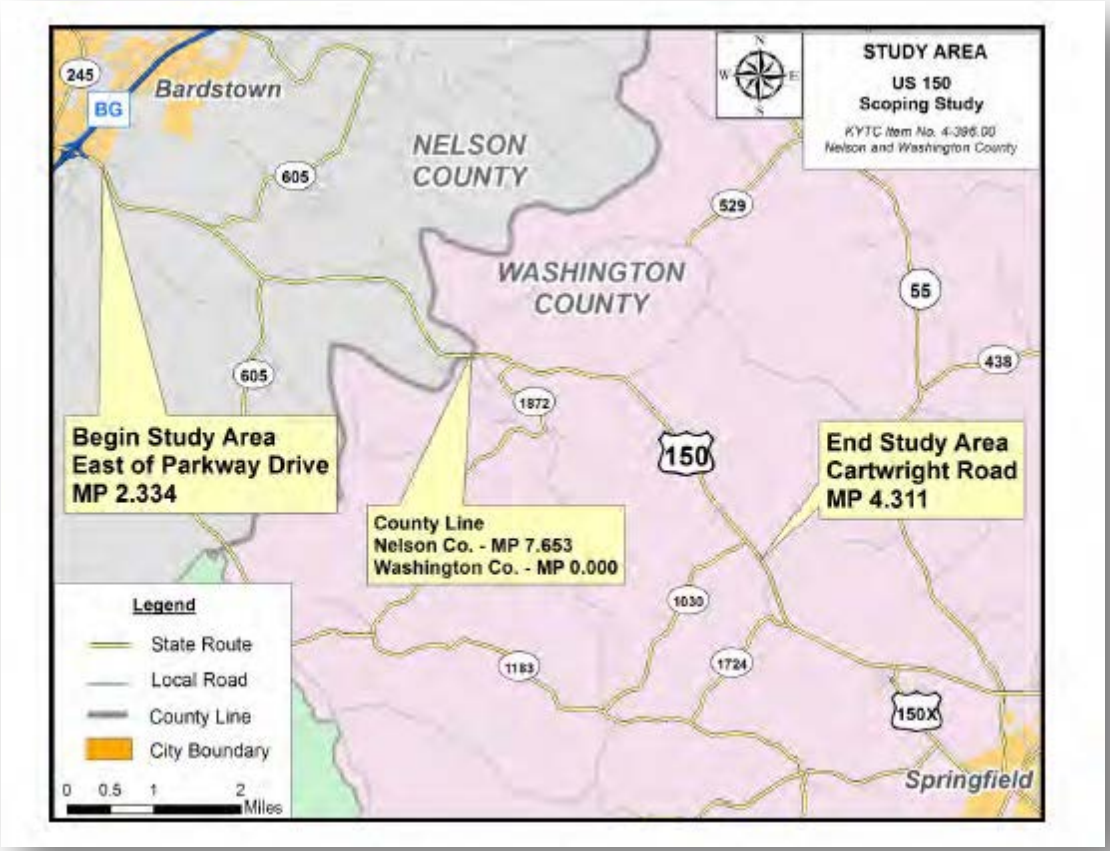
VE# 201901
Value Engineering Study Report – Final

Kentucky Transportation Cabinet
US 150 Improvement Project
Item No. 4-396.10, .20, .30
Nelson and Washington Counties



Workshop Dates: February 4-7, 2019

April 21, 2019

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# 201901
Value Engineering Study Report – Final
US 150 Improvement Project
Item No. 4-396.10, .20, .30
Nelson and Washington Counties

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 (PDF and Word) of the Implementation Form and Instructions for your use.

I appreciate your leadership and cooperation as well as that from Brad Bottoms, design team, 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
US 150 Improvement Project
Item No. 4-396.10, .20, .30
Nelson and Washington Counties

Contents

Contents (continued)

Please Note: The In-brief Presentation and Out-brief Presentation were sent under separate cover and, therefore, not included in this report.

SECTION 1:

INTRODUCTION

Value Engineering Study
Kentucky Transportation Cabinet
US 150 Improvement Project
Item No. 4-396.10, .20, .30
Nelson and Washington Counties

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:

- **Stage 1: Pre-Study**
  - Identify team members
  - Define workshop location
  - Review project documentation
  - Prepare for the Value Study (Workshop)

- **Stage 2: Value Study (Workshop) Job Plan**
  - *Phase 1: Information*
    - Gather, organize and analyze data
    - Define costs and cost models
    - Define the problem/purpose of the study
    - Define study scope, define project goals and workshop goals
  - *Phase 2: Function Analysis*
    - Define and evaluate functions
    - Define needs versus wants
  - *Phase 3: Creative*
    - What else will perform the functions?
    - Is this function required?
  - *Phase 4: Evaluation*
    - Rank and rate the ideas to select
    - Refine the best ideas for further development
  - *Phase 5: Development*
    - Develop the best ideas into VE Alternatives with support and justification
  - *Phase 6: Presentation*
    - VE study team presents results
    - Prepare and issue the report
    - Report implementation ideas

- **Stage 3: Post-Study**
  - Implement approved alternatives
  - Monitor status

Report Contents

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

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

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.

VE Recommendations and Design Suggestions – Each completed alternative and design suggestion has a separate workbook and is categorized by function. Each workbook contains the following information:

- Unique Identifying Number (XX-##)
- Creative Idea Title
- Location (see **Location Key**)
- Function Identification
- Baseline Assumption – brief description
- Proposed Alternative – brief description
- Benefits
- Risks/Challenges
- Overall Performance Score
- Cost Summary
- Baseline and Proposed Sketches, if applicable
- Discussion/Justification
- Implementation Considerations, if applicable

LOCATION KEY

Item 4-396.10 (Nelson County)
- Alternate 1 – On Corridor
- Alternate 3 – Off Corridor

Item 4-396.20 (Washington County)
- Segment IV, Section A, Alternates 1 & 2
- Segment IV, Section B, Alternates 1 & 2
- Grundy Home Road Approach, Alternates 1 & 2

Item 4-396.30 (Washington County)
- Segment V, Section C, Alternates 1 & 2
- Segment V, Section D, Alternates 1 & 2

- Impact to Performance – alternative scored against **Performance Criteria** with justification for scores
- Initial Cost Detail
- Replacement/Salvage and Annual Cost Detail, if applicable

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. Team Observations
ii. Risk Identification
iii. Agenda

PERFORMANCE CRITERIA

Maintain Access - Maintain community access (residential and business) through Botland and the two KY 605 routes

Improve Mobility - Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)

Maintenance of Traffic (short-term) - MOT during construction; need to maintain two lanes of traffic at all times during construction

Minimize Impacts - Minimize impacts to PACE, historic and residential properties

SECTION 2:

EXECUTIVE SUMMARY

Value Engineering Study
Kentucky Transportation Cabinet
US 150 Improvement Project
Item No. 4-396.10, .20, .30
Nelson and Washington Counties

Section 2: Executive Summary

Background

A Value Engineering (VE) study was conducted on the preliminary design documents for the Kentucky Transportation Cabinet's **US 150 Improvement Project (Item No. 4-396.10, .20, .30, Nelson and Washington Counties)** on February 4-7, 2019.

KYTC project manager, Brad Bottoms, and consultant representatives from Palmer Engineering and Stantec presented the project during the Information Phase kick-off meeting on Monday, February 4, 2019. A copy of this presentation is included in Section 5: Appendices, Appendix E – Supporting Data.

Project Description (excerpted from *Scoping Document*)

The study area encompasses US 150 corridor from the Bluegrass Parkway near Bardstown in Nelson County (Mile Point 2.334 to Mile Point 7.653 in Nelson County) to just west of Springfield in Washington County (Mile Point 0.000 to Mile Point 4.311 in Washington County). The project area is located in eastern Nelson County and western Washington County in central Kentucky. US 150 stretches approximately 120 miles from Louisville to Mount Vernon, Kentucky. Carrying between 8,800 and 12,000 vehicles per day through the project corridor, US 150 is a Rural Minor Arterial. Two-hundred thirty-four (234) crashes were reported along US 150 within the study area for a five-year period, between January, 2010 and December, 2014.

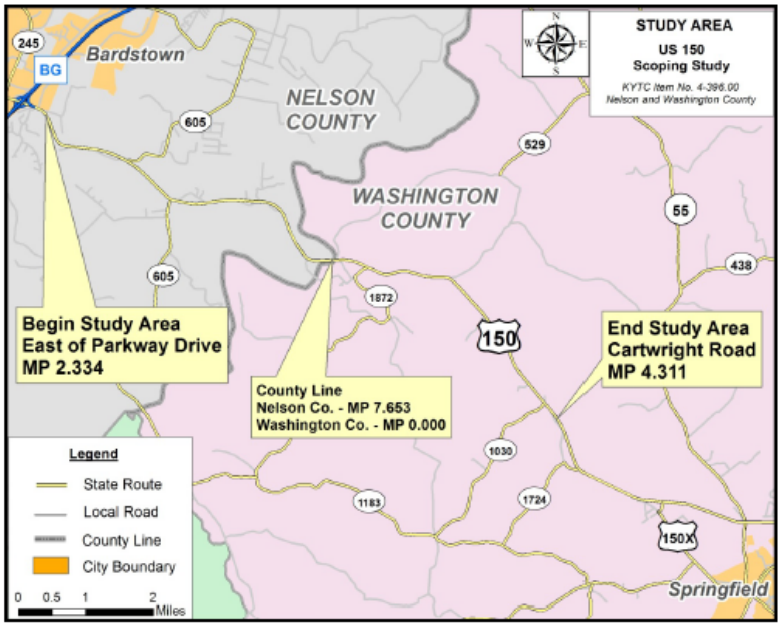


Figure 1 - Study Area - US 150 Scoping Study

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Project Purpose and Need

In the US 150 Scoping Study (December 2015), the project's Purpose and Need states:

> *The purpose of the US 150 Improvement Project is to enhance local and regional mobility, increase capacity where necessary, and to provide a safer, more efficient connection between the Bluegrass Parkway and Springfield, Kentucky.*

Project/Workshop Constraints

The decisions makers/stakeholders identified the project/workshop constraints for the VE study team during the Information Phase kick-off meeting as:

- Do not touch historic properties (For historic properties, a de minimis impact is one that results in a Section 106 determination of "no adverse effect" or "no historic properties affected."); sliver-taking may be acceptable
- Impact to PACE (Purchase of Agricultural Conservation Easements) properties may be limited
- "Do Nothing" is not an option for this corridor

Workshop Objectives

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

- Review typical sections
    - Constrained typical section through the Botland area due to historic and non-historic property impacts
    - Bardstown is configured as five lanes to tie into US 150 both "on" and "off" corridor
- Review connectivity to KY 605
- Identify opportunities to thread the alignment through the PACE properties
- Identify combinations of alternates that bring the project value (improve function/ performance and/or lower cost)

Performance Criteria

During the Information Phase, the decision makers helped the VE study team understand what defined project success for the US 150 Improvement project. Using a paired-comparison matrix, performance criteria were scored and ranked (see Section 5: Appendices, Appendix D –

Creative Idea List and Evaluation). These criteria were used later in the workshop by the VE study team for both evaluating and developing alternatives.

- **Maintain Access:** Maintain community access (residential and business) through Botland and the two KY 605 routes
- **Improve Mobility:** Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve Level of Service (current: D/E; goal B/C in the design year)
- **Maintenance of Traffic (MOT) (short-term):** MOT during construction; need to maintain two lanes of traffic at all times during construction
- **Minimize Impacts:** Minimize impacts to PACE, historic and residential properties

Summary Workshop Results

Summary workshop results are shown in the table below.

Workshop Outcome	Number	Section of Report / Result
Ideas Brainstormed	40	See Creative Idea List (Section 5: Appendices, Appendix D)
Ideas Developed into VE Workbooks	16	See Section 4: Value Engineering Proposals and Design Suggestions
Value Engineering Proposals, costed	12	
Design Suggestions, not costed	4	
Design Comments (DC), not developed	5	See Section 4: Value Engineering Proposals and Design Suggestions
ALL VE Proposals – Menu of Savings (potentially reduces initial and/or O&M cost without sacrificing function and/or performance)	10	$29,748,000 – Initial Cost See Section 4: 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)	2	($876,000) – Initial Cost See Section 4: Value Engineering Proposals and Design Suggestions

Summary tables of the Value Engineering Proposals, Design Suggestions and Design Comments are included in Section 4: Value Engineering Proposals and Design Suggestions. A description and further discussion of Value Engineering Proposals and Design Suggestions are also included in Section 4: Value Engineering Proposals and Design Suggestions. The VE alternatives are categorized in one of three key (high cost and/or high risk) functions—

- Increase Capacity (IC)
- Traverse Terrain (TT)
- Enhance Roadside-safety (ER)

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 5: 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 function was defined as *Improve Level of Service.* A Random Function Identification Worksheet was completed and is included in Appendix C.

VE Study Team

Name	Organization	Role
Shawn Russell	KYTC	Subject Matter Expert – Transportation
Peter Overmohle	American Engineers	Subject Matter Expert – Highway Engineering
Jason Littleton	American Engineers	Subject Matter Expert – Traffic Engineering
Robert Martin	Qk4	Subject Matter Expert – Constructability
Pat Miller	RHA	CVS Team Leader

Certification

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

Patrice Miller, CVS®
RHA, LLC

VALUE ENGINEERING PUNCH LIST

ITEM NO. **4-396.10, .20, .30** PROJECT COUNTY: **Nelson and Washington** DATE OF STUDY: **February 4-7, 2019**

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
VE-01	Reduce the paved shoulder from eight to four feet	Item No. 4-396.10 (Nelson County), Alternates 1 and 3; Item No. 4-396.20 (Washington County), Segment IV, Section A and B, Alternates 1 and 2; Item No. 4-396.30 (Washington County), Segment V, Section C, Alternates 1 and 2			$11,574,000	$8,762,000	$2,812,000	$0		
VE-02	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00	Item No. 4-396.10 (Nelson County), Alternate 3			$8,711,000	$8,362,000	$349,000	$0		
VE-03(a)	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south	Item No. 4-396.10 (Nelson County), Alternate 1			$11,299,000	$7,696,000	$3,603,000	$0		
VE-03(b)	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south	Item No. 4-396.10 (Nelson County), Alternate 3			$18,786,000	$13,045,000	$5,741,000	$0		
VE-04	Replace four-lane with two-lane plus auxiliary lanes at specific locations	Item No. 4-396.10 (Nelson County), Alternate 3			$18,786,000	$11,068,000	$7,718,000	$0		
VE-05	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic	Item No. 4-396.10 (Nelson County), Alternate 3			$258,000	$104,000	$154,000	$0		
VE-06	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service	Item No. 4-396.10 (Nelson County), Alternate 3			$10,401,000	$11,001,000	($600,000)	$0		
VE-07	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one	Item No. 4-396.10 (Nelson County), Alternate 3			$1,534,000	$1,015,000	$519,000	$0		
VE-08	Construct hybrid alignment based on revised traffic projections	Item No. 4-396.10 (Nelson County), Alternates 1 and 3			$36,793,000	$35,732,000	$1,061,000	$0		
VE-09(a)	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)	Item No. 4-396.10 (Nelson County), Alternate 1			$3,597,000	$2,206,000	$1,391,000	$0		
VE-09(b)	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)	Item No. 4-396.10 (Nelson County), Alternate 3			$6,578,000	$5,129,000	$1,449,000	$0		
VE-10	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes	Item No. 4-396.10 (Nelson County), Alternates 1 and 3			$23,703,000	$17,008,000	$6,695,000	$0		
VE-11	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract	Item No. 4-396.20 (Washington County), Segment IV, Section A, Alternates 1 and 2			$23,000	$15,000	$8,000	$0		
VE-12	Shift bridge location northeast to allow maintenance of traffic	Item No. 4-396.30 (Washington County), Segment V, Sections C and D, Alternates 1 and 2			$1,900,000	$2,176,000	($276,000)	$0		
Design Suggestions										
VE-13	Verify that the growth factor for traffic forecast data is accurate for design determination impacts	Item No. 4-396.10 (Nelson County), Alternates 1 and 3								
VE-14	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties	Item No. 4-396.10 (Nelson County), Alternate 3								
VE-15	Shift mainline alignment west at historic property #30	Item No. 4-396.10 (Nelson County), Alternate 3								
VE-16	Reduce the roadway ditch from 18 feet to 12 feet	Item No. 4-396.10 (Nelson County), Alternate 1; Item No. 4-396.20 (Washington County), Segment IV, Sections A and B, Alternate 2								

SECTION 3:

SUMMARY INFORMATION

Section 3: Summary Information

Introduction

The VE study team brainstormed 40 ideas. To shorten the list, the VE study team members evaluated the ideas using a two-step process. The first step identified ideas that scored as follows:

- FF Unacceptable Impacts/Fatal Flaw (Has at least one fatal/unacceptable flaw)
- O/S Out of Scope
- ABC Already Being Considered
- DC Design Comment (No cost impact, no Workbook)
- DS Design Suggestions (No cost impact, Workbook)

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 (value = function/resources) along with the idea's alignment with previously identified project goals, functions and performance criteria.

Of the 40 ideas, 12 ideas were identified for further development into Value Engineering proposals, including cost impacts. The description and further discussion of these are included in the Value Engineering Workbooks section of this report.

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

The Summary of Alternatives identifies cost impacts, initial, construction and any potential operations and maintenance (O&M). 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 study team. Life Cycle Costs are based on a 50-year life.

The VE study team also developed four Design Suggestions (DS), not costed, and identified five Design Comments (DC), not developed/costed.

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

Summary of Value Engineering Proposals (Workbook Prepared, Costed Alternative)

Idea No.	VE Proposal No.	Idea Title	Location	Overall Performance Score	Initial Cost Savings / (Add)
IC		**Increase Capacity**			
IC-05	**1**	Reduce the paved shoulder from eight to four feet	Item No. 4-396.10 (Nelson County), Alternates 1 and 3; Item No. 4-396.20 (Washington County), Segment IV, Section A and B, Alternates 1 and 2; Item No. 4-396.30 (Washington County), Segment V, Section C, Alternates 1 and 2	-0.15	$2,812,000
IC-06	**2**	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00	Item No. 4-396.10 (Nelson County), Alternate 3	6.67	$349,000
IC-08	**3(a)**	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south	Item No. 4-396.10 (Nelson County), Alternate 1	-0.98	$3,603,000
IC-08	**3(b)**	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south	Item No. 4-396.10 (Nelson County), Alternate 3	-0.98	$5,741,000
IC-09	**4**	Replace four-lane with two-lane plus auxiliary lanes at specific locations	Item No. 4-396.10 (Nelson County), Alternate 3	-4.17	$7,718,000
TT		**Traverse Terrain**			
TT-05	**5**	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic	Item No. 4-396.10 (Nelson County), Alternate 3	2.80	$154,000
TT-07	**6**	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service	Item No. 4-396.10 (Nelson County), Alternate 3	5.00	($600,000)
TT-08	**7**	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one	Item No. 4-396.10 (Nelson County), Alternate 3	4.17	$519,000

Summary of Value Engineering Proposals (Workbook Prepared, Costed Alternative)

Idea No.	VE Proposal No.	Idea Title	Location	Overall Performance Score	Initial Cost Savings / (Add)
TT-09	**8**	Construct hybrid alignment based on revised traffic projections	Item No. 4-396.10 (Nelson County), Alternates 1 and 3	4.17	$1,061,000
TT-12	**9(a)**	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)	Item No. 4-396.10 (Nelson County), Alternate 1	-0.68	$1,391,000
TT-12	**9(b)**	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)	Item No. 4-396.10 (Nelson County), Alternate 3	-0.68	$1,449,000
TT-13	**10**	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes	Item No. 4-396.10 (Nelson County), Alternates 1 and 3	-5.15	$6,695,000
TT-15	**11**	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract	Item No. 4-396.20 (Washington County), Segment IV, Section A, Alternates 1 and 2	3.33	$8,000
TT-16	**12**	Shift bridge location northeast to allow maintenance of traffic	Item No. 4-396.30 (Washington County), Segment V, Sections C and D, Alternates 1 and 2	2.80	($276,000)

Summary of Design Suggestions (Workbook Prepared, Not Costed)

Idea No.	VE Proposal No.	Idea Title	LOCATION	Overall Performance Score
IC		**Increase Capacity**		
IC-01	**13**	Verify that the growth factor for traffic forecast data is accurate for design determination impacts	Item No. 4-396.10 (Nelson County), Alternates 1 and 3	10.00
TT-04	**14**	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties	Item No. 4-396.10 (Nelson County), Alternate 3	3.33
TT-06	**15**	Shift mainline alignment west at historic property #30	Item No. 4-396.10 (Nelson County), Alternate 3	3.33
ER		**Enhance Roadside-safety**		
ER-01	**16**	Reduce the roadway ditch from 18 feet to 12 feet	Item No. 4-396.10 (Nelson County), Alternate 1; Item No. 4-396.20 (Washington County), Segment IV, Sections A and B, Alternate 2	1.67

Design Comments (No Workbook Prepared)

Idea No.	Idea Title
TT	**Traverse Terrain**
TT-18	Create Memorandum of Understanding with local governments to preserve and/or control access
TT-19	Add J-turn at KY 605, both east and west sides
TT-20	Offset left-turn lane at all intersections
TT-21	Add right-turn lanes for the two-lane typical section
TT-24	Where there are flat profile grades entering/leaving horizontal curvatures, verify that flat spots are not being created

SECTION 4:

VALUE ENGINEERING PROPOSALS AND DESIGN SUGGESTIONS

Section 4: Value Engineering Proposals and Design Suggestions

Introduction

The VE study team evaluated the baseline design using the Performance Criteria discussed in Section 2: Executive Summary. The results of this evaluation are shown on the following pages.

The VE study team developed 12 Value Engineering proposals, including cost impacts and four Design Suggestions (DS), not costed.

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

- Unique Identifying Number (XX-##)
- Creative Idea Title
- Location (see **Location Key**)
- Function Identification
- Baseline Assumption – brief description
- Proposed Alternative – brief description
- Benefits
- Risks/Challenges
- Overall Performance Score
- Cost Summary
- Baseline and Proposed Sketches, if applicable
- Discussion/Justification
- Implementation Considerations, if applicable
- Impact to Performance – alternative scored against **Performance Criteria** with justification for scores
- Initial Cost Detail
- Replacement/Salvage and Annual Cost Detail, if applicable

LOCATION KEY

Item 4-396.10 (Nelson County)
- Alternate 1 – On Corridor
- Alternate 3 – Off Corridor

Item 4-396.20 (Washington County)
- Segment IV, Section A, Alternates 1 & 2
- Segment IV, Section B, Alternates 1 & 2
- Grundy Home Road Approach, Alternates 1 & 2

Item 4-396.30 (Washington County)
- Segment V, Section C, Alternates 1 & 2
- Segment V, Section D, Alternates 1 & 2

PERFORMANCE CRITERIA

Maintain Access - Maintain community access (residential and business) through Botland and the two KY 605 routes

Improve Mobility - Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)

Maintenance of Traffic (short-term) - MOT during construction; need to maintain two lanes of traffic at all times during construction

Minimize Impacts - Minimize impacts to PACE, historic and residential properties

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

EVALUATION OF BASELINE DESIGN

TITLE:	Summary

The performance attributes (shown below) were identified during the kick-off meeting on Monday, February 4, 2019 by KYTC project manager, Bradley Bottoms, and the design team.

- **Maintain Access:** Maintain community access (residential and business) through Botland and the two KY 605 routes
- **Improve Mobility:** Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve Level of Service (current: D/E; goal B/C in the design year)
- **Maintenance of Traffic (MOT) (short-term):** MOT during construction; need to maintain two lanes of traffic at all times during construction
- **Minimize Impacts:** Minimize impacts to PACE, historic and residential properties

These attributes were then ranked through a paired comparison exercise that resulted in weights being assigned to each attribute.

Prior to developing ideas, the VE study team used the performance criteria to score the baseline design (12 alternates) and justifications provided for each score.

The following page (summary table) provides a summary for each baseline segment and includes the following information:
(1) Item Number
(2) County
(3) Alternate
(4) Overall Performance Score
(5) Cost (from Decision Matrices provided by Palmer Engineering)
(6) Ability to construct in $10-15M sections

The pages following the summary table provide detailed scores and justifications for each baseline alternate.

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Summary				
Item No. 4-396.00	County	Alternate	Overall Performance Score	Cost	Able to Phase Construction in $10-15M sections? (Y=Yes, N=No, P=Partial)
0.10	Nelson	Alternate 1 "On Corridor"	2.20	$42.4M	Y
0.10	Nelson	Alternate 1 "Off Corridor"	5.83	$58.9M	P
0.20	Washington	Segment IV, Section A, Alternate 1	0.53	$2.2M	Y
0.20	Washington	Segment IV, Section A, Alternate 2	3.18	$2.7M	Y
0.20	Washington	Segment IV, Section B, Alternate 1	2.35	$4.8M	Y
0.20	Washington	Segment IV, Section B, Alternate 2	0.68	$3.4M	Y
0.20	Washington	Grundy Home Road Approach, Alternate 1	-1.67	$500K	Y
0.20	Washington	Grundy Home Road Approach, Alternate 2	-0.15	$300K	Y
0.30	Washington	Segment V, Section C, Alternate 1	0.68	$5.1M	Y
0.30	Washington	Segment V, Section C, Alternate 2	0.53	$5.1M	Y
0.30	Washington	Segment V, Section D, Alternate 1	4.85	$2M	Y
0.30	Washington	Segment V, Section D, Alternate 2	2.35	$2M	Y

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item 4-396.10 (Nelson County): Alternate 1 - On Corridor

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	5	0.83
Justification	Adds turn lanes to improve access to the properties.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	10	5.00
Justification	Adds wider shoulders, more through lanes and clear zone will improve mobility; improves passing opportunities.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-10	-0.30
Justification	Inconvenience to drivers along the route.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	-10	-3.33
Justification	Botland and historical district are impacted.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**2.20**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.10 (Nelson County): Alternate 3 - Off Corridor

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	-5	-0.83
Justification	Bypass Botland while maintaining connectivity to KY 605.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	10	5.00
Justification	Bypass Botland while maintaining connectivity to KY 605; allows higher design speed and access control.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	Minimal impact to performance.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	5	1.67
Justification	May be able to achieve De Minimus.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**5.83**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.20 (Washington County): Segment IV, Section 1 - Alternate 1

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Adding lanes and increasing shoulder width to improve mobility.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-10	-0.30
Justification	Inconvenience to drivers along the route.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	-5	-1.67
Justification	Impact to properties.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**0.53**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.20 (Washington County): Segment IV, Section A - Alternate 2

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	10	5.00
Justification	Additional auxiliary lanes improve mobility.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Partial width construction impacts to traffic.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	-5	-1.67
Justification	Impact to properties.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**3.18**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10	Large increase in performance
5	Small increase in performance
0	No impact to performance
-5	Small negative impact to performance
-10	Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.20 (Washington County): Segment IV, Section B - Alternate 1

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Increased roadway and shoulder widths improves mobility.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Partial width construction impacts to traffic.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	Minimal impact to performance (tradeoff: relocate waterline is avoided in this alternate; buy more right-of-way).			
	OVERALL PERFORMANCE SCORE	**103.00%**		**2.35**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.20 (Washington County): Segment IV, Section B - Alternate 2

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Increased roadway and shoulder widths improves mobility.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Partial width construction impacts to traffic.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	-5	-1.67
Justification	Relocated waterline is not avoided in this alternate; more right-of-way is not required.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**0.68**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.20 (Washington County): Grundy Home Road Approach - Alternate 1

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	0	0.00
Justification	No impact to performance.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No impact to performance.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	-5	-1.67
Justification	Impacts to farmland.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**-1.67**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.20 (Washington County): Grundy Home Road Approach - Alternate 2

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	0	0.00
Justification	No impact to performance.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Will need to cross the existing approach.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	No impact to performance.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**-0.15**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.30 (Washington County): Segment V, Section C - Alternate 1

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Increased lanes and shoulders improves mobility.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Partial width construction impacts to traffic.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	-5	-1.67
Justification	Impacts barn structure.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**0.68**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.30 (Washington County): Segment V, Section C - Alternate 2

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Increased lanes and shoulders improves mobility.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-10	-0.30
Justification	Partial width construction impacts to traffic; more difficult roadway/bridge construction.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	-5	-1.67
Justification	Impacts barn structure.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**0.53**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-306.30 (Washington County): Segment V, Section D - Alternate 1

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	10	5.00
Justification	Adding passing lanes in each direction; wider shoulder than Alternate 2.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Partial width construction impacts to traffic.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	No impact to performance.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**4.85**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

US 150 Corridor Improvement
Item No. 4-396.10, .20, .30
Baseline Alternates Evaluation
Nelson and Washington Counties

TITLE:	Item No. 4-396.30 (Washington County): Segment V, Section D - Alternate 2

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Adding passing lanes in each direction.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Partial width construction impacts to traffic.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	No impact to performance.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**2.35**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSALS

VALUE ENGINEERING PROPOSAL
NO. 1
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the paved shoulder from eight to four feet
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternates 1 and 3; Item No. 4-396.20 (Washington County), Segment IV, Section A and B, Alternates 1 and 2; Item No. 4-396.30 (Washington County), Segment V, Section C, Alternates 1 and 2**
FUNCTION:	**Increase Capacity**

BASELINE ASSUMPTION:

The baseline shoulder condition shows an eight-foot paved shoulder with ten feet total, with graded shoulder.

PROPOSED ALTERNATIVE:

The proposal is to decrease the paved shoulder width to four feet paved keeping the ten feet total, graded shoulder.

BENEFITS	RISKS/CHALLENGES
• Decreases pavement cost	• The unpaved part of pavement shoulder could be rutted from vehicles that pull over
•	• Unsatisfactory past performance of six-foot paved shoulder within District
•	•
•	•
•	•
•	•
•	•

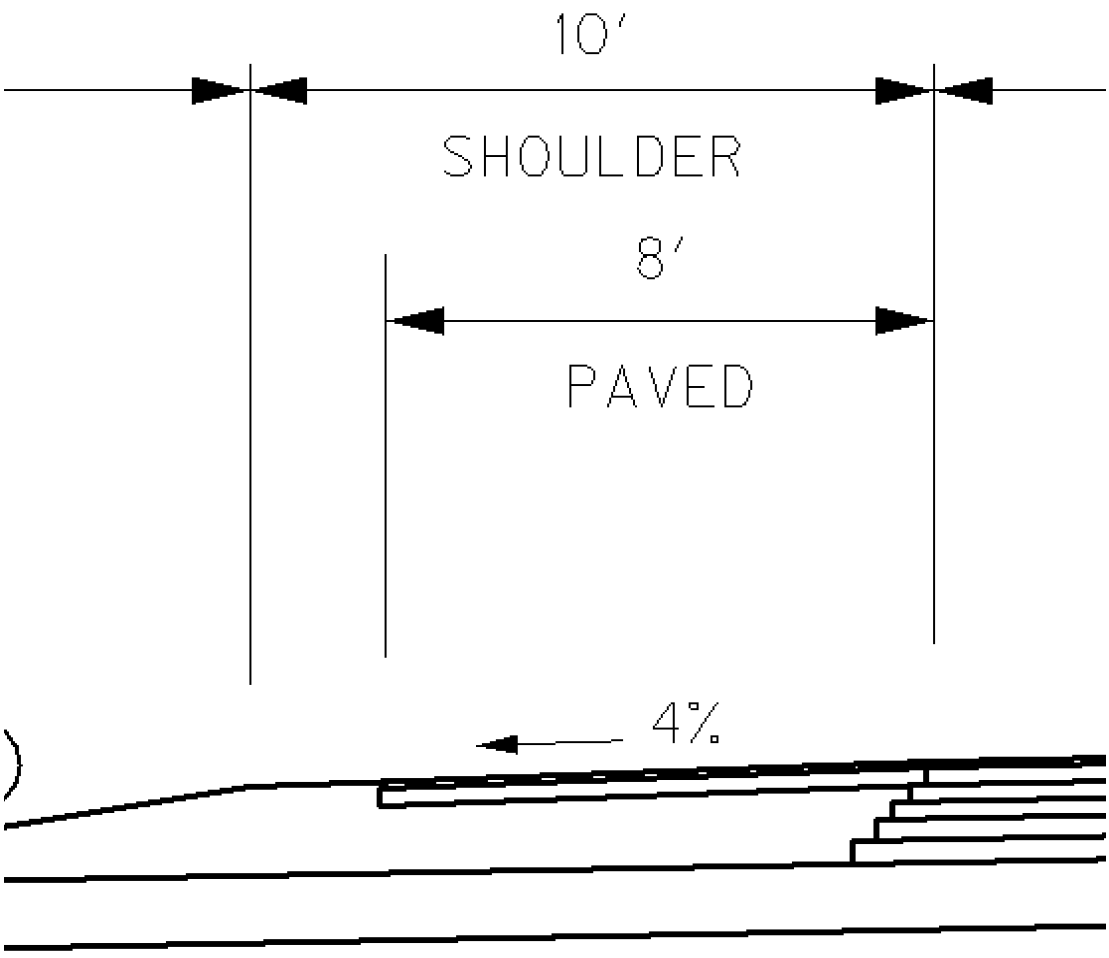
OVERALL PERFORMANCE SCORE -0.15

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 11,574,000	$ -	$ 11,574,000
PROPOSED ALTERNATIVE:	$ 8,762,000	$ -	$ 8,762,000
TOTAL (Baseline less Proposed)	$ 2,812,000	$ -	**$ 2,812,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 1
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the paved shoulder from eight to four feet

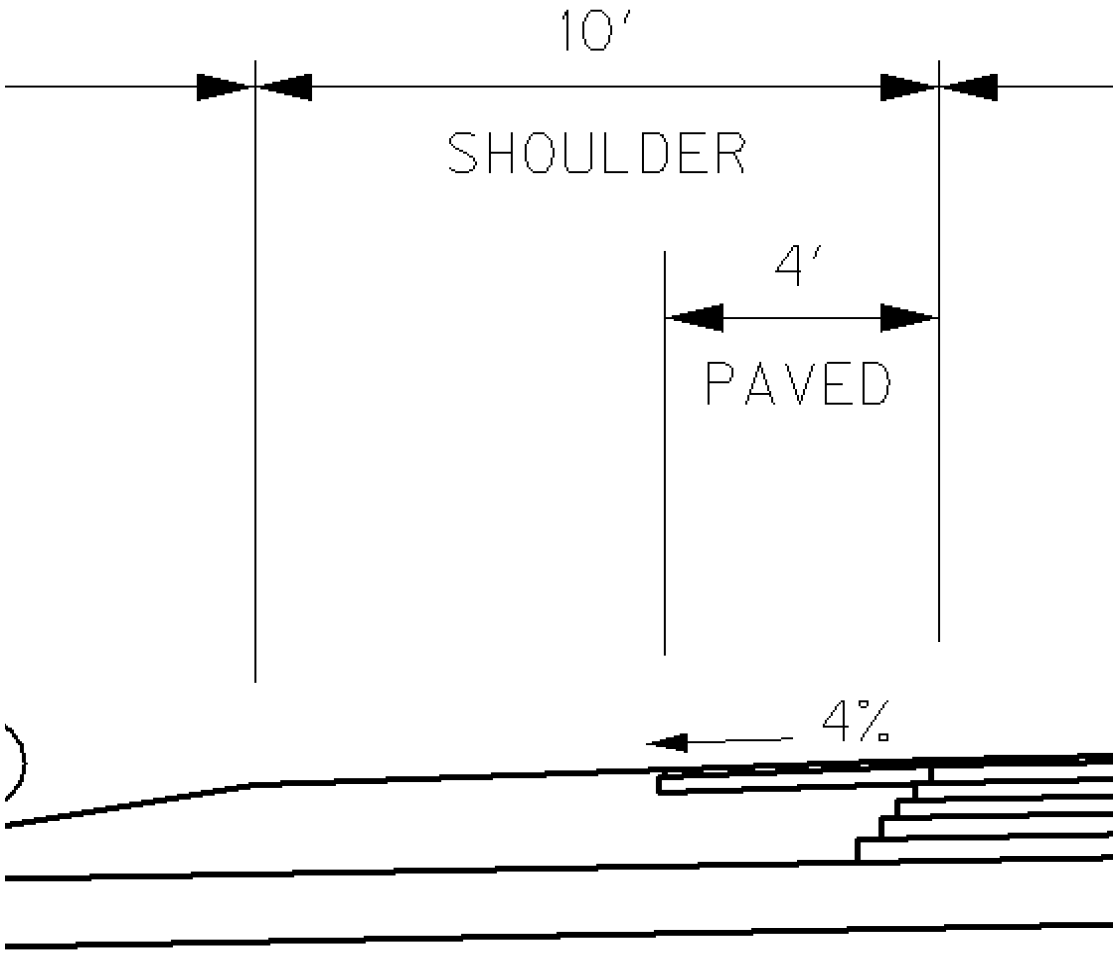
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL
NO. 1
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the paved shoulder from eight to four feet

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 1
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the paved shoulder from eight to four feet

DISCUSSION/JUSTIFICATION:

The baseline situation proposes eight-foot paved shoulders through all of Nelson County, Segment IV and Segment V, Section C in Washington County. Segment V, Section D in Washington County proposes an eight-foot shoulder in one direction of travel only.

The proposal is to reduce the paved shoulder width to four-foot paved with a total of ten-foot graded (as in the baseline). The intent with this proposal is to reduce the pavement needed while still providing a graded area where vehicles could pull off in an emergency.

The provided unit cost for mainline shoulder pavement was used to assign a cost to this proposal. The paved shoulder areas were calculated based on centerline stationing and the total outside paved shoulder width as opposed to the paved shoulder areas found in the estimates. The reduced pavement area was added back in as additional DGA/CSB to account for the addition of graded shoulder. Assuming a unit cost for CSB of $25/ton and a unit cost for asphalt of $75/ton, the unit cost for the additional DGA/CSB was assumed to be $40/SqYd based on $80/SqYd for the baseline shoulder.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 1
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the paved shoulder from eight to four feet

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance. No access will change as a result of this proposal.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	0	0.00
Justification	Because the graded shoulder width is not decreased, the facility LOS will not be impacted.			
Maintenance of Traffic (short-term)*	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Decreasing the paved shoulder width COULD have a negative effect on MOT if working room is constrained as there would be less width for potential traffic movement.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	Impacts to right-of-way would not be impacted by this proposal as the graded shoulder width is not changing.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**-0.15**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 1
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the paved shoulder from eight to four feet						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Pavement (mainline shoulders) - Nelson County	SY	48,590	80.00	3,887,200	24,295	80.00	1,943,600
Additional DGA/CSB (Nelson County)	SY				24,295	40.00	971,800
Pavement (mainline shoulders) - Washington County	SY	96,090	80.00	7,687,200	50,085	80.00	4,006,800
Additional DGA/CSB (Washington County)	SY				46,005	40.00	1,840,200
TOTAL				11,574,000			8,762,000
						CWE (BASELINE LESS PROPOSED)	**2,812,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 2
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 3**
FUNCTION:	**Increase Capacity**

BASELINE ASSUMPTION:

Four-lane divided highway typical section shows a 40-foot median (from edge of traveled lane to edge of traveled lane).

PROPOSED ALTERNATIVE:

Reduce median from 40 feet to 30 feet wide from Station 15+00 to Station 140+00.

BENEFITS	RISKS/CHALLENGES
• Reduces right-of-way	• Clear zone reduced; higher risk of head-on collisions
• Reduces earthwork	•
• Implements access management techniques	•
•	•
•	•
•	•
•	•

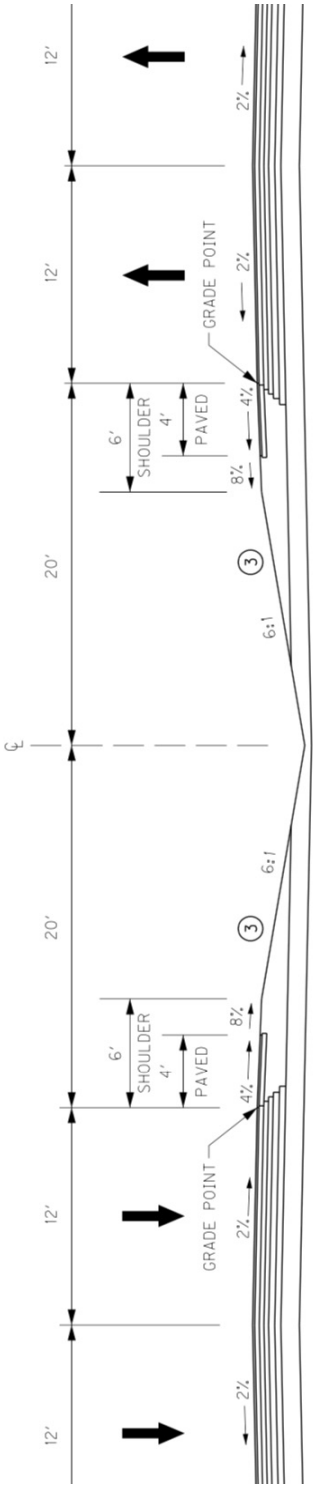
OVERALL PERFORMANCE SCORE **6.67**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 8,711,000	$ -	$ 8,711,000
PROPOSED ALTERNATIVE:	$ 8,362,000	$ -	$ 8,362,000
TOTAL (Baseline less Proposed)	$ 349,000	$ -	**$ 349,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 2
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00

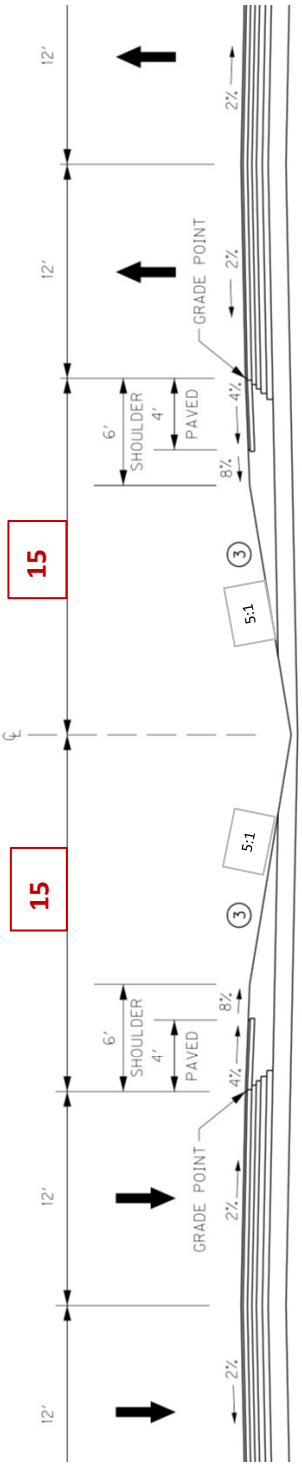
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL
NO. 2
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 2
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00

DISCUSSION/JUSTIFICATION:

Reduction in median width provides cost savings in right-of-way acquisition and earthwork. A ten-foot reduction from Station 15+00 to Station 140+00 decreases right-of-way needed by 2.9 AC. At $10,000 an acre or more, that is a cost savings of $29,000 or more. Reducing the roadway footprint width also reduces earthwork quantities at cuts and fills. A reduction in width may work well if the project team limits access. J-turns could be utilized with limited access to provide safer through movements at approach roads. *(See sketch for additional concepts to consider.)*

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 2
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact when used in conjunction with limited access.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	10	5.00
Justification	No impact when used in conjunction with limited access. Limited access improves mobility.			
Maintenance of Traffic (short-term)*	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No impact when used in conjunction with limited access.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	5	1.67
Justification	Reduces right-of-way required for constructed roadway.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**6.67**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 2
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Excavation	CY	700,000	10.00	7,000,000	668,000	10.00	6,680,000
Right-of-way acquisition	AC	171.13	10,000.00	1,711,300			
Right-of-way acquisition	AC				168.2	10,000.00	1,682,000
TOTAL				8,711,000			8,362,000
						CWE (BASELINE LESS PROPOSED)	**349,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 3
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternates 1 and 3**
FUNCTION:	**Increase Capacity**

BASELINE ASSUMPTION:

Typical section for the "on corridor" (Alternate 1) is a four-lane with two-way left-turn-lane (TWLTL) rural, from just east of Gas Station (Station 15+00) at beginning of project to just east of KY 605 south (Station 140+00).

Typical section for the "off corridor" (Alternate 3) is a four-lane with 40-foot depressed median from beginning to just east of KY 605 south.

PROPOSED ALTERNATIVE:

The new proposed typical section is a hybrid of a 2+1 and two-lane with a TWLTL between KY 605 north and KY 605 south.

BENEFITS	**RISKS/CHALLENGES**
• Reduces right-of-way and impacts to homes and businesses	• Reduction in Level of Service due to reduced number of lanes
• Passing lanes in the 2+1 will help with traffic delays	• Public expectations are not met
• Left turns through Botland will have refuge lane	• Maintenance of traffic is more difficult
• Potential for reducing utility relocations	•

OVERALL PERFORMANCE SCORE **-0.98**

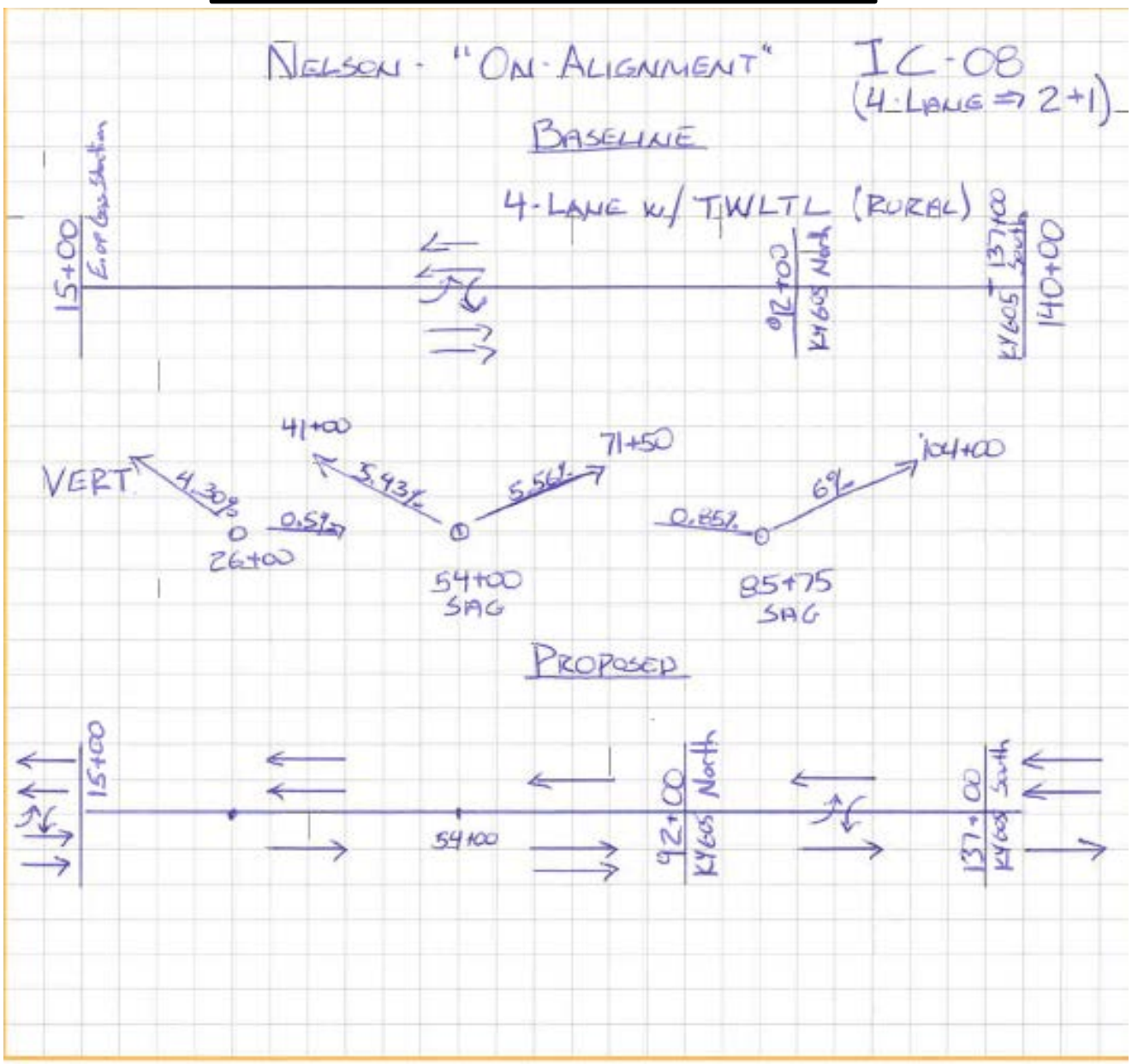
COST SUMMARY - ALTERNATE 1: ON CORRIDOR	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ 11,299,000	$ -	$ 11,299,000
PROPOSED ALTERNATIVE:	$ 7,696,000	$ -	$ 7,696,000
TOTAL (Baseline less Proposed)	$ 3,603,000	$ -	**$ 3,603,000**
			SAVINGS

COST SUMMARY - ALTERNATE 3: OFF CORRIDOR	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ 18,786,000	$ -	$ 18,786,000
PROPOSED ALTERNATIVE:	$ 13,045,000	$ -	$ 13,045,000
TOTAL (Baseline less Proposed)	$ 5,741,000	$ -	**$ 5,741,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 3
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south

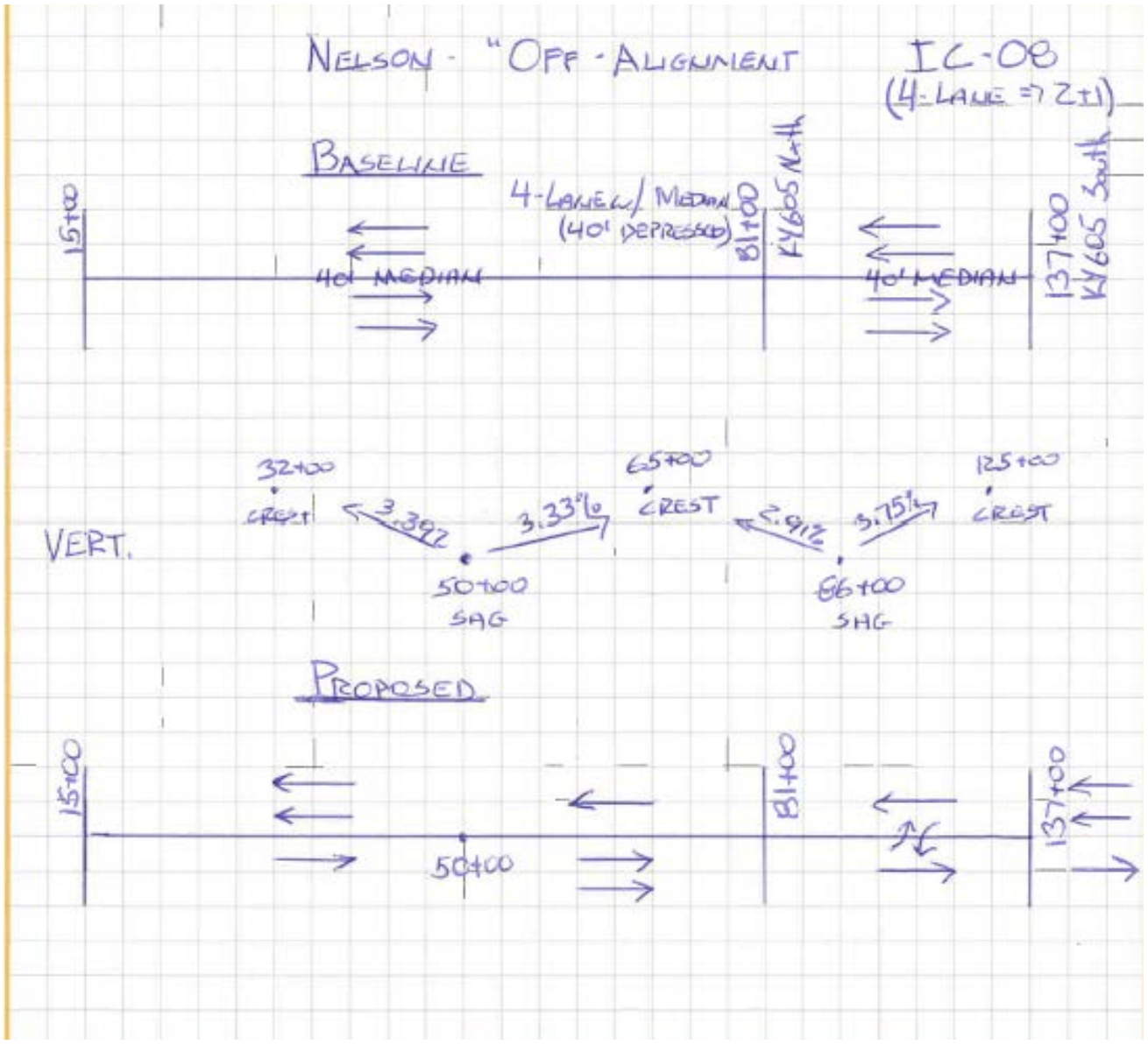
SKETCH OF BASELINE ASSUMPTION
AND PROPOSED ALTERNATIVE
ALTERNATE 1 - ON-CORRIDOR



VALUE ENGINEERING PROPOSAL
NO. 3
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south

SKETCH OF BASELINE ASSUMPTION
AND PROPOSED ALTERNATIVE
ALTERNATE 3 - OFF-CORRIDOR



VALUE ENGINEERING PROPOSAL
NO. 3
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south

DISCUSSION/JUSTIFICATION:

Current traffic volumes from the beginning of the project are 12000 ADT (2014) to KY 605 North and 9000 ADT (2014) between KY 605 North and KY 605 South. Similarly, the traffic projections for the future (2035) are 19000 ADT to KY 605 North and 13000 ADT (2035) between KY 605 North and KY 605 South. Calculated V/C ratio (2035) for the proposed 2 + 1 lane configuration is = 0.58 (using a capacity of 2800 pc/hr per direction) which is under the maximum recommended ratio of 0.9. The V/C ratio (2035) for the segment between KY 605 north and KY 605 south is 0.65 with the two-lane + TWLTL.

Right-of-way cost should be reduced due to the reduction in land. Calculated right-of-way is based on width of the reduced lane amount. The on-alignment alternative will have some added value beyond the cost per acre due to the proximity of the road to the existing homes and businesses.

The value in cost savings due to the reduction in lanes can be accounted for during the construction phase. Cost are based on an order of magnitude for earthwork, pavement and drainage assumptions.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 3
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	Access remains the same; no impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	-5	-2.50
Justification	Reduction in LOS will occur due to the reduction in number of lanes.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Reducing the number of lanes creates difficulties in the construction and workers are closer to traffic.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	5	1.67
Justification	A reduction in the ROW will occur due to the reduction in the typical section.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**-0.98**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 3
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
ALTERNATE 1: ON-CORRIDOR							
Earthwork	CY	145,700	10.00	1,457,000	138,400	10.00	1,384,000
Pavement	SY	86,000	92.00	7,912,000	51,000	92.00	4,692,000
Right-of-way acquisition	AC	30	10,000.00	300,000	22	10,000.00	220,000
Drainage	LS	1	1,630,000.00	1,630,000	1	1,400,000.00	1,400,000
TOTAL				11,299,000			7,696,000
						CWE (BASELINE LESS PROPOSED)	**3,603,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 3
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
ALTERNATE 3: OFF-CORRIDOR							
Earthwork	CY	872,210	10.00	8,722,100	566,936	10.00	5,669,360
Pavement	SY	65,100	92.00	5,989,200	50,000	92.00	4,600,000
Right-of-way acquisition	AC	76	10,000.00	760,000	59	10,000.00	590,000
Drainage	LS	1	2,842,700.00	2,842,700	1	2,185,200.00	2,185,200
Shoulder pavement	SY	5,900	80.00	472,000			
TOTAL				18,786,000			13,045,000
						CWE (BASELINE LESS PROPOSED)	**5,741,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 4
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-lane plus auxiliary lanes at specific locations
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 3**
FUNCTION:	**Increase Capacity**

BASELINE ASSUMPTION:

Typical section for the "Off-Alignment" is a four-Lane with a 40-foot depressed median from just east of Gas Station (Station 15+00) at beginning of project to just east of KY 605 south (Station 137+00).

PROPOSED ALTERNATIVE:

The proposed typical section is a super two-lane with auxiliary lanes at specific locations.

BENEFITS	RISKS/CHALLENGES
• Reduces right-of-way and impacts to homes and businesses	• Reduction in Level of Service due to reduced number of lanes
• Addition of auxiliary lanes will help with traffic delays	• Public expectations are not met
• Potential for reducing utility relocations	• Maintenance of traffic is more difficult
• Potential for crash reductions with added turn lanes	•
•	•
•	•
•	•

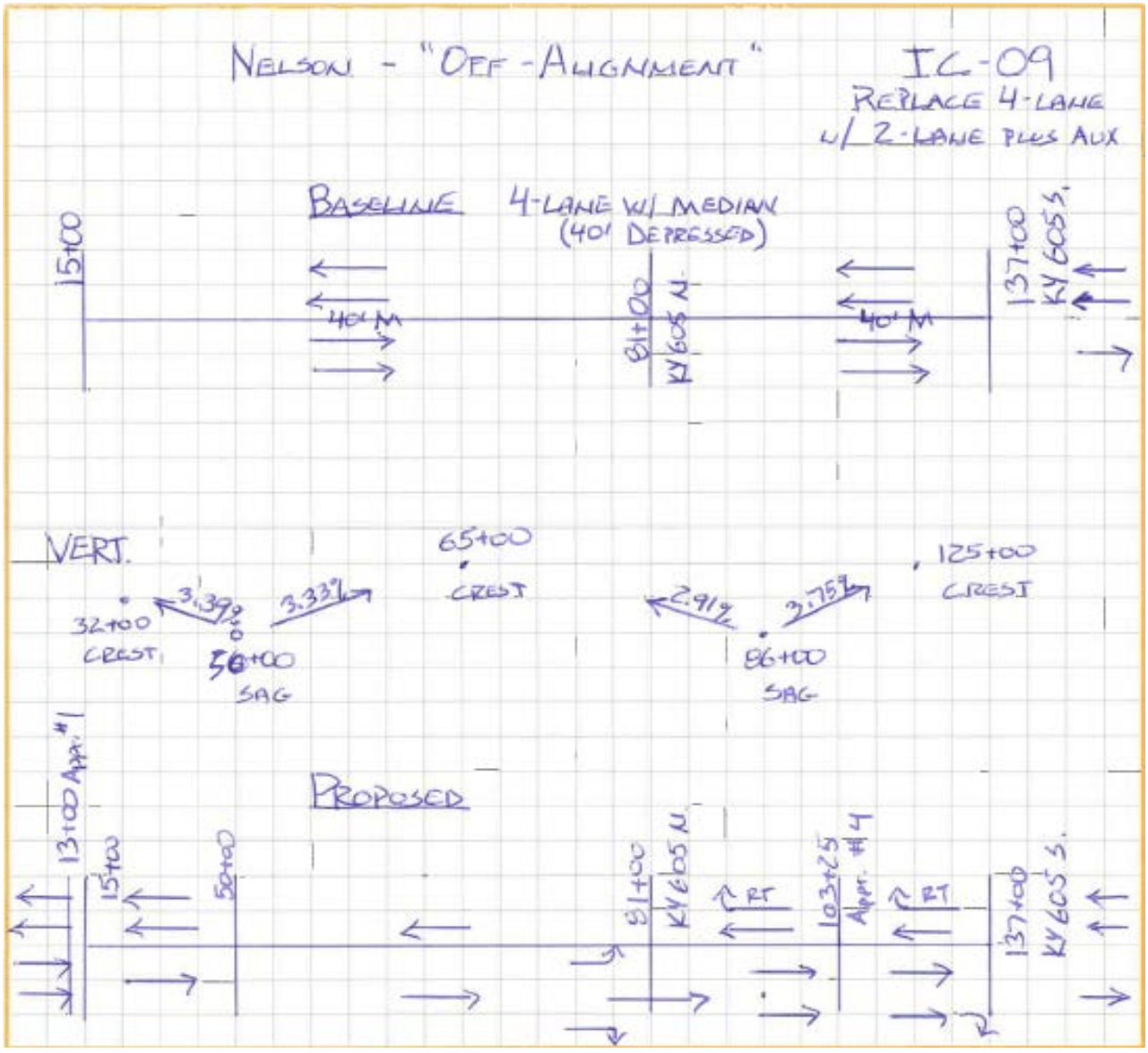
OVERALL PERFORMANCE SCORE **-4.17**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 18,786,000	$ -	$ 18,786,000
PROPOSED ALTERNATIVE:	$ 11,068,000	$ -	$ 11,068,000
TOTAL (Baseline less Proposed)	$ 7,718,000	$ -	**$ 7,718,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 4
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-lane plus auxiliary lanes at specific locations

SKETCH OF BASELINE ASSUMPTION AND PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 4
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-lane plus auxiliary lanes at specific locations

DISCUSSION/JUSTIFICATION:

Current traffic volumes from the beginning of the project are 12000 ADT (2014) to KY 605 North and 9000 ADT (2014) between KY 605 North and KY 605 South. Similarly, the traffic projections for the future (2035) are 19000 ADT to KY 605 North and 13000 ADT (2035) between KY 605 North and KY 605 South. Calculated V/C ratio (2035) for the proposed 2 + 1 lane configuration from Station 15+00 to Station 50+00 is 0.58 (using a capacity of 2800 pc/hr per direction). Calculated V/C ratio (2035) for the proposed two-lane configuration from Station 50+00 to Station 81+00 is 0.95 which is over the maximum recommended ratio of 0.9. The V/C ratio (2035) for the segment between KY 605 north and KY 605 south is 0.65 with the two-lane + auxiliary turn lanes.

Right-of-way cost should be reduced due to the reduction in land. Calculated right-of-way is based on width of the reduced lane amount. The on-alignment alternative will have some added value beyond the cost per acre due to the proximity of the road to the existing homes and businesses.

The value in cost savings due to the reduction in lanes can be accounted for during the construction phase. Costs are based on an order of magnitude for earthwork, pavement and drainage assumptions.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 4
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-lane plus auxiliary lanes at specific locations

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	-5	-0.83
Justification	Access to residential and businesses through Botland is reduced.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	-10	-5.00
Justification	Traffic Level of Service and V/C capacity is significantly less than the four-lane configuration (baseline).			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No significant change due to construction is off corridor.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	5	1.67
Justification	Right-of-way is reduced.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**-4.17**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 4
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Replace four-lane with two-lane plus auxiliary lanes at specific locations						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Earthwork	CY	872,210	10.00	8,722,100	490,000	10.00	4,900,000
Pavement	SY	65,100	92.00	5,989,200	41,500	92.00	3,818,000
Right-of-way acquisition	AC	76	10,000.00	760,000	55	10,000.00	550,000
Drainage	LS	1	2,842,700.00	2,842,700	1	1,800,000.00	1,800,000
Shoulder pavement	SY	5,900	80.00	472,000			
TOTAL				18,786,000			11,068,000
						CWE (BASELINE LESS PROPOSED)	**7,718,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 5
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 3**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Profile of roadway approach to existing US 150 appears to be about five feet above existing pavement at potential tie-in point for phased construction.

PROPOSED ALTERNATIVE:

Revise profile to better match existing pavement at this location to reduce cost of temporary tie-in and improve safety.

BENEFITS	RISKS/CHALLENGES
• Temporary connector less costly to construct	• Incremental increase in roadway excavation
• Tie-in construction significantly faster due to less placement of embankment along roadway	•
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•	•
•	•
•	•
•	•

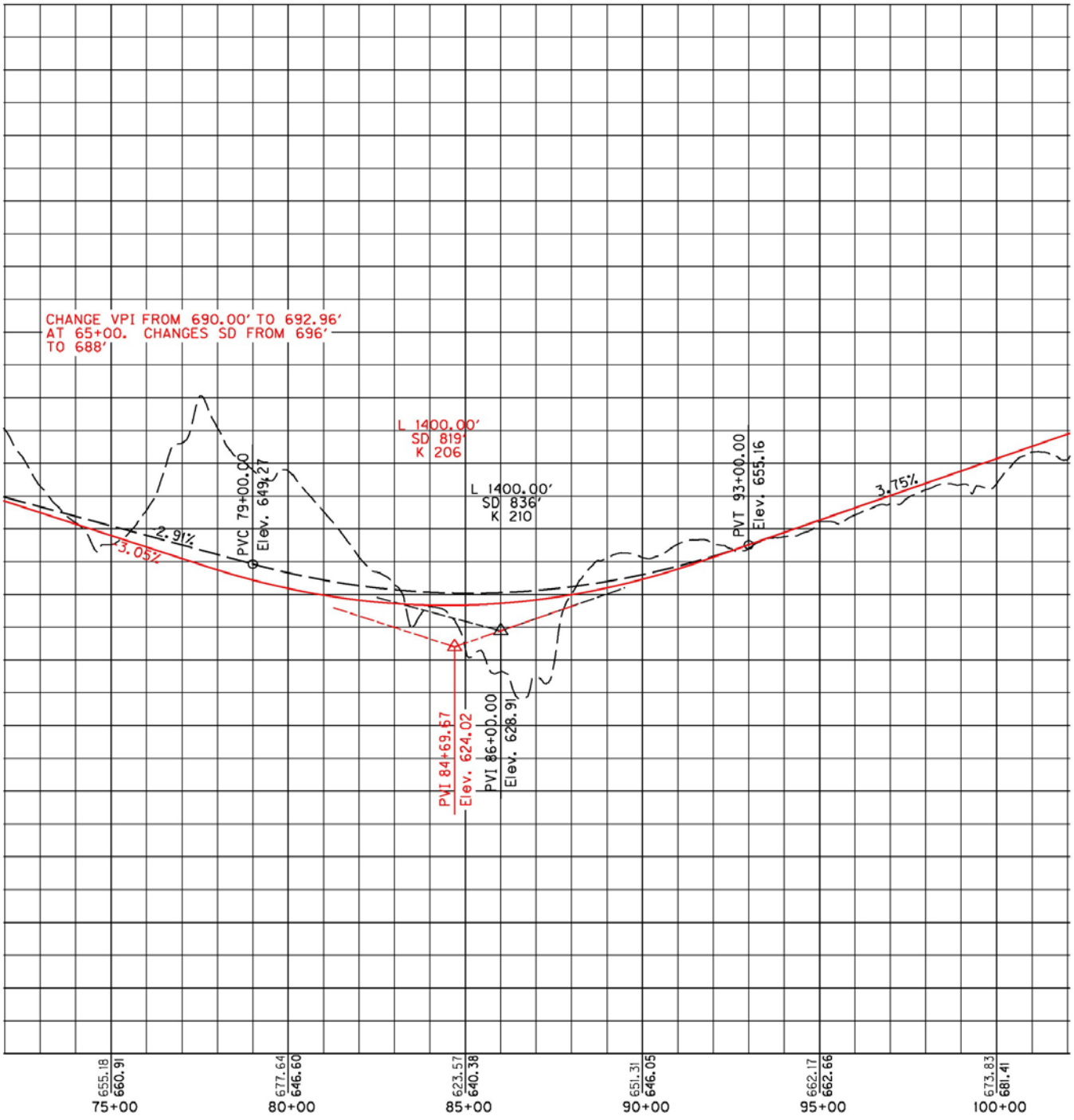
OVERALL PERFORMANCE SCORE **2.80**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 258,000	$ -	$ 258,000
PROPOSED ALTERNATIVE:	$ 104,000	$ -	$ 104,000
TOTAL (Baseline less Proposed)	$ 154,000	$ -	**$ 154,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 5
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic

SKETCH OF BASELINE ASSUMPTION AND PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 5
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic

DISCUSSION/JUSTIFICATION:

Upon review of the potential construction sections, it is anticipated that one logical place to end construction of a phase starting at the Bluegrass Parkway is approximately Station 86+00 where the new roadway would intersect with existing US 150. However, current plans indicate there is approximately a five-foot vertical grade distance between the existing and proposed grades. If the grades are brought closer together (one-foot grade difference), the work during the traffic switch between new and existing can be expedited and costs of temporary pavement greatly reduced. Also, with the work for the tie-in being done much faster, less risk for the traveling public and the workers.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 5
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No restrictions to access result.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Less disruption to traffic during construction.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	10	0.30
Justification	Allows for two lanes to be maintained at all times.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	No perceived impact to performance.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**2.80**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 5
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Temporary pavement	SY	1,200	92.00	110,400	670	92.00	61,640
Temporary earthwork	CY	3,200	40.00	128,000	800	40.00	32,000
Maintenance of Traffic (partial)	LS	1	20,000.00	20,000	1	10,000.00	10,000
TOTAL				258,000			104,000
						CWE (BASELINE LESS PROPOSED)	**154,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 6
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 3**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Two lanes in this portion includes westbound uphill passing lane.

PROPOSED ALTERNATIVE:

Same as baseline, but add eastbound down hill passing lane. This effectively becomes a four-lane undivided highway where eastbound mirrors westbound from Station 190+00 to Station 250+00. This allows passing opportunity for a mile, thus improving Level of Service.

BENEFITS	RISKS/CHALLENGES
• Provides opportunity to waste 62,000 CY	• Increases footprint by eight feet through cuts and fill areas
• Provides a passing situation for eastbound traffic	•
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•	•
•	•
•	•
•	•

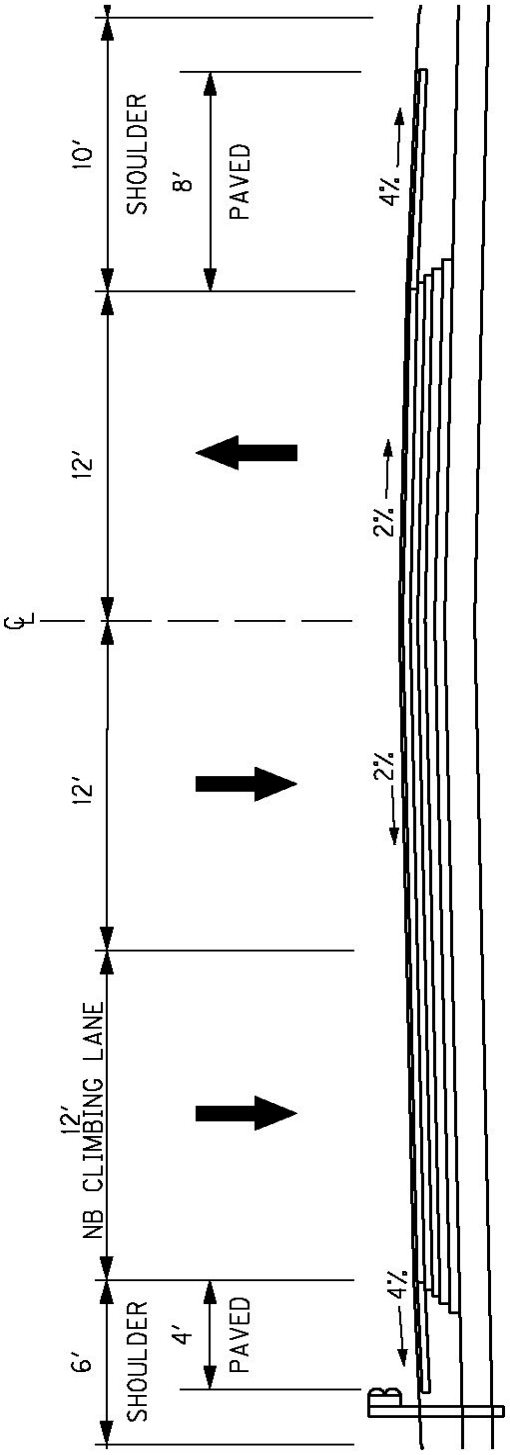
OVERALL PERFORMANCE SCORE **5.00**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 10,401,000	$ -	$ 10,401,000
PROPOSED ALTERNATIVE:	$ 11,001,000	$ -	$ 11,001,000
TOTAL (Baseline less Proposed)	$ (600,000)	$ -	**$ (600,000)**
			COST

VALUE ENGINEERING PROPOSAL
NO. 6
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service

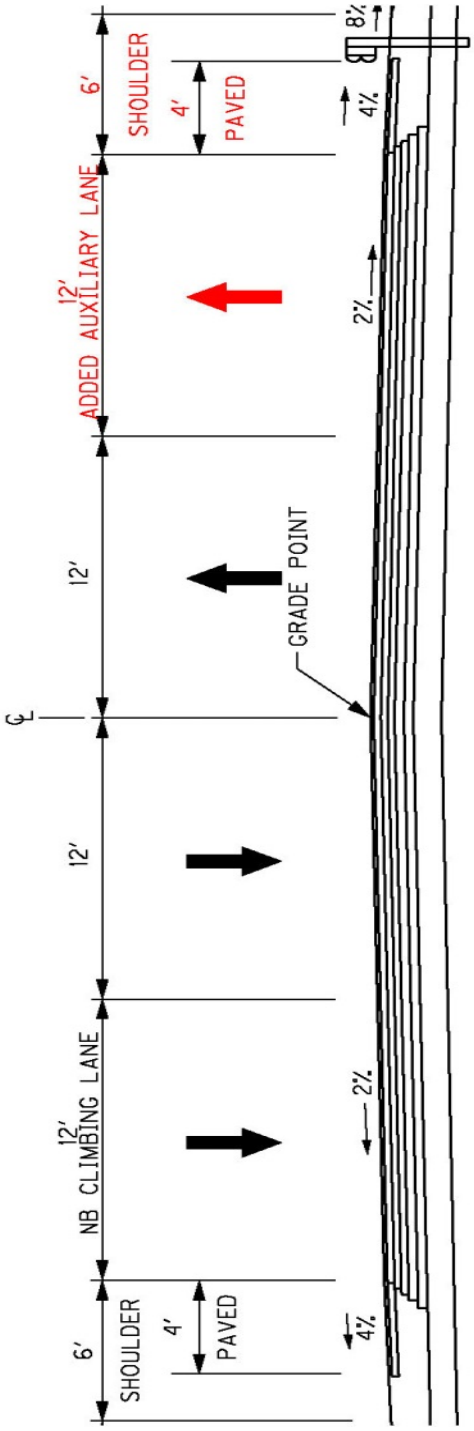
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL
NO. 6
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 6
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service

DISCUSSION/JUSTIFICATION:

Produces another opportunity for passing to reduce time spent following and increase capacity. An additional lane widens the footprint of the roadway by eight feet when six-foot shoulders are used. There is an additional cost in mainline pavements, but savings are likely with additional area to waste material.

Provides a passing situation for eastbound traffic and the only passing opportunity from KY 605 South in Nelson County to Grundy Home Road in Washington County, approximately 4.5 miles.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 6
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	10	5.00
Justification	Increases capacity; further reduces time spent following in eastbound direction.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No impact to performance.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	No impact to performance.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**5.00**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 6
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Pavement	SY	24,800	92.00	2,281,600	33,100	92.00	3,045,200
Shoulder pavement	SY	13,800	80.00	1,104,000	9,700	80.00	776,000
Earthwork	CY	701,500	10.00	7,015,000	716,000	10.00	7,160,000
Right-of-way	AC				2	10,000.00	20,000
TOTAL				10,401,000			11,001,000
						CWE (BASELINE LESS PROPOSED)	**(600,000)**

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

COST

VALUE ENGINEERING PROPOSAL
NO. 7
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 3**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

On Nelson County, Alternate 3, the KY 605 North approach ties into mainline at Station 81+00. A separate tie to existing US 150 is constructed across the Montgomery Auto Sales tract.

PROPOSED ALTERNATIVE:

The realigned KY 605 North would tie closer to Station 90+00 and provide an opportunity to tie to existing US 150 from the KY 605 North approach thus eliminating a connection to the proposed mainline. The intent is to connect the tie back to the Old US 150 from the KY 605 approach and have all that traffic entering the new alignment at a single point rather than two separate points.

This realignment would require the addition of another box culvert.

BENEFITS	RISKS/CHALLENGES
• Replaces two approaches with one	• Additional Reinforced Concrete Boc Culvert (RCBC) would need to be constructed
• Reduces total number of parcels and right-of-way takes	• Stream impacts may require additional environmental analysis
• Eliminates an approach access point	• Skewed alignment at mainline intersection
• Decreases impacts to useable land and traverses unusable land	• Not a direct access to Botland
•	•
•	•
•	•

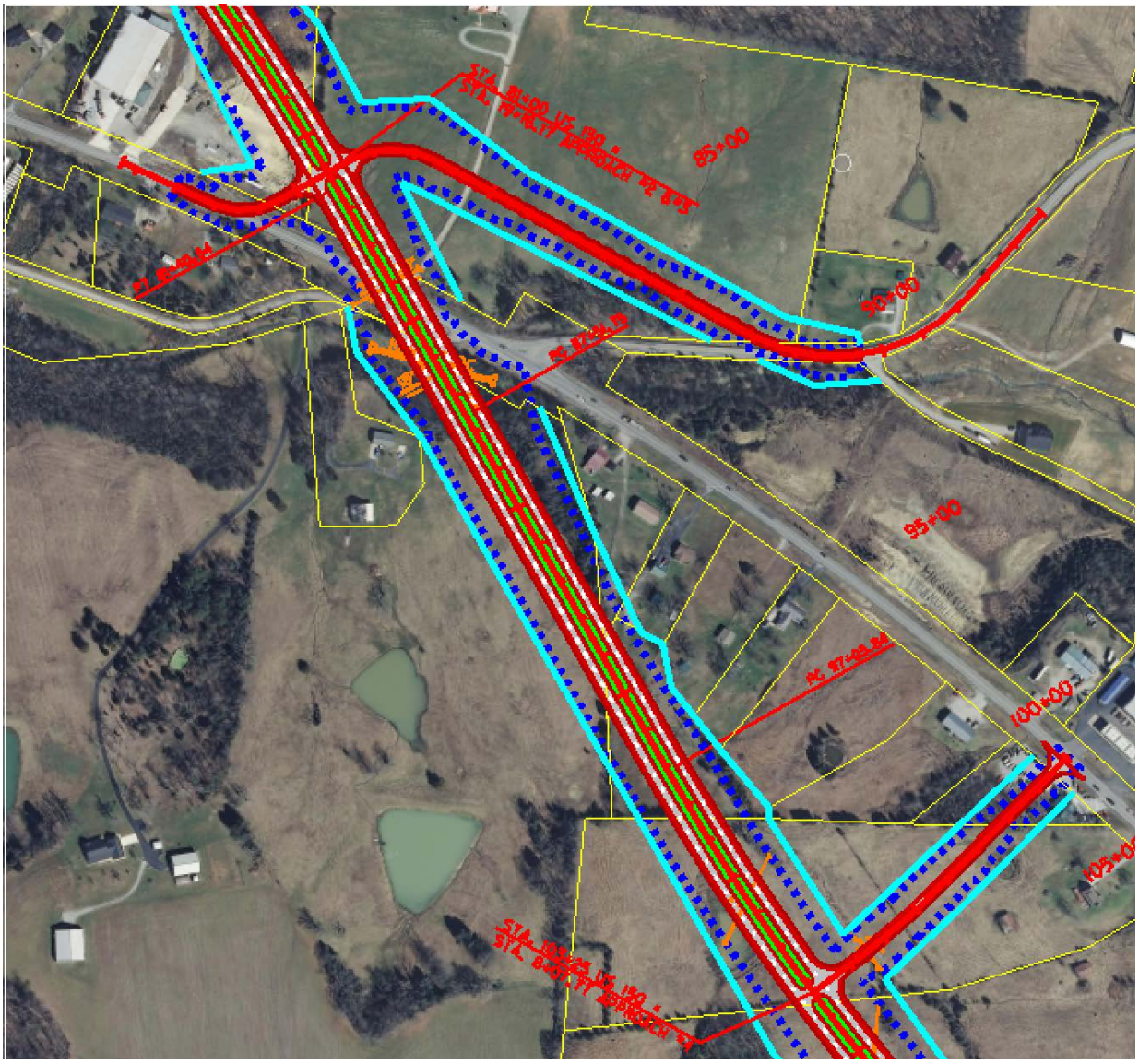
OVERALL PERFORMANCE SCORE **4.17**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 1,534,000	$ -	$ 1,534,000
PROPOSED ALTERNATIVE:	$ 1,015,000	$ -	$ 1,015,000
TOTAL (Baseline less Proposed)	$ 519,000	$ -	**$ 519,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 7
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one

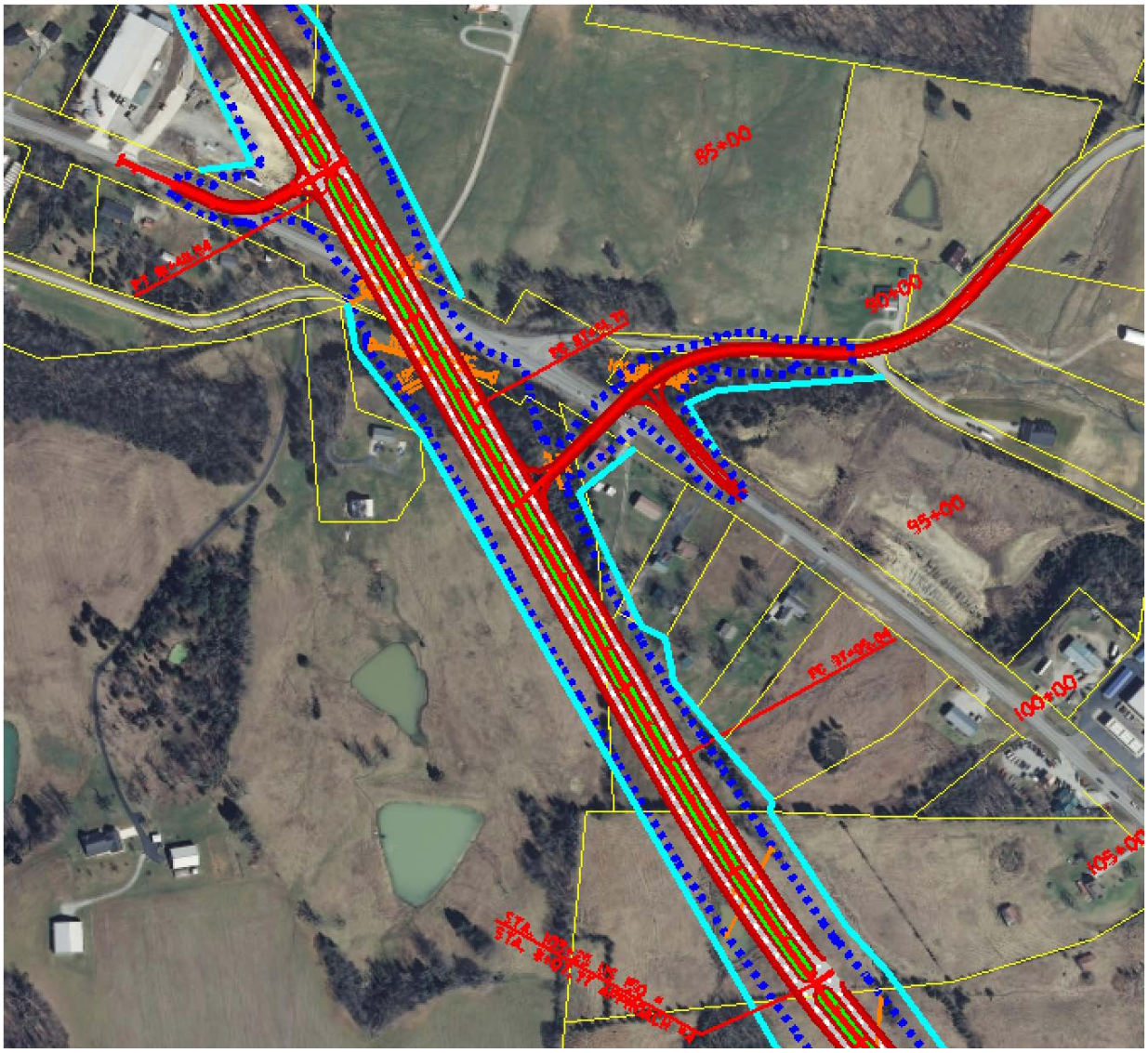
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL
NO. 7
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 7
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one

DISCUSSION/JUSTIFICATION:

The baseline KY 605 North alignment proposed with the Nelson County, off-corridor alternate traverses useable farmland with an approach alignment that is 1220 feet long. There is also another approach to tie to the section of US 150 remaining after construction that is 750 feet long. This baseline also assumes the acquisition of the Montgomery Auto Sales business. While the same cost is estimated for acquisition of a commercial parcel as for a residential parcel, the VE study team believes that the cost for commercial property will be higher than for residential in this area.

This VE proposal will eliminate the need for an additional approach tie to mainline where more substantial traffic would be entering the highway as opposed to an entrance. This proposed realignment also shortens the total approach work length to 1200 feet thus reducing pavement quantities and earthwork quantities. This realignment would require the construction of an additional 10' X 8' RCBC as it traverses a stream; however, the additional cost of this structure is offset by the savings in earthwork and pavement. In lieu of acquiring the Montgomery Auto Sales parcel, this realignment would acquire a residential parcel which the VE study team believes would be a cost savings; however, this is not reflected in the detailed cost breakdown due to trying to have an "apples-to-apples" comparison between alternates.

Costs were derived from rough design using unit costs provided to the VE study team for pavement, drainage structures and earthwork.

IMPLEMENTATION CONSIDERATIONS:

May impact stream greater than acceptable lengths for nationwide permit.

VALUE ENGINEERING PROPOSAL
NO. 7
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	Similar impact to proposed KY 605 North connection.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Improves mobility by eliminating an approach tie to mainline.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	Similar impact to proposed KY 605 North connection.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	5	1.67
Justification	Acquires residential property but eliminates the need to acquire commercial property for existing US 150 tie.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**4.17**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 7
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Pavement (approaches)	SY	5,445	92.00	500,940	2,830	92.00	260,360
Pavement (approach shoulder)	SY	1,005	80.00	80,400	546	80.00	43,680
Common excavation	CY	60,033	10.00	600,330	9,281	10.00	92,810
10'X8" RCBC with two headwalls	CF		25.00		9,360	25.00	234,000
Culvert pipe - 42 in	LF	77	155.00	11,935	77	155.00	11,935
Pipe culvert headwall - 42 in	EA	2	2,500.00	5,000	2	2,500.00	5,000
Number of parcels	EA	4	6,500.00	26,000	3	6,500.00	19,500
Right-of-way acquisition	AC	6	10,000.00	59,660	2	10,000.00	17,250
Residential # of takings	EA		250,000.00		1	250,000.00	250,000
Commercial # of takings	EA	1	250,000.00	250,000		250,000.00	
Garage/barns/sheds # of takings	EA	1	20,000.00		4	20,000.00	80,000
TOTAL				1,534,000			1,015,000
						CWE (BASELINE LESS PROPOSED)	**519,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 8
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Construct hybrid alignment based on revised traffic projections
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternates 1 and 3**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Construct five-lane section from Bluegrass Parkway to east of Botland (KY 605) off current alignment.

PROPOSED ALTERNATIVE:

Construct five lane section from Bluegrass Parkway to west intersection with KY 605 via alternate 3 and alternate 9, change to on alignment alternate 1 through Botland to KY 605, then transition back to off alignment alternate 3 with new alignment.

BENEFITS	**RISKS/CHALLENGES**
• Hybrid alignment proposed based on ADT in Botland not growing as much as projected	• Growth rate meets or exceeds projections; truck volumes in Botland unchanged
• Maintains strong connectivity to Botland (roadway remains on alignment)	• Future improvements in Botland limited to urban section
• Breaks project into construction phases comparable to desired budgets breakouts	•
• Allows for better constructability at the KY 605/US 150 western intersection	•
• Avoids major impacts to welding shop parcel	•
• Ultimately less overall lane length to maintain	•
•	•

OVERALL PERFORMANCE SCORE **4.17**

COST SUMMARY	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ 36,793,000	$ -	$ 36,793,000
PROPOSED ALTERNATIVE:	$ 35,732,000	$ -	$ 35,732,000
TOTAL (Baseline less Proposed)	$ 1,061,000	$ -	**$ 1,061,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL

NO. 8

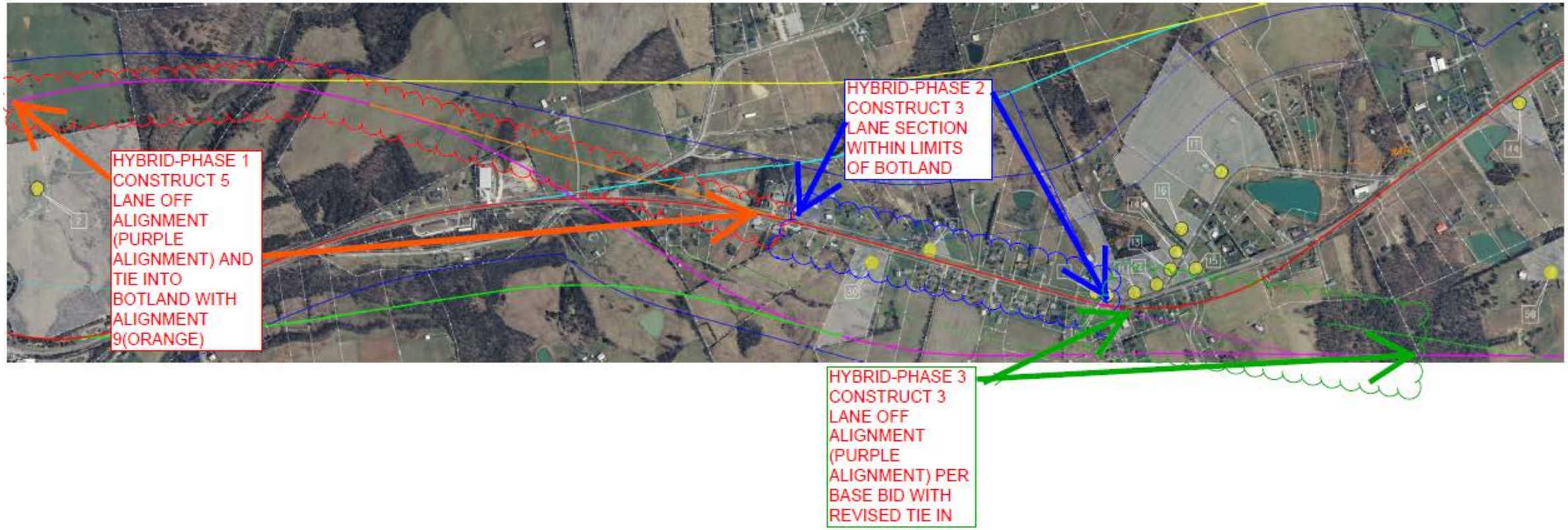
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Construct hybrid alignment based on revised traffic projections

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 8
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Construct hybrid alignment based on revised traffic projections

DISCUSSION/JUSTIFICATION:

Consideration of a hybrid approach to alignments begins with the existing traffic volumes for the project coupled with the growth rate for the design ADT. There is an existing drop in traffic volume through the Botland area of 3200 VPD compared to volumes near the Bluegrass Parkway. If applicable, when combined with a lesser growth rate, this provides for consideration of a three-lane section on alignment through Botland between the KY 605 intersections. This combination of alignments and potential construction phases would be:

1) Construct first phase as Alternate 3 (off corridor) from the Bluegrass Parkway to alignment 9 (Station 0+00 to Station 60+00). Utilize alignment 9 to tie into existing US 150. Tie western KY 605 approach to US 150 approximately Station 91+00.

2) Construct second phase on corridor through Botland to eastern KY 605 intersection with a three-lane typical section.

3) Construct third phase to begin with new alignment just east of KY 605 and tie into Alternate 3 (off corridor) to east towards the river.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 8
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Construct hybrid alignment based on revised traffic projections

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	10	1.67
Justification	Provides direct connectivity to Botland.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Improvements match traffic projections.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No impact to performance in sections 1 and 3; maintenance of traffic not as good through Botland.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	Same as on corridor alignment in Botland.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**4.17**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 8
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Construct hybrid alignment based on revised traffic projections						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
OFF ALIGNMENT - ALTERNATE 3							
Embankment	CY	700,000	10.00	7,000,000	700,000	10.00	7,000,000
Pavement (main)	SY	51,000	92.00	4,692,000	51,000	92.00	4,692,000
Pavement (shoulders)	SY	26,000	80.00	2,080,000	26,000	80.00	2,080,000
Double 12'X8' RCBC with two headwalls	CF	96,768	20.00	1,935,360	96,768	20.00	1,935,360
Contingency (25%)	LS	1	3,900,000.00	3,900,000	1	3,900,000.00	3,900,000
TOTAL				19,607,000			19,607,000
						CWE (BASELINE LESS PROPOSED)	

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

NO CHANGE

VALUE ENGINEERING PROPOSAL
NO. 8
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Construct hybrid alignment based on revised traffic projections

On Corridor between KY 605 Intersections Station 99+00 to Station 140+00

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost	TOTAL $	Qty	Unit Cost	TOTAL $
Embankment	CY	26,500	10.00	265,000	21,033	10.00	210,330
Pavement (main)	SY	16,400	92.00	1,508,800	5,466	92.00	502,872
Pavement (shoulder)	SY	7,300	80.00	584,000	7,300	80.00	584,000
TOTAL				2,358,000			1,297,000
						CWE (BASELINE LESS PROPOSED)	**1,061,000**

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

Off Corridor from KY 605 Intersection east to Bridge Station 140+00 to Station 265+00

DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Excavation	CY	1,300,000	6.50	8,450,000	1,300,000	6.50	8,450,000
Pavement (main)	SY	50,000	92.00	4,600,000	50,000	92.00	4,600,000
Pavement (shoulder)	SY	22,222	80.00	1,777,760	22,222	80.00	1,777,760
TOTAL				14,828,000			14,828,000
						CWE (BASELINE LESS PROPOSED)	**0**

Note: Total costs are rounded to the nearest thousand dollars. **NO CHANGE**

VALUE ENGINEERING PROPOSAL
NO. 9
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternates 1 and 3**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Nelson "on corridor" alternative (Alternative 1): five-lane rural section from KY 605 North to KY 605 South (approximately 4500 feet).

Nelson "off corridor" alternative (Alternative 3): four-lane with depressed median from KY 605 to KY 605 South (approximately 5600 feet)

PROPOSED ALTERNATIVE:

For Alternates 1 and 3, construct three-lane (two-lane + two-way left-turn lane) from KY 605 North to KY 605 South.

BENEFITS	**RISKS/CHALLENGES**
• Reduces right-of-way	• Future capacity needs may not be met
• Off corridor alternative misses storage barn	• Reduces Level of Service
• Eliminates drainage and maintenance in the depressed median (off corridor)	• Public expectations may not be met
• Reduces conflict points at intersections	•

OVERALL PERFORMANCE SCORE **-0.68**

COST SUMMARY - ALTERNATE 1: ON CORRIDOR	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ 3,597,000	$ -	$ 3,597,000
PROPOSED ALTERNATIVE:	$ 2,206,000	$ -	$ 2,206,000
TOTAL (Baseline less Proposed)	$ 1,391,000	$ -	**$ 1,391,000**
			SAVINGS

COST SUMMARY - ALTERNATE 3: OFF CORRIDOR	**Initial Costs**	**O&M Costs**	**Total Life Cycle Cost**
BASELINE ASSUMPTION:	$ 6,578,000	$ -	$ 6,578,000
PROPOSED ALTERNATIVE:	$ 5,129,000	$ -	$ 5,129,000
TOTAL (Baseline less Proposed)	$ 1,449,000	$ -	**$ 1,449,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL

NO. 9

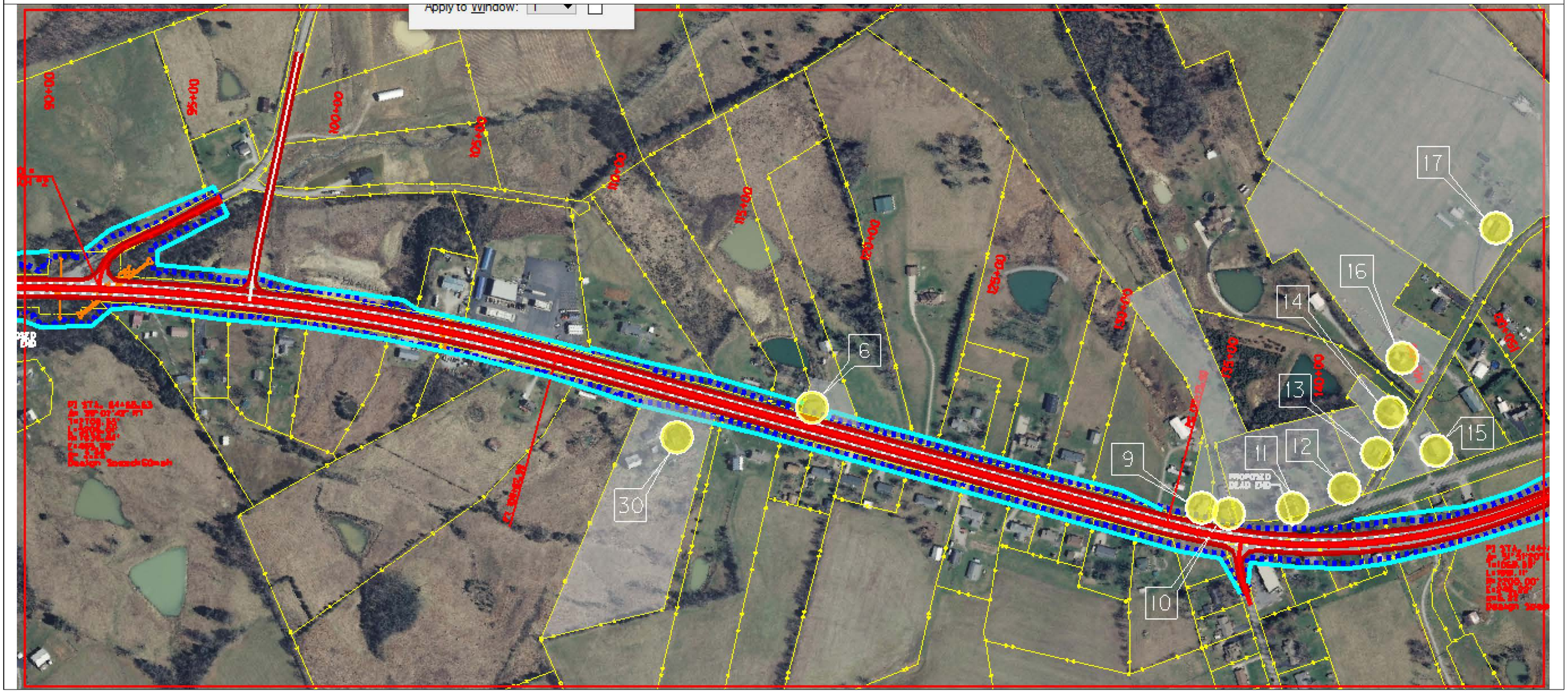
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)

SKETCH OF BASELINE ASSUMPTION – ON CORRIDOR



VALUE ENGINEERING PROPOSAL

NO. 9

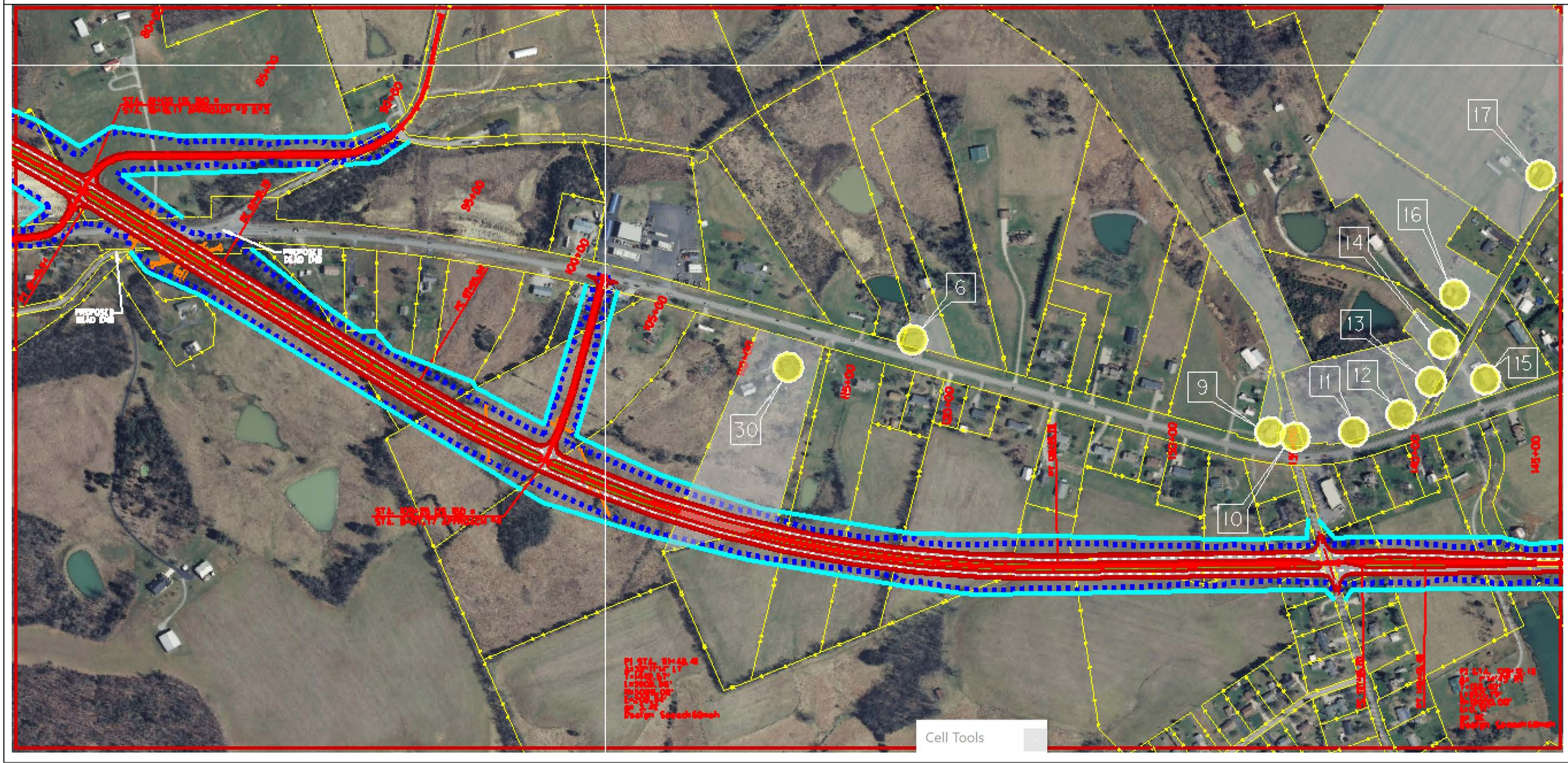
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)

SKETCH OF BASELINE ASSUMPTION – OFF CORRIDOR



VALUE ENGINEERING PROPOSAL

NO. 9

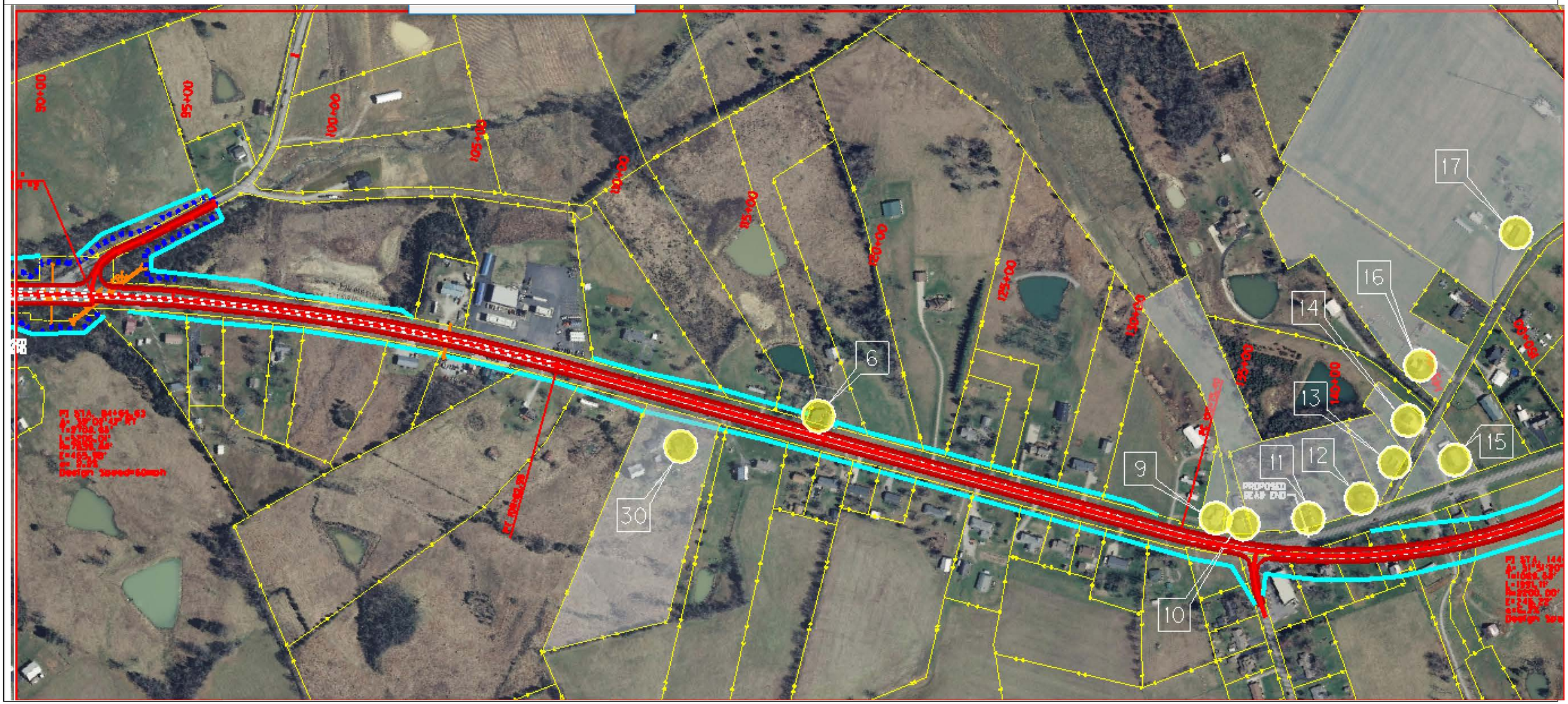
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)

SKETCH OF PROPOSED ALTERNATIVE – ON CORRIDOR



VALUE ENGINEERING PROPOSAL

NO. 9

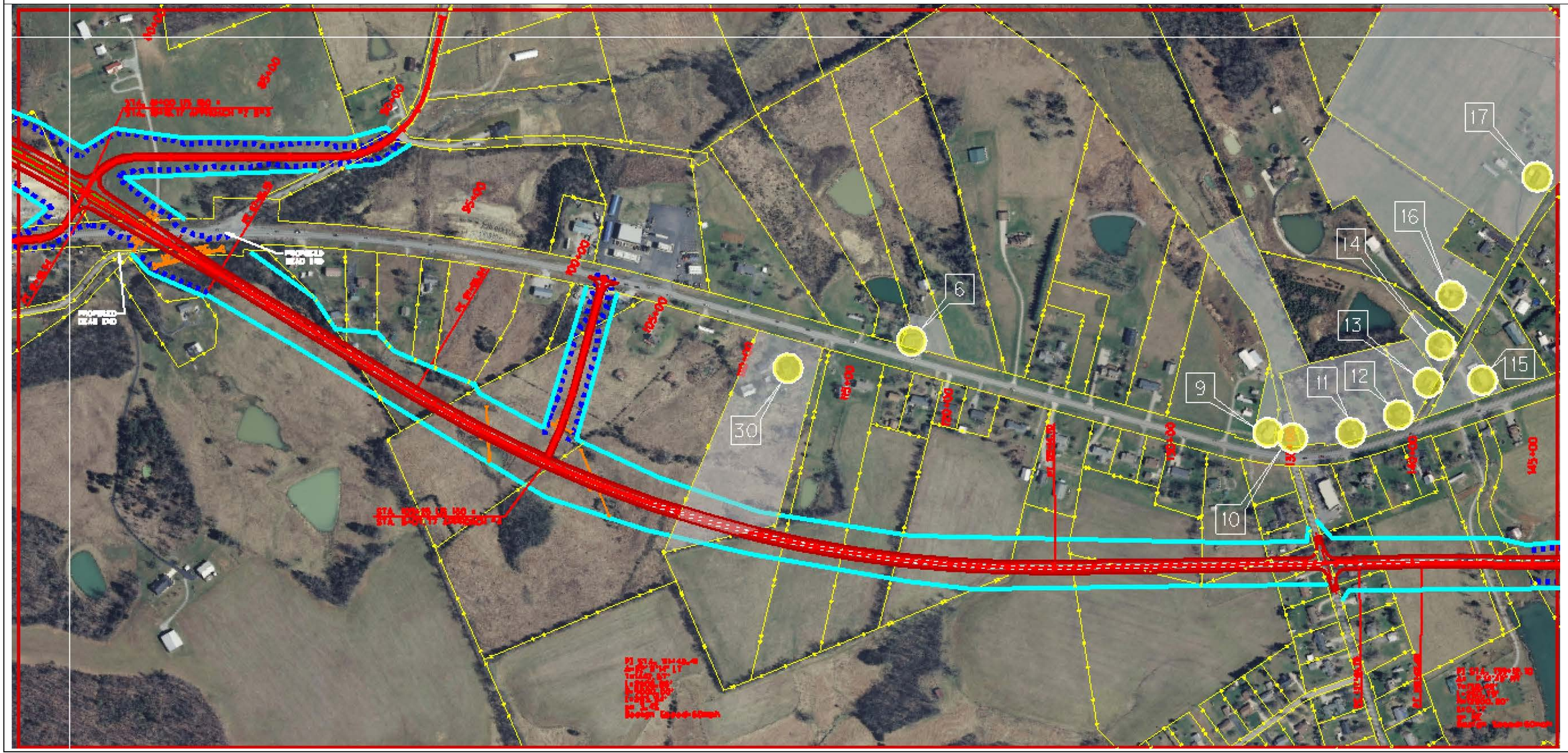
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)

SKETCH OF PROPOSED ALTERNATIVE – OFF CORRIDOR



VALUE ENGINEERING PROPOSAL
NO. 9
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)

DISCUSSION/JUSTIFICATION:

Current traffic volumes are 9000 ADT (2014) or less between KY 605 North and KY 605 South. The increase in traffic is west of the KY 605 intersection. Similarly, the traffic projections for the future (2035) are 13000 ADT. Basic traffic engineering requirements allow for 17,000 ADT for a two-lane facility.

Right-of-way cost should be reduced due to the reduction in land and one storage barn acquisition. Calculated right-of-way is based on width of the reduced lane amount. The on corridor alternative will have some added value beyond the cost per acre due to the proximity of the road to the existing homes and businesses.

The value in cost savings due to the reduction in lanes can be accounted for during the construction phase. Costs are based on an order of magnitude for earthwork, pavement and drainage assumptions.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 9
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No changes to access.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	-5	-2.50
Justification	Some reduction in Level of Service.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	5	0.15
Justification	Maintenance of traffic through Botland may be slightly compromised due to the minimal widening and reduced width for two lanes of traffic and working room.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	5	1.67
Justification	Some reduction in right-of-way.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**-0.68**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 9
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
ALTERNATE 1 - ON CORRIDOR							
Earthwork	CY	56,865	10.00	568,650	36,278	10.00	362,780
Pavement	SY	31,000	92.00	2,852,000	19,000	92.00	1,748,000
Right-of-way acquisition	AC	5.65	10,000.00	56,500	3	10,000.00	30,000
Drainage	LS	1	100,000.00	100,000	1	65,000.00	65,000
Right-of-way acquisition (storage)	LS	1	20,000.00	20,000			
TOTAL				3,597,000			2,206,000
						CWE (BASELINE LESS PROPOSED)	**1,391,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 9
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
ALTERNATE 3 - OFF CORRIDOR							
Earthwork	CY	226,729	10.00	2,267,290	199,520	10.00	1,995,200
Pavement	SY	29,900	92.00	2,750,800	23,700	92.00	2,180,400
Pavement - shoulder	SY	5,000	80.00	400,000	-	80.00	
Right-of-way acquisition	AC	26	10,000.00	260,000	18	10,000.00	180,000
Drainage	LS	1	899,410.00	899,410	1	773,000.00	773,000
TOTAL				6,578,000			5,129,000
						CWE (BASELINE LESS PROPOSED)	**1,449,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 10
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 1**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

The Nelson County, on corridor alternate was used as the baseline for this proposal. The on corridor alternate proposes to construct five lanes from the beginning to the southern intersection of KY 605. Three lanes are constructed from that point to the river.

PROPOSED ALTERNATIVE:

Construct a two-lane facility with full paved shoulders and dedicated left-turn lanes at major intersections.

BENEFITS	RISKS/CHALLENGES
• Limits impacts to historic and other properties	• Increases difficulty of maintenance of traffic
•	• Decreases Level of Service compared to baseline
•	•
•	•
•	•
•	•
•	•

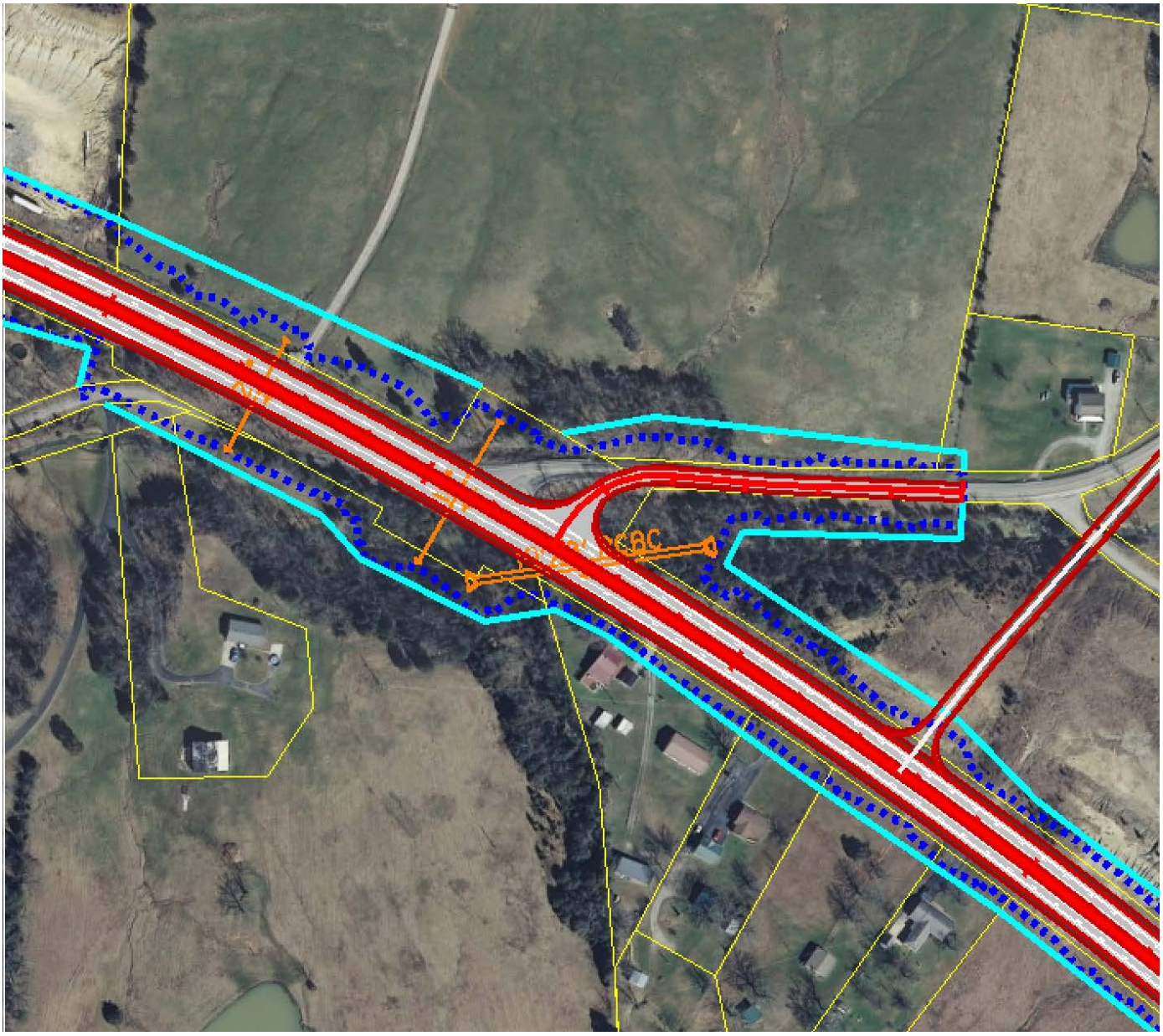
OVERALL PERFORMANCE SCORE **-5.15**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 23,703,000	$ -	$ 23,703,000
PROPOSED ALTERNATIVE:	$ 17,008,000	$ -	$ 17,008,000
TOTAL (Baseline less Proposed)	$ 6,695,000	$ -	**$ 6,695,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 10
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes

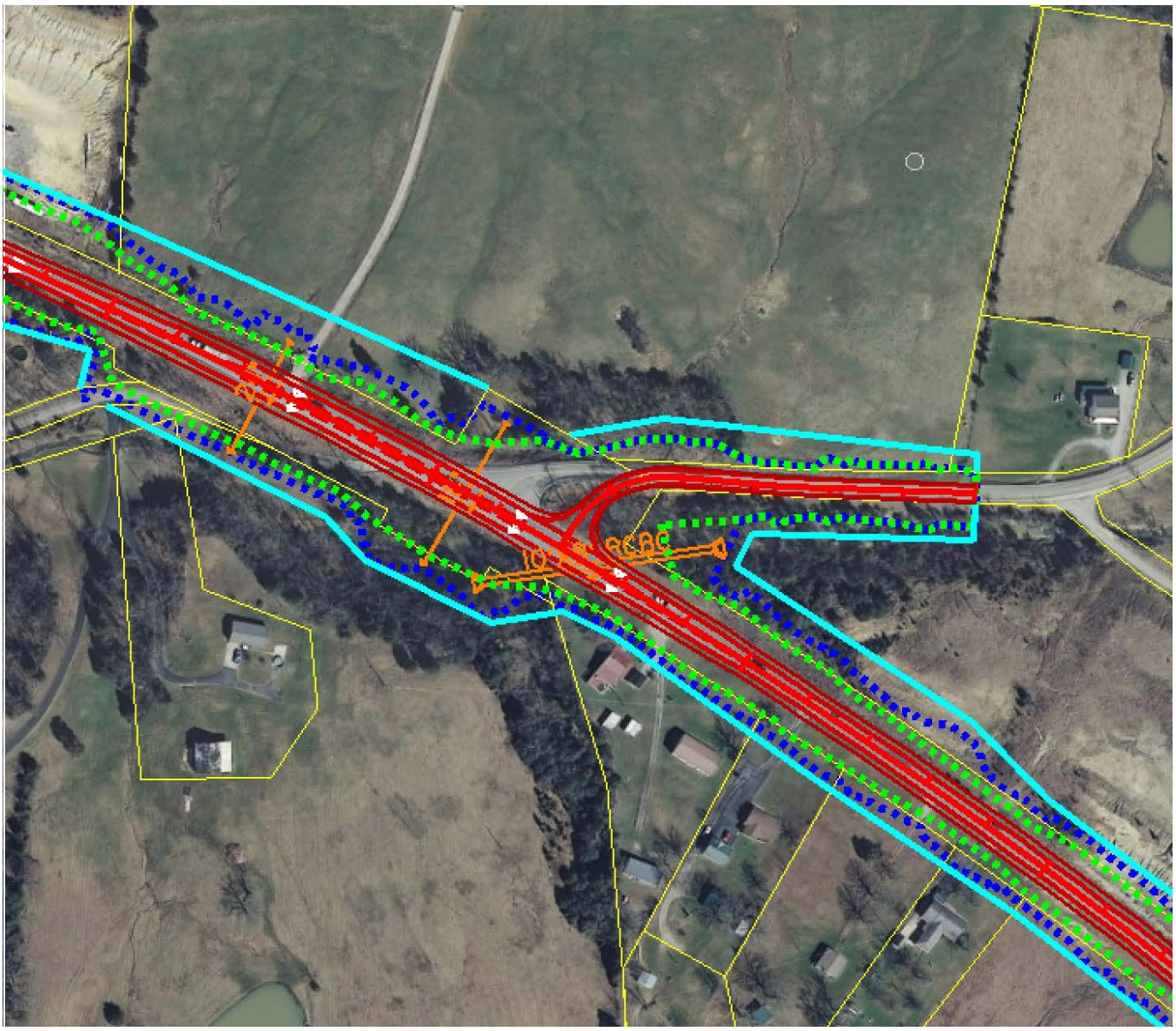
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL
NO. 10
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 10
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes

DISCUSSION/JUSTIFICATION:

The baseline condition proposes a five-lane roadway near existing alignment from the interchange to the southern intersection of KY 605. The sections is predicated on an aggressive traffic growth factor of 2.2%. Assuming a lower growth factor, it may be possible to construct turn lanes in lieu of additional through lanes.

This proposal considers dedicated left turn lanes at both KY 605 intersections. It also keeps the truck climbing lane coming into Bardstown from the river. This is based on the assumption that the KY 605 intersections have sufficient turning volume to warrant dedicated turn lanes.

Based on input from the design team, constructing a two-lane facility off corridor was not a feasible alternative.

The cost was estimated based on rough modeling for earthwork volumes and paving areas. Additional cost avoidance may be achieved when considering drainage structures.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 10
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No change in access is anticipated with this proposal compared to the baseline.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	-10	-5.00
Justification	The elimination of through lanes will negatively impact mobility when compared to the baseline.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	-5	-0.15
Justification	Due to the narrower width, MOT will be more difficult and will likely require revision of the baseline to perform widening, utilizing existing pavement.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	While a narrower footprint could be used, for this proposal, the proposed right-of-way was assumed to be unchanged for future widening.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**-5.15**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 10
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Pavement (mainline)	SY	152,426	92.00	14,023,192	93,118	92.00	8,566,856
Pavement (mainline shoulders)	SY	48,001	80.00	3,840,080	60,731	80.00	4,858,480
Embankment in place	CY	583,937	10.00	5,839,370	358,225	10.00	3,582,250
TOTAL				23,703,000			17,008,000
						CWE (BASELINE LESS PROPOSED)	**6,695,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 11
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract
LOCATION:	**Item No. 4-396.20 (Washington County), Segment IV, Section A, Alternates 1 and 2**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Using 2+1 template through the area of the PACE tract, the curve is adjusted significantly toward the PACE tract from existing radius 1145.92 feet to baseline radius 1750 feet.

PROPOSED ALTERNATIVE:

By adjusting the tangent by 15 minutes and utilizing a 1500-foot radius, the alignment can be pulled away from the hillside at the PC approximately 23+50 but stay closer to the existing centerline through the majority of the curve to limit impacts to the PACE parcel.

BENEFITS	**RISKS/CHALLENGES**
• Reduces impacts to PACE parcel	• Still impacts PACE parcel
•	• Reduces roadway radius
•	•
•	•
•	•
•	•
•	•

OVERALL PERFORMANCE SCORE **3.33**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 23,000	$ -	$ 23,000
PROPOSED ALTERNATIVE:	$ 15,000	$ -	$ 15,000
TOTAL (Baseline less Proposed)	$ 8,000	$ -	**$ 8,000**
			SAVINGS

VALUE ENGINEERING PROPOSAL

NO. 11

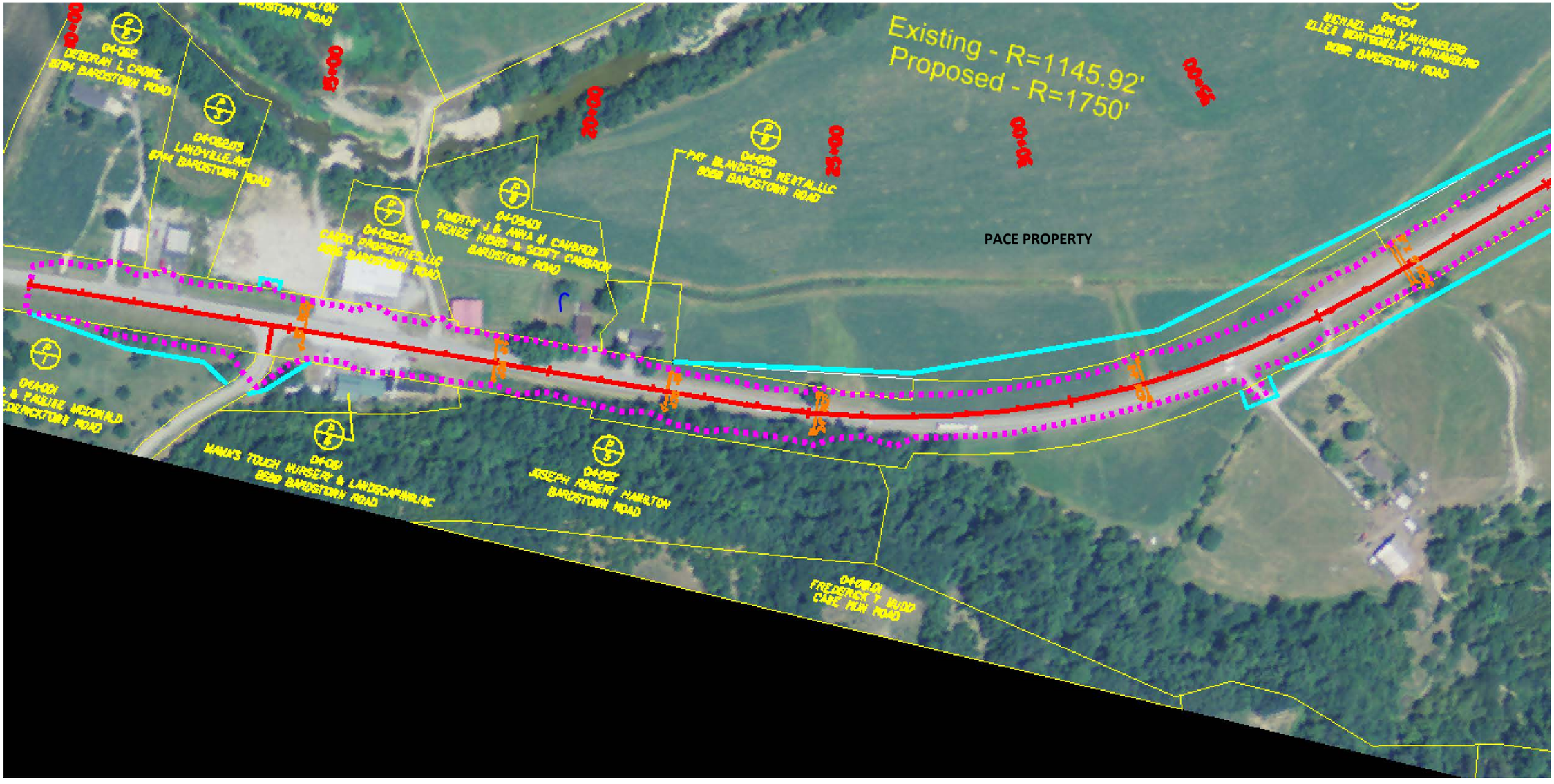
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract

SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL

NO. 11

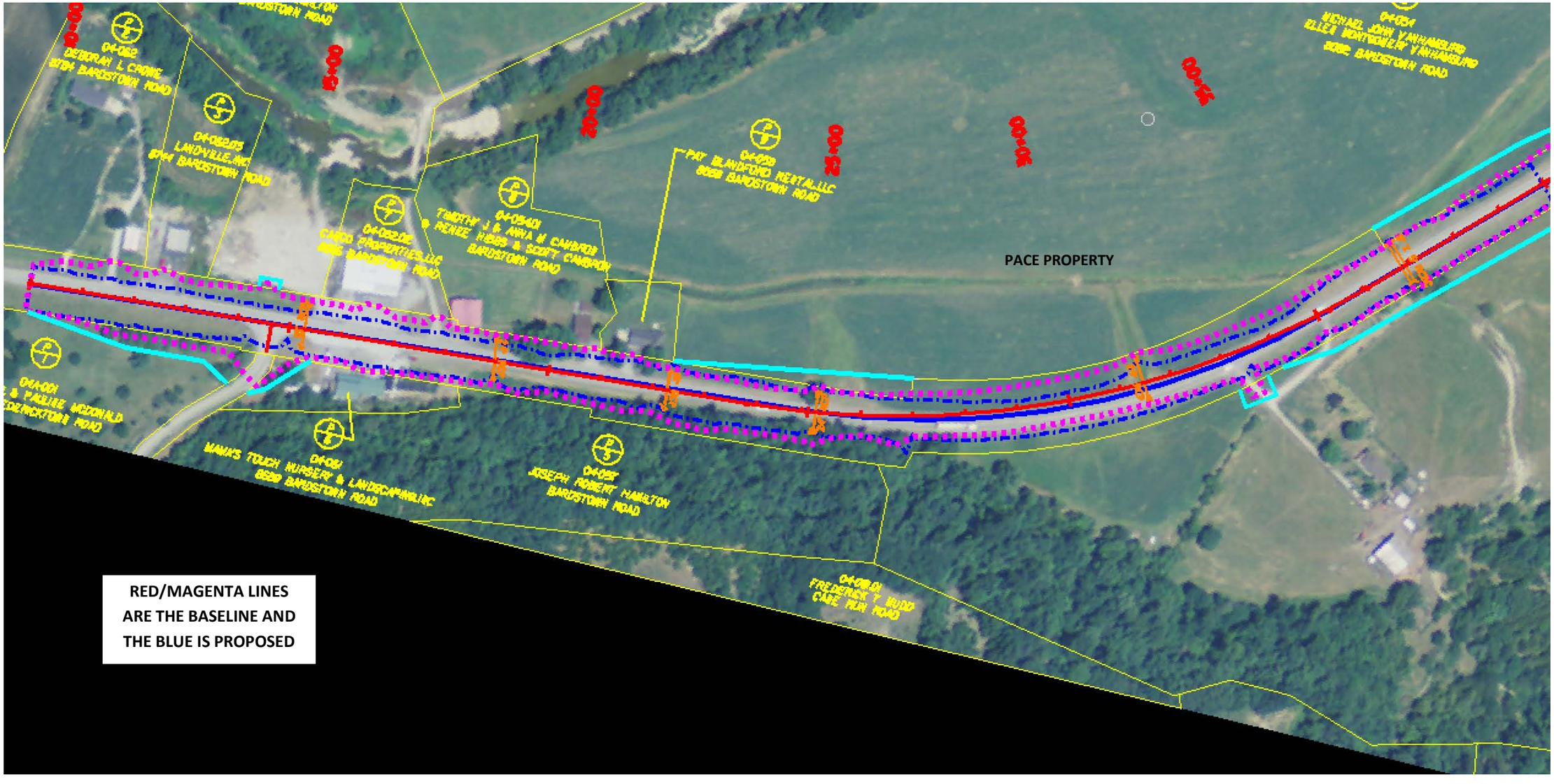
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 11
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract

DISCUSSION/JUSTIFICATION:

The purpose of this proposal is to reduce or eliminate right-of-way takings from the parcel covered by the PACE. In investigating this proposal, one potential constraint necessitating moving away from existing in this location was determined as the tall existing cut which would result in large cuts and wide disturbed limits.

To remedy this situation, the VE study team has proposed to adjust the baseline alignment from the beginning of Segment IV, Section A through the subject curve. An adjustment of just 0°15" in bearing will pull the centerline away from the hillside by 6 feet by the time you reach the original PC. Adjusting the horizontal radius from 1750 feet to 1500 feet will move centerline back toward existing centerline and away from the PACE tract.

Changes to construction costs were assumed to be negligible and the main savings is in right-of-way. The necessary right-of-way from the PACE tract would decrease from 1.6ac in the baseline to 0.8ac with this proposal. The 2+1 westbound passing segment was also adjusted to end earlier in an effort to minimize impact at the existing right-of-way "pinch point" around baseline Station 27+00.

Another possible solution to navigating the PACE issues may be to acquire any necessary area in temporary easement for the duration of construction at which time it would convert back to its agricultural purpose. From the KY Department of Agriculture's website, the PACE program is intended to "ensure that lands currently in agricultural use will continue to remain available for agriculture and not be converted to other uses." From this description it may be possible to argue that a temporary easement is not changing the use of the land.

It should also be noted that in analyzing this proposal, it was determined that the roadway grade in the area of the superelevation transition may not be sufficient to maintain pavement drainage. It is recommended that this be looked at further as well as other areas with flat longitudinal grade (<~0.75%) in the area of superelevation transition to ensure pavement drainage is maintained.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 11
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	0	0.00
Justification	No impact to performance.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	MOT will be made marginally more difficult; however, two-lane traffic can still be maintained during construction.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	10	3.33
Justification	Impacts to the PACE parcel will be reduced by half, although impacts are still present.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**3.33**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 11
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty	Unit Cost $	TOTAL $
Number of parcels	EA	1	6,500.00	6,500	1	6,500.00	6,500
Right-of-way acquisition	AC	1.677	10,000.00	16,770	0.856	10,000.00	8,560
TOTAL				23,000			15,000
						CWE (BASELINE LESS PROPOSED)	**8,000**

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

SAVINGS

VALUE ENGINEERING PROPOSAL
NO. 12
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift bridge location northeast to allow maintenance of traffic
LOCATION:	**Item No. 4-396.30 (Washington County), Segment V, Sections C and D, Alternates 1 and 2**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Reconstruct bridge over Cartwright Creek at same location, matching either Section C alternate 1 (widen with truck climbing lane to north) or alternate 2 (widen for truck lane symmetrically along existing).

PROPOSED ALTERNATIVE:

Reconstruct bridge over Cartwright Creek offset north to allow existing bridge to remain in use during phased construction of new structure.

BENEFITS	RISKS/CHALLENGES
• Roadway remains open during construction	• Narrower lanes during construction
• Traffic remains on alignment during construction, less confusing to drivers	• Transitions may require additional foot print to accommodate shift
• New structure will have wider shoulders similar to proposed roadway template	•
•	•
•	•
•	•
•	•

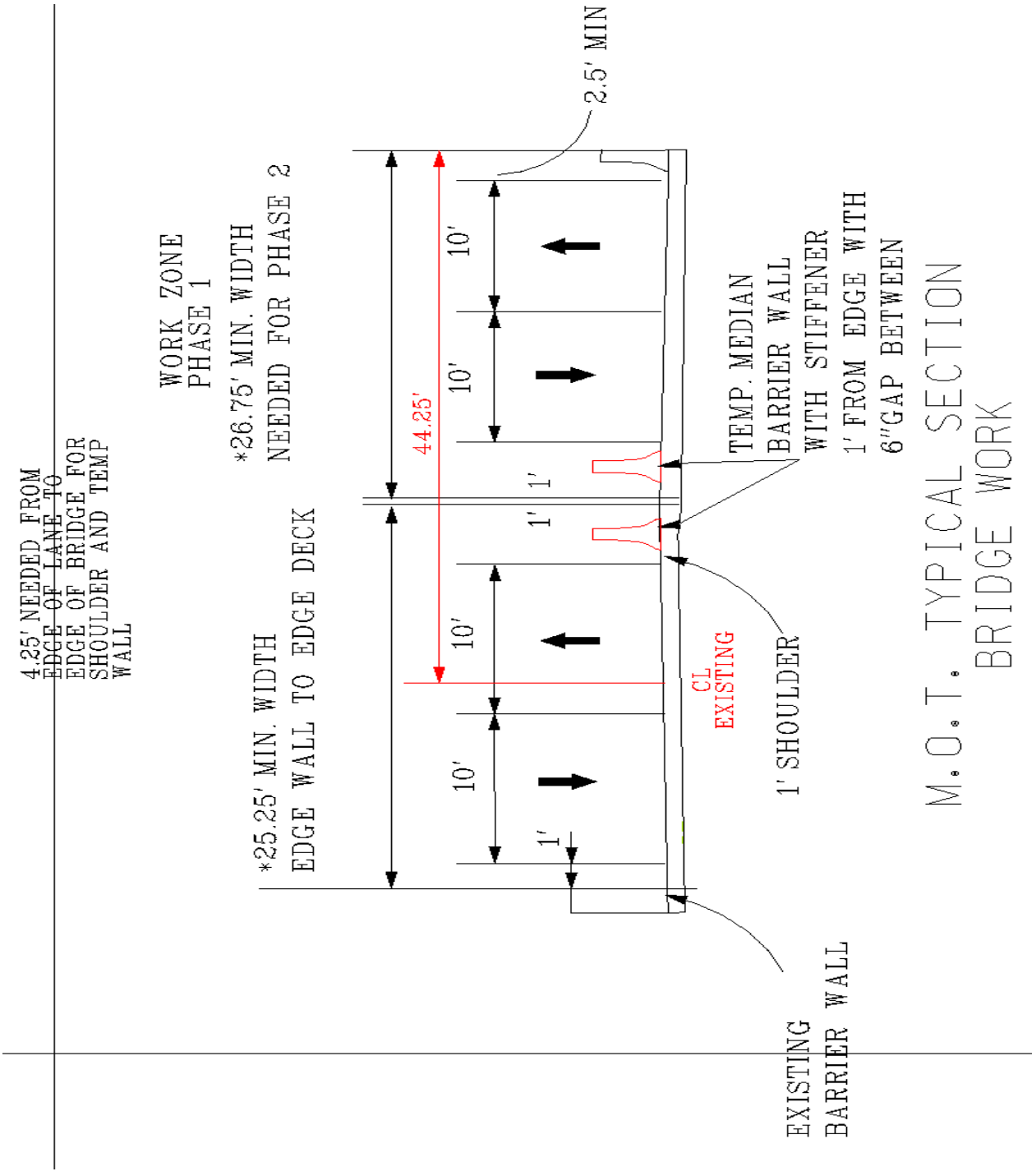
OVERALL PERFORMANCE SCORE **2.80**

COST SUMMARY	Initial Costs	O&M Costs	Total Life Cycle Cost
BASELINE ASSUMPTION:	$ 1,900,000	$ -	$ 1,900,000
PROPOSED ALTERNATIVE:	$ 2,176,000	$ -	$ 2,176,000
TOTAL (Baseline less Proposed)	$ (276,000)	$ -	**$ (276,000)**
			COST

VALUE ENGINEERING PROPOSAL
NO. 12
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift bridge location northeast to allow maintenance of traffic

SKETCH OF BASELINE ASSUMPTION AND PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 12
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift bridge location northeast to allow maintenance of traffic

DISCUSSION/JUSTIFICATION:

With no viable detour to reroute traffic around the US 150 bridge to be reconstructed over Cartwright Creek at the north end of 4-396.30, Section C, it is expected the bridge will need to be reconstructed in phases. Based on discussions with the design team, maintaining two lanes of traffic on US 150 at all times during construction is required. It is suggested consideration be given to shifting (widening) the new bridge during phase 1 to the northeast to allow for sufficient width to be constructed without impacting traffic on the existing bridge. The width of new bridge constructed during phase 1 on the northeast side needs to be at least 26.75' in width so that two lanes of traffic can be shifted to the new structure during phase 2. See example sketch for further information regarding proposed temporary lane widths. It is our understanding a 44-foot wide bridge is being proposed. This will be very difficult to build part width and maintain lane widths that can accommodate.

It is expected that this proposal results in minimal additional costs based upon the following:

1) Unless the roadway at the bridge is restricted to 1 lane width during construction, traffic will need to use the shoulders temporarily to navigate around the work zone. Any additional temporary pavement needed for this is required in both the baseline option and this option.

2)This proposal fits very well with Alternate 1 (widen for truck lane to North), allowing for less temporary pavement than the Alternate 2 (symmetrical version)

3) Shift in alignment could be used to better match bridge shift or just have shoulder wider on one side.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 12
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift bridge location northeast to allow maintenance of traffic

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No restrictions to access.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	5	2.50
Justification	Roadway traffic flow impacts are minimized during construction.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	10	0.30
Justification	Allows for two lanes to be maintained at all times.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	0	0.00
Justification	No impact to performance.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**2.80**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 12
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift bridge location northeast to allow maintenance of traffic						
DESIGN ELEMENT	**BASELINE ASSUMPTION**				**PROPOSED ALTERNATIVE**		
Description	Unit	Qty	Unit Cost $	TOTAL $	Qty		TOTAL $
Bridge*	SF	9,350	203.21	1,900,014	10,710	203.21	2,176,379
TOTAL				1,900,000			2,176,000
						CWE (BASELINE LESS PROPOSED)	**(276,000)**

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

COST

***Additional cost shown is based on total bridge width of 47' per baseline versus 55' needed to build in phases without a detour or diversion. Shifting the alignment may also increase earthwork and right-of-way impacts (not accounted for in this VE proposal).

DESIGN SUGGESTIONS

VALUE ENGINEERING PROPOSAL
NO. 13
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Verify that the growth factor for traffic forecast data is accurate for design determination impacts
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternates 1 and 3**
FUNCTION:	**Increase Capacity**

BASELINE ASSUMPTION:

The growth rate used for traffic projections for this project corridor is very aggressive (2.2%/1.9% for the Nelson County sections).

PROPOSED ALTERNATIVE:

It is suggested that the Design Team revisit the growth rate used and determine if this rate is truly sustainable for 20 years. This information can be used as a tool for the development of a phased approach that better matches performance based solutions and as a budgetary tool to plan for implementation of construction phases based on performance projections.

BENEFITS	RISKS/CHALLENGES
● Performance Based Flexible Solution (PBFS)	● Growth rate prediction is not an exact science
● Allows for more accurate implementation of phased approach	● "If growth rate accelerates," implementation of final phases sooner than planned
● Construction budget tool	●
● Potential design changes result in cost savings	●
●	●
●	●
●	●

OVERALL PERFORMANCE SCORE **10.00**

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL

NO. 13

Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Verify that the growth factor for traffic forecast data is accurate for design determination impacts

SKETCH OF BASELINE ASSUMPTION AND PROPOSED ALTERNATIVE

ADT 12000 CURRENT

	YEAR					PROJECTED ADT BASED ON COMPUND GROWTH RATE SHOWN															
G RATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	USE
0.01	12120	12241	12364	12487	12612	12738	12866	12994	13124	13255	13388	13522	13657	13794	13932	14071	14212	14354	14497	14642	15000
0.015	12180	12363	12548	12736	12927	13121	13318	13518	13721	13926	14135	14347	14563	14781	15003	15228	15456	15688	15923	16162	
0.0175	12210	12424	12641	12862	13087	13316	13549	13787	14028	14273	14523	14777	15036	15299	15567	15839	16116	16398	16685	16977	
0.02	12240	12485	12734	12989	13249	13514	13784	14060	14341	14628	14920	15219	15523	15834	16150	16473	16803	17139	17482	17831	
0.022	12264	12534	12810	13091	13379	13674	13975	14282	14596	14917	15245	15581	15924	16274	16632	16998	17372	17754	18145	18544	

ADT 12000 HYBRID GROWTH

0.022	12264	12534	12810	13091	13379	13674															
0.015							13879	14087	14298	14513	14730										
0.01												14878	15027	15177	15329	15482	15637	15793	15951	16111	16000

BASELINE

ADT		
G RATE	20	USE
0.01	14642	15000
0.015	16162	
0.0175	16977	
0.02	17831	
0.022	18544	19000

PROPOSED

ADT		
0.022		
0.015		
0.01	16111	16000

VALUE ENGINEERING PROPOSAL
NO. 13
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Verify that the growth factor for traffic forecast data is accurate for design determination impacts

Safety Evaluation of Installing Center Two-Way Left-Turn Lanes on Two-Lane Roads - See following page

CRASH MODIFICATION FACTORS CLEARINGHOUSE

Study Details

Study Title: Safety Evaluation of Installing Center Two-Way Left-Turn Lanes on Two-Lane Roads

Authors: Persaud et al.

Publication Date: 2008

Abstract: The Federal Highway Administration organized a Pooled Fund Study of 26 States to evaluate low-cost safety strategies as part of its strategic highway safety effort. One of the strategies chosen to be evaluated for this study was the installation of center two-way left-turn lanes on two-lane roads. This strategy is intended to reduce the frequency of crashes involving a turning vehicle, which could be classified as head on or rear end. Geometric, traffic, and crash data were obtained for 78 sites (34.9 km (21.3 mi)) in North Carolina, 10 sites(9.7 km (6.0 mi)) in Illinois, 31 sites (10.95 km (6.8 mi)) in California, and 25 sites (21.25 km (13.2 mi)) in Arkansas. Empirical Bayes methods were incorporated in a before-after analysis to determine the safety effectiveness of installing the two-way left-turn lanes. There was a statistically significant reduction in total and rear-end crashes in each of four States whose installations were evaluated. Rural installations were found to be more effective in reducing crashes than urban ones in each of the four States. Lower cost installations of TWLTLs can be a cost-effective treatment for two-lane rural locations, especially those with a high frequency of rear-end collisions involving a lead vehicle desiring to make a turn.

Study Citation: Persaud, B., Lyon, C., Eccles, K., Lefler, N., Carter, D., and Amjadi, R., "Safety Evaluation of Installing Center Two-Way Left-Turn Lanes on Two-Lane Roads", Report No. FHWA-HRT-08-042, Federal Highway Administration, Washington, D.C., (2008)

CMFs Associated With This Study

Category: Roadway

Countermeasure: Introduce TWLTL (two-way left turn lanes) on rural two lane roads

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type
0.64	36	★★★★★	All	All	Not specified	Rural
0.65	35	★★★★☆	All	A,B,C	Not specified	Rural
0.53	47	★★★★★	Rear end	All	Not specified	Rural

This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the University of North Carolina Highway Safety Research Center

For more information, contact Karen Scurry at karen.scurry@dot.gov

VALUE ENGINEERING PROPOSAL
NO. 13
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Verify that the growth factor for traffic forecast data is accurate for design determination impacts

DISCUSSION/JUSTIFICATION:

The growth rate from the Scoping Study for the Nelson County sections is very aggressive. At 2.2% compounded for 20 years, the current ADT of 12000 near the western end of the project jumps to 19000 in the design year. Recognizing that growth rate predictions are not an exact science, multiple factors, including available budget, are project considerations that are expected to be discussed when decisions are made on how to move forward with the project. One of the challenges is that there are capacity issues now with the two lane section currently in place with a LOS of E. While traffic may not increase as much as predicted, it is not realistic to expect the volumes to go down for the foreseeable future in this area. Also, there are several areas with accident issues, with over 65% attributable to rear end collisions or run off the road issues.

Attached is supplemental information with a couple of exhibits that may help when working through project decisions. First, is a simple spreadsheet showing how the ADT might vary based on a range of growth rates. For instance, if a straight growth rate of 1% is used, the design year ADT drops from 19000, to just under 15000. If a staggered rate is used, assuming the 2.2% is maintained for several years than falls off to 1%, then the design ADT is at 16000. Again, the existing two lane roadway with no turn lanes does not perform very well (no build) in this situation and accident issues continue to get worse. However, using the staggered ADT approach, from a discretionary perspective, appears to have merit. While the 2.2% may be accurate, at the least it is an anomaly that does not coincide with much of the rest of the state.

Second, attached please find a report from FHWA documenting improved performance of three lane versus two lane sections in regards to rural applications. While this is already under consideration for several sections of the project in Washington County, this may be of use if the project team determines this to be a viable option in the Botland area.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 13
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Verify that the growth factor for traffic forecast data is accurate for design determination impacts

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	10	1.67
Justification	Provides updated traffic information to improve design decisions.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	10	5.00
Justification	Provides updated traffic information to improve design decisions.			
Maintenance of Traffic (short-term)*	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No impact to performance.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	10	3.33
Justification	Provides updated traffic information to improve design decisions.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**10.00**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 14
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 3**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Five-lane depressed median is currently designed from Station 15+00 and beyond the historic properties # 1 and #2. Current alignment takes approximately three acres off historic property #1.

PROPOSED ALTERNATIVE:

Provide the same five-lane depressed median typical from Station 15+00 and beyond the historic properties # 1 and #2 with a shift in alignment to try and thread the needle between the two historic properties.

BENEFITS	RISKS/CHALLENGES
• Reduces right-of-way impacts to the historical properties	• Potential alignment challenges beyond Station 45+00
• Potentially omits any right-of-way impacts to the two historic properties	•
• No changes to the four-lane typical profile	•
•	•
•	•
•	•
•	•

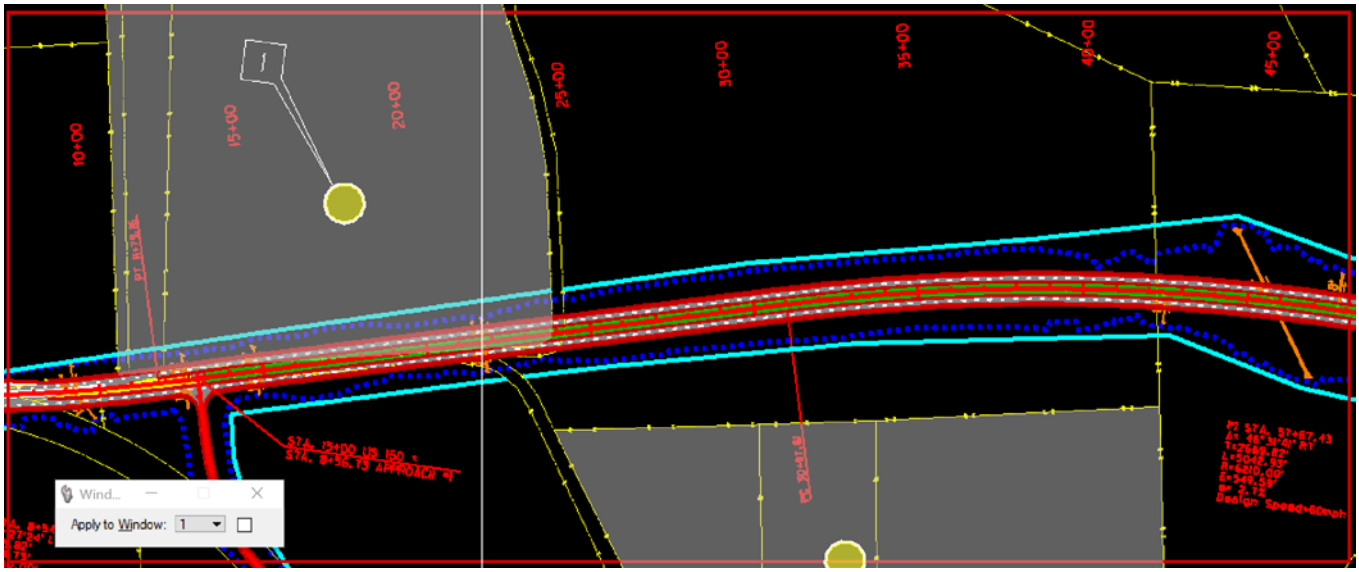
OVERALL PERFORMANCE SCORE **3.33**

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL
NO. 14
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties

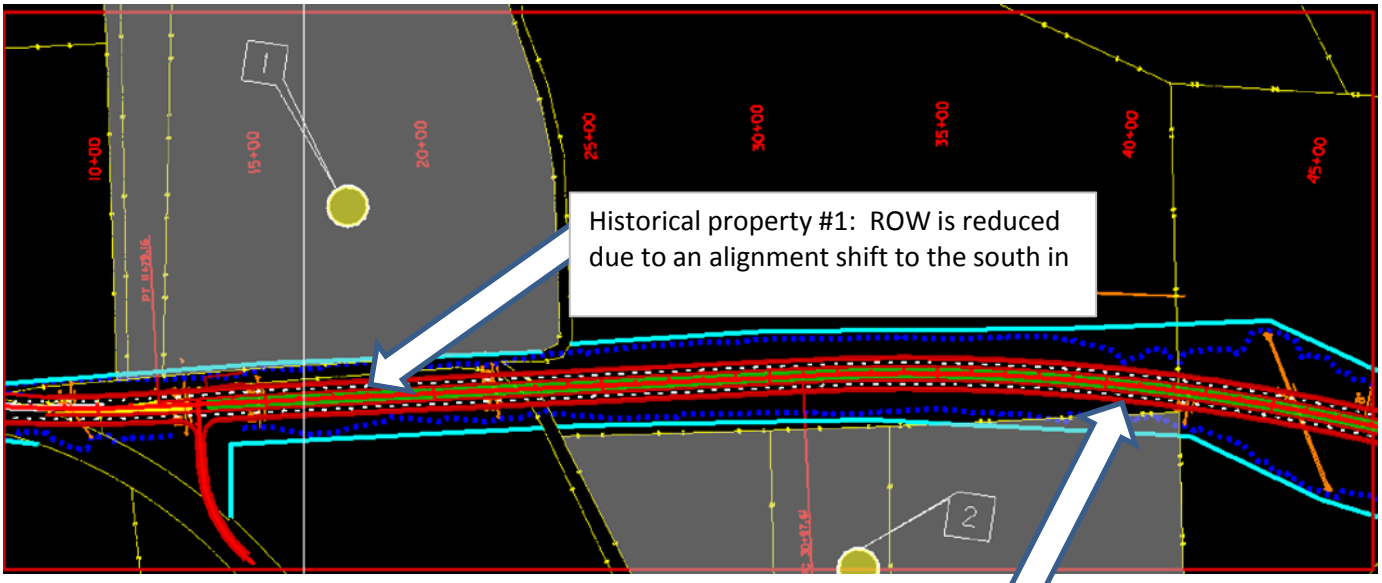
SKETCH OF BASELINE ASSUMPTION



VALUE ENGINEERING PROPOSAL
NO. 14
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 14
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties

DISCUSSION/JUSTIFICATION:

The current alignment takes a relatively large section of right-of-way off the frontage of historical property #1, north of the mainline. Shifting the alignment slightly to the west and keeping if off the historical property to the south will significantly help in the right-of-way acquisition process. There are no changes to capacity, and any difference in construction cost should be insignificant.

The sketch shows clipping a portion of historical property #2; however, the curve to the right could be shifted further east to miss this property as well.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 14
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No perceived impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	0	0.00
Justification	No perceived impact to performance.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No perceived impact to performance.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	10	3.33
Justification	Avoids historic properties.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**3.33**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 15
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift mainline alignment west at historic property #30
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 3**
FUNCTION:	**Traverse Terrain**

BASELINE ASSUMPTION:

Nelson County Alternate 3 is an off corridor alignment. As the alignment bypasses Botland, a 5000-foot radius curve traverses the back part of Historic Property #30.

PROPOSED ALTERNATIVE:

The proposed alternate revises this alignment to avoid impacts to Historic Property #30.

BENEFITS	RISKS/CHALLENGES
• Avoids impacts to Historic Property #30	• Potential grade challenges south of existing US 150
• Minimizes impacts to residential tracts adjacent to Historic Property #30	• More impact to farm field near Botland
•	• Adds reverse curves
•	•
•	•
•	•
•	•

OVERALL PERFORMANCE SCORE **3.33**

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL

NO. 15

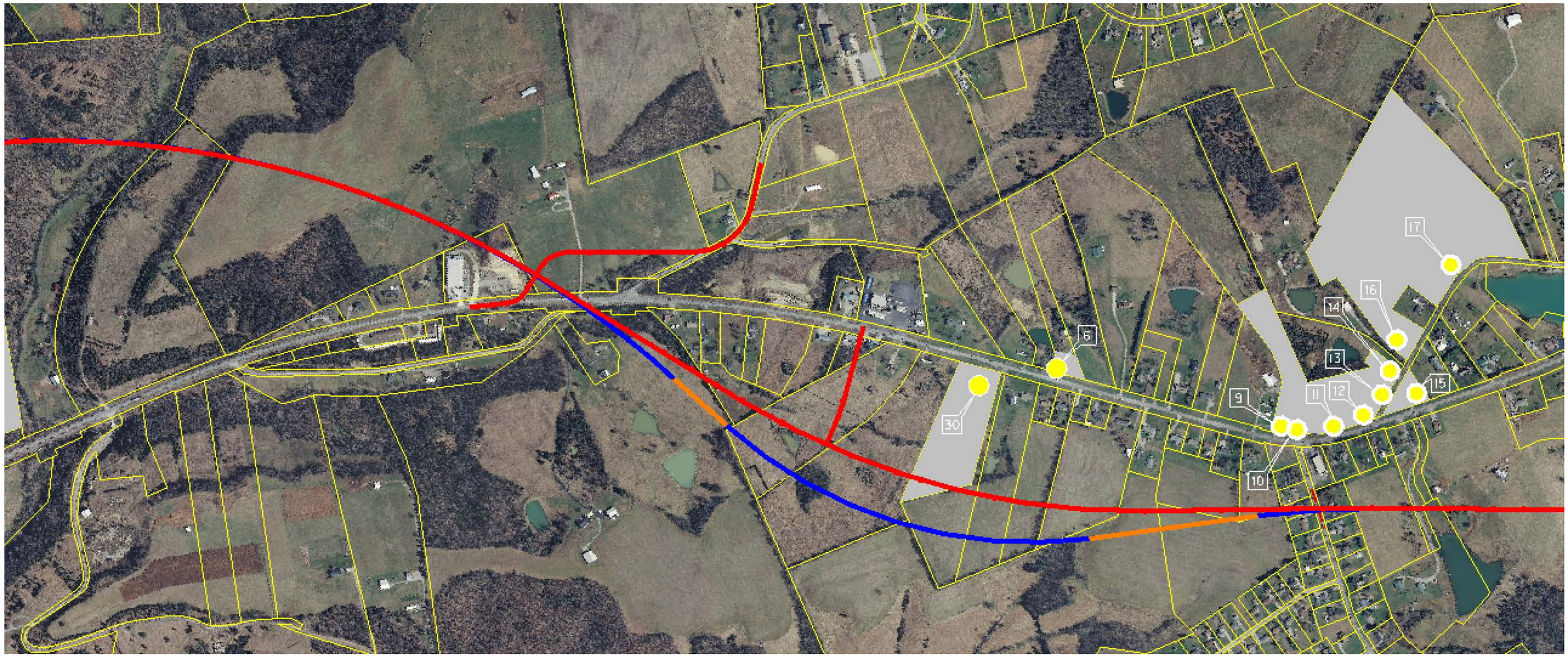
Kentucky Transportation Cabinet

US 150 Corridor Improvement, Item No. 4-396.10, .20, .30

Nelson and Washington Counties

TITLE:	Shift mainline alignment west at historic property #30

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 15
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift mainline alignment west at historic property #30

DISCUSSION/JUSTIFICATION:

The baseline alignment for Nelson County Alternate 3 provides two large, sweeping curves to Botland with the baseline alignment crossing existing US 150 near the intersection with the northern leg of KY 605. This crossing occurs where existing US 150 traverses between two hillsides making the maintenance of traffic difficult as the baseline shows a 4.5-foot fill over top of existing US 150.

By adjusting the angle of the baseline crossing of existing US 150 slightly as well as using a tighter radius in the second curve, impacts to the Historic Property #30 can be avoided. Adjusting this alignment can also help to minimize property impacts to the residential properties located adjacent and in the vicinity of Historic Property #30 by traversing those parcels closer to their existing property line.

With the revised crossing, vertical grades coming away from existing US 150 will be steeper than the baseline. This is in direct competition to maintaining traffic during construction and trying to cross existing near grade. One option to remedy this conflict would be to construct a grade separated crossing with the existing roadway. This will allow the project team to flatten grades leading to the US 150 crossing. This would also eliminate the need for the 10'x8' RCBC but would increase the impacts to the commercial and residential properties in the immediate area.

With a grade separated crossing, no ties from proposed to existing would be constructed but the entirety of existing US 150 would remain and tie at the beginning, end and at Botland. A new tie to KY 605 North could be constructed with this proposal if it ties west of the crossing (i.e., does not cross existing US 150).

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 15
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Shift mainline alignment west at historic property #30

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	0	0.00
Justification	No impact to performance.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	No impact to performance.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	10	3.33
Justification	By revising the alignment, impact to historic property can be reduced or eliminated.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**3.33**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

VALUE ENGINEERING PROPOSAL
NO. 16
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the roadway ditch from 18 feet to 12 feet
LOCATION:	**Item No. 4-396.10 (Nelson County), Alternate 1; Item No. 4-396.20 (Washington County), Segment IV, Sections A and B, Alternate 2**
FUNCTION:	**Enhance Roadside-safety**

BASELINE ASSUMPTION:

Typical sections show 18-foot foreslopes for 6:1 ditches.

PROPOSED ALTERNATIVE:

Reduce the size of the foreslope at 6:1 roadway ditches to 12 feet.

BENEFITS	RISKS/CHALLENGES
• Reduces right-of-way acquisition	• Decreases distance from 2:1 backslope
• Reduces earthwork in cut sections	•
• Maintain consistency throughout corridor	•
•	•
•	•
•	•
•	•

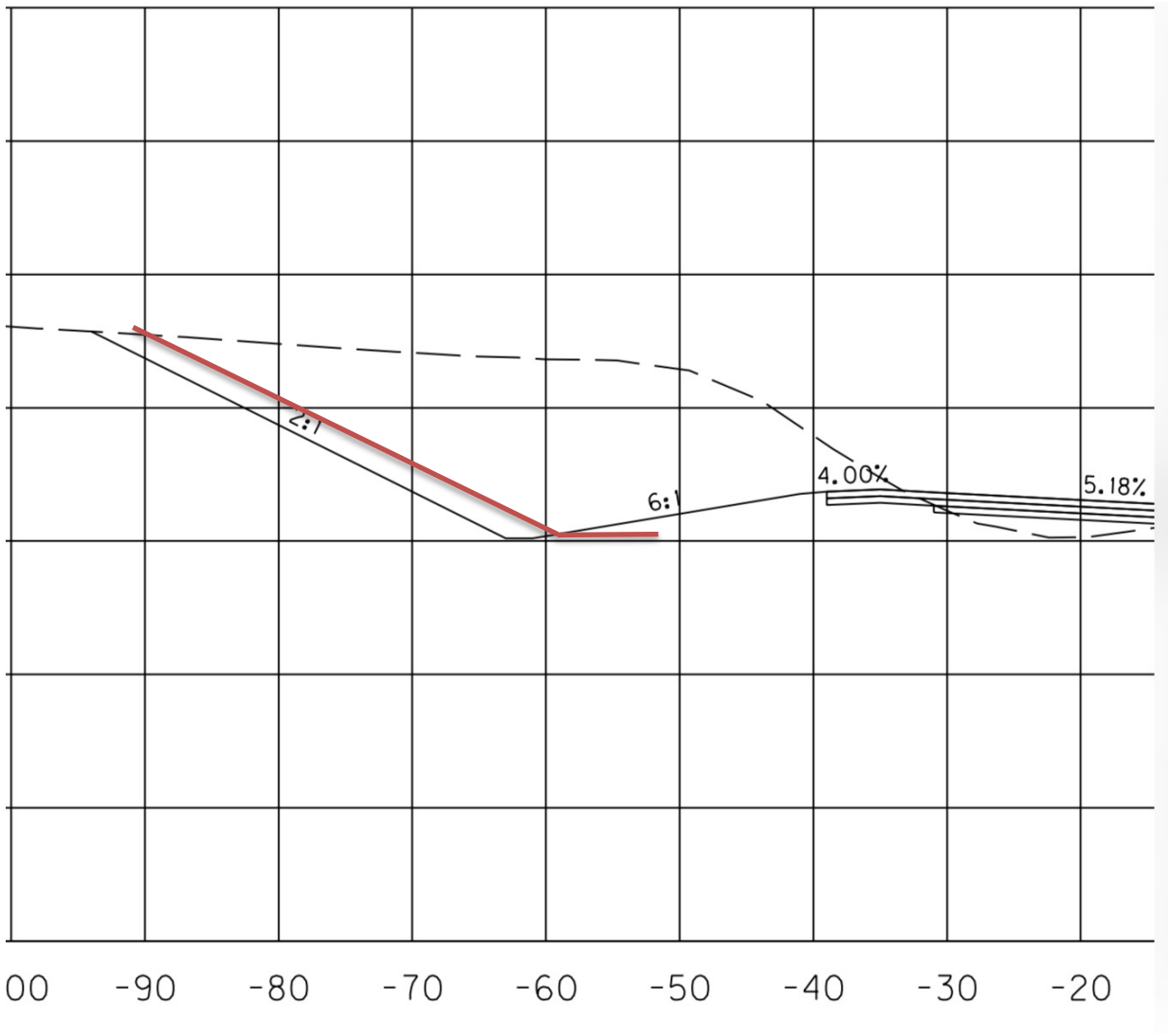
OVERALL PERFORMANCE SCORE **1.67**

DESIGN SUGGESTION

VALUE ENGINEERING PROPOSAL
NO. 16
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the roadway ditch from 18 feet to 12 feet

SKETCH OF PROPOSED ALTERNATIVE



VALUE ENGINEERING PROPOSAL
NO. 16
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the roadway ditch from 18 feet to 12 feet

DISCUSSION/JUSTIFICATION:

Employ foreslope utilized in Washington County Segment V of 12-foot throughout corridor. The baseline currently utilizes 18-foot foreslope for Nelson County On-Corridor, Alternate 1 and Washington County Segment IV, Sections A and B, Alternate 2. Matching the 12-foot foreslope on the corridor will narrow the footprint of the roadway reducing earthwork in cut sections and reducing potential conflicts with existing historic properties. For the baseline example shown, the reduction in foreslope from 18-foot to 12-foot would result in 260 CY less cut within a 100 FT. With just a mile of similar existing conditions in cut sections, total earthwork could be reduced by 10,000 CY.

IMPLEMENTATION CONSIDERATIONS:

None apparent.

VALUE ENGINEERING PROPOSAL
NO. 16
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

TITLE:	Reduce the roadway ditch from 18 feet to 12 feet

IMPACT TO PERFORMANCE

Performance Attribute	Definition	Weight	Impact (use Scale)	Score
Maintain Access	Maintain community access (residential and business) through Botland and the two KY 605 routes	16.67%	0	0.00
Justification	No impact to performance.			
Improve Mobility	Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	50.00%	0	0.00
Justification	No impact to performance.			
Maintenance of Traffic (short-term)	MOT during construction; need to maintain two lanes of traffic at all times during construction	3.00%	0	0.00
Justification	Work off shoulder should not impact MOT. Decreased width may help maintain on existing. Reduction in footprint may impact width needed to maintain two lanes.			
Minimize Impacts	Minimize impacts to PACE, historic and residential properties	33.33%	5	1.67
Justification	A slight reduction in impacts by moving top of 2:1 slope closer to mainline.			
	OVERALL PERFORMANCE SCORE	**103.00%**		**1.67**

**Note:* *Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.*

SCALE

10 Large increase in performance
5 Small increase in performance
0 No impact to performance
-5 Small negative impact to performance
-10 Large negative impact to performance

SECTION 5:

APPENDICES

Value Engineering Study
Kentucky Transportation Cabinet
US 150 Improvement Project
Item No. 4-396.10, .20, .30
Nelson and Washington Counties

Section 5: Appendices

Appendix A – Study Participants

VALUE ENGINEERING STUDY ATTENDEES

Kentucky Transportation Cabinet (KYTC)
US 150 Improvement Project, Item No. 4-396
Nelson and Washington Counties

February				Name	Organization	Position	Office Phone Mobile Phone	Email
4	5	6	7					
	✓		✓	Brent Sweger	KYTC	Manager, Quality Assurance Branch	502-782-4912	Brent.Sweger@ky.gov
✓			✓	Bradley Bottoms	KYTC	Project Manager	270-766-5066	Bradley.Bottoms@ky.gov
✓				Gary Sharpe	Palmer Engineering	Consultant Project Manager	859-744-1218 859-221-6912	GSharpe@palmernet.com
✓			✓	David Shain	Palmer Engineering	Consultant Project Engineer	502-491-2411 502-331-5312	Dshain@palmernet.com
✓			✓	Glenn Hardin	Stantec	Consultant	859-233-2100	Glenn.Hardin@stantec.com
✓	✓	✓	✓	Shawn Russell	KYTC	VE Team SME	502-229-5670	Shawn.Russell@ky.gov
✓	✓	✓	✓	Peter Overmohle	American Engineers	VE Team SME	270-651-7220 272-670-5394	povermohle@aei.cc
✓	✓	✓	✓	Jason Littleton	American Engineers	VE Team SME	502-245-3813 859-576-4192	jlittleton@aei.cc
✓	✓	✓	✓	Robert Martin	Qk4	VE Team SME	502-435-2140	rmartin@qk4.com
✓	✓	✓	✓	Pat Miller	RHA, LLC	VE Team Leader (CVS)	602-493-1947 480-773-8533	patrice@teamrha.com
			✓	Vibert Forsythe	KYTC	Construction	502-564-4780	

T=via Telephone

VALUE ENGINEERING STUDY ATTENDEES

Kentucky Transportation Cabinet (KYTC)
US 150 Improvement Project, Item No. 4-396
Nelson and Washington Counties

February				Name	Organization	Position	Office Phone Mobile Phone	Email
4	5	6	7					
			✓	Tim Layson	KTYC	Location Engineer	502-229-6418	tim.layson@ky.gov
			✓	Aaron Buckner	FHWA		502-223-6749	aaron.buckner@dot.gov
			✓	Dana Robbins	FHWA	Transportation Engineer	502-223-6757	dana.robbins@dot.gov
			✓	Paul Sanders	KYTC - D4	CDE	270-766-5066	paul.sanders@ky.gov
			✓	Beth Lykins	KYTC - CO	Highway Design	502-727-6206	elizabeth.lykins@ky.gov
			✓	David Lanham	Palmer Engineering	Consultant	502-491-2411	dlanham@palmernet.com

T=via Telephone

Appendix B – Pareto Cost Models

Cost models (following pages) were prepared from the cost estimate data provided by Palmer Engineering. The models are 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.

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.10 (Nelson County) - #1 On Corridor

Item Code	Description	Estimated Cost	% Total	% Cumm
	Pavement (mainline)	$ 14,023,151	50.6%	50.6%
2230	Embankment in place	$ 5,839,372	21.1%	71.6%
	Pavement (mainline shoulders)	$ 3,840,053	13.8%	85.5%
	Maintenance of Traffic	$ 1,000,000	3.6%	89.1%
	Double 12'x10' RCBC with 2 headwalls	$ 720,000	2.6%	91.7%
	10'x8' RCBC with 2 headwalls	$ 652,000	2.4%	94.0%
	Pavement (approaches)	$ 606,556	2.2%	96.2%
462	Culvert pipe 18 in	$ 167,750	0.6%	96.8%
	Concrete entrance	$ 125,667	0.5%	97.2%
	Asphalt entrance	$ 117,000	0.4%	97.7%
466	Culvert pipe 30 in	$ 105,375	0.4%	98.0%
464	Culvert pipe 24 in	$ 99,360	0.4%	98.4%
	Pavement (approach shoulders)	$ 96,160	0.3%	98.8%
	10'x5' RCBC with 2 headwalls	$ 81,250	0.3%	99.0%
469	Culvert pipe 42 in	$ 56,575	0.2%	99.2%
468	Culvert pipe 36 in	$ 50,000	0.2%	99.4%
	Gravel entrance	$ 48,000	0.2%	99.6%
1411	Metal end section TY 4 - 18 in	$ 19,500	0.1%	99.7%
1204	Pipe culvert headwall 18 in	$ 18,000	0.1%	99.7%
1210	Pipe culvert headwall 30 in	$ 13,600	0.0%	99.8%
1208	Pipe culvert headwall 24 in	$ 12,800	0.0%	99.8%
1810	Standard curb and gutter	$ 11,538	0.0%	99.9%
1214	Pipe culvert headwall 42 in	$ 10,000	0.0%	99.9%
1212	Pipe culvert headwall 36 in	$ 9,200	0.0%	99.9%
1451	S&F box inlet-outlet 24 in	$ 7,000	0.0%	100.0%
1414	Metal end section TY 4 - 30 in	$ 6,000	0.0%	100.0%
1450	S&F box inlet-outlet 18 in	$ 2,600	0.0%	100.0%

461	Culvert pipe 15 in	$	-	0.0%	
473	Culvert pipe 66 in	$	-	0.0%	
1222	Pipe culvert headwall 66 in	$	-	0.0%	
1452	S&F box inlet-outlet 30 in	$	-	0.0%	
1413	Metal end section TY 4 - 24 in	$	-	0.0%	
1490	Drop box inlet Type 1	$	-	0.0%	
1505	Drop box inlet Type 5B	$	-	0.0%	
	12'x6' RCBC with 2 headwalls	$	-	0.0%	
	Double 12'x8' RCBC with 2 headwalls	$	-	0.0%	
	TOTAL	**$**	**27,738,507**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.10 (Nelson County) - #3 Off Corridor

Item Code	Description	Estimated Cost	% Total	% Cumm
2230	Common excavation	$ 20,947,989	49.0%	49.0%
	Pavement (mainline)	$ 11,588,708	27.1%	76.1%
	Pavement (mainline shoulders)	$ 4,537,973	10.6%	86.7%
	Double 12'x8' RCBC with 2 headwalls	$ 1,935,360	4.5%	91.3%
	Pavement (approaches)	$ 846,216	2.0%	93.2%
	10'x8' RCBC with 2 headwalls	$ 562,000	1.3%	94.6%
	Maintenance of Traffic	$ 400,000	0.9%	95.5%
	12'x6' RCBC with 2 headwalls	$ 396,000	0.9%	96.4%
	10'x5' RCBC with 2 headwalls	$ 300,000	0.7%	97.1%
462	Culvert pipe 18 in	$ 273,020	0.6%	97.8%
464	Culvert pipe 24 in	$ 188,255	0.4%	98.2%
	Pavement (approach shoulders)	$ 150,640	0.4%	98.6%
	Asphalt entrance	$ 135,000	0.3%	98.9%
	Concrete entrance	$ 108,333	0.3%	99.1%
473	Culvert pipe 66 in	$ 84,000	0.2%	99.3%
1505	Drop box inlet Type 5B	$ 70,000	0.2%	99.5%
468	Culvert pipe 36 in	$ 43,875	0.1%	99.6%
	Gravel entrance	$ 33,333	0.1%	99.7%
466	Culvert pipe 30 in	$ 25,000	0.1%	99.7%
1204	Pipe culvert headwall 18 in	$ 22,500	0.1%	99.8%
1208	Pipe culvert headwall 24 in	$ 19,200	0.0%	99.8%
461	Culvert pipe 15 in	$ 14,160	0.0%	99.9%
1212	Pipe culvert headwall 36 in	$ 11,500	0.0%	99.9%
1450	S&F box inlet-outlet 18 in	$ 10,400	0.0%	99.9%
1222	Pipe culvert headwall 66 in	$ 10,000	0.0%	99.9%
1490	Drop box inlet Type 1	$ 8,400	0.0%	99.9%
1810	Standard curb and gutter	$ 7,936	0.0%	100.0%
1210	Pipe culvert headwall 30 in	$ 6,800	0.0%	100.0%
1452	S&F box inlet-outlet 30 in	$ 6,000	0.0%	100.0%
1413	Metal end section TY 4 - 24 in	$ 1,600	0.0%	100.0%
1411	Metal end section TY 4 - 18 in	$ 1,300	0.0%	100.0%
469	Culvert pipe 42 in	$ -	0.0%	
1214	Pipe culvert headwall 42 in	$ -	0.0%	
1451	S&F box inlet-outlet 24 in	$ -	0.0%	
1414	Metal end section TY 4 - 30 in	$ -	0.0%	
	Double 12'x10' RCBC with 2 headwalls	$ -	0.0%	
	TOTAL	**$ 42,745,498**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.20 (Washington) - Segment IV, Section A, Alt 1

Item Code	Description	Estimated Cost	% Total	% Cumm
2091	Remove pavement	$ -		
	Pavement widening (shoulder)	$ 904,800	40.5%	40.5%
	Pavement widening (mainline)	$ 746,948	33.4%	73.9%
2230	Embankment in place	$ 181,580	8.1%	82.0%
	1.5 asphalt overlay (mainline)	$ 90,800	4.1%	86.0%
	Leveling & wedging	$ 70,200	3.1%	89.2%
	Pavement widening (entrance)	$ 48,060	2.1%	91.3%
	Extend 8'x5' RCBC	$ 33,600	1.5%	92.8%
464	Culvert pipe 24 in	$ 26,910	1.2%	94.0%
1451	S&F box inlet-outlet 24 in	$ 24,500	1.1%	95.1%
441	Entrance pipe - 18 in	$ 23,040	1.0%	96.2%
462	Culvert pipe 18 in	$ 20,680	0.9%	97.1%
	Asphalt pave milling & texturing	$ 15,912	0.7%	97.8%
1450	S&F box inlet-outlet 18 in	$ 15,600	0.7%	98.5%
	Extend 5'x5' RCBC	$ 13,125	0.6%	99.1%
1452	S&F box inlet-outlet 30 in	$ 9,200	0.4%	99.5%
466	Culvert pipe 30 in	$ 7,000	0.3%	99.8%
1490	Drop box inlet Type 1	$ 4,200	0.2%	100.0%
	1.5 asphalt overlay (shoulder)	$ -	0.0%	100.0%
	Standard curb and gutter	$ -	0.0%	100.0%
	TOTAL	**$ 2,236,155**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.20 (Washington) - Segment IV, Section A, Alt 2

Item Code	Description	Estimated Cost	% Total	% Cumm
	Pavement widening (mainline)	$ 1,291,036	48.0%	48.0%
	Pavement widening (shoulder)	$ 736,720	27.4%	75.3%
2230	Embankment in place	$ 223,680	8.3%	83.6%
	1.5 asphalt overlay (mainline)	$ 93,576	3.5%	87.1%
	Leveling & wedging	$ 72,375	2.7%	89.8%
	Extend 8'x5' RCBC	$ 50,400	1.9%	91.7%
	Pavement widening (entrance)	$ 48,510	1.8%	93.5%
464	Culvert pipe 24 in	$ 29,670	1.1%	94.6%
1451	S&F box inlet-outlet 24 in	$ 24,500	0.9%	95.5%
	Extend 5'x5' RCBC	$ 23,625	0.9%	96.4%
441	Entrance pipe - 18 in	$ 23,040	0.9%	97.2%
462	Culvert pipe 18 in	$ 20,680	0.8%	98.0%
	Asphalt pave milling & texturing	$ 16,405	0.6%	98.6%
1450	S&F box inlet-outlet 18 in	$ 15,600	0.6%	99.2%
1452	S&F box inlet-outlet 30 in	$ 9,200	0.3%	99.5%
466	Culvert pipe 30 in	$ 8,500	0.3%	99.8%
1490	Drop box inlet Type 1	$ 4,200	0.2%	100.0%
	1.5 asphalt overlay (shoulder)	$ -	0.0%	100.0%
	Standard curb and gutter	$ -	0.0%	100.0%
	TOTAL	**$ 2,691,717**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.20 (Washington) - Segment IV, Section B, Alt 1

Item Code	Description	Estimated Cost	% Total	% Cumm
2091	Remove pavement	$ -		
	Pavement widening (shoulder)	$ 610,080	13.5%	13.5%
	Pavement widening (mainline)	$ 1,849,292	40.8%	54.3%
2200	Roadway excavation	$ 1,396,640	30.8%	85.1%
	1.5 asphalt overlay (mainline)	$ 24,640	0.5%	85.6%
	Leveling & wedging	$ 35,250	0.8%	86.4%
	Pavement widening (entrance)	$ 53,460	1.2%	87.6%
	8'x5' RCBC	$ 95,000	2.1%	89.7%
464	Culvert pipe 24 in	$ 3,680	0.1%	89.8%
440	Entrance pipe 15 in	$ 2,805	0.1%	89.8%
469	Culvert pipe 42 in	$ 17,515	0.4%	90.2%
462	Culvert pipe 18 in	$ 27,500	0.6%	90.8%
2677	Asphalt pave milling & texturing	$ 4,318	0.1%	90.9%
470	Culvert pipe 48 in	$ 22,400	0.5%	91.4%
1204	Pipe culvert headwall - 18 in	$ 6,000	0.1%	91.6%
1208	Pipe culvert headwall - 24 in	$ 6,400	0.1%	91.7%
466	Culvert pipe 30 in	$ 21,500	0.5%	92.2%
1210	Pipe culvert headwall - 30 in	$ 6,800	0.2%	92.3%
1214	Pipe culvert headwall - 42 in	$ 5,000	0.1%	92.4%
1216	Pipe culvert headwall - 48 in	$ 5,800	0.1%	92.6%
1432	Sloped box outlet type 1-15 in	$ 1,900	0.0%	
	38' PPCDU	$ 335,000	7.4%	
	TOTAL	**$ 4,530,980**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.20 (Washington) - Segment IV, Section B, Alt 2

Item Code	Description	Estimated Cost	% Total	% Cumm
	Pavement widening (mainline)	$ 1,259,388	37.5%	37.5%
	Pavement widening (shoulder)	$ 609,520	18.1%	55.7%
2200	Roadway excavation	$ 674,980	20.1%	75.8%
	1.5 asphalt overlay (mainline)	$ 76,240	2.3%	78.0%
	Leveling & wedging	$ 115,125	3.4%	81.4%
1204	Pipe culvert headwall - 18 in	$ 6,000	0.2%	81.6%
	Pavement widening (entrance)	$ 60,975	1.8%	83.4%
464	Culvert pipe 24 in	$ 3,680	0.1%	83.6%
1208	Pipe culvert headwall - 24 in	$ 6,400	0.2%	83.7%
1210	Pipe culvert headwall - 30 in	$ 6,800	0.2%	83.9%
441	Entrance pipe - 15 in	$ 2,805	0.1%	84.0%
462	Culvert pipe 18 in	$ 21,340	0.6%	84.7%
	Asphalt pave milling & texturing	$ 13,362	0.4%	85.1%
1214	Pipe culvert headwall - 42 in	$ 5,000	0.1%	85.2%
1216	Pipe culvert headwall - 48 in	$ 5,800	0.2%	85.4%
466	Culvert pipe 30 in	$ 21,500	0.6%	86.0%
1432	Sloped box outlet Type 1-15 in	$ 1,900	0.1%	86.1%
	38' PPCDU	$ 335,000	10.0%	
	8'x5' RCBC	$ 95,000	2.8%	
	1.5 asphalt overlay (shoulder)	$ -	0.0%	86.1%
	Standard curb and gutter	$ -	0.0%	86.1%
469	Culvert pipe 42 in	$ 15,035	0.4%	
470	Culvert pipe 48 in	$ 22,400	0.7%	
	TOTAL	**$ 3,358,250**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.20 (Washington) - Grundy Home Road Approach - Alternate #1

Item Code	Description		Estimated Cost	% Total	% Cumm
	Pavement widening (mainline)	$	194,304	44.0%	44.0%
	38' PPCDU	$	160,000	36.2%	80.2%
2230	Embankment in place	$	87,400	19.8%	
2091	Remove Pavement	$	-		
	TOTAL	**$**	**441,704**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.20 (Washington) - Grundy Home Road Approach - Alternate #2

Item Code	Description		Estimated Cost	% Total	% Cumm
	Pavement widening (mainline)	$	137,540	52.9%	52.9%
2200	Roadway excavation	$	108,170	41.6%	94.4%
466	Culvert pipe - 30 in	$	11,125	4.3%	98.7%
1210	Pipe culvert headwall - 30 in	$	3,400	1.3%	100.0%
	TOTAL	**$**	**260,235**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.30 (Washington) - Segment V, Section C, Alt 1

Item Code	Description	Estimated Cost	% Total	% Cumm
	Roadway excavation	$ 783,050	36.9%	36.9%
	Asphalt base	$ 517,276	24.4%	61.3%
	Asphalt surface	$ 273,440	12.9%	74.1%
	Crushed stone base	$ 253,710	12.0%	86.1%
	Box culvert	$ 150,000	7.1%	93.2%
	Headwall	$ 110,000	5.2%	98.3%
	Entrance pipe 18 in	$ 35,394	1.7%	100.0%
	TOTAL	**$ 2,122,870**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.30 (Washington) - Segment V, Section C, Alt 2

Item Code	Description	Estimated Cost	% Total	% Cumm
	Roadway excavation	$ 745,710	35.9%	35.9%
	Asphalt base	$ 514,080	24.8%	60.7%
	Asphalt surface	$ 273,360	13.2%	73.9%
	Crushed stone base	$ 246,258	11.9%	85.8%
	Box culvert	$ 150,000	7.2%	93.0%
	Headwall	$ 110,000	5.3%	98.3%
	Entrance pipe 18 in	$ 35,394	1.7%	100.0%
	TOTAL	**$ 2,074,802**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.30 (Washington) - Segment V, Section D, Alt 1

Item Code	Description	Estimated Cost	% Total	% Cumm
	Asphalt base	$ 490,552	30.5%	30.5%
	Roadway excavation	$ 377,150	23.4%	53.9%
	Asphalt surface	$ 325,040	20.2%	74.1%
	Crushed stone base	$ 234,630	14.6%	88.6%
	Headwall	$ 110,000	6.8%	95.5%
	Box culvert	$ 60,000	3.7%	99.2%
	Entrance pipe 18 in	$ 12,808	0.8%	100.0%
	TOTAL	**$ 1,610,180**		

Cost Model
Kentucky Transportation Cabinet
US 150 Corridor Improvement
Item No. 4-396.30 (Washington) - Segment V, Section D, Alt 2

Item Code	Description	Estimated Cost	% Total	% Cumm
	Asphalt base	$ 605,336	36.4%	36.4%
	Roadway excavation	$ 366,340	22.0%	58.4%
	Asphalt surface	$ 297,440	17.9%	76.2%
	Crushed stone base	$ 212,832	12.8%	89.0%
	Headwall	$ 110,000	6.6%	95.6%
	Box culvert	$ 60,000	3.6%	99.2%
	Entrance pipe 18 in	$ 12,808	0.8%	100.0%
	TOTAL	**$ 1,664,756**		

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 **US 150 Improvement 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		COMMENT	CLASSIFICATION	HIGH COST?	HIGH RISK?
Active Verb	**Measureable Noun**				
Enhance	Mobility	*See Purpose and Need**	Higher Order		
Improve	Level-of-Service		Basic Function		
Increase	Capacity	Lane quantity	Secondary	✓	
Connect	Community		Secondary		
Convey	Traffic		Secondary		
Accommodate	Trucks	Transport freight	Secondary		
Reduce	Crash-severity		Secondary		
Support	Load	Pavement	Secondary	✓	✓
Delineate	Lane		Secondary		
Separate	Traffic	Median	Secondary		
Achieve	Geometry		Secondary	✓	✓
Enhance	Roadside-safety	Accommodate broken down and errant vehicles; shoulders	Secondary	✓	✓
Establish	Clear-zone		Secondary		
Span	Space	Bridge	Secondary	✓	✓
Traverse	Terrain	Earthwork	Secondary	✓	✓
Convey	Water		Secondary		
Maintain	Traffic		Secondary		
Protect	Slope		Secondary		
Relocate	Utilities		Secondary	✓	✓
Phase	Construction		Secondary		
Meet	Standards		Secondary		

FUNCTION		COMMENT	CLASSIFICATION	HIGH COST?	HIGH RISK?
Active Verb	Measureable Noun				
Acquire	Right-of-way		Secondary	✓	✓
Limit	Access		Secondary		
Secure	Funding		Lower Order		

High cost and/or high risk functions were identified using cost data and the VE study team expertise. The VE study team identified **Improve Level-of-Service** as the basic function 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?"
- **Lower Order Function** is a function that is selected to initiate the project and is outside the scope of the subject under study.

Appendix D – Creative Idea List and Evaluation

Creative Idea List

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.

Value Engineering Study
Kentucky Transportation Cabinet
US 150 Corridor Improvement, Item No. 4-396.10, .20, .30
Nelson and Washington Counties

Creative Idea List

Idea No.	Resp	Idea Title	Score
IC		**Increase Capacity**	
IC-01	RM	Verify that the growth factor for traffic forecast data is accurate for design determination impacts	DS
IC-02		Build project in phases based on comprehensive review of growth factor	w/IC-01
IC-03		Evaluate growth factor to understand Level of Service	w/IC-01
IC-04		Limit access points (driveways, approach roads) to increase capacity	w/IC-06
IC-05	JL	Reduce the paved shoulder from eight to four feet	4
IC-06	SR	Reduce median width from 40 feet to 30 feet; Station 15+00 to Station 140+00	4
IC-07		Add cable guard rail to the reduced median	3
IC-08	PO	Replace four-lane with two-plus-one lane between KY 605 north and KY 605 south	4
IC-09	PO	Replace four-lane with two-lane plus auxiliary lanes at specific locations	4
IC-10		Identify alternative locations for auxiliary lane	w/TT-07
IC-11		Replace Super-two with two-plus-one lane	2
TT		**Traverse Terrain**	
TT-01		Use steeper grade toward river in Nelson County and request Design Exception (Nelson County - Alternate 3 "off corridor")	3
TT-02		Shift alignment south from Station 230+00 to Station 180+00 to reduce cut and increase fill	2
TT-03		Shift alignment in Section D (Washington County) to keep two lanes of traffic open during construction	w/TT-16
TT-04	PO	Shift alignment west from Station 5+00 to Station 45+00 to reduce impacts to historic properties	DS
TT-05	RM	Revise profile from Station 70+00 to Station 95+00 to improve maintenance of traffic	4
TT-06	JL	Shift mainline alignment west at historic property #30	DS
TT-07	SR	Add auxiliary lane southbound between Station 190+00 and Station 250+00 to reduce earthwork and improve Level of Service	4

O/S=Out of Scope
FF=Fatal Flaw
ABC=Already Being Considered

DS=Design Suggestion (Workbook)
DC=Design Comment (No Workbook)

5=Great Opportunity
4=Good Opportunity
3=Moderate Opportunity
2=Poor Opportunity

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Creative Idea List

Idea No.	Resp	Idea Title	Score
TT-08	JL	Revise KY 605 alignment on east side to reduce length of approach; replace two approaches with one	5
TT-09	RM	Construct hybrid alignment based on revised traffic projections	5
TT-10		Revise KY 605 alignment to tie in with hybrid alignment (TT-09)	w/TT-09
TT-11		Phase hybrid alignment (TT-09) in three phases to meet desirable budgetary constraints	w/TT-09
TT-12	PO	Terminate five-lane section east of KY 605 North to KY 605 South; use three-lane (two-lane + TWLTL)	5
TT-13	JL	Reduce Nelson County corridor from five-lane to two-lane with dedicated turn lanes	5
TT-14		Relocate Grundy Home Road tie-in to Station 84+00 to eliminate bridge on approach (Alternate 1; already shown on Alternate 2)	ABC
TT-15	JL	Adjust horizontal curve back toward existing to minimize right-of-way impact to PACE tract	4
TT-16	RM	Shift bridge location northeast to allow maintenance of traffic	5
TT-17		Construct a wider shoulder on current bridge alignment to allow maintenance of traffic	w/TT-16
TT-18		Create Memorandum of Understanding with local governments to preserve and/or control access	DC
TT-19		Add J-turn at KY 605, both east and west sides	DC
TT-20		Offset left-turn lane at all intersections	DC
TT-21		Add right-turn lanes for the two-lane typical section	DC
TT-22		Shift alignment to the east from Station 150+00 to Station 170+00 (Segment V, Section C, both alternates) for constructability; eliminates full-depth shoulder	3
TT-23		Vary the centerline to minimize right-of-way impacts; "hybrid" of Segment V, Section C, both alternates) to Station 190+00 to Station 205+00	3
TT-24		Where there are flat profile grades entering/leaving horizontal curvatures, verify that flat spots are not being created	DC
ER		**Enhance Roadside-safety**	
ER-01	SR	Reduce the roadway ditch from 18 feet to 12 feet	DS
ER-02		Utilize barn template to eliminate guardrail	3

O/S=Out of Scope
FF=Fatal Flaw
ABC=Already Being Considered

DS=Design Suggestion (Workbook)
DC=Design Comment (No Workbook)

5=Great Opportunity
4=Good Opportunity
3=Moderate Opportunity
2=Poor Opportunity

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Creative Idea List

Idea No.	Resp	Idea Title	Score
ER-03		Reduce guardrail shoulder widening of three feet with the use of long posts, where necessary	3
SS		**Span Space**	
SS-01		Investigate use of bridge and deep fills to minimize need for borrow and right-of-way footprint	2
SS-02		Replace double 12'x8' box culvert with bridge at Station 53+00	3

O/S=Out of Scope
FF=Fatal Flaw
ABC=Already Being Considered

DS=Design Suggestion (Workbook)
DC=Design Comment (No Workbook)

5=Great Opportunity
4=Good Opportunity
3=Moderate Opportunity
2=Poor Opportunity

Evaluation Process

The project decision makers identified, defined and ranked the performance attributes using a paired comparison matrix, shown below.

					TOTAL	%
Maintain Access - Maintain community access (residential and business) through Botland and the two KY 605 routes	**A**	b	a	d	**1.0**	**16.67%**
Improve Mobility - Reduce travel time and increase the reliability (peak hours, passing opportunities, freight movement) of the corridor; improve level of service (current: D/E; goal B/C in the design year)	**B**	b	b		**3.0**	**50.00%**
Maintenance of Traffic (short-term) - MOT during construction; need to maintain two lanes of traffic at all times during construction	**C**	d			**0.0**	**3.00%**
Minimize Impacts - Minimize impacts to PACE, historic and residential properties	**D**				**2.0**	**33.33%**
					6.0	**103.00%**

a	More Important
a/b	Equal Importance

***Note:** Although this performance attribute did not have any weight during the initial assessment, the VE team acknowledges it is an attribute that should be considered in the performance evaluation of alternatives.

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

- FF Unacceptable Impacts/Fatal Flaw (Has at least one fatal/unacceptable flaw)
- O/S Out of Scope
- ABC Already Being Considered
- DC Design Comment (No cost impact, no Workbook)
- DS Design Suggestions (No cost impact, Workbook)

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 shown on the following page** 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 (Workbook)
- 4 – Good Value meeting the criteria (Workbook)
- 3 – Moderate Value meeting the criteria (No Workbook)
- 2 – Poor Value (No Workbook)

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Value Relationship Key		**Value = Function / Cost**					
Rating							
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++	

*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

Appendix E – Supporting Data

Team Observations

The VE study team identified observations, concerns and opportunities to be addressed during the creative generation of potential ideas and alternatives. The following is a list of the VE study team's observations:

- Project cost is largely focused in pavement and excavation (cut and fill); right-of-way and utility costs may also run high
- The same unit cost for excavation ($10/CY) was used on both Nelson County, Alternate 1 ("On Corridor") and Alternate 3 ("Off Corridor"); Alternate 1 ("On Corridor") would be more expensive than Alternate 3 ("Off Corridor")
- The project team does not want to widen the bridge; reconstruct instead at a cost of $1.9 million
- Concerned that the traffic forecast data (especially for Nelson County) is driving the decision to build five lanes
- In Nelson County, south of the mainline at the bridge, there is room for waste material

Risk Identification

When brainstorming alternatives during the creative phase, the VE study team considered the following risks that were identified during the Information Phase kick-off meeting:

- Unknown archaeological findings
- Unknown hazardous material findings
- Historic documents are pending approval
    - Not approved by SHPO
    - Does not allow *de minimis*
- PACE properties
    - Does not allow condemnation
    - Cannot seek solution with PACE Board
- Utilities – not in control of the process, especially "on corridor"; schedule and cost concerns
- Floodplains – unknown limits that need to be defined (not perceived to be a risk – Zone A)
- Soils conditions – degrading shale

Value Engineering Study –Agenda

Kentucky Transportation Cabinet

Agenda February 4-7, 2019

Study Location

KYTC Office, 200 Mero Street, Frankfort, KY – 1st Floor, Conference Room 109

Day 1: Monday, February 4, 2019

INFORMATION PHASE

9:00-9:15	Introductions (All) & Brief Overview of the VE Process *(Team Leader-Pat Miller)*
9:15-10:30	Project Overview, Presentation *(KYTC Project Manager Brad Bottoms, Palmer Engineering Gary Sharpe)*
10:30-10:45	Break
10:45-12:00	Project Goals & Constraints, Workshop Objectives, Identify Key Performance Attributes Identify Project Risks
12:00-1:00	Lunch
1:00-1:15	Review Cost Estimate / Cost Model
1:15-1:45	VE Team Observations

FUNCTION ANALYSIS PHASE

1:45-2:15	Function Identification of Project Elements
2:15-2:30	Break

CREATIVE PHASE

2:30-5:00	Brainstorm Ideas / Alternatives
5:00	Adjourn

Day 2: Tuesday, February 5, 2019

8:00-8:05	Check-in with VE Team

CREATIVE PHASE (continued)

8:05-10:00	Brainstorm Ideas / Alternatives
10:00-10:15	Break
10:15-12:00	Brainstorm Ideas / Alternatives
12:00-1:00	Lunch

EVALUATION PHASE

1:00-2:30	Evaluation of Ideas – Team Assignments for Development

DEVELOPMENT PHASE

2:30-2:45	Break
2:45-5:00	Develop / Cost Alternatives
5:00	Adjourn

Day 3: Wednesday, February 6, 2019

8:00-8:05 Check-in with VE Team

DEVELOPMENT PHASE

8:05-12:00 Develop / Cost Alternatives
12:00-1:00 Lunch
1:00-5:00 Develop / Cost Alternatives
5:00 Adjourn

Day 4: Thursday, February 7, 2019

8:00-8:05 Check-in with VE Team

DEVELOPMENT PHASE

8:05-10:00 Develop / Cost Alternatives
10:00-12:00 Group Review of VE Alternatives / Prepare Presentation
12:00-1:00 Working Lunch
1:00-2:00 Presentation Run-through
2:00-3:30 Presentation of VE Alternatives / Out-brief Meeting *(Management, Stakeholders)*
3:30-4:00 Wrap-up with VE Team
4:00 Adjourn