highway Design
☑	☐	☑	☐	☐	☐	☐	☑	Jason Bricker	Stantec	Design Team
☑	☐	☐	☐	☐	☐	☐	☑	Craig Moore	KYTC	Project Delivery
☑	☐	☐	☐	☐	☐	☐	☑	Brad Frazier	KYTC	
☐	☐	☐	☐	☐	☐	☐	☑	Anthony Damron	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-71 Gallatin County
Dates/Time: August 13-15, 2024 *(times listed below)*
Study Location: Virtual // Microsoft Teams

Day 1: Tuesday, August 13, 2024; 8:00AM – 5:00PM ET

MS Teams Meeting Link: Click here to join the meeting | **Meeting ID**: 284 632 277 548 | **Call-in #:** +1 323-484-8978; 559304985#

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: ● 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 ● 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**: 284 632 277 548 | **Call-in #:** +1 323-484-8978; 559304985#

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**: 284 632 277 548 | **Call-in #:** +1 323-484-8978; 559304985#

Time	VE Study Activity	Participants	Comments
8:00	Check-in & Team Event	VE Team	Team-building exercise
DEVELOPMENT PHASE *(continued)*			
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

Appendix

B

Project Analysis

B.1 Unit Cost Updates

The VE team updated the unit costs for 11 high-impact line items on the cost estimate provided by KYTC and Stantec (dated 07/03/2024) to more accurately reflect current, region-specific bid prices based on the VE team's experience with similar projects. Prices were sourced from several places, including Bidx (the software used by KYTC's bidders) and average unit bids for 2023 specific to the project area. Based on this exercise, the VE team believes bid prices are likely to come in higher than what is currently estimated.

The table below compares a summary of the VE team's prices for these 11 items to their prices in the baseline cost estimate:

Table B-1: Updated VE Team Cost Summary

Line Item:	Original Estimate Unit Price:	Original Estimate Total Cost:	VE Team Unit Price:	VE Team Total Cost:
DRAINAGE BLANKET-TYPE II-ASPH	$78.00	$3,636,126.00	$83.55	$3,894,850.00
LEVELING & WEDGING PG64-22	$85.00	`$1,989,340.00	$105.40	$2,466,781.60
CL3 ASPH BASE 1.00D PG64-22	$74.996	$2,547,096.62	$118.41	$4,021,558.83
CL4 ASPH BASE 1.00D PG64-22	$85.00	$5,926,625.00	$92.21	$6,429,342.25
CL4 ASPH BASE 1.00D PG76-22	$88.47	$2,746,220.86	$84.13	$2,611,647.59
CL4 ASPH BASE 0.75D PG64-22	$90.00	$2,535,210.00	$110.00	$3,098,590.00
CL4 ASPH SURF 0.38A PG76-22	$122.77	$2,260,991.25	$120.00	$2,209,920.00
CONC MEDIAN BARRIER TYPE A TL5 56 IN	$100.00	$1,980,400.00	$225.00	$4,455,900.00
ROADWAY EXCAVATION	$16.11	$1,652,611.81	$28.20	$2,892,389.40
CONCRETE BARRIER WALL TYPE 9T	$24.34	$1,054,992.91	$33.38	$1,447,023.00
G/R STEEL W BEAM-S FACE (7 FT POST)	$34.18	$577,710.61	$36.40	$615,160.00

B.2 VE Team Observations

As part of their preparation for the workshop, the value team reviewed the available project documents and prepared Key Issues Memos (KIMs) documenting their preliminary observations on issues, potential value engineering (VE) opportunities, and risks. The following is a list of these observations:

- **Issues/Observations**
  - The 4'x4' culvert size is problematic. A 6'x6' is easier for future maintenance and a 4'x4' lends itself to precast, which is not desirable on a fill this size. Precast should not be allowed.
  - Use of ASPH BASE 0.75D PG 64-22: the minimum thickness called for in the plans (2") is less than what warrants allow (2.5"). Layer thickness at 3 or 4 typicals will need to be adjusted.
  - There are several locations with either sliver fills or sliver cuts. Embankment benching needs to be shown for most, if not all, of the sliver fills for stability. Some of the sliver cuts can be eliminated.
  - There appear to be many areas with sliver cuts due to 6:1 foreslopes and 2:1 backslopes – consider whether these can shim up to 4:1s and 2:1s behind the guardrail areas to avoid the earthwork outside the existing shoulders.
  - The maintenance of traffic (MOT) appears to be slightly short for room needed to construct. Reduce lanes in phase 1B and 1D to 11' and shift wall out.
  - Ramp typical sheets: The bottom layer of base shown as variable will have to be placed with a road widener. This makes for a poor-quality layer. If the layer is extended to full-width, the amount of additional is small and provides better quality. Shown on detail K.
  - Sheet R2E: Asphalt curing seal is not used on top of the 4-inch DGA layer, only on top of the chemical stabilization.
  - Contractors will generally use tack non-tracking in place of asphalt curing seal. It also eliminates the need for a sand blotter layer.
  - Sheet R2F Wedge Curb: The concrete wedge curb needs to be placed on asphalt. It will fail as shown in the detail. It should be a total of 5.5-inches tall and should sit in the top layer of base.
  - Sheet R2L Drainage Summary: There are only a small number of companies that complete fold and form linings. The current company on KYTC's list has allowed their prequalification to expire and has not renewed at this time.
  - The special note for rolling roadblocks requires an LEO as one of the vehicles performing the RR.
  - Sheet 148: The drilling and adding of bars into the existing columns call out grout as the binding agent. This material has always been an approved epoxy. Grout is not typically used in this application.
- **Preliminary VE Opportunities**
  - Limit scope to curve corrections and spot widening.
  - Possible slope revisions.
  - Pavement thickness modifications.
  - Exchange rock roadbed for subgrade stabilization (depending on rock encountered).
  - Convert all ASPH BASE 0.75D PG 64-22 to ASPH BASE 1.0D PG 64-22 at the lower bid price for cost savings. Layer thickness will need to be adjusted to make this change.
  - Change foreslopes to minimize or eliminate earthwork to the outside.

- Given the soil horizon testing shown, KYTC would save money and get a better subgrade by changing the chemical stabilization to 12" instead of 8". This would also eliminate the 4" of DGA and one layer of asphalt curing seal, which would not be used either way.

- **Project Risks**
  - Slides are prevalent in the side hill cuts and fills.
  - Poor quality shale in the area could cause large settlement long term.
  - Potential cold stream impacts of construction in the area.
  - Added weight from the addition of material could lower the stability of some of the slopes. History of slope failures in this area.
  - MOT limitations such as bridge removal, length of closures, etc. will increase prices unnecessarily and result in change orders.
  - Allowance of lane closure for beam installations.
  - Drainage has been and will be an issue in phases 1C, 2, and 3. Water will pond on the inside shoulder unless the median boxes are made to accept water prior to the final surface being laid.
  - Phase 1C will require asphalt wedges around each median box to prevent a roadway hazard.
  - Phases 2 and 3 should be checked for water ponding in the MOT transitions. This is another area in which KYTC has experienced issues previously.

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 **"Improve Conditions"** as the basic function of the project. The Function Analysis Worksheet (Table C-1) is shown for the project and reflects the complete list of functions.

Table C-1: Random Function Identification Worksheet for Project

Identify Functions		Classify Functions	Prioritize Functions
Active Verb	**Measurable Noun**	**Higher-Order Basic Secondary**	**SELECT FOR CREATIVITY PHASE**
Meet	*Demand*	*Higher-Order*	
Enhance	*Safety*	*Higher-Order*	
Improve	*Mobility*	*Higher-Order*	
Increase	*Opportunity*	*Higher-Order*	
Improve	**Capacity**	**Basic**	
Improve	Connectivity	Secondary	
Maintain	Traffic	Secondary	YES
Increase	Width	Secondary	
Support	Economy	Secondary	
Deliver	Comfort	Secondary	
Decrease	Complaints	Secondary	
Prevent	Accidents	Secondary	YES
Deliver	Economic-opportunity	Secondary	
Decrease	Congestion	Secondary	
Improve	Sight-distance	Secondary	YES
Increase	Weave-areas	Secondary	
Meet	Requirements	Secondary	YES
Lengthen	Ramp	Secondary	
Access	Site	Secondary	
Optimize	Staging	Secondary	
Update	Barrier-systems	Secondary	
Improve	Safety	Secondary	YES

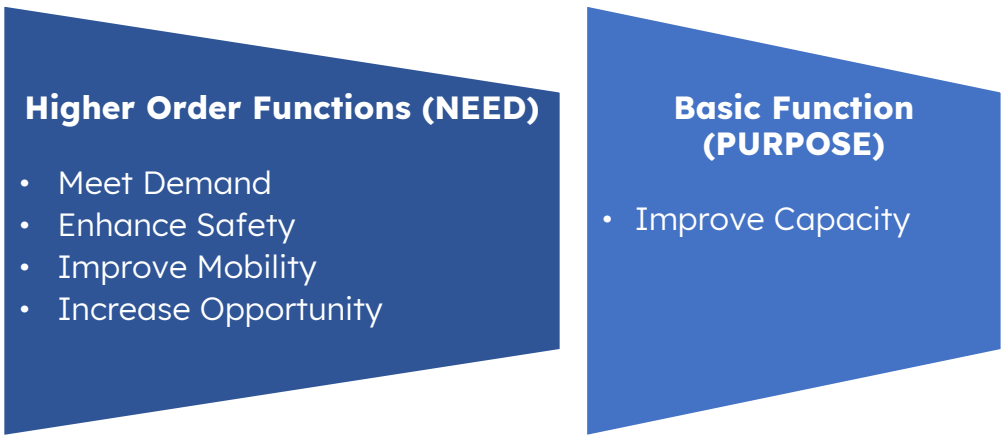
Identify Functions		Classify Functions	Prioritize Functions
Active Verb	**Measurable Noun**	**Higher-Order Basic Secondary**	**SELECT FOR CREATIVITY PHASE**
Optimize	Phasing	Secondary	YES
Meet	Schedule	Secondary	
Enhance	Longevity	Secondary	YES
Reduce	Risk	Secondary	YES
Improve	Biddability	Secondary	YES
Minimize	Cost	Secondary	YES
Increase	Constructability	Secondary	
Maintain	Drainage	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

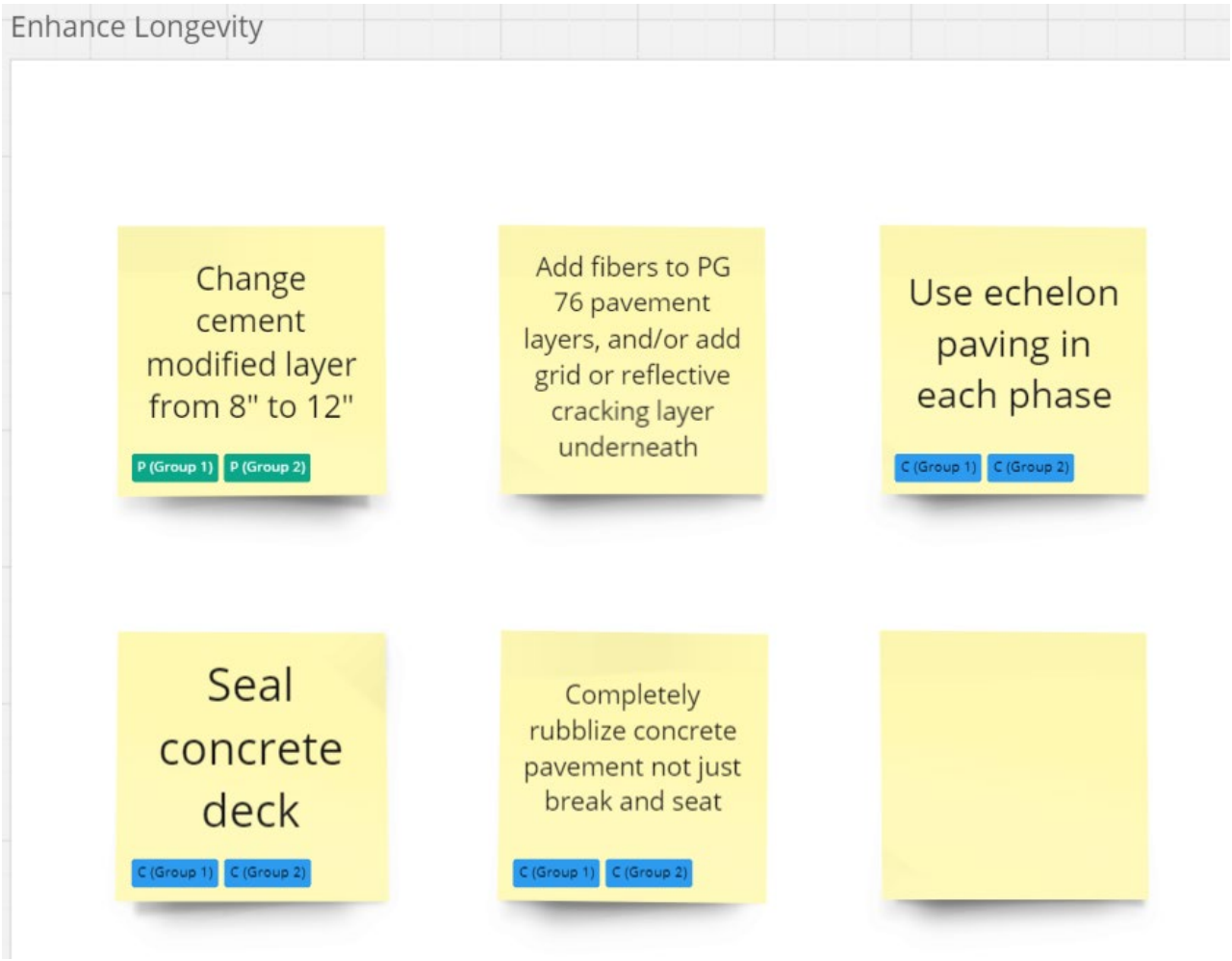
D.1 Introduction

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 51 ideas. Of these, 12 ideas were identified for further development into Value Proposals. In addition, 21 standalone Design Comments were identified during the value study to be considered in the next phase of design development. The VE team members brainstormed creative ideas in a collaborative virtual whiteboard space on Miro where ideas were brainstormed on "sticky notes" under each project function, first independently and then in groups.

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



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.

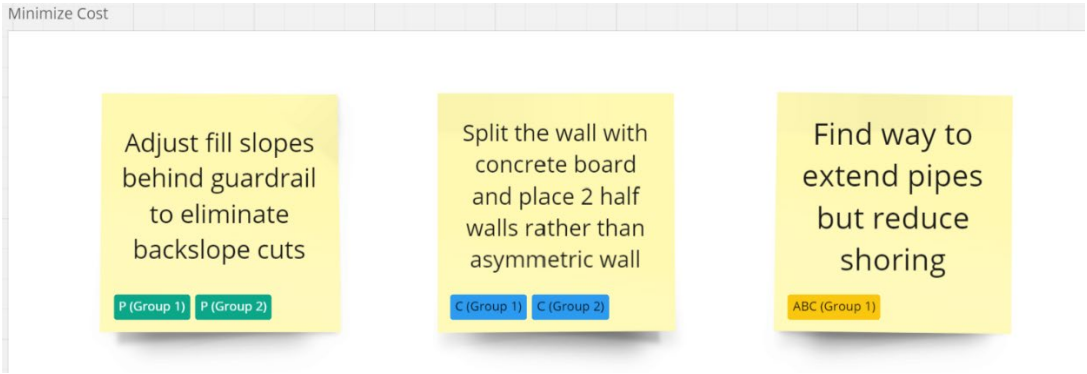
Table D-1: Summary of Ideas Brainstormed (by Function)

Function / Focus Area	Abbreviation	Total Number of Ideas Brainstormed	Total Number of Value Proposals Developed (Costed)	Total Number of Design Comments
Improve Sight-distance	IS	1	0	1
Meet Requirements	MR	4	1	3
Reduce Risk	RR	1	0	0
Optimize Phasing	OP	2	0	0
Improve Biddability	IB	6	2	2
Minimize Cost	MC	13	7	2
Maintain Traffic	MT	6	1	3
Prevent Accidents	PA	3	0	1
Improve Safety	IS	3	0	2
Enhance Longevity	EL	5	1	3
Miscellaneous	MI	7	0	4
	Total	**51**	**12**	**21**

D.3 Evaluation Techniques Used

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

Figure D-2: Preliminary Evaluation



In the second step of evaluation, the value team reviewed and discussed each idea and its preliminary score as a whole group to refine the score by reaching a group consensus. The preliminary scores and refined scores used in the creative idea list (**Table D-3**) on the following pages are as follows:

Table D-2: Evaluation Score Key

Preliminary Evaluation Score	Definition	Final Score in Table D-3
P: Proposal	Idea is valuable and should be developed into a written Value Proposal	**P** (Quantitative Value Proposal) if costed, or **DS** (Design Suggestion) if cost impacts not quantified
C: Comment	Idea is valuable and self-explanatory as a standalone comment	**DC** (Design Comment)
X: Do Not Pursue	Idea does not offer improved value to the project and should not be pursued further	**X** (Poor Opportunity)
ABC: Already Being Considered	Idea has already been considered by the project design team	**ABC** (Already Being Considered)

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-3: "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 Sight-distance		
IS-01	Cut the top of the hills to reduce fill at sag	DC
Meet Requirements		
MR-01	Extend asphalt under concrete wedge curb to prevent cracking	P
MR-02	Change crash wall ties from grout to epoxy	DC
MR-03	Evaluate overhead sign supports (OHSS) for re-use	DC
MR-04	Evaluate median boxes for extra weight of single-slope median barrier (SSMB)	DC
Reduce Risk		
RR-01	Create a detour up and around US 42 so KY 47 can stay closed (22 miles)	w/IB-02
Optimize Phasing		
OP-01	Check bore and jack pipe lengths and locations	X
OP-02	Eliminate small cuts	w/MC-01
Improve Biddability		
IB-01	KYTC should keep maintenance function	DC
IB-02	Update time constraints to allow for more realistic construction requirements, i.e. lane closures for bridge removal and beam setting	P
IB-03	Do not adopt CA wall	ABC
IB-04	Switch to 1.0" base throughout	P

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		
IB-05	Modify note to allow elimination of rumble strips just ahead of work completion	DC
IB-06	Reduce asphalt bid items	w/IB-04
Minimize Cost		
MC-01	Adjust fill slopes behind guardrail to eliminate backslope cuts	P
MC-02	Remove 4-in DGA layer	P
MC-03	Change 0.75″ base to 1.0″ base	w/IB-04
MC-04	Use T631 rail instead of W beam typical	X
MC-05	Allow non-tracking tack as an asphalt seal coat	DC
MC-06	Cheat inside shoulder rather than widen to outside	X
MC-07	Split the wall with concrete board and place 2 half walls rather than asymmetric wall	DC
MC-08	Use fibers in asphalt to improve functionality	P
MC-09	Find way to extend pipes but reduce shoring	ABC
MC-10	Reuse cable for cable barrier replacement	P
MC-11	Install guardrail to eliminate any earthwork to the outside, tie down at 2:1	P
MC-12	Use metal end sections or mitered ends on pipes to reduce head wall costs	P
MC-13	Instead of milling to concrete, saw and excavate and cement stabilize to reduce cost	P
Maintain Traffic		
MT-01	Reduce lane widths in MOT phases to allow for more space behind barrier wall	DC
MT-02	Reduce shoulder widths in MOT to allow for constructability (Phases 1B, 1D, 2)	DC
MT-03	Move both southbound lanes to northbound side for Phase 2 to reduce the amount of temporary barrier wall relocation	w/MT-04
MT-04	Use contraflow traffic to allow surface to be paved in echelon	P
MT-05	Allow KY 47 to be closed for weekend for bridge removal and add detours	w/IB-02
MT-06	Safe load pipes and bore and jack pipes	DC
Prevent Accidents		
PA-01	Create areas where people can be pulled over for Kentucky Vehicle Enforcement (KVE)	X
PA-02	Account for drainage ponding in phasing 1B, 1C, and 1D	DC
PA-03	Include pull-offs for emergency use	X
Improve Safety		
IS-01	Have recovery service on site 24/7	X
IS-02	Close shoulders 2 miles before project to give visual cue of entering a work zone	DC
IS-03	Use orange for WZ striping	DC
Enhance Longevity		
EL-01	Change cement modified layer from 8″ to 12″	P
EL-02	Add fibers to PG 76 pavement layers, and/or add grid or reflective cracking layer underneath	w/MC-08
EL-03	Use echelon paving in each phase	DC
EL-04	Seal concrete deck	DC
EL-05	Completely rubblize concrete pavement not just break and seat	DC

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		
Miscellaneous		
MI-01	Avoid making widened layer so small that paver cannot lay	DC
MI-02	Go to 2:1 behind rail	w/MC-01
MI-03	Take bends out of pipes	ABC
MI-04	Cut the median wall short of bend at ends and use "permanent temporary" 9T to match up to next phase	DC
MI-05	Reuse cable rail rope	w/MC-10
MI-06	Allow excavation waste in gore areas	DC
MI-07	Ensure there is adequate room behind the temporary 9T wall	DC

Appendix

E

Certification Statement

SAVE International Value Standard Certification

Kentucky Transportation Cabinet

I-71, Gallatin County (Item No. 6-20021.00)

Value Study Dates: August 13-15, 2024

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.

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