VE# 202101

Value Engineering Study Report

Kentucky Transportation Cabinet

I-71 Widening to Six Lanes from Downtown to I-265

Item No. 5-48.10 to 5-557.00

Jefferson County

Workshop Dates: March 15-19, 2021

Guiding Teams – Building Success

April 21, 2021

Brent A. Sweger, PE
Manager, Quality Assurance Branch
Division of Highway Design
Kentucky Transportation Cabinet
200 Mero Street
Frankfort, KY 40622
Brent.Sweger@ky.gov

RE: VE# 202101
Value Engineering Study Report
I-71 Widening to Six Lanes from Downtown to I-265
Item No. 5-48.10 to 5-557.00
Jefferson County

Dear Brent:

Transmitted herewith is an electronic copy (PDF) of the final Value Engineering Study Report for the above referenced project. In addition, attached is an electronic copy (Excel) of the VE Punchlist Form and Instructions for your use.

I appreciate your leadership and cooperation as well as that from Justin Harrod, KYTC, HDR, WSP, the Value Engineering study team and all other stakeholders. Should you have any questions, please contact me at (602) 493-1947.

Thank you for the opportunity to work with you and your team!

Sincerely,

RHA, LLC

Patrice Miller

Patrice Miller, CVS
Managing Partner

Value Engineering Study
Kentucky Transportation Cabinet
i-71 Widening to Six Lanes from Downtown to I-265 Project
Items Nos. 5-48.10 and 5-557.00
Jefferson County

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SECTION

1

INTRODUCTION

Value Engineering Study
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265 Project
Items Nos. 5-48.10 and 5-557.00
Jefferson County

Section 1: Introduction

Value Methodology

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. The workshop is conducted in accordance with the methodology as established by SAVE International, the value society, and is structured using the Job Plan as outlined as follows:

Value Methodology Phase	Objectives of this Phase	Outcomes of this Phase
Stage 1: Pre-workshop Study (Preparation)		
Pre-workshop	▪ Identify study project ▪ Identify study 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 virtual workshop ▪ Send team primer to value study team ▪ Value 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

Value Methodology Phase	Objectives of this Phase	Outcomes of this Phase
Stage 2: Workshop Study		
Phase 1: Information	▪ Present design concept ▪ Present stakeholders' interests ▪ Review project issues and objectives ▪ Discuss deviation from design standards ▪ Define project performance metrics ▪ Discuss problems the project must solve; identify issues the design may not address ▪ Visit project site / virtual site tour	▪ Brings all value study team members to a common understanding of the project, including its challenges and constraints ▪ Establishes the benchmark for which to identify alternatives ▪ Gains a real-world perspective of the project and builds foundation for function analysis
Phase 2: Function Analysis	▪ 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 3: Creative	▪ Brainstorm to generate performance-focused ideas for alternative ways to perform functions ▪ Discuss, build-on and clarify ideas	▪ Value team develops a broad array of ideas that provides a wide variety of possible alternative components or methods to improve project value

Value Methodology Phase	Objectives of this Phase	Outcomes of this Phase
Phase 4: Evaluation	▪ 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 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 5: Development	▪ Validate and refine idea concepts ▪ Compare to original design concept ▪ Define implementation considerations ▪ Prepare sketches and calculations ▪ Measure performance ▪ Estimate costs, life-cycle cost benefits/costs	▪ Provides side-by-side comparison of baseline and alternative—concepts, initial costs, life-cycle costs, sketches, performance metrics
Phase 6: Presentation	▪ 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

Value Methodology Phase	Objectives of this Phase	Outcomes of this Phase
Stage 3: Post-workshop Study (Implementation)		
Post-workshop	▪ Document process and study findings ▪ Develop and distribute VE study summary report ▪ Review study summary report ▪ Assess alternatives for acceptance ▪ Prepare draft implementation dispositions ▪ Resolve conditionally accepted alternatives ▪ Develop implementation plan with project manager ▪ Project manager sign-off on VE implementation plan ▪ Final presentation of study results	▪ Involves those who will implement and increases likelihood of implementation ▪ Improves actual value of the project

Report Contents

The report provides the outcomes associated with this VE workshop and includes the following sections:

Section 1: Introduction – This section outlines the VE process and explains the content of the report.

Section 2: Project Description – This section outlines the project background, project corridor and project purpose and need.

Section 3: Executive Summary – This section is an overview that includes project background, summary of results, a list of the VE study team members and the VE punch list.

Section 4: Summary Information – This section provides an overview in table format of the VE Proposals, Design Suggestions and Design Comments.

Section 5: VE Proposals and Design Suggestions – This section includes alternatives developed as a workbook during the workshop. Each workbook contains the following information:

- Unique Identifying Number (i.e., VE-01, VE-02, etc.)
- Creative Idea Title
- Function Identification
- Baseline Assumption – brief description
- Proposed Alternative – brief description
- Benefits
- Risks/Challenges
- Sketches (Baseline and Proposed), if applicable
- Discussion/Justification
- Implementation Considerations, if applicable
- Initial Cost Detail
- Replacement/Salvage and Annual Cost Detail, if applicable

Section 6: Appendices

Appendix A – Study Participants
Appendix B – Pareto Cost Models
Appendix C – Function Analysis
Appendix D - Creative Idea List and Evaluation
Appendix E – Supporting Data
    i. Risk Identification
    ii. Agenda

SECTION

2

PROJECT DESCRIPTION

Section 2: Project Description

5-48.10 (I-71 Widening, between Kennedy Interchange and Zorn Avenue Interchange)

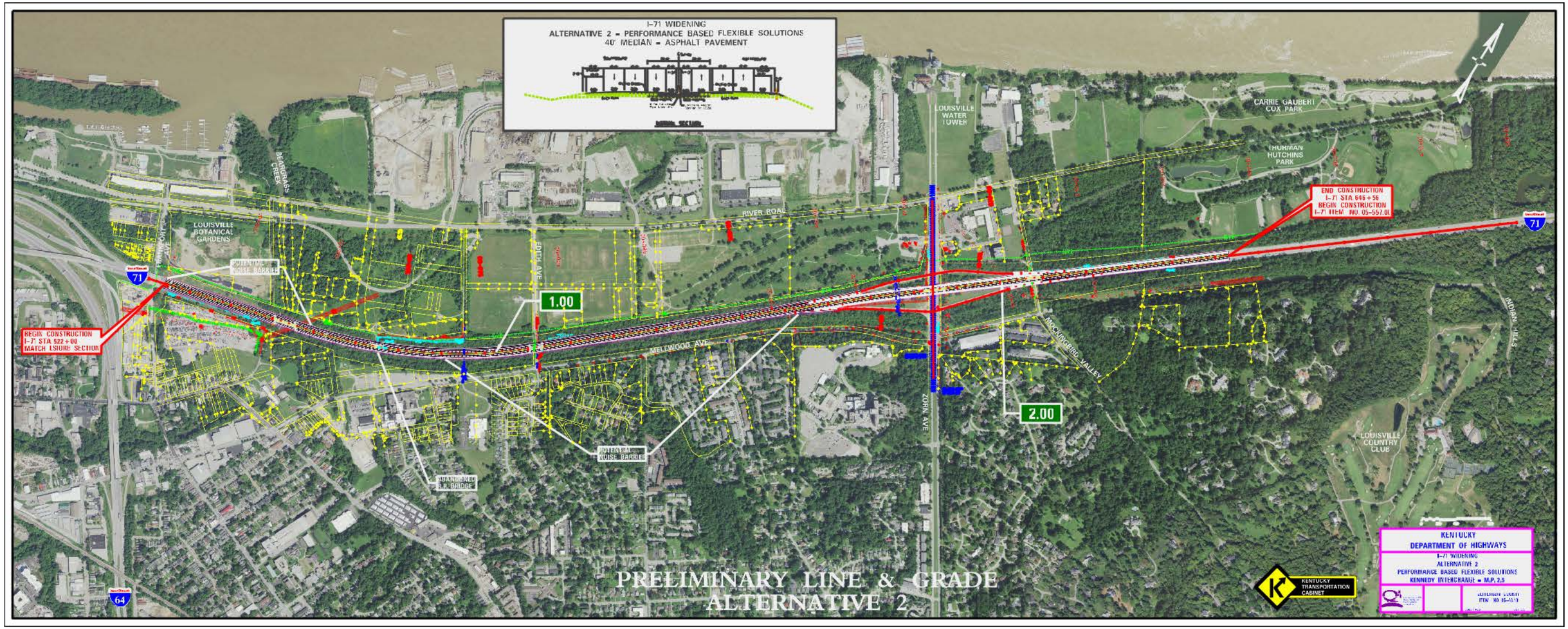
Purpose & Need: The purpose of the project is to improve operations and safety along I-71, between the Kennedy Interchange and Zorn Avenue interchange (Exit 2).

Traffic Operations. Existing (year 2019) I-71 mainline traffic volumes are 62,300 vehicles per day (vpd) through the project area, with 5,600 to 7,600 vpd using each of the four ramps. Peak hours show strong directional trends--towards downtown in the morning and away in the afternoon. Applying Highway Capacity Manual procedures to calculate Level of Service (LOS), southbound I-71 operates at LOS D/E during the AM peak hour, with a volume-to-capacity ratio (v/c) of 0.74-0.89 surrounding the Zorn interchange. Northbound I-71 operates at LOS D/E during the PM peak hour, with a v/c of 0.76-0.94. The intersection with Zorn Avenue and the northbound ramps is signalized; it operates at LOS B overall during both the AM and PM peak hours. During the PM peak, the eastbound approach (i.e., the off-ramp) operates at LOS D. At unsignalized intersections, only stop-controlled movements are measured. At Zorn Avenue and the southbound ramps, the off-ramp operates at LOS F during both the AM and PM peak hours. Future No-Build traffic volumes are anticipated to grow steadily, further degrading operations. Prior to the 2045 analysis year, the network fails—with I-71 operating at LOS F and all v/c greater than 1.0.

Safety. Based on 2017-2019 reports available from the KY State Police, there were 167 crashes along mainline I-71 between MP 0.0-2.5. This includes no fatalities but 24 injury collisions. The majority of crashes are rear end collisions (50%), followed by single vehicle crashes (24%) and same direction sideswipes (22%). Crashes along Zorn Avenue and each of the four interchange ramps were also tabulated and analyzed. Applying a statistical procedure to identify locations where crashes are happening more often than predicted by random occurrence, four 0.10-mile long high crash spots appear:

- Zorn Avenue through the interchange (MP 1.5-1.6) contains 17 crashes, resulting in a Critical Rate Factor (CRF) of 1.1.
- The top of the southbound off-ramp (MP 0.0-0.1) contains 15 crashes, resulting in a CRF of 2.0.
- The terminal of the southbound off-ramp (MP 0.2-0.3) at its two-way stop-controlled intersection with Zorn contains 18 crashes, resulting in a 2.4 CRF.
- The terminal of the northbound off-ramp (MP 0.2-0.3) at its signalized intersection with Zorn contains 54 crashes, resulting in a 5.8 CRF.

Figure 1. ***Preliminary Line & Grade, Alternative 2***



Value Engineering Study Baseline: Two alternatives were evaluated and both widen to the inside, satisfy the project purpose and need, and no right-of-way acquisitions or major utility impacts are anticipated for either alternative. The preferred and selected alternative is a "Performance-based Flexible Solution" (PBFS) option (see previous page **Figure 1**, *Preliminary Line & Grade, Alternative 2*) that includes three 12-foot travel lanes per direction with outside shoulders at least 10 feet wide and is estimated to cost around 70% of the other alternative.

5-557.00 (I-71 Widening, between Zorn Avenue and I-265)

Purpose & Need: The purpose of this project is to decrease congestion and improve traffic flow, safety, and operations into and out of the Louisville Metro area along the I-71 corridor between Zorn Avenue and I-265 (Gene Snyder Freeway).

The project is needed to address increased traffic as the existing roadway is operating at or near capacity. Based on the current traffic projections, it is expected that traffic on Section 1, Zorn Ave to I-264, will exceed 80,560 vehicles per day by 2045 while traffic on Section 2, I-264 to I-265, will exceed 103,070 vehicles per day by 2045. These traffic numbers are well over the capacity of the current four-lane highway. Congestion issues exist currently and are not only related to the lack of capacity but also are related to the present configuration of the I-264 interchange. The interchange creates bottlenecks at peak traffic periods due to its geometric deficiencies in both directions involving site distance and sharp curves. Additionally, the area between Zorn Avenue and I-264 includes 2 locations of primary safety concerns. Traffic incidents in this section of the corridor cause major "non-recurrent" congestion problems as was documented in the 2014 I-71 Corridor Study. A review of crash data for this section of the interstate also shows that the number of crashes has increased every year since 2012. The number of crashes has increased faster than the traffic volume, indicating that the crash rate has also been increasing.

Value Engineering Study Baseline: In December 2019, the HDR/WSP team completed a study and development of alternative typical sections. It was ultimately decided that the widening, to provide 3 lanes in each direction, would be accomplished within the medians, that existing ditch width would not be changed such that new cut slopes would be required, the existing fill areas would not be widened, nor would any fill slopes be flattened. Note that the median barrier wall reflected in these plans is now a single slope Type B TL5 56 inch. Lighting the entire length of the roadway (not just the interchange) is recommended as an improvement to safety. See **Figure 2**, *I-71 Widening, between Zorn Avenue and I-265* (following page).

Figure 2. ***I-71 Widening, between Zorn Avenue and I-265***

5-557.00 (I-71/I-264 Interchange)

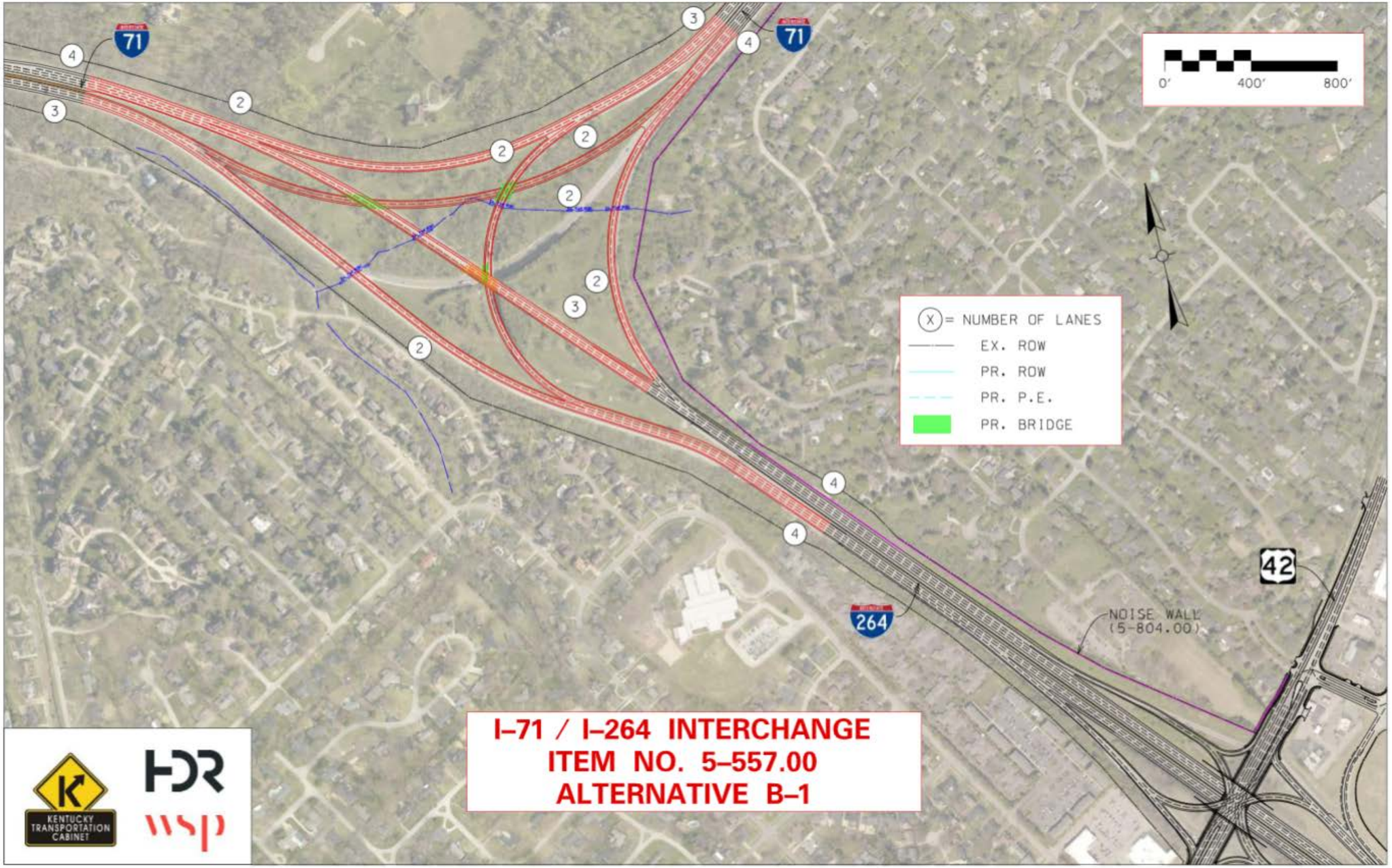
Purpose & Need: The purpose of the I-71/I-264 systems interchange improvements is to (1) Improve traffic operations; (2) Improve safety; and (3) Promote regional reliability of the Interstate corridor.

The I-71 / I-264 system interchange in Jefferson County, KY is a critical piece of infrastructure serving and connecting Louisville, Southern Indiana, and the rest of Kentucky. The current I-71/I-264 interchange cannot adequately support current or future traffic demands and has been identified for improvements. Widening projects for I-71 and I-264 that tie into this interchange are currently in the project development phase. These projects should improve traffic operations and safety by adding capacity to the existing system (new lanes) and upgrading key interchange elements (ramps and intersections) to adequately move people and goods. Traffic delays and congestion at the interchange are already evident and are projected to become more significant in the future. The primary need is to improve the interchange to better accommodate peak period traffic volumes, while improving safety at this interchange. Crashes within the interchange have caused serious injuries and significant traffic delays. Safety enhancements are also needed to reduce severe crashes and to promote the reliability of the interstate traffic flow.

Value Engineering Study Baseline: After evaluation several alternatives and a comprehensive screening process, three concepts are retained for further consideration by the project team. For the purposes of the value engineering study, concept B-1 was used by the VE team as the recommended alternative (see the following page **Figure 3**, I-71/I-264 Interchange, Alternative B-1). The VE team acknowledges that a preferred alternative has not been selected by the project team.

Concept B-1 features weaves in Areas A and B (#1) and retains the left-sided ramp configuration in Area C(#2). This concept is the closest to the No-Build scenario as the only major change within the interchange is the realignment of I-71 NB through the interchange (#3) and the widening of the I-71 SB to I-264 WB (#4) and I-264 EB to I-71 NB ramps (#5). The second of these ramp widening elements will be completed with project 5-804.00.

Figure 3. ***I-71/I-264 Interchange, Alternative B-1***



SECTION

3

EXECUTIVE SUMMARY

Section 3: Executive Summary

Background

A Value Engineering (VE) study was conducted on the preliminary design and planning documents for the Kentucky Transportation Cabinet's **I-71 Widening to Six Lanes from Downtown to I-265 Project** (Item Nos. 5-48.10 and 5-557.00, Jefferson County) on March 15-19, 2021.

The VE team provided a review of the design and/or planning document submissions prepared by Qk4 and HDR/WSP. The general impression of the VE team was that the design was complete for this level of submission. The design teams had successfully developed concepts that met the purpose and need, and functional requirements of the scope of work. The transportation improvements as conceived are constructible and function efficiently.

The VE team, having reviewed the documents and received the in-briefing presentation by the design teams, began to see their opportunity was to contribute quantitative and qualitative suggestions and improvements to the design that would improve the value of this project through improved function. While the VE team was able to pursue cost savings and/or achieve savings through suggested changes, the real focus of the team was to enhance the quality that was already taking shape in the current design. The VE team had the benefit of providing a new set of lenses in trying to find additional enhancements to the design, as they are not burdened by the history of the project. The team could see the project with fresh eyes; and the value alternatives are offered as creative contributions to an excellent design effort that has brought the project to this point.

In all cases, the focus was to search for opportunities that will enhance the functionality of the facility to support instruction while reducing the resources required to build, operate and maintain it. The documentation that follows will indicate the process that was followed resulting in the value alternatives in this report.

Workshop In-brief Meeting

KYTC design representatives from Qk4 (5-48.10) and HDR/WSP (5-557.00) presented the project during the Information Phase kick-off meeting on Monday, March 15, 2021.

The workshop objectives were identified at the start of the workshop and are used to focus the VE team's efforts:

- Identify value opportunities for—
  - Maintenance of Traffic / Sequencing of Work

- I-264 Interchange
- Zorn Avenue
- Median
- Structures

Performance Criteria

During the Information Phase, the decision makers helped the VE team understand what defined project success for the project. These criteria were used later in the workshop by the VE team for both evaluating and developing alternatives.

- Maintenance of Traffic - free-flow traffic movements during construction
- Right-of-way - stay within the right-of-way
- Environmental - noise impacts only
- Safety - minimize traffic incidents
- Maintainability - long-term maintenance costs
- Mobility - long-term operations on the Interstate

Summary Workshop Results

Summary workshop results are shown in the table below.

Workshop Outcome	Number	Section of Report / Result
Ideas Brainstormed	103	See Creative Idea List and Evaluation (Section 6: Appendices, Appendix D)
Ideas Developed into VE Workbooks	27	See Section 4: Summary Information and Section 5: Value Engineering Proposals and Design Suggestions
Value Engineering Proposals, costed	18	
Design Suggestions, not costed	9	
Design Comments (DC), not developed	14	See Section 4: Summary Information
ALL VE Proposals – Menu of Savings (potentially reduces initial and/or O&M cost without sacrificing function and/or performance)	12	$18,817,000 (Section 5: Value Engineering Proposals and Design Suggestions)
ALL VE Proposals – Menu of Added Costs (at a cost add to the project, potentially improves function and/or performance)	6	($916,000) (Section 5: Value Engineering Proposals and Design Suggestions)

Summary tables of the Value Engineering Proposals, Design Suggestions and Design Comments are included in Section 4: Summary Information. A description and further discussion of Value Engineering Proposals and Design Suggestions are also included in Section 5: Value Engineering

Proposals and Design Suggestions. The VE alternatives are categorized in one of six key focus areas—

- Maintenance of Traffic / Sequencing
- I-264 Interchange
- Zorn Avenue
- Median
- Structures
- Pavement

Function Analysis

Function definition and analysis is the heart of Value Engineering. It is the primary activity that separates VE from all other "improvement" programs. The objective of this phase is to ensure the entire team agrees upon the purpose of the project elements. Furthermore, this phase assists with development of the most beneficial areas for continuing the study. The data supporting the function analysis can be found in Section 6: Appendices, Appendix C.

The VE team identified the functions using active verbs and measurable nouns. This process allowed the team to truly understand all of the functions associated with the project. The basic functions (the "purpose" of the Purpose and Need) were defined as *Improve Safety* and *Improve Operations.* A Random Function Identification Worksheet was completed and is included in Appendix C.

Value Engineering Punch List

This section includes a Value Engineering Punch List that the decisions makers can use to guide and track decisions as they determine the ultimate disposition of each VE alternative.

VE Team

Top Row, left to right: Pat Miller (RHA), CVS Team Leader; Mike Spain (KYTC), MOT/Constructability
Second Row, left to right: Rob Martin (Qk4), MOT/Constructability; Justin Harrod (KYTC); Kenny Ott (AEI), Structures
Third Row, left to right: Brent Sweger (KYTC); Colin Miller (RHA), Technical Assistant
Bottom Row, left to right: Dan O'Dea (Stantec), Traffic Modeling; Jason Littleton (AEI), Roadway/Geometrics

Certification

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

Patrice Miller, CVS®
Certification No. 201410500

VALUE ENGINEERING PUNCH LIST

ITEM NO. **5-48.10 and 5-557.00** PROJECT COUNTY: **Jefferson** DATE OF STUDY: **March 15-19, 2021**

VE Alternative Number	Description	Location (Item No., Segment, Alternate)	Activity (Y,N,UC-Date)	Implemented Life Cycle Cost Savings	Original Cost	Alternative Cost	Initial Cost Saving	Life Cycle Cost Savings (Total Present Worth)	FHWA Categories	Remarks
Maintenance of Traffic Sequencing VE Proposals / Design Suggestions (DS)										
1	Sequencing of project corridor construction				DS	DS	DS	DS		
2	"Get It Done 71!"				DS	DS	DS	DS		
3	Phase the project in order to minimize impacts to the traveling public during construction				DS	DS	DS	DS		
4	Use directional lane with NB in the morning and SB in the evening				DS	DS	DS			
Interchange VE Proposals / Design Suggestions (DS)										
5	Use Accelerated Bridge Construction (ABC) methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline				$7,242,000	$5,376,000	$1,866,000			
6	Build I-264 EB to I-71 SB offline to the west of the existing ramp				$3,000,000	$2,766,000	$234,000			
7	Build I-71 SB to I-264 WB offline to the east of existing ramp				$2,100,000	$1,239,000	$861,000			
8	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid				$12,929,000	$4,642,000	$8,287,000			
Zorn Avenue VE Proposals / Design Suggestions (DS)										
9	Include the slip ramp for the I-71 NB off-ramp at Zorn Ave into the existing signal				$0	$100,000	($100,000)			
10	At the intersection of Zora Avenue and Mellwood Avenue propose right in/right out only at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point.				$0	$125,000	($125,000)			
11	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp termini in lieu of signals				$100,000	$218,000	($118,000)			
Median VE Proposals / Design Suggestions (DS)										
12	Use decreased lane widths to allow more room for the shoulder; 11.5-feet in lieu of 12-feet in project section 5-48.10				No Change	No Change	No Change			
13	Use cable barrier and a depressed median in lieu of concrete barrier wall - project section 2 of 5-557.00				$3,052,000	$232,000	$2,820,000			
14	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall				$3,827,000	$595,000	$3,232,000			

VE Alternative Number	Description	Location (Item No., Segment, Alternate)	Activity (Y,N,UC-Date)	Implemented Life Cycle Cost Savings	Original Cost	Alternative Cost	Initial Cost Saving	Life Cycle Cost Savings (Total Present Worth)	FHWA Categories	Remarks
15	Use TDOT barrier (51-inch tall) that is being used on I-MOVE in lieu of 56-inch tall barrier wall (Caltrans)				$975,000	$769,000	$206,000			
Structures VE Proposals / Design Suggestions (DS)										
16	Replace the 247-foot bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork				$1,750,000	$2,237,000	($487,000)			
17	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the Nagle Sign				$1,741,000	$1,797,000	($56,000)			
18	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB				$2,370,000	$2,252,000	$118,000			
19	Consider constructing noise wall on the median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall				DS	DS	DS			
20	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier				$497,000	$115,000	$382,000			
21	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening				$493,000	$0	$493,000			
22	Verify minimum clearance for Barbour Lane overpass (Section 2)				DS	DS	DS			
23	Replace existing I-71 bridges with wagon box structures at crossroads				$1,364,000	$1,123,000	$241,000			
24	Construct innovative noise wall solutions to reduce height				DS	DS	DS			
Pavement VE Proposals / Design Suggestions (DS)										
25	Consider use of larger (stone) asphalt base				$5,225,000	$5,255,000	($30,000)			
26	Verify that noise analysis was considered for the use of quiet pavement				DS	DS	DS			
27	KYTC joins the FHWA Quiet Pavement pilot program to take advantage of the SMA asphalt pavement that is to be placed				DS	DS	N/A			

SECTION

4

SUMMARY INFORMATION

Section 4: Summary Information

Introduction

The VE study team brainstormed 103 ideas. To shorten the list, the VE team evaluated the ideas using a simultaneous two-step process (further described in Appendix D). A total of 18 ideas were developed as Value Engineering Proposals with costs; and nine ideas were developed as Value Engineering Proposals without costs (Design Suggestions). The table below summarizes the 27 proposals and their respective cost implications, if any. It's important to note that costs reflected in positive numbers indicate a cost savings and costs reflected in negative numbers (parentheses) indicate a cost add. It's also important to note that, due to the conceptual nature of the alternatives and the early level of the design metrics, most costs are high level estimations. As the project design progresses and harder metrics are generated, these costs will need to be refined. The value team has attempted to maintain a high level of conservatism when making the estimations in this report.

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

$$\text{Value} = \frac{\text{Function Performance}}{\text{Cost}}$$

Understanding functional performance for each of the ideas is important as it supports the formula above. The performance for this project was analyzed by the value team and is included in the VE Proposals & Design Suggestions table.

Several of the proposals overlap or represent different ways of approaching the same issue. As a result, the savings/cost in the summary table is not cumulative.

The following pages list the Value Engineering Proposals, Design Suggestions and Design Comments in table format.

Value Engineering Study
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265 Project
Items Nos. 5-48.10 and 5-557.00
Jefferson County

Summary of Value Engineering Proposals & Design Suggestions

VE Proposal No.	Idea No.	Idea Title	Evaluation Score	IMPACT TO PERFORMANCE						Initial Cost Avoidance / (Cost Add)	O&M Avoidance / (Cost Add)	Total Life Cycle Cost Avoidance / (Cost Add)	VE Team Recommends YES or NO
				Maintenance of Traffic	Right-of-way	Environmental	Mobility	Safety	Maintainability				
Maintenance of Traffic / Sequencing													
1	MI-004	Sequencing of project corridor construction	DS	Improves	No impact	No impact	Improves	Improves	Improves	N/A	N/A	N/A	YES
2	MT-020	"Get It Done 71!"	DS	Impact to traffic flow	No impact	No impact	Impact to traffic flow	Improves worker safety	Improves	N/A	N/A	N/A	YES
3	MI-006	Phase the project in order to minimize impacts to the traveling public during construction	DS	Increased effectiveness	No impact	No impact	Increased	Increased	Increased	N/A	N/A	N/A	YES
4	MT-012	Use directional lane with NB in the morning and SB in the evening	DS	Impacts to MOT	No impact	No impact	Mobility of travel public will be impacted	Impacts safety of workers and traveling public	No impact	N/A	N/A	N/A	YES
Interchange													
5	MT-001	Use Accelerated Bridge Construction (ABC) methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline	5	Impact	No impact	No impact	No impact	Improves worker safety	Improves	$1,866,000		$1,866,000	YES
6	MT-003	Build I-264 EB to I-71 SB offline to the west of the existing ramp	4	Major improvement to MOT	No impact	No impact	No impact	No impact	Major improvement as it eliminates the old steel bridges that criss cross over the deep rock cut.	$283,000		$283,000	YES
7	MT-005	Build I-71 SB to I-264 WB offline to the east of existing ramp	4	Greatly improves to MOT	No impact	No impact	No impact	Some impact as it flattens the curve from 680-ft radius to 800-ft radius.	Some impact as it flattens the curve from 680-ft radius to 800-ft radius.	$889,000		$889,000	YES
8	MT-004	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid	4	Improves MOT	Reduces/ eliminates RW need for US 42 ramp braid	No impact	No impact	Minor safety degradation associated with tighter radius on I-264EB to I-71 NB ramp movement	No impact	$8,287,000		$8,287,000	YES
Zorn Avenue													
9	ST-012	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal	4	No impact	No impact	No impact	No impact	Improves safety - potential to reduce crashes	No impact	($100,000)		($100,000)	YES
10	MT-015	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out only at NB Mellwood Avenue and force downstream turnaround (U-turn) access point	4	Would install turn lane first before closing off median	No Impact	No Impact	Impact due to change in how traffic operates at Zorn and Mellwood intersection and downstream intersection 1000' away	Reduces rear-end/T-bone collisions	Very little except maintenance of turn lane	($125,000)		($125,000)	YES

Value Engineering Study
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265 Project
Items Nos. 5-48.10 and 5-557.00
Jefferson County

Summary of Value Engineering Proposals & Design Suggestions

VE Proposal No.	Idea No.	Idea Title	Evaluation Score	IMPACT TO PERFORMANCE						Initial Cost Avoidance / (Cost Add)	O&M Avoidance / (Cost Add)	Total Life Cycle Cost Avoidance / (Cost Add)	VE Team Recommends YES or NO
				Maintenance of Traffic	Right-of-way	Environmental	Mobility	Safety	Maintainability				
11	CR-002	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp terminals in lieu of signals	4	More complex to build under traffic than the proposed design.	No impact	No impact	Improved mobile - creates near free flow conditions throughout all hours of the day	Improves safety	Likely improves - eliminating the signals will remove the maintenance and retiming costs	($118,000)		($118,000)	YES
Median													
12	SL-004	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12'; 5-48.10	4	No Impact	No Impact	No Impact	No Impact	Safety of median shoulder may improve, travel speed may be reduced, reduction of lane separation may cause reduction of safety	No Impact	No Change	No Change	No Change	YES
13	ST-002	Use cable barrier and a depressed median in lieu of barrier wall - project section 2 of 5-557.00	4	Less impact than currently proposed, because they are pretty much leaving existing section	No impact	If some earthwork is needed on the sides, does that mean having to go back for more NEPA amendments?	No impact	No impact	Cable barrier would probably have to be replaced more than using just a concrete barrier	$2,820,000		$2,820,000	YES
14	ST-003	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall	4	No impact or very little, because the change proposed is within the median that would be dealt with current MOT.	No impact	No impact	No impact	Might be a little better than using a cable barrier, but at the same time does not make a huge improvement/ worsen the safety factor	Probably have to replace guardrail more than a concrete barrier	$3,232,000		$3,232,000	YES
15	ST-007	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of 56" tall barrier wall (Caltrans)	4	No impact	No impact	No impact	No impact	Minor reduction in crash performance	No impact	$206,000		$206,000	YES
Structures													
16	SO-001	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork	4	Necessitates phasing construction and shifting traffic for subsequent construction phases.	No impact (unless billboard is removed)	Potential impact from work in Beargrass Creek	No impact	Increases safety by eliminating bridge walls and snow & ice location	Improves maintainability by eliminating bridge.	($487,000)		($487,000)	YES

Summary of Value Engineering Proposals & Design Suggestions

VE Proposal No.	Idea No.	Idea Title	Evaluation Score	IMPACT TO PERFORMANCE						Initial Cost Avoidance / (Cost Add)	O&M Avoidance / (Cost Add)	Total Life Cycle Cost Avoidance / (Cost Add)	VE Team Recommends YES or NO
				Maintenance of Traffic	Right-of-way	Environmental	Mobility	Safety	Maintainability				
17	SO-016	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard	4	No impact	No impact	No impact	No impact	Increases safety slightly due to no icing on bridge	Large improvement	($56,000)		($56,000)	YES
18	SO-005	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB	4	No impact	May have impact to ROW regarding lease agreement of billboard	No impact	No impact	No impact	Improves maintainability of bridge	$118,000		$118,000	YES
19	AS-001	Consider constructing the noise wall on median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall	DS	Little to no change since still installing a noise wall, just breaking it up into 2 smaller noise walls instead of one bigger noise wall	No impact	Would changing the noise wall height and what it is used cause needed to go back for additional environmental review?	No impact	No impact	Replace sections of noise wall if parts are destroyed in a traffic accident	N/A	N/A	N/A	YES
20	AS-015	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier	4	Improves MOT	No impact	No impact	No impact	Negligible degradation of safety in area of bridge	No impact	$382,000		$382,000	YES
21	SO-010	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening	4	Improves MOT	No impact	No impact	No impact	Degrades safety	Degrades maintainability	$493,000		$493,000	YES
22	SO-018	Verify minimum clearance for Barbour Lane overpass (Section 2)	DS	No Impact	No Impact	No Impact	No Impact	Safety impacted if vertical clearance is not satisfied	No impact	N/A	N/A	N/A	YES
23	SO-023	Replace existing I-71 bridges with wagon box structures at crossroads	4	No impact	No impact	No impact	No impact	Increases safety slightly due to no icing on bridge	Large improvement	$241,000		$241,000	YES
24	AS-006	Construct innovative noise wall solutions to reduce height	DS	No impact	No impact	No impact	No impact	No impact	No impact	N/A	N/A	N/A	YES
Pavement													
25	SL-006	Consider use of larger (stone) asphalt base	4	No impact	No impact	No impact	No impact	No impact	Improves long-term life of the pavement	($30,000)		($30,000)	YES
26	SL-007	Verify that noise analysis was considered for the use of quiet pavement	DS	Increase at time resurfacing is needed	No impact	If noise walls are avoided, then the project could eliminate tree removal at RW line	No impact	No impact	Increases maintenance	N/A	N/A	N/A	NO
27	AS-003	KYTC joins the FHWA quiet pavement pilot program and can take advantage of the SMA asphalt pavement that is to be placed	DS	Increase at time of resurfacing	No impact	No impact	No impact	No impact	Increase	N/A	N/A	N/A	NO

Design Comments (No Workbook Prepared)

	Idea Title
SL	**Support Load**
SL-012	Evaluate various pavement sections versus costs versus life expectancy and then ratio them to compare
SL-013	Rock roadbed for portion of 5-557 rather than cement stabilize, based on amount of rock available in interchange area
SL-016	Add fibers in the asphalt to reduce layer thickness without decreasing structural number
ST	
ST-004	Add edge-lined rumble strips
ST-005	Add raised pavement markers
ST-006	Provide high profile pavement striping and/or markings
MT	
MT-002	Consider building I-264 interchange ramps as part of US 42 project
MT-019	Schedule any major lane closers to occur between Memorial Day and Labor Day and encourage work to continue during nights, weekends, and holidays
AS	
AS-005	A good education program during public meetings/hearings is critical to manage expectations regarding the efficacy of noise walls
AS-012	Build sounds walls with aesthetic consideration
AS-016	Place light fixtures on noise walls instead of in the median
AS-018	Provide lighting on outside shoulder to reduce glare in homes
CR	
CR-001	Add sidewalk through Zorn Avenue interchange area (ramp-to-ramp)

SECTION

5

VALUE ENGINEERING PROPOSALS & DESIGN SUGGESTIONS

Section 5: Value Engineering Proposals and Design Suggestions

Introduction

The VE team brainstormed 103 ideas. Of these, 27 ideas were identified for further development into Value Engineering proposals, 18 with cost impacts and nine with no cost impacts (Design Suggestions). The description and further discussion of these are included in this section and are categorized by the following focus areas:

- Maintenance of Traffic / Sequencing (4 developed proposals)
- Interchange (4 developed proposals)
- Zorn Avenue (3 developed proposals)
- Median (4 developed proposals)
- Structures (9 developed proposals)
- Pavement (3 developed proposals)

Several of the proposals overlap or represent different ways of approaching the same issue. Cost savings are shown as positive costs while any added costs are noted in parenthesis. Total Life Cycle Costs are the summation of the initial plus O&M costs as estimated by the VE team.

The VE team also identified 14 Design Comments (DC); a list of these was provided in Section 4: Summary Information.

Please note that two VE proposals are not recommended by the VE team, VE-26 and VE-27, but are included for documentation purposes.

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

- Unique Identifying Number (1, 2, 3, etc.)
- Unique Creative Idea Number (XX-###)
- Creative Idea Title
- Function Identification
- Baseline Assumption – brief description
- Proposed Alternative – brief description
- Benefits
- Risks/Challenges
- Cost Summary
- Baseline and Proposed Sketches, if applicable
- Discussion/Justification

- Impact to Performance, if applicable
- Implementation Considerations, if applicable
- Initial Cost Detail
- Replacement/Salvage and Annual Cost Detail, if applicable

Cost Estimating for VE Proposals

The costs used are those provided by the design teams and KYTC. Where the VE team has offered alternate costs, they are provided for information only, reflective of the short duration of the VE study and should be evaluated by the design teams and KYTC. Value Engineering ideas are provided for their evaluation and implementation exclusively by the design teams and KYTC.

VALUE ENGINEERING PROPOSAL NO. 01
Idea No. MI-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Sequencing of project corridor construction
FUNCTION	**Miscellaneous**

BASELINE ASSUMPTION:

The VE team was tasked with reviewing the sequence of projects and to make recommendations as to most efficient ways to bundle the projects if this becomes an option. This includes addressing best ways to group any changes needed within the I-71 and I-264 interchange with the respective widening projects to selectively maximize performance and safety.

PROPOSED ALTERNATIVE:

The VE team proposes the following work sequence:
1) Improve the US 42 interchange in conjunction with addressing the merge with I-264 EB with I-71 NB
2) Widen I-71 5-557 section 2
3) Widen I-71 5-48.10
4) Widen I-71 5-557 section 1 and 71 SB to 264 WB ramp to 2 lanes
5) If work in phase (1) hasn't helped, include NB 71 relocation in (4)

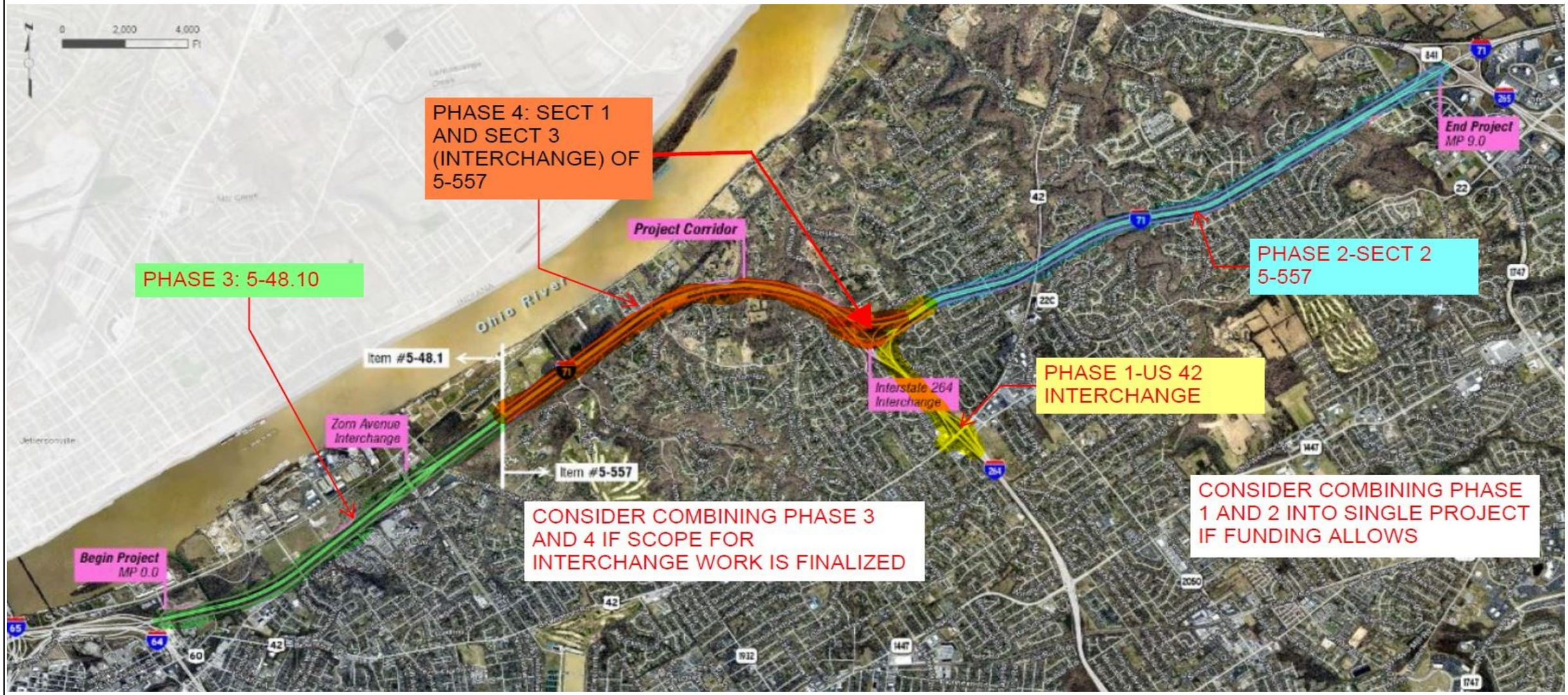
BENEFITS	RISKS/CHALLENGES
● Focuses improvements on areas identified with critical issues to be addressed in first two phases of work	● Funding
● Sequence can be adapted to innovative contracting methods such as Design Build if needed to expedite the project	●
● Sequence takes into account maintenance of traffic options in the interchange that could maximize potential savings if determined improvements are needed	●
● Sequence takes into account items such as earthwork, creating projects that can efficiently use materials rather than be forced to waste it	●
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 01
Idea No. MI-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Sequencing of project corridor construction

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 01
Idea No. MI-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Sequencing of project corridor construction

DISCUSSION/JUSTIFICATION:

The VE team was tasked with reviewing sequence and recommending the most efficient ways to bundle the projects if this becomes an option. This exercise was intended to include addressing best ways to group any changes needed within the I-71 and I-264 interchange with the respective widening projects to selectively maximize performance and safety.

From the project briefing and information provided in the planning documents prepared by the Design Team, the VE team developed a suggested phased sequence of projects focusing on making improvements identified as critical to the success of the project in the early stages. These critical issues the VE team focused on were:

1) Improve performance of the US 42-I-264 interchange first phase. This opens up options for MOT for work on the widening I-71 in future phases

2) I-71 NB merge with I-264 EB deemed critical in terms of creating performance issues, creating backups during PM peak and other safety issues on I-71 NB. The VE team believes improvements planned for with the US 42 interchange, supplemented with improvements planned for with the project section 2 of 5-557 widening, will make a significant improvement in performance for the overall corridor. If an expedited funding option becomes available, such as a Federal Infrastructure Stimulus program, it is recommended that the US 42 interchange project be grouped with project section 2 of 5-557, possibly as a Design Build project. The US 42 interchange project is in the ROW phase and an accelerated letting using Design Build is certainly an option. The scope of project section 2 is very straight forward, with no ROW or Utilities. The perspective DB teams would be able to hit such a project on all fronts, designers focusing on project section 2 and contractors focusing on the US 42 interchange. In many respects, such a project could be ready for letting in less than four months if needed.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Improves
Right-of-way: None
Environmental: None
Mobility: Improves
Safety: Improves
Maintainability: Improves

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 01
Idea No. MI-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Sequencing of project corridor construction

DISCUSSION/JUSTIFICATION:

3) The VE team proposes the next phase to be done following (1) and (2) is 5-48.10. The thought behind this is to monitor the performance of the I-71 and I-264 interchange to determine the impact of the earlier work before committing to interchange improvements. Completion of 5-48.1 during this monitoring process keeps the project moving forward. The "monitoring" time frame duration is subjective of course. The goal is prior to beginning Phase 4 Section 1 of 5-557, the scope of work needed at the interchange can be more easily finalized.

4) Phase 4 Section 1 of 5-557 would be to complete the widening of I-71 in conjunction with complete improvements needed at the I-71 and I-264 interchange. Phase 4 could be grouped with Phase 3 as single project once scope of interchange work is finalized. Again, innovative contract techniques are an option. Once the scope of work at the interchange is more clear, Design Build or other options could be considered, based on the funding a needs to expedite the work.

VALUE ENGINEERING PROPOSAL NO. 02
Idea No. MT-020
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	"Get It Done 71!"
FUNCTION	**Maintain Traffic**

BASELINE ASSUMPTION:

The VE team was tasked with reviewing sequence of projects and make recommendations as to most efficient ways to bundle the projects if this becomes an option. This includes addressing best ways to group any changes needed within the I-71 and I-264 interchange with the respective widening projects to selectively maximize performance and safety

PROPOSED ALTERNATIVE:

The VE team looked at multiple variations of grouping the projects together into a phasing plan with the goal of maximizing work areas available to the contractor in order to expedite the construction of the entire corridor. While the phases could be done as separate projects similar to MT-004, this concept was developed to work towards treating as single project with multiple phases. Innovative contracting options are definitely an option, including both Design Build and Construction Manager General Contractor (CMGC). CMGC is possible option to assist with finalizing the scope at the I-71 and I-264 interchange while moving forward with other elements of the project where the scope is more straight forward.

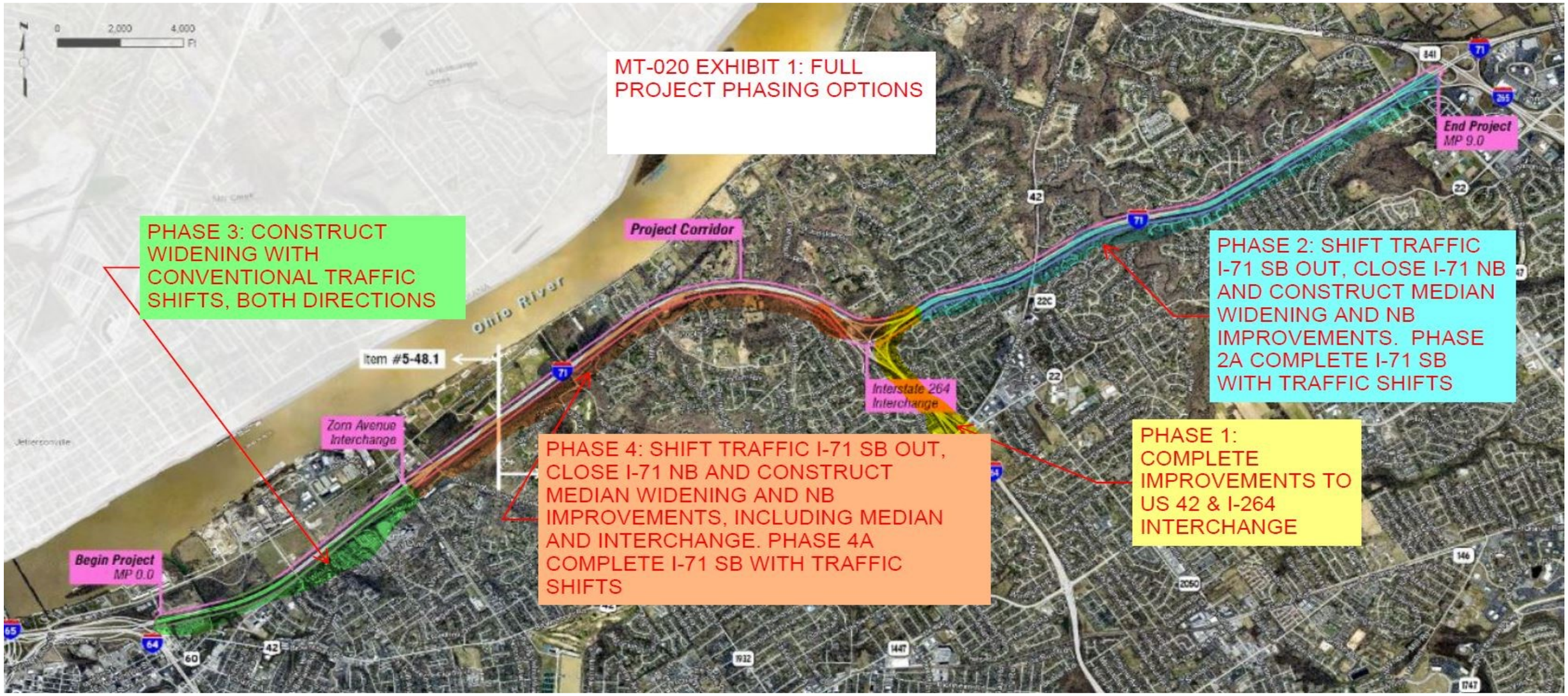
BENEFITS	RISKS/CHALLENGES
● Expedites project delivery	● Greater road user impacts
● Provides safer work zone	●
●	●
●	●
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 02
Idea No. MT-020
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	"Get It Done 71!"

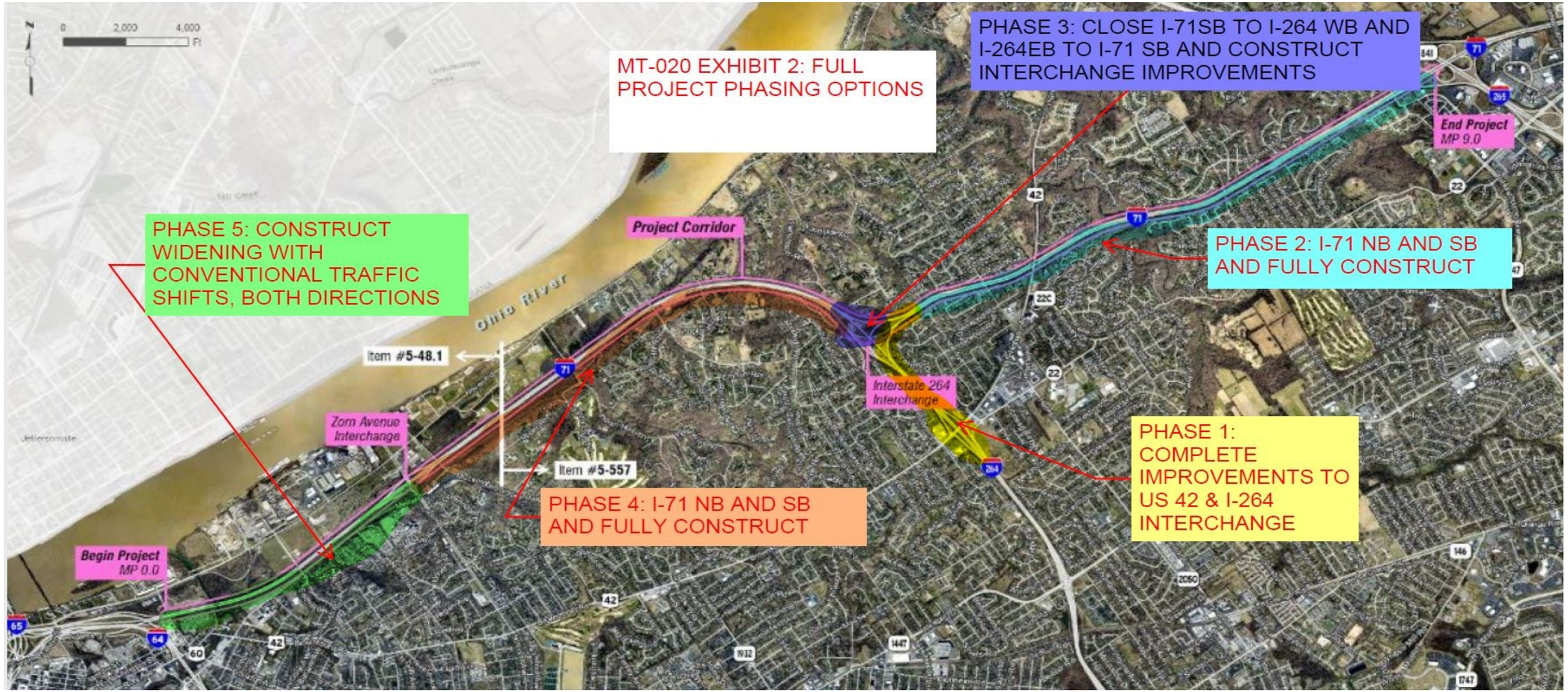
SKETCH 1 OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 02
Idea No. MT-020
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	"Get It Done 71!"

SKETCH 2 OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 02
Idea No. MT-020
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	"Get It Done 71!"

DISCUSSION/JUSTIFICATION:

The VE team looked at multiple variations of grouping the projects together into a phasing plan with the goal of maximizing work areas available to the contractor in order to expedite the construction of the entire corridor. While the phases could be done as separate projects similar to MT-004, this concept was developed to work towards treating as a single project with multiple phases. Innovative contracting options are definitely an option using this approach, including both Design Build and Construction Manager General Contractor (CMGC). CMGC is possible option to assist with finalizing the scope at the I-71 and I-264 interchange while moving forward with other elements of the project where the scope is more straight forward. In general, it is believed innovative contracting methods would be most beneficial in a scenario where funding for the project could be obtained thru a Federal Highways Infrastructure Stimulus Program that required an expedited delivery similar to the ARRA program several years ago.

The premise for these variations of phasing focuses on: 1) The US 42 interchange with I-264 will be improved and operational before closures on I-71 are allowed 2) While overall the observation that the traffic volumes are balanced per ADT's provided, traffic has distinct "directional" movements, meaning heavy into the City (SB) in the morning peak and heavy (NB) in the afternoon peak.

The VE team first looked at the approach that "get people to work" downtown" in the morning and spread traffic out in the system in the afternoon. In other words, close I-71 NB, in sections, with some phases limiting access for I-71 SB to I-264 WB. Overall, it is projected this approach would expedite overall construction time an estimated 20% faster. See Proposed Exhibit 1 for this concept.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Impact to traffic flow
Right-of-way: None
Environmental: None
Mobility: Impact to traffic flow
Safety: Improves worker safety
Maintainability: Improves

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 02
Idea No. MT-020
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	"Get It Done 71!"

DISCUSSION/JUSTIFICATION:

Second, the VE team looked at an approach similar to Restore 64, depending on the final scope of work at the interchange. Essentially split the project into 3 phases "after" Phase 1: US 42 interchange with I-264 has been constructed. Phase 2: Close I-71 from I-264 to I-265 and fully construct. Phase 3: Close ramps from I-264 EB to I-71 SB and I-71 SB to I-264 WB and construct interchange improvements Phase 4: Close I-71 from Zorn Avenue to I-264 and fully construct. Phase 5: Construct from downtown to Zorn Avenue using conventional split traffic phasing. This work could be done in conjunction with any of the other phases. See Proposed Exhibit 2 for this concept.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: impacts to traffic flow
Right-of-way: none
Environmental: none
Mobility: impacts to traffic flow
Safety: improves
Maintainability: improves

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 03
Idea No. MI-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Phase the project in order to minimize impacts to the traveling public during construction
FUNCTION	**Miscellaneous**

BASELINE ASSUMPTION:

The existing design calls for I-264 EB to I-71 SB and the SB I-71 to WB I-264 be constructed in the existing ramp location. For the purposes of the value engineering study, concept B-1 was used by the VE team as the recommended alternative (see the following page Figure 3, I-71/I-264 Interchange, Alternative B-1). The VE team acknowledges that a preferred alternative has not been selected by the project team.

PROPOSED ALTERNATIVE:

Move alignment off the existing roadway to accommodate partial width or full construction of bridges and/or roadway to minimize traffic impacts.

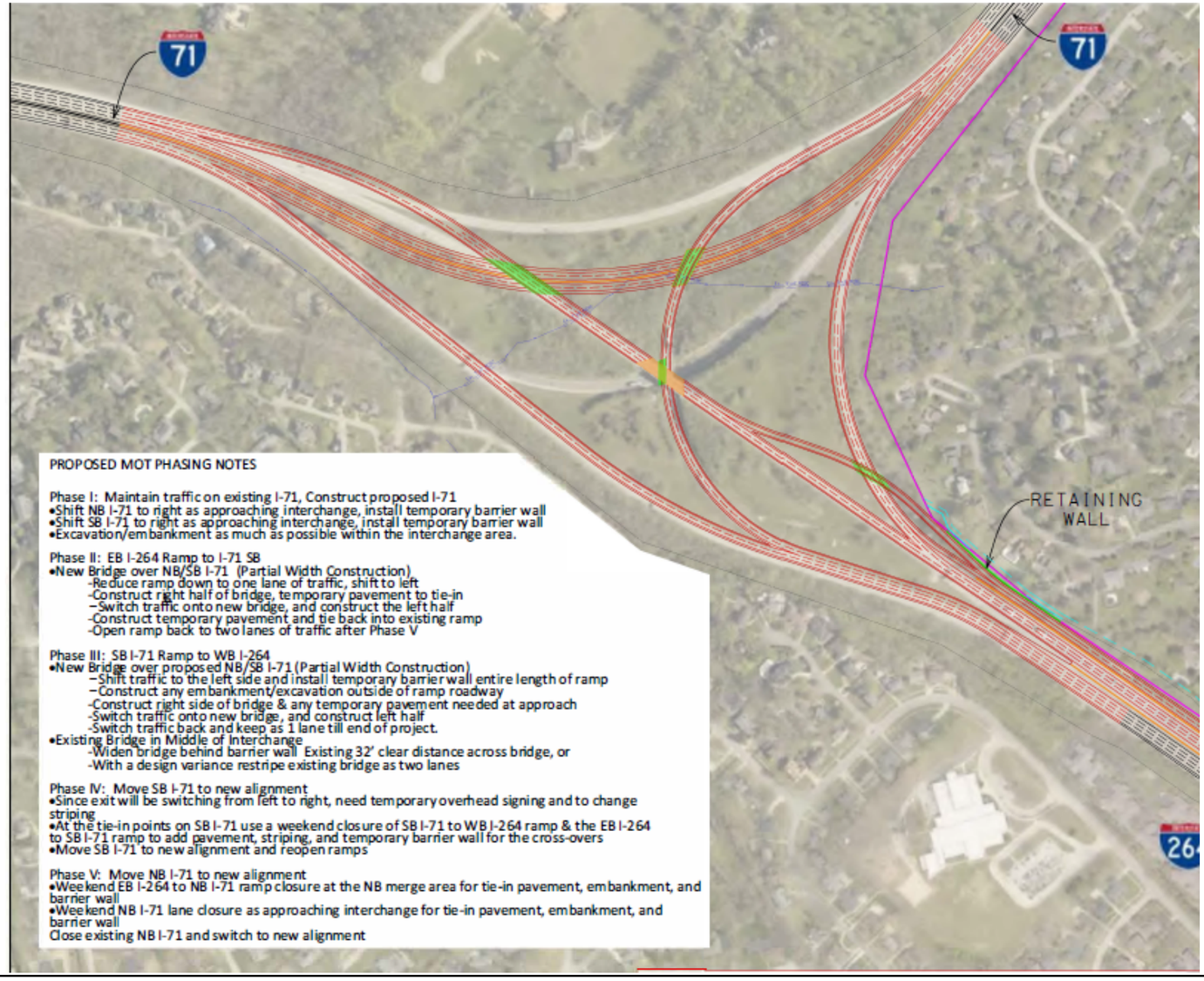
BENEFITS	RISKS/CHALLENGES
● Decrease traffic impacts	● Increase in costs due to additional pavement needed
● Increase in constructability	●
●	●
●	●
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 03
Idea No. MI-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Phase the project in order to minimize impacts to the traveling public during construction

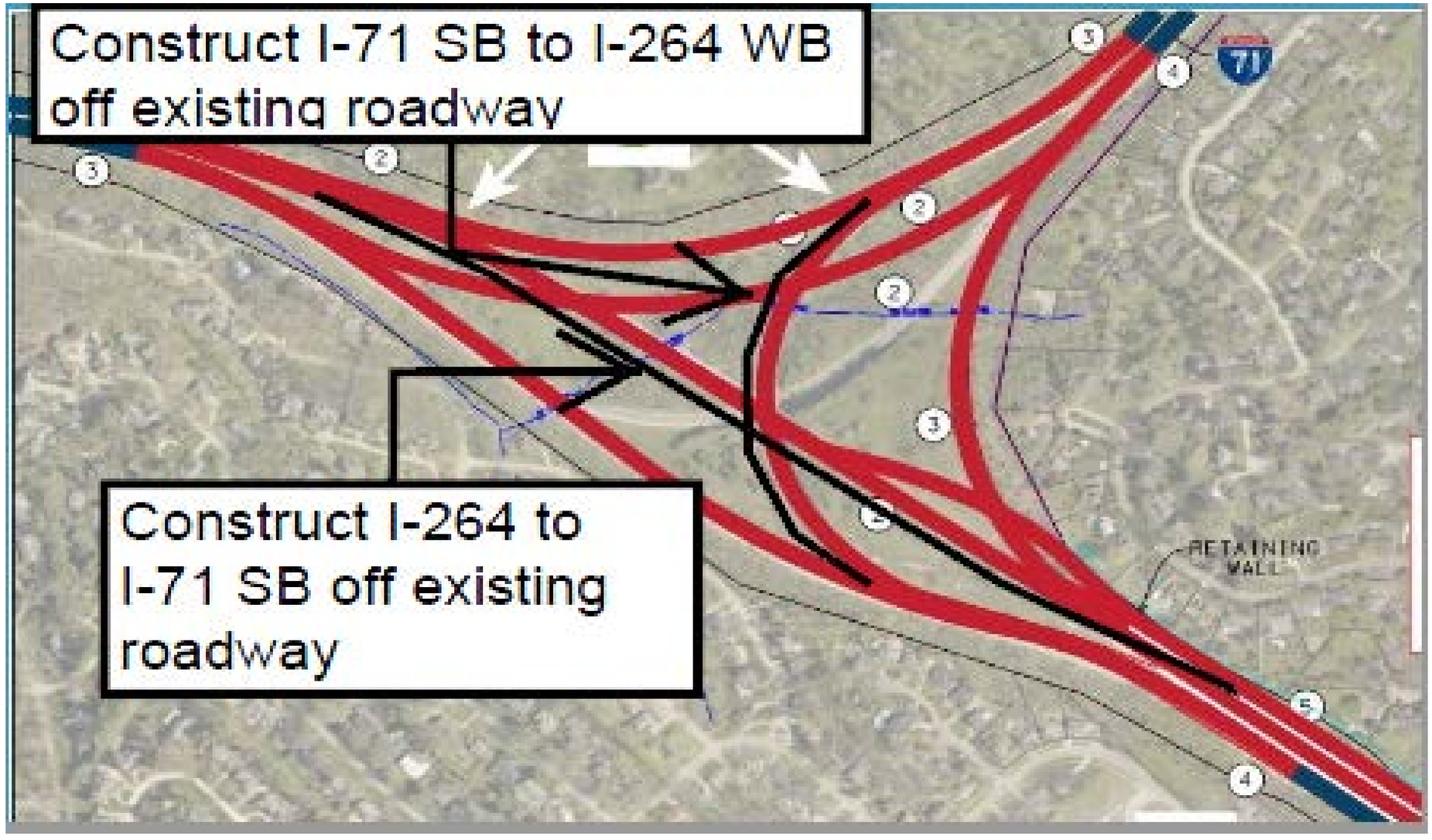
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 03
Idea No. MI-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Phase the project in order to minimize impacts to the traveling public during construction

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 03
Idea No. MI-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Phase the project in order to minimize impacts to the traveling public during construction

Realign proposed I-264 EB to I-71 SB ramps and I-71 SB to I-264 WB off existing roadway to allow for the existing number of lanes to be left open during proposed bridge and roadway construction to allow for a near normal flow while constructing these areas. If ramp is realigned to the left, this will also increase width on right side to allow for future construction in the weaving area between US 42 and I-264 EB to I-71 NB ramp. This will also allow for construction of relocated I-71 NB in phases with no traffic.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Increased effectiveness
Right-of-way: No impact
Environmental: No impact
Mobility: Increased
Safety: Increased
Maintainability: Increased

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 04
Idea No. MT-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use directional lane with NB in the morning and SB in the evening
FUNCTION	**Maintain Traffic**

BASELINE ASSUMPTION:

The Maintenance of Traffic (MOT) plans may require the contractor to maintain a minimum of two travel lanes in each direction on I-71 for the duration of the project.

PROPOSED ALTERNATIVE:

The VE Team suggests the MOT plans require the contractor to only maintain a minimum of two travel lanes for the southbound I-71 during AM peak hours and northbound I-71 during PM peak hours.

BENEFITS	RISKS/CHALLENGES
● Contractor can work more efficiently, project is completed sooner	● Substantial delays for non-peak direction of travel
● Contractor can work in a larger work zone, project is completed sooner	● Traffic backups could result in an increase in rear end collisions
● Contractor employees have safer work zone	● May involve a more comprehensive public information campaign to advise motorists of potential delays
●	●
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 04
Idea No. MT-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

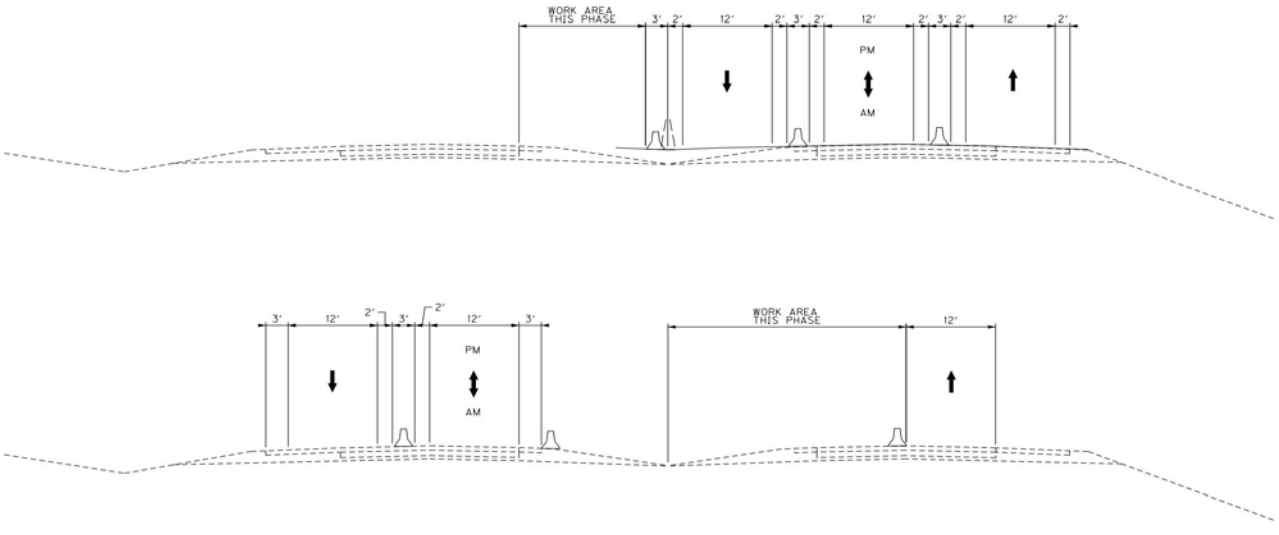
TITLE	Use directional lane with NB in the morning and SB in the evening

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING PROPOSAL NO. 04
Idea No. MT-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use directional lane with NB in the morning and SB in the evening

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 04
Idea No. MT-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use directional lane with NB in the morning and SB in the evening

DISCUSSION/JUSTIFICATION:

The VE team suggests the MOT plans require the contractor to only maintain two minimum travel lanes for southbound I-71 during AM peak hours and northbound I-71 during PM peak hours. By requiring the contractor to only maintain two travel lanes during the peak hours for each peak directional movement, the contractor will have flexibility to consider innovative / approved temporary traffic control strategies. Strategies include but would not be limited to work zone median crossovers, two-way traffic operation on same side, and separated travel lanes in the same direction. The proposed sketch includes samples of typical sections in which a center lane in the MOT could be used to alternate between NB and SB traffic for the respective peak periods. In these scenarios, the barrier walls separating traffic in opposing directions would remain for the duration of the construction phase. All strategies would be implemented with the purpose of completing required construction phases more expeditiously while still protecting employees in the work zone as well as the travelling public.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Impacts to MOT
Right-of-way: No impacts
Environmental: No impacts
Mobility: Mobility of traveling public will be impacted for the duration of construction
Safety: Impacts safety of workers and traveling public for the duration of construction
Maintainability: No impact

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 05
Idea No. MT-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use Accelerated Bridge Construction (ABC) methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline
FUNCTION	**Maintain Traffic**

BASELINE ASSUMPTION:

As part of the construction for the relocation of I-71 NB, in order to maintain traffic on the bridges (one existing and one proposed) for the I-264 east ramp to I-71 SB, traffic would need to be maintained on at least one lane during this work. This process is to be repeated for the ramp from I-71 SB to I-264 WB.

PROPOSED ALTERNATIVE:

Close the I-264 ramps to I-71 SB and require the contractor to utilize accelerated bridge construction techniques to expedite the construction of the new bridges and widening of the existing bridge. The existing bridge for the ramp from I-71 SB to I-264 WB can be converted to an at-grade crossing, eliminating the existing.

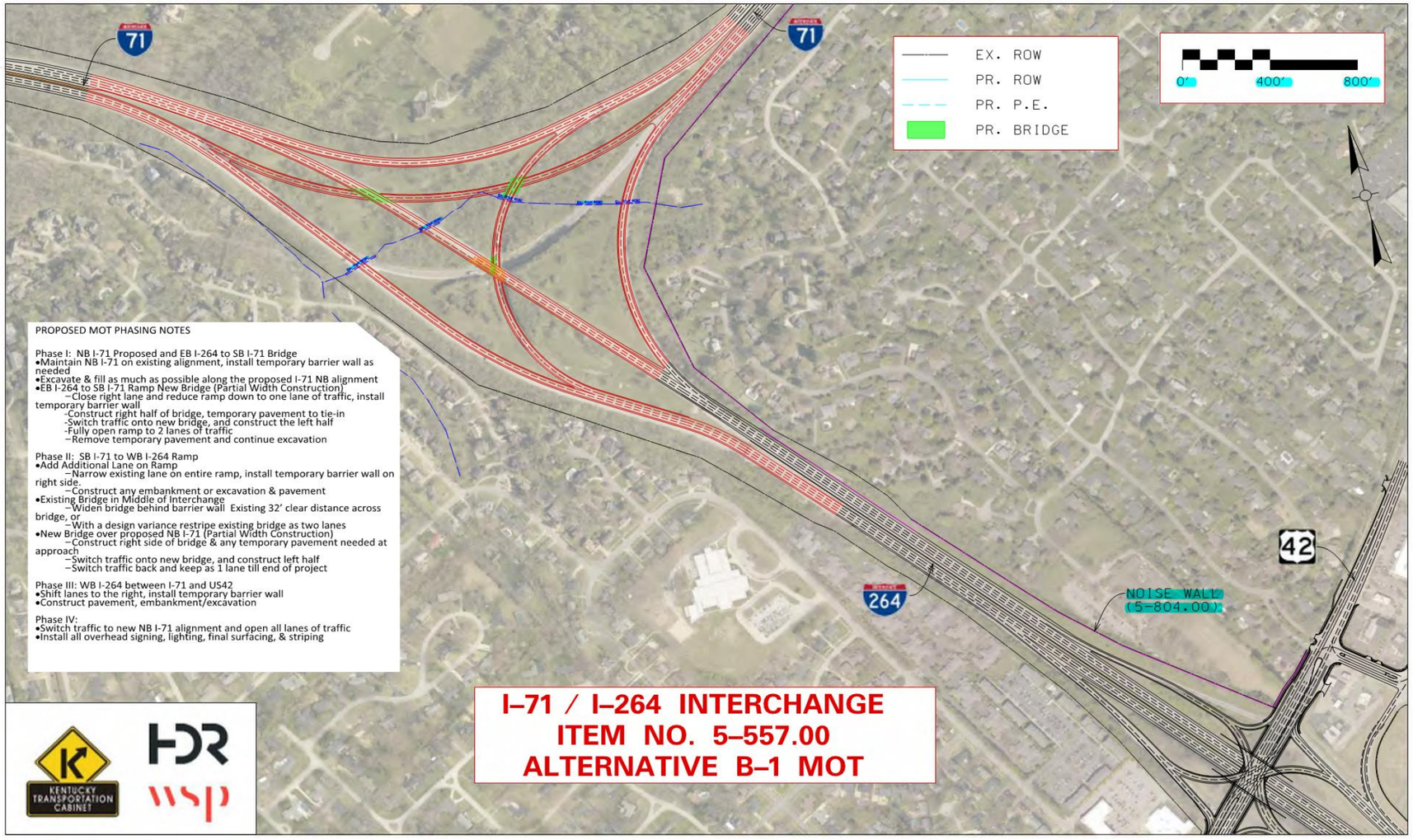
BENEFITS	RISKS/CHALLENGES
● Cost savings	● Public buy-in may be challenging
● Expedites construction	● Potential travel delay
● Eliminates bridge	●
● Provides safety during construction	●
●	●
●	●
●	●

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 7,242,000	$ -	$ 7,242,000
PROPOSED ALTERNATIVE:	$ 5,376,000	$ -	$ 5,376,000
TOTAL (Baseline less Proposed)	$ 1,866,000	$ -	$ 1,866,000

AVOID COST

TITLE	Use Accelerated Bridge Construction (ABC) methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline

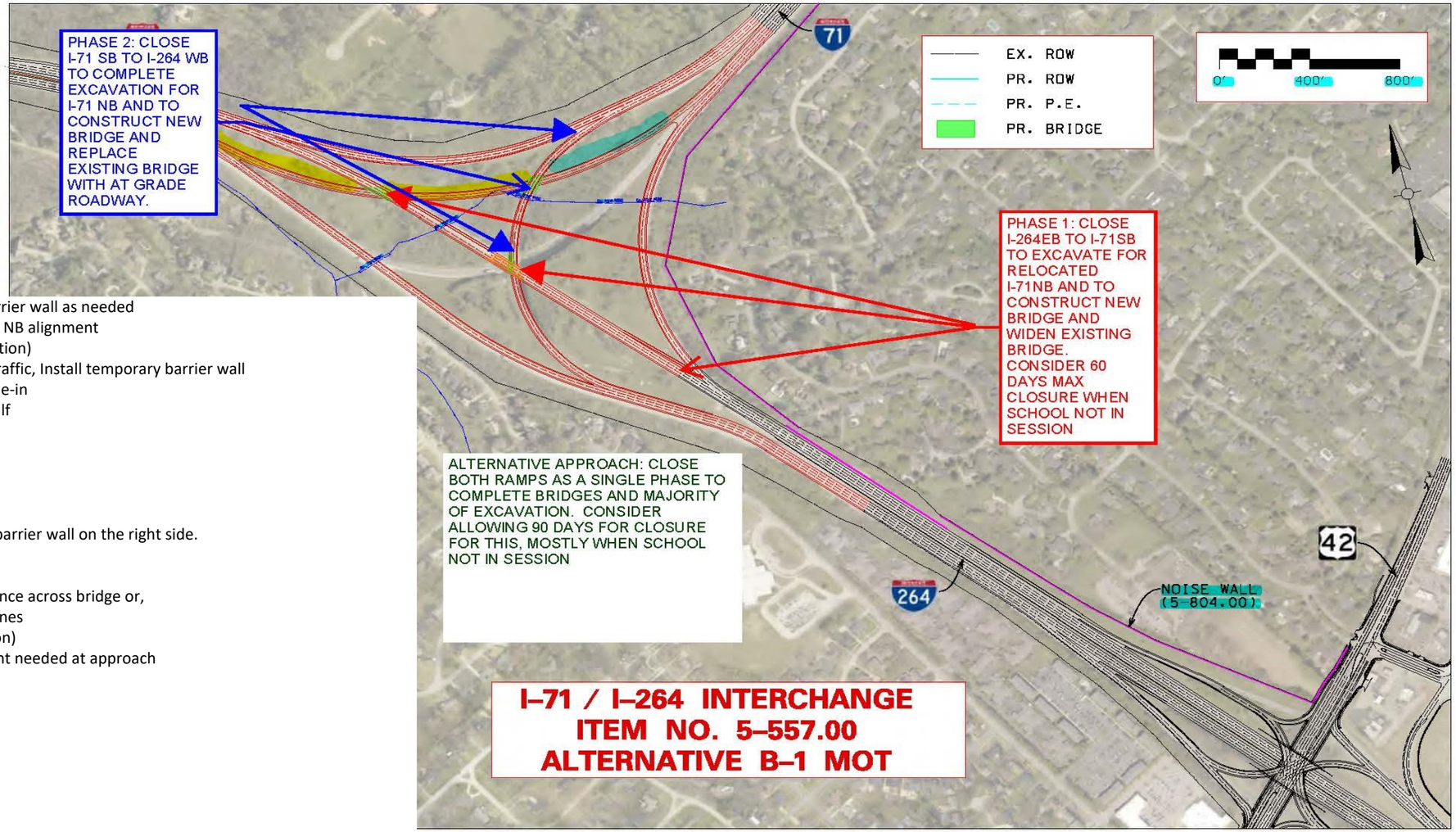
SKETCH OF BASELINE



VALUE ENGINEERING PROPOSAL NO. 05
Idea No. MT-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE Use Accelerated Bridge Construction (ABC) methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline

SKETCH OF PROPOSED ALTERNATIVE



PROPOSED MOT PHASING NOTES

Phase I: NM I-71 Proposed and EB I-264 to SB I-71 Bridge
*Maintain NB I-71 on existing alignment, install temporary barrier wall as needed
*Excavate and fill as much as possible along the proposed I-71 NB alignment
*EB I-264 to SB I-71 Ramp New Bridge (Partial Width Construction)
-Close right lane and reduce ramp down to one lane of traffic, Install temporary barrier wall
-Construct right half of bridge, temporary pavement to tie-in
-Switch traffic onto new bridge, and construct the left half
-Fully open ramp to 2 lanes of traffic
-Remove temporary pavement and continue excavation

Phase II: SB I-71 to WB I-264 Ramp
*Add Additional Lane on Ramp
-Narrow existing lane on entire ramp, install temporary barrier wall on the right side.
-Construct any embankment or excavation & pavement
*Existing Bridge in Middle of Interchange
-Widen bridge behind barrier wall Existing 32' clear distance across bridge or,
-With a design variance restripe existing bridge as two lanes
*New Bridge over proposed NB I-71 (Partial Width Construction)
-Construct right side of bridge & any temporary pavement needed at approach
-Switch traffic onto new bridge and construct left half
-Switch traffic back and keep as 1 lane till end of project

Phase III: WB I-264 between I-71 and US42
*Shift lanes to the right, install temporary barrier wall
*Construct pavement, embankment/excavation

Phase IV:
*Switch traffic to new NB I-71 alignment and open all lanes of traffic
*Install all overhead signing, lighting, final surfacing & striping

VALUE ENGINEERING PROPOSAL NO. 05
Idea No. MT-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use Accelerated Bridge Construction (ABC) methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline

DISCUSSION/JUSTIFICATION:

The reconstruction of the I-264 interchange with I-71 offers some unique challenges compared to the other elements to be constructed for this project. The area for the construction of the new bridges over ramps for relocated I-71 NB, based on reviewing the existing rock cuts in the area, appears to require a substantial amount of solid rock to be excavated from "under" the proposed bridges for I-264 EB to I-71 SB and for I-71 SB to I-264 WB. Blasting for rock excavation in an area this close to live traffic has inherent risks. Alternatives such as "mechanical removal" of rock is extremely expensive. Phasing of the blasting to "fracture" the rock under the existing I-264 EB ramp but not remove utilizing a weekend closure is an option, but has a higher level of risk and ultimately is more costly because of this. In this scenario, both new bridges are still constructed using part width.

Based on these constructability\cost issues, The VE team proposes the KYTC consider closing the I-264 EB to I-71 SB ramp to allow for this new bridge construction to take place as part of PHASE 1. In addition, the widening of the existing I-264 EB bridge over the ramp from I-71SB to I-264 WB could also be completed during this closure. PHASE 2 would be a repeat of this, only close the ramp from I-71 SB to I-264 WB to complete the new bridge for this ramp over relocated I-71 NB. Once I-71 NB is relocated and it is acceptable to leave the I-71 SB to I-264 WB ramp closed, the I-71 SB Ramp to I-264 WB existing bridge over old I-71 NB could be removed and replaced on grade rather than widen the existing structure. There are multiple variations of this that can be accomplished, depending on the amount of time it is acceptable to keep the ramps between I-71SB and I-264 closed. Doing this work in a single phase "closing all ramps between I-264 and I-71 SB" appears to have the best opportunity to reduce construction costs for the new ramp bridges over relocated I-71 NB and replace the old ramp bridge with on-grade crossing. This would need a very robust public information plan as part of this proposal.

Common cost estimating for bridge construction when comparing part width construction versus the ability to construct the bridge in its entirety is 30% more for part width construction. Replacement of the existing ramp bridge with an at grade crossing while the ramps are closed is more straightforward. Due to the location for the blasting (still between I-71 NB and SB) potential cost savings are more difficult to predict for blasting\excavation. In general, the work will be done faster and a case can be made that "user costs" for additional travel time required to bypass the work zone are offset by increased speed in which the construction is completed. Predicted cost savings for this proposal will only address the bridges for these reasons.

It is suggested by the VE team that the contractor be given 90 days maximum, during times when school is not in session, to accomplish this work.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Improves MOT
Right-of-way: No impact
Environmental: No impact
Mobility: Temporary degradation during construction
Safety: Improves worker safety during construction; no impact after construction
Maintainability: Improves maintainability by eliminating the existing I-71SB to I-264 WB bridge

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 05
Idea No. MT-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use Accelerated Bridge Construction (ABC) methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
I-264 EB OVER I-71 NB (30% COST REDUCTION)	SF	12,000	$ 300.00	$ 3,600,000	12,000	$ 225.00	$ 2,700,000
I-71 SB OVER I-71 NB	SF	8,640	$ 300.00	$ 2,592,000	8,640	$ 225.00	$ 1,944,000
I-264 EB OVER I-71 SB TO WB RAMP (WIDEN EXISTING)	SF	1,800	$ 350.00	$ 630,000	1,800	$ 275.00	$ 495,000
I-71SB OVER OLD I-71 NB WIDEN	SF	1,200	$ 350.00	$ 420,000			
I-71SB OVER OLD I-71 NB DEMO	LS				1	$ 90,000.00	$ 90,000
I-71SB OVER OLD I-71 NB EMB	CY				4,400	$ 15.00	$ 66,000
PAVEMENT	SY				667	$ 46.20	$ 30,815
CONTINGENCY	LS				1	$ 50,000.00	$ 50,000
TOTAL				$ 7,242,000			$ 5,376,000
						CWE (BASELINE LESS PROPOSED)	$ 1,866,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 06
Idea No. MT-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-264 EB to I-71 SB offline to the west of the existing ramp
FUNCTION	**Maintain Traffic**

BASELINE ASSUMPTION:

The alignment of all three alternates is along the existing alignment except for I-71 NB and the corresponding MOT plan calls for part-width construction of the proposed bridge over the proposed I-71 NB. All three alternates also widen the existing 55-yr old steel bridge over the deep rock cut.

PROPOSED ALTERNATIVE:

Shift the alignment to the west so that the entire proposed two-lane bridge can be constructed while maintaining traffic on the existing bridge. This existing steel bridge will be removed and replaced with a new bridge over the realigned I-71 SB to I-264 WB (see MT-005).

BENEFITS	RISKS/CHALLENGES
● Lowers construction cost	● Complete new alignment so existing ramp pavement cannot be used
● Reduces construction time	● Temporary diversion from existing ramp to new ramp will need to be constructed north ex. deep rock cut
● Greatly improves MOT	●
● Eliminates future maintenance of the old steel bridges which can be very costly	●
● Proposed Bridges will be out of deep rock cuts as evidenced by the original quad	●
●	●
●	●

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 3,000,000	$ -	$ 3,000,000
PROPOSED ALTERNATIVE:	$ 2,766,000	$ -	$ 2,766,000
TOTAL (Baseline less Proposed)	$ 234,000	$ -	$ 234,000

AVOID COST

TITLE	Build I-264 EB to I-71 SB offline to the west of the existing ramp

SKETCH OF BASELINE ASSUMPTION

PROPOSED MOT PHASING NOTES

Phase I: NB I-71 Proposed and EB I-264 to SB I-71 Bridge
- Maintain NB I-71 on existing alignment, install temporary barrier wall as needed
- Excavate & fill as much as possible along the proposed I-71 NB alignment
- EB I-264 to SB I-71 Ramp New Bridge (Partial Width Construction)
  - Close right lane and reduce ramp down to one lane of traffic, install temporary barrier wall
  - Construct right half of bridge, temporary pavement to tie-in
  - Switch traffic onto new bridge, and construct the left half
  - Fully open ramp to 2 lanes of traffic
  - Remove temporary pavement and continue excavation

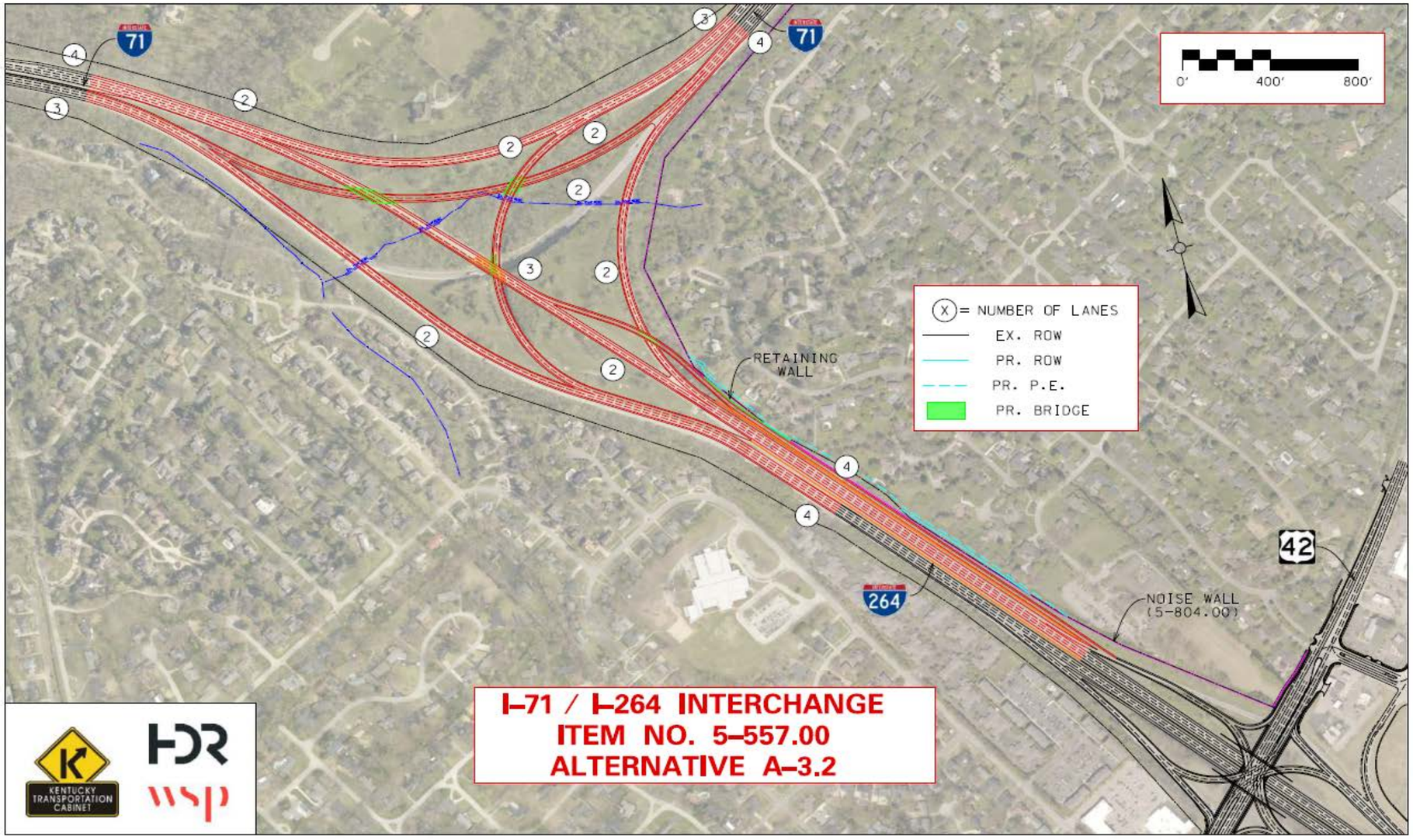
Phase II: SB I-71 to WB I-264 Ramp
- Add Additional Lane on Ramp
  - Narrow existing lane on entire ramp, install temporary barrier wall on right side.
  - Construct any embankment or excavation & pavement
- Existing Bridge in Middle of Interchange
  - Widen bridge behind barrier wall Existing 32' clear distance across bridge, or
  - With a design variance restripe existing bridge as two lanes
- New Bridge over proposed NB I-71 (Partial Width Construction)
  - Construct right side of bridge & any temporary pavement needed at approach
  - Switch traffic onto new bridge, and construct left half
  - Switch traffic back and keep as 1 lane till end of project

Phase III: WB I-264 between I-71 and US42
- Shift lanes to the right, install temporary barrier wall
- Construct pavement, embankment/excavation

Phase IV:
- Switch traffic to new NB I-71 alignment and open all lanes of traffic
- Install all overhead signing, lighting, final surfacing, & striping

TITLE	Build I-264 EB to I-71 SB offline to the west of the existing ramp

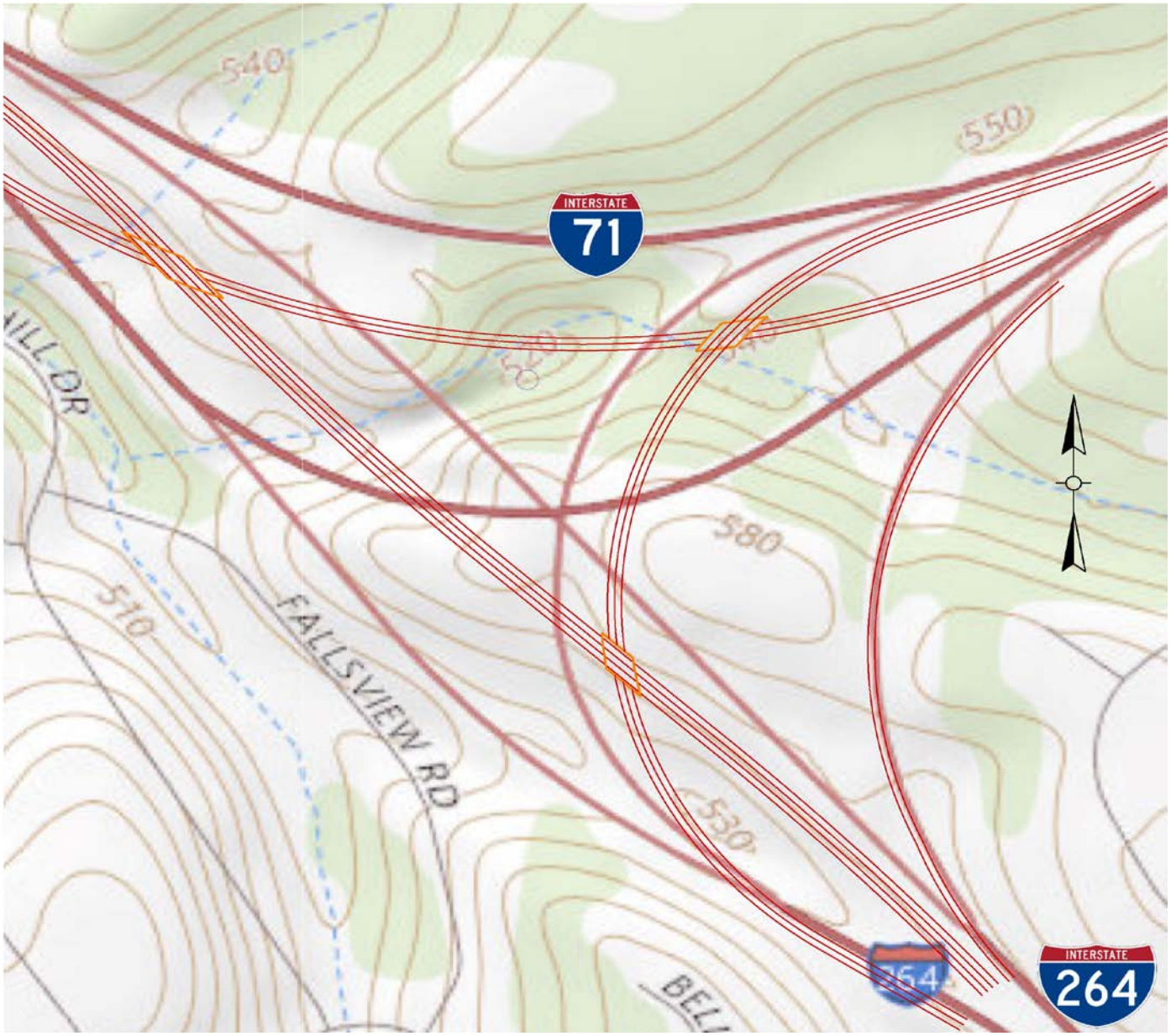
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 06
Idea No. MT-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-264 EB to I-71 SB offline to the west of the existing ramp

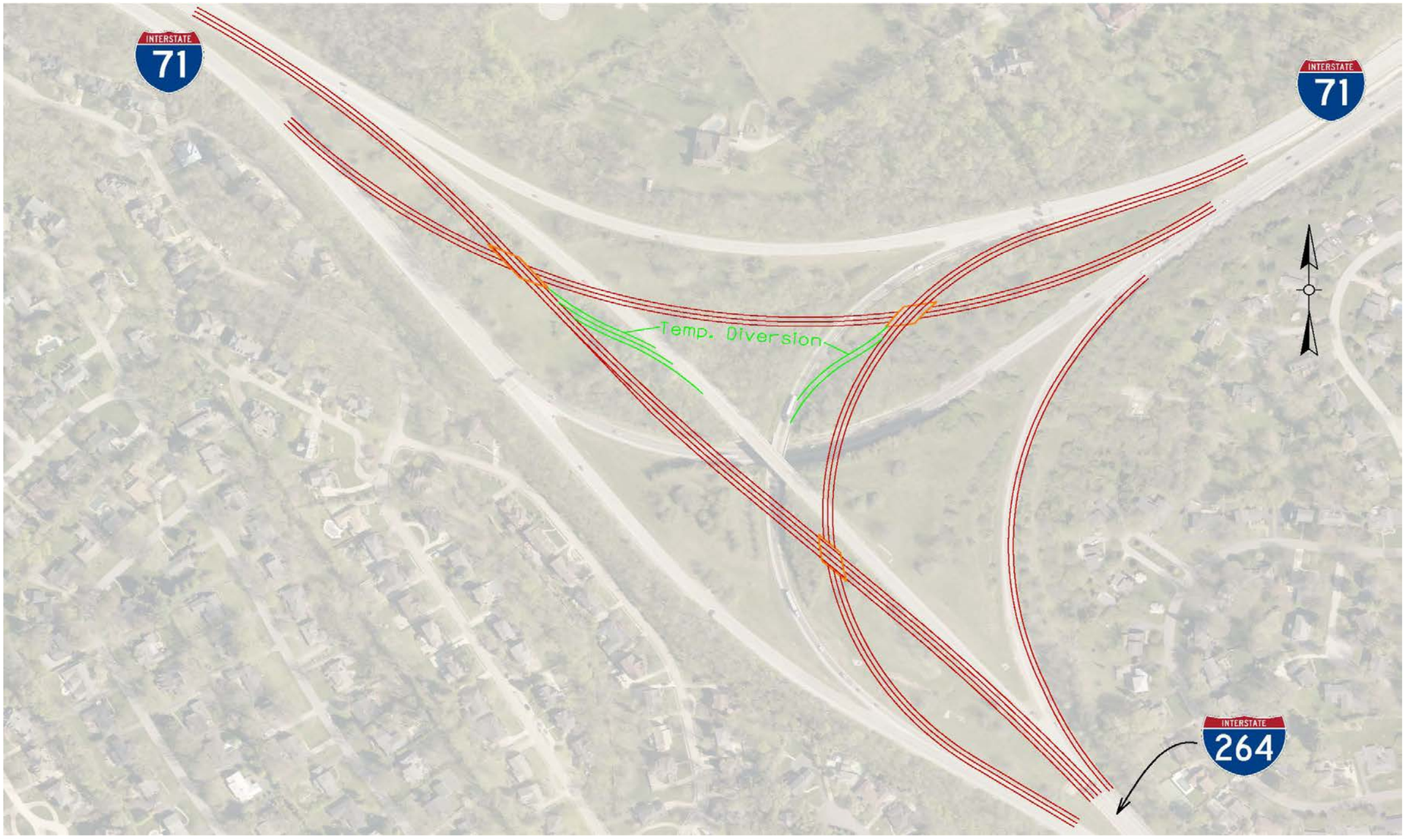
SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 06
Idea No. MT-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-264 EB to I-71 SB offline to the west of the existing ramp

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 06
Idea No. MT-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-264 EB to I-71 SB offline to the west of the existing ramp

DISCUSSION/JUSTIFICATION:

I-264 EB to I-71 SB is shifted left (west) and constructed offline so the proposed bridge over the proposed new alignment of I-71 NB can be fully constructed immediately without affecting any existing traffic except at the tie-in points at each end. Note that this location should have no rock to cut since it is in an originally low area as evidenced by the original quad map (see attached 8.5 x 11 proposed sketch). This also eliminates the existing steel bridge over the deep rock cut which needs to be widened under all three alternates, so this cost is eliminated. Eliminating this 55-yr old steel bridge will greatly reduce future maintenance cost and thus a major improvement to life cycle cost. However, in its place, a new bridge will need to be added to carry this ramp over the proposed widened ramp from I-71 SB to I-264 WB. This new bridge is also constructed offline and can be constructed immediately without affecting existing traffic. This greatly enhances the MOT for this interchange as it allows it to be fully constructed while maintaining all existing traffic lanes throughout construction, except for closure of I-71 SB to I-264 WB (MT-005). It needs to be closed to construct where it crosses this ramp so construction of this ramp can be completed and traffic shifted over from the existing ramp. Then the I-71 SB ramp (MT-005) can be completed where it crosses the existing I-264 EB ramp. A temporary diversion (shown in green) from the existing ramp to the new ramp north of the existing steel bridge over the deep rock cut will need to be constructed, as this bridge will need to be used to maintain traffic. Bridges are assumed to have full height abutments and will be relatively costly based on square foot cost, therefore we have assumed a $225 per square foot. We also have assumed that bridges constructed under part-width construction will cost $300 per square foot (roughly 30% more). For the widened steel bridges we have assumed $350 per square foot (more than 50%).

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Major Improvement
Right-of-way: No impact
Environmental: No impact
Mobility: No impact
Safety: No impact
Maintainability: Major as it eliminates the old steel bridges that crisscross over the deep rock cut.

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 06
Idea No. MT-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-264 EB to I-71 SB offline to the west of the existing ramp

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
I-264 E Ramp bridge over I-71N	SF	6,500	$ 300.00	$ 1,950,000	6,500	$ 225.00	$ 1,462,500
Widen existing steel bridge over rock cut and SB to WB	SF	3,000	$ 350.00	$ 1,050,000	0	$ 350.00	$ -
New bridge over widen SB ramp	SF	0	$ 225.00	$ -	3,800	$ 225.00	$ 855,000
Proposed ramp pavement	SY	0	$ 46.50	$ -	6,000	$ 46.50	$ 279,000
Proposed ramp earthwork	CY				12,000	$ 10.00	$ 120,000
Temporary diversion pavement	SY				880	$ 46.50	$ 40,920
Temporary diversion earthwork	CY				880	$ 10.00	$ 8,800
TOTAL				$ 3,000,000			$ 2,766,000
						CWE (BASELINE LESS PROPOSED)	$ 234,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 07
Idea No. MT-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-71 SB to I-264 WB offline to the east of existing ramp
FUNCTION	**Maintain Traffic**

BASELINE ASSUMPTION:

This ramp is built on the existing alignment and widens the existing bridge over I-71 NB and the ramp from I-71 SB to I-264 WB, at the deep rock cut. The proposed bridge over the proposed I-71 NB requires part-width construction.

PROPOSED ALTERNATIVE:

Build the ramp to the west of the existing ramp so that the bridge over the rock cut is no longer needed and does not need to be widened. Then the proposed bridge over the proposed I-71 NB can be fully constructed immediately and eliminating the part-width construction currently proposed. A temporary tie to the existing ramp will be required to maintain traffic on the existing steel bridge while the proposed I-71 NB is being constructed where it crosses the existing ramp.

BENEFITS	**RISKS/CHALLENGES**
● Existing steel bridge is eliminated so no need to widen	● Tie to existing ramp will be required to use existing bridge during construction of proposed I-71 NB
● Allows offline construction of bridge over I-71 NB	● This ramp will need to close to construct the crossing at the proposed I-264 E to I-71 S
● Allows offline construction of proposed I-264 EB over this I-71 SB ramp (see MT-003).	●
●	●
●	●
●	●
●	●

COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ 2,100,000	$ -	$ 2,100,000
PROPOSED ALTERNATIVE:	$ 1,239,000	$ -	$ 1,239,000
TOTAL (Baseline less Proposed)	$ 861,000	$ -	$ 861,000

AVOID COST

TITLE	Build I-71 SB to I-264 WB offline to the east of existing ramp

SKETCH OF BASELINE ASSUMPTION

PROPOSED MOT PHASING NOTES

Phase I: NB I-71 Proposed and EB I-264 to SB I-71 Bridge
- Maintain NB I-71 on existing alignment, install temporary barrier wall as needed
- Excavate & fill as much as possible along the proposed I-71 NB alignment
- EB I-264 to SB I-71 Ramp New Bridge (Partial Width Construction)
  - Close right lane and reduce ramp down to one lane of traffic, install temporary barrier wall
  - Construct right half of bridge, temporary pavement to tie-in
  - Switch traffic onto new bridge, and construct the left half
  - Fully open ramp to 2 lanes of traffic
  - Remove temporary pavement and continue excavation

Phase II: SB I-71 to WB I-264 Ramp
- Add Additional Lane on Ramp
  - Narrow existing lane on entire ramp, install temporary barrier wall on right side.
  - Construct any embankment or excavation & pavement
- Existing Bridge in Middle of Interchange
  - Widen bridge behind barrier wall Existing 32' clear distance across bridge, or
  - With a design variance restripe existing bridge as two lanes
- New Bridge over proposed NB I-71 (Partial Width Construction)
  - Construct right side of bridge & any temporary pavement needed at approach
  - Switch traffic onto new bridge, and construct left half
  - Switch traffic back and keep as 1 lane till end of project

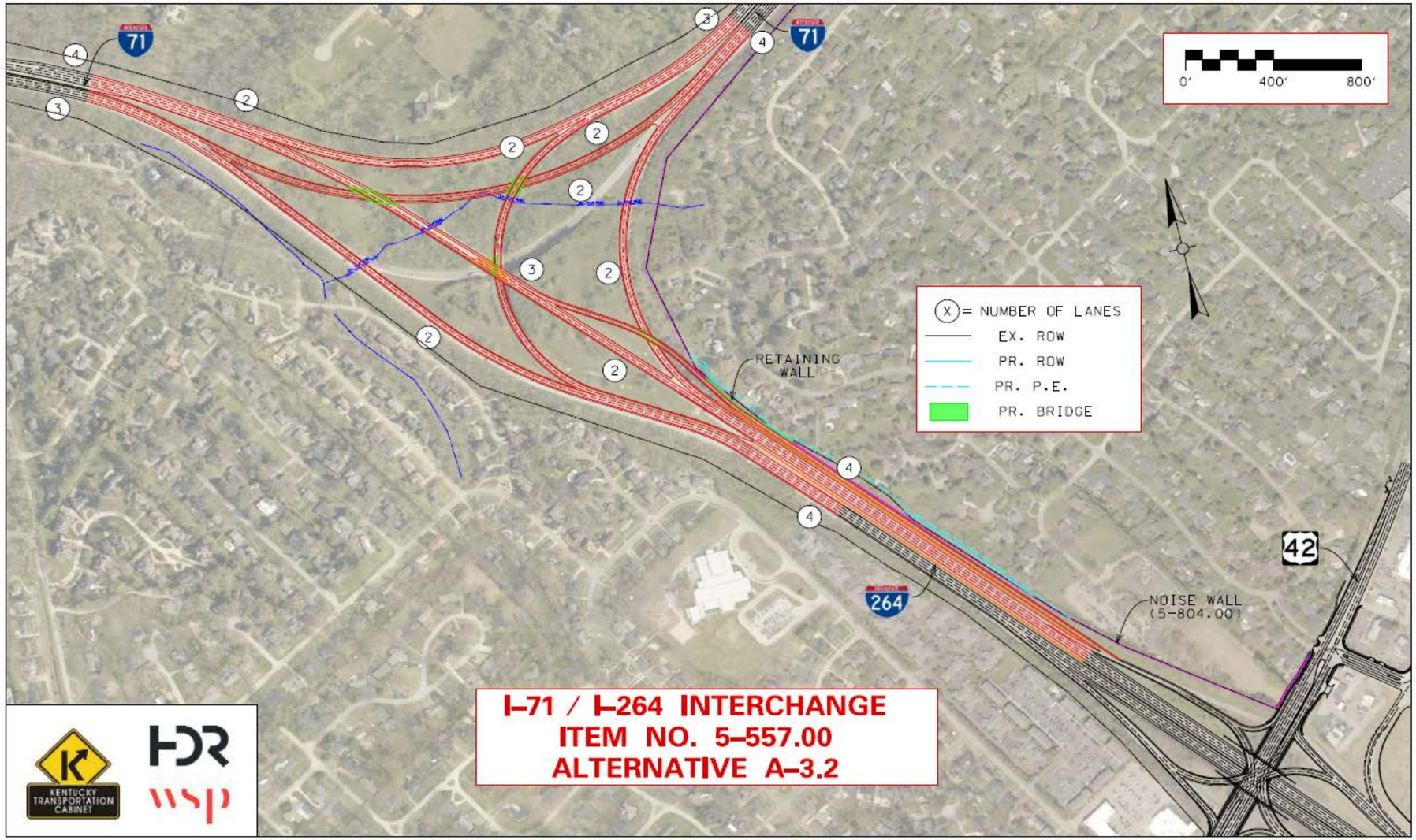
Phase III: WB I-264 between I-71 and US42
- Shift lanes to the right, install temporary barrier wall
- Construct pavement, embankment/excavation

Phase IV:
- Switch traffic to new NB I-71 alignment and open all lanes of traffic
- Install all overhead signing, lighting, final surfacing, & striping

VALUE ENGINEERING PROPOSAL NO. 07
Idea No. MT-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-71 SB to I-264 WB offline to the east of existing ramp

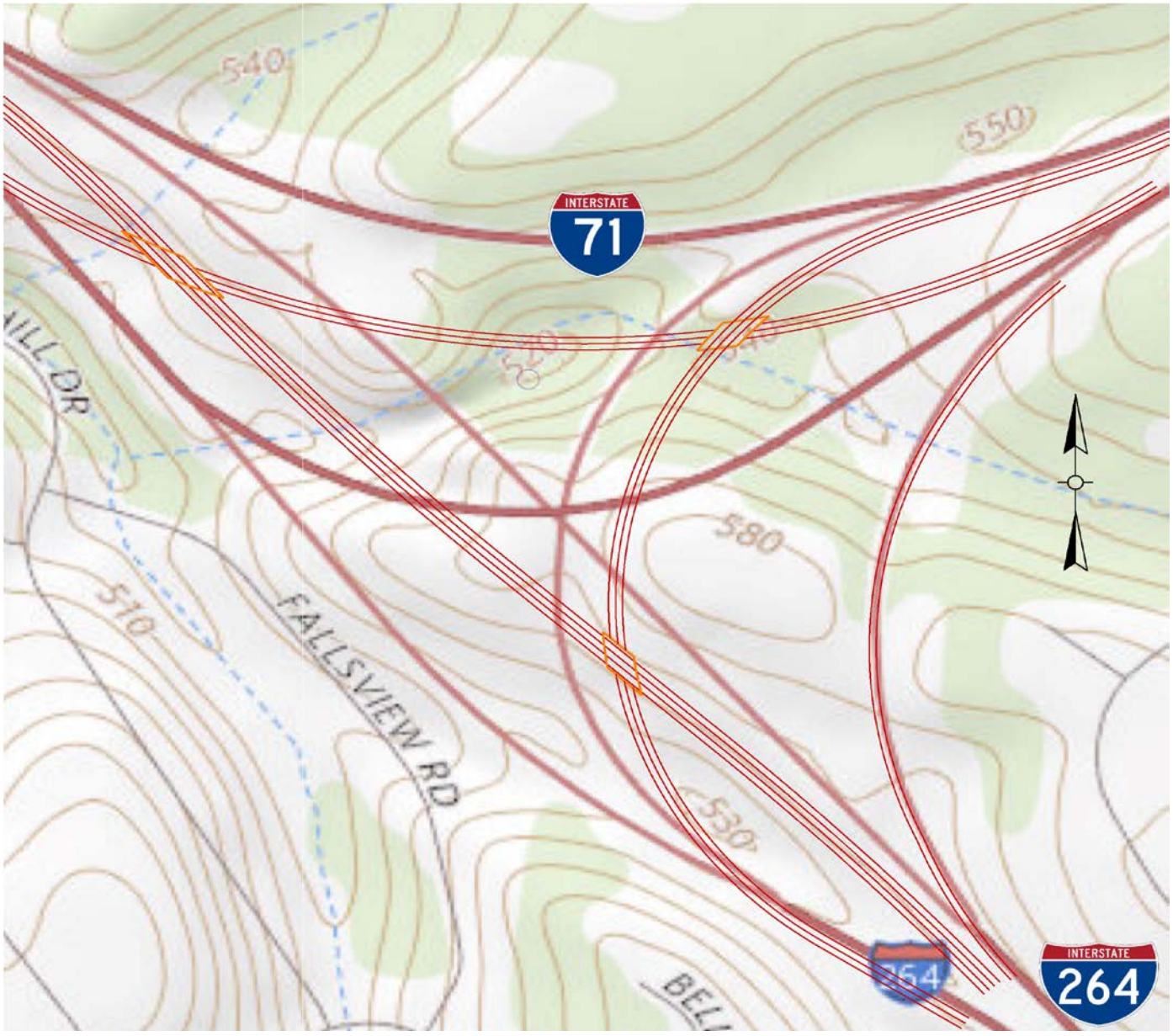
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 07
Idea No. MT-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-71 SB to I-264 WB offline to the east of existing ramp

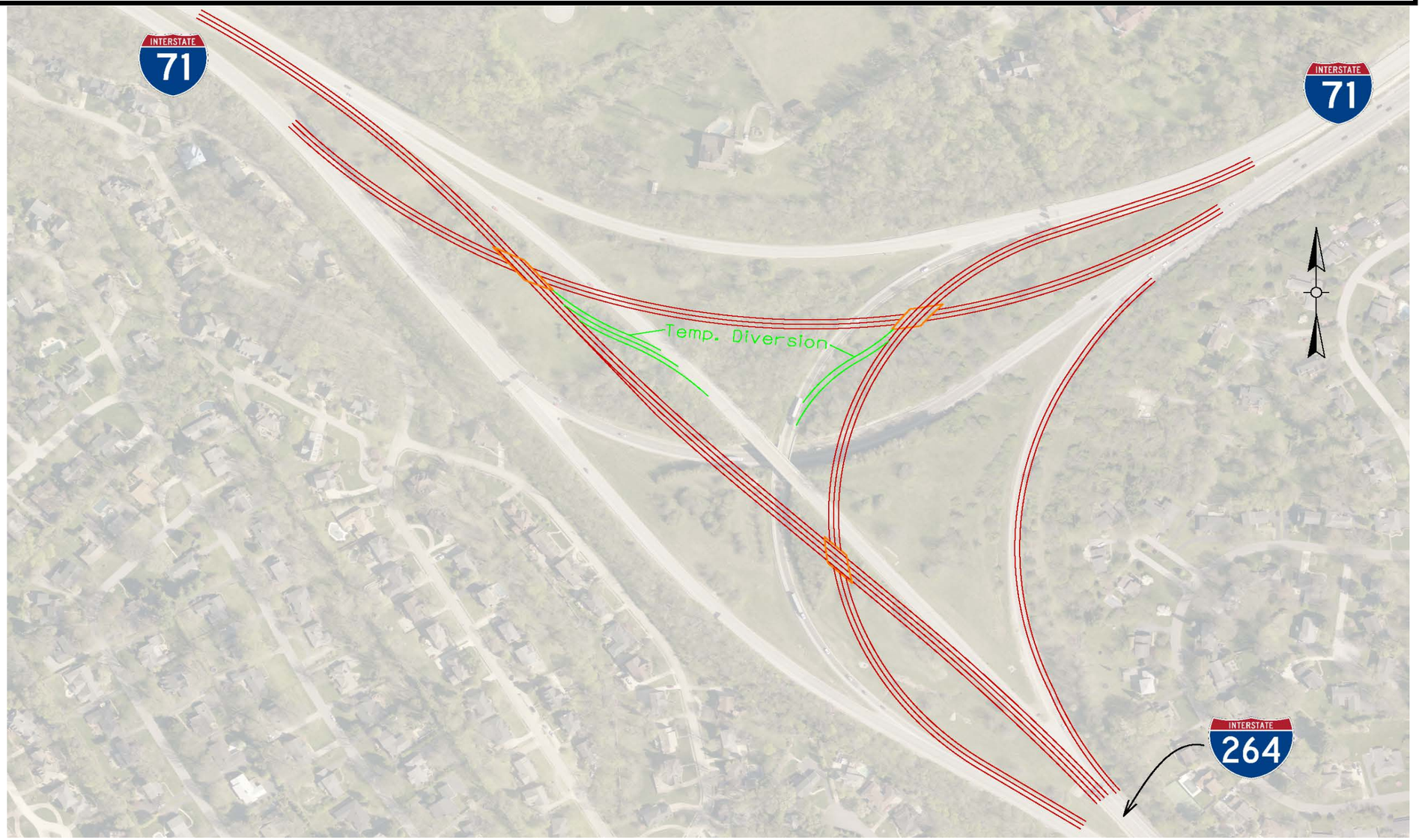
SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 07
Idea No. MT-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-71 SB to I-264 WB offline to the east of existing ramp

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 07
Idea No. MT-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-71 SB to I-264 WB offline to the east of existing ramp

DISCUSSION/JUSTIFICATION:

Construct this ramp to the right/east of the existing ramp so that it can be completely constructed without affecting the existing ramp traffic except at the tie-in points at each end. The proposed bridge is in an original low area as evidenced by the old quad so there should be little to no rock excavation. A temporary tie to the existing ramp will be needed north of the existing steel bridge so that traffic can be maintained while the proposed I-71 NB is constructed at the existing ramp location. Once the proposed I-71 NB ramp is fully constructed and traffic shifted to the new ramp, the existing deep rock cut can be filled in the ramp constructed across the rock cut. This is also true for the proposed offline I-264 EB to I-71 SB ramp (see MT-003). Elimination of the old steel bridge will greatly reduce future maintenance cost and thus the Life Cycle Cost.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Greatly improved
Right-of-way: none
Environmental: none
Mobility: none
Safety: Some impact as it flattens the curve from 680-ft radius to 800-ft radius.
Maintainability: Some impact as it flattens the curve from 680-ft radius to 800-ft radius..

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 07
Idea No. MT-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Build I-71 SB to I-264 WB offline to the east of existing ramp

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Widen existing bridge	SF	2,400	$ 350.00	$ 840,000	0	$ 2,400.00	$ -
New bridge	SF	4,200	$ 300.00	$ 1,260,000	4,200	$ 225.00	$ 945,000
Proposed ramp pavement	SY	0	$ 46.50	$ -	4,000	$ 46.50	$ 186,000
Proposed ramp earthwork	CY				8,000	$ 10.00	$ 80,000
Temporary diversion pavement	SY				500	$ 46.50	$ 23,250
Temporary diversion earthwork	CY				500	$ 10.00	$ 5,000
TOTAL				$ 2,100,000			$ 1,239,000
						CWE (BASELINE LESS PROPOSED)	$ 861,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 08
Idea No. MT-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid
FUNCTION	**Maintain Traffic**

BASELINE ASSUMPTION:

Interchange Alternate A-3.2 provides a braided ramp configuration at US 42 to I-71 SB movement.

PROPOSED ALTERNATIVE:

Reduce shoulder widths between US 42 interchange and I-71 interchange on I-264, while also realigning I-264 EB with a curve similar to the I-264 WB direction. Realign I-264 EB to I-71 SB ramp off existing alignment to allow for easier maintenance of traffic.

BENEFITS	RISKS/CHALLENGES
● Reduces/Eliminates need for right-of-way acquisition from residential properties on NE side of I-264	● Requires construction of new bridge over I-71 SB to I-264 WB ramp
● Eases Maintenance of Traffic (MOT) for construction of I-71 NB realignment (if desired)	● Requires reconstruction of I-264 EB to I-71 NB ramp
● Eases MOT for construction of I-264 EB to I-71 SB bridges	● Requires reconstruction of I-264 EB to I-71 NB ramp EB to I-71 SB ramp
● Eliminates retaining wall for braided US 42 ramp	●
●	●
●	●
●	●

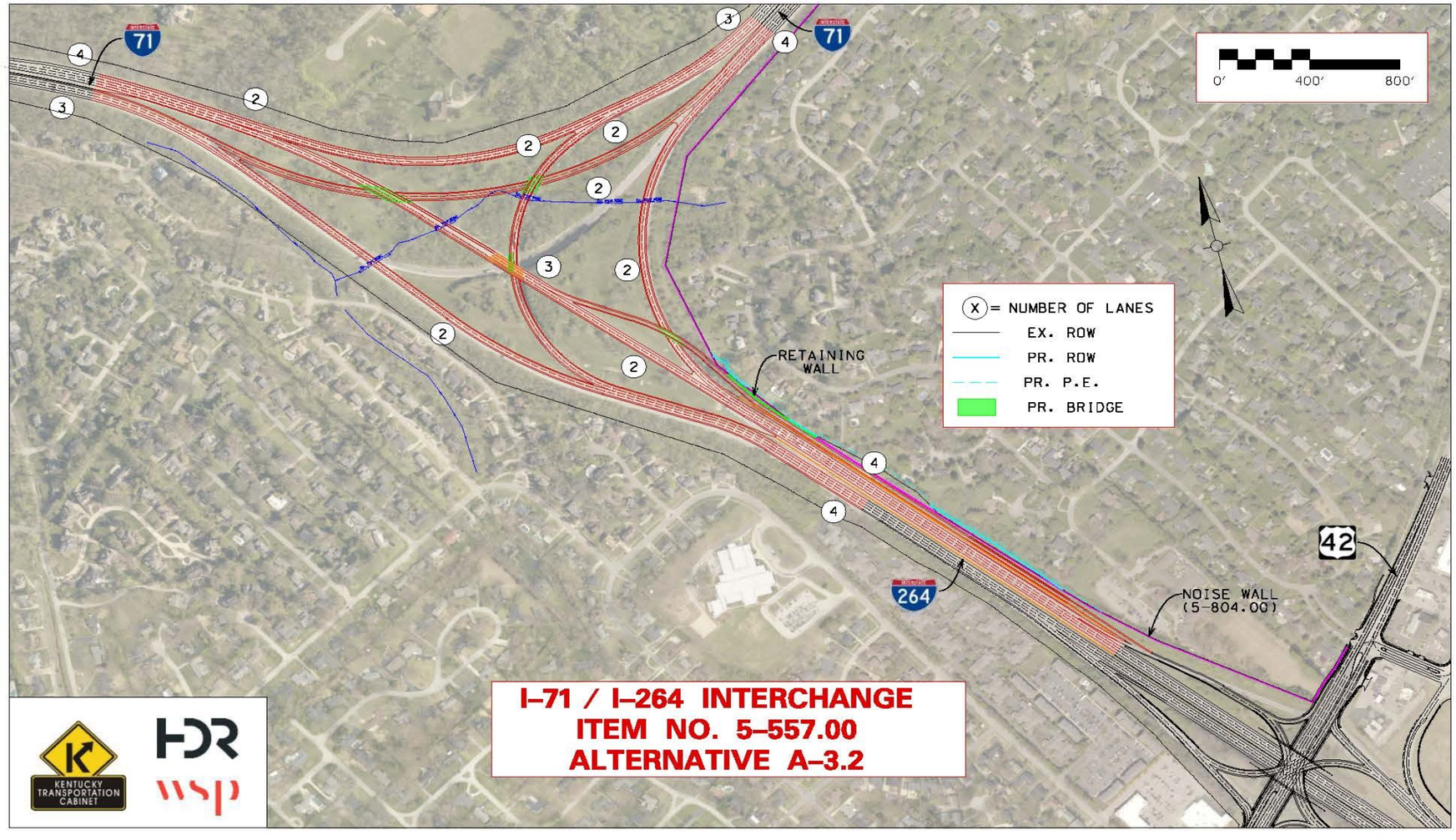
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 12,929,000	$ -	$ 12,929,000
PROPOSED ALTERNATIVE:	$ 4,642,000	$ -	$ 4,642,000
TOTAL (Baseline less Proposed)	$ 8,287,000	$ -	$ 8,287,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 08
Idea No. MT-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid

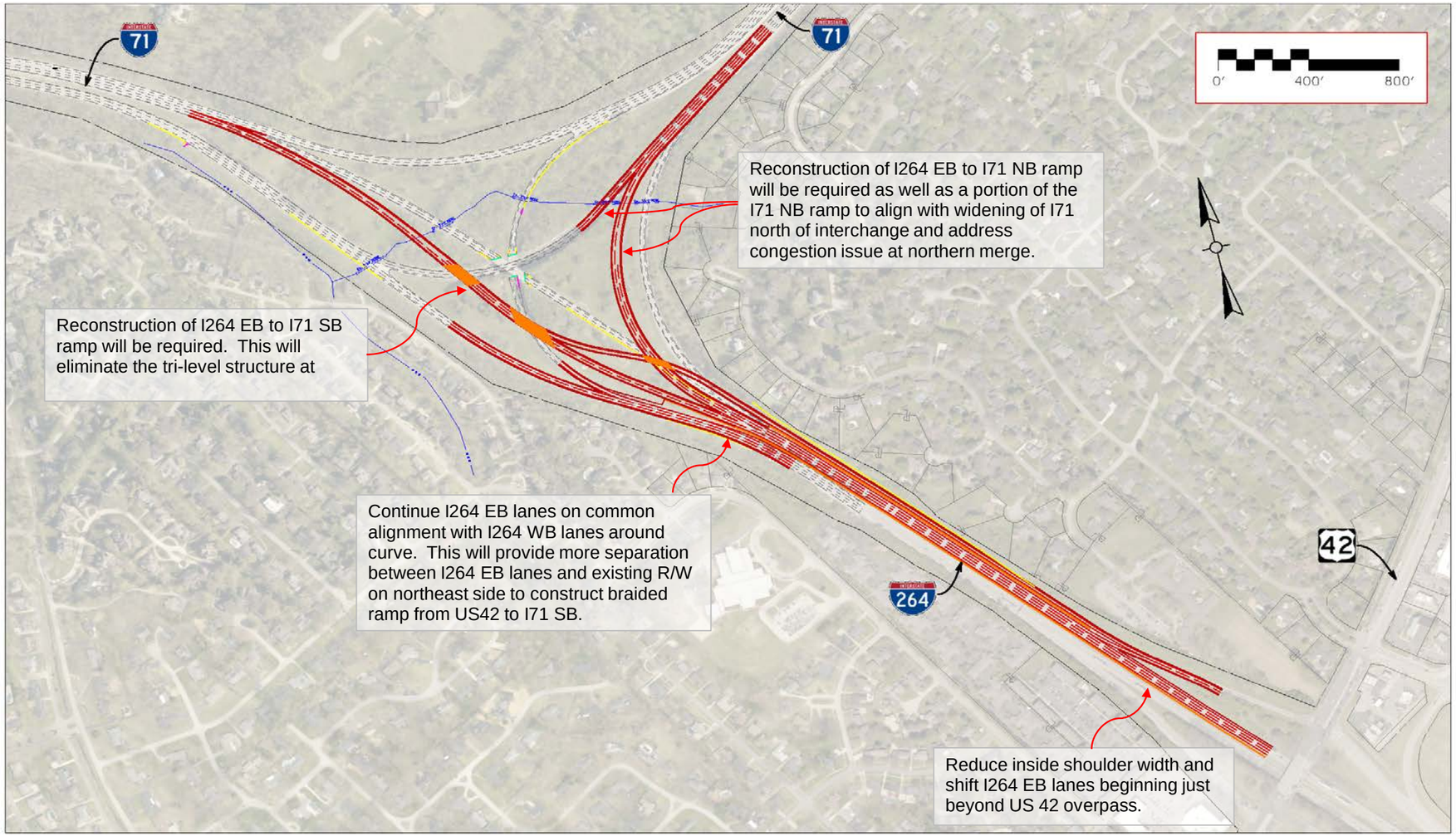
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 08
Idea No. MT-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 08
Idea No. MT-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid

DISCUSSION/JUSTIFICATION:

The concept behind this proposal is to shift the I-264 EB and US 42 ramps further southwest to provide additional room to construct the future braiding of the US 42 ramp to I-71 SB. The proposed sketch assumes that I-71NB movement is not realigned due to minimal safety improvement. It also assumes the I-71 SB to I-264 WB movement remains a 1-lane ramp due to project team comment that said movement does not exhibit a need for a second ramp lane. Both could be included with this proposal.

Begin shifting I-264 EB traffic just north of the US 42 bridge, construct 6' inside shoulder on I-264 in both directions between I-71 and US 42. Carry I-264 EB traffic along a common alignment with I-264 WB alignment to pull lanes away from eastern R/W as much as possible.

Ramp from I-264 EB to I-71 SB would be reconstructed off alignment to ease in maintenance of traffic and would require the construction of a new bridge over I-71 SB to I-264 WB ramps. In the baseline, the bridge at this location was to be widened. A new 7'x4' RCBC would also need to be constructed based on the sizes of adjacent structures under existing ramps.

Due to shifting the I-264 EB lanes further southwest, the ramp from I-264 EB to I-71 NB will need to be reconstructed to provide room for braiding of the US 42 to I-71 SB movement. This will require the ramp radius to be decreased from the existing ~950' radius to ~800'.

Construction sequencing for this concept would be:
1) Construct I-264 EB to I-71 SB new ramp alignment and shifted I-264 EB lanes
2) Construct I-264 EB to I-71 NB new ramp alignment
3) Construct US 42 to I-71 SB ramp braid over new I-264 EB to I-71 NB new ramp alignment.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Improves maintenance of traffic over baseline
Right-of-way: Reduces/Eliminates RW need for US 42 ramp braid
Environmental: No impact
Mobility: No impact
Safety: Minor safety degradation associated with tighter radius on I-264EB to I-71 NB ramp movement
Maintainability: No impact

SPECIAL IMPLEMENTATION CONSIDERATIONS:

This concept could be utilized without I-71NB realignment (as shown) or with I-71 NB realignment.

VALUE ENGINEERING PROPOSAL NO. 08
Idea No. MT-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
I-264 EB to I-71 SB existing bridge widening	SF	4,224	$ 250.00	$ 1,056,000	0	$ 250.00	$ -
I-264 EB to I-71 SB New Bridge over I-71 NB	SF	7,301	$ 200.00	$ 1,460,200	6,332	$ 200.00	$ 1,266,400
I-264 EB to I-71 SB New Bridge over I-71 SB to I-264 WB	SF	0	$ 200.00	$ -	9,730	$ 200.00	$ 1,946,000
7-foot x 4-foot RCBC	LF	0	$ 1,000.00	$ -	100	$ 1,000.00	$ 100,000
US 42 to I-71 SB bridge over I-264 EB to I-71 NB ramp	SF	4,390	$ 200.00	$ 878,000	2,900	$ 200.00	$ 580,000
US42 ramp retaining wall	LF	500	$ 1,000.00	$ 500,000	0	$ 1,000.00	$ -
I-264 EB to I-71 SB ramp realignment	Miles	0.0	$ 750,000.00	$ -	0.6	$ 750,000.00	$ 450,000
I-264 EB to I-71 NB ramp realignment	Miles	0.0	$ 1,000,000.00	$ -	0.3	$ 1,000,000.00	$ 300,000
RW acquired	AC	0.95	$ 100,000.00	$ 95,000	0	$ 100,000.00	$ -
Parcels Impacted	Each	14	$ 10,000.00	$ 140,000	0	$ 10,000.00	$ -
I-71 NB Realignment	LS	1	$ 8,800,000.00	$ 8,800,000	0	$ 8,800,000.00	$ -
TOTAL				$ 12,929,000			$ 4,642,000
						CWE (BASELINE LESS PROPOSED)	$ 8,287,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 09
Idea No. ST-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal
FUNCTION	**Separate Traffic**

BASELINE ASSUMPTION:

The existing design retains the existing slip ramp from the I-71 northbound off-ramp to southbound Mellwood Avenue.

PROPOSED ALTERNATIVE:

The VE team recommends removal of the slip ramp from I-71 northbound off-ramp to southbound Zorn Avenue and adding a dedicated right-turn lane for this movement within control of the existing traffic signal.

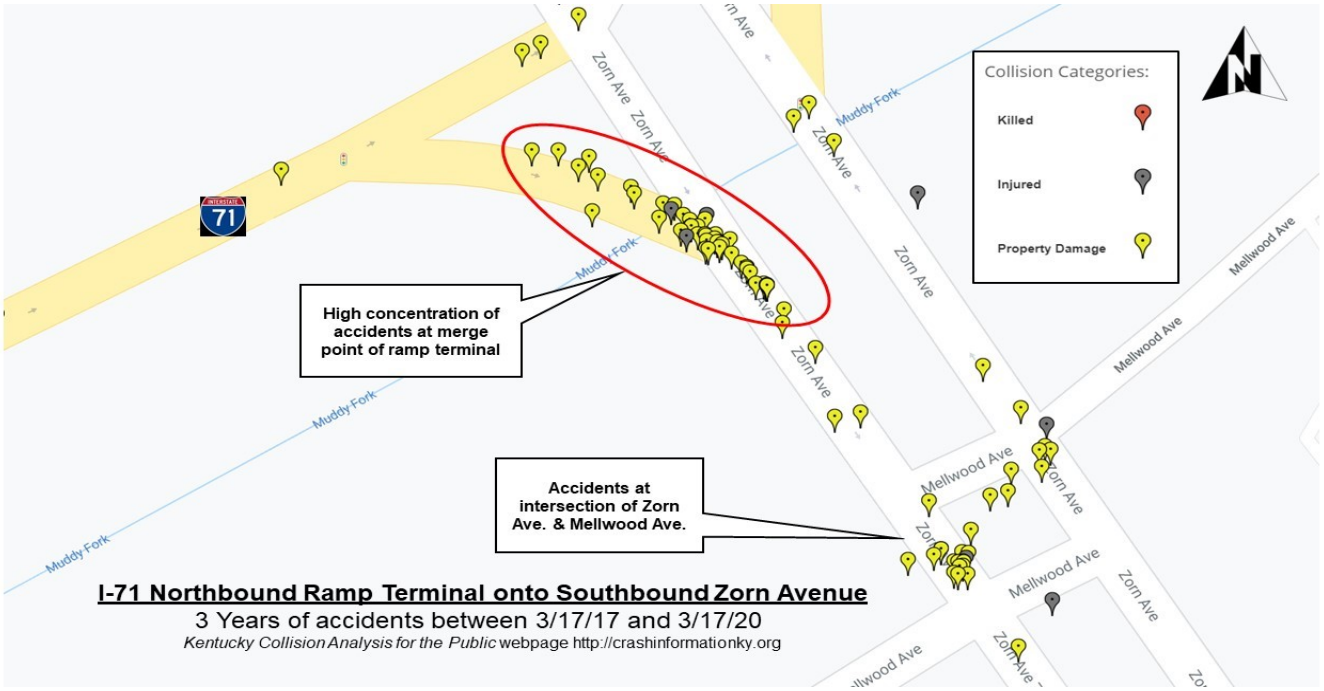
BENEFITS	RISKS/CHALLENGES
● Improved safety for the merge condition onto southbound Zorn Avenue	● Existing traffic signal strain pole on southwest corner may be have to be relocated
● Improved safety for motorists exiting from the eastbound Mellwood Avenue approach	●
● Alignment is more conducive to accommodating future bike / pedestrian movements	●
●	●
●	●
●	●
●	●

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:		$ -	$ -
PROPOSED ALTERNATIVE:	$ 100,000	$ -	$ 100,000
TOTAL (Baseline less Proposed)	$ (100,000)	$ -	$ (100,000)
			ADD COST

VALUE ENGINEERING PROPOSAL NO. 09
Idea No. ST-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal

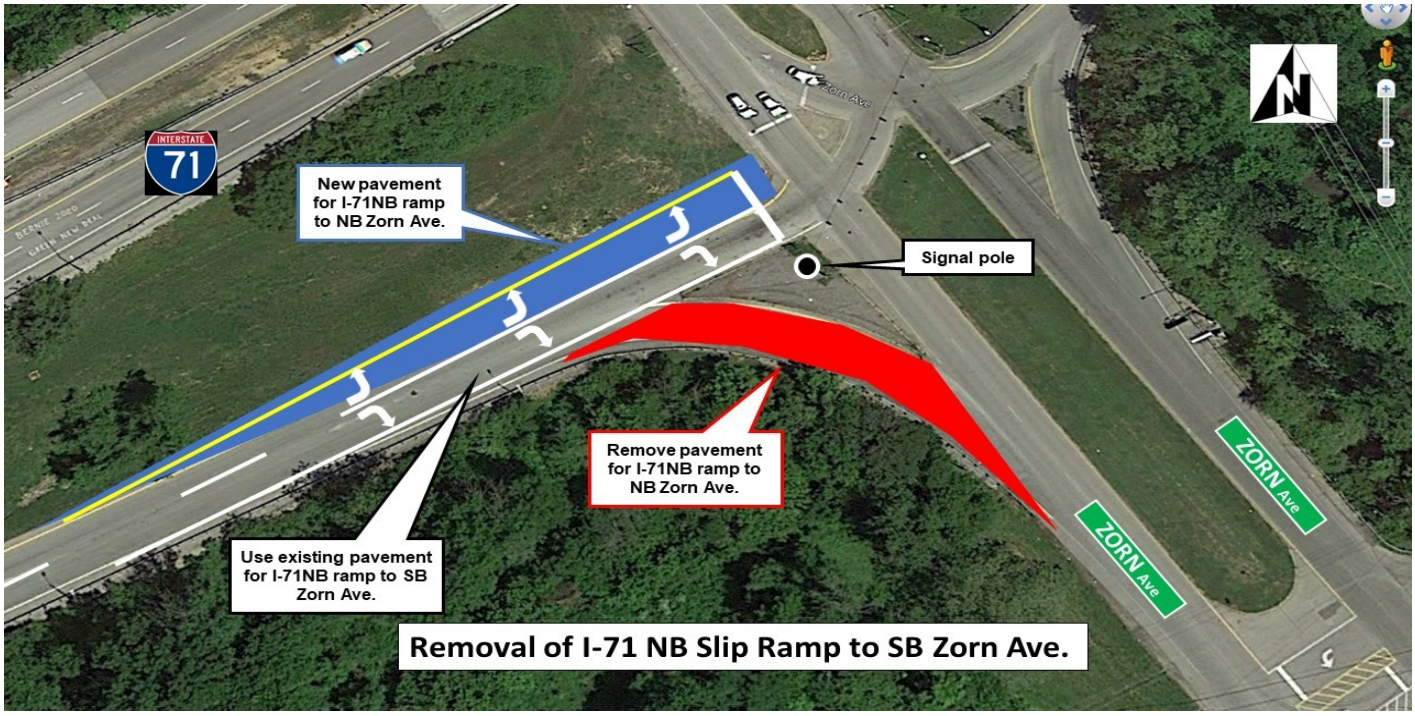
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 09
Idea No. ST-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 09
Idea No. ST-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal

DISCUSSION/JUSTIFICATION:

The VE team recommends removal of the slip ramp from I-71 NB off-ramp to SB Zorn Avenue and adding a dedicated right-turn lane for this movement within control of the existing traffic signal. The intersection of Zorn Avenue with Mellwood Avenue is located approximately 200-feet south of the end of the off-ramp from I-71 NB onto SB Zorn Avenue. A three-year review of accidents from the Kentucky Collision Analysis for the Public website reveals a high concentration of accidents at the merge point of the ramp terminal as well as a number of accidents at the intersection of Zorn Avenue with Mellwood Avenue (see attached map). Relocating the ramp to terminate perpendicularly with Zorn Avenue and including the ramp under control of the existing traffic signal is expected to reduce accidents and improve safety (see attached detail). Revised configuration would also be more conducive to any future bicycle and pedestrian accommodations on the west side of Zorn Avenue. In order to avoid conflicts with the existing traffic signal on the SW corner of the intersection, the I-71 NB off ramp would have to be widened on the north side. The existing I-71 NB to Zorn Avenue NB left-turn lane would become the new right-turn lane to SB Zorn Avenue. The new proposed lane would become the left-turn lane from I-71 NB ramp to Zorn Avenue NB. The VE team recognizes that additional analysis would be required to confirm the turning radius for the relocated left-turn movement from I-71 NB off ramp to NB Zorn Avenue.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact
Right-of-way: No impact
Environmental: No impact
Mobility: No impact
Safety: Improves safety-potential to reduce crashes
Maintainability: No impact

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 09
Idea No. ST-012
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
New pavement, pavement removal, minor signal head adjustments, new in-pavement vehicle sensor	LS	NA	$ -	$ -	1	$ 100,000.00	$ 100,000
TOTAL				$ -			$ 100,000
						CWE (BASELINE LESS PROPOSED)	$ (100,000)

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

ADD COST

VALUE ENGINEERING PROPOSAL NO. 10
Idea No. MT-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point
FUNCTION	**Maintain Traffic**

BASELINE ASSUMPTION:

Allow traffic to go straight into a queuing section (one to two cars at most) and turn left or right onto Zorn Avenue out of NB or SB Mellwood Avenue.

PROPOSED ALTERNATIVE:

Allow traffic to only have a right in/right out at NB Mellwood Avenue while also closing off the median. Leave median open to SB Mellwood Avenue and all traffic movements. Force traffic to a downstream turnaround (U-turn) access point by either with the addition of a left turn lane that is roughly 1,000-feet long at the Country Club Road/Riverwood Drive intersection, or a halfway turnaround point in the median. See options one or two on the proposed sketch.

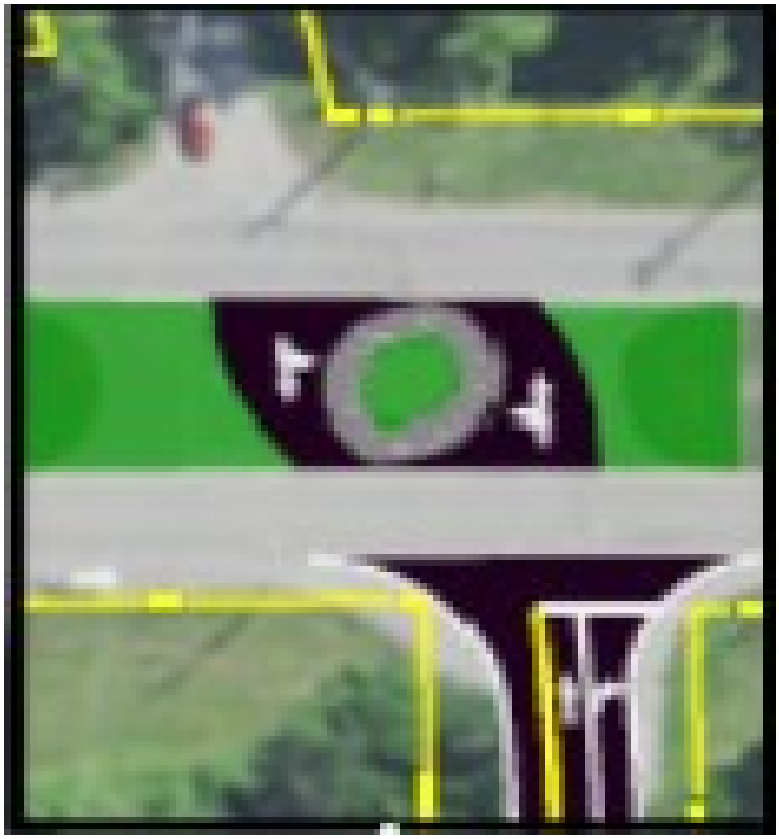
BENEFITS	RISKS/CHALLENGES
● Increases safety by reducing rear-end/T-bone collisions due to the slip ramp of the I-71 NB off Ramp 200-feet from the Zorn Avenue and Mellwood Avenue intersection and the intersection itself	● Public perception of being forced to a downstream turnaround at different location
● Left turn lane downstream that benefits neighborhood as well as accommodating the traffic for the turnaround	●
●	●
●	●
●	●
●	●
●	●

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE:	$ 125,000	$ -	$ 125,000
TOTAL (Baseline less Proposed)	$ (125,000)	$ -	$ (125,000)
			ADD COST

VALUE ENGINEERING PROPOSAL NO. 10
Idea No. MT-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point

SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 10
Idea No. MT-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point

SKETCH OF PROPOSED ALTERNATIVE

VALUE ENGINEERING PROPOSAL NO. 10
Idea No. MT-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point

DISCUSSION/JUSTIFICATION:

Traffic coming off of I-71 NB off Ramp (more specifically the slip ramp) onto Zorn Avenue is almost immediately confronted with the access point at the intersection of Zorn Avenue at Mellwood Avenue. Current drawings show traffic out of NB and SB Mellwood Avenue being able to either go straight into a queuing section (which looks to hold about one-two vehicles or one truck) or to turn right onto Zorn Avenue. A safety analysis done between March 2017-March 2020 at these two sections has shown multiple rear-end collisions over the years.

From discussion with QK4, it was noted that six alternate designs were made for this intersection, but due to underground waterlines, most alternatives were disregarded. While out of those six alternate designs, the best one in the VE team's opinion had been picked. We think another alternate design that should be considered would be restricting NB Mellwood Avenue to a right in/right out only. This would include closing the median at this intersection just for the NB side and forcing traffic to a downstream turnaround (U-turn) access point. The VE team understands this could be done by two options. Option one would be to installing a left turn lane at the Zorn Avenue at the Country Club Road/Riverwood Drive intersection. Installing this left turn lane would be beneficial to not only the neighborhood that Riverwood Drive serves, but would also allow for the traffic to have a safer U-turn due to having to wait for the traffic light. Traffic should be light enough that queuing past the left turn lane would not be an issue. Option two would install a turnaround access point about halfway (500-feet) between the two intersections, which would mean the left turn lane from Option one would not be needed. This would also greatly reduce the added cost to the project.

The public may perceive being forced downstream to a U-turn or left turn lane roughly 1,000-feet away to be an inconvenience. However, cutting down on rear-end (and possible T-bone) collisions at the slip ramp and NB Mellwood Avenue intersection with Zorn Avenue would outweigh the inconvenience of such changes implemented.

The VE team recognizes the need to protect the underground waterlines in the median of Zorn Avenue. These options were considered under the assumption that the waterlines were buried enough that minor surface work would not cause any issues.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Would install turn lane first before closing off median
Right-of-way: No impact
Environmental: No impact
Mobility: Impact due to change in how traffic operates at the Zorn and Mellwood intersection and downstream intersection 1000-feet away
Safety: Reduces rear-end/T-bone collisions
Maintainability: Very little except maintenance of turn lane

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 10
Idea No. MT-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point

DESIGN ELEMENT	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Add left turn lane (300-feet)	LS	0	$ -	$ -	1	$ 100,000.00	$ 100,000
Mill of pavement to close off a section of median to put turf on top. Add "pork chop" to NB Mellwood Avenue, and restripe pavement.	LS	0	$ -	$ -	1	$ 25,000.00	$ 25,000
TOTAL				$ -			$ 125,000
						CWE (BASELINE LESS PROPOSED)	$ (125,000)

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

ADD COST

VALUE ENGINEERING PROPOSAL NO. 11
Idea No. CR-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp termini in lieu of traffic signals
FUNCTION	**Connect Roadways**

BASELINE ASSUMPTION:

The current design has minimal changes to the signalized intersection of Zorn Avenue and the northbound ramp termini. The design calls for the addition of a traffic signal at the intersection of Zorn Avenue and southbound ramp termini.

PROPOSED ALTERNATIVE:

Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp termini in lieu of traffic signals. The existing traffic signal would be removed.

BENEFITS	RISKS/CHALLENGES
● Efficient design with low traffic delays at both intersections	● Challenge with building roundabouts under traffic
● Safer than traffic signal (fewer conflict points)	● Construction within the median area is overtop major water mains
● Allows for U-turns if Mellwood Avenue becomes right-in/right-out operation	●
● Free flow ramp into a receiving lane on Zorn Avenue can be accommodated with no additional pavement	●
● Fits within current roadway footprint	●
● Minimizes work needed on all ramps	●
● Reduced maintenance costs by removing signal	●

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 100,000	$ -	$ 100,000
PROPOSED ALTERNATIVE:	$ 218,000	$ -	$ 218,000
TOTAL (Baseline less Proposed)	$ (118,000)	$ -	$ (118,000)
			ADD COST

VALUE ENGINEERING PROPOSAL NO. 11
Idea No. CR-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp termini in lieu of traffic signals

SKETCH OF PROPOSED ALTERNATIVE

Sizing and location of 130' diameter roundabouts.
(Does not include details on approaches and ramps.)

Sizing and location of 130-foot diameter roundabouts.

VALUE ENGINEERING PROPOSAL NO. 11
Idea No. CR-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp termini in lieu of traffic signals

DISCUSSION/JUSTIFICATION:

The operations of the intersections between Zorn Avenue and the interchange ramp terminals were examined using roundabouts. This alternative provides both operational and safety benefits. During analysis, it was determined that both could operate as a single lane; however, a dedicated (free flow) turning lane for traffic exiting and entering all ramps will greatly improve the operations and is recommended. It would also be beneficial to make the westbound approach at the southbound ramp a dual entry - one lane for left turns and the other for through movement.

Operations

An HCS roundabout analysis was done using the projected peak hour future traffic for the design year as identified on the Zorn Avenue exhibit for post PL&G. Overall, the results showed excellent performance for the overall intersection and each approach, including the exit ramps. The table below shows the estimated delays and 95th percentile queue length. (Note that the analysis reflects a dual lane WB entry at the southbound terminal intersection.)

Location	Period	Direction	Delay (s)	Queue (ft)
NB Ramp/Zorn	AM	EB	8	50
NB Ramp/Zorn	AM	WB	6	60
NB Ramp/Zorn	AM	NB	15	110
NB Ramp/Zorn	PM	EB	11	100
NB Ramp/Zorn	PM	WB	10	120
NB Ramp/Zorn	PM	NB	16	100
SB Ramp/Zorn	AM	EB	5	30
SB Ramp/Zorn	AM	WB	5	40
SB Ramp/Zorn	AM	SB	7	70
SB Ramp/Zorn	PM	EB	18	170
SB Ramp/Zorn	PM	WB	5	30
SB Ramp/Zorn	PM	SB	6	40

IMPACT TO PERFORMANCE:

Maintenance of Traffic: This project will be more complex to build under traffic than the proposed design.
Right-of-way: None. No additional ROW is necessary.
Environmental: None.
Mobility: Improved. This will create near free flow conditions throughout all hours of the day.
Safety: Improved.
Maintainability: Likely improved as eliminating the signals will remove the maintenance and retiming costs.

SPECIAL IMPLEMENTATION CONSIDERATIONS:

Bypass lanes exiting the ramps should be pulled tight next to the roundabout and can have a dedicated receiving lane onto Zorn Avenue. Ramp widening to provide the storage lengths of the queues can likely be reduced and should be sized based on the operational analysis. The proposal is for a 130-foot inscribed diameter roundabout. If a dual entry is chosen as part of the current project at the southbound terminal, there is room to fit a 180-foot inscribed diameter to accommodate. Although it appears unnecessary at this time, the project team could plan for a future multi-lane scenario and size the roundabout larger for future capacity, if desired.

VALUE ENGINEERING PROPOSAL NO. 11
Idea No. CR-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp termini in lieu of traffic signals

DISCUSSION/JUSTIFICATION:

Safety

According to a safety analysis of the interchange area by the project team, high concentrations of crashes occur on several of the ramps based on 2017-2019 data. Applying the statistical procedure, four 0.10-mile long high crash spots appear:

- Zorn Avenue through the interchange contains 17 crashes, resulting in a Critical Rate Factor (CRF) of 1.1. A CRF greater than 1.0 indicates crashes are likely occurring due to circumstances that cannot be attributed to random occurrence.
- The terminal of the southbound off-ramp at its two-way stop-controlled intersection with Zorn Avenue contains 18 crashes, resulting in a 2.4 CRF.
- The terminal of the northbound off-ramp at its signalized intersection with Zorn Avenue contains 54 crashes, resulting in a 5.8 CRF.

Nearly three quarters of the crashes along Zorn Avenue within the operational area of the interchange were categorized as angle or opposing left turn. It is expected that the use of roundabouts will nearly eliminate them due to the removal of crossing conflict points. Additionally, with the introduction of a predictable slow speed operations of roundabouts, along with very small queues, it should be expected to greatly reduce the rear-end type crashes both on Zorn Avenue and the ramps.

Multimodal

This alternative also will be compatible with any future plans that are developed to accommodate sidewalks or a shared-use path. A crossing should be provided across each ramp and at least one across Zorn Avenue at each location.

VALUE ENGINEERING PROPOSAL NO. 11
Idea No. CR-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp termini in lieu of traffic signals

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Curb/gutter	LF				3,200	$ 30.00	$ 96,000
Concrete (Splitter island and Truck Aprons)	CY				240	$ 300.00	$ 72,000
Asphalt resurfacing on Zorn Avenue only	TON				400	$ 100.00	$ 40,000
Signing and striping	EA				1	$ 10,000.00	$ 10,000
Traffic Signal	EA	1	$ 100,000.00	$ 100,000			
TOTAL				$ 100,000			$ 218,000
						CWE (BASELINE LESS PROPOSED)	$ (118,000)
							ADD COST

VALUE ENGINEERING PROPOSAL NO. 12
Idea No. SL-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12' in project section 5-48.10
FUNCTION	**Support Load**

BASELINE ASSUMPTION:

The existing design includes 12' travel lanes and 6' inside shoulder for project section 5-48.10.

PROPOSED ALTERNATIVE

VE team proposes consideration of 11.5' travel lane widths in lieu of 12' travel lane widths and 7.5' inside shoulder widths in lieu of 6' inside shoulder widths for project section 5-48.10.

BENEFITS	**RISKS/CHALLENGES**
● Inside median could be widened by 1.5' thereby improving safety	● Narrower lanes may have an adverse effect on safety
● Narrower lanes may passively encourage a reduction in travel speed	●
●	●
●	●
●	●
●	●
●	●

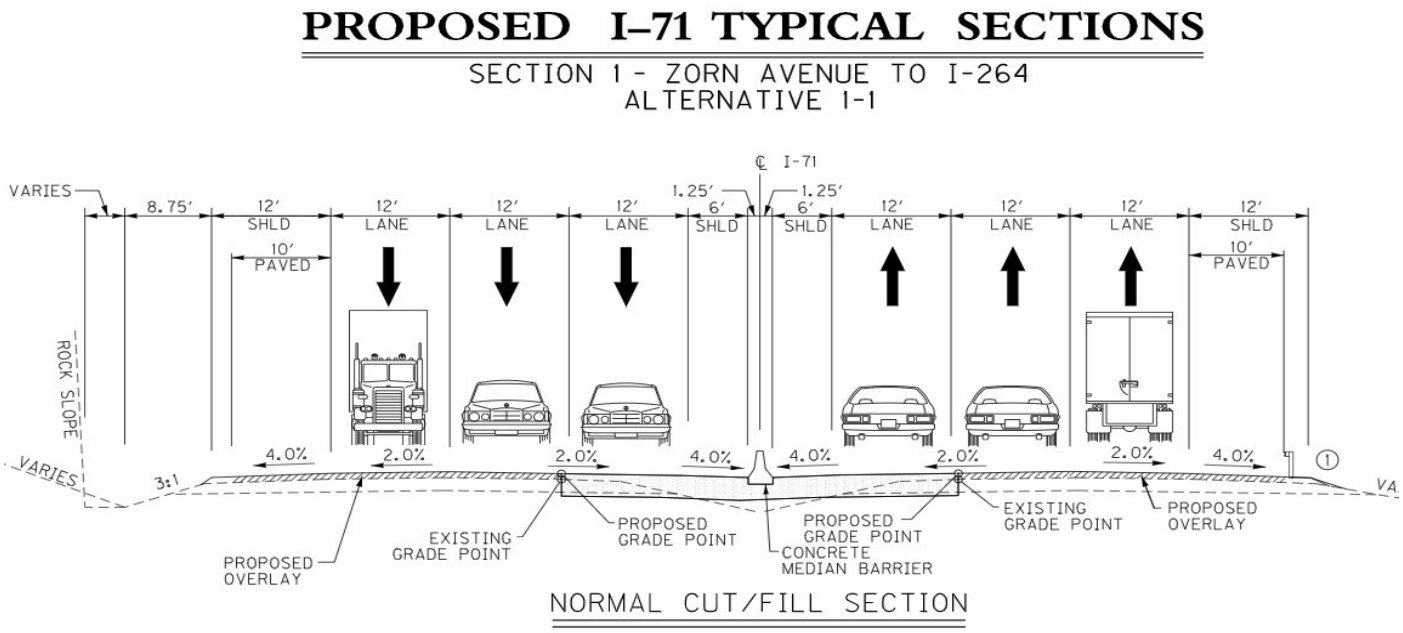
COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ -	$ -	$ -
PROPOSED ALTERNATIVE	$ -	$ -	$ -
TOTAL (Baseline less Proposed)	$ -	$ -	$ -

NO CHANGE

VALUE ENGINEERING PROPOSAL NO. 12
Idea No. SL-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12' in project section 5-48.10

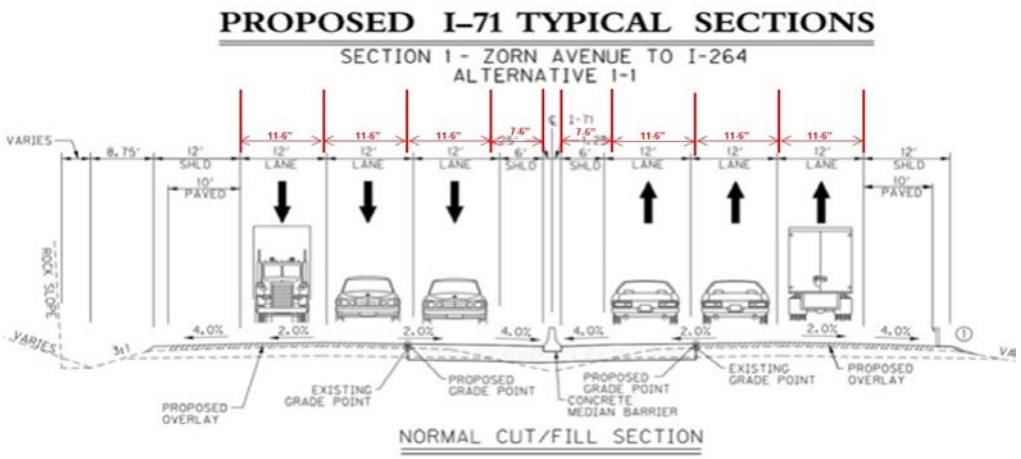
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 12
Idea No. SL-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12' in project section 5-48.10

SKETCH OF PROPOSED ALTERNATIVE



SECTION 1 – ZORN AVE. TO I-264 – PROPOSED TYPICALS

Three alternatives were developed for Section 1 (see sheets 3-5) – each keeping construction within the existing right of way – and are summarized as follows:

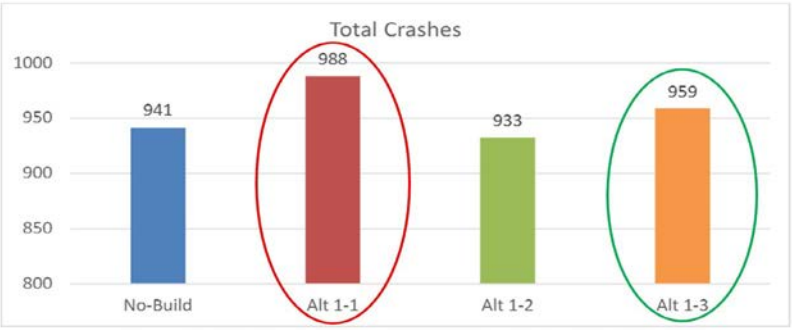
ALT.	LANES / WIDTH	OUTSIDE SHOULDERS	MEDIAN BARRIER WALL	INSIDE SHOULDERS	DITCH / SLOPE	CLEAR ZONE
1-1	6 / 12'	12' (10' paved)	2.5'	6' paved	8.75' / 3:1	20'
1-2	6 / 11.5'	12' (10' paved)	2.5'	10' paved	6.25' / 1.5:1	Guardrail
1-3	6 / 11.5'	12' (10' paved)	2.5'	8.25' paved	8' / 3:1	20'

Alternative 1-1 is similar to an alternative being considered for Item No. 05-48.10, which is shown in Appendix C – the difference being the inside shoulders and barrier wall width.

As follows are the construction cost estimates that have been developed:

ALTERNATIVE 1-1	ALTERNATIVE 1-2	ALTERNATIVE 1-3
$21,800,000	$35,900,000	$25,600,000

Commonwealth of Kentucky, Department of Highways, I-71 Widening Study and Development of Typical Sections (2019)



Commonwealth of Kentucky, Department of Highways, I-71 Widening Study and Development of Typical Sections (2019)

VALUE ENGINEERING PROPOSAL NO. 12
Idea No. SL-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12' in project section 5-48.10

DISCUSSION/JUSTIFICATION:

The existing design includes an outside shoulder width of 12-feet (10-feet paved), three 12-foot travel lanes, and a 6-foot inside shoulder width. A reduction in width of the three travel lanes from 12-feet to 11.5-feet would allow a revised typical section of an outside shoulder width of 12-feet (10-feet paved), three 11.5-foot travel lanes, and an inside shoulder width of 7.5-feet for example (see revised Typical Section on Proposed Sketch tab). The revised typical section could also apply the additional width gained from reduced travel lanes to the outside shoulder (instead of the inside shoulder) if additional safety analysis determines a greater reduction in predictive crashes. There would be no additional cost to construction or maintenance. The KYTC I-71 Widening Study and Development of Typical Sections (2019) analyzed the predictive crashes over 20 years from three typical sections for the Section 5-48.10 of the project (see Table on Proposed Sketch tab). Results indicate that a reduction of travel lane width from 12-feet to 11.5-feet combined with an increase in inside width from 6-feet to 8.25-feet would result in 29 fewer predictive crashes over 20 years (see Bar Graph on Proposed Sketch tab). A reduction of travel lane width from 12-feet to 11.5-feet combined with an increase in inside shoulder width from 6-feet to 7.5-feet may also result in fewer predictive crashes over 20 years. The VE team recognizes the proposed lane width reduction modification would require a design exception from FHWA.

PERFORMANCE:

Maintenance of Traffic: No impact
Right-of-way: No impact
Environmental: No impact
Mobility: No impact
Maintainability: No impact
Safety: Safety of median shoulder may improve, travel speed may be reduced, reduction of lane separation may cause reduction of safety
Maintainability: No impact

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 12
Idea No. SL-004
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12' in project section 5-48.10

DESIGN ELEMENT	BASELINE ASSUMPTION				PROPOSED ALTERNATIVE		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Reduction of travel lanes from 12' to 11.5, widen inside shoulder from 6' to 7.5'	NA	NA	$ -	$ -	NA	$ -	$ -
TOTAL				$ -			$ -
						CWE (BASELINE LESS PROPOSED)	

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

NO CHANGE

VALUE ENGINEERING PROPOSAL NO. 13
Idea No. ST-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use cable barrier and a depressed median in lieu of concrete barrier wall - project section 2 of 5-557.00
FUNCTION	**Separate Traffic**

BASELINE ASSUMPTION:

Concrete median barrier type B TL5 currently proposed - project section 2 of 5-557.00.

PROPOSED ALTERNATIVE:

Use a cable barrier within the depressed median in lieu of a concrete median barrier type B TL5 - project section 2 of 5-557.00.

BENEFITS	RISKS/CHALLENGES
● Proposed alternative has been used on Interstates around the State (including I-71)	● Changing median design of proposed project section 2 of 5-557.00
● Not too far off from existing typical section	● Public perception or local officials may need to be notified of the change
●	● Could decrease safety due to difference in cable barrier versus concrete barrier
●	●
●	●
●	●
●	●

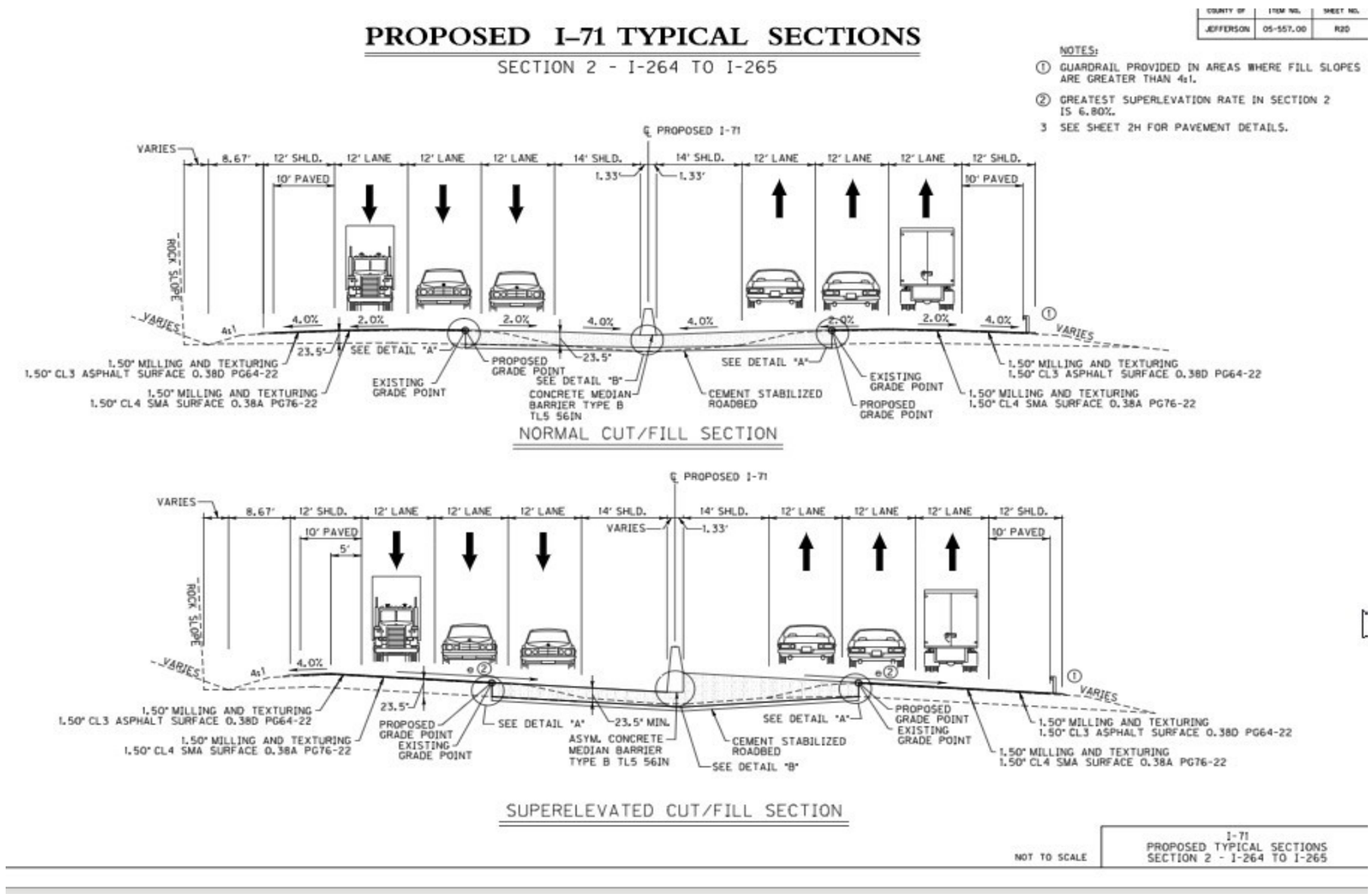
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 3,052,000	$ -	$ 3,052,000
PROPOSED ALTERNATIVE:	$ 232,000	$ -	$ 232,000
TOTAL (Baseline less Proposed)	$ 2,820,000	$ -	$ 2,820,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 13
Idea No. ST-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use cable barrier and a depressed median in lieu of concrete barrier wall - project section 2 of 5-557.00

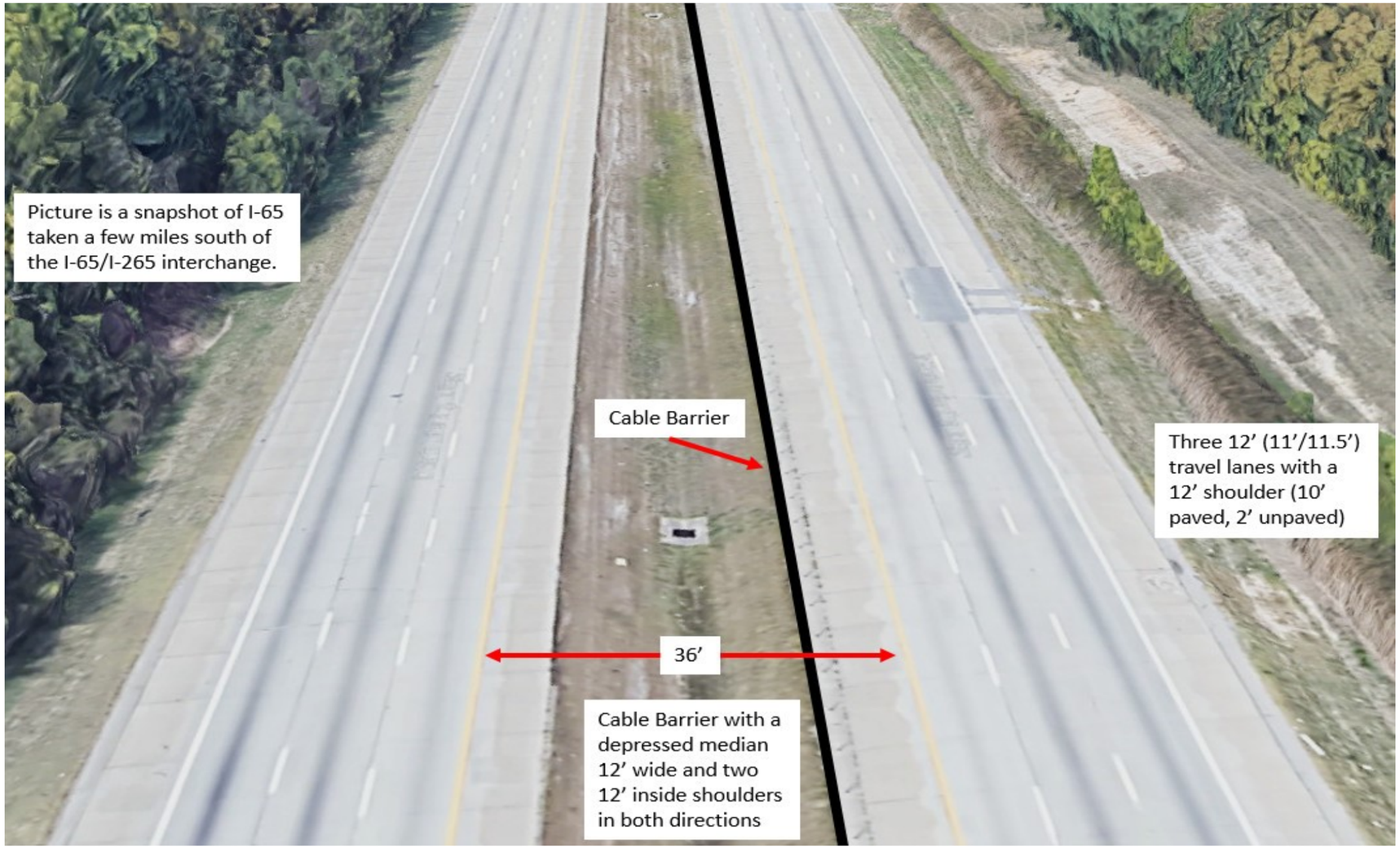
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 13
Idea No. ST-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use cable barrier and a depressed median in lieu of concrete barrier wall - project section 2 of 5-557.00

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 13
Idea No. ST-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use cable barrier and a depressed median in lieu of concrete barrier wall - project section 2 of 5-557.00

DISCUSSION/JUSTIFICATION:

The proposed I-71 typical section is wanting to move the travel lanes towards the inside which would separate both directions of traffic by a 30-foot median (14-foot inside shoulders for each direction and a 2-foot concrete barrier). That would be followed by three 12-foot travel lanes, a 12-foot shoulder (10-foot paved and 2-foot unpaved), and then an 8-foot grade at 4:1 after that.

The existing typical section is a 60-foot median (48-foot depressed median and 6-foot inside shoulders for each direction). A cable barrier is currently installed on one travel direction with two 12-foot travel lanes in each direction. A 12-foot outside shoulder is also present on each side (10-foot paved and 2-foot unpaved) with an 8-foot grade at 4:1 after that.

The VE team would propose taking the existing median and narrowing it to 36-feet which would create 1) a 12-foot grass depressed median and 12-foot inside shoulders for each travel direction or 2) could cut the inside shoulders to 6-foot in each travel direction, which would leave a 24-foot grass depressed median. Note, the cost information provided went with a 12-foot median and 12-foot inside shoulders. A cable barrier would still be installed to one of the travel directions. With the proposed alternate, only the median would change. Everything else the design team had in the proposed typical section drawings would stay the same. Upon originally coming up with the idea, the team wanted to leave the existing as is and just widen to the outside, but too much earthwork would have been needed, and that would have cut into cost savings too much.

The VE team was under the assumption that the safety/crash analysis was not yet ready for all of the 557.00 project outside the interchanges. However, after looking at this data in regards to 5-48.10, it looks like roughly eight fatal/injury crashes would occur yearly as well as a total of roughly 50 crashes annually with this type of method. With the 557.00 safety/crash analysis not yet available, the team cannot compare to the proposed I-71 typical section with the concrete barrier. One could assume that safety may decrease with the difference between a cable barrier versus a concrete barrier.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact or very little, because the change proposed is within the median that would be dealt with current MOT.
Right-of-way: No impact
Right-of-way: No impact
Environmental: No impact
Mobility: No impact
Safety: Could decrease a little due to the change in barrier types used.
Maintainability: Probably have to replace Cable barrier more than a Concrete barrier.

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 13
Idea No. ST-002
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use cable barrier and a depressed median in lieu of concrete barrier wall - project section 2 of 5-557.00

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Concrete barrier wall Ty B TL5 56"	LF	15,136	$ 150.00	$ 2,270,400	0	$ -	$ -
DGA	Ton	3,481	$ 23.00	$ 80,063	0	$ -	$ -
Asphalt base Cl 3 1.0 64-22	Ton	6,105	$ 72.50	$ 442,613	0	$ -	$ -
Asphalt surface Cl 3 0.50 PG64-22	Ton	832	$ 85.00	$ 70,720	0	$ -	$ -
Drainage blanket	Ton	2,775	$ 54.00	$ 149,850	0	$ -	$ -
Asphalt seal aggregate	Ton	0	$ -	$ -	269	$ 157.25	$ 42,300
Asphalt seal coat	Ton	0	$ -	$ -	32	$ 1,186.52	$ 38,313
Cement stabilized roadbed	SY	11,028	$ 3.50	$ 38,598	0	$ -	$ -
Cable barrier		0	$ -	$ -	30,272	$ 5.00	$ 151,360
TOTAL				$ 3,052,000			$ 232,000
						CWE (BASELINE LESS PROPOSED)	$ 2,820,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 14
Idea No. ST-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall
FUNCTION	**Separate Traffic**

BASELINE ASSUMPTION:

Concrete median barrier type B TL5 currently proposed - project section 2 of 5-557.00.

PROPOSED ALTERNATIVE:

Use a guard rail within the narrower median in lieu of a concrete median barrier type B TL5 - project section 2 of 5-557.00.

BENEFITS	RISKS/CHALLENGES
● Proposed alternative has been used on Interstates around the State	● Changing median design of proposed project section 2 of 5-557.00
● Only a minor tweak to the current proposed typical section	● Public perception or local officials may need to be notified of the change
●	● Could decrease safety due to difference in guardrail barrier versus concrete barrier
●	●
●	●
●	●
●	●

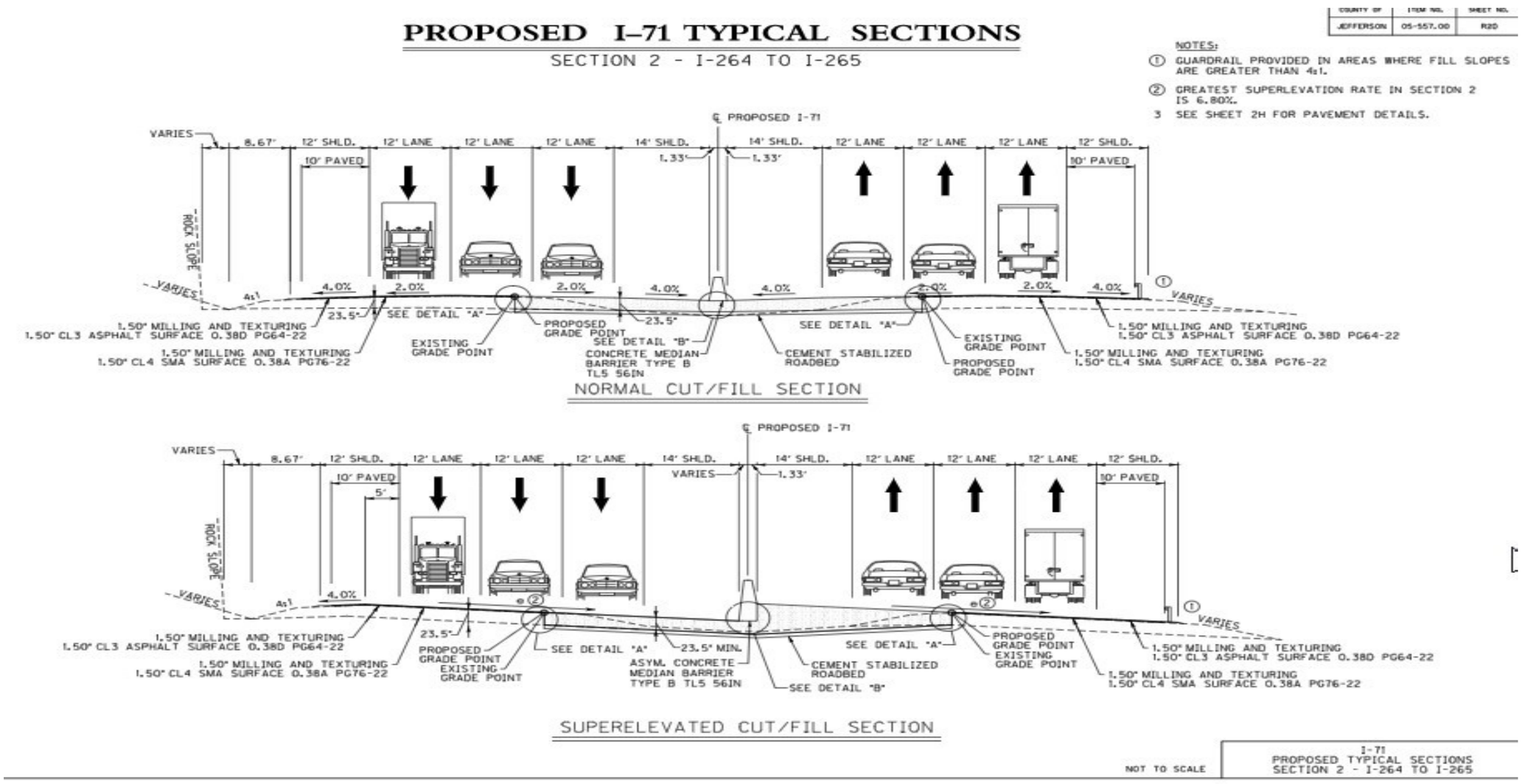
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 3,827,000	$ -	$ 3,827,000
PROPOSED ALTERNATIVE:	$ 595,000	$ -	$ 595,000
TOTAL (Baseline less Proposed)	$ 3,232,000	$ -	$ 3,232,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 14
Idea No. ST-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall

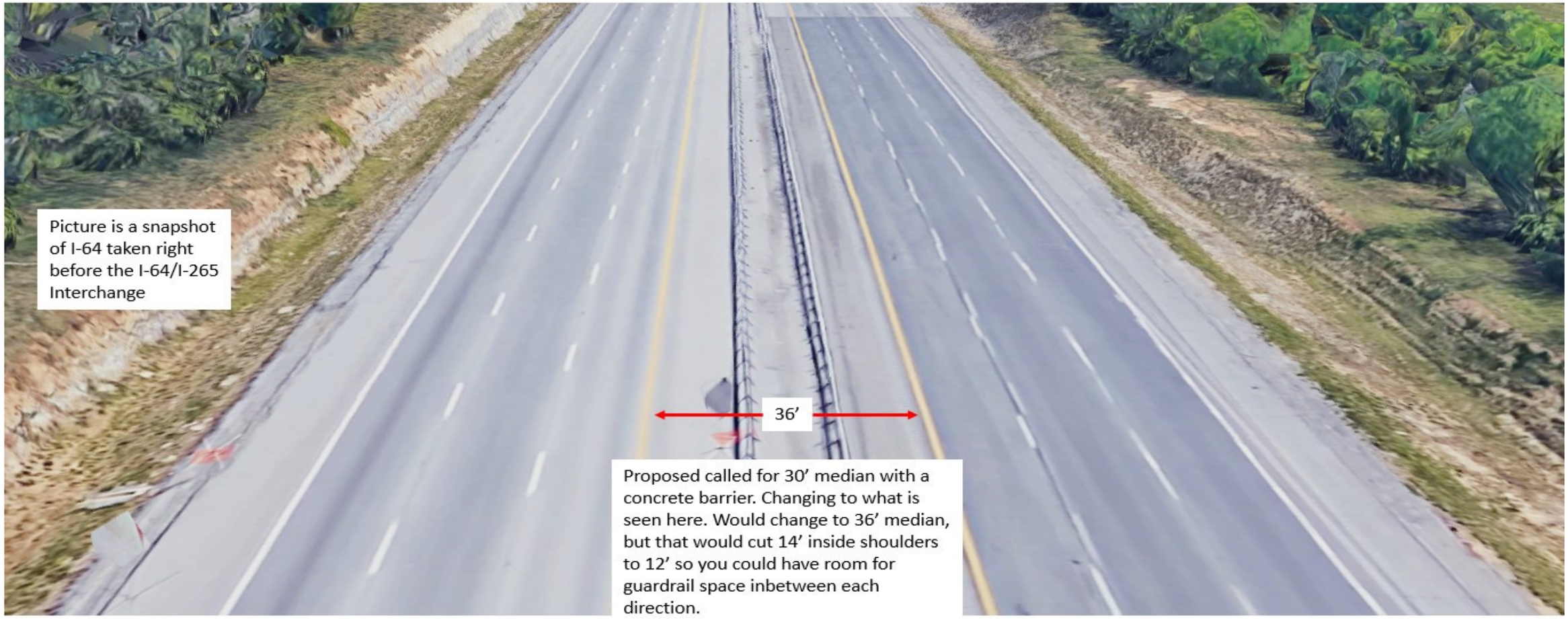
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 14
Idea No. ST-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 14
Idea No. ST-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall

DISCUSSION/JUSTIFICATION:

The proposed I-71 typical section is wanting to move the travel lanes towards the inside which would separate both directions of traffic by a 30-foot median (14-foot inside shoulders for each direction and a 2-foot concrete barrier). That would be followed by three 12-foot travel lanes, a 12-foot shoulder (10-foot paved and 2-foot unpaved), and then an 8-foot grade at 4:1 after that.

The existing typical section is a 60-foot median (48-foot depressed median and 6-foot inside shoulders for each direction). A cable barrier is currently installed on one travel direction with two 12-foot travel lanes in each direction. A 12-foot outside shoulder is also present on each side (10-foot paved and 2-foot unpaved) with an 8-foot grade at 4:1 after that.

The VE team would propose taking the existing median and narrowing it to 36-foot which would create a 12-foot median between the 12-foot inside shoulders for each travel direction. A guardrail barrier would still be installed at the end of the 12-foot inside shoulders to allow for a roughly 8-foot space between each guardrail to allow for space to catch vehicles should accidents towards the inside lanes occur. The team assumes each guardrail section could be up to 2-feet in width once posts and the actual railing is installed. With the proposed alternate, only the median would really change. Everything else the design team had in the proposed typical section drawings would just shift 3-feet towards the outside shoulder in each travel direction. Such a change would not amount to much cost difference, but it does take into account the current proposed typical section is only 30-feet and the VE team is wanting the median to be 36-inches. This could be done with 30-foot median if the 12-foot inside shoulders are narrowed even more, but the cost savings reflected does not not show that.

The VE team was under the assumption that the safety/crash analysis was not yet ready for all of the 557.00 project outside the interchanges. However, after looking at this data in regards to 5-48.10, it looks like roughly eight fatal/injury crashes would occur yearly as well as a total of roughly 50 crashes annually with this type of method. With the 557.00 safety/crash analysis not yet available, cannot compare to the proposed I-71 typical section with the concrete barrier. There is some potential that safety may decrease with the difference between a guard rail versus concrete barrier.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact or very little, because the change proposed is within the median that would be dealt with current MOT.
Right-of-way: No impact
Environmental: No impact
Mobility: No impact
Safety: Might be a little better than using a cable barrier, but at the same time does not make a huge improvement/worsen the safety factor
Maintainability: Probably have to replace guard rail more than a concrete barrier.

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 14
Idea No. ST-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Concrete barrier wall Ty B TL5 56-inch	LF	15,136	$ 150.00	$ 2,270,400	0	$ -	$ -
DGA	Ton	6,963	$ 23.00	$ 160,149	0	$ -	$ -
Asphalt base Cl 3 1.0 64-22	Ton	12,210	$ 72.50	$ 885,225	0	$ -	$ -
Asphalt surface Cl 3 0.50 PG64-22	Ton	1,664	$ 85.00	$ 141,440	0	$ -	$ -
Drainage blanket	Ton	5,549	$ 54.00	$ 299,646	0	$ -	$ -
Asphalt seal aggregate	Ton	0	$ -	$ -	269	$ 157.25	$ 42,300
Asphalt seal coat	Ton	0	$ -	$ -	32	$ 1,186.52	$ 38,313
Cement stabilized roadbed	SY	20,181	$ 3.50	$ 70,634	0	$ -	$ -
Guard rail		0	$ -	$ -	30,272	$ 17.00	$ 514,624
TOTAL				$ 3,827,000			$ 595,000
						CWE (BASELINE LESS PROPOSED)	$ 3,232,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 15
Idea No. ST-007
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of 56" tall barrier wall (Caltrans)
FUNCTION	**Separate Traffic**

BASELINE ASSUMPTION:

KYTC has elected to use 56-inch tall TL 5 concrete median barrier.

PROPOSED ALTERNATIVE:

Consider use of 51-inch tall TL 4 concrete median barrier, especially in areas with wider medians and shoulders.

BENEFITS	RISKS/CHALLENGES
● Cost savings for materials	● Minor reduction in crash performance
●	●
●	●
●	●
●	●
●	●
●	●

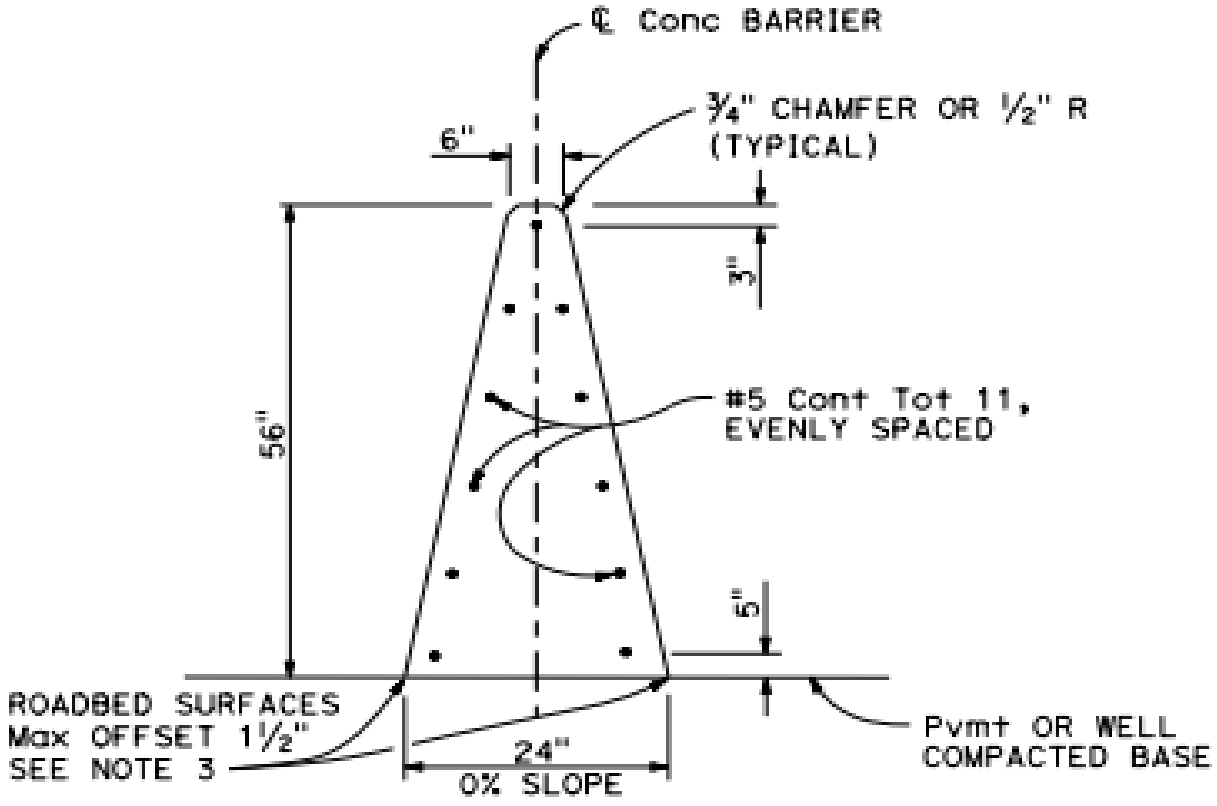
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 975,000	$ -	$ 975,000
PROPOSED ALTERNATIVE:	$ 769,000	$ -	$ 769,000
TOTAL (Baseline less Proposed)	$ 206,000	$ -	$ 206,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 15
Idea No. ST-007
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of 56" tall barrier wall (Caltrans)

SKETCH OF BASELINE ASSUMPTION



CONCRETE BARRIER TYPE 60MG

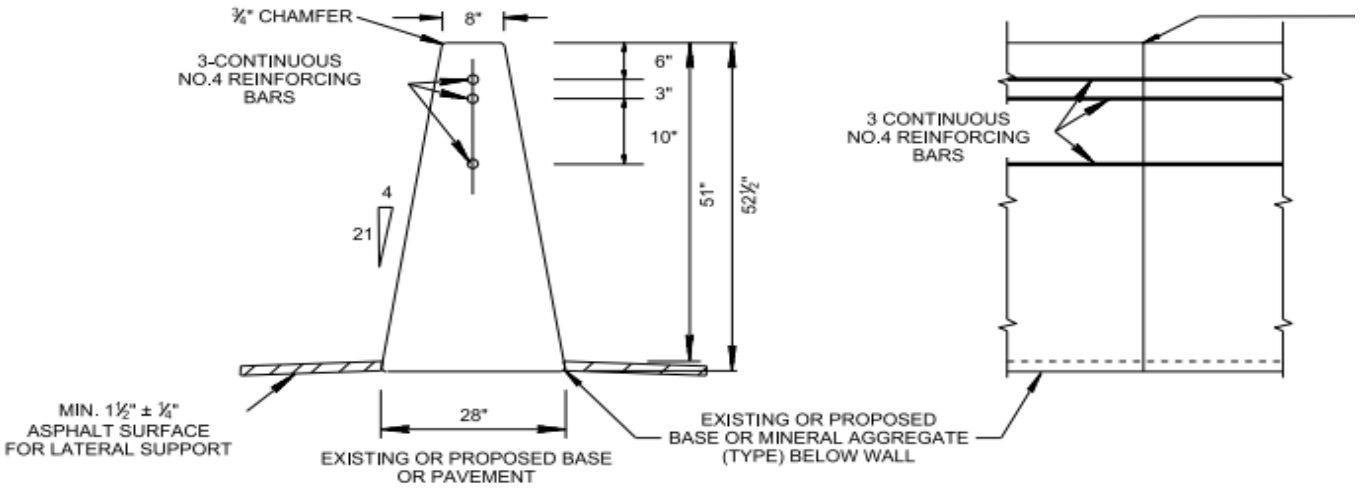
(Monolithic concrete
glare screen/barrier)

Detail from Caltrans Standard Plans. The Type B wall as detailed in the Preliminary line and grade plans has a base of 32" wide and a top projected to be 10.75" wide (based on constant slope of TDOT wall)

VALUE ENGINEERING PROPOSAL NO. 15
Idea No. ST-007
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of 56" tall barrier wall (Caltrans)

SKETCH OF PROPOSED ALTERNATIVE



51" HEIGHT WALL

(J) MIN. SAFETY PERFORMANCE OF 51" SINGLE SLOPE WALL IS ACCEPTABLE ACCORDING TO THE TL-4 EVALUATION CRITERIA SPECIFIED IN NCHRP REPORT 350.

(K) IF GRADE SEPARATION EXCEEDS 2' USE S-SSMB-9 INSTEAD.

VALUE ENGINEERING PROPOSAL NO. 15
Idea No. ST-007
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of 56" tall barrier wall (Caltrans)

DISCUSSION/JUSTIFICATION:

KYTC has elected to go with a Type B-56-inch tall concrete median barrier with a TL 5 rating, similar to a concrete median barrier used by Caltrans. It is certainly difficult to make a case for consideration of a concrete median barrier with a lower test level, but under some circumstances, a concrete median barrier similar to the TDOT 51-inch wall with a TL 4 rating could adequately meet the project need in terms of performance based flexible solutions, and provide a savings that can be used to make the project more affordable, freeing up funds to do additional work and other projects.

In general, research and common practice from other states, obviously including TN, indicates that a concrete median with TL 4 is acceptable for use on the interstate. In discussions within the VE team, it was determined that the suggestion to KYTC be made that a TL 4 concrete median barrier be used in areas where full median shoulders are to be in place. In this situation, with a 12-14-foot median shoulder along with median barrier width itself, establishes a width between opposing traffic lanes of 26-30-feet. With the full shoulder, a larger vehicle will have more width to recover and if does strike the wall, there is a greater chance that the vehicle will not be on as severe a crash angle, keeping the vehicle on their side of the median wall.

To summarize, in a scenario where full median shoulders are provided, it is suggested KYTC consider TL 4 concrete median barrier. The TDOT wall takes approximately 21% less concrete to construct. Reinforcement Steel was considered to be equivalent. Maintenance life cycle costs for either concrete median barrier are considered equal.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact
Right-of-way: No impact
Environmental: No impact
Mobility: No impact
Safety: Minor reduction in crash performance
Maintainability: No impact

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 15
Idea No. ST-007
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of 56" tall barrier wall (Caltrans)

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
CONCRETE MEDIAN BARRIER-56" (MATERIALS ONLY) Sect 1 and 2	CY	8,128	$ 120.00	$ 975,360	6,410	$ 120.00	$ 769,200
TOTAL				$ 975,000			$ 769,000
						CWE (BASELINE LESS PROPOSED)	$ 206,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 16
Idea No. SO-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork
FUNCTION	**Span Opening**

BASELINE ASSUMPTION:

Widen existing twin bridges in the median over Greenway, Beargrass Creek and the access road to the billboard and repair the existing twin bridges.

PROPOSED ALTERNATIVE:

Replace the bridge over Greenway, Beargrass Creek and the access road to the billboard with buried box structures. Buried box for Beargrass Creek to be sized to pass necessary flow. Buried box for Greenway to be sized to provide adequate clearance for the multi-use path. Buried box for billboard access to be sized to provide adequate room for vehicular access to the billboard.

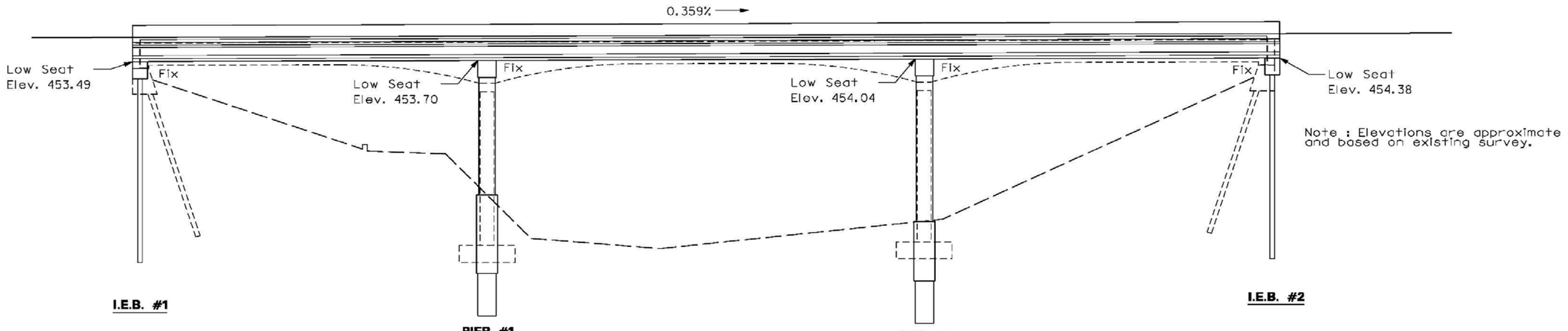
BENEFITS	RISKS/CHALLENGES
● Reduces long-term maintenance of bridge structure	● Must be constructed within existing piers
● Eliminates snow and ice location	●
●	●
●	●
●	●
●	●
●	●

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 1,750,000	$ -	$ 1,750,000
PROPOSED ALTERNATIVE:	$ 2,237,000	$ -	$ 2,237,000
TOTAL (Baseline less Proposed)	$ (487,000)	$ -	$ (487,000)
			ADD COST

VALUE ENGINEERING PROPOSAL NO. 16
Idea No. SO-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork

SKETCH OF BASELINE ASSUMPTION



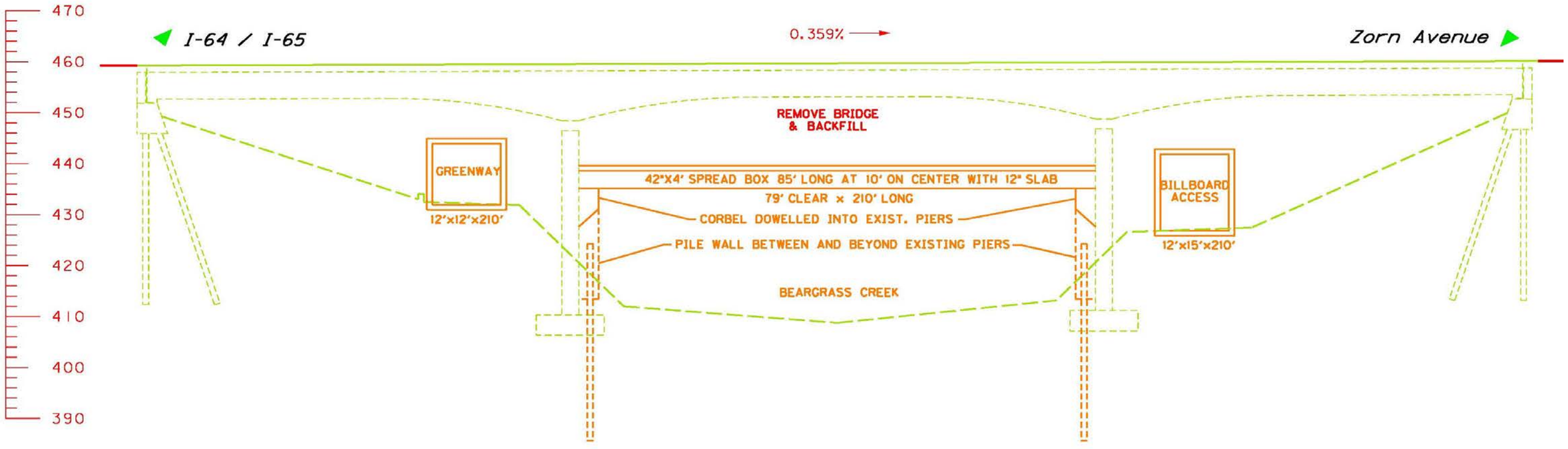
ELEVATION

Twin 3 Span 74'-7⅛"x94'-0"x74'-8⅜" PCI Type 4 Beam, Spans Continuous for Live Load
1.25 x HL-93 Live Load (KY HL-93)
20° Skew Lt. ~ 51'-8 1/4" Bridge Roadway Width ~ 2:1 Fill Slopes

VALUE ENGINEERING PROPOSAL NO. 16
Idea No. SO-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 16
Idea No. SO-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork

DISCUSSION/JUSTIFICATION:

The baseline condition is proposing to perform $1,230,000 in widening of the existing bridges over Beargrass Creek. There is also another $280,000 in required repairs and $240,000 in recommended repairs. The sum total of all work recommended on the existing bridges is $1,750,000. Portions of the bridge that was built in 1966 would remain.

This proposal is to remove the existing bridge and replace it with box structures to serve the independent purpose of each bridge span. We have estimated a 12-foot x12-foot box to provide access for the Greenway with 10-foot clearance as recommended by AASHTO for pedestrian facilities, a Bebo E84T with an 84-foot span and 29-foot 10-inch rise for Beargrass Creek as well as a 16-foot x12-foot box for the access to the billboard.

The structures would be built in place beneath the existing bridge. The structures would be backfilled in the median and outside the existing bridges with traffic running on the existing bridges. Once the median is constructed, traffic would be shifted to the median to allow bridges in each direction to be demolished and backfilled.

Alternate designs to this concept include eliminating the access to the billboard (See SO-005) to eliminate the need for that box. Also, could combine the Beargrass Creek and Greenway structures to a shared structure while still eliminating the access road to the billboard.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Necessitates phasing construction and shifting traffic for subsequent construction phases
Right-of-way: No impact (unless billboard is removed)
Environmental: Potential impact from work in Beargrass Creek
Mobility: No impact
Safety: Increases safety by eliminating bridge walls and snow & ice location
Maintainability: Improves maintainability by eliminating bridge

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 16
Idea No. SO-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
I-71 SB Bridge required repairs	LS	1	$ 160,000.00	$ 160,000			
I-71 SB Bridge recommended repairs	LS	1	$ 120,000.00	$ 120,000			
I-71 SB Bridge widening	LS	1	$ 615,000.00	$ 615,000			
I-71 NB Bridge required repairs	LS	1	$ 120,000.00	$ 120,000			
I-71 NB Bridge recommended repairs	LS	1	$ 120,000.00	$ 120,000			
I-71 NB Bridge widening	LS	1	$ 615,000.00	$ 615,000			
12-foot X 12-foot RCBC	CY				404	$ 700.00	$ 283,111
Box beams	LF				1,700	$ 350.00	$ 595,000
12-inch slab	CY				661	$ 500.00	$ 330,556
Walls	CY				583	$ 500.00	$ 291,667
Earthwork	CY				24,203	$ 10.00	$ 242,030
16-foot x12-foot RCBC	LF				451	$ 700.00	$ 315,778
Pavement	SY				3,012	$ 46.50	$ 140,059
HP 12 x 53	LF				960	$ 40.00	$ 38,400
TOTAL				$ 1,750,000			$ 2,237,000
						CWE (BASELINE LESS PROPOSED)	$ (487,000)

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

ADD COST

VALUE ENGINEERING PROPOSAL NO. 17
Idea No. SO-016
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard
FUNCTION	**Span Opening**

BASELINE ASSUMPTION:

Widen existing twin bridges in the median and repair existing twin bridges.

PROPOSED ALTERNATIVE:

Construct pile supported wall between existing bridge piers, remove existing superstructure and place 42-inch deep spread box beams at 10-foot on center that cantilever 13-feet beyond the supporting wall/existing piers at each end. Close off each end with a concrete wall to form a box for the greenway on the left and for the billboard access road on the right. The box beams will have a 12-inch concrete slab.

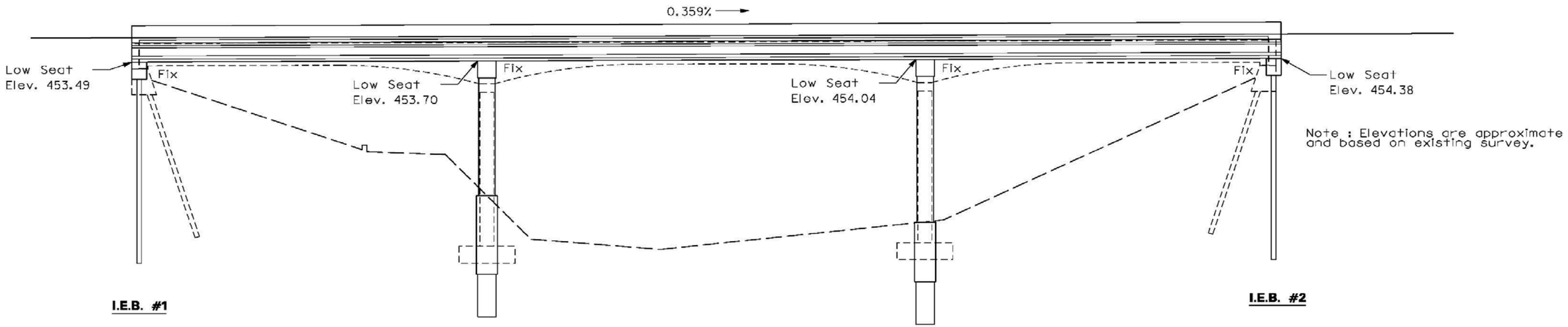
BENEFITS	**RISKS/CHALLENGES**
● Eliminates the twin bridges and widening them in the median	● First phase MOT-placing fill on spill through slopes while maintaining traffic on existing twin bridges
● Eliminates the need for required repairs and recommended repairs to the existing twin bridges	● Coordination with Greenway/Metro Louisville
● Eliminates future bridge maintenance	●
●	●
●	●
●	●
●	●

COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ 1,741,000	$ -	$ 1,741,000
PROPOSED ALTERNATIVE:	$ 1,797,000	$ -	$ 1,797,000
TOTAL (Baseline less Proposed)	$ (56,000)	$ -	$ (56,000)
			ADD COST

VALUE ENGINEERING PROPOSAL NO. 17
Idea No. SO-016
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard

SKETCH OF BASELINE ASSUMPTION



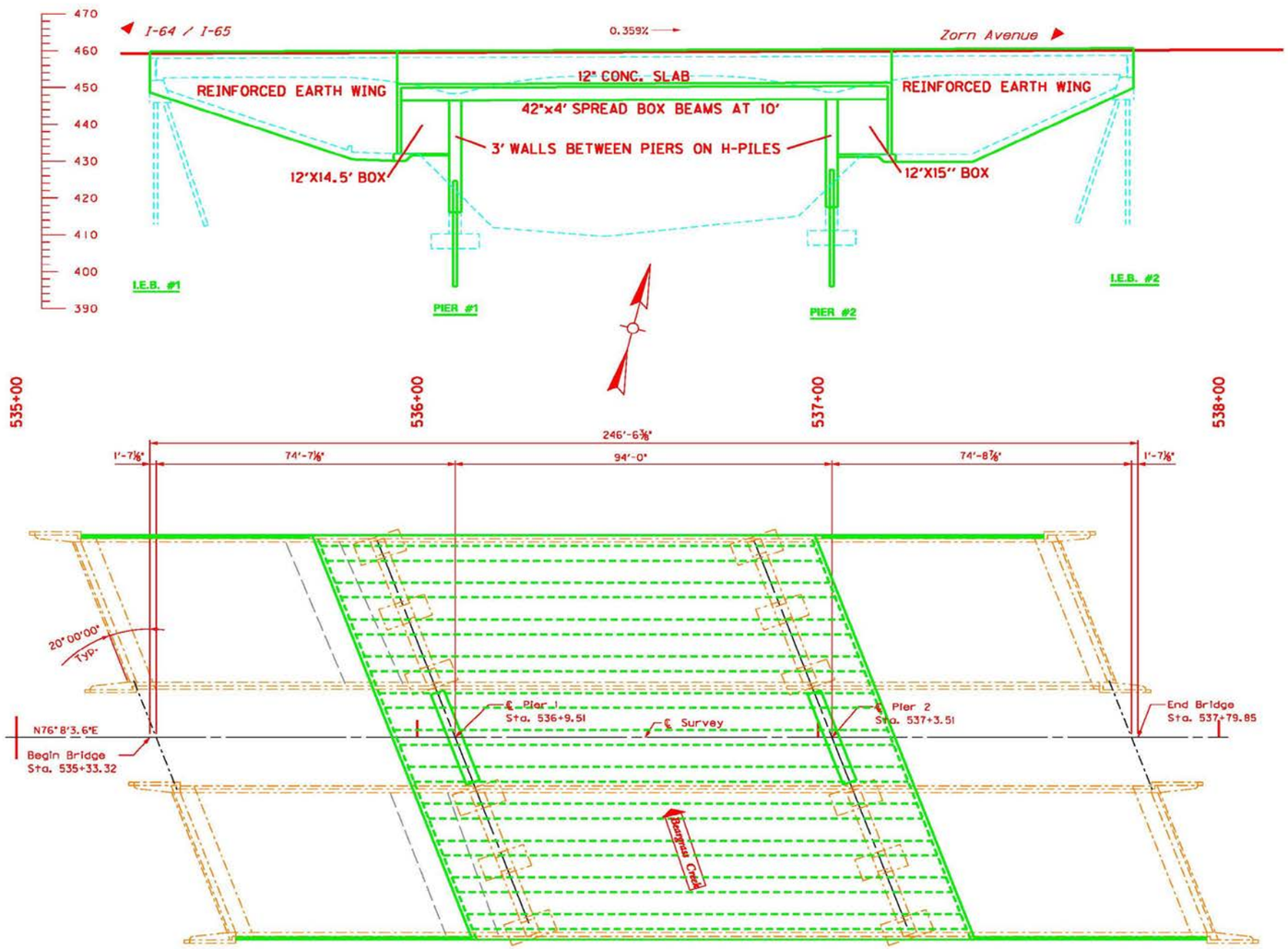
ELEVATION

Twin 3 Span 74'-7⅛"x94'-0"x74'-8⅞" PCI Type 4 Beam, Spans Continuous for Live Load
1.25 x HL-93 Live Load (KY HL-93)
20° Skew Lt. ~ 51'-8 1/4" Bridge Roadway Width ~ 2:1 Fill Slopes

VALUE ENGINEERING PROPOSAL NO. 17
Idea No. SO-016
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 17
Idea No. SO-016
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard

DISCUSSION/JUSTIFICATION:

The main purpose of SO-016 is to completely eliminate this 247-foot three-span bridge that is almost 60-years old and the maintenance issues will continue. The current combined required and recommended repairs are $512,176. This is an alternate to SO-001 to take advantage of the existing piers. Due to the shallow fill over the beams, the parapet will be in-line with the existing barrier and the beams will be placed along the 20-degree skew instead of perpendicular to stream as in SO-001. This should make construction of the buried bridge easier and less costly. The haunched girders allow the beams to be set low enough to get adequate fill over the buried bridge for constructing the entire pavement section. The beams will have a non-standard design since they will cantilever over the piers/new wall between to carry the vertical load on the box openings for the greenway and the access road for the billboard, so the side walls on theses boxes only carry lateral earth pressure.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact
Right-of-way : None required, no impact
Environmental: No impact
Mobility: No impact
Safety: Slight safety increase due to no icing on the bridge
Maintainability: Large improvement

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 17
Idea No. SO-016
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Maintenance to existing bridges	LS	1	$ 512,176.00	$ 512,176	0	$ 512,176.00	$ -
Widen bridges in the median	LS	1	$ 1,228,810.00	$ 1,228,810	0	$ 1,228,810.00	$ -
box beams	LF	0	$ 350.00	$ -	1,356	$ 350.00	$ 474,513
12 inch slab	CY	0	$ 500.00	$ -	501	$ 500.00	$ 250,494
3-ft walls	CY	0	$ 500.00	$ -	277	$ 500.00	$ 138,333
Greenway Box	CY	0	$ 700.00	$ -	143	$ 700.00	$ 99,929
Access Road Box	CY	0	$ 700.00	$ -	145	$ 700.00	$ 101,443
Earthwork	CY	0	$ 10.00	$ -	12,845	$ 10.00	$ 128,448
Pavement	SY	0	$ 46.50	$ -	3,012	$ 46.50	$ 140,059
HP12 x 53	LF	0	$ 40.00	$ -	400	$ 40.00	$ 16,000
Reinforced Walls for 4 wings	SF	0	$ 80.00	$ -	5,600	$ 80.00	$ 448,000
TOTAL				$ 1,741,000			$ 1,797,000
						CWE (BASELINE LESS PROPOSED)	$ (56,000)

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

ADD COST

VALUE ENGINEERING PROPOSAL NO. 18
Idea No. SO-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB
FUNCTION	**Span Opening**

BASELINE ASSUMPTION:

The existing design includes a bridge on I-71 which spans a shared-use path, Beargrass Creek, and gravel road. The gravel road only provides access to a billboard facing southbound I-71.

PROPOSED ALTERNATIVE:

Eliminating the billboard will eliminate the need for the gravel access road which subsequently eliminates the need for one of the buried boxes in SO-005.

BENEFITS	RISKS/CHALLENGES
● Reduction in cost of bridge construction assuming SO-001 is advanced	● There may be a long-term lease agreement in place
● Improves constructability	●
● Reduction in future buried-box maintenance costs	●
●	●
●	●
●	●
●	●

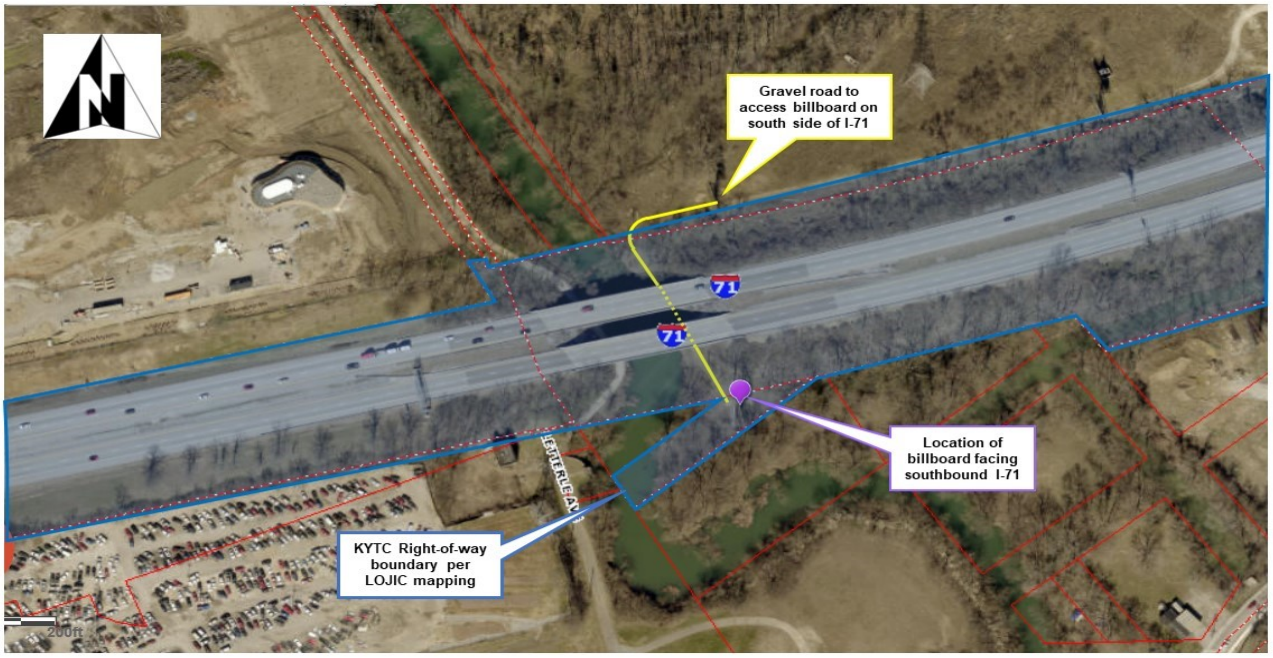
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 2,370,000	$ -	$ 2,370,000
PROPOSED ALTERNATIVE:	$ 2,252,000	$ -	$ 2,252,000
TOTAL (Baseline less Proposed)	$ 118,000	$ -	$ 118,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 18
Idea No. SO-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB

SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 18
Idea No. SO-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB

DISCUSSION/JUSTIFICATION:

The existing bridges span approximately 245-feet over a shared-use path, Beargrass Creek, and a gravel access road. The gravel access road only provides access to a billboard facing southbound I-71 (MP 0.328). If the alternatives described in SO-001 were ultimately advanced, an opportunity may exist to eliminate the buried box for the billboard access road thereby reducing the cost of the bridge replacement. This opportunity is contingent upon the elimination of the billboard. Based on LOJIC aerial mapping, the billboard appears to sit on a parcel of publicly owned property. Adjacent parcels and the parcel on the north side of I-71 from where the access road originates are owned by "1860, Mellwood LLC". Because the access road is a connection between a common parcel owner, additional investigation is necessary to determine the feasibility of this concept. The VE team also recognizes that this concept may deviate from the original intent of avoiding conflicts outside of right-of-way. However, it may still be prudent to investigate options with the property owner as well as review the terms of the existing lease with the billboard company.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact
Right-of-way: May have impact to ROW regarding lease agreement of billboard
Environmental: No impact
Mobility: No impact
Safety: No impact
Maintainability: Improves maintainability of bridge

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 18
Idea No. SO-005
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Removal of buried box for billboard access road (assuming SO-005 is advanced to eliminate the existing span bridge). The proposed alternative assumes a 10% reduction in costs by removing buried box. (See SO-001 for cost breakdown.)	LS	1	$2,370,000	$ 2,370,000	1	$ 2,251,500.00	$ 2,251,500
TOTAL				$ 2,370,000			$ 2,252,000
						CWE (BASELINE LESS PROPOSED)	$ 118,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 19
Idea No. AS-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider constructing noise wall on the median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall
FUNCTION	**Absorb Sound**

BASELINE ASSUMPTION:

It is proposed that a noise wall on the right barrier wall would be between 18-20-feet, which also requires additional support.

PROPOSED ALTERNATIVE:

Construct a noise wall on the median of the bridge (9-foot), which could then help to reduce the height of the noise wall on the right barrier wall (roughly 8-foot). Total of 17-feet instead of 18-20-feet. This would also help to reduce the amount of support needed for outside barrier wall on the bridge.

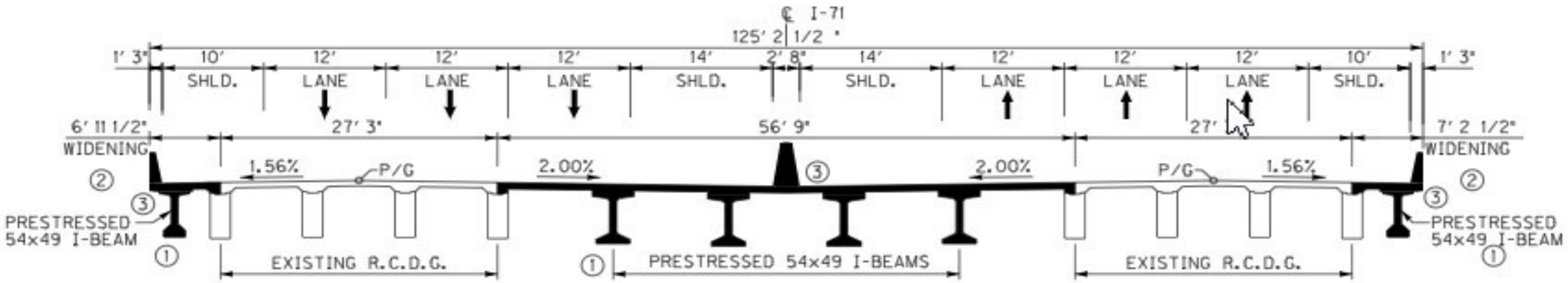
BENEFITS	RISKS/CHALLENGES
● Help to reduce noise without having to have a taller noise wall on outside barrier wall	● Public perception of noise wall not being tall enough to block all of noise
● If a taller noise wall is not needed on outside barrier wall, then less support would be needed as well	● Parallel wall analysis will need to verify this does not worsen the problem
● Less noise wall needed (roughly 1-3-feet), which leads to some cost savings	● Noise wall on the inside median has not been done in the State, so would be innovative
● Provides some noise reduction for receptors north of I-71 which currently have nothing separating them from road noise	●
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 19
Idea No. AS-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider constructing noise wall on the median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall

SKETCH OF BASELINE ASSUMPTION



PROPOSED BRIDGE SECTION

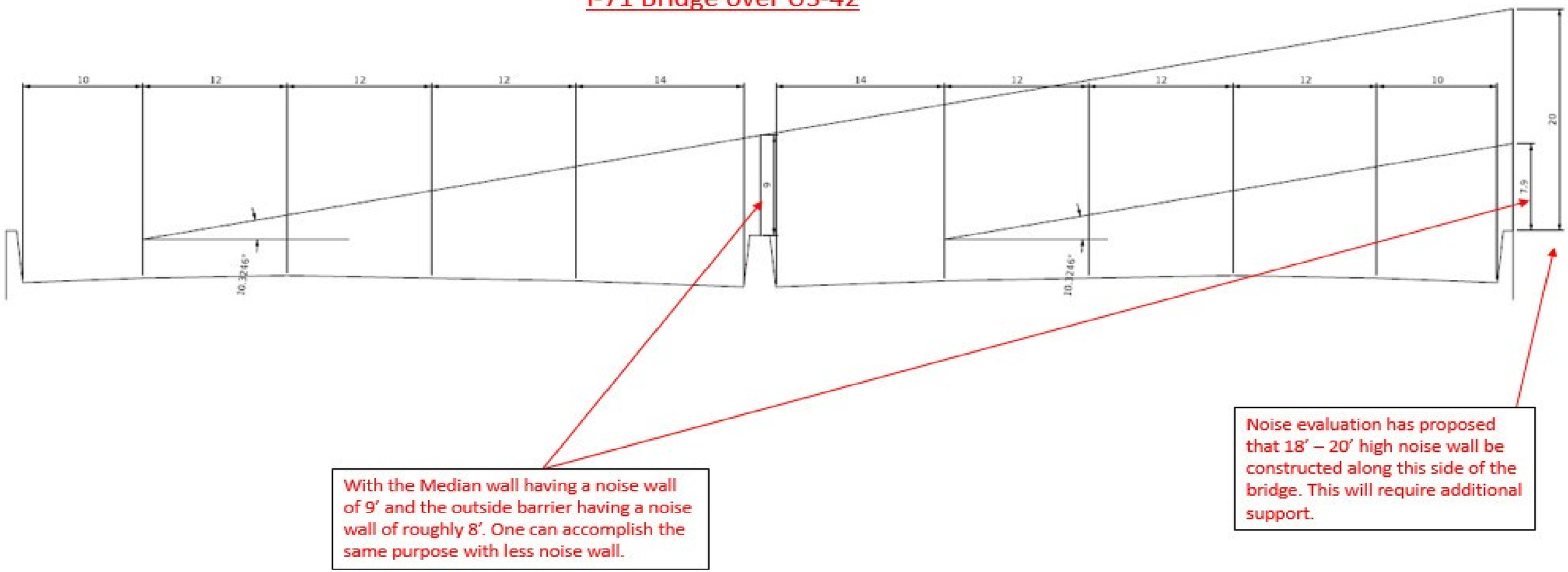
I-71 OVER US 42

NOISE EVALUATION HAS PROPOSED THAT 18' - 20' HIGH NOISE WALL BE CONSTRUCTED ALONG THIS SIDE OF THE BRIDGE. THIS WILL REQUIRE ADDITIONAL SUPPORT.

VALUE ENGINEERING PROPOSAL NO. 19
Idea No. AS-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider constructing noise wall on the median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 19
Idea No. AS-001
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider constructing noise wall on the median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall

DISCUSSION/JUSTIFICATION:

The language concerning the noise wall for the I-71 Bridge over US 42 states, "Noise evaluation has proposed that 18–20-foot high noise wall be constructed along this side of the bridge. This will require additional support." When looking at the proposed sketch of the I-71 bridge over US-42, one can see that the same purpose of lowering the noise of traffic 7-10 decibels can also be done by using a different innovative method. A noise wall of 9-feet being installed on the median would help in blocking the noise of the traffic on the SB side of the road. On the opposite side, a noise wall of 7.9-feet (roughly 8-feet) could be installed on the outside barrier wall and block the noise of the NB traffic. Since tire noise is the main culprit of road/traffic noise, these two noise walls being installed like that would serve the same purpose as installing a 18-20-foot noise wall just on the outside barrier wall. This could also aid in reducing the amount of required additional support needed if one is not needing to support an 18-20-foot noise wall vs a roughly 8-foot noise wall.

The VE team recognizes that this idea is innovative and has not been done within the State. The VE team also recognizes that sight distance might also be an issue of concern. However, there are noise walls that are clear and could be used in lieu of solid noise walls.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Little to no change since still installing a noise wall, just breaking it up into two smaller noise walls instead of one bigger noise wall.
Right-of-way: No impact
Environmental: Would changing the noise wall height and what it is used for require additional environmental review?
Mobility: No impact
Safety: No impact
Maintainability: Replace sections of noise wall if parts are destroyed in a traffic accident.

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 20
Idea No. AS-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier
FUNCTION	**Absorb Sound**

BASELINE ASSUMPTION:

The bridge over US 42 is being widened to provide 10-foot outside shoulders with 14-foot inside shoulders. This bridge also requires the construction of an 18-20-foot noise wall on one side.

PROPOSED ALTERNATIVE:

Shift I-71 traffic toward the median, reducing the width of the inside shoulder but maintaining the width of the outside shoulder, such that all bridge widening is performed on the inside of the bridges. Utilize innovative noise walls with lighter weight material to eliminate the need for additional support under the wall itself.

BENEFITS	RISKS/CHALLENGES
● Eliminates need for bridge widening on both exterior walls	● No new support (beam) under proposed noise wall
● Eases construction by eliminating two additional construction phases	●
● Narrows separation from noise source to noise wall	●
●	●
●	●
●	●
●	●

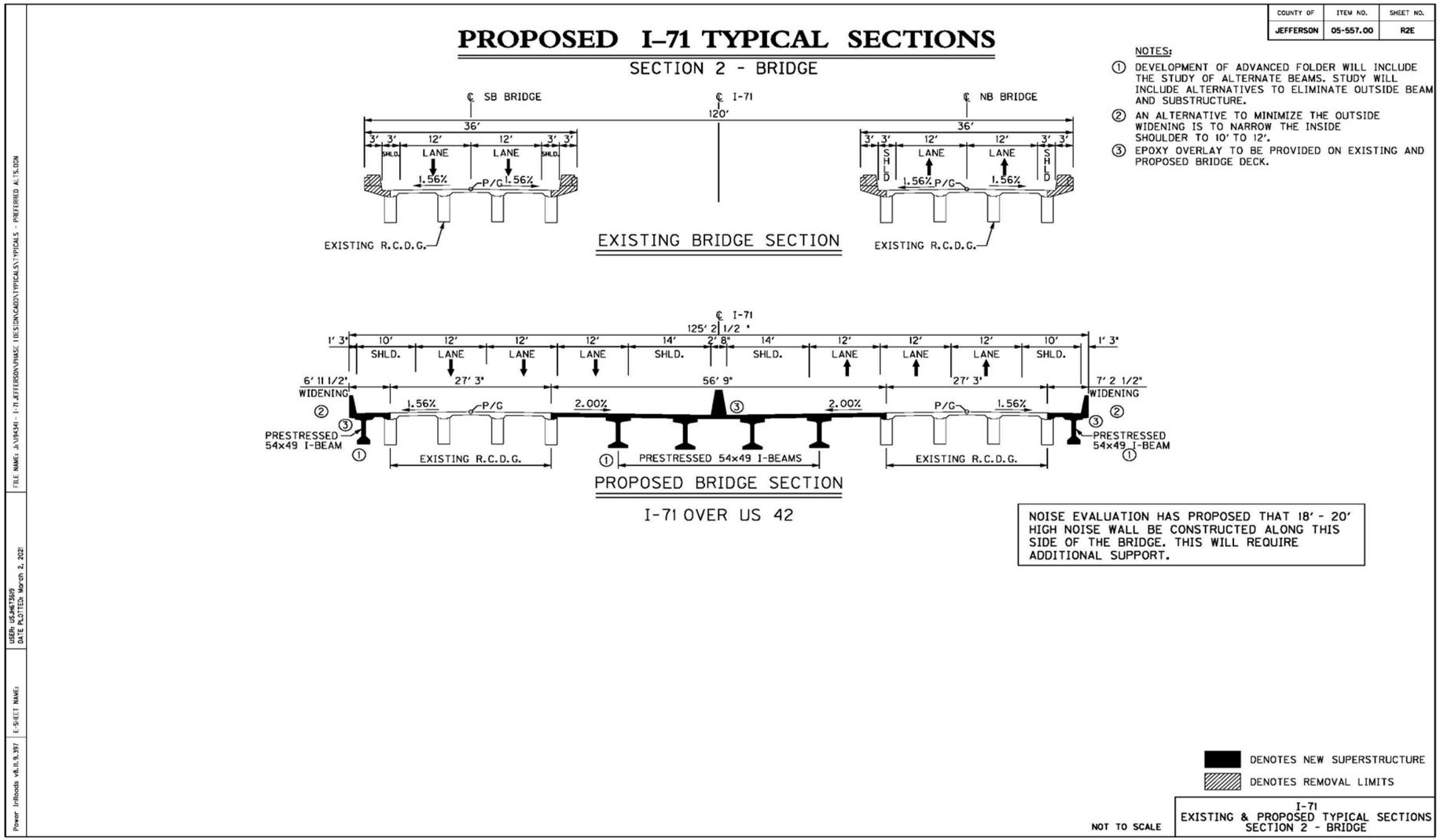
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 497,000	$ -	$ 497,000
PROPOSED ALTERNATIVE:	$ 115,000	$ -	$ 115,000
TOTAL (Baseline less Proposed)	$ 382,000	$ -	$ 382,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 20
Idea No. AS-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier

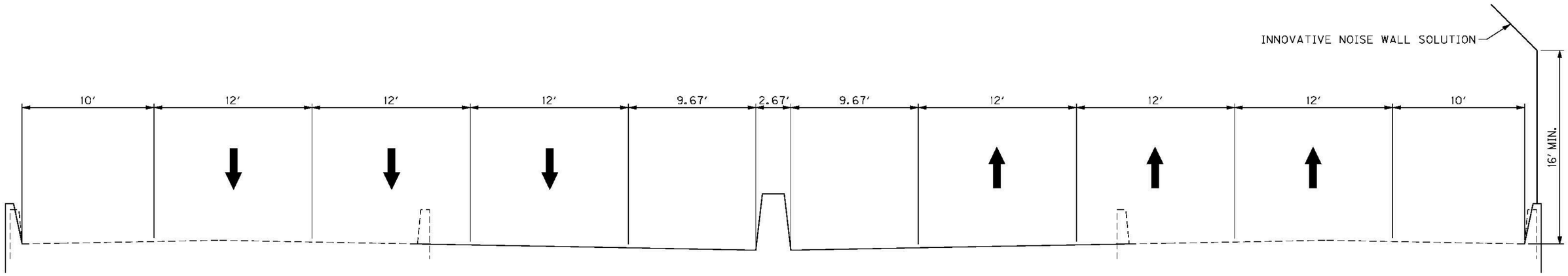
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 20
Idea No. AS-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL NO. 20
Idea No. AS-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier

DISCUSSION/JUSTIFICATION:

In an effort to minimize the separation between either 1) the noise source and the noise wall or 2) the noise receptor and the noise wall, this concept proposes to reduce inside shoulder widths to work toward minimizing the distance between the noise source and noise wall.

This concept also will avoid widening of the existing bridges and would hold the existing outside edge of shoulder in its current location. The approaches to the bridge would need to be shifted such that the outside shoulder point would align with the existing outside shoulder across the bridge. Upgrading the bridge railing to the current KYTC 40-inch Single Slope barrier is still recommended. This would allow an opportunity to provide any additional structure in the wall for mounting of the noise wall on top.

The reduced inside shoulder width with this proposal would be just under 10-feet as opposed to the 14-feet in the baseline. This will have an adverse impact on the safety of the corridor, however any impacts will be negligible due to the shoulder still providing room for a vehicle to pull out of the way of traffic coupled with the short distance over which this would apply.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Improves MOT
Right-of-way: No Impact
Environmental: No Impact
Mobility: No Impact
Safety: Negligible degradation of safety in area of bridge
Maintainability: No Impact

SPECIAL IMPLEMENTATION CONSIDERATIONS:

If using a curved noise wall, curve must not start prior to 16' from paved shoulder elevation to meet DOD requirements.

VALUE ENGINEERING PROPOSAL NO. 20
Idea No. AS-015
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
54x49 I-Beam	LF	510	$ 500.00	$ 255,000	0	$ 500.00	$ -
40-inch Single Slope Barrier	LF	510	$ 150.00	$ 76,500	510	$ 150.00	$ 76,500
MOT for exterior widening	% total	50%		$ 165,750	1		$ 38,250
TOTAL				$ 497,000			$ 115,000
						CWE (BASELINE LESS PROPOSED)	$ 382,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 21
Idea No. SO-010
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening
FUNCTION	**Span Opening**

BASELINE ASSUMPTION:

All interchange alternates assume the widening of the bridge servicing the I-71 SB to I-264 WB movement to provide two ramp lanes. The widening will occur on the western side of the bridge and it appears lanes will be shifted westward to provide more inside shoulder. Limiting stopping sight distance based on Horizontal Sight Offset is estimated at approximately 300 foot-equivalent to just under 40 MPH design speed.

PROPOSED ALTERNATIVE:

Utilize existing bridge width to construct two ramp lanes with narrower shoulder across the bridge.

BENEFITS	RISKS/CHALLENGES
● Eliminates cost of bridge widening	● Degrades sight distance due to narrower inside shoulder
● Eliminates need for maintaining traffic due to bridge widening	●
●	●
●	●
●	●
●	●
●	●

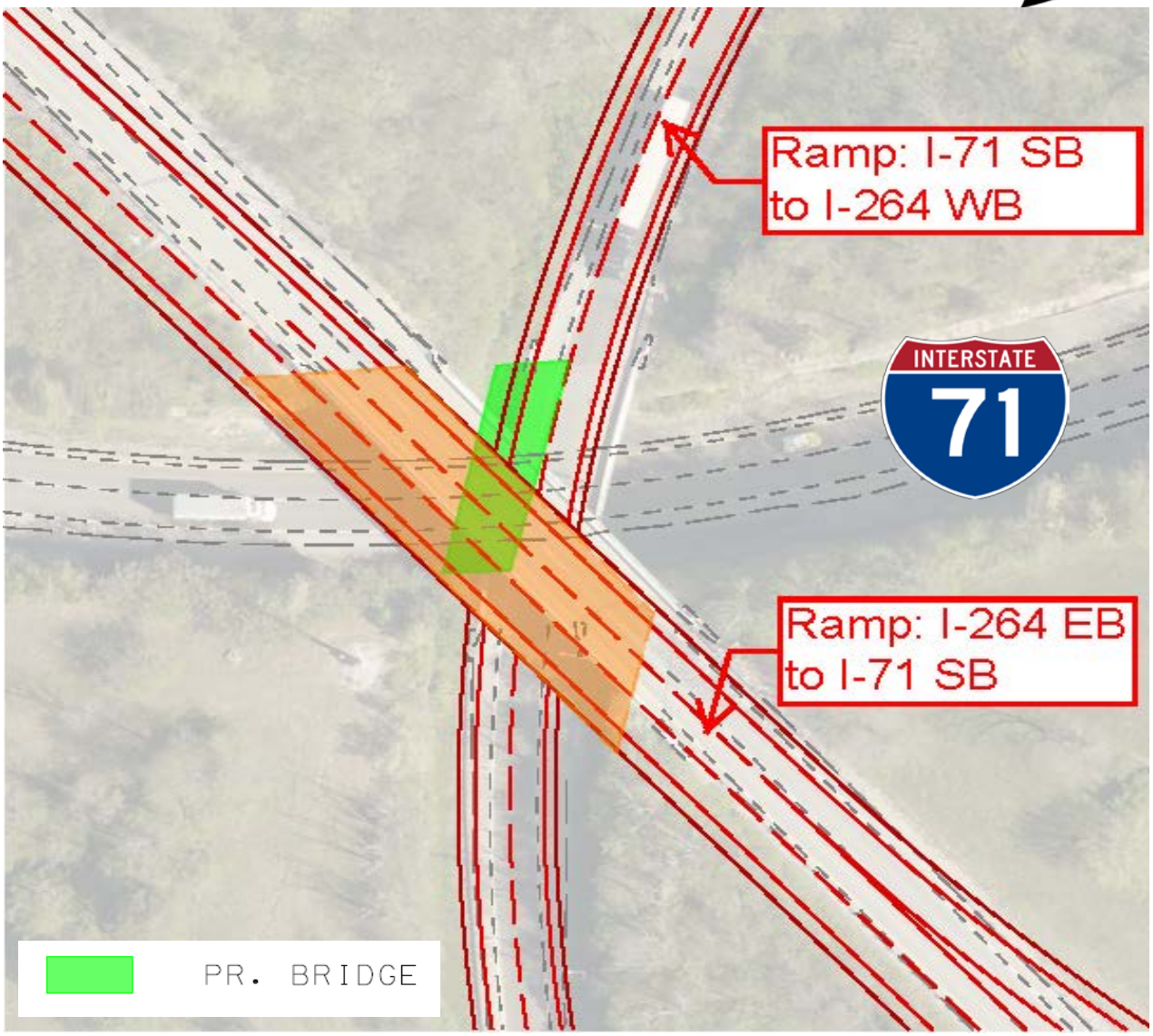
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 493,000	$ -	$ 493,000
PROPOSED ALTERNATIVE:	$ -	$ -	$ -
TOTAL (Baseline less Proposed)	$ 493,000	$ -	$ 493,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 21
Idea No. SO-010
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening

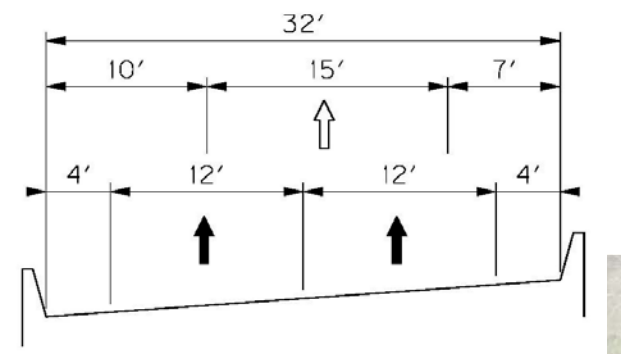
SKETCH OF BASELINE ASSUMPTION

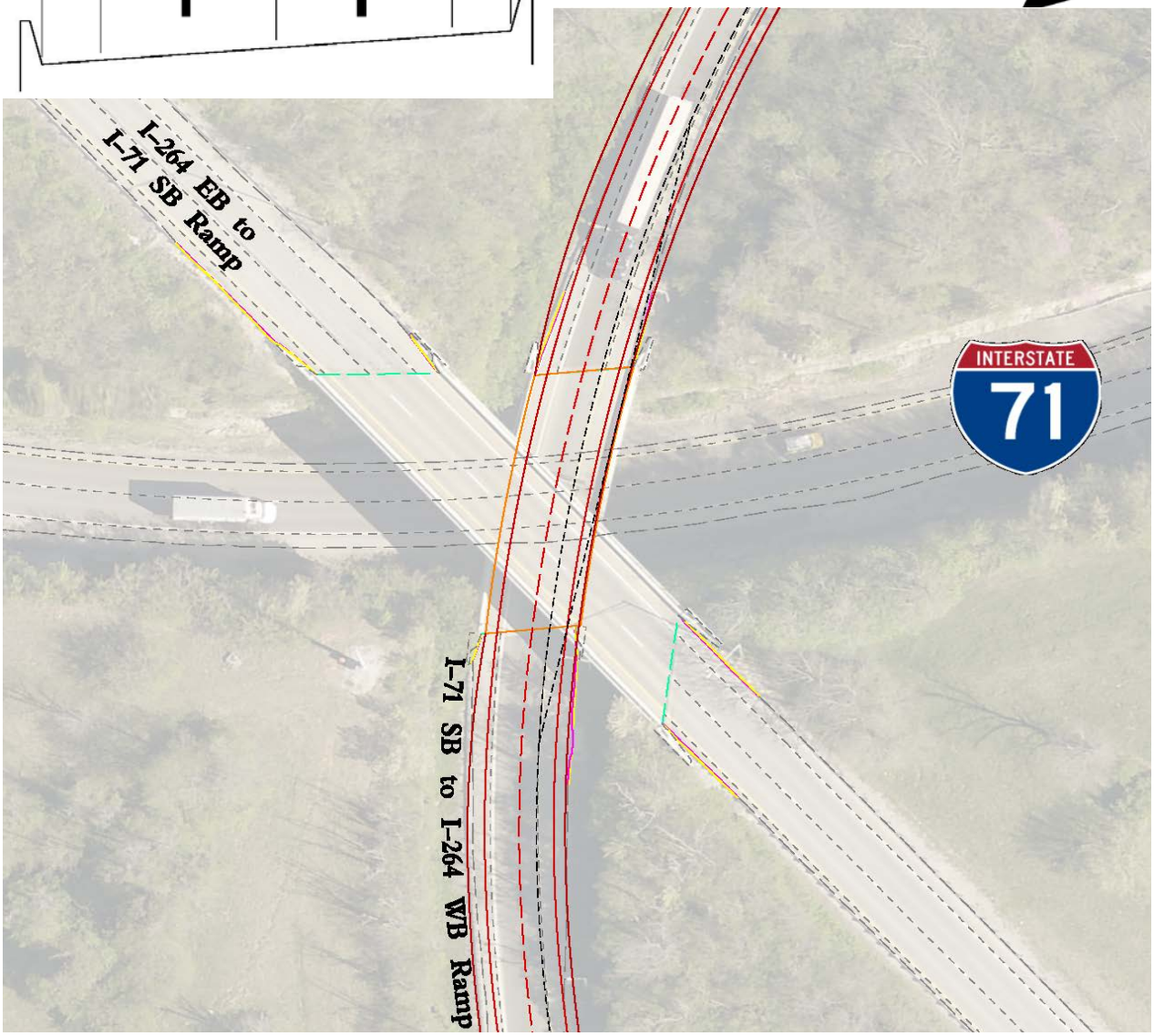


VALUE ENGINEERING PROPOSAL NO. 21
Idea No. SO-010
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening

SKETCH OF PROPOSED ALTERNATIVE





VALUE ENGINEERING PROPOSAL NO. 21
Idea No. SO-010
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening

DISCUSSION/JUSTIFICATION:

The existing bridge is 32-feet from barrier to barrier. The current configuration provides a 15-foot lane with a 10-foot inside shoulder and 7-foot outside shoulder. Assuming that a sight line cannot cross the edge of shoulder (based on guardrail or bridge parapet wall), the stopping sight distance for the existing ramp configuration would be approximately 320-feet--meeting a 40 MPH design.

This proposal recommends to utilize and reconfigure the existing bridge to provide two lanes on the ramp. This will require shoulders to be narrowed at the bridge and will hamper stopping sight distance. Assuming that a sight line cannot cross the edge of shoulder (based on guardrail or bridge parapet wall), the stopping sight distance for this new ramp configuration would be approximately 250-feet--meeting a 35 MPH design.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Improves MOT
Right-of-way: No Impact
Environmental: No Impact
Mobility: No impact
Safety: Degrades safety
Maintainability: Degrades maintainability

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 21
Idea No. SO-010
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
I-264 EB to I-71 SB existing bridge widening	SQFT	1,972	$ 250.00	$ 493,000			
TOTAL				$ 493,000			$ -
						CWE (BASELINE LESS PROPOSED)	$ 493,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 22
Idea No. SO-018
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Verify minimum clearance for Barbour Lane overpass (Section 2)
FUNCTION	**Span Opening**

BASELINE ASSUMPTION:

The widening of I-71 in the median will not affect the existing Barbour Lane bridge over I-71.

PROPOSED ALTERNATIVE:

Because the existing Barbour Lane bridge over I-71 (MP 7.49) has a haunched-girder span, the vertical clearance in both the proposed lane adjacent to the median and inside shoulder lane will be less than the vertical clearance for the existing travel lanes. The VE team advises that the minimum vertical clearance be verified for both the proposed travel lanes and inside shoulders adjacent to the median.

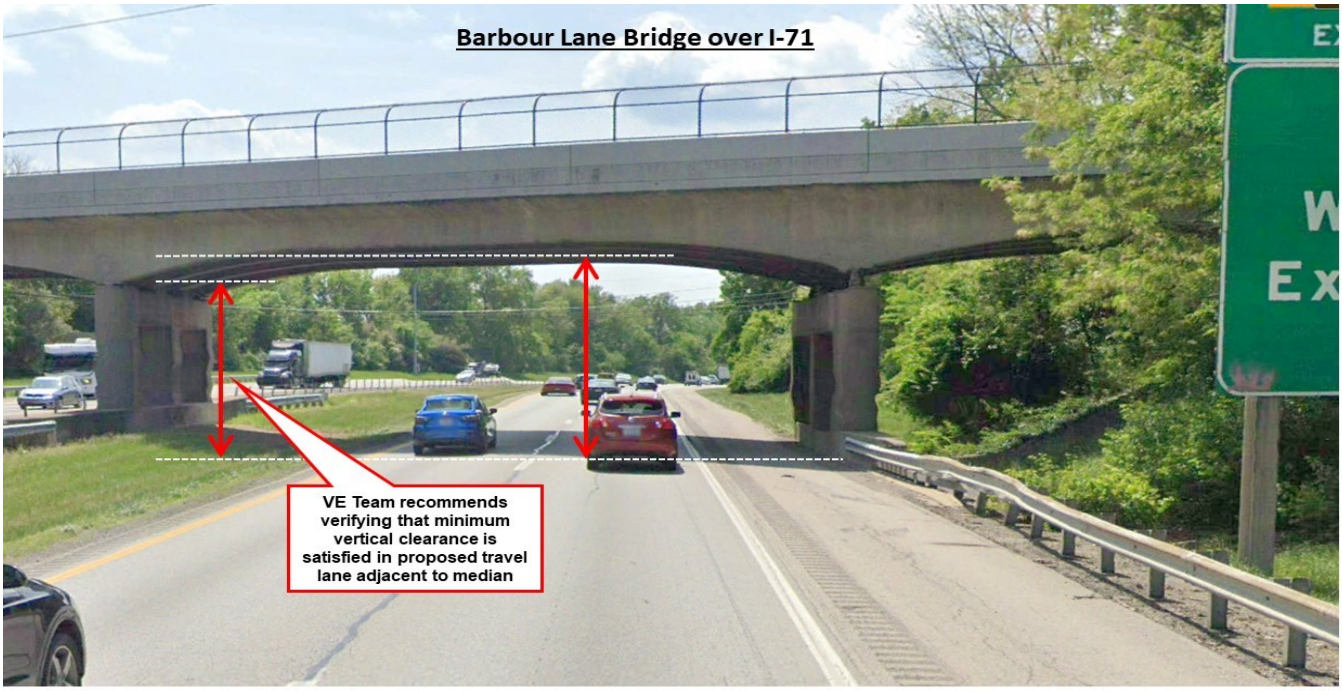
BENEFITS	RISKS/CHALLENGES
● Confirmation of the vertical clearance prior to bid will eliminate a costly change order later	● Safety of trucks traveling on inside lanes may be compromised
●	● I-71 under the Barbour Lane Bridge may have to lowered
●	●
●	●
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 22
Idea No. SO-018
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Verify minimum clearance for Barbour Lane overpass (Section 2)

SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 22
Idea No. SO-018
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Verify minimum clearance for Barbour Lane overpass (Section 2)

DISCUSSION/JUSTIFICATION:

Because the existing Barbour Lane bridge over I-71 (MP 7.49) has a haunched-girder span, the vertical clearance in both the proposed lane adjacent to the median and inside shoulder lane will be less than the vertical clearance for the existing travel lanes. The minimum vertical clearance is required over any point over pavement including the travelled lanes and shoulders. The VE team advises that the minimum vertical clearance be verified for the proposed travel lanes and inside shoulders adjacent to the median. Potential mitigation strategies to satisfying minimum vertical clearance requirements would be to lower the I-71 grade or to jack the bridge. The existing bridge approaches on Barbour Lane are already steep and jacking the bridge higher would exacerbate this situation.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact
Right-of-way: No Impact
Environmental: No impact
Mobility: No impact
Safety: Safety impacted if vertical clearance is not satisfied
Maintainability: No impact

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 23
Idea No. SO-023
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace existing I-71 bridges with wagon box structures at crossroads
FUNCTION	**Span Opening**

BASELINE ASSUMPTION:

Widen existing twin bridges in the median and repair existing twin bridges.

PROPOSED ALTERNATIVE:

Utilize existing piers to convert twin bridges to single buried bridge. This VE proposal can apply to Edith Road, Mockingbird Valley, Indian Hills Trace, and Blankenbaker. However, this VE proposal, SO-023, has been prepared for Mockingbird Valley only.

BENEFITS	RISKS/CHALLENGES
● Eliminates existing old bridges and therefore future bridge maintenance	● Utilities if behind existing piers
● No icing on bridges during winter months	● MOT to fill on top of spill through slopes in median while maintaining traffic on existing bridges
●	● Flowable fill on top of box beams may be needed instead of earth fill
●	●
●	●
●	●
●	●

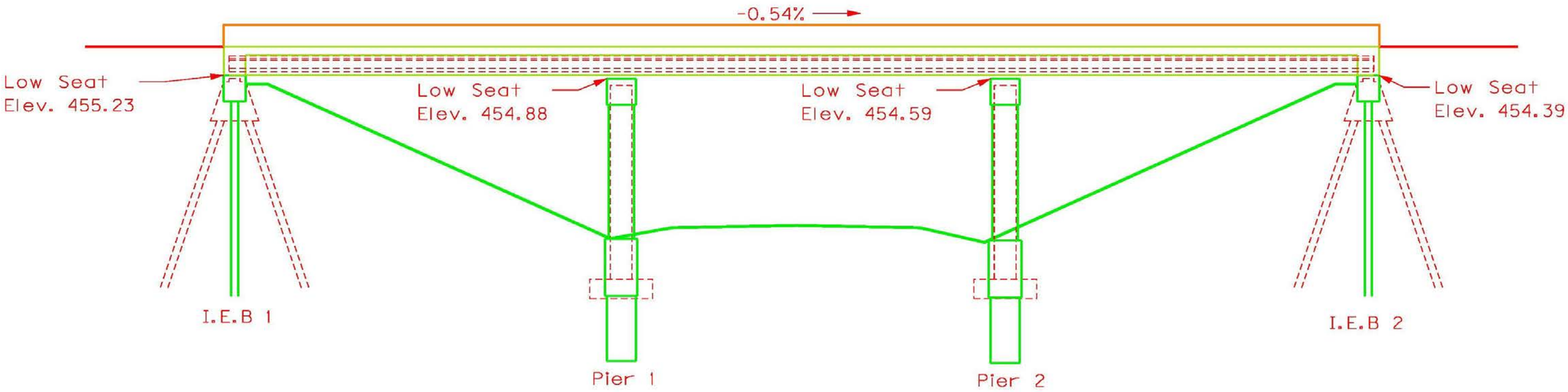
COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 1,364,000	$ -	$ 1,364,000
PROPOSED ALTERNATIVE:	$ 1,123,000	$ -	$ 1,123,000
TOTAL (Baseline less Proposed)	$ 241,000	$ -	$ 241,000

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 23
Idea No. SO-023
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace existing I-71 bridges with wagon box structures at crossroads

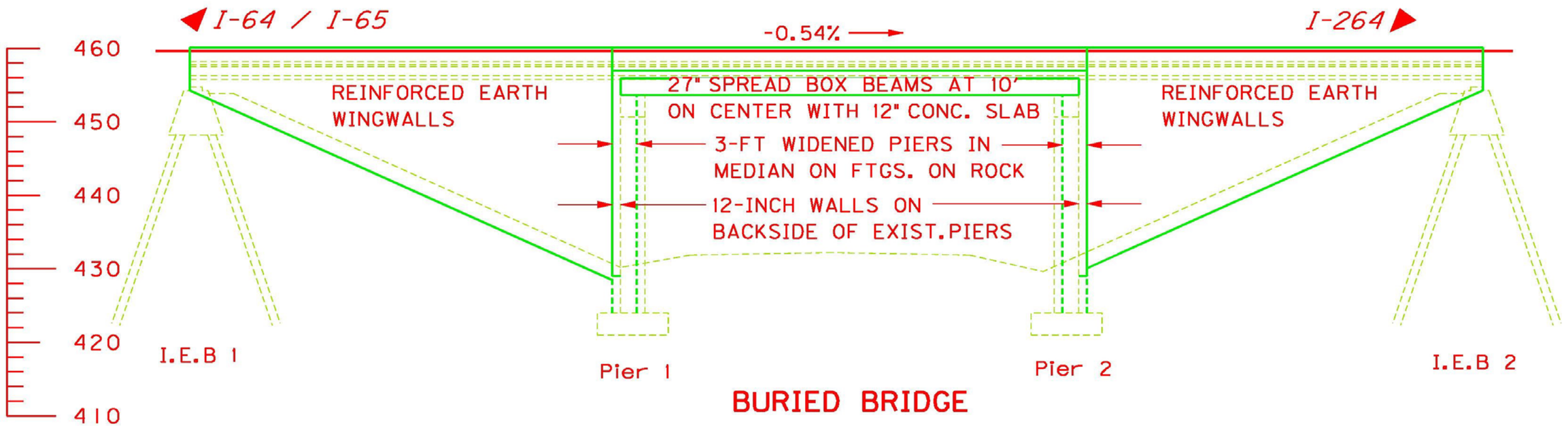
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL NO. 23
Idea No. SO-023
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace existing I-71 bridges with wagon box structures at crossroads

SKETCH OF PROPOSED ALTERNATIVE



BURIED BRIDGE

VALUE ENGINEERING PROPOSAL NO. 23
Idea No. SO-023
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace existing I-71 bridges with wagon box structures at crossroads

DISCUSSION/JUSTIFICATION:

The required and recommended repairs to the existing Mockingbird Valley twin bridge is $557,482. This bridge as well as Edith, Indian Hills Trace, and Blankenbaker are all over 50-years old and high maintenance cost will continue to be an issue. Replacing these bridges with new buried structures will eliminate these high future maintenance costs. For the Mockingbird Valley bridge when including these required and recommended maintenance costs, this buried bridge option reduces this initial cost by $241,000 on top of eliminating all of the potential future maintenance costs. This same solution should also be considered for the other three bridges carrying I-71 over.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: No impact
Right-of-way: No impact
Environmental: No impact
Mobility: No impact
Safety: Slight improvement related to no icing on bridges.
Maintainability: Large improvement

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 23
Idea No. SO-023
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Replace existing I-71 bridges with wagon box structures at crossroads

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Bridge widening NB	LS	1	$ 403,463.00	$ 403,463			
Bridge widening SB	LS	1	$ 403,463.00	$ 403,463			
Required repairs NB	LS	1	$ 73,588.00	$ 73,588			
Recommended repairs NB	LS	1	$ 75,490.00	$ 75,490			
Required repairs SB	LS	1	$ 328,034.00	$ 328,034			
Recommended repairs SB	LS	1	$ 80,370.00	$ 80,370			
27-inch spread box beams	LF				840	$ 250.00	$ 210,000
12-inch slab	CY				345	$ 500.00	$ 172,479
12-inch walls on backside of existing piers	CY				229	$ 700.00	$ 160,300
Pier widening and footings	CY				116	$ 500.00	$ 58,000
Reinforced earth walls for four wings	SF				3,600	$ 80.00	$ 288,000
Earth fill	CY				11,185	$ 10.00	$ 111,852
Pavement	SY				2,631	$ 46.50	$ 122,347
TOTAL				$ 1,364,000			$ 1,123,000
						CWE (BASELINE LESS PROPOSED)	$ 241,000

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

AVOID COST

VALUE ENGINEERING PROPOSAL NO. 24
Idea No. AS-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Construct innovative noise wall solutions to reduce height
FUNCTION	**Absorb Sound**

BASELINE ASSUMPTION:

Noise wall construction is planned for I-71 (I-64 to Zorn Avenue), I-71 (Zorn Avenue to I-265), and the I-71/I-264 Interchange.

PROPOSED ALTERNATIVE:

As an alternative, this VE proposal explores the construction of innovative noise wall solutions (to reduce height).

BENEFITS	RISKS/CHALLENGES
● Possibility of minimizing total SF of noise wall	● Would create an increase in Maintenance cost due to debris collection
● Slightly better general appearance depending on type used	●
●	●
●	●
●	●
●	●
●	●

DESIGN SUGGESTION

TITLE Construct innovative noise wall solutions to reduce height

SKETCH OF PROPOSED ALTERNATIVE

Innovative Noise Barrier Designs

Rating Scale
1 Substantially better than conventional barrier
2 Somewhat better than conventional barrier
3 Similar to conventional barrier
4 Somewhat worse than conventional barrier
5 Substantially worse than conventional barrier

	Acoustic Performance			Availability / Economic Considerations		Constructability Considerations		
Barrier Type	Added IL * (dBA)	Potential reduced height (Range)	Potential reduced height (Average)	Special or proprietary material?	Additional cost	Foundation requirements	Structural issues	Drainage issues
T-top barrier design	1 - 1.5	2 - 3	2.5	no	3	3	3	3
T-top design with absorptive material	2 - 3	4 - 6	5	no / yes	4	3	3	3
Y-top barrier design	0.5 - 1	1 - 2	1.5	no	4	3	3	4
Jagged-top barrier design	0 - 6	0 - 3	1.5	no	3	3	3	3
Cylindrical top treatment	2 - 3	3 - 4	3.5	yes	5	3	4	3
Mushroom-shaped top treatment	0.5 - 1	1 - 2	1.5	yes	4	3	4	3
Multiple-edge top treatments	1.9 - 4	3 - 5	4	no / yes	4	3	4	4
Active noise control top treatment	2 - 4	4 - 6	5	yes	5	3	3	3
Angled barrier design	0	0	0	no	4	5	5	4
Absorptive barrier material	1 - 3	2 - 5	3.5	yes	4	3	3	3
Transparent barrier material	0	0	0	no / yes	3	3	3	3
Woven metal barrier material	0	0	0	yes	5	4	3	3

IL = Insertion Loss

	Maintenance Consideration			Aesthetic Considerations					
Barrier Type	Added maintenance	Debris collection	Durability	General appearance	Elimination of shadows	Increased visibility / views	Average Score **	Average Score Weighted for Potential Reduced Height **	Rank **
T-top barrier design	3	4	3	2	2	2	**2.8**	3.5	5
T-top design with absorptive material	4	4	4	2	1	1	**2.9**	**2.6**	**1**
Y-top barrier design	4	5	3	3	2	2	3.3	5.4	8 (tie)
Jagged-top barrier design	3	3	3	4	3	3	3.1	5.1	7
Cylindrical top treatment	4	3	4	4	2	2	3.4	3.6	6
Mushroom-shaped top treatment	4	3	4	4	2	2	3.3	5.4	8 (tie)
Multiple-edge top treatments	4	5	3	3	2	2	3.4	3.4	4
Active noise control top treatment	5	4	5	3	1	1	3.3	**3.0**	**2**
Angled barrier design	3	4	3	2	2	2	3.4	9.7	11
Absorptive barrier material	4	3	4	3	2	2	3.1	**3.3**	**3**
Transparent barrier material	5	3	4	2	1	1	**2.8**	8.0	10
Woven metal barrier material	5	4	4	2	3	3	3.6	10.3	12

** Shading indicates top three

VALUE ENGINEERING PROPOSAL NO. 24
Idea No. AS-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Construct innovative noise wall solutions to reduce height

DISCUSSION/JUSTIFICATION:

Baseline Assumption

For I-71 Widening, I-64 to Zorn Avenue (Item No. 5-48.10): 4,100-feet of average 12-foot barrier wall is planned for I-71 South, and 1,750' of average 16-foot barrier wall is planned for the Waterfront Botanical Gardens.

For I-71 Widening, Zorn Avenue to I-265 (Item No. 5-557.00): Four noise barriers totaling 14,019 feet in length were found to be feasible and reasonable according to KYTC guidelines. A meeting of benefited receptors, to occur during the final design phase, will determine whether noise walls are desired by those benefitted.

For I-71/I-264 Interchange (Item No. 5-557.00): Based on the noise analysis results from the I-71 widening project identifying noise impacts above Noise Abatement Criteria, noise impacts would be anticipated in the interchange planning study area. As such, a traffic noise analysis will likely be necessary for the interchange project as part of the environmental documentation necessary during any future development phase of the interchange.

Proposed Alternative

Consider the use of an innovative noise barrier to reduce wall height required minimizing the total square Feet (SF) necessary for noise abatement if total cost can be reduced. The proposed sketch lists various barrier types and evaluates the following: acoustic performance, availability/economic considerations, constructability considerations, maintenance considerations and aesthetic considerations. The three highest ranking are (1) T-top design with absorptive material, (2) Active noise control top treatment, and (3) Absorptive barrier material.

Source: "Evaluation of Benefits and Opportunities for Innovative Noise Barrier Designs" (prepared for the Arizona Department of Transportation, November 2006). Link: **https://arc-solutions.org/wp-content/uploads/2012/03/Watson-2006-Evaluation-of-benefits-and-opportunities-of-noise-barrier-designs.pdf**

IMPACT TO PERFORMANCE:

Maintenance of Traffic: None
Right-of-way: None
Environmental: None
Mobility: None
Safety: None

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 25
Idea No. SL-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider use of larger (stone) asphalt base
FUNCTION	**Support Load**

BASELINE ASSUMPTION:

The pavement design provided for the project includes the use of asphalt base using 1.0 size stone and also includes a layer of dense grade aggregate (DGA).

PROPOSED ALTERNATIVE:

Consider using asphalt base with a stone size with of 1.5 in the lower lifts and consider replacing the DGA under the widening with a combination of additional cement stabilization, asphalt treated drainage blanket and 1.5 asphalt base for better rut resistance and subgrade drainage.

BENEFITS	RISKS/CHALLENGES
● Improved pavement rut resistance	● None apparent
● Improved subgrade drainage	●
● Reduced future maintenance	●
●	●
●	●
●	●
●	●

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 5,225,000	$ -	$ 5,225,000
PROPOSED ALTERNATIVE:	$ 5,255,000	$ -	$ 5,255,000
TOTAL (Baseline less Proposed)	$ (30,000)	$ -	$ (30,000)

ADD COST

VALUE ENGINEERING PROPOSAL NO. 25
Idea No. SL-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider use of larger (stone) asphalt base

SKETCH OF BASELINE ASSUMPTION / PROPOSED ALTERNATIVE

3	**DRAFT PLAN**				**PROPOSED**
4	**Roadbed Preparation:**				
5	00008	Cement Stabilized Roadbed (8")	sq yd		Cement Stabilized Roadbed (12")
6	02542	Cement (8")	ton		Cement (12")
7	00358	Asphalt Curing Seal (2.0	ton		SAME
8	02702	Sand for Blotter (5.0	ton		SAME
9	**Asphalt:**				
10		Full Depth Inside Travel Lanes			
11	00001	DGA	6.0 in depth		0
12	00018	Drainage Blanket Type II -Asphalt	10.0 in depth		4 in depth
13		CL4 Asphalt Base 1.5D PG64-22	0		4.5 in depth
14	00217	CL4 Asphalt Base 1.00D PG64-22	8.00 in depth		Same
15	00219	CL4 Asphalt Base 1.00D PG76-22	3.00 in depth		Same
16	00397	CL4 SMA Surface 0.38A PG76-22	1.50 in depth		Same

VALUE ENGINEERING PROPOSAL NO. 25
Idea No. SL-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider use of larger (stone) asphalt base

DISCUSSION/JUSTIFICATION:

Enhancing subgrade drainage and utilizing asphalt materials with greater rut resistance are both elements of improved long term performance of asphalt pavements, especially in situations with higher truck volumes. As with this project, there are areas of the project with very flat profile grades, which tend to have poor subgrade drainage over the life cycle of the pavement. The use of DGA, a material with a significant amount of fines within the structure, is anticipated to have long term stability issues under these conditions. The use of asphalt treated drainage blanket, supplemented by Cl 4 Asphalt Base 1.5D PG 64-22 in the lower lift in place of the layer of DGA is anticipated to provide better long term performance for only a marginal cost increase. It is difficult to provide a cost for the savings in regards to long term maintenance, since the project will need to be resurfaced every 8-10 years. The real maintenance savings will come in the minimization of full depth pavement repairs that might develop over time. As detailed in the cost estimate provided, a cost of $250 per SY for pavement failure repairs, not including traffic control, is a substantial future maintenance cost that is best minimized as much as is practical.

IMPACT TO PERFORMANCE:

Maintenance of Traffic:
Right-of-way:
Environmental:
Mobility:
Safety:
Maintainability:

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 25
Idea No. SL-006
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Consider use of larger (stone) asphalt base

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Cement stabilize roadbed (8-inch): for 12-inch add 20%	SY	167,361	$ 3.50	$ 585,764	167,361	$ 4.20	$ 702,916
Cement (8-inch): for 12-inch add 30%	TON	3,615	$ 166.97	$ 603,597	4,700	$ 166.97	$ 784,759
DGA	TON	57,739	$ 23.00	$ 1,327,997	44,425	$ 23.00	$ 1,021,775
ADTB (10-inch)	TON	50,140	$ 54.00	$ 2,707,560	28,916	$ 54.00	$ 1,561,464
CL 4 ASPH BASE 1.5D PG 64-22 (4.5-inch LIFT)	TON				9,550	$ 76.00	$ 725,800
ADTB (4-inch)	TON				8,490	$ 54.00	$ 458,460
TOTAL				$ 5,225,000			$ 5,255,000
						CWE (BASELINE LESS PROPOSED)	$ (30,000)

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

ADD COST

VALUE ENGINEERING PROPOSAL NO. 26
Idea No. SL-007
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Verify that noise analysis was considered for the use of quiet pavement
FUNCTION	**Support Load**

BASELINE ASSUMPTION:

The use of Quiet Pavement does not appear to have been taken into consideration for use on this project in an attempt to minimize or eliminate the necessity of sound wall.

PROPOSED ALTERNATIVE:

Consider the application of Quiet Pavements to minimize or eliminate the need for sound wall in the corridor.

BENEFITS	RISKS/CHALLENGES
● Possibly reduce cost for noise abatement	● Public may have objections if wall is not installed
● Trees and other vegetation could be left undisturbed at right-of-way line	● Future pavement rehabilitation will need to be Quiet Pavement for the life of roadway
●	● In corresponding with KYTC DEA, the VE team found that Quite Pavement is somewhat discouraged by FHWA
●	● High maintenance cost
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 26
Idea No. SL-007
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	Verify that noise analysis was considered for the use of quiet pavement

DISCUSSION/JUSTIFICATION:

Quiet Pavements, if recognized as a noise abatement measure by KYTC, could be utilized to reduce or possibly eliminate the necessity of the proposed sound wall. The trees and other vegetation along existing right-of-way could also be left in place as a visual barrier where sound wall is eliminated.

Please refer to MI-006 for further discussion of the FHWA program.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Increase at time resurfacing is needed
Right-of-way: None
Environmental: Eliminate tree removal at RW line
Mobility: None
Safety: None
Maintainability: Increase

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL NO. 27
Idea No. AS-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	KYTC joins the FHWA Quiet Pavement pilot program to take advantage of the SMA asphalt pavement that is to be placed
FUNCTION	**Absorb Sound**

BASELINE ASSUMPTION:

Quiet Pavements do not appear to have been considered to reduce the height and/or amount of sound wall needed on corridor for traffic noise abatement.

PROPOSED ALTERNATIVE:

Consider joining the FHWA Pilot Program for Quiet Pavements and reassess traffic noise in an attempt to reduce the amount of sound wall necessary for this project.

BENEFITS	RISKS/CHALLENGES
● Possibly reduces cost for noise abatement	● Public may have objections to eliminating sound wall
● Existing trees and vegetation could be left in place	● Future pavement rehabilitation will have to be Quiet Pavement for the life of the roadway
●	● In corresponding with KYTC DEA, the VE team found that quiet pavement is somewhat discouraged by FHWA
●	● High maintenance cost
●	●
●	●
●	●

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL NO. 27
Idea No. AS-003
Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00 (Jefferson County)

TITLE	KYTC joins the FHWA Quiet Pavement pilot program to take advantage of the SMA asphalt pavement that is to be placed

DISCUSSION/JUSTIFICATION:

Quiet Pavement could be a way to possibly minimize or eliminate sound walls. This in addition would eliminate removal of vegetation and trees from R\W line leaving what visual barrier is now in place.

Downfalls to elimination of the sound wall would include the likelihood of being opposed by property owners, high maintenance costs for replacement and the discouragement of FHWA.

IMPACT TO PERFORMANCE:

Maintenance of Traffic: Increase at time of resurfacing
Right-of-way: None
Environmental: None
Mobility: None
Safety: None
Maintainability: Increase

SPECIAL IMPLEMENTATION CONSIDERATIONS:

None apparent.

SECTION

6

APPENDICES

Section 6: Appendices

Appendix A – Study Participants

A copy of the workshop attendee list is included for reference.

VALUE ENGINEERING STUDY
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00
Jefferson County
Kentucky Transportation Cabinet
Workshop Location: Virtual
Workshop Dates: March 15-19, 2021
Workshop Attendee List

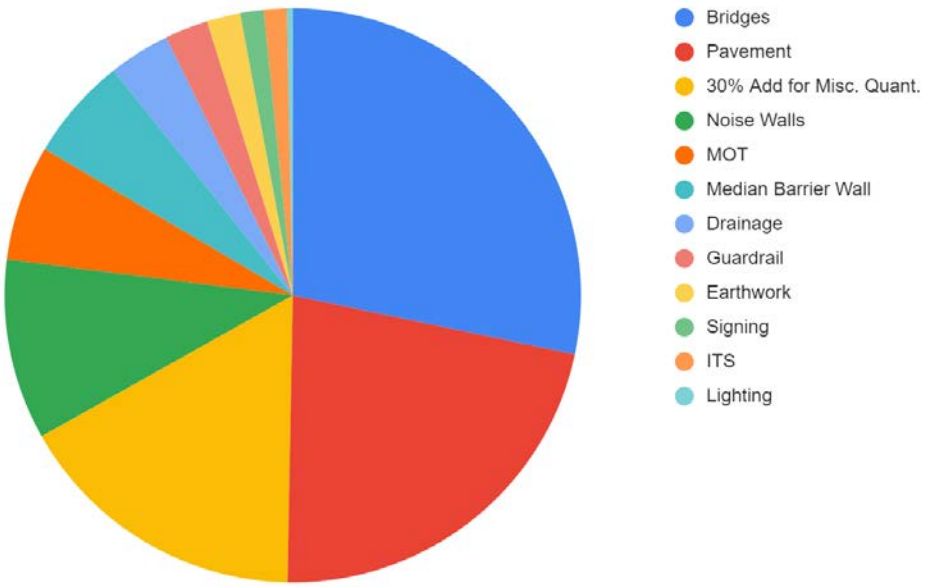
Mar 3	March 15-19, 2021										Name	Organization	Position
	15		16		17		18		19				
DR	am	pm	am	pm	am	pm	am	pm	am	pm			
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Miller, Patrice	RHA	Team Leader
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Miller, Colin	RHA	Technical Assistant
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Harrod, Justin	KYTC	Transportation Engineering Technologist III
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Sweger, Brent	KYTC	Quality Assurance Branch TEBM
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Littleton, Jason	AEI	Roadway, Geometrics
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Martin, Robert	QK4	Constructability, MOT
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	O'Dea, Danny	Stantec	Traffic Modeling
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Ott, Kenny	AEI	Structures
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	Spain, Mike	KYTC	Constructability
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	Bailey, Kevin	KYTC	
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Bullock, Matt	KYTC	Chief Engineer
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	Ford, Duffy	QK4	
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Fraizer, Rob	HDR Inc.	
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Garrison, Billy		TRUE
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Gossom, Ryan	KYTC	
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Kelly, Taylor	QK4	Project Manager 5-48
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Layson, Tim	KYTC	Director of Highway Design
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Lovell, Tracy	KYTC	Project Development (District 5)
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	Loyselle, Michael	FHWA	Transportation Engineer (District 5)
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Matheny, Patrick	KYTC	Project Manager (Distrct 5)
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Miles, Jon	QK4	
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Moore, John	KYTC	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Niyonshima, Jean Claude	KYTC	
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Perry, Patrick	KYTC	Location Engineer
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	Schaefer, Jeff	HDR Inc.	Environmental
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Slade, Steve	WSP	Preliminary Grading on site plan
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Vaughan, Eileen	FHWA	Program Coordinator for VE Quality Assurance
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	Warnick, Anne	WSP	Traffic Modeling
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	West, Johnathan	HDR Inc.	Project Manager 5-557
☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	Wright, Tom	KYTC	D05
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	502.472.4796		
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			

Appendix B – Pareto Cost Model

Cost model (below and following page) was prepared from the cost estimate data provided by Qk4 and HDR/WSP. The model is organized to identify major tasks and KYTC's estimated costs of total project cost for the significant cost items. The cost models clearly illustrated the cost drivers for the project and were used to guide the VE study team during the workshop.

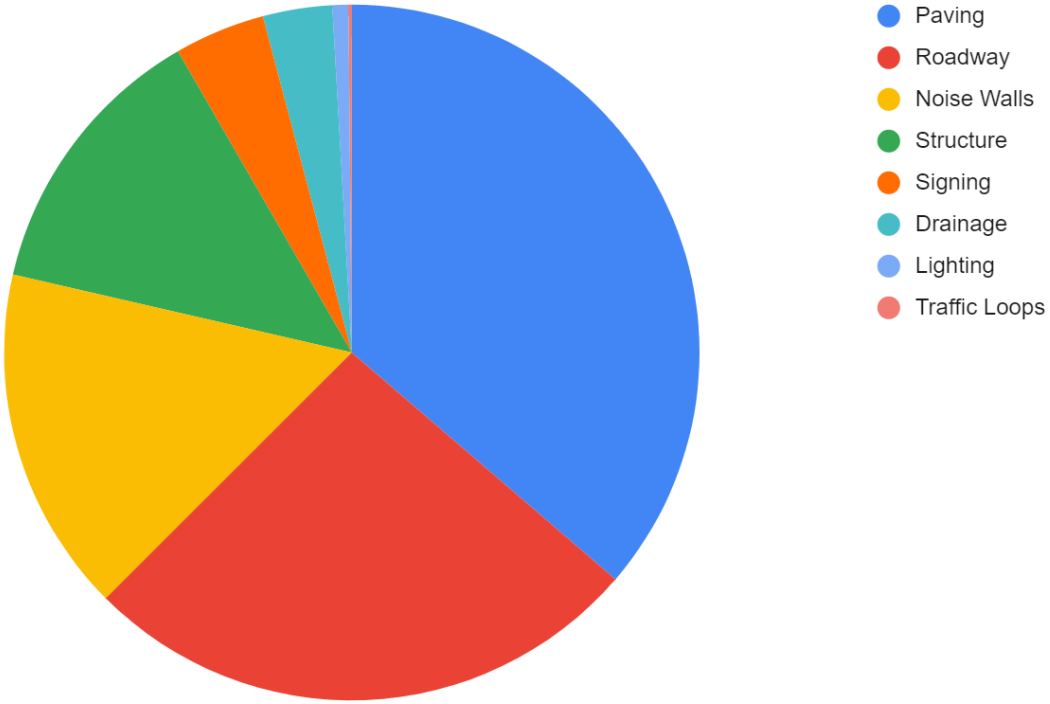
Item No. 5-48.10 (I-71 Widening, between Kennedy Interchange and Zorn Avenue Interchange)

Description	Estimated Cost	% Total	% Cumulative
Bridges	$6,460,945	28.30%	28.30%
Pavement	$5,019,597	21.99%	50.29%
30% Add for Misc. Quant.	$3,777,322	16.55%	66.83%
Noise Walls	$2,319,600	10.16%	77.00%
MOT	$1,486,170	6.51%	83.50%
Median Barrier Wall	$1,326,980	5.81%	89.32%
Drainage	$785,000	3.44%	92.76%
Guardrail	$554,424	2.43%	95.18%
Earthwork	$429,429	1.88%	97.07%
Signing	$300,000	1.31%	98.38%
ITS	$294,875	1.29%	99.67%
Lighting	$75,000	0.33%	100.00%
Retaining Walls	$0	0.00%	100.00%
Total	**$22,829,342**	**100.00%**	



Item No. 5-557.00 (I-71 Widening, between Zorn Avenue and I-265)

Description	Estimated Cost	% Total	% Cumulative
Paving	$17,674,000	36.31%	36.31%
Roadway	$12,750,000	26.19%	62.50%
Noise Walls	$7,835,000	16.10%	78.60%
Structure	$6,358,000	13.06%	91.66%
Signing	$2,052,000	4.22%	95.88%
Drainage	$1,570,000	3.23%	99.10%
Lighting	$361,000	0.74%	99.85%
Traffic Loops	$75,000	0.15%	100.00%
Total	**$48,675,000**	**100.00%**	



5-557.00 (I-71/I-264 Interchange)

This segment of the project is in the planning stages and, therefore, detailed costs were not available to the VE team.

Appendix C – Function Analysis

Function definition and analysis is the heart of Value Engineering. It is the primary activity that separates VE from all other "improvement" programs. The objective of this phase is to ensure the entire team agrees upon the purposes for the project elements. Furthermore, this phase assists with development of the most beneficial areas for continuing study.

The VE study team identified the functions of the **I-71 Widening to Six Lanes from Downtown to I-265 Project** using active verbs and measurable nouns. This process allowed the team to truly understand the functions associated with the project. A Random Function Identification Worksheet is provided below.

FUNCTION ANALYSIS WORKSHEET I-71 Widening to Six Lanes from Downtown to I-265 Item Nos. 5-48.10 and 5-557.00 Kentucky Transportation Cabinet							
	IDENTIFY FUNCTIONS		CLASSIFY FUNCTIONS	PRIORITIZE FUNCTION			
Item Name	**Active Verb**	**Measurable Noun**	**Higher Order Basic Secondary**	**COST**	**RISK**	**SELECT FOR CREATIVE PHASE**	**Remarks**
Project 05-48.10	Improve	Safety	Basic				$23M
	Improve	Operations	Basic				
Project 05-557.00 (I-71 Widening)	Improve	Safety	Basic				$49M
	Improve	Operations	Basic				
Project 05-557.00 (Interchange)	Improve	Safety	Basic				$16.6M (B1), $25.4M (A2.2), $25.2M (A3.2)
	Improve	Operations	Basic				
	Connect	Roadways	Secondary				
	Promote	Regional-reliability	Higher Order				
Pavement	Support	Load	Secondary	High	High	YES	High Cost - 5.48.10; 5-557.00 (I-71 Widening) - see Cost Model
	Transmit	Load	Secondary				
Earthwork	Level	Area	Secondary				

FUNCTION ANALYSIS WORKSHEET I-71 Widening to Six Lanes from Downtown to I-265 Item Nos. 5-48.10 and 5-557.00 Kentucky Transportation Cabinet							
	IDENTIFY FUNCTIONS		CLASSIFY FUNCTIONS	PRIORITIZE FUNCTION			
Item Name	**Active Verb**	**Measurable Noun**	**Higher Order Basic Secondary**	**COST**	**RISK**	**SELECT FOR CREATIVE PHASE**	**Remarks**
Drainage	Collect	Surface-water	Secondary				
	Direct	Surface-water	Secondary				
	Protect	Substructure	Secondary				
	Prevent	Erosion	Secondary				
Median Barrier Wall	Separate	Traffic	Secondary	High	High	YES	High Cost - 5-48.10 - see Cost Model
	Prevent	Crashes	Secondary				
Guardrail	Protect	Motorist	Secondary				
	Reduce	Collision-severity	Secondary				
	Prevent	Vehicle-veer	Secondary				
Retaining Walls	Manage	Soil	Secondary				
	Contain	Soil	Secondary				
	Separate	Grade	Secondary				
	Reduce	ROW	Secondary				
MOT	Maintain	Traffic	Secondary	High	Medium	YES	High Cost - 5.48.10; 5-557.00 (I-71 Widening) - see Cost Model; political risk associated with public acceptance
	Protect	Work-zone	Secondary				
	Create	Work-zone	Secondary				
	Maintain	Access	Secondary				
	Enable	Construction	Secondary				
Signing	Direct	Traffic	Secondary				
	Inform	User	Secondary				

FUNCTION ANALYSIS WORKSHEET I-71 Widening to Six Lanes from Downtown to I-265 Item Nos. 5-48.10 and 5-557.00 Kentucky Transportation Cabinet							
	IDENTIFY FUNCTIONS		CLASSIFY FUNCTIONS	PRIORITIZE FUNCTION			
Item Name	**Active Verb**	**Measurable Noun**	**Higher Order Basic Secondary**	**COST**	**RISK**	**SELECT FOR CREATIVE PHASE**	**Remarks**
Lighting	Illuminate	Area	Secondary				
ITS	Communicate	Information	Secondary				
	Guide	Traffic	Secondary				
	Control	Access	Secondary				
	Control	Traffic-flow	Secondary				
Noise Walls	Absorb	Sound	Secondary	High	High	YES	High Cost - 5-48.10; 5-557.00 (I-71 Widening) - see Cost Model; political risk if these are eliminated
	Create	Privacy	Secondary				
Bridges	Span	Opening	Secondary	High	High	YES	High Cost - 5-48.10; 5-557.00 (I-71 Widening) Structures - see Cost Model
	Span	Obstacle	Secondary				
	Support	Load	Secondary				

High cost and/or high risk functions were identified using cost data and the VE study team expertise. The VE study team identified **Improve Safety** and **Improve Operations** the basic functions of the project.

The definitions of the classifications are:

- **Higher Order Function** defines the specific goal or need for which the basic function exists and is outside the scope of the project under study.
- **Basic Function** defines the specific purpose(s) for which a project exists; it answers the question, “What must it do?”
- **Secondary Function** supports the basic function or required secondary function(s) and results for the specific design approach to achieve the basic function; answers the question, “What else do we want or does it do?”

Appendix D – Creative Idea List and Evaluation

Creative Idea List

The objective of the Creative 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 Creative Phase of the value methodology successful is for the team not to conceive ways to design a project, but to develop ways to perform the functions selected for study. Past experience is combined and recombined to form new combinations that will perform the desired functions, regardless of what is included in the original project concept, and improve the value of the project compared to what was originally considered attainable.

The list of ideas from the study is shown on successive pages. Some of the ideas were selected for further development as represented in the previous alternatives.

Idea No.	Idea Title
SL	**Support Load**
SL-001	Provide full inside shoulder (10') in lieu of 6'
SL-002	Provide full inside shoulder (10') in lieu of full outside shoulder; may require DE
SL-003	Use decreased lane widths to allow more room for the shoulder; 11' in lieu of 12' (9' inside shoulder); 5-48.10
SL-004	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12'; 5-48.10
SL-005	Eliminate dense graded aggregate (DGA)
SL-006	Consider use of larger (stone) asphalt base
SL-007	Verify that noise analysis was considered for the use of quiet pavement
SL-008	Build roundabout at each ramp terminal
SL-009	Use non-skid asphalt pavement to reduce superelevation required
SL-010	Use profile mill/structural overlay of existing rather than mill and fill 1.5" (NOTE: continuity of grade may not warrant this)
SL-011	Eliminate the “00219 CL4 Asphalt Base 1.00D PG76-22” layer (3”) in the pavement design for 557.00 (Zorn to I-265)
SL-012	Evaluate various pavement sections versus costs versus life expectancy and then ratio them to compare
SL-013	Rock roadbed for portion of 5-557 rather than cement stabilize, based on amount

Idea No.	Idea Title
	of rock available in interchange area
SL-014	Use concrete pavement in lieu of asphalt
SL-015	Realign I-71 NB ramp with larger radius (B-1)
SL-016	Add fibers in the asphalt to reduce layer thickness without decreasing structural number
SL-017	Specify that heavy traffic use right two lanes; lighten up the new lane in the median
SL-018	Don't change the pavement thickness; add fibers in the two heavy traffic lanes
SL-019	Utilize conventional pavement mixtures on 5-557 portion in lieu of SMA as KYTC is not a participant in the FHWA quiet pavement pilot program
ST	**Separate Traffic**
ST-001	Use depressed median and widen to the outside
ST-002	Use cable barrier and a depressed median in lieu of barrier wall - Section 2 of 5-557.00
ST-003	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall
ST-004	Add edge-lined rumble strips
ST-005	Add raised pavement markers
ST-006	Provide high profile pavement striping and/or markings
ST-007	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of 56" tall barrier wall (Caltrans)
ST-008	Install ramp meter on SB Zorn Avenue entrance ramp
ST-009	Use barrier less than the TL-4; trucks are not allowed in the new lane (mash-tested for car not a truck; TL-3)
ST-010	Make inside lane HOV only
ST-011	Make HOV lane separated by barrier wall with lesser wall between HOV lanes
ST-012	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal
ST-013	Use dual-faced guardrail in lieu of concrete barrier to separate traffic
ST-014	Single slope barrier on outside shoulders with concrete ditch on outside so 8.75' to 18-ft on each side can be picked up in median; i.e., 17.5' to 36' so depressed median with cable barrier can be maintained
MT	**Maintain Traffic**
MT-001	Use ABC construction methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline
MT-002	Consider building I-264 interchange ramps as part of US 42 project

Idea No.	Idea Title
MT-003	Build I-264 EB to I-71 SB offline to the west of the existing ramp
MT-004	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid
MT-005	Build I-71 SB to I-264 WB offline to the east of existing ramp
MT-006	Build I-71 SB to I-264 WB offline also to the north
MT-007	"Get It Done 71!" Shut down I-71 between Zorn Avenue and I-265 to allow contractor to construct widening and interchange without traffic
MT-008	"Get It Done 71!" Shut down I-71 between Zorn Avenue and I-264 to allow contractor to construct widening without traffic
MT-009	"Get It Done 71!" Shut down I-71 between I-264 to I-265 to allow contractor to construct widening without traffic
MT-010	"Get It Done 71!" Shut down I-71 SB to I-264 WB ramp to allow contractor to construct widening and bridges without traffic
MT-011	Explore a partial directional shutdown (to be determined) - "slinky" (AM/NB and PM/SB)
MT-012	Use directional lane with NB in the morning and SB in the evening
MT-013	Build all of I-71 (5-48.10 and 5-557) in same contract. Close I-71 to traffic and divert traffic around I-265 to I-64 (reduce the length of pain to I-71 commuters and commercial traffic)
MT-014	Allow single lane on I-71 NB in the morning and I-71 SB in evening
MT-015	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out only at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point
MT-016	"Get It Done 71!" Close I-71 NB from Zorn Avenue to I-264, build it all
MT-017	At I-71 NB off-ramp Mellwood & Zorn, move the end of the ramp for SB Zorn closer to intersection to create more space between Mellwood intersection; remove slip ramp
MT-018	If decision was made to keep I-71N "as-is" through the rock cut, consider some additional rock cuts to minimize existing "tunnel effect"
MT-019	Schedule any major lane closers to occur between Memorial Day and Labor Day and encourage work to continue during nights, weekends, and holidays
MT-020	"Get It Done 71!"
SO	**Span Opening**
SO-001	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork
SO-002	Eliminate the 145' bridge over CSXT as the spur was removed over 20 years ago
SO-003	Install a wagon box over Edith and eliminate the existing twin bridge

Idea No.	Idea Title
SO-004	Install a wagon box over Mockingbird Valley and eliminate the existing twin bridge
SO-005	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB
SO-006	Span both Greenway and Beargrass Creek with one structure; phase around existing piers
SO-007	Build the new alignment off-line and flatten the curves
SO-008	Build new 2 lane interchange ramps offline so traffic is maintained on existing ramps during construction
SO-009	Construct tunnels/bridges under existing 2 ramps for new 71N 2-lane ramp; similar to the I-64/I-265 interchange
SO-010	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening
SO-011	Use reduced shoulder on/under bridge from I-264 EB to I-71 SB to utilize existing bridge width without widening
SO-012	Relocate the Nagle sign (outside of right-of-way) to eliminate the need for access road
SO-013	Consider wagon box bridge over Blankenbaker Lane
SO-014	Consider wagon box for bridge over Indian Hills Trail
SO-015	Barbour Lane overpass in section 2 of 5-557 has haunched girders. is there a clearance issue with a widened I-71
SO-016	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard
SO-017	Use reduced shoulder on bridges over Blankenbaker Lane and Indian Hills Trail
SO-018	Verify minimum clearance for Barbour Lane overpass (Section 2)
SO-019	If Barbour Lane overpass does not have minimum clearance, then narrow shoulders
SO-020	If Barbour Lane overpass does not have minimum clearance, then lower the grade of I-71
SO-021	If Barbour Lane overpass does not have minimum clearance, then jack the bridge
SO-022	If Barbour Lane overpass does not have minimum clearance, then replace the bridge
SO-023	Replace existing I-71 bridges with wagon box structures at crossroads
AS	**Absorb Sound**
AS-001	Consider constructing noise wall on median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall

Idea No.	Idea Title
AS-002	Use rubberized asphalt concrete (RAC) in lieu of traditional paving material
AS-003	KYTC joins the FHWA quiet pavement pilot program and can take advantage of the SMA asphalt pavement that is to be placed
AS-004	Noise wall on top of median barrier will block half of the traffic noise each side of I-71 and the wall should not need to be very tall to do that
AS-005	A good education program during public meetings/hearings is critical to manage expectations regarding the efficacy of noise walls
AS-006	Construct innovative noise wall solutions to reduce height
AS-007	Do not construct noise walls on bridges
AS-008	Add earth mounds to reduce the height of the walls
AS-009	Construct noise wall at reduced height; requires noise analysis
AS-010	Plant evergreens that are staggered to provide double the sound protection in lieu of sound walls
AS-011	Construct barrier walls in lieu of guard rail; barriers at the shoulders designed to support sound walls as closer to the road should reduce the required height especially when I-71 is in fill areas
AS-012	Build sounds walls with aesthetic consideration
AS-013	Consider using noise "fence" on top of barrier wall combo (like the type used at I-264E to I-64E interchange ramp)
AS-014	Curved noise walls to reduce height
AS-015	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier
AS-016	Place light fixtures on noise walls instead of in the median
AS-017	Construct the sound wall on the bridge median barrier for I-71 over US 42 instead of on the south barrier
AS-018	Provide lighting on outside shoulder to reduce glare in homes
AS-019	Use bamboo for noise suppression in lieu of wall
CR	**Connect Roadways**
CR-001	Add sidewalk through Zorn Avenue interchange area (ramp-to-ramp)
CR-002	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp terminals in lieu of signals
MI	**Miscellaneous**
MI-001	Phase the project - scheme A: Widen the existing I-71 NB through movement in its current location
MI-002	Phase the project - scheme B: Redo the interchange with a new I-71 NB through movement (baseline)

Idea No.	Idea Title
MI-003	Phase the project - scheme C: Address I-264 EB to I-71 NB ramp widening only
MI-004	Sequencing of project corridor construction
MI-005	Push any of the interchange work (like slip ramps) to the 804.00 project (US-42) to cut down cost on some of the alternates, which would make them more desirable than just B-1
MI-006	Phase the project in order to minimize impacts to the traveling public during construction

Evaluation Process

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

Evaluation Score	Definition	Key
Out-of-Scope	Not a part of this project	OS
Already Being Considered or Already Being Done	Included in the baseline project	ABC or ABD
Design Comment	Stand-alone comment that needs no further explanation; a list of these will be given to the design team	DC
Design Suggestion	More than a DC, requires further explanation	DS
Fatal Flaw	Violates a code or standard	FF

This first step evaluation scored the ideas as appropriate to eliminate them from further evaluation.

The second step scored the remaining ideas using the Value Relationship Key along with the idea's alignment with previously identified project goals, functions and performance criteria. The prioritization for further development and documentation is as follows:

Score =

- 5 – Great Value meeting the criteria (A Workbook is prepared)
- 4 – Good Value meeting the criteria (A Workbook is prepared)

- 3 – Moderate Value meeting the criteria (No Workbook will be prepared)
- 2 – Poor Value (No Workbook will be prepared)

Rating

Value Relationship	Value = Function / Cost					
5. Great Opportunity	F C--	F+ C--	F++ C	F++ C-	F++ C--	F++ C+
4. Good Opportunity	F- C--	F C-	F+ C	F+ C-	F+ C+	F++(*) C++
3. Moderate Value	F-- C--	F- C-	F++(*) C++			
2. Poor Value	F-- C	F- C--	F C+	F C++	F++(*) C++	
1. Unacceptable Impacts / Fatal Flaw (Covered under Step 1)						

**Is the Function improved to the point that it overcomes the high cost?*

VALUE CUE KEY – MAGNITUDE OF CHANGE

F = No impact to function F- = Small negative impact to function F-- = Large negative impact to function F+ = Small increase in function F++ = Large increase in function	C = No impact to cost C- = Small decrease in cost C-- = Large decrease in cost C+ = Small increase in cost C++ = Large increase in cost

The following table lists the scored creative ideas with those ideas scoring a “5,” “4,” or “DS” moving forward into the next phase, Development.

Idea No.	Idea Title	Score
SL	**Support Load**	
SL-001	Provide full inside shoulder (10') in lieu of 6'	2
SL-002	Provide full inside shoulder (10') in lieu of full outside shoulder; may require DE	2
SL-003	Use decreased lane widths to allow more room for the shoulder; 11' in lieu of 12' (9' inside shoulder); 5-48.10	2

Idea No.	Idea Title	Score
SL-004	Use decreased lane widths to allow more room for the shoulder; 11.5' in lieu of 12'; 5-48.10	4
SL-005	Eliminate dense graded aggregate (DGA)	w/SL-006
SL-006	Consider use of larger (stone) asphalt base	4
SL-007	Verify that noise analysis was considered for the use of quiet pavement	DS
SL-008	Build roundabout at each ramp terminal	w/CR-002
SL-009	Use non-skid asphalt pavement to reduce superelevation required	ABD
SL-010	Use profile mill/structural overlay of existing rather than mill and fill 1.5" (NOTE: continuity of grade may not warrant this)	3
SL-011	Eliminate the “00219 CL4 Asphalt Base 1.00D PG76-22” layer (3”) in the pavement design for 557.00 (Zorn to I-265)	3
SL-012	Evaluate various pavement sections versus costs versus life expectancy and then ratio them to compare	DC
SL-013	Rock roadbed for portion of 5-557 rather than cement stabilize, based on amount of rock available in interchange area	DC
SL-014	Use concrete pavement in lieu of asphalt	2
SL-015	Realign I-71 NB ramp with larger radius (B-1)	ABC
SL-016	Add fibers in the asphalt to reduce layer thickness without decreasing structural number	DC
SL-017	Specify that heavy traffic use right two lanes; lighten up the new lane in the median	2
SL-018	Don't change the pavement thickness; add fibers in the two heavy traffic lanes	w/SL-016
SL-019	Utilize conventional pavement mixtures on 5-557 portion in lieu of SMA as KYTC is not a participant in the FHWA quiet pavement pilot program	2
ST	**Separate Traffic**	
ST-001	Use depressed median and widen to the outside	2
ST-002	Use cable barrier and a depressed median in lieu of barrier wall - Section 2 of 5-557.00	4
ST-003	Use guard rail on the inside with a narrower depressed median in lieu of barrier wall	4
ST-004	Add edge-lined rumble strips	DC
ST-005	Add raised pavement markers	DC
ST-006	Provide high profile pavement striping and/or markings	DC
ST-007	Use TDOT barrier (51" tall) that is being used on I-MOVE in lieu of	4

Idea No.	Idea Title	Score
	56" tall barrier wall (Caltrans)	
ST-008	Install ramp meter on SB Zorn Avenue entrance ramp	2
ST-009	Use barrier less than the TL-4; trucks are not allowed in the new lane (mash-tested for car not a truck; TL-3)	3
ST-010	Make inside lane HOV only	2
ST-011	Make HOV lane separated by barrier wall with lesser wall between HOV lanes NOTE: This idea originally scored a "4"; however, during the Development Phase it was dropped because it cannot be constructed. The existing bridge is only 32' wide and we need to place 36' of lanes across it.	2
ST-012	Include the slip ramp for the I-71 NB off-ramp at Zorn Avenue into the existing signal	4
ST-013	Use dual-faced guardrail in lieu of concrete barrier to separate traffic	3
ST-014	Single slope barrier on outside shoulders with concrete ditch on outside so 8.75' to 18-ft on each side can be picked up in median; i.e., 17.5' to 36' so depressed median with cable barrier can be maintained	2
MT	**Maintain Traffic**	
MT-001	Use ABC construction methods and close I-264 east ramp to SB I-71 to finish bridge on new I-71 NB mainline	5
MT-002	Consider building I-264 interchange ramps as part of US 42 project	DC
MT-003	Build I-264 EB to I-71 SB offline to the west of the existing ramp	4
MT-004	Realign the EB I-264 movement constructing the EB to SB off-alignment; provides additional room to build future braid	4
MT-005	Build I-71 SB to I-264 WB offline to the east of existing ramp	4
MT-006	Build I-71 SB to I-264 WB offline also to the north	w/MT-005
MT-007	"Get It Done 71!" Shut down I-71 between Zorn Avenue and I-265 to allow contractor to construct widening and interchange without traffic	w/MT-020
MT-008	"Get It Done 71!" Shut down I-71 between Zorn Avenue and I-264 to allow contractor to construct widening without traffic	w/MT-020
MT-009	"Get It Done 71!" Shut down I-71 between I-264 to I-265 to allow contractor to construct widening without traffic	w/MT-020
MT-010	"Get It Done 71!" Shut down I-71 SB to I-264 WB ramp to allow contractor to construct widening and bridges without traffic	w/MT-020

Idea No.	Idea Title	Score
MT-011	Explore a partial directional shutdown (to be determined) - "slinky" (AM/NB and PM/SB)	w/MT-012
MT-012	Use directional lane with NB in the morning and SB in the evening	DS
MT-013	Build all of I-71 (5-48.10 and 5-557) in same contract. Close I-71 to traffic and divert traffic around I-265 to I-64 (reduce the length of pain to I-71 commuters and commercial traffic)	w/MT-020
MT-014	Allow single lane on I-71 NB in the morning and I-71 SB in evening	w/MT-012
MT-015	At the intersection of Zorn Avenue and Mellwood Avenue, propose right in/right out only at NB Mellwood Avenue and force a downstream turnaround (U-turn) access point	4
MT-016	"Get It Done 71!" Close I-71 NB from Zorn Avenue to I-264, build it all	w/MT-020
MT-017	At I-71 NB off-ramp Mellwood & Zorn, move the end of the ramp for SB Zorn closer to intersection to create more space between Mellwood intersection; remove slip ramp	w/ST-012
MT-018	If decision was made to keep I-71N "as-is" through the rock cut, consider some additional rock cuts to minimize existing "tunnel effect"	2
MT-019	Schedule any major lane closers to occur between Memorial Day and Labor Day and encourage work to continue during nights, weekends, and holidays	DC
MT-020	"Get It Done 71!"	DS
SO	**Span Opening**	
SO-001	Replace the 247' bridge over Beargrass Creek with a buried box large enough to handle the outflow from the upstream pump station and Muddy Fork	4
SO-002	Eliminate the 145' bridge over CSXT as the spur was removed over 20 years ago	ABC
SO-003	Install a wagon box over Edith and eliminate the existing twin bridge	w/SO-023
SO-004	Install a wagon box over Mockingbird Valley and eliminate the existing twin bridge	w/SO-023
SO-005	Remove the billboard (outside of right-of-way) to eliminate the need for access road; MP 0.328 on I-71 SB	4
SO-006	Span both Greenway and Beargrass Creek with one structure; phase around existing piers	w/SO-001
SO-007	Build the new alignment off-line and flatten the curves	w/MT-005, MT-006

Idea No.	Idea Title	Score
SO-008	Build new 2 lane interchange ramps offline so traffic is maintained on existing ramps during construction	w/MT-003
SO-009	Construct tunnels/bridges under existing 2 ramps for new 71N 2-lane ramp; similar to the I-64/I-265 interchange	DC
SO-010	Use reduced shoulder on/under bridge from I-71 SB to I-264 WB to utilize existing bridge width without widening	4
SO-011	Use reduced shoulder on/under bridge from I-264 EB to I-71 SB to utilize existing bridge width without widening	2
SO-012	Relocate the Nagle sign (outside of right-of-way) to eliminate the need for access road	w/SO-005
SO-013	Consider wagon box bridge over Blankenbaker Lane	w/SO-023
SO-014	Consider wagon box for bridge over Indian Hills Trail	w/SO-023
SO-015	Barbour Lane overpass in section 2 of 5-557 has haunched girders. is there a clearance issue with a widened I-71	2
SO-016	Beargrass Creek Buried Bridge alternate 2 is using existing piers along with pier widening to support side-by-side box beams that are filled over; these boxes can cantilever past the piers to provide the roof structure for the greenway and access road to the billboard	4
SO-017	Use reduced shoulder on bridges over Blankenbaker Lane and Indian Hills Trail	2
SO-018	Verify minimum clearance for Barbour Lane overpass (Section 2)	DS
SO-019	If Barbour Lane overpass does not have minimum clearance, then narrow shoulders	w/SO-018
SO-020	If Barbour Lane overpass does not have minimum clearance, then lower the grade of I-71	w/SO-018
SO-021	If Barbour Lane overpass does not have minimum clearance, then jack the bridge	w/SO-018
SO-022	If Barbour Lane overpass does not have minimum clearance, then replace the bridge	w/SO-018
SO-023	Replace existing I-71 bridges with wagon box structures at crossroads	4
AS	**Absorb Sound**	
AS-001	Consider constructing noise wall on median barrier at US 42 bridge to reduce height of noise wall needed on right barrier wall	DS
AS-002	Use rubberized asphalt concrete (RAC) in lieu of traditional paving material	2
AS-003	KYTC joins the FHWA quiet pavement pilot program and can take advantage of the SMA asphalt pavement that is to be placed	DS

Idea No.	Idea Title	Score
AS-004	Noise wall on top of median barrier will block half of the traffic noise each side of I-71 and the wall should not need to be very tall to do that	w/AS-001
AS-005	A good education program during public meetings/hearings is critical to manage expectations regarding the efficacy of noise walls	DC
AS-006	Construct innovative noise wall solutions to reduce height	DS
AS-007	Do not construct noise walls on bridges	3
AS-008	Add earth mounds to reduce the height of the walls	2
AS-009	Construct noise wall at reduced height; requires noise analysis	3
AS-010	Plant evergreens that are staggered to provide double the sound protection in lieu of sound walls	2
AS-011	Construct barrier walls in lieu of guard rail; barriers at the shoulders designed to support sound walls as closer to the road should reduce the required height especially when I-71 is in fill areas	w/ST-014
AS-012	Build sounds walls with aesthetic consideration	DC
AS-013	Consider using noise "fence" on top of barrier wall combo (like the type used at I-264E to I-64E interchange ramp)	w/AS-006
AS-014	Curved noise walls to reduce height	w/AS-006
AS-015	Narrow bridge typicals (reduced shoulders) to minimize width across which noise travels to reduce wall height on barrier	4
AS-016	Place light fixtures on noise walls instead of in the median	DC
AS-017	Construct the sound wall on the bridge median barrier for I-71 over US 42 instead of on the south barrier	w/AS-001
AS-018	Provide lighting on outside shoulder to reduce glare in homes	DC
AS-019	Use bamboo for noise suppression in lieu of wall	2
CR	**Connect Roadways**	
CR-001	Add sidewalk through Zorn Avenue interchange area (ramp-to-ramp)	DC
CR-002	Construct single-lane roundabouts with right-turn bypass lanes on/off each ramp on Zorn Avenue at the ramp terminals in lieu of signals	4
MI	**Miscellaneous**	
MI-001	Phase the project - scheme A: Widen the existing I-71 NB through movement in its current location	w/MI-006
MI-002	Phase the project - scheme B: Redo the interchange with a new I-71 NB through movement (baseline)	w/MI-006
MI-003	Phase the project - scheme C: Address I-264 EB to I-71 NB ramp	w/MI-006

Idea No.	Idea Title	Score
	widening only	
MI-004	Sequencing of project corridor construction	DS
MI-005	Push any of the interchange work (like slip ramps) to the 804.00 project (US-42) to cut down cost on some of the alternates, which would make them more desirable than just B-1	w/MT-002
MI-006	Phase the project in order to minimize impacts to the traveling public during construction	DS

Appendix E – Supporting Data

Risk Identification

Risk is a measure of future uncertainties in achieving program and/or project performance goals and objectives within defined cost, schedule and performance constraints. Risk can be associated with all aspects of a program/project (e.g., threat, technology maturity, supplier capability, design maturation, performance against plan) as these aspects relate across the project's cost and schedule. Risk addresses the potential variation in the planned approach and its expected outcome. Risks may also represent opportunities within a project that could be exploited to the benefit of the project.

The following risks were identified by the VE team as part of their preparation (Key Issues Memos); these were reviewed during the Information Phase and additional risks were added. Please note that these identified risks assisted the VE team in prioritizing functions for selection to brainstorm alternatives, and were an opportunity to identify mitigation measures during the Creative Phase.

- Possible delay in schedule to design Mellwood Avenue at Zorn Avenue versus how it is currently designed; may need to go back to the public or local officials because of the change.
- Read language that any changes to the Interchange Study is directly linked to the 05-557.00 and 05-804.00 Projects, "any improvement concepts developed for the interchange must link to proposed configurations of the widening project. Concepts developed for this study must also tie into the adjacent project under development to improve the US42 at I-264 interchange and widen I-264 between I-71 and the Westport Rd. interchange (Item #: 5-804.00)."
- Rock Blasting while maintaining traffic during construction of the I-71/I-264 system interchange.
- MOT impacts at interchange; MOT during reconstruction of the system interchange.
- Minimize additional right-of-way in the area as it will be costly.
- Utility impacts at Zorn Avenue will be costly to both time and budget.
- Positive risk is you have a lot of room to work within the I-71/I-264 interchange.

Agenda

A copy of the workshop agenda is included for reference.

Value Engineering (VE) Workshop Agenda

Project Name: Kentucky Transportation Cabinet
I-71 Widening to Six Lanes from Downtown to I-265
Item Nos. 5-48.10 and 5-557.00
Jefferson County

Dates: VE Workshop
March 15-19, 2021 (see detailed times below)

Study Location: Virtual

Day 1: Monday, March 15, 2021, 9:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 1: **(CLICK HERE)**

Or call in (audio only) +1 323-484-8978 - Phone Conference ID: 133 851 665#

Time EST	VE Activity	Participants	Comments
9:00	Welcome & Introductions Brief Overview of Value Engineering Process & VE Agenda Review (CVS Facilitator)	All	
	INFORMATION PHASE		
9:20	Project Overview, Presentation & Virtual Site Tour (KYTC Project Manager, Consultant Design Lead/s)	All	
10:30	Short Break		
10:45	Identify/Review: ▪ Project Goals ▪ VE Study Objectives (Focus of VE Study) ▪ VE Study Constraints ▪ Identify, Define & Rank Performance Attributes	All	
12:00	Conclusion of In-brief meeting / Long Break		
1:00	Discuss Team Observations, Project Risks Review Cost Model, Schedule, Other	VE Team	
	FUNCTION ANALYSIS PHASE		
2:00	Function Identification of Project Elements ▪ Identify/Classify Project Functions ▪ Apply Risks/Resources to Functions ▪ Select Specific Functions for Study	VE Team	
3:00	Short Break		
	CREATIVE PHASE		
3:15	Brainstorm Ideas / Alternatives		
5:00	Adjourn		

Day 2: Tuesday, March 16, 2021, 9:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 2: **(CLICK HERE)**

Or call in (audio only) +1 323-484-8978 - Phone Conference ID: 673 525 266#

Time EST	VE Activity	Participants	Comments
9:00	Check-in	VE Team	
CREATIVE PHASE - continued			
9:05	Brainstorm Ideas / Alternatives	VE Team	
10:30	Short Break		
10:45	Brainstorm Ideas / Alternatives	VE Team	
12:00	Long Break		
EVALUATION PHASE			
1:00	Evaluation of Ideas – Team Assignments for Development	VE Team	
3:00	Short Break		
DEVELOPMENT PHASE			
3:15	Review Workbook Template & Process Flow Develop / Cost Alternatives	VE Team	
5:00	Adjourn		

Day 3: Wednesday, March 17, 2021, 9:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 3: **(CLICK HERE)**

Or call in (audio only) +1 323-484-8978 - Phone Conference ID: 783 818 153#

Time EST	VE Study Activity	Participants	Comments
9:00	Check-in	VE Team	
DEVELOPMENT PHASE - continued			
9:05	Develop / Cost Alternatives	VE Team	
10:45	Develop / Cost Alternatives	VE Team	
11:30	Check-in	VE Team	
12:00	Long Break		
1:00	Develop / Cost Alternatives	VE Team	
4:30	Check-in	VE Team	
5:00	Adjourn		

Day 4: Thursday, March 18, 2021, 9:00 AM – 5:00 PM EST

MS Teams Invitation Link – Day 4: **(CLICK HERE)**

Or call in (audio only) +1 323-484-8978 - Phone Conference ID: 944 553 418#

Time EST	VE Study Activity	Participants	Comments
9:00	Check-in	VE Team	
DEVELOPMENT PHASE - continued			
9:10	Develop / Cost Alternatives - Complete	VE Team	
11:30	Check-in		
12:00	Long Break		
1:00	Alternatives to Present Peer Review Workbooks Prepare Presentation	VE Team	
4:00	Run-through Presentation	VE Team	
5:00	Adjourn		

Day 5: Friday, March 19, 2021, 8:00 AM – Noon EST

MS Teams Invitation Link – Day 5: **(CLICK HERE)**

Or call in (audio only) +1 323-484-8978 - Phone Conference ID: 869 660 649#

Time EST	VE Study Activity	Participants	Comments
8:00	Check-in	VE Team	
DEVELOPMENT PHASE - continued			
8:05	Peer Review Workbooks – Complete Practice Presentation	VE Team	
9:30	Short Break		
9:45	Ready to present	VE Team	
PRESENTATION PHASE			
10:00	Presentation of Key Finding/VE Alternatives to Stakeholders/Decision-makers	All	
11:30	Workshop Close-out	VE Team	
12:00	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