Value Engineering Study Report – Final

OHIO RIVER CROSSING

I-69 Ohio River Crossing Project
Evansville, IN and Henderson, KY

Workshop Dates: March 12-14, 2019

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Value Engineering Study
I-69 Ohio River Crossing (ORX) Project

Contents

Section 5: Implementation

SECTION 1: EXECUTIVE SUMMARY

Value Engineering Study
I-69 Ohio River Crossing (ORX) Project

Section 1: Executive Summary

Background

A Value Engineering (VE) Study was conducted on the Draft Environmental Impact Statement (DEIS) documents for the **I-69 Ohio River Crossing Project** for the Indiana Department of Transportation (INDOT) and Kentucky Transportation Cabinet (KYTC) on March 12-14, 2019 for the project described below.

On February 20, 2019, representatives from the design team of Parsons, led by Steven Nicaise, briefed the Value Engineering (VE) Team on the project. At the start of the VE workshop on March 12, 2019, Steven Nicaise reviewed the VE Team's questions and representatives from INDOT, KYTC and the design team answered additional questions.

The workshop objectives were reviewed at the start of the workshop as follows:

- Identify possible cost schedule savings or risk avoidance options
  - I-69
  - Interchanges
  - Structures

Additionally, the project's goals were reviewed as it relates to the success of the project:

- Provide cross-river system linkage and connectivity between I-69 IN and I-69 KY that is compatible with the national I-69 Corridor
- Develop a solution to address long-term cross-river mobility
- Create a cross-river connection that reduces traffic congestion and delay
- Improve safety for cross-river traffic

Project Description *(Excerpted from Draft Environmental Impact Statement)*

The project includes the development of an interstate highway across the Ohio River that would connect the southern terminus of I-69 in Indiana with the northern terminus of I-69 in Kentucky. Currently, cross-river traffic is limited to two US 41 bridges, which are classified as principal arterials, and do not meet interstate design standards. The I-69 ORX project is needed because there is a lack of system linkage across the Ohio River for the National I-69 Corridor, which extends between Mexico and Canada. The

purpose of the project is to provide system linkage and connectivity between I-69 in Indiana and I-69 in Kentucky that are compatible with the National I-69 Corridor.

The project area for the I-69 ORX DEIS extends from I-69 (formerly I-164) on the south side of Evansville, IN (i.e., northern terminus) across the Ohio River to I-69 (formerly Edward T. Breathitt Pennyrile Parkway) at the KY 425 interchange southeast of Henderson, KY (i.e., southern terminus). The section of Edward T. Breathitt Pennyrile Parkway between KY 351 and KY 425 that was not re-designated as I-69 was recently re-designated as US 41. The western limit of the project area is parallel to and extends a maximum of about 2,000 feet west of US 41. The eastern limit of the project area extends from about 1,500 feet to 3.4 miles east of US 41.

Summary Workshop Results

Summary workshop results are shown in the table below.

Workshop Outcome	Number	Section of Report/Summary
Number of Ideas Brainstormed	56	See Creative Idea List (found in Section 4: Support Data)
Number of Ideas Developed (Total Quantitative and Qualitative)	20	See Section 2: Summary Information and Section 3: Value Engineering Workbooks
Number of Quantitative Alternatives Developed	18	
Number of Qualitative Alternatives (Design Suggestions) Developed	2	
Number of Design Comments (DC), Not Developed	13	See Section 2: Summary Information
Number of Estimate Comments (EC), Not Developed	2	See Section 2: Summary Information
Number of VE Alternatives – "Further Study"	12	See Section 5: Implementation
Number of VE Alternatives – "Reject"	8	See Section 5: Implementation

Description of Study

The study was conducted in accordance with the SAVE International Value Methodology, found in Section 4: Support Data. The Value Methodology includes pre-

workshop (Stage 1), workshop (Stage 2) and post-workshop (Stage 3) activities. Stage 2, workshop activities includes six phases as follows: Information (Phase 1), Function Analysis (Phase 2), Creative (Phase 3), Evaluation (Phase 4), Development (Phase 5) and Presentation (Phase 6).

The Summary of Value Engineering Proposals, Design Suggestions, Design Comments and Estimate Comments are found in Section 2: Summary Information. This summarizes the ideas brainstormed and developed during the study indicating the areas of opportunity for improving the value, performance and functions of the project. A complete list of all of the ideas, the Creative idea List, is located in Section 4: Support Data.

Details of the Value Engineering Proposals and Design Suggestions can be found in Section 3: Value Engineering Workbooks. A presentation of the VE study recommendations and key findings was given to the decision makers on March 14, 2019; a copy is included in Section 4: Support Data.

The disposition of alternatives is provided in Section 5: Implementation and includes the VE Alternatives Initial Assessment/Comment Form and documents decisions made by the project team.

Value Engineering Study Team

- Richard Hein (Parsons)
- Adam McLain (Stantec)
- Mark Orton (INDOT)
- Ted Zoli III (HNTB)
- Eddie He (Parsons)
- Marvin Wolfe (KYTC)
- Ed Spahr (INDOT)
- Stuart Tyler (Parsons)
- Brandon Miller (INDOT)
- Rob Wahr (HNTB)
- Jason Ward (KYTC)
- Andy Ghofrani (Parsons)
- Anthony Schuler (INDOT)
- Kaitlyn Stewart (RHA, LLC)
- Pat Miller (RHA, LLC)

SECTION 2: SUMMARY INFORMATION

Section 2: Summary Information

Introduction

The VE study team brainstormed 56 ideas. A total of 20 ideas were developed as either Value Engineering Proposals (with costs) or Design Suggestions (without costs).

Eighteen ideas were identified for further development into Value Engineering proposals, including cost impacts. The description and further discussion of these are included in Section 3: Value Engineering Workbooks. The VE proposals are categorized by function (or category) as follows:

- Support Redundancy
- Maintain Facility
- Access Community
- Span Space
- Miscellaneous

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

The Summary of Alternatives identifies cost impacts and performance. Cost avoidance is shown as positive costs while any added costs are noted in parenthesis.

The VE study team also identified two Design Suggestions (DS), not costed, 13 Design Comments (DC) and two Estimate Comments (EC) to be considered in the next phase of design development.

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

Value Engineering Study
I-69 Ohio River Crossing

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

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTION SCHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS
SR	**Support Redundancy**					
SR-02	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum shoulders	$24.5M	No perceived impact to schedule	MINIMAL	YES	YES
SR-06	Remove US 60 interchange	$5M	Reduce 3 MONTHS	MINIMAL	YES	YES
SR-07	Remove US 41 interchange	$45M	Reduce 5-7 MONTHS	PUBLIC PERCEPTION (-); EIS (-)	NO	YES
SR-08	Modify Veterans Memorial Parkway interchange	$37M	No perceived impact to schedule	PUBLIC PERCEPTION (-); EIS (-)	NO	YES
SR-09	Remove KY2084 ramp southbound	$5M	Reduce 2 MONTHS	MINIMAL	YES	YES
SR-10	Reduce median width	Minimal cost impact	Reduce 8 MONTHS	MINIMAL	YES	YES
SR-14	Investigate alternate location for eastern crossing	$50M	Reduce 6 MONTHS	EIS (++); CONSTRUCTION (--)	NO	YES
MF	**Maintain Facility**					
MF-08	Add community betterment (ped crossing, bike/ped path, waterfront) for enhancements	*DESIGN SUGGESTION*		MINIMAL	NO	YES
AC	**Access Community**					
AC-01	Optimize interchanges in terms of connectivity and priority of access (US 60)	$5M	Reduce 3 MONTHS	MINIMAL	YES	YES

Value Engineering Study
I-69 Ohio River Crossing

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

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTION SCHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS
AC-02	Collapse/combine US 41/US 60 interchanges	$21M	Reduce 3 MONTHS	EIS (--)	NO	YES
AC-03	Relocate Parcel 627 access	$1.06M	Reduce 3 MONTHS	MINIMAL	YES	YES
AC-05	Simplify/minimize I-69 interchange at Veterans Memorial Parkway	$30M	Reduce 9 MONTHS	MINIMAL	YES	YES
AC-07	Reconfigure the US 41 interchange to reduce structure requirements	$20M	Increase 6 MONTHS	MINIMAL	YES	YES
AC-08	Reduce the amount of structure on the US 41 interchange by a more detailed hydraulic analysis	$23.6M++	No perceived impact to schedule	FLOODWAY DESIGNATION (-)	MAYBE	YES
SS	**Span Space**					
SS-01	In lieu of bridge/fill, use prefabricated culvert (BEBO)	$17.2M	Reduce 6 MONTHS	FLOODPLAIN (-); MAINTENANCE (-)	YES	YES
SS-05	Use cut and cover or trench section in lieu of bridges on floodplain	$9.4M	Reduce 2-3 MONTHS	MAINTENANCE (-); EIS (-)	NO	YES
M	**Miscellaneous**					
M-01	Allow temporary hydraulic surge during construction	$6M	Reduce 3 MONTHS	UPSTREAM FLOODING (--)	YES	YES
M-04	Use federal aid for project, except river spans, to reduce cost of materials	$25-35M	No perceived impact to schedule	LEGAL (--); PUBLIC PERCEPTION (--)	NO	NO

Value Engineering Study
I-69 Ohio River Crossing

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

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTION SCHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS
M-07	Phase project in two construction packages: (1) direct connection, (2) build out interchanges and existing US 41	*DESIGN SUGGESTION*		PUBLIC (-)	YES	YES
M-08	In lieu of pier support islands, build roadway embankment on the north to shorten bridge	No perceived impact to cost	No perceived impact to schedule	HYDRAULICS (--)	NO	NO

Design Comments (No Workbook Prepared)

IDEA NO.	Idea Title
SR	**Support Redundancy**
SR-11	Standardize bridge type (precast I-beam bridges, precast AASHTO girder)
SR-16	Add bid alternate for pavement (asphalt, concrete, other)
MF	**Maintain Facility**
MF-01	Maximize use of concrete superstructures in lieu of steel
MF-02	Add bid alternate for bridge rebar (epoxy)
MF-03	Build thicker bridge deck to reduce Operations and Maintenance
SS	**Span Space**
SS-03	Verify that .14-foot is not required for US 41/I-69 interchange

Estimate Comments (No Workbook Prepared)

IDEA NO.	Idea Title
M	**Miscellaneous**
M-09	Validate overall cost estimate (i.e., segmental bridge pricing for the river crossing)
M-10	Reduce construction contingency from 33% to 25% - $38M cost avoidance

SECTION 3: VALUE ENGINEERING WORKBOOKS

Section 3: Value Engineering Workbooks

Introduction

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

- Unique Identifying Number (XX-##)
- Creative Idea Title
- Function Identification
- Original Concept
- Alternative Concept
- Benefits of Alternative Concept
- Risks/Challenges of Alternative Concept
- Cost Impact
- Schedule Impact
- Alternative Concept Discussion/Justification, including any implementation considerations
- Original Concept and Alternative Concept Sketches, if applicable

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

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SR-02

Idea Title	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum width shoulders
Function	Support Redundancy

ORIGINAL CONCEPT:

Mainline I-69 bridge over the Ohio River provides AASHTO-preferred minimum travel lane width (12 feet) and exceeds the AASHTO-preferred inside shoulder width (8 feet) and outside shoulder width (12 feet).

ALTERNATIVE CONCEPT:

Reduce the shoulder widths for the mainline Ohio River Bridge and the bridge approach spans.

- Inside shoulder width: 4 feet
- Outside shoulder width: 10 feet

Overall width reduction: 93.5 feet → 81.5 feet = 12 feet

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Reduces cost of the I-69 Ohio River bridge and approach spans • Still allows for 1+1 / directional closure during future Maintenance of Traffic (MOT) • Still have the ability to have three 11-foot lanes with 2-foot shoulders in the future	• Reduces shoulder widths present challenges for emergency vehicle response • Future widening to 6-lane section would require more construction • Reduces storage for disabled vehicles and police/maintenance operations

COST IMPACT:

<u>Rough order of magnitude impact to cost (potential cost avoidance) - $24.5 million</u>

South Approach Bridge
Length: 2730 feet
Reduction Area: 2730*12 = 32,760 square feet
$ per square foot: $138

Ohio River Crossing Bridge
Length: 2260 feet
Reduction Area: 2260*12 = 27,120 square feet
$ per square foot: $582

North Approach Bridge
Length: 2560 feet
Reduction Area: 2560*12 = 30,720 square feet
$ per square foot: $135

Total Cost Avoidance: (32760*138)+(27120*582)+(2560*135) = $20,650,000

SCHEDULE IMPACT:

<u>Rough order of magnitude impact to schedule (no perceived impact to schedule) – 0</u>

Idea Title	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum width shoulders
Function	Support Redundancy

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

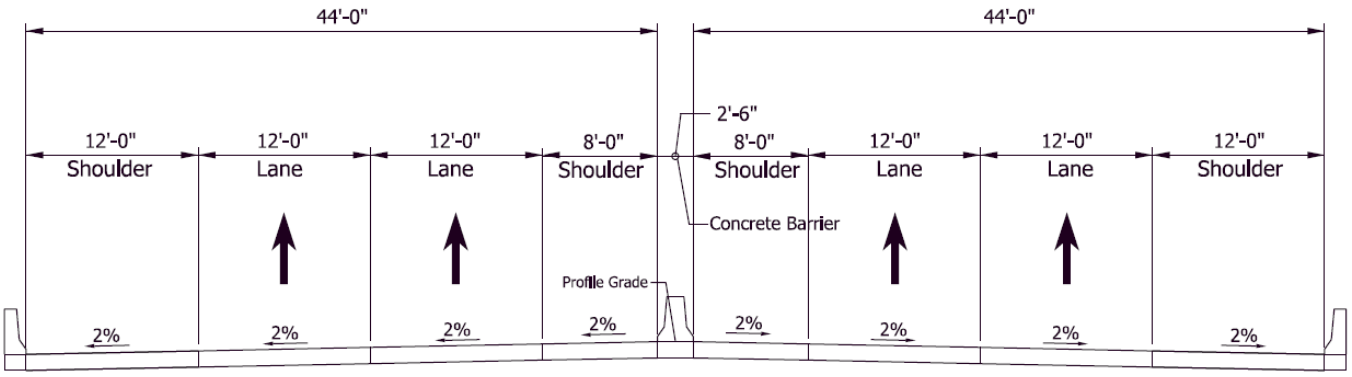
The reduction of the shoulder width to AASHTO minimum allowable meets design standards and will reduce the overall cost of an expensive project component.

The VE team does not recommend further reduction of the shoulder widths beyond the alternative concept because of the challenges with maintenance of traffic for future bridge widening, and the concerns with lane reduction on the bridge during emergency situations. The VE team does not recommend that the design team pursue a design exception to further reduce the shoulder width; the spacing of the adjacent interchanges (~5 miles) is too substantial to allow alternate travel routes during emergency/maintenance scenarios.

During the design of the new I-69 bridge, consideration should be given to potential future expansion of the bridge. The need for expansion could result from either the need to take the remaining US 41 bridge out of service or demand for travel on I-69 that exceeds the capacity of the proposed 4-lane structure.

Idea Title	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum width shoulders
Function	Support Redundancy

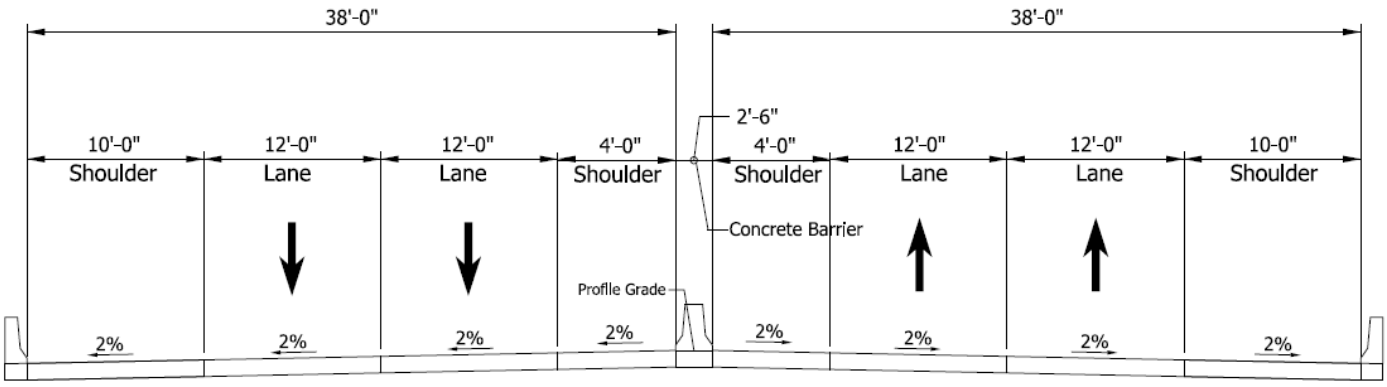
ORIGINAL CONCEPT SKETCH:



MAIN SPAN BRIDGE TYPICAL SECTION - RURAL

Idea Title	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum width shoulders
Function	Support Redundancy

ALTERNATIVE CONCEPT SKETCH:



MAIN & APPROACH SPAN BRIDGE TYPICAL SECTION

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SR-06

Idea Title	Remove US 60 interchange
Function	Support Redundancy

ORIGINAL CONCEPT:

Construct interchange from proposed I-69 with US 60. Realignment of US 60 to reduce impact to historical properties.

ALTERNATIVE CONCEPT:

Delete construction of proposed interchange on US 60 at proposed I-69. Leave current US 60 alignment unchanged. Construct I-69 overpass at US 60. Construction of interchange may be built in the future when needed.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Encourages use of Audubon Parkway for travel between Henderson & Owensboro • No impact to historical properties • Little to no benefit of interchange; little return on investment; low traffic volumes and little opportunity for future development • Interchange does not add true purpose to the project • Henderson projections show a decline in population • Reduces utility impact • Eliminates traffic impacts to US 60 • Reduces right-of-way acquisition • Removes need of new bridge over railroad	• Public disapproval • Loss of potential development in vicinity of proposed interchange

COST IMPACT:	**<u>Rough order of magnitude impact to cost (potential cost avoidance) - $5M</u>** The reduction in cost is due to eliminating the new alignment of US 60 at the I-69 interchange, eliminating the ramps for the interchange and removing a new bridge over the railroad. The cost of the bridge over the railroad is about $2M and the cost of the interchange, road, and ramp construction are about $3M.
SCHEDULE IMPACT:	**<u>Rough order of magnitude impact to schedule (reduce schedule) – 3 months</u>** The reduction in time is due to removing the ramps, omitting the shift of the US 60 interchange, and removing the need to build a new bridge over the railroad.

Idea Title	Remove US 60 interchange
Function	Support Redundancy

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

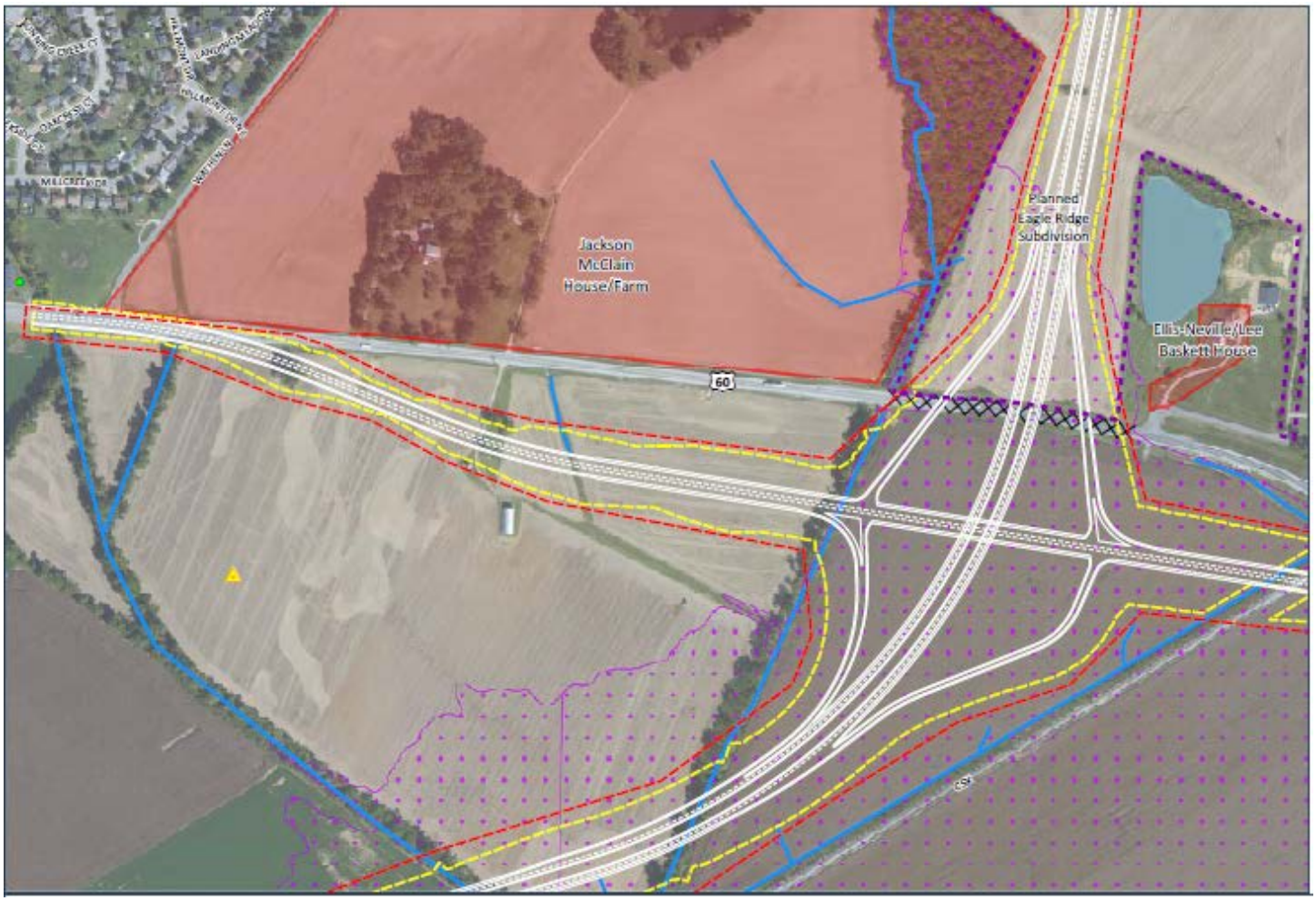
Eliminate construction of interchange with US 60 in Kentucky. Build I-69 overpass of US 60. Leave US 60 current alignment unchanged. Allow design of overpass for future interchange construction. This alternate reduces impact to historical properties, reduces right-of-way requirements, reduces cost, and eliminates inconvenience to traffic on US 60. This interchange does not add to the true purpose of the project and clearly eliminating it would save significant money. Impact to growth is minimal, as no development currently exists in the area and future projections show a population decline for Henderson.

Should this advance, there are a few implementation considerations: Design the interchange for future construction if needed. Look for a partnership with the local county to cost share in right-of-way purchase to preserve the land needed for the future interchange.

This alternate design reduces impact to historical properties and therefore reducing the need for any special waivers, design exceptions, etc.

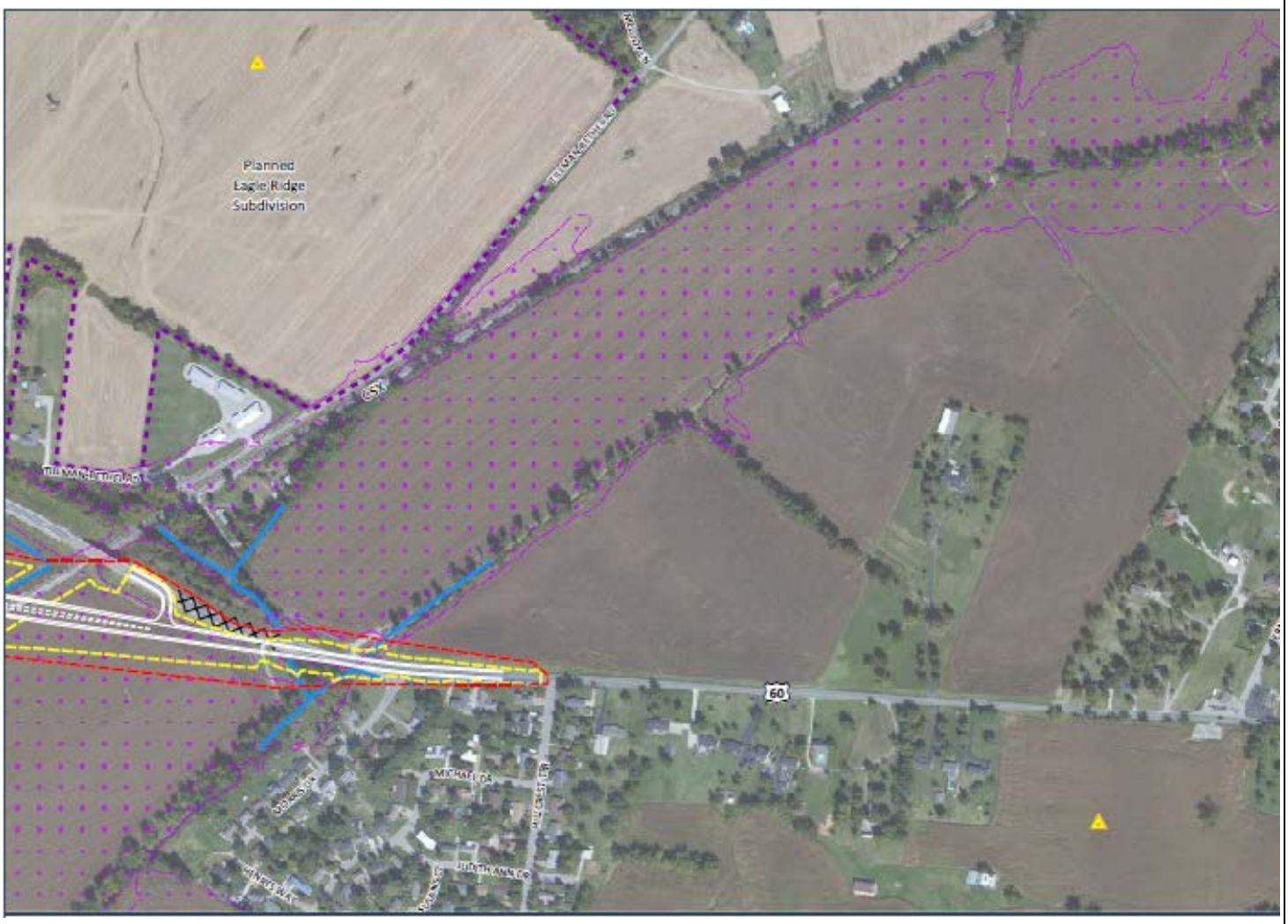
Idea Title	Remove US 60 interchange
Function	Support Redundancy

ORIGINAL CONCEPT SKETCH:



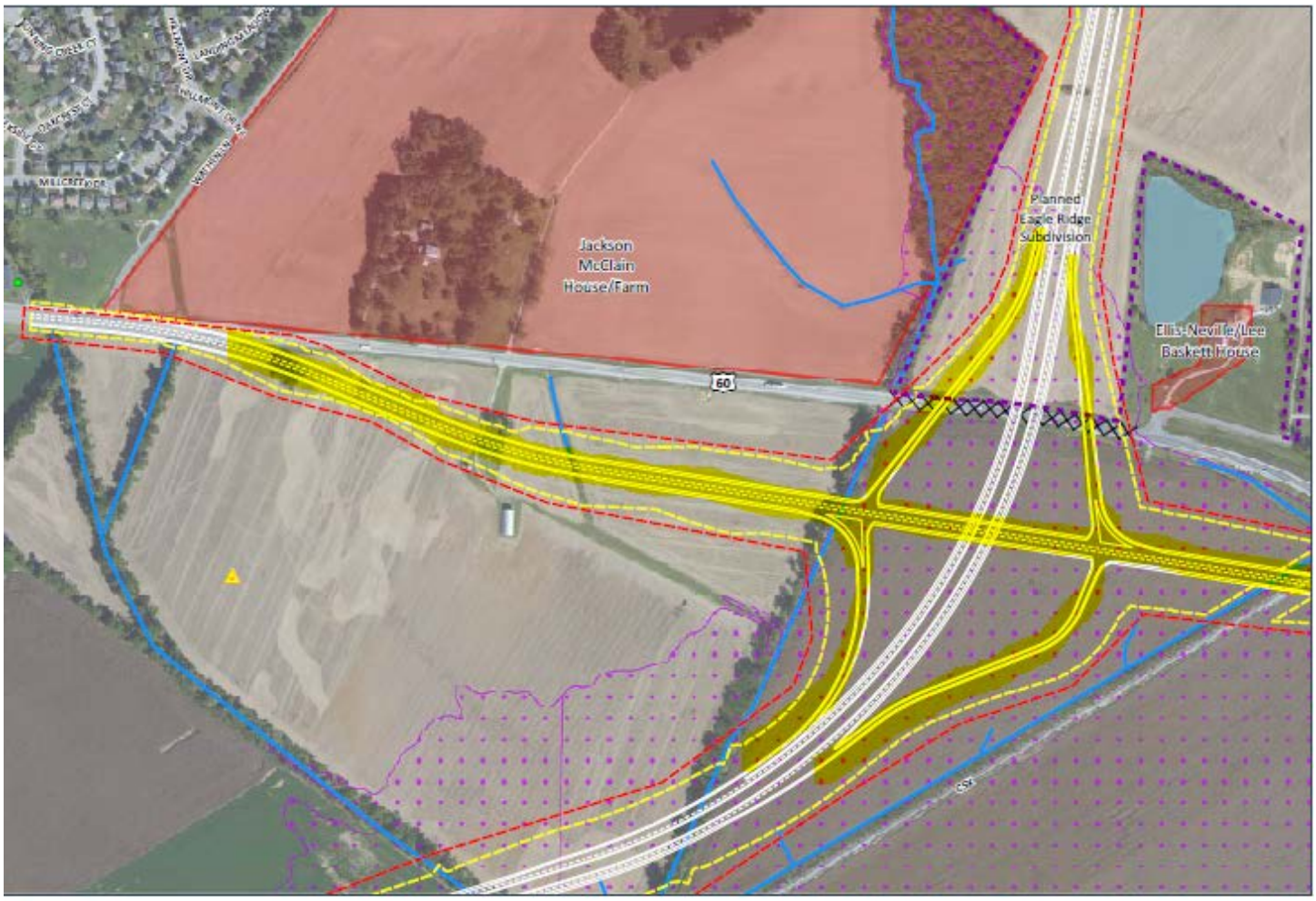
Idea Title	Remove US 60 interchange
Function	Support Redundancy

ORIGINAL CONCEPT SKETCH:



Idea Title	Remove US 60 interchange
Function	Support Redundancy

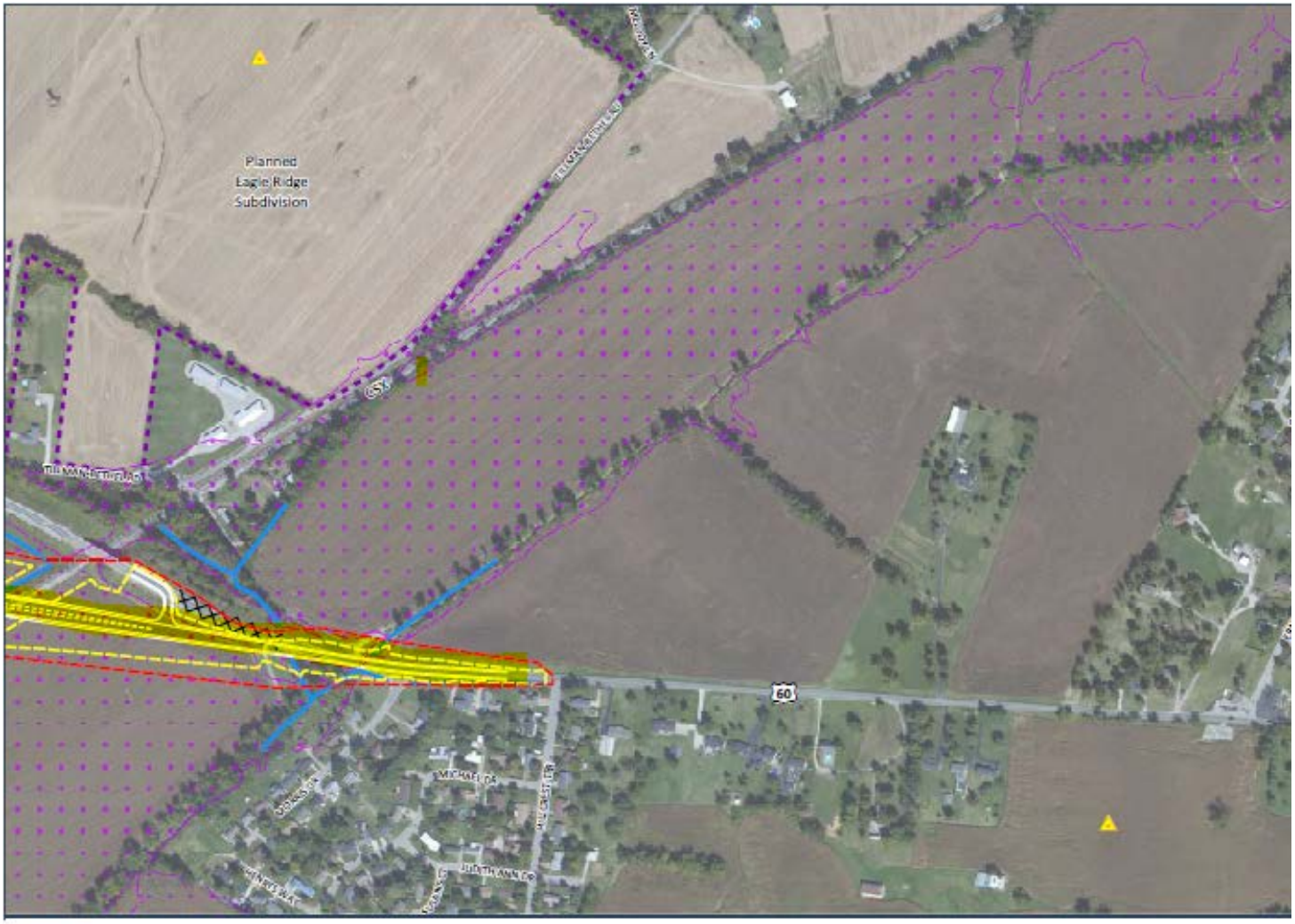
ALTERNATIVE CONCEPT SKETCH:



Proposed construction deletion

Idea Title	Remove US 60 interchange
Function	Support Redundancy

ALTERNATIVE CONCEPT SKETCH:



Proposed construction deletion

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SR-07

Idea Title	Remove US 41 Interchange
Function	Support Redundancy

ORIGINAL CONCEPT:

At the convergence of the proposed I-69 alignment and existing US 41 alignment, construct an interchange allowing traffic to move fluidly between roadways.

ALTERNATIVE CONCEPT:

In lieu of a full interchange allowing entrance and egress in all flowing directions between proposed I-69 and existing US 41, only construct a direct junction of proposed I-69 to existing US 41.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Reduces overall footprint of the interchange • Encourages free flowing traffic by reducing movements • Aids in limiting heavy truck traffic through business US 41 (downtown Henderson)	• Public may oppose a lack of connectivity

COST IMPACT:

<u>Rough order of magnitude impact to cost (potential cost avoidance) - $45M</u>

Scope Reductions:

- 200,000 sf of Bridge at $250/sf = $50,000,000
- 12,500 sy of ramps at $70/sy = $875,000
- Total Reduction = $50,875,000

Scope Additions:

- 12,500 sy of ramps at $70/sy = $875,000
- 20,000 sf of bridge at $250/sf = $5,000,000
- Total Add = $5,875,000

Net Reduction

- $45,000,000

SCHEDULE IMPACT:

<u>Rough order of magnitude impact to schedule (reduce schedule) – 5-7 months</u>

The reduction of this scope of work would result in the removal of scope equal to approximately 5-7 months of construction.

Idea Title	Remove US 41 Interchange
Function	Support Redundancy

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

The intended value of this alternative is to reduce the overall scope of the project. The scope reduction is attained by removing the roadway and structures required in facilitating the traffic movements associated with the directional transitions providing the mergers to and from proposed I-69 to existing US 41. Function is retained by constructing a direct junction of proposed I-69 to existing US 41, creating the connectivity of I-69 across the Indiana and Kentucky border.

The lack of movement options between I-69 and US 41 may generate some push-back from the local public.

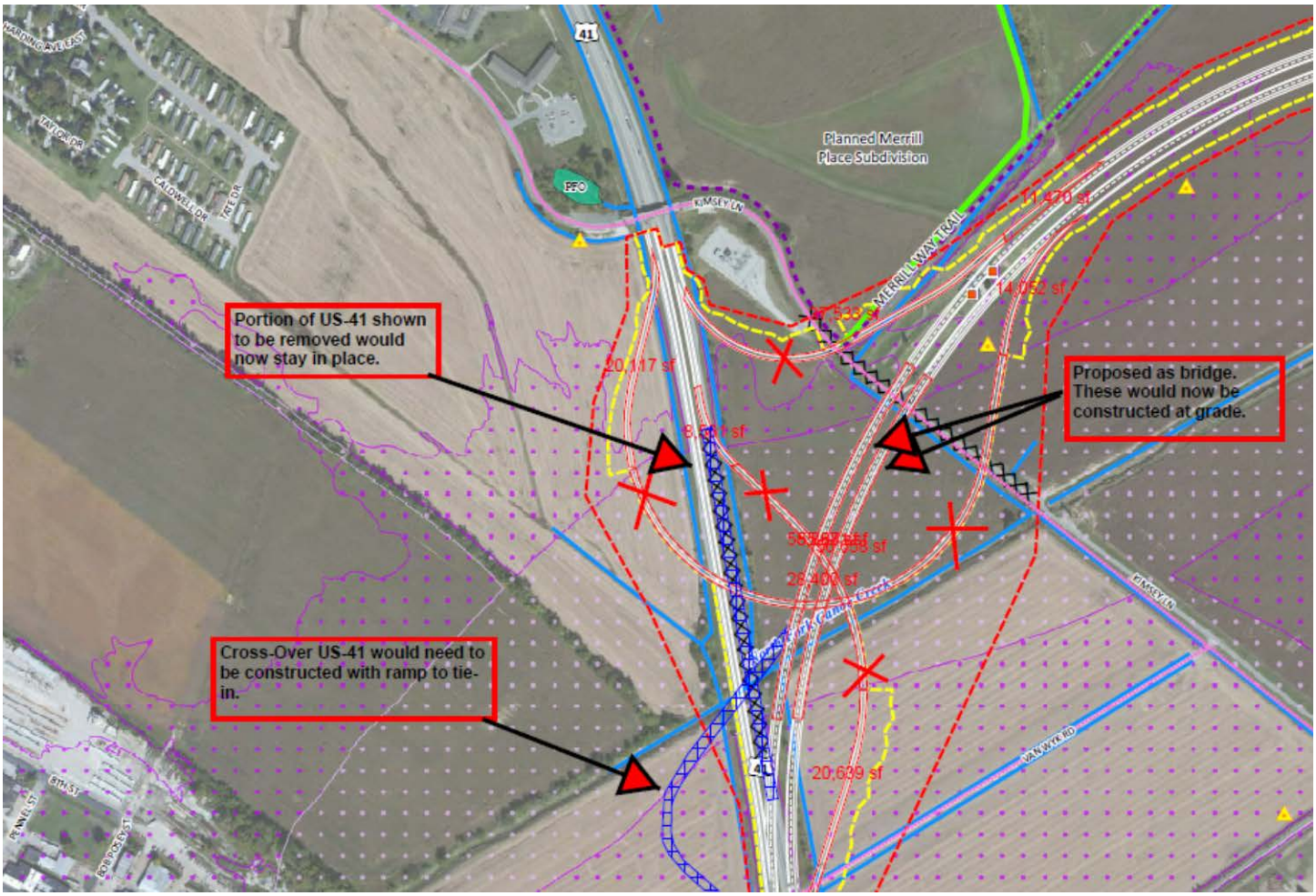
Connecting northbound I-69 to northbound US 41 may make it more acceptable to the public.

Idea Title	Remove US 41 Interchange
Function	Support Redundancy

ORIGINAL CONCEPT SKETCH:

Idea Title	Remove US 41 Interchange
Function	Support Redundancy

ALTERNATIVE CONCEPT SKETCH:



OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SR-08

Idea Title	Modify Veterans Memorial Parkway interchange
Function	Support Redundancy

ORIGINAL CONCEPT:

Provide full access to Veterans Memorial Parkway from new I-69 interchange.

ALTERNATIVE CONCEPT:

Delete access from east bound Veterans Memorial Parkway to southbound I-69 and northbound I-69 to westbound Veterans Memorial Parkway. Maintains east-west connectivity along Veterans Memorial Parkway.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Significant reduction of impacts to floodplain • Minimal impacts to local traffic patterns • Increases safety by eliminating weaving traffic movements • Maintains current Veterans Memorial Parkway function east-west • Increase toll revenue from I-69	• May impact local traffic patterns • Reduces redundancy access to I-69

COST IMPACT:	**Rough order of magnitude impact to cost (potential cost avoidance) - $37M** The cost reduction is due to the decrease of time, materials, and structures.
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (no perceived impact to schedule) - 0** No significant changes to the construction schedule.

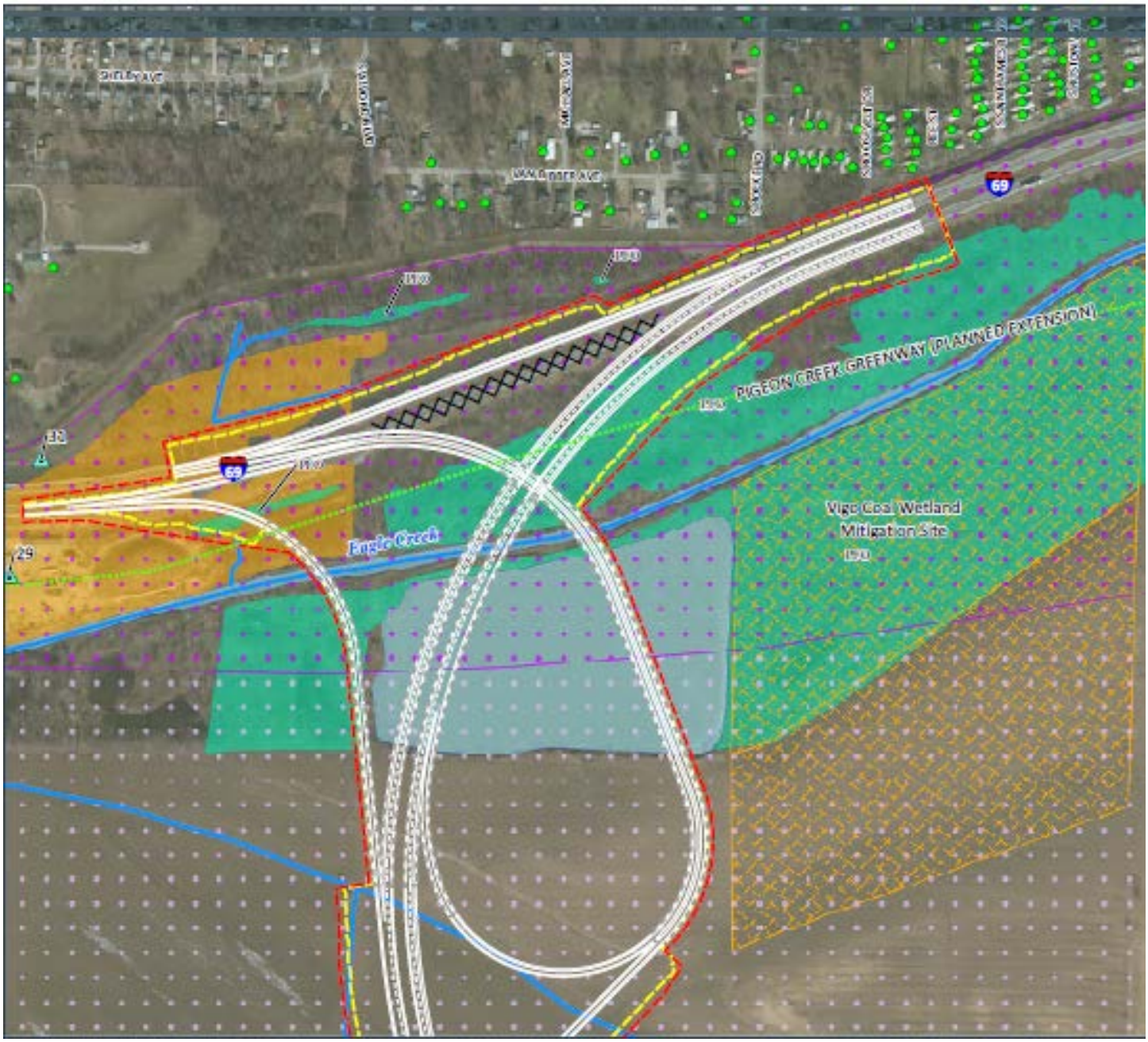
ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

I-69 will have reduced access to the Veterans Memorial Parkway. Access to westbound Veterans Memorial Parkway will be a direct ramp from southbound I-69 / Veterans Memorial Parkway. Eastbound access from Veterans Memorial Parkway to I-69 northbound will be via a single lane directional ramp entering I-69 from the median side (left side merge onto mainline). A grade separation structure will be required where the eastbound ramp crosses under south bound I-69.

FHWA approval of a new partial interchange on the interstate system may be difficult.

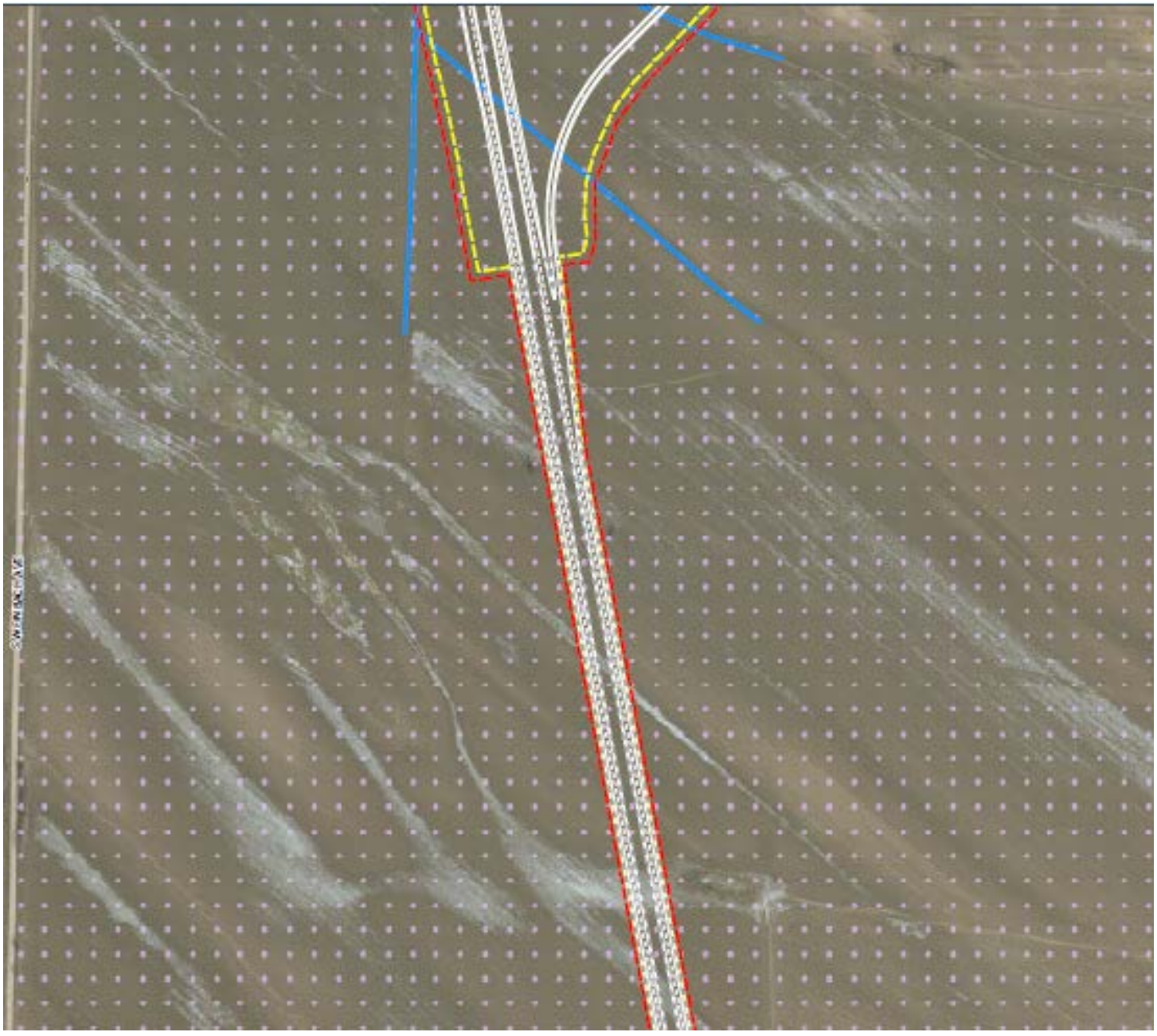
Idea Title	Modify Veterans Memorial Parkway interchange
Function	Support Redundancy

ORIGINAL CONCEPT SKETCH:



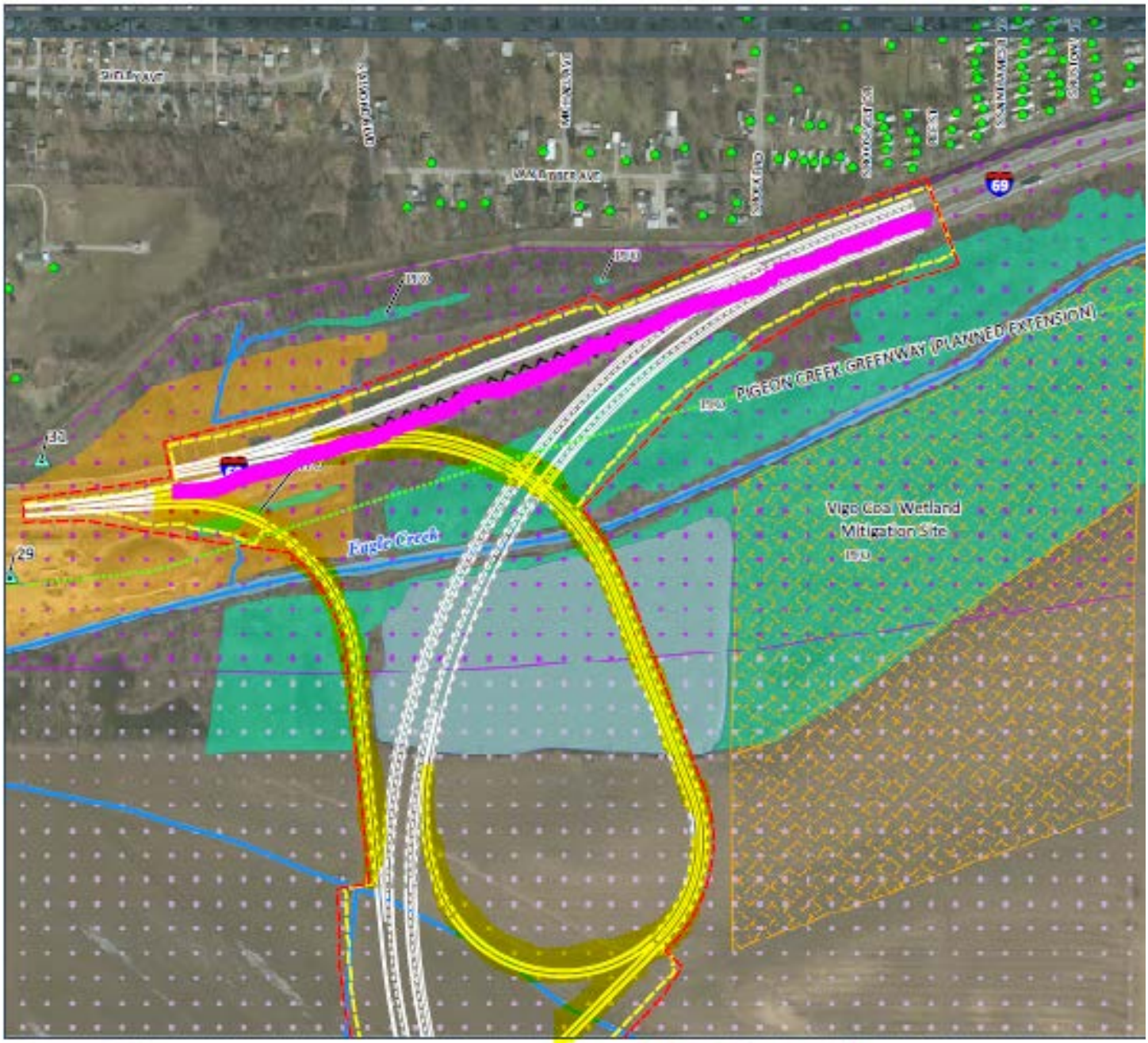
Idea Title	Modify Veterans Memorial Parkway interchange
Function	Support Redundancy

ORIGINAL CONCEPT SKETCH:



Idea Title	Modify Veterans Memorial Parkway interchange
Function	Support Redundancy

ALTERNATIVE CONCEPT SKETCH:

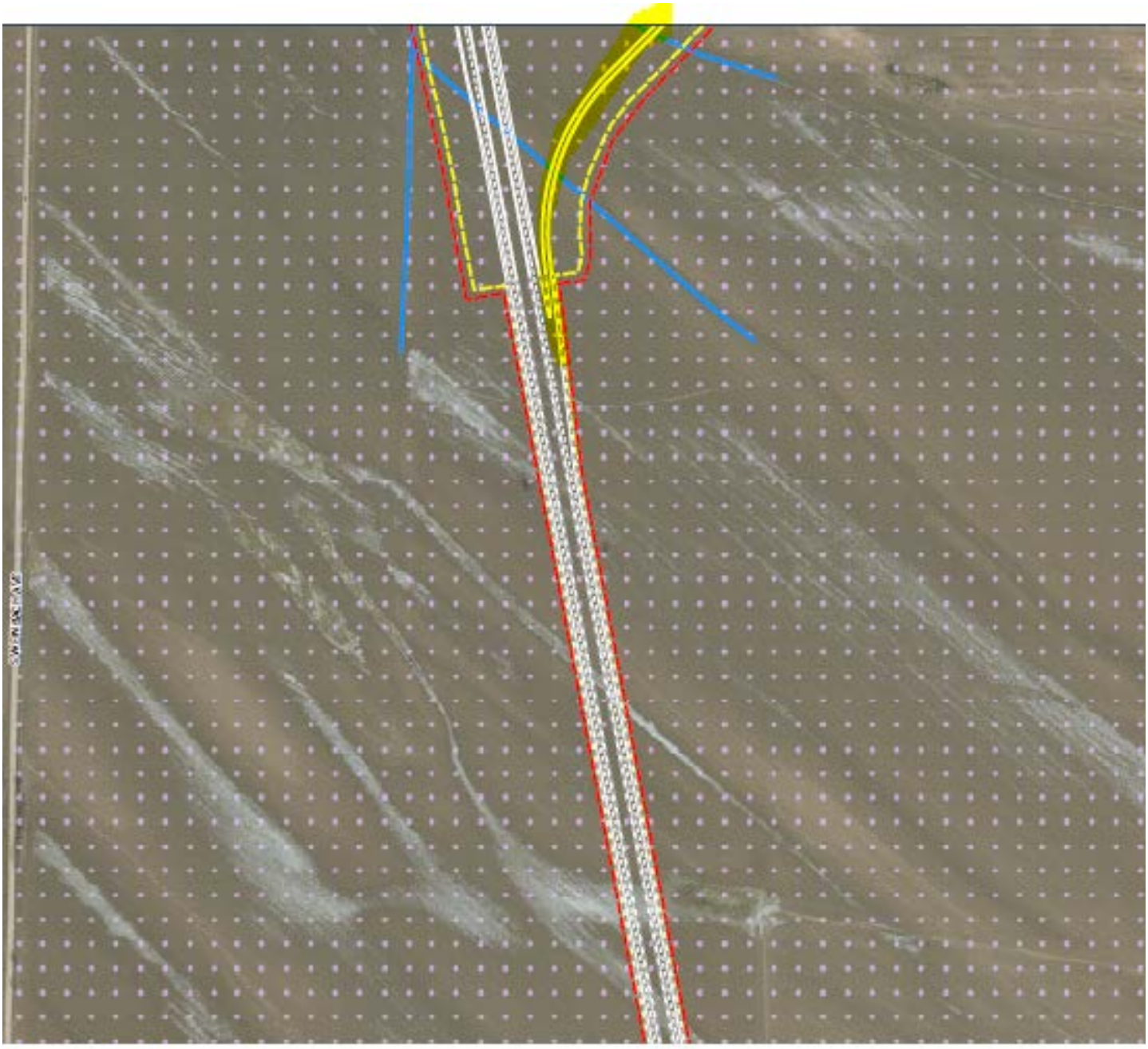


Eliminate

Proposed Alternate

Idea Title	Modify Veterans Memorial Parkway interchange
Function	Support Redundancy

ALTERNATIVE CONCEPT SKETCH:



Eliminate

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SR-09

Idea Title	Remove KY2084 ramp southbound
Function	Support Redundancy

ORIGINAL CONCEPT:

Proposed design removes existing US 41 southbound off ramp to KY 2084 southbound and new construction of a US 41/I-69 southbound ramp terminating with KY 2084 at a T-Intersection. KY 2084 northbound ramp onto US 41 northbound/I-69 has no significant change to current in-place geometry. Widened a section of KY 2084 to two lanes north of the existing southbound off ramp from US 41 southbound.

ALTERNATIVE CONCEPT:

Remove the interchange of KY 2084 with US 41/I-69. This interchange is in close proximity with the current and proposed interchange with KY 351/2nd Street.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Improves safety; elimination of close proximity interchanges thereby reducing movements and conflict points • Minimum distance increase to access US 41/I-69; close proximity interchanges both north and south of proposed interchange are eliminated • Minimum traffic volume utilizing current interchange • Removal of bridge from structure inventory, thereby reducing maintenance cost • Reduces utility impact • Interchange does not add to the true purpose of the project • Henderson projections show a decline in population • Reduces the number of driver decisions	• Public displeasure due to perceived inconvenience • Slight increase in traffic volume to KY 425 and KY 351/2nd Street • Concerns regarding increased truck traffic to KY 351/2nd Street • Business concerns due reduced access to US 41

COST IMPACT:	**Rough order of magnitude impact to cost (potential cost avoidance) - $5M** The reduction in cost is due to the elimination of building two ramps for the interchange and future maintenance costs.
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (reduce schedule) – 2 months** The reduction in schedule is due to eliminating the construction of the two ramps at the interchange.

Idea Title	Remove KY2084 ramp southbound
Function	Support Redundancy

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

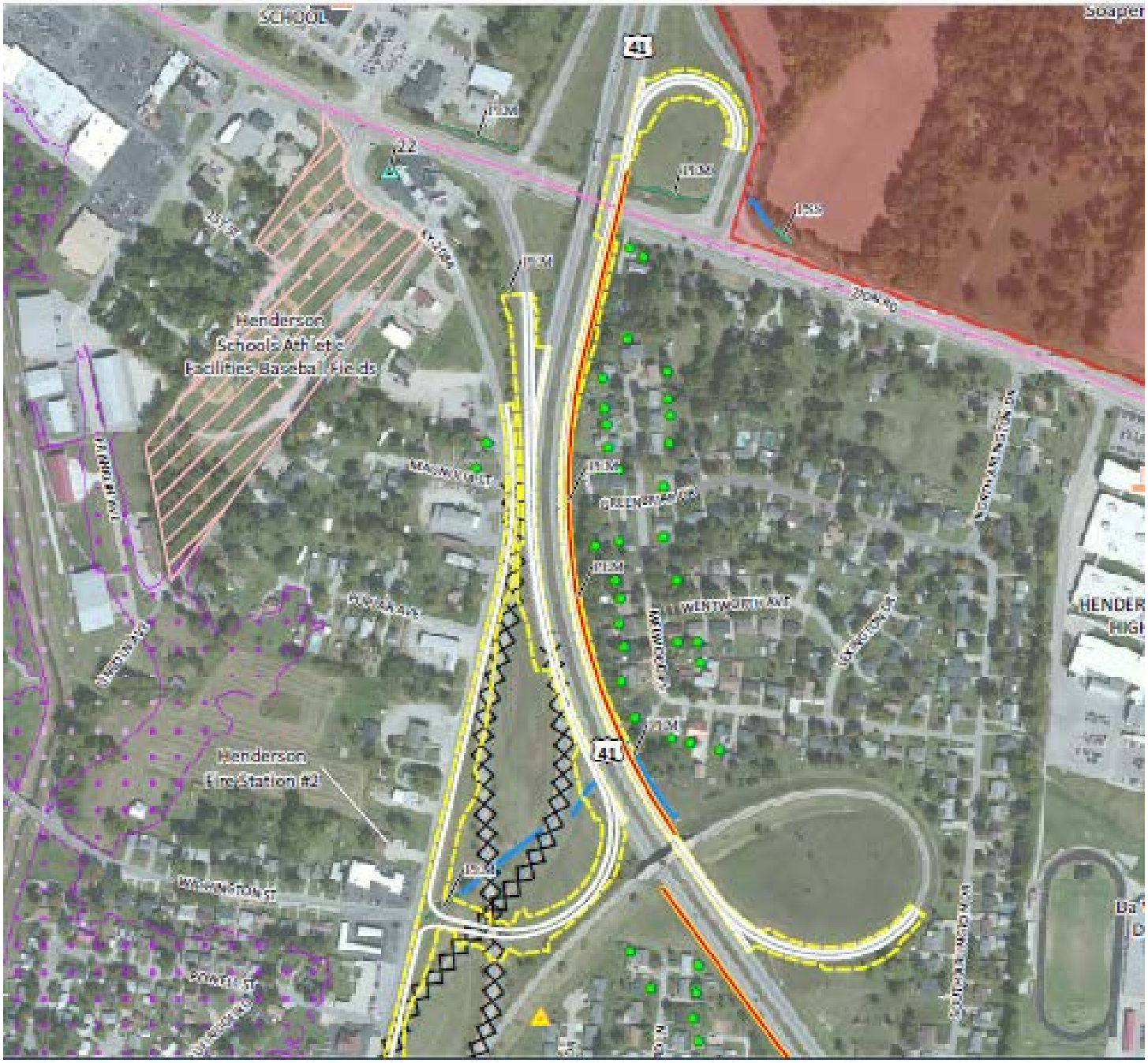
Remove KY 2084 interchange with US 41/I-69. This interchange is less than ½ mile from the KY 351/2nd Street interchange. Removal of KY 2084 interchange increases safety along the corridor due to the extreme close proximity of interchanges thereby reducing traffic movements/weaving within this short distance. Current interchange has minimum traffic volume compared to the immediate northern and southern interchanges. Impact to motorist is minimum, approximately one mile increase in distance to access US 41/I-69.

Good public relations to obtain support from the public. Decision makers must keep in their forethought the purpose of the project is to connect I-69, not to build interchanges. In addition, decision makers need to prevent the few from affecting the majority. Do not allow a few displeased citizens along KY 2084 prevent construction of project due to cost.

The removal of the KY 2084 interchange likely reduces the need for a design exception and reduces driver "decisions" in the area.

Idea Title	Remove KY2084 ramp southbound
Function	Support Redundancy

ORIGINAL CONCEPT SKETCH:

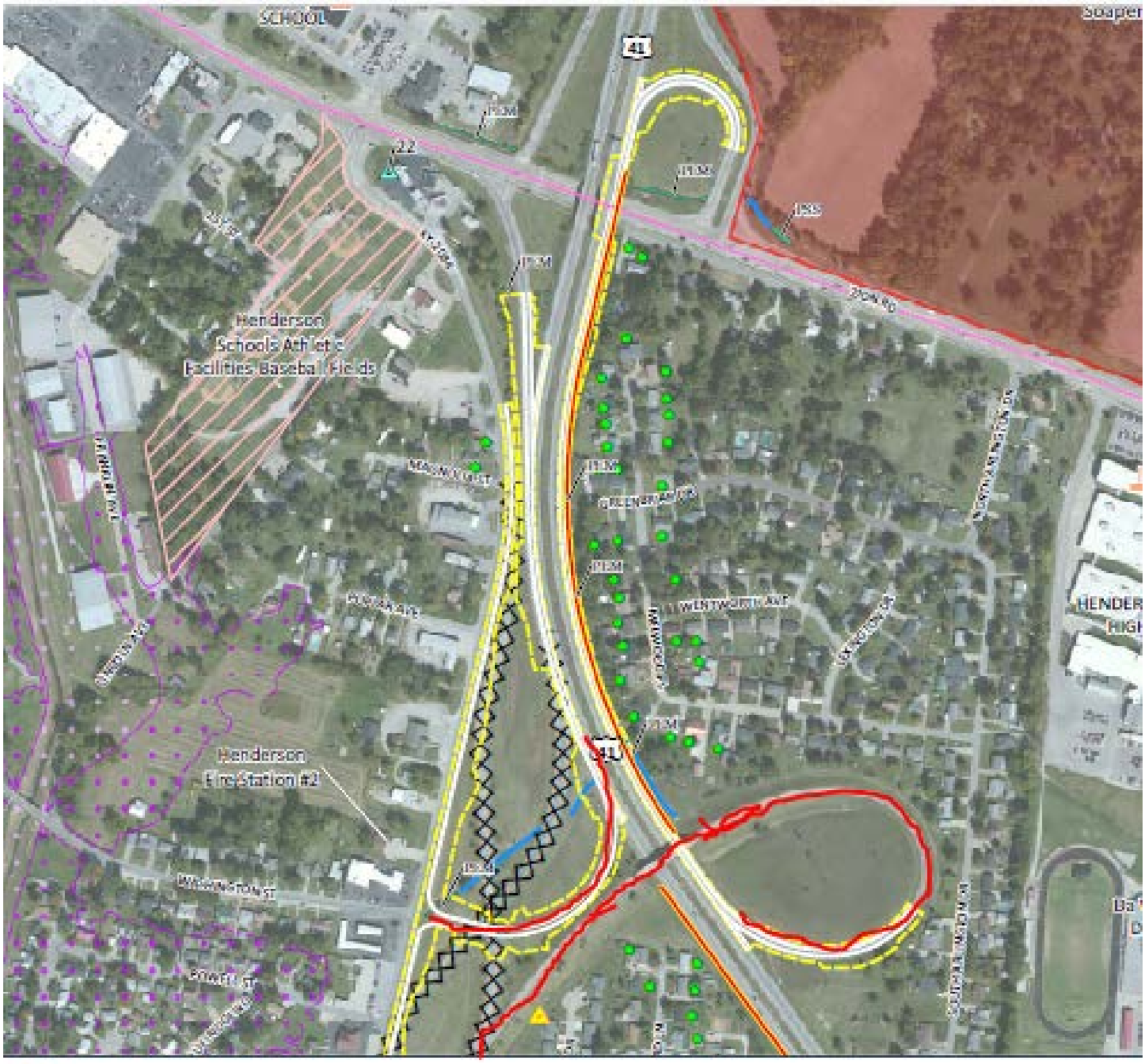


Idea Title	Remove KY2084 ramp southbound
Function	Support Redundancy

ORIGINAL CONCEPT SKETCH:

Idea Title	Remove KY2084 ramp southbound
Function	Support Redundancy

ALTERNATIVE CONCEPT SKETCH:



Proposed Removal

Idea Title	Remove KY2084 ramp southbound
Function	Support Redundancy

ALTERNATIVE CONCEPT SKETCH:

Proposed Removal

Idea Title	Reduce median width
Function	Support Redundancy

ORIGINAL CONCEPT

The current typical section for the mainline I-69 for the median is to provide the AASHTO minimum median width of 50 feet for interstates. This would also protect corridor for the possibility for future expansion to six lanes.

The typical section also shows the embankment slopes on the outside shoulders to provide slopes in compliance with the AASHTO Roadside Design Guide to provide clear zone.

Following the workshop, an additional option was identified for consideration. Reducing the median width to 40 feet (instead of the 26.5 feet discussed above) would allow room for future widening (two 12-foot lanes) without the need to pave the full median and install concrete barrier. It is likely that a cable barrier system would be sufficient. The potential savings for this option has not been developed and should be evaluated further during the design phase.

ALTERNATIVE CONCEPT:

The proposal would be to reduce the width of the median to 26.5 feet with concrete barrier wall. I-69 south of Henderson has a median width less than or equal to 40 feet. Due poor soils and the risk of cost overruns, reducing the footprint of the roadway should be considered.

Reduce embankment slopes from 3:1 to 2:1, again further reduces the footprint of the embankment and amount of embankment material. 3:1 would be preferred for maintenance and possible slope stabilization issues.

This proposal should be considered in conjunction with Creative Idea SR-15, Steepen slopes.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Reduces embankment cost (106,304 cubic yards per mile) • Reduces right-of-way (Reduces footprint ± 9.7 acres per mile) • Reduces risk related to mitigation of poor soils • If concrete barrier is used in median, provides added safety from cross over crashes • Reduces floodplain impacts	• Future traffic growth and the perceived need for expansion • Reduces slopes-cost of guardrail and maintenance of guardrail • Reduces median of less than 50 feet barrier should be considered in accordance with the Roadside Design Guide; a TL-4 crashworthy system for Interstates should be considered that leaves cable barrier wall. • Closed median adds shoulder pavement (8 feet each side) and cost for median barrier

Idea Title	Reduce median width
Function	Support Redundancy

COST IMPACT:	**Rough order of magnitude impact to cost (minimal perceived impacts to cost) - 0** Cost impact is minimal. Cost savings could be realized in reduction in right-of-way and construction schedule (see the following page for calculations).
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (reduce schedule) – 8 Months** Estimate placing 3,500 cubic yards per day per mile equates to 30 days per mile; assuming project length 8 miles (based on preliminary design of one contract).

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

It is proposed to reduce the median width from 50 feet to 26.5 feet. This would require widening the inside shoulder to 12 feet separated by a concrete barrier wall. Outside side slopes would be reduced to 2:1 with guardrail added to the outside shoulder. The benefit would be the reduction to the following: embankment material, risk to soil mitigation, right-of-way and construction schedule.

Reduction:

Embankment (assume 15-ft average height)	106,300 cubic yard per mile x $6.53 per cubic yard = $ 694,139 per mile
Right-of-way	about (80 feet x 5280)/43560 = 9.7 acre per mile
Soils Stabilization	80 feet x 5280/9 x $8.00 per square yards *= $375,467per mile
Work Days	about 30 days per mile

Cost Reduction (not including right-of-way and work day reduction) = **$1,069,603/mile**

Addition:

Pavement (shoulder)	9,387 square yard per mile	x $62.51 = $586,781
Guardrail	10,560 feet per mile	x $29.27 = $309,091
Barrier Wall	5,280 feet per mile	x $53.64 = $219,283

Cost Addition = **$1,114,155/ mile**

Total: $1,114,155/ mile - $1,069,603/mile = **$44,552/mile** (Right-of-way and work days reduction not included)

***VE Team opinion is that these unit costs are low.**

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SR-14

Idea Title	Investigate alternate location for eastern crossing
Function	Support Redundancy

ORIGINAL CONCEPT:

The preferred alternative in the Draft EIS is the central corridor primarily in that it minimizes residential relocations and right-of-way costs as compared to the original east corridor alignment. However, the original east corridor alternative was aligned to the east of the Angel Mounds State Historic Site which was where the majority of the high cost Indiana residential relocations occurred.

ALTERNATIVE CONCEPT:

The alternative concept modifies the location of the east crossing to span the Ohio River just to the west of the Angel Mounds Site. This requires a separate crossing of the green river and splits the two Green River Forest parcels but avoids all the Indiana residential relocations in the eastern corridor and significantly reduces right of way costs. A primary benefit of this alignment is that it reduces to the extent possible, the portion of the river crossing over Indiana and therefore reduces the hydraulic impacts where Indiana has more stringent requirements.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Removes the bridge alignment from a bend in the river such that it reduces vessel collision risk and likely results in shorter main span requirements, and avoids proximity to the Green River and the fleeting loading/unloading operations • Minimizes the portion of the alignment in the Indiana floodplain where the soil conditions are poor • Minimizes the portion of the alignment that is subject to liquefaction and lateral spreading • The interchange location is at a higher elevation and therefore less likely to flood • I-69 thru traffic more likely to stay on I-69 to pay toll • Remains far enough away from Angel Mounds to avoid 4(f) impacts	• Green River National Wildlife Refuge in the EA process has reserved two corridors; this eastern corridor would be much different than the central corridor and would have to be coordinated with the EA in the near term • The proposed interchange would be too close to the Green Street interchange which would have to be integrated into the alignment • This alignment requires a separate crossing of the Green River • Bisects large farm parcels in Indiana and Kentucky • Additional environmental and navigational studies would be necessary (mussels, archeology, environmental justice, right-of-way takes)

COST IMPACT:	**<u>Rough order of magnitude impact to cost (cost avoidance) - $50M</u>** The cost savings is associated with the potential for reduced main span lengths and reduced foundation costs given better soil conditions, shallower bedrock depth, reduced seismic demands, and less foundation work in the floodway.

Idea Title	Investigate alternate location for eastern crossing
Function	Support Redundancy

SCHEDULE IMPACT:	**Rough order of magnitude impact to construction schedule (reduction) 180 Days, note potential negative impact to EIS schedule of 1 year+** Given that a significant portion of the proposed alignment is not in the floodway as compared to the proposed alignment, there is significantly less schedule impact due to flooding during foundation construction. Foundation construction in the floodway represents a significant schedule risk to the project.

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

This alternative is a modification to the east corridor alternative, with the alignment shifted to the west of the Angels Mounds State Historic Site. More importantly, it moves the river crossing to a location in the river where there is no bend, and moves the crossing away from the confluence of the green river, where there is significant fleeting and loading/unloading activity. This location will substantially reduce the likelihood of vessel collision risk, and with a navigation simulation, likely reduce the requirements for main span length. The overall length of the water crossing, as well as the total area of bridge in the floodplain, is not significantly different from the central corridor.

Also, there has been a liquefaction lateral spreading risk assessment for Evansville completed by Purdue University, which highlights the sensitivity of the Indiana floodplain to liquefaction and lateral spreading. This can negatively impact foundation costs (these impacts could be significant depending on degree of lateral spreading and liquefaction). A liquefaction risk potential map has been included with the central and proposed eastern alignment overlaid to give a sense of relative risk. As an aside, the existing US 41 bridge alignment is in the worst part of the corridor, and in a seismic event for historic structures not designed to resist seismic loads. Significant damage to the existing bridge in a major seismic event is likely.

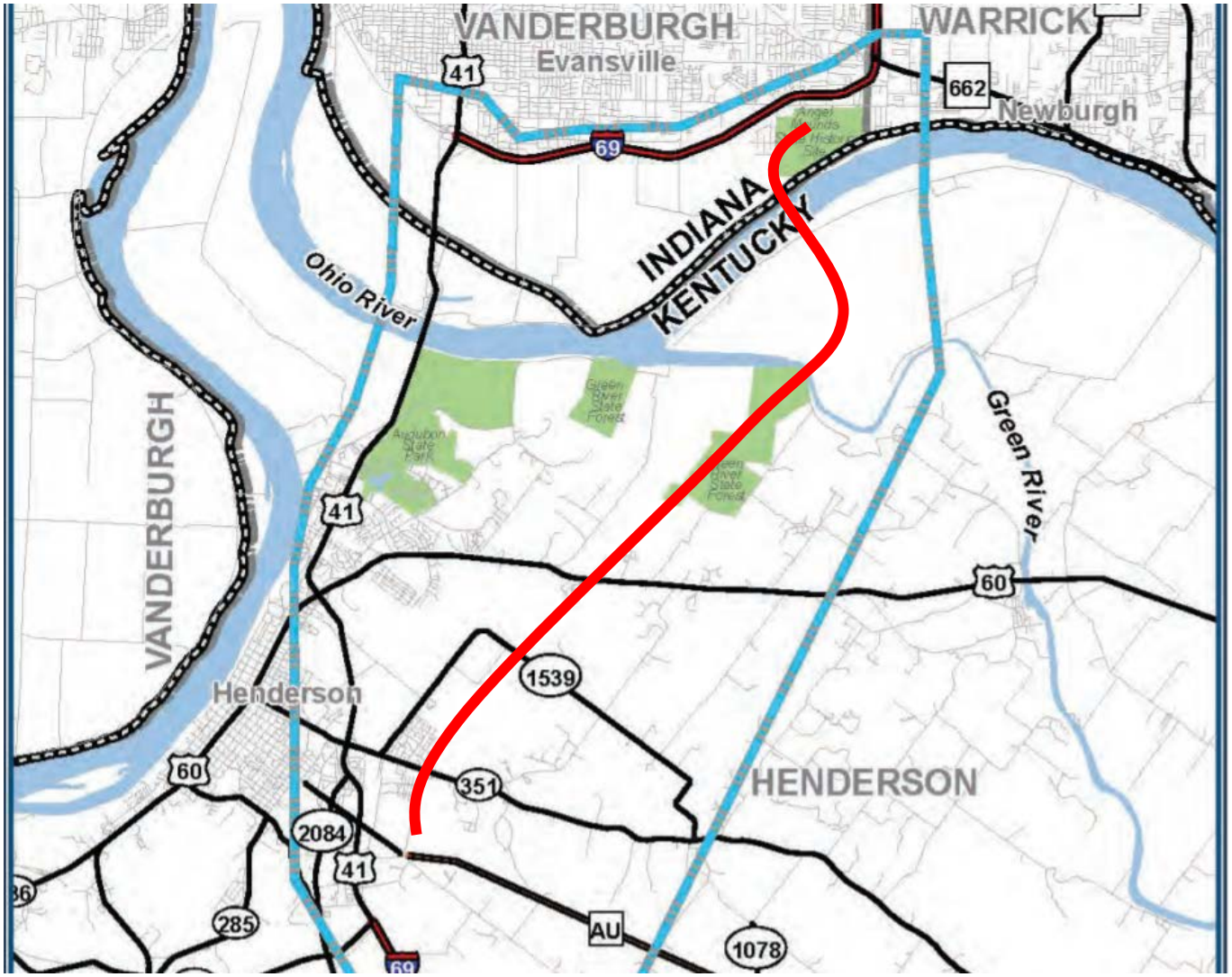
Depth to sound bedrock also correlates with foundation costs for major bridges, and the proposed easterly alignment puts a significant portion of the bridge in areas where bedrock is relatively shallow which should reduce foundation costs and construction schedule / risk.

Deep foundations which require heavy equipment and complex logistics are reduced to the extent possible in the floodplain, so that flood impacts to construction activities (particularly foundation construction) will be minimized. The portion of the alignment in the floodway has been significantly reduced where the likelihood of flood risk during construction is the highest.

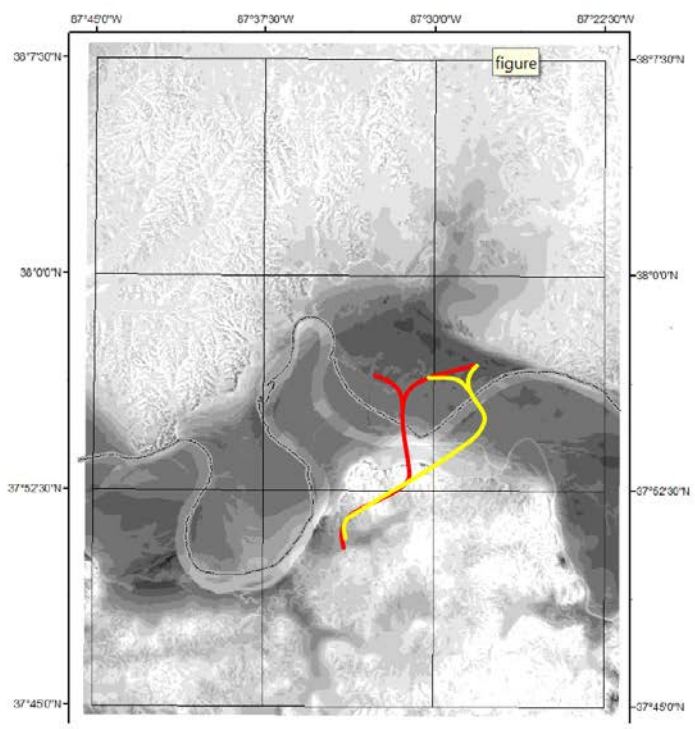
In terms of implementation, a major issue is that this revises the preferred alternative in the draft EIS and would either require a supplemental draft or has the potential of delaying completion of the environmental process. It also requires a re-evaluation of the navigational requirements at this location, as well as interchange design work in Indiana. Estimated time impact (delay) to the environmental process is 1 to 2 years. Also, it will be important in the near term to coordinate with the proposed Green River National Wildlife Refuge for an alternate corridor, or corridor flexibility for the revised alignment, before the EA is finalized.

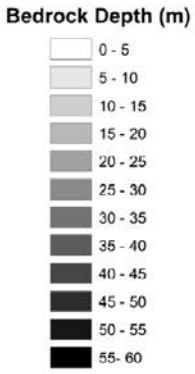
Idea Title	Investigate alternate location for eastern crossing
Function	Support Redundancy

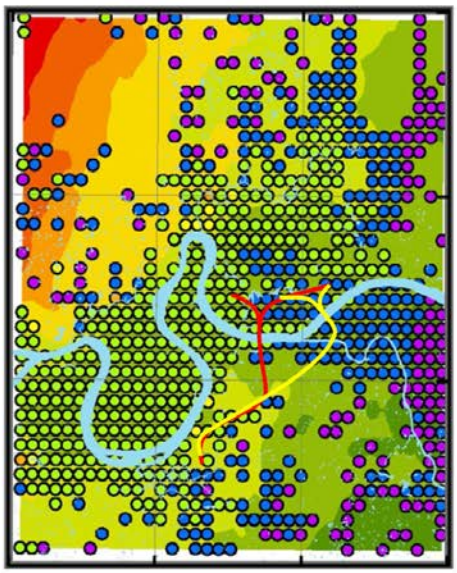
ALTERNATIVE CONCEPT SKETCHES:



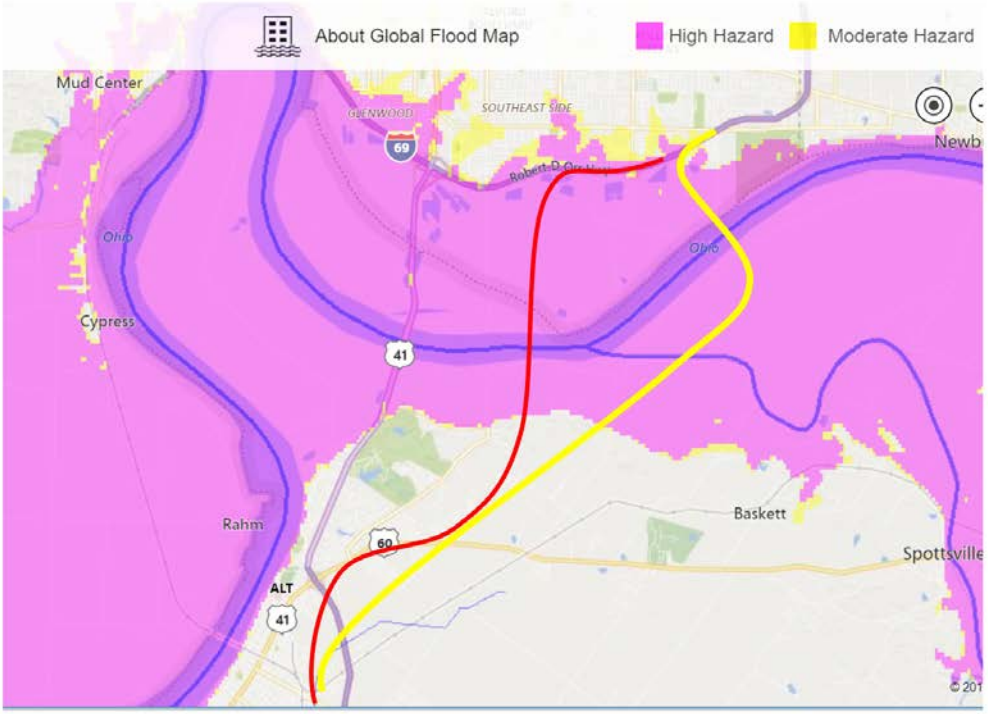
Idea Title	Investigate alternate location for eastern crossing
Function	Support Redundancy





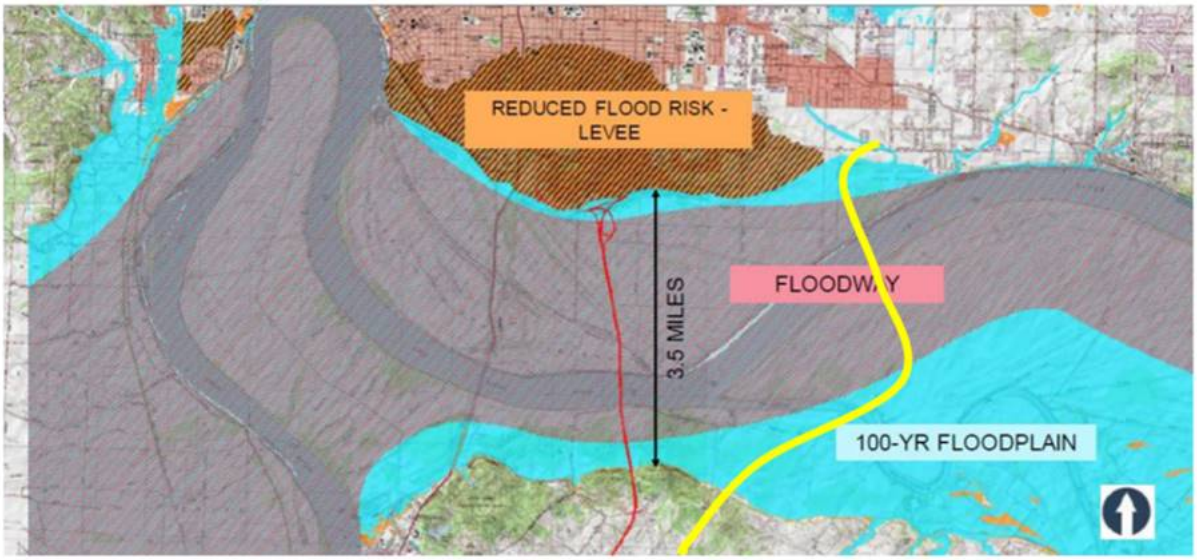


Idea Title	Investigate alternate location for eastern crossing
Function	Support Redundancy



Idea Title	Investigate alternate location for eastern crossing
Function	Support Redundancy

FEMA Hazard Map



OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. MF-08
Design Suggestion

Idea Title	Add community betterment (ped crossing, bike/ped path, waterfront) for enhancements
Function	Maintain Facility

ORIGINAL CONCEPT:

Realign existing Merrill Way Trail to maintain connectivity. There is no other planned betterment within the US 41 corridor as a result of diverted traffic.

ALTERNATIVE CONCEPT:

Allocate funds to Henderson to improve or create pedestrian crossings, bicycle/pedestrian paths, and improve the waterfront to offset impacts. This is associated with closure of US 41 bridge(s) and removal/alteration of interchanges on the Kentucky side from other value engineering (VE) proposals discussed below and on the following page.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Community enhancement strategy to offset impacts • Provides a reason for pass through traffic in the US 41 corridor • Improves standard of living for Henderson residents • Could stimulate economic growth	• Additional costs

COST IMPACT:	**Rough order of magnitude impact to cost (dependent on chosen alternates) - Unknown** There is a cost is associated with potential savings in other VE proposals. In the Draft Environmental Impact Statement (DEIS), there is no planned cost for mitigating in the US 41 corridor because of diverted traffic to I-69. The current DEIS proposes full interchanges at US 41 (Kentucky), US 60, and Veteran's Memorial Parkway. If other VE proposals are accepted that would divert more traffic away from the US 41 corridor, they may cause enough of an impact to the community that mitigation needs to be considered (which would decrease the overall cost benefits of the other VE proposals).
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (no perceived impact to schedule) – 0 days** Should not directly affect the I-69 schedule.

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

This is a design suggestion. It is dependent on US 41 bridge(s) closure decisions or the acceptance of other value engineering proposals. A discussion of when to consider community betterment for Henderson is described below for proposals that may divert traffic away and may affect the economic sustainability of the US 41 corridor. The idea behind the suggestion is that if too much traffic is directed away because of other accepted VE proposals, it may have a detrimental effect or perceived detrimental effect.

SR-06 - Remove US 60 Interchange. This likely wouldn't affect the US 41 Corridor in Henderson. Traffic will have to make a decision at the US 41 Interchange as to staying on I-69 or getting onto US 41. This proposal will

Idea Title	Add community betterment (ped crossing, bike/ped path, waterfront) for enhancements
Function	Maintain Facility

possibly have no impact on traffic patterns at US 41 interchange. All US 60 traffic would have to "backtrack" to get onto I-69 and would likely cross the river via the US 41 crossing. No need to evaluate betterment if this decision is taken.

SR-07 - Remove US 41 Interchange. This likely would divert traffic from the US 41 corridor. If the US 60 interchange is kept, traffic likely will continue on I-69 and won't "backtrack" to the US 41 corridor without a reason. Betterment of Henderson would likely be helpful to divert the traffic back to the US 41 corridor.

SR-08 – Remove Veterans Memorial Parkway interchange. This could divert traffic away from the US 41 corridor depending on if any connection between existing I-69 and Veterans Memorial Highway is removed or cut off. Betterment would have to be considered if it appears that traffic is substantially diverted away from US 41.

AC-01 – Optimize interchanges in terms of connectivity and priority (US 60). Remove US 60 Interchange. This likely wouldn't affect the US 41 Corridor in Henderson. Traffic will have to make a decision at the US 41 Interchange as to staying on I-69 or getting onto US 41. It will possibly have no impact on traffic patterns at US 41 interchange. All US 60 traffic would have to "backtrack" to get onto I-69 and would likely cross the river via the US 41 crossing. Betterment could offset reduced connectivity of added travel time.

AC-02 – Collapse/combine US 41/US 60 interchanges. This likely wouldn't affect the US 41 Corridor in Henderson. Traffic will still be allowed to choose between US 41 and I-69. It could decrease traffic that is northbound from US 60. The traffic pattern change would likely be insubstantial. No need to evaluate betterment if this decision is taken.

AC-05 – Simplify/minimize I-69 interchange at Veterans Memorial Parkway. This likely wouldn't affect the US 41 Corridor in Henderson. Traffic flow would still be allowed. No need to evaluate betterment if this decision is taken.

AC- 07 – Reconfigure the US 41 interchange to reduce structure requirements. This likely wouldn't affect the US 41 Corridor in Henderson. Traffic will still have a southern choice to make. Traffic flows would likely still be the same as currently analyzed. No need to evaluate betterment if this decision is taken.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-01

Idea Title	Optimize interchanges in terms of connectivity and priority of access (US 60)
Function	Access Community

ORIGINAL CONCEPT:

Interchange proposed at I-69 crossing of US 60 approximately 2.5 miles east of US 41.
Existing interchange of US 60 with US 41 less than a mile north of proposed I-69/US 41 interchange.

ALTERNATIVE CONCEPT:

Prioritize existing US 60/US 41 interchange over construction of new interchange at I-69/US 60 to serve access to US 60.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Avoids construction of new interchange in the near term • Defers cost of new US 60 interchange to sometime in future, thereby making I-69 project more affordable • Avoids / defers Section 106 impacts to two historic properties • Avoids / defers cost of constructing new bridge over railroad just east of new interchange • Avoids / defers indirect impacts incurred by induced development • Focuses project implementation on key need of achieving I-69 crossing of Ohio River	• Defers transportation support for economic development desired by localities in an area that is currently largely undeveloped, and therefore may not garner support by local officials and the public • Potentially diminishes travel demand, and therefore revenue, for the new interstate facility • Preserves option for implementing a new interchange in the future through right-of-way preservation

COST IMPACT:	**Rough order of magnitude impact to cost (potential cost avoidance) - $5M** Reduce cost by roughly the same number as for SR-06, Remove US 60 interchange.
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (reduce schedule) – 3 months** Same schedule savings as SR-06, Remove US 60 interchange.

Idea Title	Optimize interchanges in terms of connectivity and priority of access (US 60)
Function	Access Community

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

The new proposed interchange of I-69 with US 60 would be deferred until some later time, which would defer the costs until some later time. Although this would eliminate an access point to I-69 for the near term, access would still be available via the existing US 60/US 41 interchange. This would involve:

- Redefining the preferred alternative, communicating that change to the public, and documenting it in the FEIS.
- Conducting additional traffic analysis to identify changes in traffic volumes and potential implications for revenue, and what portion of volumes projected to access I-69 at the new interchange would find/use alternative path to get on I-69 at the I-69/US 41 interchange.
- Including design and right of way elements to not preclude implementation of the interchange later on.

If locals want an interchange, typically for Indiana it is anticipated that the locals participate in the funding (20%-50%).

No additional considerations need to be taken.

Idea Title	Optimize interchanges in terms of connectivity and priority of access (US 60)
Function	Access Community

ORIGINAL CONCEPT SKETCH:

Idea Title	Optimize interchanges in terms of connectivity and priority of access (US 60)
Function	Access Community

ALTERNATIVE CONCEPT SKETCH:

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-02

Idea Title	Collapse/combine US 41/US 60 interchanges
Function	Access Community

ORIGINAL CONCEPT:

Currently, there are two new interchanges proposed for the *Central Alternatives 1A and 1B I-69 Alignment (Preferred Alternative)*—one at US 60 and one at US 41. Both the US 60 and US 41 interchanges provide full access for all movements to/from I-69.

A new **service interchange** would be provided at US 60 east of Henderson. Central Alternatives 1A and 1B (Preferred) would also include a new **system interchange** with free-flow ramps at US 41 approximately one mile south of the US 60 interchange.

ALTERNATIVE CONCEPT:

The Alternative Concept proposes to either "collapse and/or combine" the US 60 and US 41 interchanges currently proposed under the Preferred Alternative into either one interchange or possibly into two partial interchanges. This reduces cost through the elimination of non-critical movements, and therefore access ramps and potential structure modifications, based on traffic demand needs and an aim to reduce redundant movements in proximity to one another. Since the proposed US 60 interchange is currently classified as a "service interchange" and the US 41 is classified as a "system interchange" it would be more practical to eliminate the US 60 interchange (refer to proposal SR-06, Remove US 60 interchange) or reduce access and provide main access to US 60 via US 41 to be confirmed via O/D analysis.

BENEFITS OF ALTERNATIVE CONCEPT:

- Consolidation of traffic movements – based on an analysis of traffic origins/destinations, it would make sense to consolidate traffic movements, likely accommodating the majority of movements via the US 41 interchange
- Cost savings – the elimination of various access ramps and/or structures would provide a varying degree of cost savings based on the number of movements, and hence access ramps/structures, removed or modified
- Protection for future access – options for additional access could be accommodated for in the current design (corridor protection) should it be required in the future
- The elimination of the US 60 interchange would allow US 60 to remain on the current alignment thus removing need of right-of-way acquisition
- Potential reduction in floodway impacts

RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:

- Public resistance – there may be some potential resistance to the elimination of specific movements with the consolidation of the US 41/US 60 interchanges; however, since the interchanges are in proximity to each other, it is anticipated that the resistance would be low
- The consolidation of movements may affect safety as this concept will increase traffic volumes for some movements
- Any redesign of the US 41 interchange will need to be cognizant of any potential impacts to future area developments
- US 60 ramps would still have to avoid the 4(f) resources depending on what is kept in the project

ORX 69 OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-02

Idea Title	Collapse/combine US 41/US 60 interchanges
Function	Access Community

COST IMPACT:	**Rough order of magnitude impact to cost (potential cost avoidance) - $21M** Potential cost targets (depends on elimination and/or reconfiguration of interchanges): 1. US 60 On Ramp - $388,000 2. US 60 On Ramp - $414,000 3. US 60E Off Ramp - $388,000 4. US 60W Off Ramp - $647,000 5. Reconfigurations to US 41 On/Off Ramps vary – current ramp costs are as follows: a. Ramp 1 Segment 2 – US 41E Off Ramp - $752,000 b. Ramp 2 Segment 2 – US 41 On Ramp - $297,000 c. Ramp 3 Segment 2 – US 41E Off Ramp - $219,000 d. Ramp 4 Segment 2 – US 41 On Ramp - $282,000 e. Bridge #2.1 – Over Van 439yk Road, North - $2,439,000 f. Bridge #2.1 – Over Van Wyk Road, South - $2,439,000 g. Bridge #2.2 – Over Canoe Creek North - $2,591,000 h. Bridge #2.2 – Over Canoe Creek, South - $2,591,000 i. Bridge #2.3 – I-69, North - $3,646,000 j. Bridge #2.3 – I-69, South - $3,653,000 Total - Potential cost targets: **$20,746,000** Note: Estimated costs are based on current construction cost estimate for preferred alternative. Updated or more current construction costs may be available.
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (reduce schedule) – 3 to 6 months** It is anticipated that there would be a positive impact toward reducing the overall construction schedule.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-02

Idea Title	Collapse/combine US 41/US 60 interchanges
Function	Access Community

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

Based on a refinement of the traffic analysis (origin/destination survey), it is proposed that the interchanges of US 60 and US 41 with the proposed alignment of I-69 be reviewed to determine which movements should be accommodated as critical movements and which movements should be eliminated or provided for in the future (where practical). This reconfiguration would provide a cost savings to the currently proposed baseline project (Central Alternatives 1A and 1B I-69 Alignment). As current traffic data is not available at this time, the approach of this concept is to point out the potential "cost targets" that make up the estimated construction cost of the various ramps and structures that could be either eliminated or reconfigured—approximately $21M. The total cost savings would depend on the elimination/reconfiguration of ramps and the reduction of structural costs based on the interchange refinements.

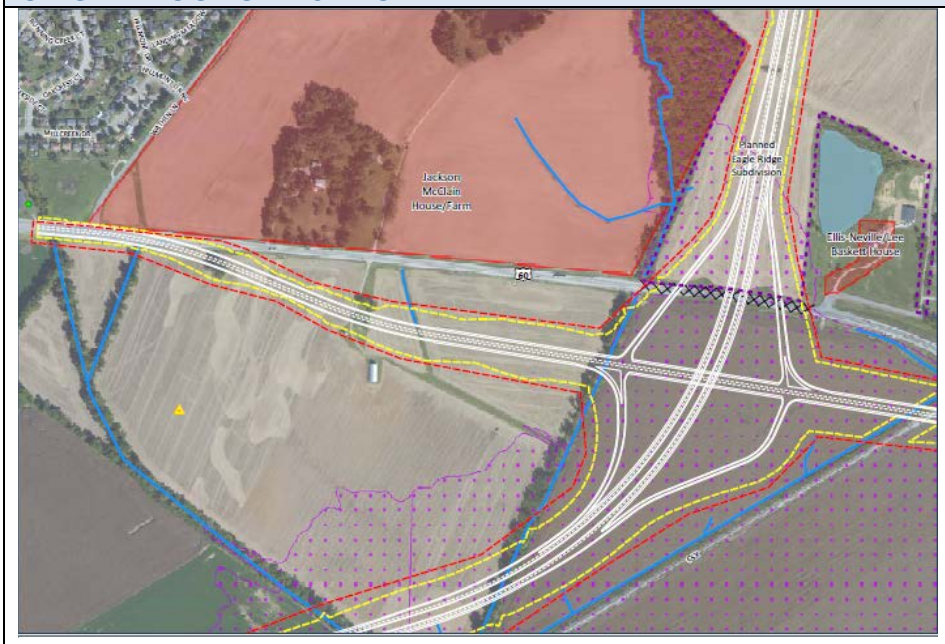
Justification for implementing this concept, based on available information at this time include the following:

- Preliminary traffic data seems to point to low traffic volumes projected to the year 2045 along US 60 and for other traffic movements though the US 41 interchange.
- The proposed location of US 60 and US 41 interchanges are in proximity to each other (one mile apart) and therefore it is anticipated that travel times would not be significantly impacted should access be eliminated at US 60 with I-69. Alternatively, ramps for movements deemed critical could be provided through a partial interchange configuration.
- Free flow movements to/from US 41 and I-69 could be accommodated with modifications to the secondary ramps provided (potential non-free flow) representing structural cost savings.
- Protection of the roadway corridor based on future access could be accommodated now so that future access, should it be warranted, could easily be accommodated (design for it now and implement it later).

Any redesign will need to ensure that any future development, historical resources or environmental features are not impacted and any safety impacts should be considered as part of the redesign.

Idea Title	Collapse/combine US 41/US 60 interchanges
Function	Access Community

ORIGINAL CONCEPT SKETCH:



Central Alternatives 1A and 1B – Preferred Alternative – I-69 and US 60 Interchange

Central Alternatives 1A and 1B – Preferred Alternative – I-69 and US 41 Interchange

Idea Title	Collapse/combine US 41/US 60 interchanges
Function	Access Community

ALTERNATIVE CONCEPT SKETCH:

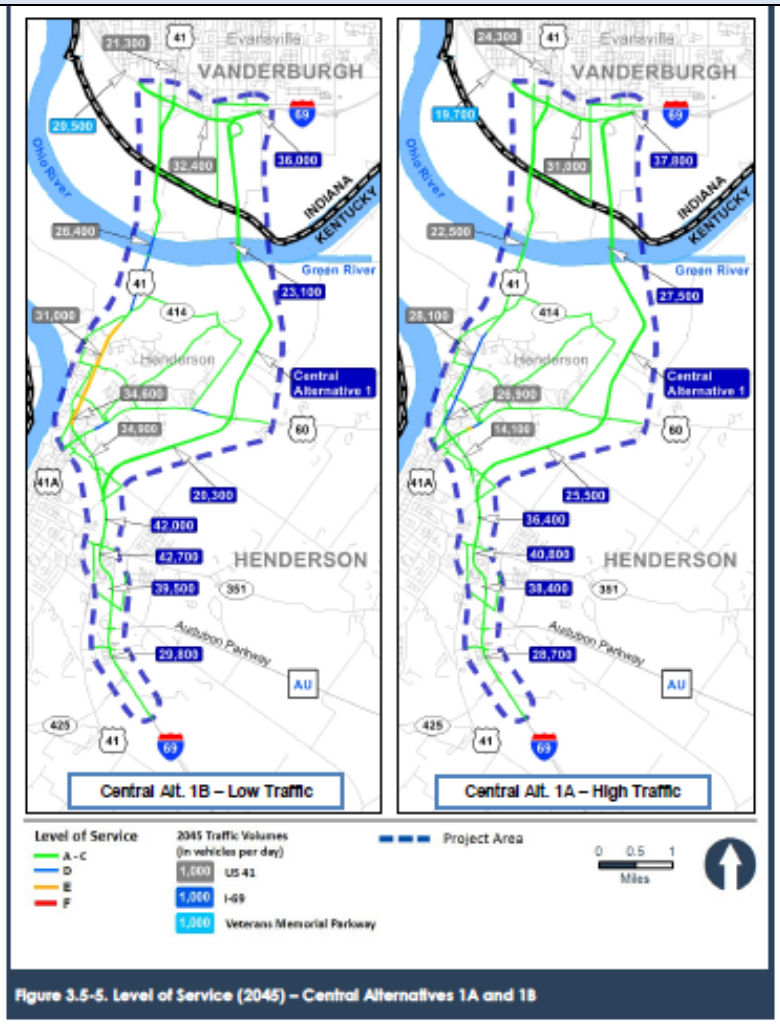


Figure 3.5-5. Level of Service (2045) – Central Alternatives 1A and 1B

Excerpt from APPENDIX D-1 - Traffic Technical Report
I-69 Ohio River Crossing Project
Draft Environmental Impact Statement

The alternative concept sketch would include the following options:

1. Elimination of US 60 interchange; keep the proposed US 41 interchange as proposed.
2. Elimination of US 60 interchange; reconfigure ramps at US 41 to provide free flow high volume movements to I-69; reconfigure ramps to US 41 (and other connections) to minimize cost.
3. Reconfigure both US 60 and US 41 interchange ramps to provide necessary access based on O/D analysis (potential for partial interchanges at both locations) related to critical movements.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-03

Idea Title	Relocate Parcel 627 access
Function	Access Community

ORIGINAL CONCEPT:

A gravel access road connecting Parcel 627 to SR 414/Wathen Lane intersects the proposed alignment of I-69. The proposed solution is to build a bridge over I-69 to retain access.

ALTERNATIVE CONCEPT:

The proposed alternative would relocate the access road by following the proposed alignment to US 60 thus eliminating the need for a bridge over I-69.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Reduces cost of construction • Provides the same function • Lowers maintenance cost by removing a bridge • Frees up schedule by removing a bridge	• Property owner might object

COST IMPACT:	**Rough order of magnitude impact to cost (reduce cost) - $1,006,000** See calculation below
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (add/reduce schedule) – 3 months** Eliminating the bridge and being able to construct the gravel road at the same time as the I-69 corridor

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

This proposed alternate would relocate the current gravel road that provides access to Parcel 627. It would connect Parcel 627 with a gravel road from to US 60 instead of retaining the connection to SR 414/Wathen Lane and building a bridge for I-69. By eliminating the need to construct a four-lane bridge over I-69, the alternate provides the same function as well as decreases costs and reduces the time needed to construct. This proposal also decreases the future costs of maintenance by not having a bridge to maintain.

The downside of this alternative is the length of gravel road for the property owner increases to 1.5 miles, but the cost savings outweigh the negative impact. It is worth noting that there are opportunities to reduce the length of the alternative by connecting to a non-state route such as Bowling Lane or Melody Lane, but would require more right-of-way to be acquired.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-03

Idea Title	Relocate Parcel 627 access
Function	Access Community

Cost Calculation:

From Parsons Estimate Summary:

Bridge #3.3 = $853,000 + $807,000 = $1,660,000

Proposed Gravel Road:

1.5 miles*5280 ft/miles* 10 ft / 9 ft²/sys = 8800 sys

From Parsons Estimate:

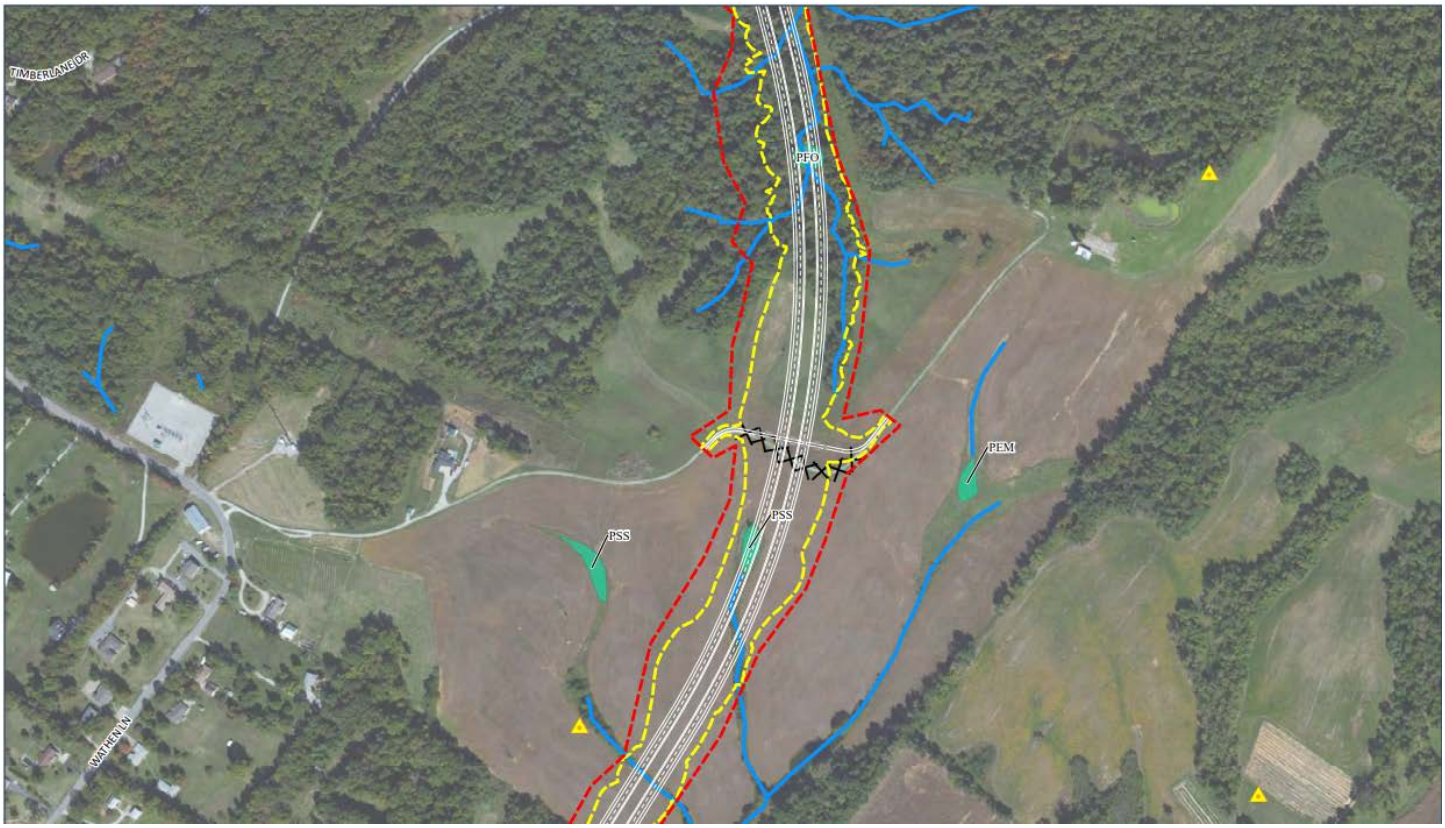
Gravel Road Unit Cost = $67.95/sys

8800 sys * $67.95 = $597,960 ~ $600,000

$1,660,000 - $600,000 = $1,060,000

Idea Title	Relocate Parcel 627 access
Function	Access Community

ORIGINAL CONCEPT SKETCH:

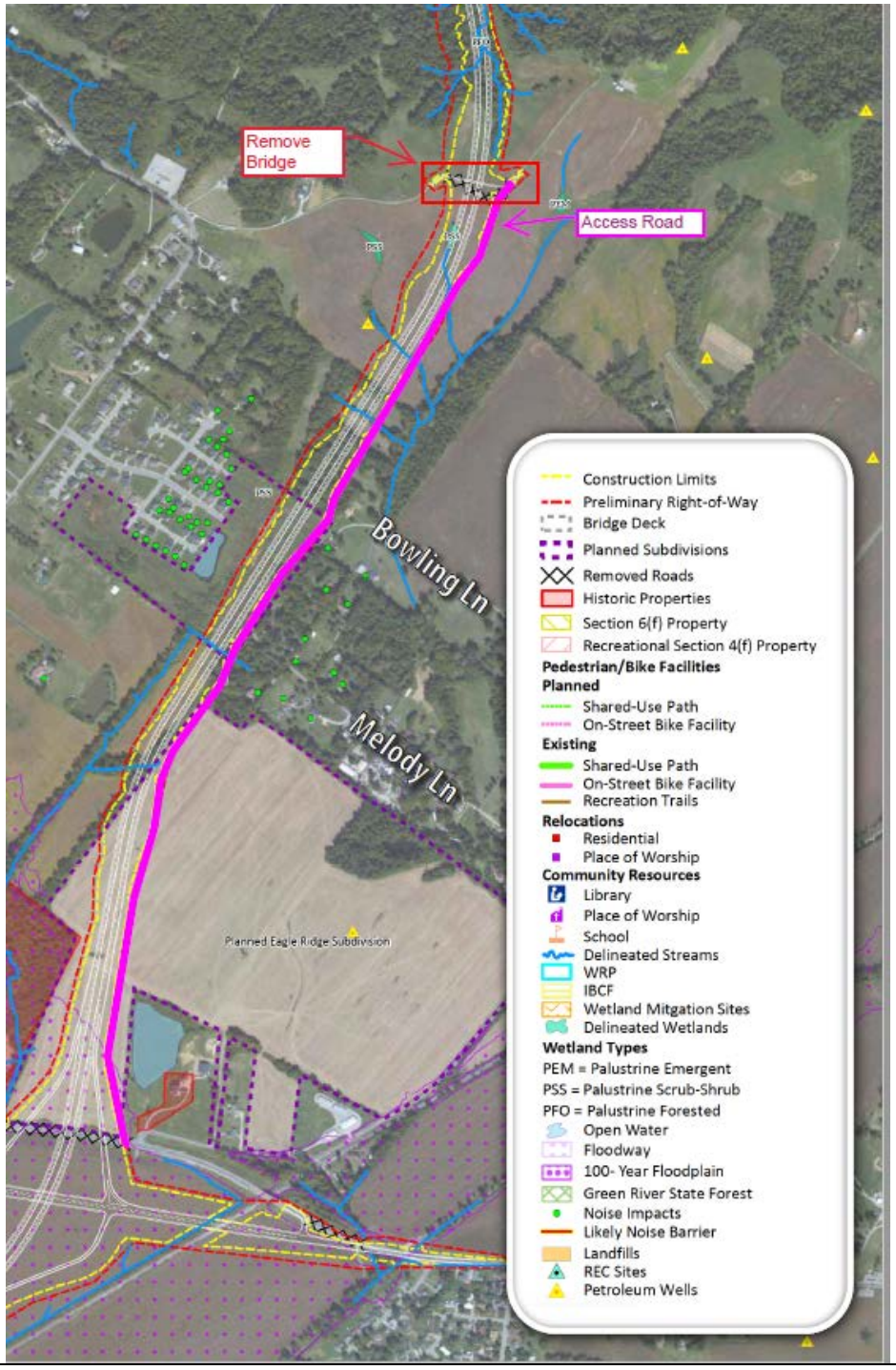


OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-03

Idea Title	Relocate Parcel 627 access
Function	Access Community

ALTERNATIVE CONCEPT SKETCH:



OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-05

Idea Title	Simplify/minimize I-69 interchange at Veterans Memorial Parkway
Function	Access Community

ORIGINAL CONCEPT:

Proposed interchange of I-69 at Veterans Memorial Parkway (VMP) includes construction of three significant size bridges outside of the mainline. One significant bridge with radius for eastbound VMP to southbound I-69; one smaller bridge with a radius for eastbound VMP to northbound I-69. The largest and widest bridge carries traffic from northbound I-69 to westbound VMP and eastbound VMP to northbound I-69. Additionally, the interchange includes a widened section of bridge at the gore area of the northbound I-69 ramp to westbound VMP. This interchange also includes embankment construction for northbound I-69 to westbound VMP and eastbound VMP to northbound I-69.

ALTERNATIVE CONCEPT:

Minimize footprint of interchange that reduces requirement for one structure and shortens the length of one structure:

1. No change to eastbound VMP to southbound I-69 ramp movement.

2. Construct northbound I-69 at a higher elevation (17 feet) than southbound I-69. This allows a northbound I-69 left off ramp (fast lane exit) to crossover southbound I-69 to tie-in with westbound VMP. Additionally, this same northbound I-69 to westbound VMP will have a left side on-ramp to westbound VMP. This left-off to left-on ramp proposal shortens the bridge length requirement and allows for a great portion of the ramp constructed on fill.

3. Eastbound VMP ramp to northbound I-69 requires two grade separation structures with invert on-grade with eastbound VMP ramp to northbound I-69. One structure under northbound I-69 ramp to westbound VMP and a second structure under southbound I-69. Eastbound VMP ramp departs from left lane of eastbound VMP and enters northbound I-69 on the left lane (fast lane).

4. No change to southbound I-69 to westbound VMP ramp.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Minimizes footprint • Lessens impact to flood plain • Reduces bridge construction in poor soil conditions • Reduces bridging requirements • Eastbound VMP to northbound I-69 travel times reduced via more direct route	• Left departure off-ramps are not desirable • Left entry on-ramps are not desirable • Possible traffic weaving WB VMP to US 41 exit ramp

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-05

Idea Title	Simplify/minimize I-69 interchange at Veterans Memorial Parkway
Function	Access Community

COST IMPACT:	**Rough order of magnitude impact to cost (potential cost avoidance) - $30M** $30M cost reduction.
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (reduce schedule) – 2 months** 9 month reduction in construction schedule.

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

This alternate utilizes left off to left on ramps for northbound I-69 to westbound VMP and eastbound VMP to northbound I-69 ramp. Utilizing the left off to left on concept reduces the footprint of the interchange in an environmentally sensitive floodplain area achieving a $30M reduction in the cost of construction. The northbound I-69 to westbound VMP and eastbound VMP to southbound I-69 can share a single bridge structure, reducing bridging need.

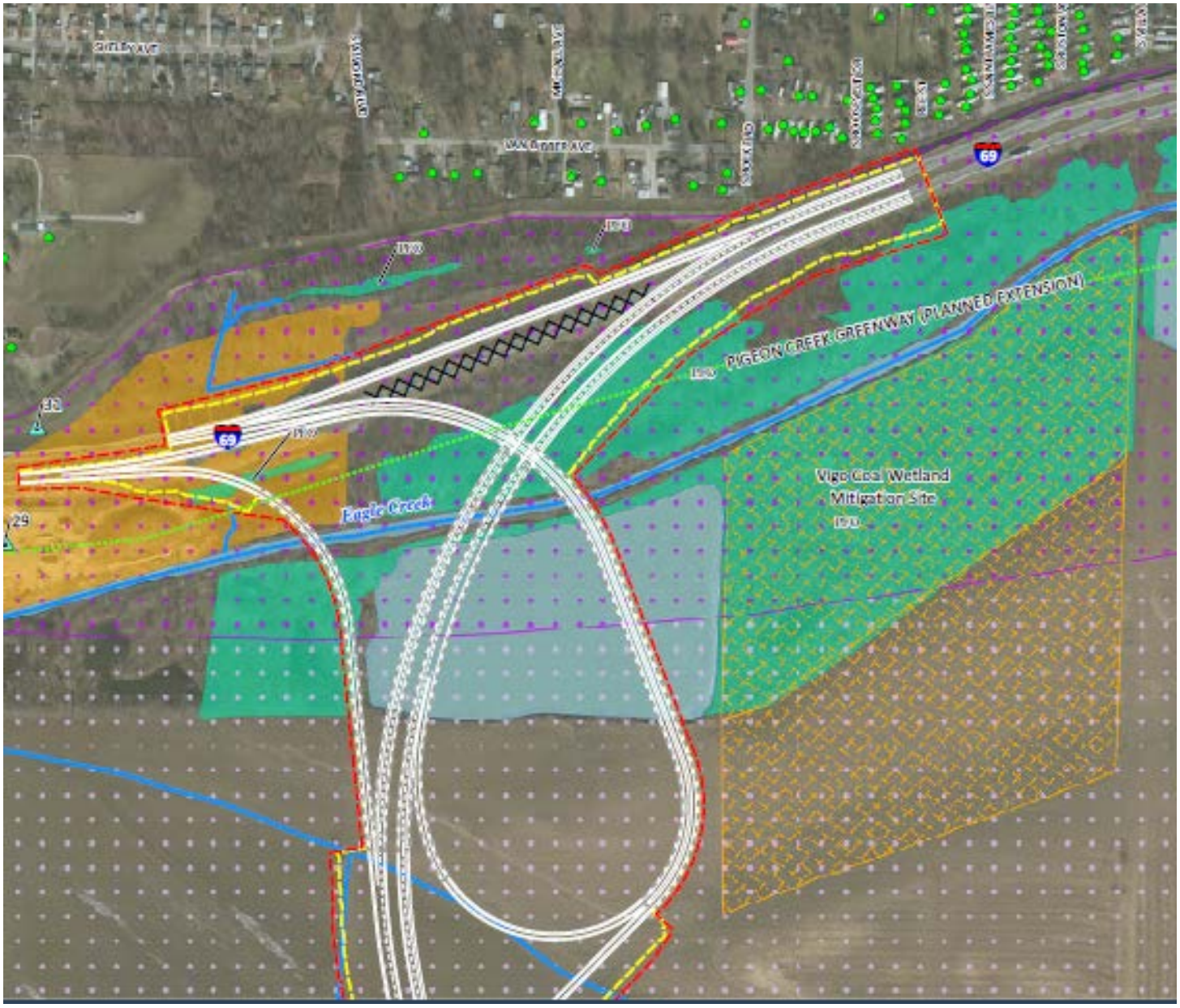
Small traffic volumes are likely on the westbound VMP to southbound I-69 ramp. Most traffic is likely to utilize existing US 41 river crossing. Consider omitting the westbound VMP to southbound I-69 ramp.

May require design exception for left exit ramp departures and left entry on-ramps. May also require longer parallel auxiliary lanes and long tapers to allow for freeway-speed left-side exit and entry.

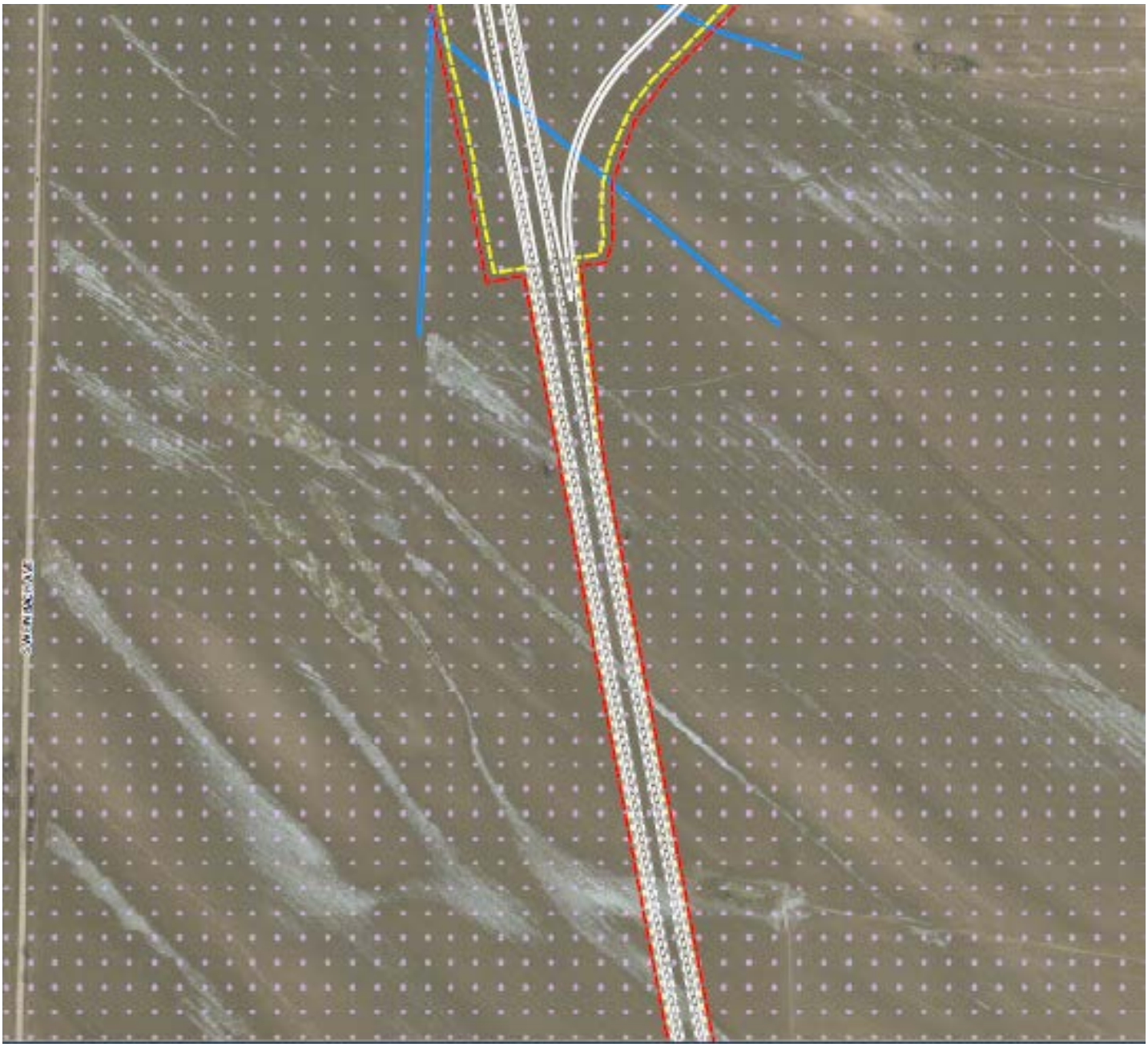
May reduce environmental permit requirements by smaller footprint construction in floodplain.

Idea Title	Simplify/minimize I-69 interchange at Veterans Memorial Parkway
Function	Access Community

ORIGINAL CONCEPT SKETCH:

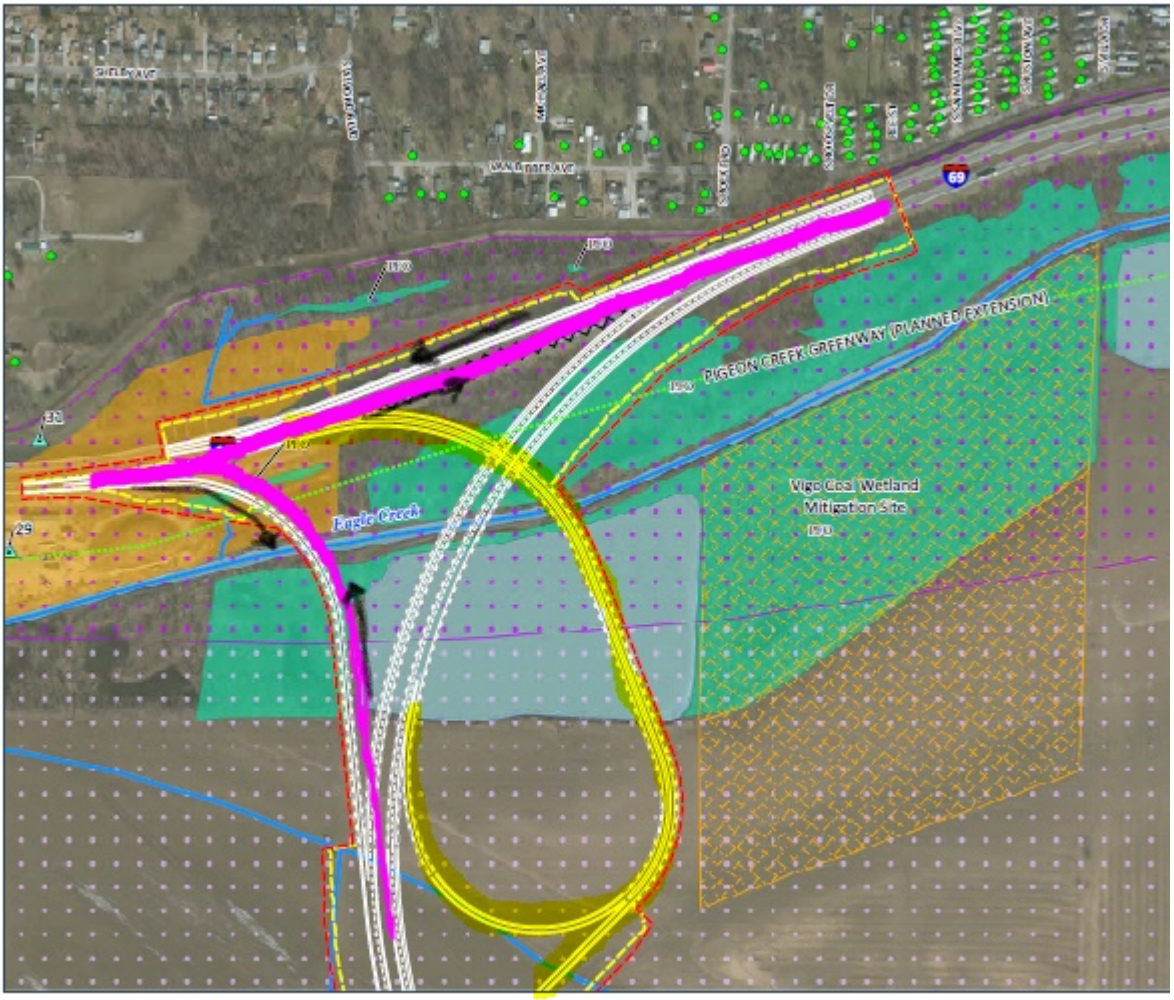


Idea Title	Simplify/minimize I-69 interchange at Veterans Memorial Parkway
Function	Access Community



Idea Title	Simplify/minimize I-69 interchange at Veterans Memorial Parkway
Function	Access Community

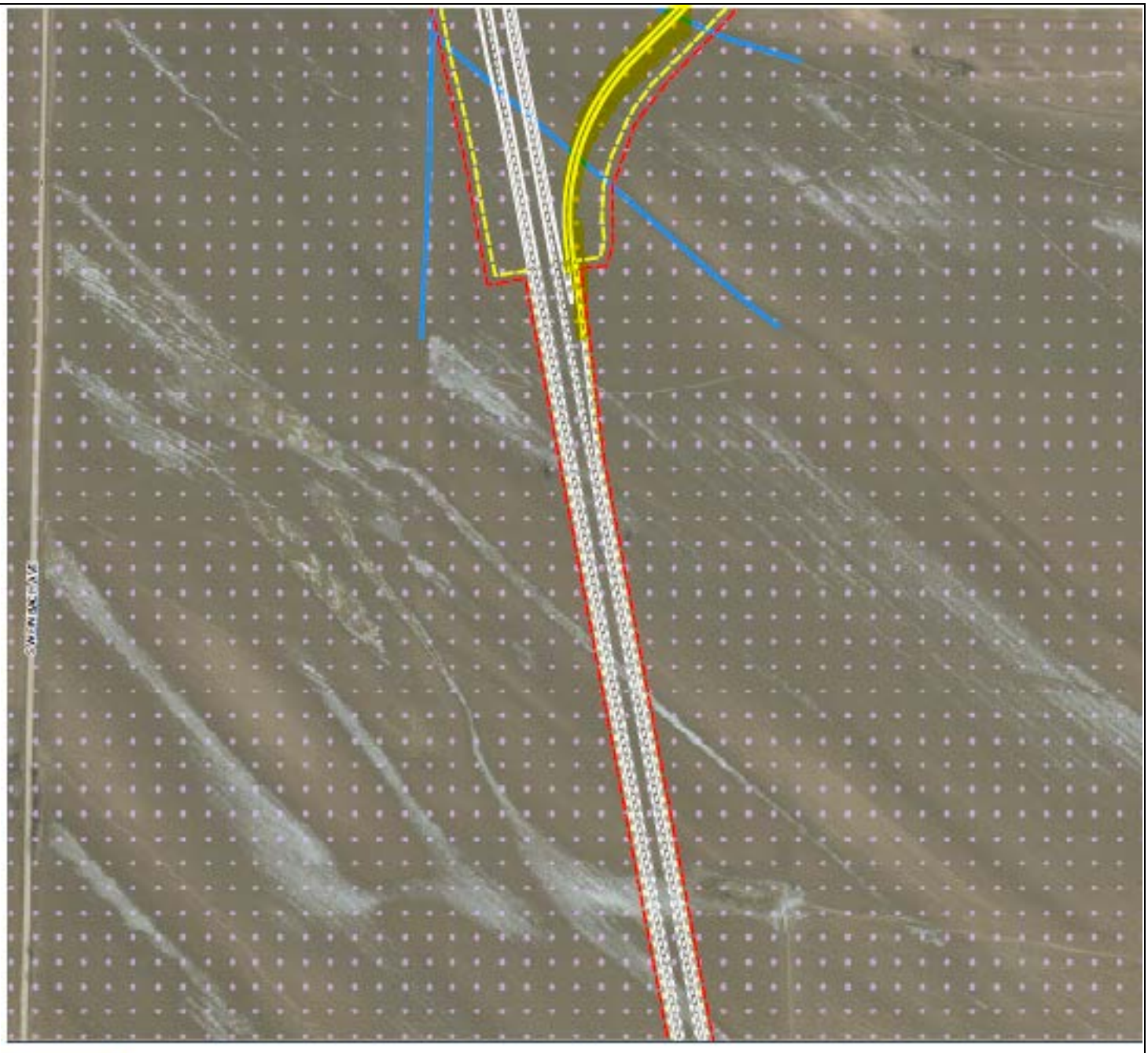
ALTERNATIVE CONCEPT SKETCH:



Eliminate

Proposed change

Idea Title	Simplify/minimize I-69 interchange at Veterans Memorial Parkway
Function	Access Community



Eliminate

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-07

Idea Title	Reconfigure the US 41 interchange to reduce structure requirements
Function	Access Community

ORIGINAL CONCEPT:

The project design team has proposed a US 41 interchange with the proposed I-69 mainline alignment. The directional interchange provides free-flow ramp movements. I-69 bridges the floodway of the North Fork Canoe Creek, the directional ramp geometry to/from US 41 requires lengthy bridges to span the interchange.

ALTERNATIVE CONCEPT:

The alternative concept raises the grade of I-69 mainline, north of the Van Wyk Road bridge, using a 3% grade to achieve a high point elevation of 420 feet at approximately Sta. 3820+00. This allows the interchange ramps to be dropped below I-69 to approximately elevation of 395 feet, which is still several feet above the floodway elevation of 388.3 feet.

To avoid a flyover ramp and to maintain the direct access for northbound and southbound US 41 to Henderson, a single-lane roundabout is introduced slightly east of existing northbound US 41. This roundabout would service the following maneuvers: southbound US 41 to northbound I-69, and northbound I-69 to northbound US 41.

This alternative concept would be on bridge I-69 from just north of the North Fork Canoe Creek crossing, to north of the Kimsey Lane crossing, approximately 1800 feet. All of the interchange ramps would be on grade. A retaining wall would be needed between the southbound US 41 to northbound I-69 ramp and northbound I-69.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Eliminates need for multi-level flyover ramps for the US 41 interchange • On-grade access for northbound US 41 through traffic, several feet higher than existing northbound US 41 • Elimination of through traffic on Kimsey Lane improves safety for the at-grade railroad crossing	• Through access along Kimsey Lane would be closed. Local access is available via US 60 and Zion Road • Roundabout acceptance from local officials and citizens • If the northbound US 41 through traffic needs to be on a bridge within the floodway, the cost benefit would be reduced

Idea Title	Reconfigure the US 41 interchange to reduce structure requirements
Function	Access Community

COST IMPACT:	**<u>Rough order of magnitude impact to cost (potential cost avoidance) - $20M</u>** Eliminate SB US 41 to NB I-69 ramp bridge Bridge Area: 65,025 sf Bridge cost/sf: $300 Cost decrease: (65025*300) = -$19,508,000, rounded to $19.6 million Eliminate NB I-69 to NB US 41 ramp bridge Bridge Area: 29,360 sf Bridge cost/sf: $300 Cost decrease: (29630*300) = -$8,889,000, rounded to $8.9 million Eliminate SB I-69 to NB US 41 ramp bridge over Kimsey Lane Bridge Area: 3,100 sf Bridge cost/sf: $300 Cost decrease: (3100*300) = -$930,000, rounded to $1.0 million Increase in I-69 mainline bridge cost resulting from profile grade change: Original Length of I-69 bridges over North Fork Canoe Creek and floodway: 1600′ @ 41′ deck width = 131,200 sf Original cost of I-69 bridges over North Fork Canoe Creek and floodway: (131200*300) = $39,360,000 Additional bridge substructure cost because of grade change: 5% of original concept cost = $39,360,000 *.05 = +$1,968,000, rounded to $2.0 million Alternative Concept bridge area: 200′ length @ 41′ deck width = 8,200 sf Cost increase: (8200*300) = +$2,460,000, rounded to $2.5 million Additional costs: Retaining Walls: +$2.5 million (~1000 lf, 15 ft average height, $150/sf) Embankment: +$1.5 million Pavement: +$1.0 million **Total Cost Reduction**: -19.6-8.9-1.0+2.0+2.5+2.5+1.5+1.0 = **$20,000,000**
SCHEDULE IMPACT:	**<u>Rough order of magnitude impact to schedule (increase schedule) – 6 months</u>** The construction schedule would be impacted by the alternative concept. Maintenance of traffic along NB US 41 would need to be phased to facilitate construction of the roundabout, and the ramps to I-69. It is anticipated that this schedule impact would be approximately 6 months.

Idea Title	Reconfigure the US 41 interchange to reduce structure requirements
Function	Access Community

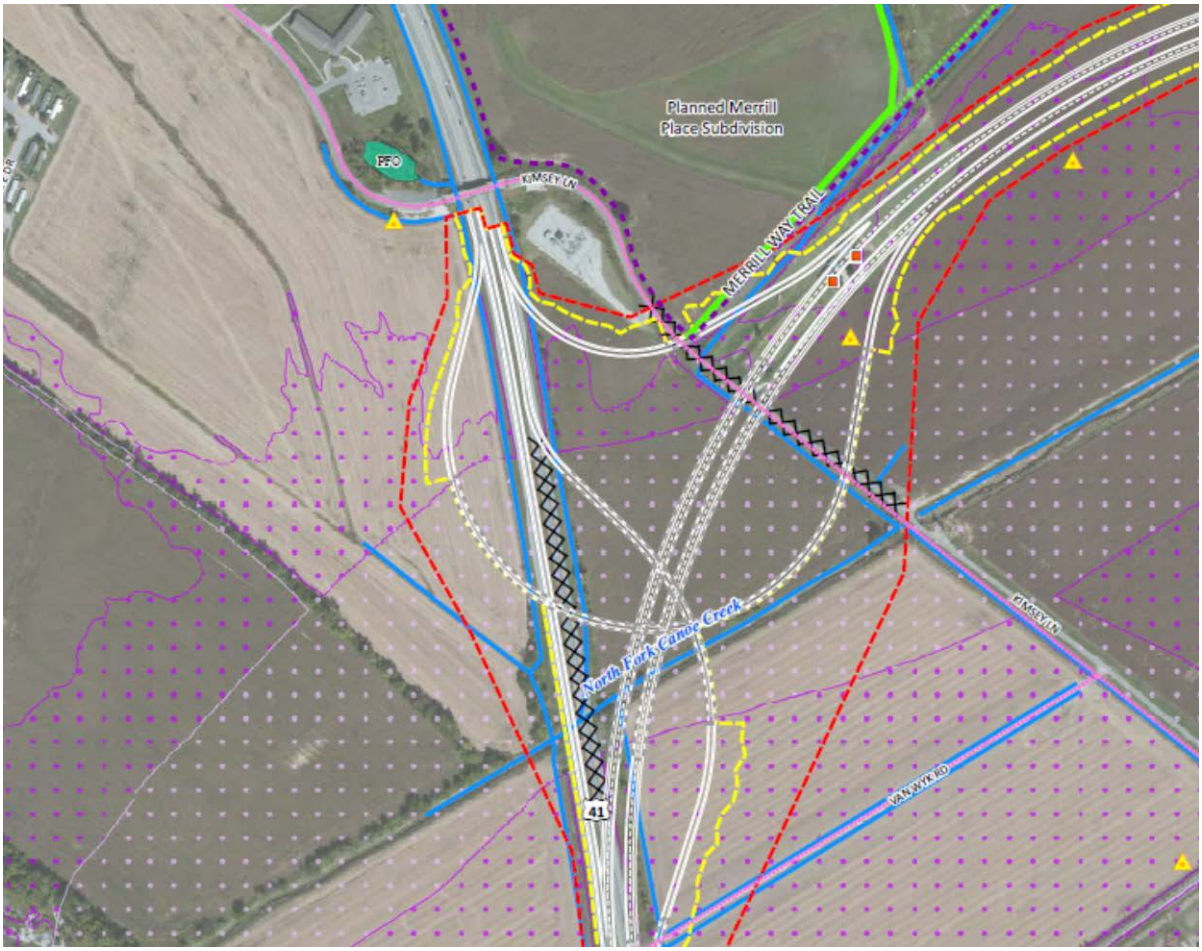
ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

The alternative concept provides a signature entry point from I-69 to downtown Henderson.
This concept provides a two-level interchange, with minimal bridge structures, and minimizes ramp maneuvers within the limits of the floodway.

Additionally, a signalized single crossover and a Single-Point Urban Interchange (SPUI) alternative were briefly reviewed for this location, but the project team's expressed desire to maintain an unimpeded movement for through traffic on US 41 halted further exploration. The single crossover required implementation of a multi-level interchange, where the cost savings would have been negligible.

Idea Title	Reconfigure the US 41 interchange to reduce structure requirements
Function	Access Community

ORIGINAL CONCEPT SKETCH:



Idea Title	Reconfigure the US 41 interchange to reduce structure requirements
Function	Access Community

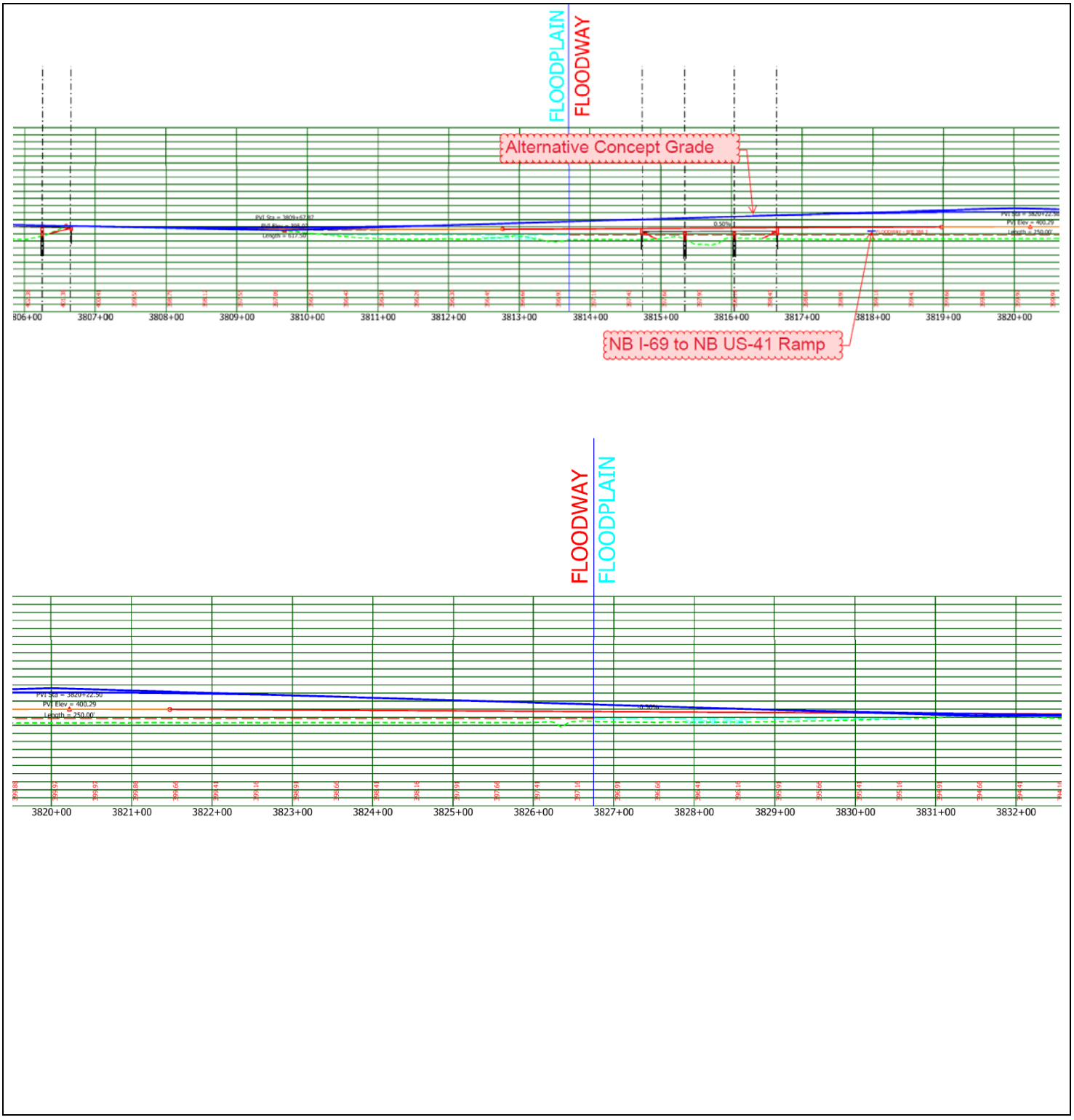
ALTERNATIVE CONCEPT SKETCHES:

Plan

Profile

Maximum grade is 3%. Blue line is Alternative Concept Grade

Idea Title	Reconfigure the US 41 interchange to reduce structure requirements
Function	Access Community



OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. AC-08

Idea Title	Reducing the amount of structure on US 41 interchange by a more detailed hydraulic analysis
Function	Access Community

ORIGINAL CONCEPT:

Current design calls for four bridges to span over Canoe Creek with a total of 215,285 square feet of bridge decks. The limit of bridges is based on getting out of floodway.

ALTERNATIVE CONCEPT:

This alternative places most of the I-69 structure on embankment (with small opening for the creek) and reduce the bridge length of ramp structure. A detailed hydraulic study should justify having roadway or embankment within the floodway limit.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Reduces cost	• Requires a more detailed hydraulic study

COST IMPACT:	**Rough order of magnitude impact to cost (reduce cost) - $23.6M++** Reducing bridge deck area by 124,000 square feet
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (no perceived impact to schedule) – 0 days** Since the construction of this interchange is not likely on the critical path

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

The hydraulics around proposed I-69 / Canoe Creek area offers unique opportunity to reduce the bridge structure within the floodway areas. In Figure 2, this proposal reduces the hydraulic opening to about 250 feet. There are three factors supporting replacing bridge structure with embankment or roadway within the floodway area:

1. The project design criteria treat existing condition as hydraulic condition in backwater analysis. The existing (and remaining) US 41 southbound consists a rather small opening (bridge spans 120 feet with slope fronts). There will be no benefit to have a proposed hydraulic opening of 950 feet (as the current design to match the width of floodway) right next to the existing 120-foot opening. The proposed 250-foot opening seems to be a conservative starting point, and perhaps can be further reduced.
2. Based on a rough measure from Google Map, the Canoe Creek covers a tributary area of about 20 square miles (see Figure 1). Therefore, the amount of water expected to flow out of Canoe Creek at the US 41 interchange is small. The floodway area here behaves more as storage, not waterway. Additional storage capacity can be easily provided to compensate the area occupied by proposed roadway within the floodplain.
3. The Kentucky one-foot back water requirement provides a relatively large allowance in terms of hydraulic impact. Considering the rather small tributary area and the flat and large flood storage area, it will be very unlikely the proposed change will result in high back water.

Idea Title	Reducing the amount of structure on US 41 interchange by a more detailed hydraulic analysis
Function	Access Community

The historic observations seem to agree with the above. This section of US 41 has no known record of flooding with the current 120-foot opening.

The estimate provided does not reflect the current bridge layout. Measured from the current bridge layout, the bridge areas of the four structures are: I-69 northbound on ramp 65,025 sf, I-69 NB off ramp: 29,360 sf, I-69 NB: 59,700 sf, I-69 SB 61,200 sf, for a total of 215,285 sf. Figure 2 shows the proposed bridge layout, using a hydraulic opening of 250 feet. The proposed bridge areas are approximately: I-69 north bound on ramp 43,500 sf, I-69 north bound off ramp: 17,600 sf, I-69 north bound: 15,000 sf, I-69 south bound 15,000 sf, for a total of 91,100 sf. The average bridge cost from the estimate is about $300 per square foot. There would be an estimated saving of $190 per square foot from bridge to embankment. The total saving of this proposal is estimated at $23.6M.

This proposal can work along with other ideas of modifying/reconfiguring US 41 interchange; for example, shifting the interchange north to move further away from the floodway.

Idea Title	Reducing the amount of structure on US 41 interchange by a more detailed hydraulic analysis
Function	Access Community

ORIGINAL CONCEPT SKETCH:

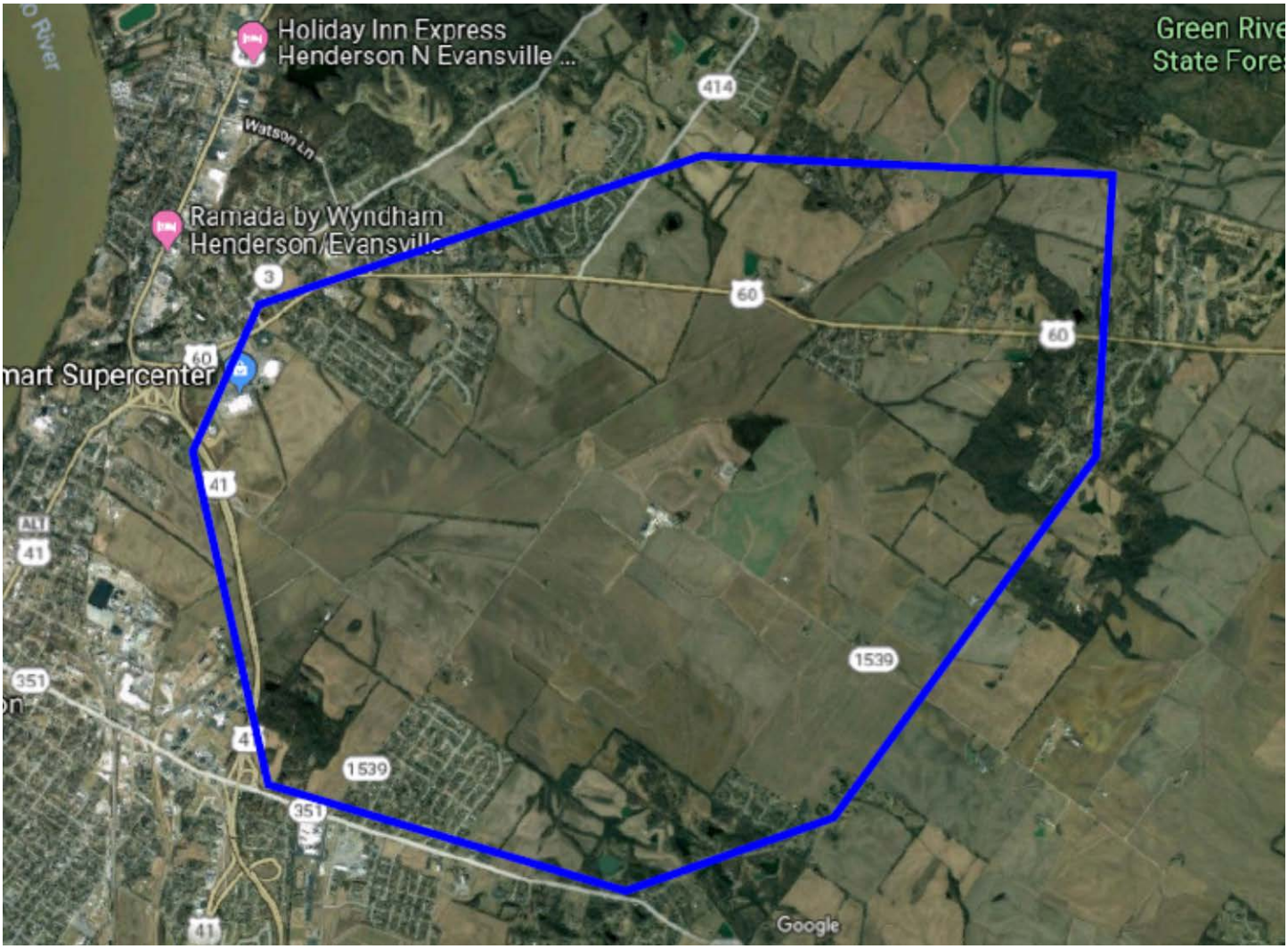


Figure 1: Estimated Tributary area of Canoe Creek

Idea Title	Reducing the amount of structure on US 41 interchange by a more detailed hydraulic analysis
Function	Access Community

ALTERNATIVE CONCEPT SKETCH:

Figure 2: Proposed Bridge Layout

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SS-01

Idea Title	In lieu of bridge/fill, use prefabricated culvert (BEBO)
Function	Span Space

ORIGINAL CONCEPT:

The original concept is to use the use of fill in floodplain in lieu of bridge structures.

ALTERNATIVE CONCEPT:

The alternative concept proposes to use buried type structures such as BEBO or multiplate arch type structures and replace the north approach bridges for I-69. This would replace the original fill section north of the river crossing around Station 4150+00 with an equal amount of foundation in the floodplain for BEBO structures.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Faster construction / shorter schedule • Reduces bridge maintenance	• Obstruction in floodplain • Debris removal after flood • Adds culvert maintenance

COST IMPACT:	**<u>Rough order of magnitude impact to cost (potential cost avoidance) - $17.2M</u>** See justification below for calculation.
SCHEDULE IMPACT:	**<u>Rough order of magnitude impact to schedule (reduce schedule) –6 months in the bridge construction.</u>** Saving in schedule due to minimal winter weather impact for the alternate construction method. Shorter schedule by 6 months for the north bridge construction.

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

The original concept designed a fill section from Station 4150+00 to past Station 4160+00 as well as about 7000-feet of bridge with its associated pier walls. This created an approximate 1300 feet of obstruction in the flood plain in the direction of flow with no surge above the allowable 0.14-foot. The alternative concept suggests replacing these 1300 feet of disturbance in the floodplain with an equivalent pier wall / foundation footprint of BEBO type structures.

Assuming 10-foot wide per typical BEBO pier wall / foundation perpendicular to flow, the original fill could be replaced by 130 each BEBO spans. Assuming 70-foot spans this could allow replacing up to 130 each. X 70 feet = 9,100 feet of bridge.

Hydraulic impact and surge need to be further analyzed because of restricted flow, added friction and freeboard requirements.

This concept could completely replace the north I-69 approach over floodplain which is about 494,000 square feet of aerial structures. The original estimate assumed $135 per square-foot for this area and BEBO structure

Idea Title	In lieu of bridge/fill, use prefabricated culvert (BEBO)
Function	Span Space

or multiplate could cost about $100 per square-foot or less*. The net potential saving of $35 per square-foot could equal approximately $17.3M. (494,000sf X 35 $/sf = $17,290,000)

Due to the prefabricated nature of the BEBO structures the construction schedule will be shortened and not impacted by winter shutdown as compared to a regular precast bridge construction. Net schedule could be 6 months shorter than conventional bridge construction.

The design team would have to check hydraulic surge. The hydraulic design team anticipates there is potential merits to this alternative concept but it requires additional evaluation.

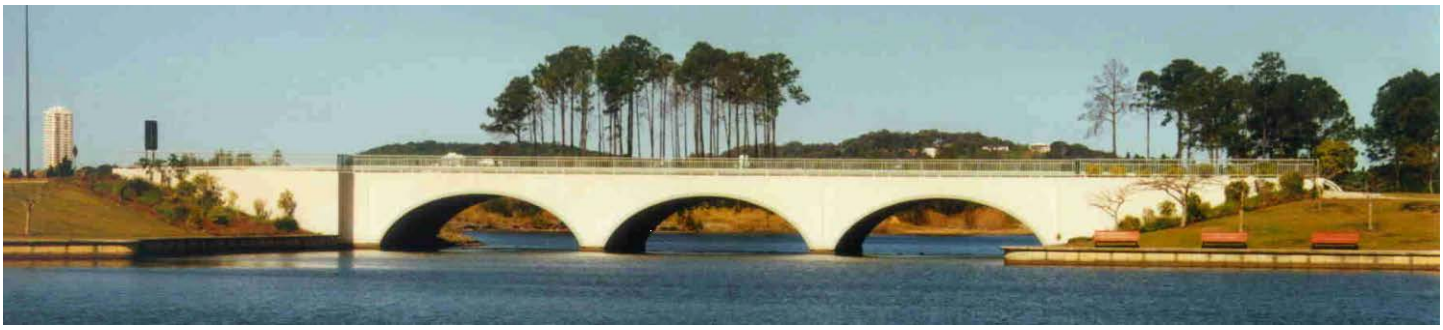
*For a more accurate estimate, confirm the cost of BEBO structures per square foot.

Idea Title	In lieu of bridge/fill, use prefabricated culvert (BEBO)
Function	Span Space

ORIGINAL CONCEPT SKETCH:

Idea Title	In lieu of bridge/fill, use prefabricated culvert (BEBO)
Function	Span Space

ALTERNATIVE CONCEPT SKETCHES:



Idea Title	In lieu of bridge/fill, use prefabricated culvert (BEBO)
Function	Span Space

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. SS-05

Idea Title	Use trench section in lieu of bridges in the floodplain
Function	Span Space

ORIGINAL CONCEPT:

Proposed interchange of Veterans Memorial Parkway and I-69 utilizes elevated bridge segments to facilitate the traffic movements to maintain traffic flow in all directions.

ALTERNATIVE CONCEPT:

Remove the elevated ramp connecting Veterans Memorial Parkway to proposed I-69 southbound and replace with depressed / tunnel segments and elevated ramp.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Reduction in bridge construction • Reduced impact to the floodplain • Efficiency in traffic movements • Less obstructions in waterway thus reducing backwater issues	• Challenges in management of groundwater • Risk of tunnel flooding and being out of service • Regulations prohibiting interstate from being constructed below floodplain level

COST IMPACT:

Rough order of magnitude impact to cost (potential cost avoidance) - $9.4M

Scope Removal:

- Bridge #4.6 – 77,825sf - $14,797,000
- Bridge #4.7 – 73,880sf - $14,189,000
- Total - $28,986,000

Scope Addition:

- 150′ Tunnel + Approaches - $7,000,000
- 66,000 SF Elevated Ramp - $12,540,000
- Total Cost - $19,540,000

Total Reduction of Cost - <$9,446,000>

SCHEDULE IMPACT:

Rough order of magnitude impact to schedule (reduce schedule) – 2-3 months

The schedule impact of this modification is approximately 2-3 months of savings.

The scope of work representative of the cost reduction generates a labor effort reflective of approximately two to three months of work. It should be noted that when packaged with the full project scope, this duration may be diluted due to its impact to the true critical path of the project.

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

Existing Veterans Memorial Parkway:

Depress the east bound lanes as the Parkway ties into I-69 North. The deepest point will result in a 150 LF tunnel section of the Parkway. This tunnel section allows the proposed I-69 South ramp to cross the Parkway at grade. The first modification allows for removal of the proposed elevated looping ramp system providing connectivity of the Parkway to I-69.

Idea Title	Use trench section in lieu of bridges in the floodplain
Function	Span Space

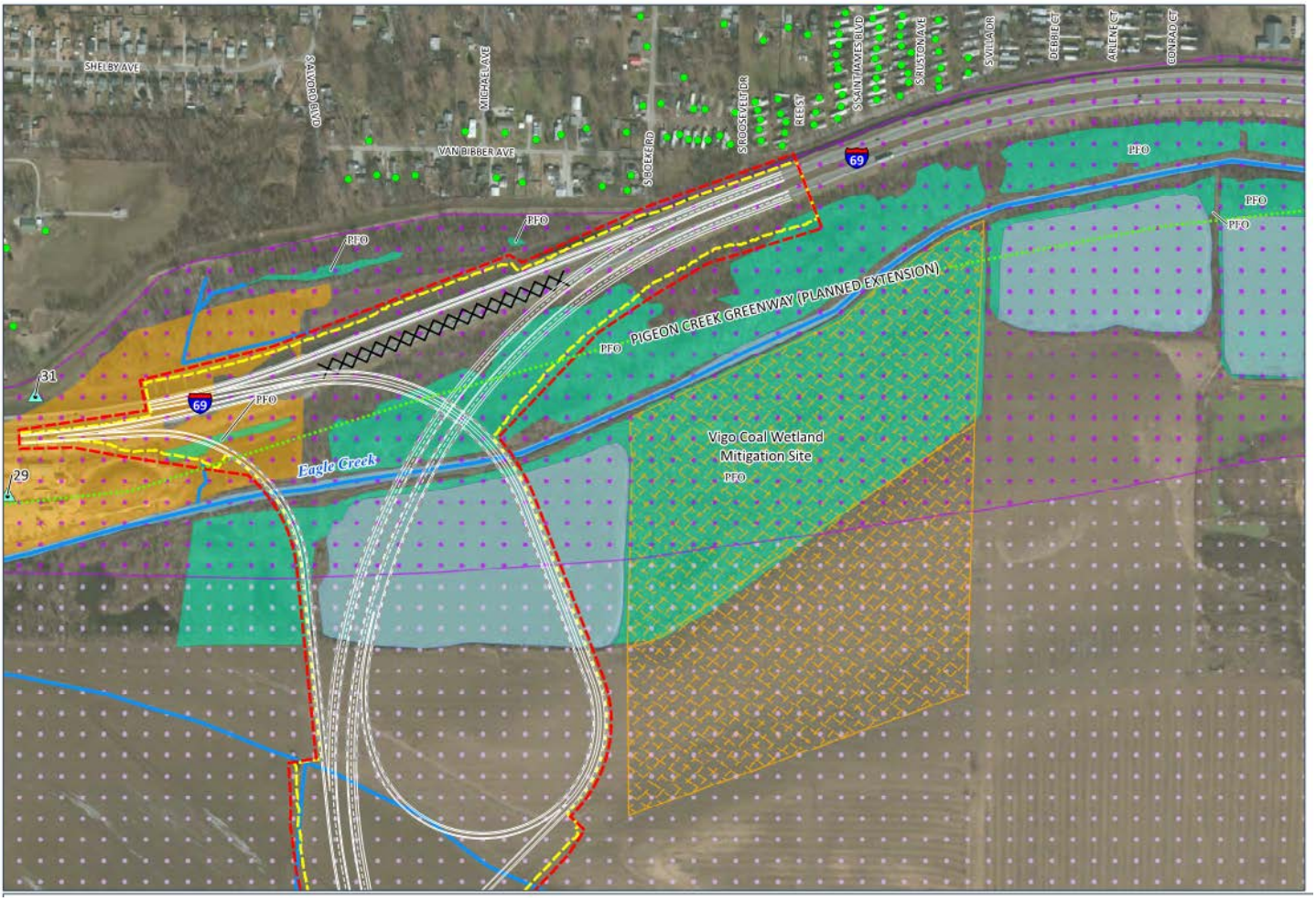
The second modification involves constructing a 3,000 LF elevated ramp connecting proposed North I-69 to West Veterans Memorial Parkway.

The combination of these two modifications allows for the removal of approximately 180,000 SF of bridge. Potential challenges in implementing this modification include:

- Dewatering and management of groundwater during construction
- Support of excavation
- Flood management of the finished tunnels
- Safety and monitoring systems for the finished tunnel
- Access to the work zone during construction
- Interstate regulations related to construction below flood level

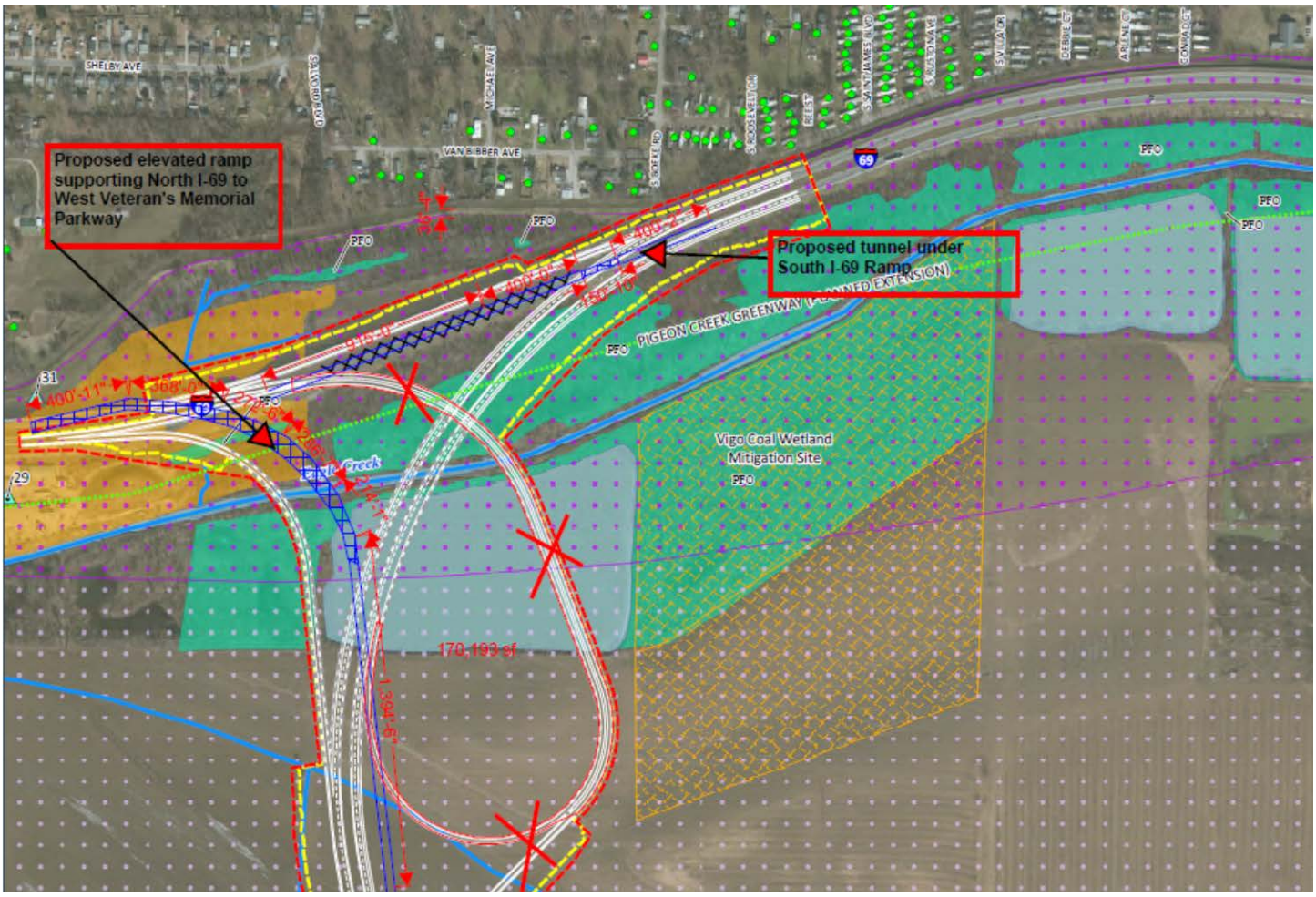
Idea Title	Use trench section in lieu of bridges in the floodplain
Function	Span Space

ORIGINAL CONCEPT SKETCH:



Idea Title	Use trench section in lieu of bridges in the floodplain
Function	Span Space

ALTERNATIVE CONCEPT SKETCH:



OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. M-01

Idea Title	Allow temporary hydraulic surge during construction
Function	Miscellaneous

ORIGINAL CONCEPT:

Indiana state law allows a maximum 1%EP (Q_{100}) water surface elevation increase of 0.14-foot in the permanent condition but is otherwise silent about the temporary (construction) condition. It's assumed the 0.14-foot elevation increase limit was also used as the limit for the temporary (construction) condition.

ALTERNATIVE CONCEPT:

This proposal would allow the contractor to temporarily exceed the 0.14-foot maximum water surface elevation increase only during construction activities. The design team will have to utilize hydraulic analysis to provide contractor with maximum desirable increase before impacts to structures occurs.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Potential for less work stoppages due to weather which equals faster construction • Less risk of loss of equipment and completed work perceived by contractor • Less risk of construction delay • Reduces potential and realized liquidated damages due to delay of project completion • More competitive bids from contractors and lower final construction cost due to reduced risk	• Greater potential for damage upstream during potential flood event

COST IMPACT:	**<u>Rough order of magnitude impact to cost (potential cost avoidance) - $6M</u>** Difficult to assess potential cost avoidance without more information about incentives/disincentives, construction schedule and acceptable water surface elevation. Assume liquidated damages could be as much as 1% of initial construction costs ($6 million)
SCHEDULE IMPACT:	**<u>Rough order of magnitude impact to schedule (reduce schedule) – 3 months</u>** Reduce schedule by 30 days per construction season (month of April during spring flooding) x 3 construction seasons = 90 days total (3 months)

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

Recently completed projects to construct major Ohio River crossings at Milton/Madison, Utica (IN) and Louisville have included long delays when the Ohio River flooded the construction site for extended periods of time. The design team can determine the maximum water surface elevation before there are impacts to upstream structures. The contractor would then be able to set cofferdams, formwork, causeways and other temporary obstructions to limit the potential for flooding. The higher elevation would minimize downtime and risk of loss for equipment, construction days and possibly portions of the project under construction.

Utilize hydraulic analysis to provide the contractor with maximum desirable increase before impacts to structures occur. This information would be conveyed to the contractor in the contract bid documents.

There are no known waivers, permits or design exceptions required to implement this concept.

VALUE ENGINEERING PROPOSAL NO. M-04

Idea Title	Use federal aid for project, except river spans, to reduce cost of materials
Function	Miscellaneous

ORIGINAL CONCEPT:

The original concept is to treat the project as a single federal aid project that will be tolled in the future in accordance with current legislation (23 U.S. Code § 129. Toll roads, bridges, tunnels, and ferries).

ALTERNATIVE CONCEPT:

Given the additional requirements for federal aid projects, in particular the Buy American Act, consider breaking the project into two separate projects:

i) the river spans, which have a strong potential for the use of structural steel superstructures, and
ii) the approaches, which will use conventional bridge superstructures (multi-girder precast concrete).

The need to separate the crossing into two projects is necessary in order to have a clear distinction between the portion of the project subject to federal aid requirements, and the portion that is not using federal aid. As the project is anticipated to be funded with toll revenues and federal/state funds, only the toll revenue funding would be considered for the river crossing segment.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Reduce costs for the river crossing • Enhances potential for local contractors to participate in the approach bridges	• Segmenting the project risks federal aid, setting a bad precedent for future projects • Public opposition to off-shoring jobs and manufacturing

COST IMPACT:	**Rough order of magnitude impact to cost (potential cost avoidance) - $25M to $35M** There is a significant savings in cost of fabricated structural steel for major bridges if it can be off-shored. For complex bridges, fabricated structural steel cost reduction on the order of 50% is anticipated. Similarly, for the foundations, the use of large diameter cased drilled shafts is anticipated and there can be major cost savings for the casings depending on diameter and casing thickness. Labor costs for all on-site work will be reduced if prevailing wage rates are not required.
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (no perceived impact to schedule) – 0** Given shipping time and the need to have completed fabrication prior to shipping, there is likely no schedule advantage to off-shoring steel fabrication.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. M-04

Idea Title	Use federal aid for project, except river spans, to reduce cost of materials
Function	Miscellaneous

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

The proposed alternative concept is to separate the project into two segments, the river spans and the approaches. Given that the project is being partially funded with future toll revenues, this funding mechanism would be used for the river spans only. The remaining portion of the project (approaches and interchanges) would be executed as a federal aid project with the associated requirements. Superstructure steel fabrication, raised cofferdam and drilled shaft steel casing construction would be off-shored where there would be significant cost savings. For the in-river foundation work, which is labor intensive, high-risk due to the potential for flooding and therefore costly, the waiver of prevailing wage rates creates an opportunity for reduced labor costs.

A primary implementation concern is public perception on off-shoring manufacturing (steel fabrication). This has been a problem for toll authorities in this current political climate, though toll authorities have off-shored bridge fabrication, particularly for orthotropic decks, for decades. An argument would have to be made that a significant majority of the program remains subject to federal aid requirements and that the savings associated with off-shoring the river spans is an important strategy in making the project cost-effective.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. M-07
Design Suggestion

Idea Title	Phase project in two construction packages: (1) direct connection, (2) build out interchanges and existing US 41
Function	Miscellaneous

ORIGINAL CONCEPT:

The current design does not detail phased construction and of phased construction.

ALTERNATIVE CONCEPT:

Recommend procurement of the construction into two packages, I-69 through traffic and connection on south end and north end (with Veteran Memorial Parkway connection) as the first package supporting the generation of toll revenue before the completion of the entire corridor improvement. The second package will focus on community access by construction of interchanges.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Generates toll revenue earlier • Reduces risk of project delay due to uncertainty of existing US 41 structures • Potential cost reduction when combining with idea M-04, Use federal aid for project, except river spans, to reduce cost of materials	• Could increase total construction costs • Delays works for connecting to existing roadway will prolong the inconvenience for local residents • Push back from public and local officials

COST IMPACT:	**Rough order of magnitude impact to cost (cannot quantify at this time) - Unknown** The main benefit is reducing the risk and an accelerated path to toll revenue could be considered a cost savings. Also depends on whether VE Proposal M-04 is accepted.
SCHEDULE IMPACT:	**Rough order of magnitude impact to schedule (cannot quantify at this time) – Unknown** If accepted, will reduce the time it takes to start tolling.

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

This proposal divides the project into two packages. The advanced package consists of works only essential to provide I-69 through movement. This includes connections to existing roadway at both south and north ends. Depending on community demand, an intermediate connection (such as the US 41 interchange) might also need to be included. Other works, such as all interchanges, repair / retrofit of the existing US 41 will be completed in a second construction package.

Such approach can be implemented in the same contract or in two separate contracts. The two separate contracts might be advantageous when combined with VE proposal M-04, Use federal aid for project, except river spans, to reduce cost of materials. The first package can be funded without federal funding. The VE proposal M-04 discusses the potential cost savings for this approach by removing some restrictions associated with federal funding. The second project will mostly utilize federal funding.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. M-07
Design Suggestion

Idea Title	Phase project in two construction packages: (1) direct connection, (2) build out interchanges and existing US 41
Function	Miscellaneous

The other advantage of two separate contracts is that it significantly reduces the risk of a P3 contract, which can typically result in better price. The main risk of this project is the uncertain condition of existing US 41 bridges and cost of repair/retrofit.

During a future design phase, consider phasing the project to allow early tolling by completing only an essential part of the project.

The design team will need to investigate the feasibility of separating the project into two separate contracts.

OHIO RIVER CROSSING

VALUE ENGINEERING PROPOSAL NO. M-08

Idea Title	In lieu of pier support islands, build roadway embankment on the north to shorten bridge
Function	Miscellaneous

ORIGINAL CONCEPT:

Hydraulic design proposes two "islands" in the floodplain. The island's function is to reduce bridge spans by building on embankment. They are each long enough to have embankment construction efficiencies.

ALTERNATIVE CONCEPT:

Instead of constructing these islands which remove flow area from the river cross section, remove that flow area from the north end and shorten the structure.

BENEFITS OF ALTERNATIVE CONCEPT:	RISKS/CHALLENGES OF ALTERNATIVE CONCEPT:
• Minimizes main structure length • Edge of floodway flow is not very effective • Removing islands eliminates local scour • Eliminates the need for complex hydraulic evaluation	• Complex hydraulics yield proposed situation • May not be able to construct in this area • Narrower top width increases contraction scour • Embankment in wide floodplain provides lateral support to structures.

COST IMPACT:	**<u>Rough order of magnitude impact to cost (no perceived impact to cost) - $0</u>** The impact to cost is not significant. The earthwork is shifted away from the channel.
SCHEDULE IMPACT:	**<u>Rough order of magnitude impact to schedule (no perceived impact to schedule) – 0 days</u>** The impact to schedule is also minimal. The same work takes place at different locations.

ALTERNATIVE CONCEPT DISCUSSION / JUSTIFICATION:

The original proposed bridge is over 10,000 feet long and immediately upstream of the US 41 bridge which is approximately 7400 feet long.

These islands will block flow and the flow be subject to local scour on both sides

Permits from the U.S. Army Corps of Engineers would need to be modified if already obtained. If a Letter of Map Revision (LOMR) has been completed, it would need to be re-done.

Idea Title	In lieu of pier support islands, build roadway embankment on the north to shorten bridge
Function	Miscellaneous

ORIGINAL CONCEPT SKETCH:

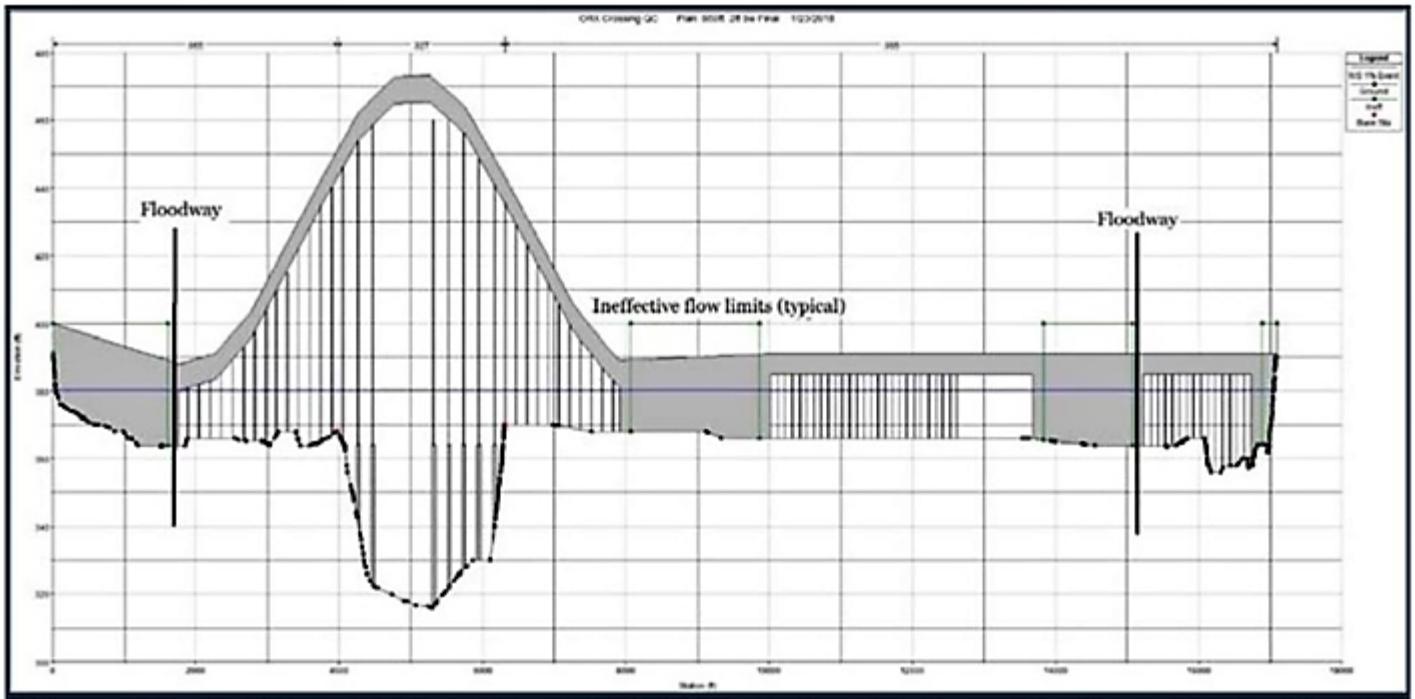


Figure 3-1. An Example from the HEC-RAS Analysis of a Cross Section with Ineffective Flow Limits

Idea Title	In lieu of pier support islands, build roadway embankment on the north to shorten bridge
Function	Miscellaneous

ALTERNATIVE CONCEPT SKETCH:

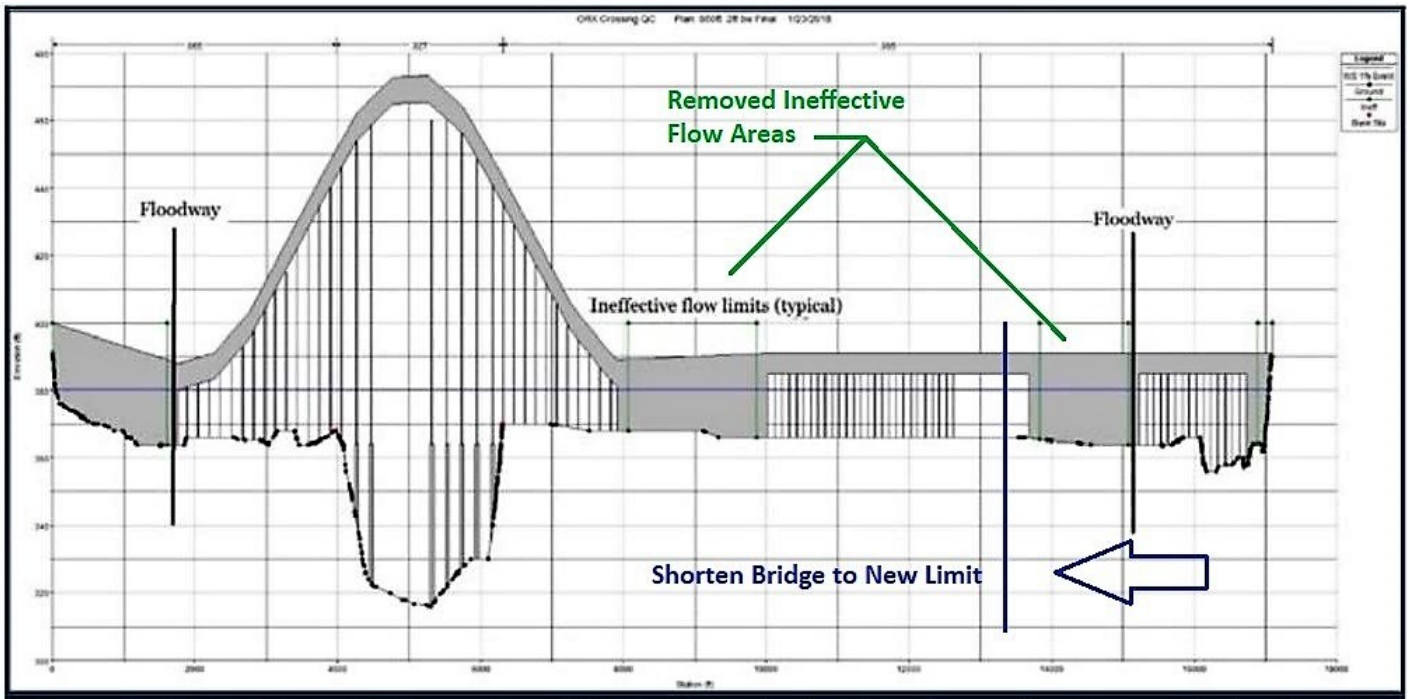


Figure 3-1. An Example from the HEC-RAS Analysis of a Cross Section with Ineffective Flow Limits

SECTION 4: SUPPORT DATA

Section 4: Support Data

Team Observations

The VE 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 team's observations:

- The cost for the approach roads seems high at $131M; the perceived high cost may have something to do with the floodway constraint (.14')
- There may be an opportunity to reduce the contingency ($177M)
- There may be an opportunity to analyze inflation
- $148M for US41 Bridge Operations and Maintenance is per bridge; however, project is only keeping one of the bridges
- There may be an opportunities to reduce/analyze Operations and Maintenance, $148M and $86M for US 41 Bridge and I-69 Roadway and Bridges, respectively
- The 2021 construction start time may not be realistic; 2024 may be more realistic
- This project may have legal issues potentially delaying the project
- This project may burn up time with the FEIS process and NEPA challenges
- Not a high confidence level in the unit cost for the bridges

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:

- Floodway - 0.14-foot (Indiana); the north side of the river
- Span arrangement
    - 800-foot navigational channel (one)
    - 650-foot navigational channel (two)
- General central alignment corridor set; not going back to look at the west (existing US 41)

Risk Identification

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

The VE Study Team identified potential risks related to the overall project success and then considered these risks in the Creative Phase during the workshop. The list of major risks is shown below:

- Funding availability
- Public support for retaining both US 41 bridges and to keep them toll-free
- Design/construction risks
    - Floodway construction
    - Borrow sources
- Lateral spreading and liquefaction; seismic hazard

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 key findings

- **Stage 3: Post Study**
  - Prepare and issue the report
  - Report implementation ideas
  - Implement approved alternatives
  - Monitor status

Function Analysis

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

The VE study team identified the functions of the **I-69 Ohio River Crossing (ORX) Project** using active verbs and measurable nouns. This process allowed the team to truly understand the functions associated with the project.

Function		Function Classification?	Comment	High Cost?	High Risk?
Active Verb	**Measurable Noun**				
Collect	*Revenue*	*Higher Order*			YES
Support	*Economic-development*	*Higher Order*			
Connect	**Interstate**	**Basic**			
Access	Communities	Secondary		YES	
Support	Redundancy	Secondary		YES	YES
Span	Water	Secondary		YES	YES
Span	Space	Secondary		YES	YES
Support	Truck-traffic	Secondary			
Maintain	Facility	Secondary		YES	
Improve	Safety	Secondary			
Supports	Roadway	Secondary	Earthwork	YES	
Manage	Flood-risk	Secondary		YES	YES
Complete	*Design*	*Lower Order*			

The definitions of the classifications are:

- **Higher Order Function:** The specific goals or needs for which the basic function exists and is outside the scope of the subject under study.
- **Basic Function:** The specific purpose(s) for which a project exists and answers the question, "what must it do?"

- **Secondary Function:** A function that supports the basic function or required secondary functions and results from the specific design approach to achieve the basic function.
- **Lower Order Function:** The function that is selected to initiate the value study (an input) and is outside the scope of the subject under study.

High cost and/or high risk functions were identified using cost data and the VE study team expertise. A function model, or Function Analysis System Technique (FAST) diagram, was not developed for this project. The VE study team identified **Connect Interstate** as the basic function of the project.

Creative Idea List

The list of ideas and comments from the study immediately follows this page.

Some of the ideas were selected for further development as represented in the previous alternatives.

Value Engineering Study
I-69 Ohio River Crossing (ORX)

Creative Idea List

IDEA NO.	Idea Title	Score
SR	**Support Redundancy**	
SR-01	Build a two-lane (one lane in each direction) bridge (I-69) with wide shoulders in lieu of a four-lane bridge	FF
SR-02	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum shoulders	5
SR-03	Replace US 41 superstructure	3
SR-04	Restrict US 41 traffic to passenger vehicles only	3
SR-05	Remove southbound US 41 bridge	ABC
SR-06	Remove US 60 interchange	5
SR-07	Remove US 41 interchange	4
SR-08	Modify Veterans Memorial Parkway interchange	4
SR-09	Remove KY2084 ramp southbound	5
SR-10	Reduce median width	4
SR-11	Standardize bridge type (precast I-beam bridges, precast AASHTO girder)	DC
SR-12	Build flop diamond in lieu of full diamond (at US 60 interchange)	2
SR-13	Review alignment of new roadway; streamline alignment	W/SR-14
SR-14	Investigate alternate location for eastern crossing	4
SR-15	Steepen slopes	w/SR-10
SR-16	Add bid alternate for pavement (asphalt, concrete, other)	DC
MF	**Maintain Facility**	
MF-01	Maximize use of concrete superstructures in lieu of steel	DC
MF-02	Add bid alternate for bridge rebar (epoxy)	DC
MF-03	Build thicker bridge deck to reduce Operations and Maintenance	DC
MF-04	Have the ability to add width to new bridge to add capacity and meet flexibility	2
MF-05	Replace existing US 41 truss in lieu of rehabilitate	w/SR-03
MF-06	Replace existing US 41 truss to accommodate both directions of traffic	2
MF-07	Demolish both US 41 bridges to eliminate future maintenance	FF
MF-08	Add community betterment (ped crossing, bike/ped path, waterfront) for enhancements	DS
MF-09	Have Henderson and/or Evansville to own/operate/maintain US 41 bridge (one or both)	ABC

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

Value Engineering Study
I-69 Ohio River Crossing (ORX)

Creative Idea List

IDEA NO.	Idea Title	Score
AC	**Access Community**	
AC-01	Optimize interchanges in terms of connectivity and priority of access (US 60)	4
AC-02	Collapse/combine US 41/US 60 interchanges	4
AC-03	Relocate Parcel 627 access	4
AC-04	Remove Parcel 627 access	2
AC-05	Simplify/minimize I-69 interchange at Veterans Memorial Parkway	5
AC-06	Signalize the Veterans Memorial Parkway interchange access	2
AC-07	Reconfigure the US 41 interchange to reduce structure requirements	4
AC-08	Reduce the amount of structure on the US 41 interchange by a more detailed hydraulic analysis	4
CR	**Collect Revenue**	
CR-01	Retroactively issue permit with Weigh-In-Motion (WIM); I 69 (KY, IN)	O/S
CR-02	Create corridor tax district	O/S
SS	**Span Space**	
SS-01	In lieu of bridge/fill, use prefabricated culvert (BEBO)	4
SS-02	Dredge Indiana approach for water storage and create community feature or habitat	2
SS-03	Verify that .14-foot is not required for US 41/I-69 interchange	DC
SS-04	Create water storage by levee wall height increase	2
SS-05	Use cut and cover or trench section in lieu of bridges on floodplain	4
SS-06	Create new alignment on east side to minimize the alignment over Indiana floodway to reduce bridge length	w/SR-14
SS-07	Build cable stay in lieu of segmental bridge	DC
SS-08	Build arch in lieu of segmental bridge	DC
SS-09	Add bid alternate for bridge type that meets community need	DC
SS-10	Build a double-deck bridge	2
M	**Miscellaneous**	
M-01	Allow temporary hydraulic surge during construction	4
M-02	Force majeure impact (flooding) - owner/contractor to share	DC
M-03	Force majeure impact (flooding) - hedge against with insurance (owner, contractor, toll authority)	DC

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

Value Engineering Study
I-69 Ohio River Crossing (ORX)

Creative Idea List

IDEA NO.	Idea Title	Score
M-04	Use federal aid for project, except river spans, to reduce cost of materials	4
M-05	Use Construction Manager/General Contractor (CM/GC) in lieu of Design-Build	DC
M-06	Use Public-Private-Partnership (P3) in lieu of Design-Build	DC
M-07	Phase project in two construction packages: (1) direct connection, (2) build out interchanges and existing US 41	DS
M-08	In lieu of pier support islands, build roadway embankment on the north to shorten bridge	4
M-09	Validate overall cost estimate (i.e., segmental bridge pricing for the river crossing)	EC
M-10	Reduce construction contingency from 33% to 25% - **$38M cost avoidance**	EC
M-11	Conduct a risk workshop to develop accurate contingency for cost and schedule	DC

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

During the kick-off meeting on March 12, 2019, the decision makers helped the VE study team understand what defined project success for the I-69 ORX Project. These criteria were used in the workshop by the VE study team for both evaluating and developing alternatives, and included:

- Connect communities; direct and simple approaches
- Provide cross-river system linkage and connectivity between I-69 IN and I-69 KY that is compatible with the national I-69 Corridor
- Develop a solution to address long-term cross-river mobility
- Create a cross-river connection that reduces traffic congestion and delay
- Improve safety for cross-river traffic

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)
- DS – Design Suggestion (Workbook, not costed)
- DC – Design Comment (No cost impact, no Workbook)
- EC – Estimate Correction
- O/S – Out of Scope
- ABC – Already Being Considered
- ABD – Already Being Done

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)

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 FOR FUNCTION			**VALUE CUE KEY – MAGNITUDE OF CHANGE FOR COST**		
F	=	No impact to function			
F-	=	Small negative impact to function	C	=	No impact to cost
F--	=	Large negative impact to function	C-	=	Small decrease in cost
F+	=	Small increase in function	C--	=	Large decrease in cost
F++	=	Large increase in function	C+	=	Small increase in cost

I-69 OHIO RIVER CROSSING (ORX)

VALUE ENGINEERING STUDY OUT-BRIEF PRESENTATION

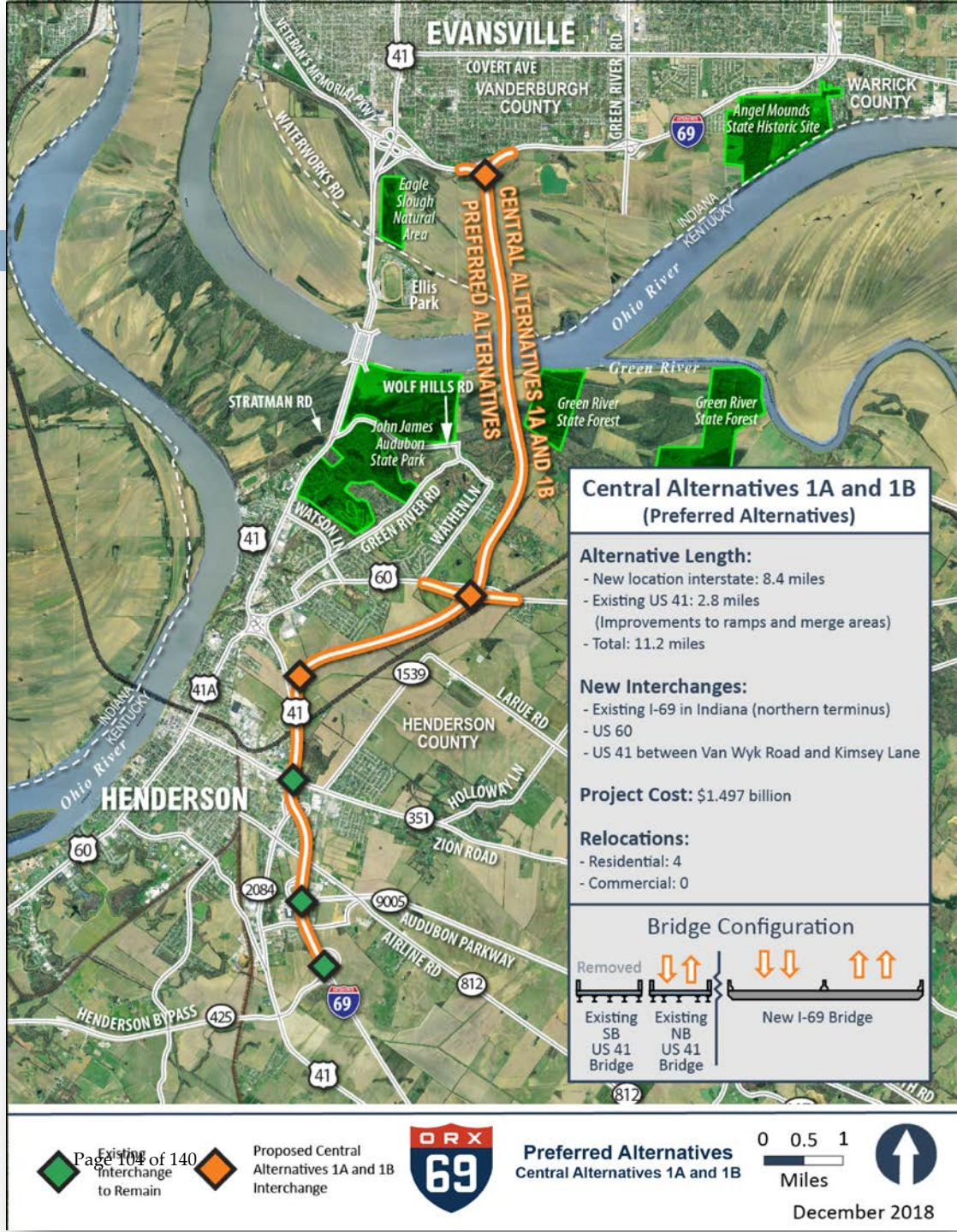
March 14, 2019

VE Study Team

- Richard Hein (Parsons)
- Adam McLain (Stantec)
- Mark Orton (INDOT)
- Ted Zoli III (HNTB)
- Eddie He (Parsons)
- Marvin Wolfe (KYTC)
- Ed Spahr (INDOT)
- Stuart Tyler (Parsons)
- Brandon Miller (INDOT)
- Rob Wahr (HNTB)
- Jason Ward (KYTC)
- Andy Ghofrani (Parsons)
- Anthony Schuler (INDOT)
- Kaitlyn Stewart (RHA, LLC)
- Pat Miller (RHA, LLC)

Workshop Objectives

- Identify possible cost, schedule and risk avoidance alternatives
  - Interchanges
  - Ramps
  - Bridges
  - Earthwork



VE Job Plan

Information – Analyze Information

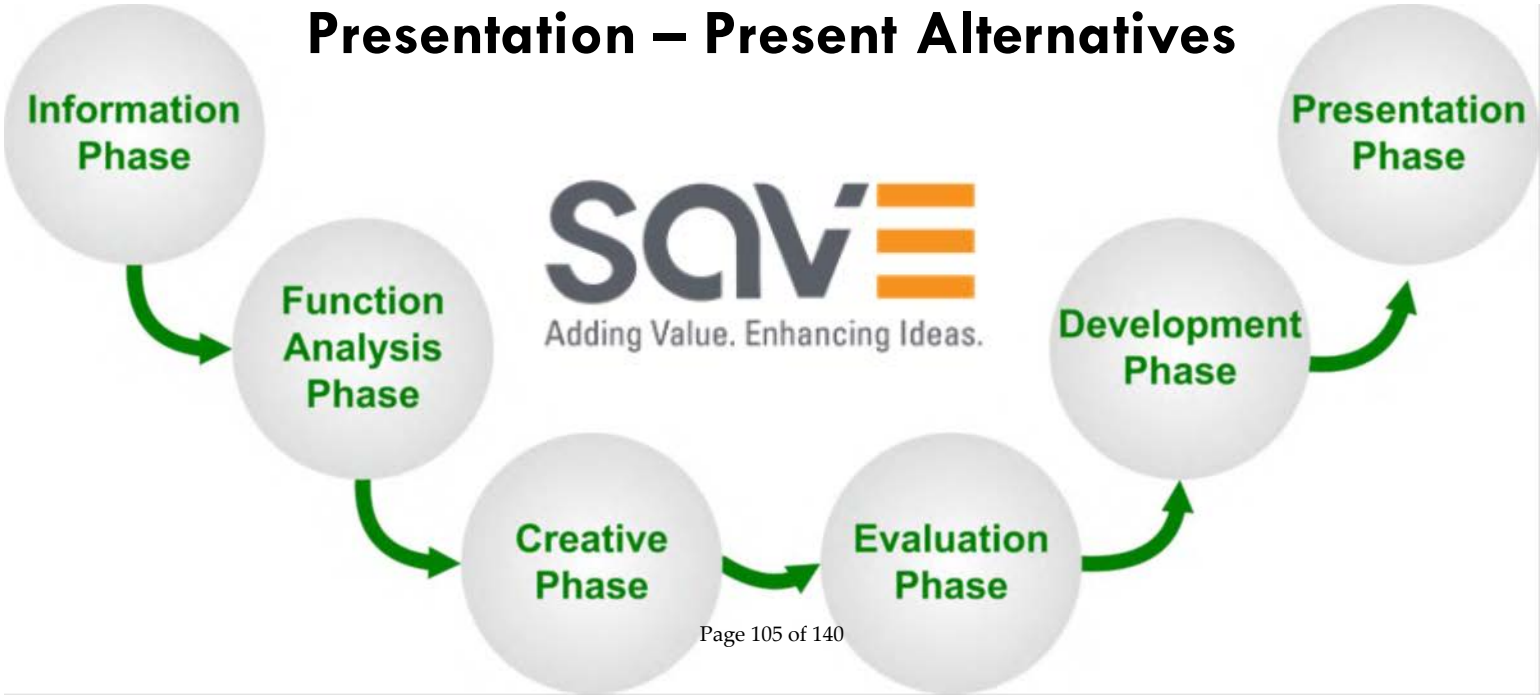
Function Analysis – Define Functions

Creative – Generate Ideas

Evaluation – Select Ideas

Development – Develop Ideas

Presentation – Present Alternatives



Project/Workshop Constraints

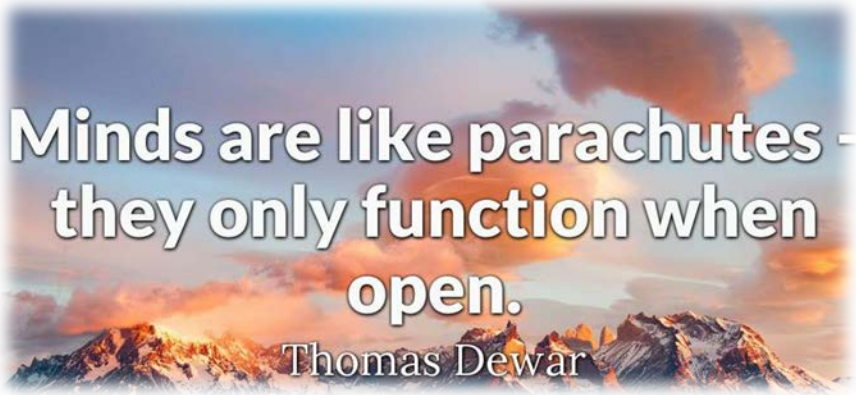
- Floodway - 0.14-foot (Indiana)
  - North side of river
- Span arrangement
  - 800-foot navigational channel (one)
  - 650-foot navigational channel (two)
- General central alignment corridor set; not going back to look at the west (existing US 41)

Project Risks

- Funding availability
- Public support for retaining both US 41
- Design/construction risks
  - Floodway construction
  - Borrow sources
- Lateral spreading and liquefaction; seismic hazard

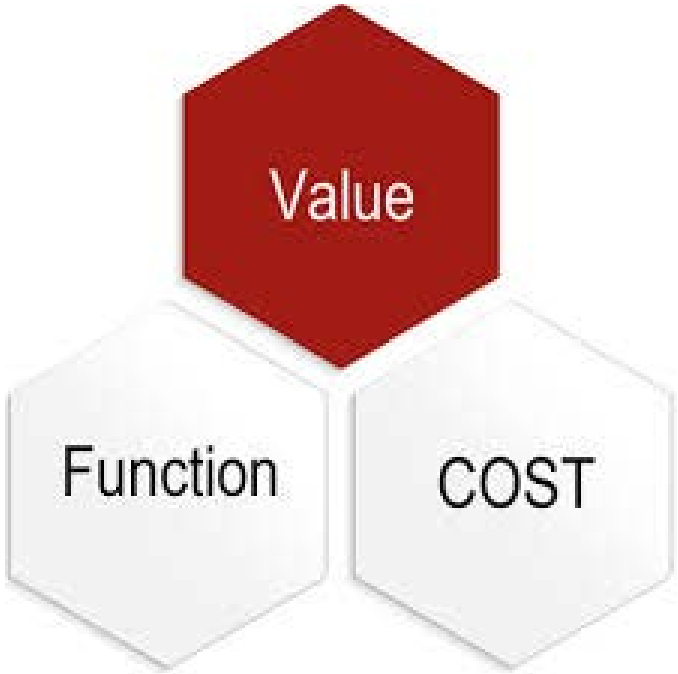
Project Functions

- Basic Function (What must this project do?)
  - Connect Interstate
- Higher Order Function (Project Goal)
  - Support Economic-development
  - Collect Revenue
- Brainstormed alternatives using key functions (high cost/high risk)
  - Support Redundancy
  - Access Community
  - Span Space
  - Miscellaneous



Creative Ideas

- **56** Ideas brainstormed
  - **20** VE Alternatives developed
  - **13** Design Comments identified
  - **2** Estimate Comments identified



VE Proposals - Summary

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

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTIONS CHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS
SR	Support Redundancy					
SR-02	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum shoulders	$24.5M	No perceived impact to schedule	MINIMAL	YES	YES
SR-06	Remove US 60 interchange	$5M	Reduce 3 MONTHS	MINIMAL	YES	YES
SR-07	Remove US 41 interchange	$44.2M	Reduce 5-7 MONTHS	PUBLIC PERCEPTION (-); EIS (-)	NO	YES
SR-08	Modify Veterans Memorial Parkway interchange	$36.8M	No perceived impact to schedule	PUBLIC PERCEPTION (-); EIS (-)	NO	YES
SR-09	Remove KY2084 ramp southbound	$5M	Reduce 2 MONTHS	MINIMAL	YES	YES
SR-10	Reduce median width	Minimal cost impact	Reduce 8 MONTHS	MINIMAL	YES	YES
SR-14	Investigate alternate location for eastern crossing	$50M	Reduce 6 MONTHS	EIS (++); CONSTRUCTION (--)	NO	YES
MF-08	Add community betterment (ped crossing, bike/ped path, waterfront) for enhancements	*DESIGN SUGGESTION*		MINIMAL	NO	YES

VE Proposals - Summary

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

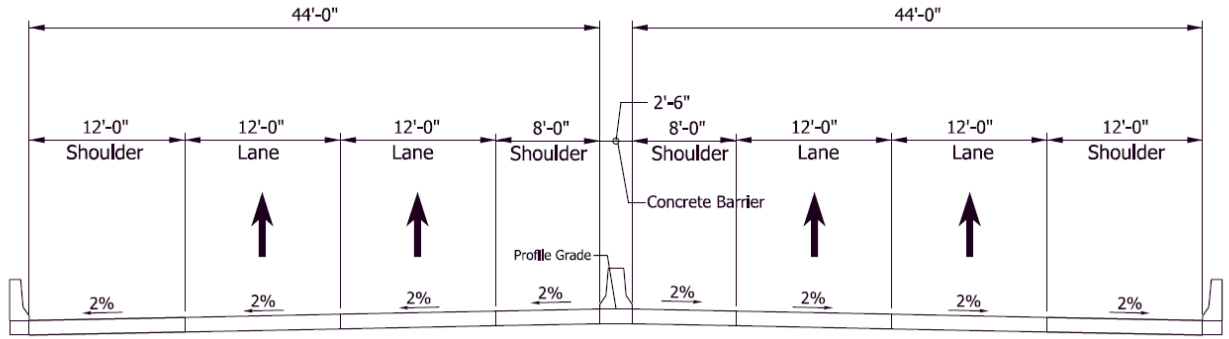
IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTIONS CHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS
AC	Access Community					
AC-01	Optimize interchanges in terms of connectivity and priority of access (US 60)	$5M	Reduce 3 MONTHS	MINIMAL	YES	YES
AC-02	Collapse/combine US 41/US 60 interchanges	$21M	Reduce 3 MONTHS	EIS (--)	NO	YES
AC-03	Relocate Parcel 627 access	$1.06M	Reduce 3 MONTHS	MINIMAL	YES	YES
AC-05	Simplify/minimize I-69 interchange at Veterans Memorial Parkway	$30M	Reduce 9 MONTHS	MINIMAL	YES	YES
AC-07	Reconfigure the US 41 interchange to reduce structure requirements	$20M	Increase 6 MONTHS	MINIMAL	YES	YES
AC-08	Reduce the amount of structure on the US 41 interchange by a more detailed hydraulic analysis	$23.6M++	No perceived impact to schedule	FLOODWAY DESIGNATION (-)	MAYBE	YES
SS	Span Space					
SS-01	In lieu of bridge/fill, use prefabricated culvert (BEBO)	$12M++	Reduce 6 MONTHS	FLOODPLAIN (-); MAINTENANCE (-)	YES	YES
SS-05	Use cut and cover or trench section in lieu of bridges on floodplain	$9.4M	Reduce 2-3 MONTHS	MAINTENANCE (-); EIS (-)	NO	YES
M	Miscellaneous					
M-01	Allow temporary hydraulic surge during construction	$3-6M	Reduce 3 MONTHS	UPSTREAM FLOODING (--)	YES	YES

VE Proposals - Summary

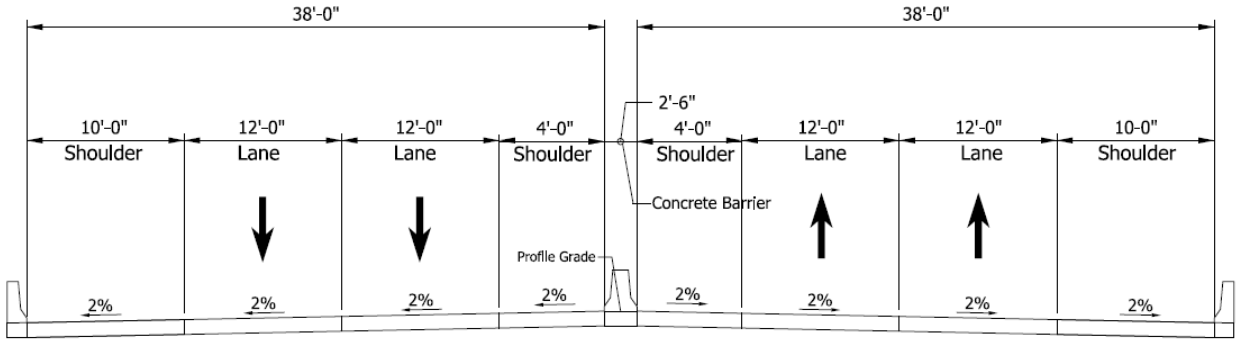
Summary of Value Engineering Proposals (Workbook Prepared, Costed Alternative)

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTIONS CHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS
M-04	Use federal aid for project, except river spans, to reduce cost of materials	$25-35M	No perceived impact to schedule	LEGAL (--); PUBLIC PERCEPTION (--)	NO	NO
M-07	Phase project in two construction packages: (1) direct connection, (2) build out interchanges and existing US 41	*DESIGN SUGGESTION*		PUBLIC (-)	YES	YES
M-08	In lieu of pier support islands, build roadway embankment on the north to shorten bridge	No perceived impact to cost	No perceived impact to schedule	HYDRAULICS (--)	NO	NO

SR-02 Build a four-lane (two lanes in each direction) bridge (I-69) with minimum shoulders



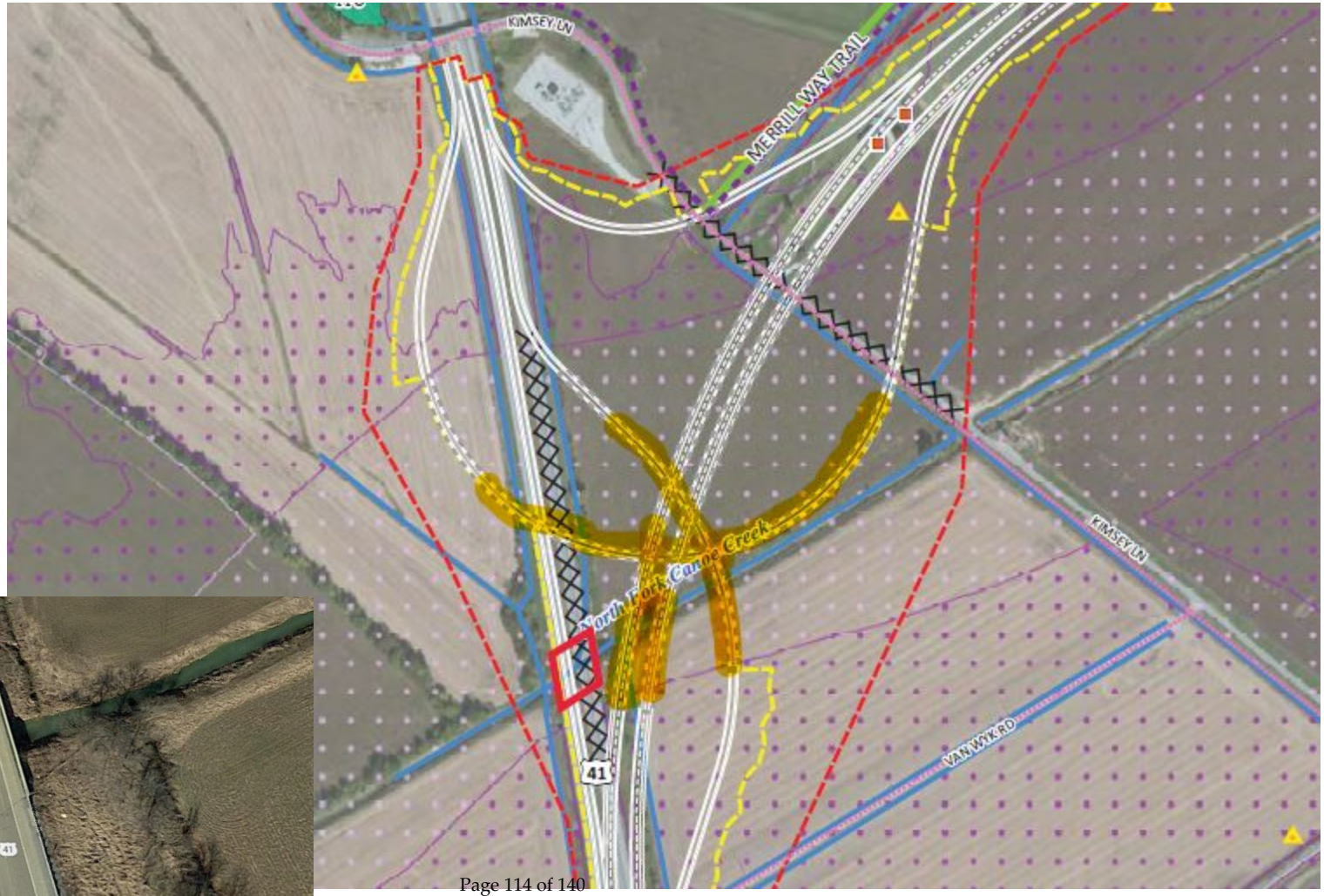
MAIN SPAN BRIDGE TYPICAL SECTION - RURAL



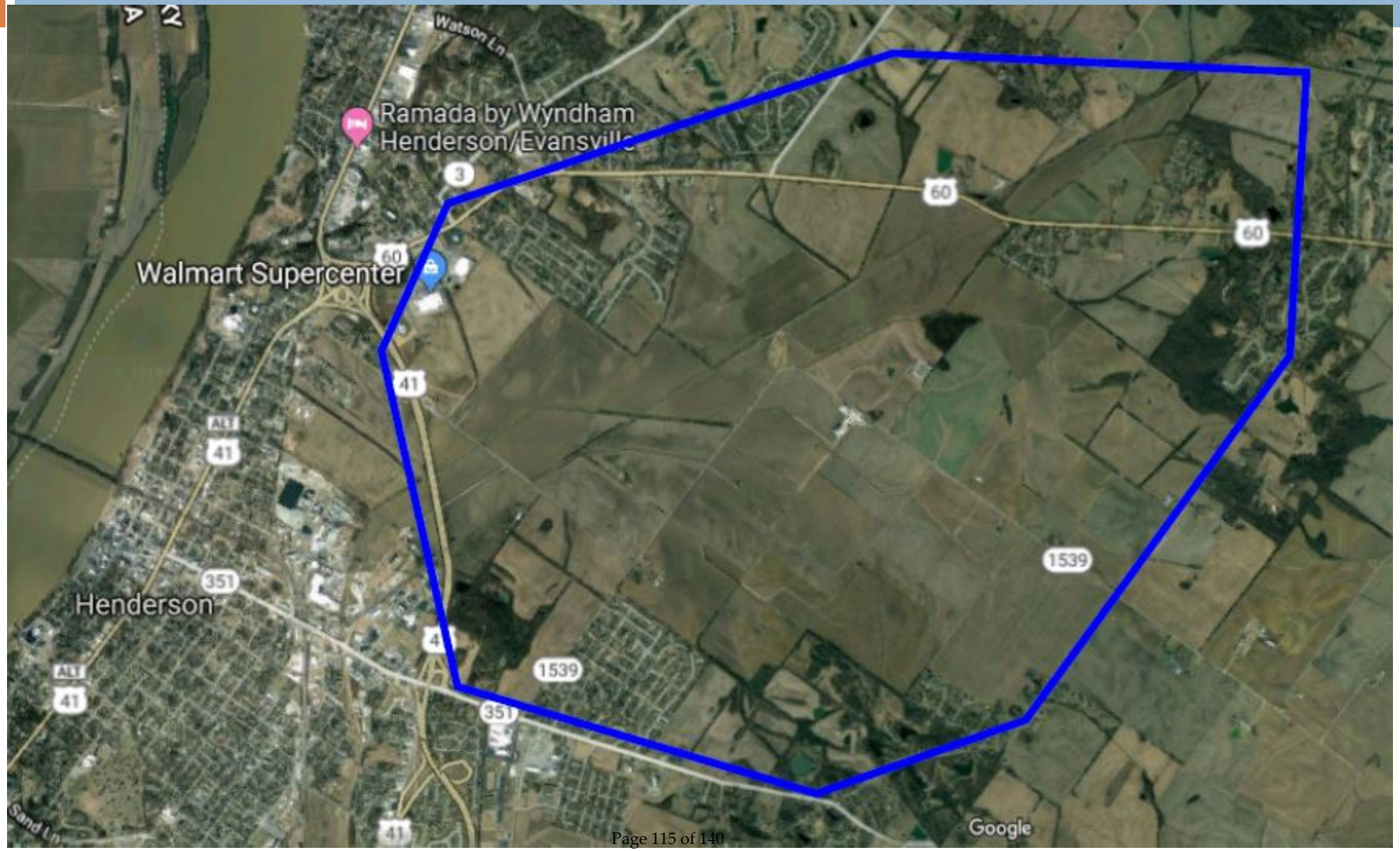
MAIN & APPROACH SPAN BRIDGE TYPICAL SECTION

Potential Cost Avoidance: $24.5M

AC-08 Reduce the amount of structure on the US 41 interchange by a more detailed hydraulic analysis



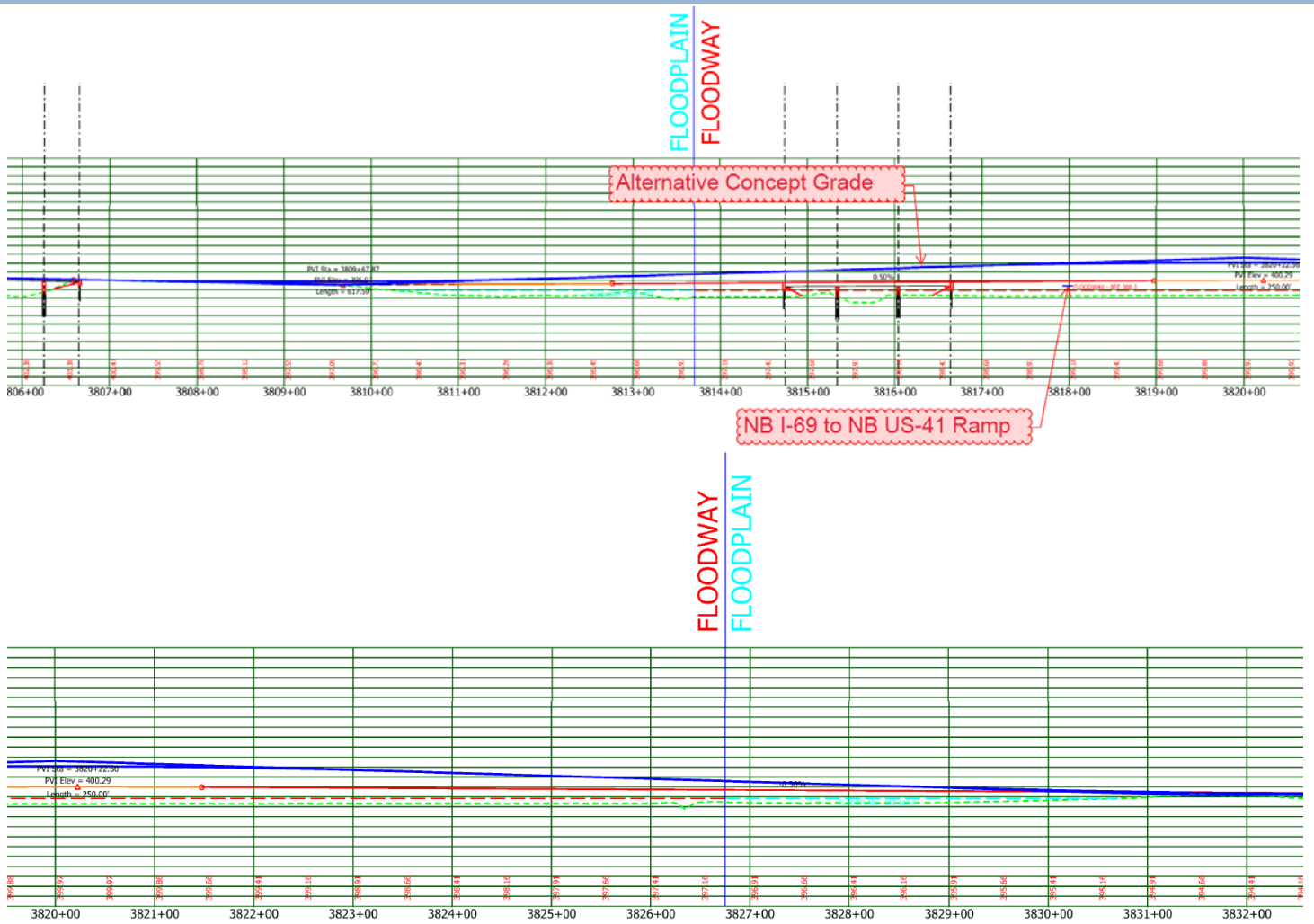
AC-08 Reduce the amount of structure on the US 41 interchange by a more detailed hydraulic analysis



Potential Cost Avoidance: $23.6M

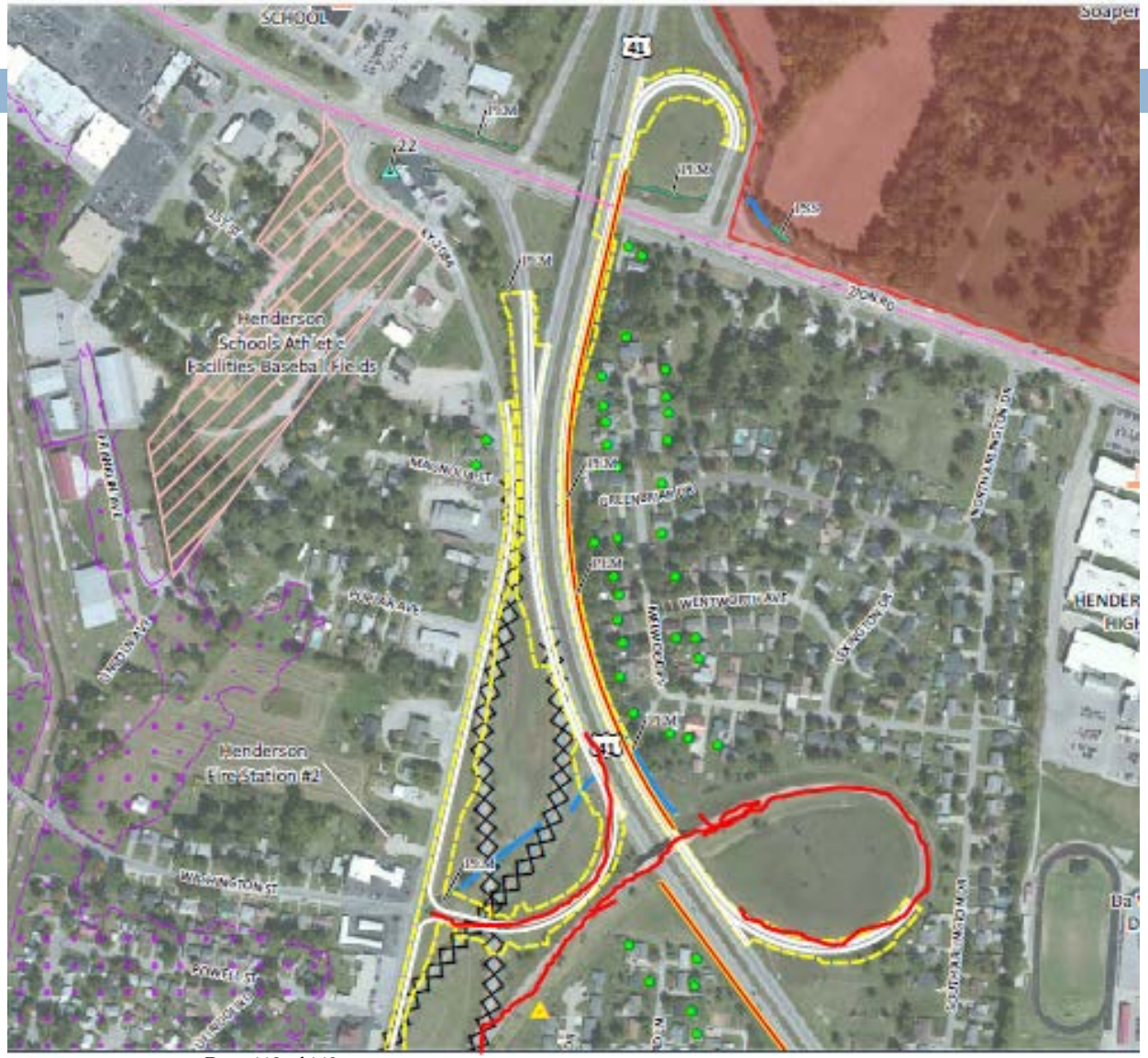
AC-07 Reconfigure the US 41 interchange to reduce structure requirements

AC-07 Reconfigure the US 41 interchange to reduce structure requirements



Potential Cost Avoidance: $20M

SR-09 Remove KY2084 ramp southbound



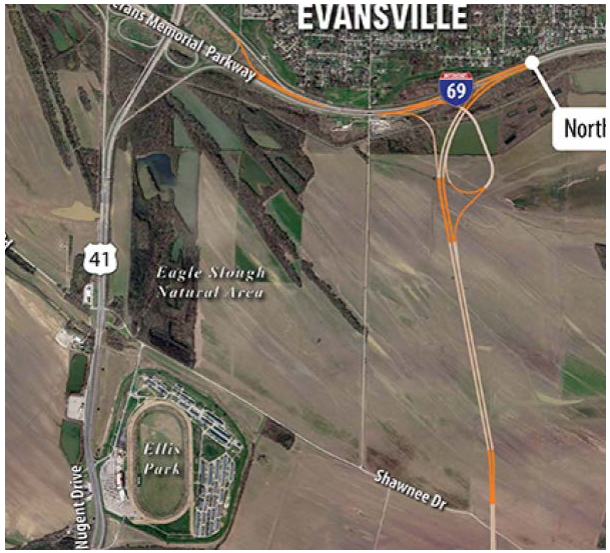
Potential Cost Avoidance: $5M

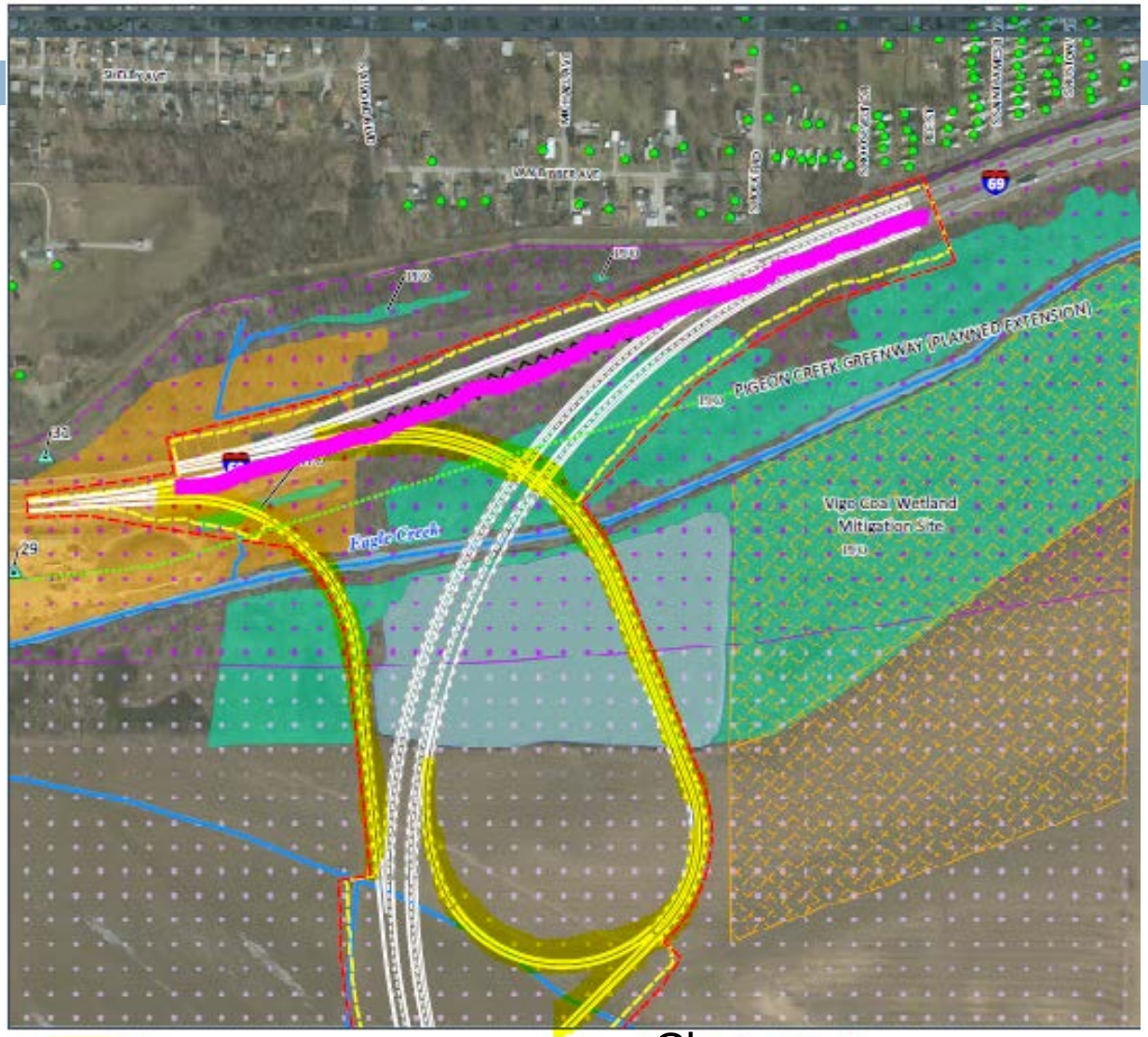
SR-06 Remove US 60 interchange

SR-06 Remove US 60 interchange

Potential Cost Avoidance: $5M

SR-08 Remove Veterans Memorial Parkway interchange



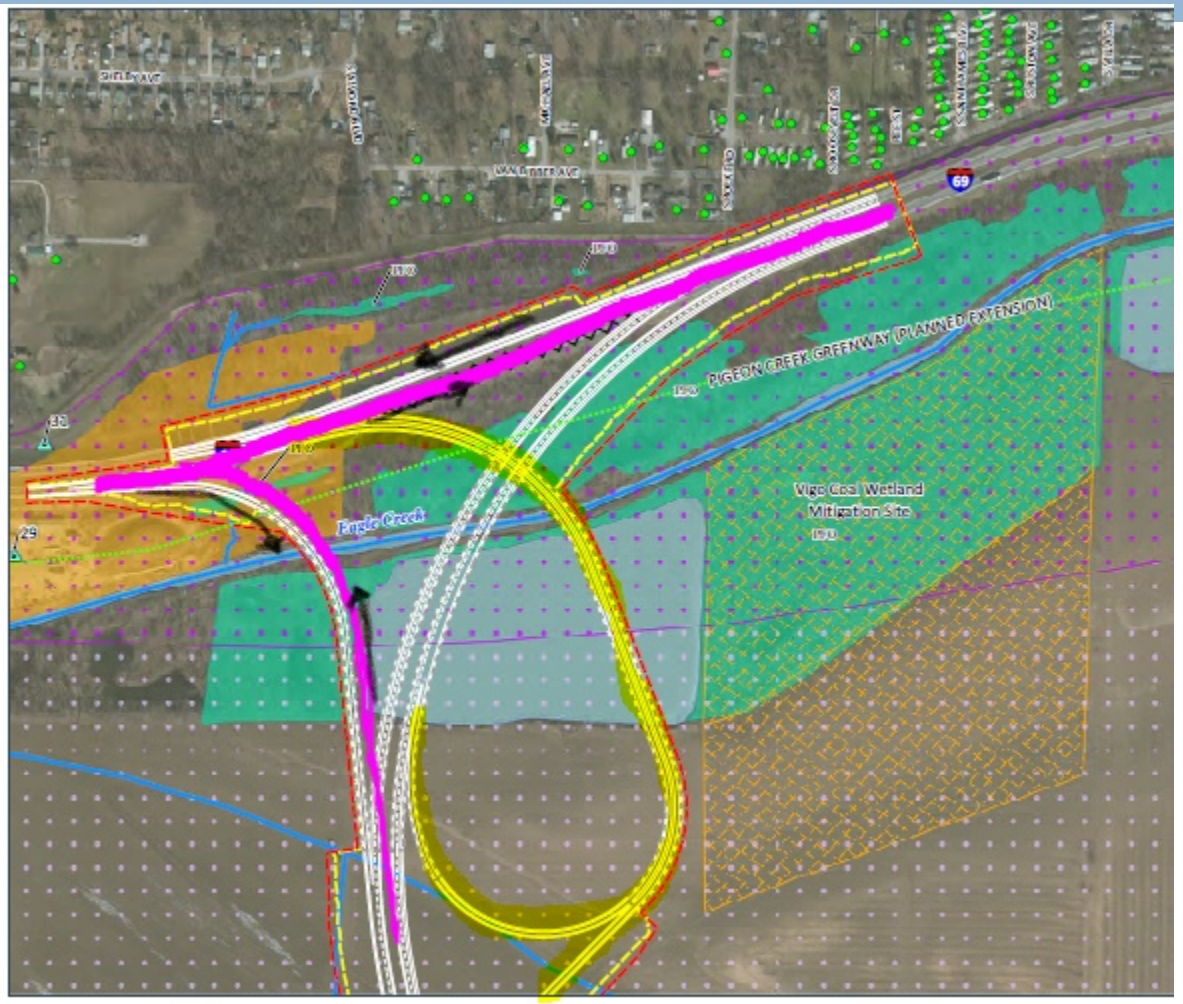


Eliminate

Change

Potential Cost Avoidance: $36.8M

AC-05 Simplify/minimize I-69 interchange at Veterans Memorial Parkway

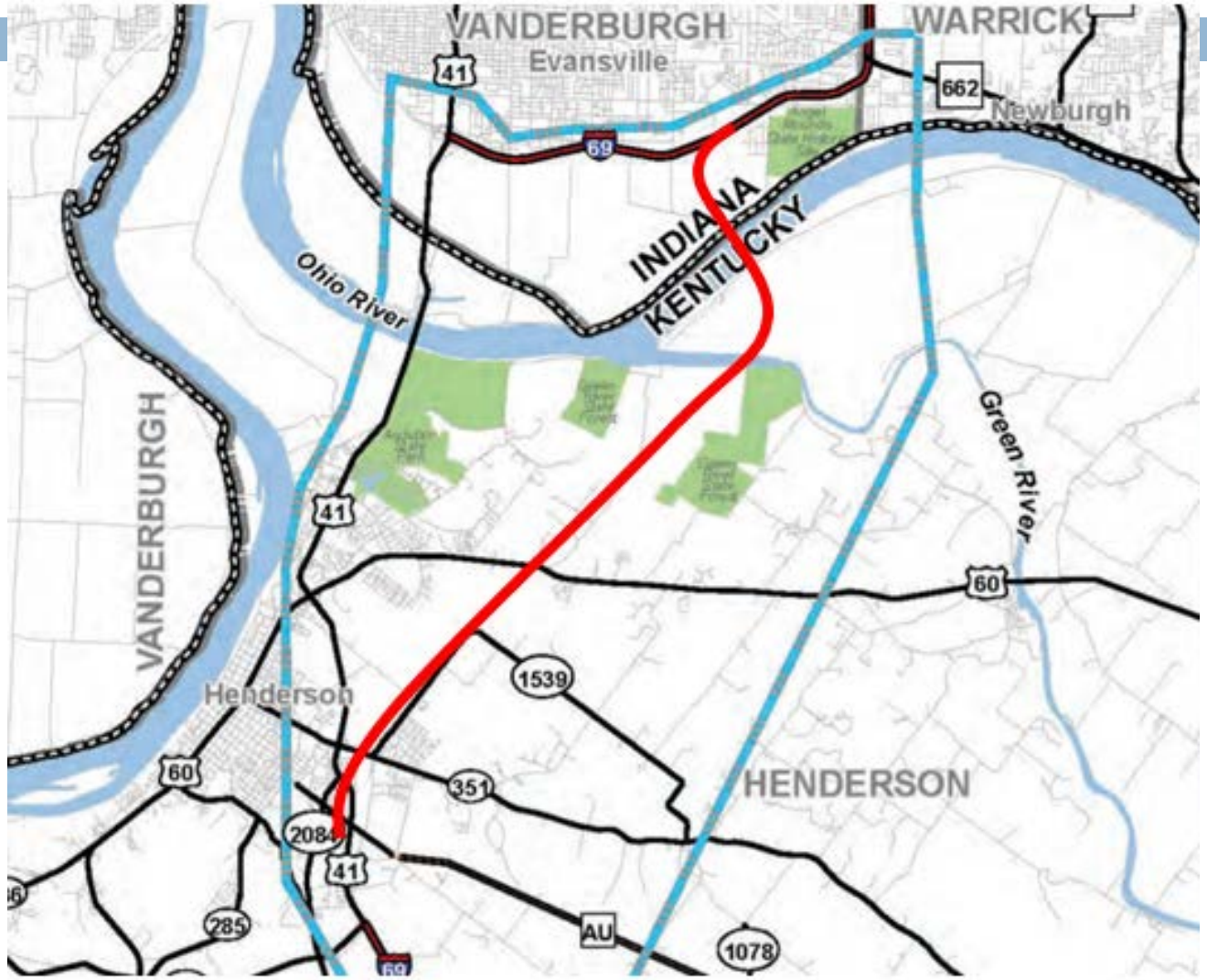


Eliminate

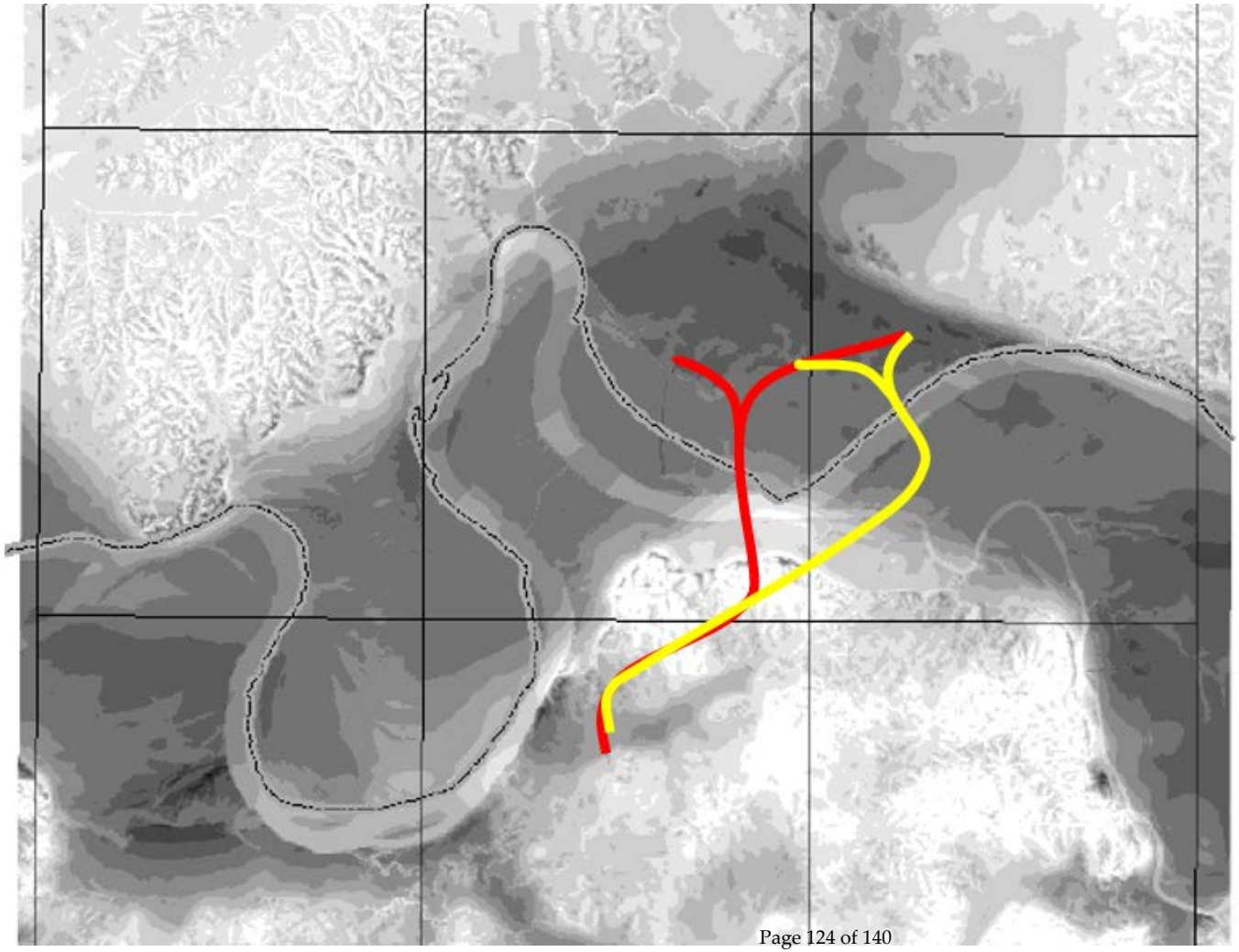
Change

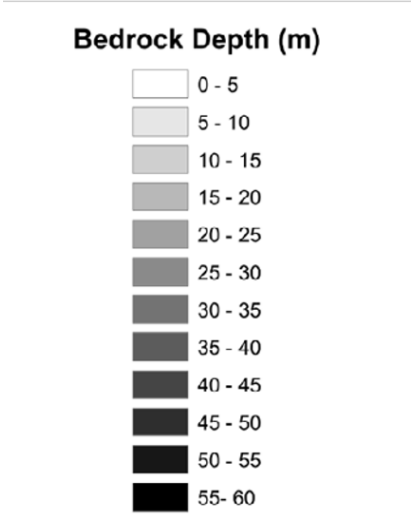
Potential Cost Avoidance: $30M

SR-14 Investigate alternate location for eastern crossing

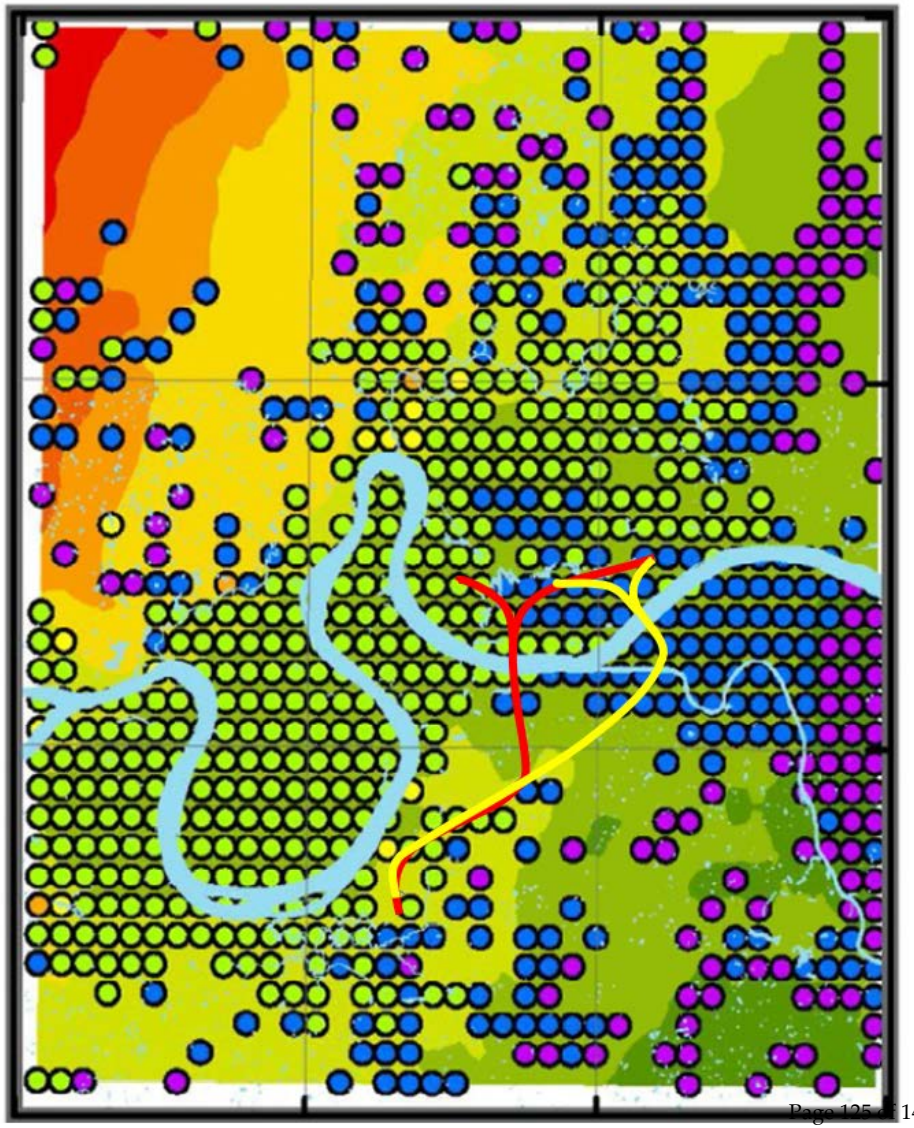


SR-14 Investigate alternate location for eastern crossing

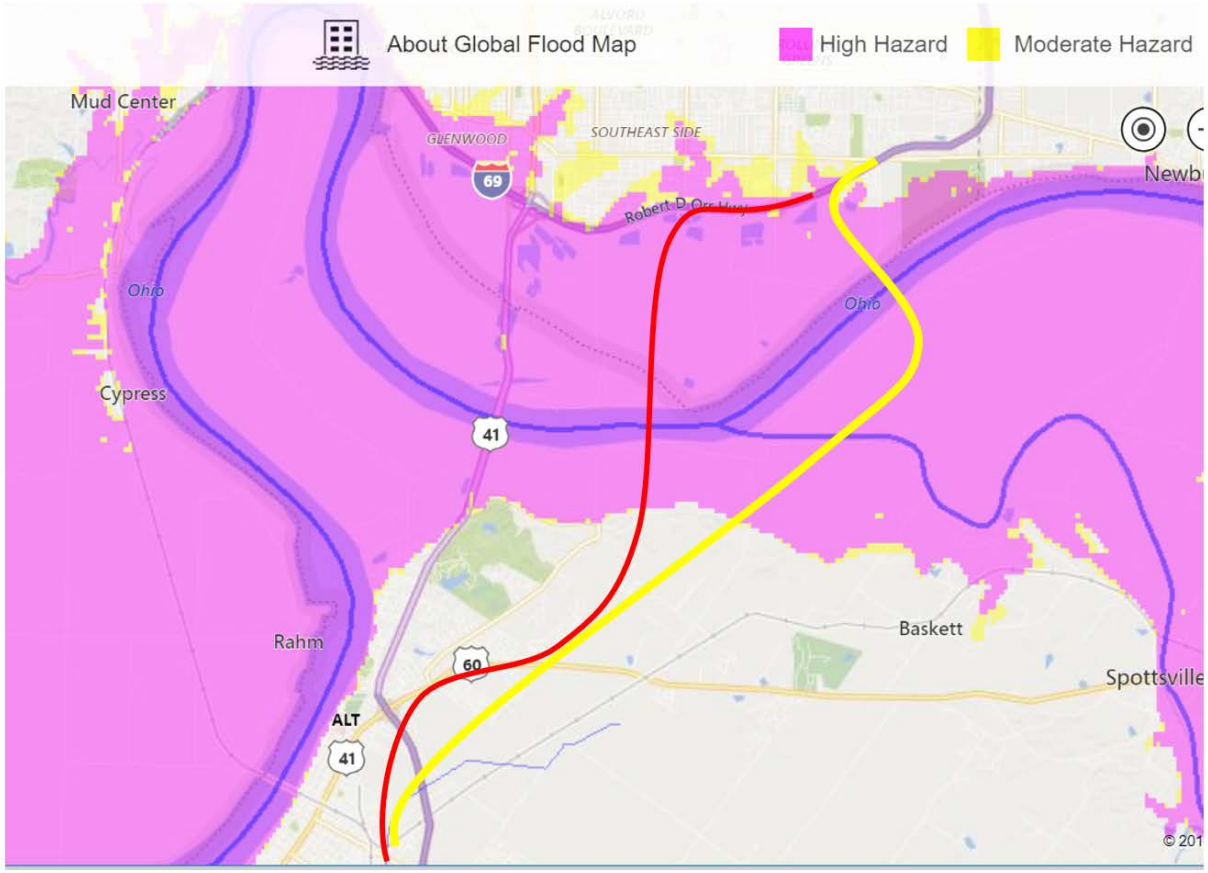




SR-14 Investigate alternate location for eastern crossing

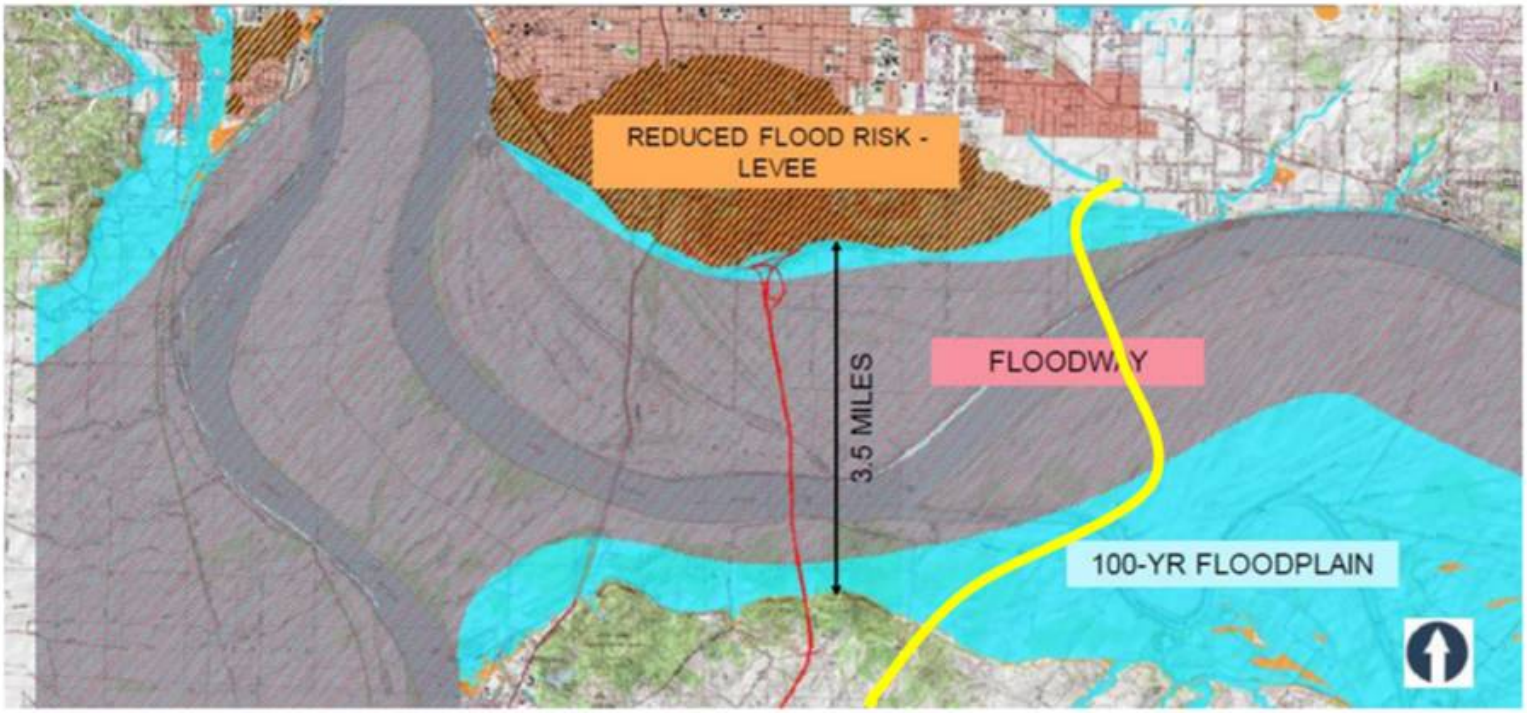


SR-14 Investigate alternate location for eastern crossing



SR-14 Investigate alternate location for eastern crossing

FEMA Hazard Map



SR-14 Investigate alternate location for eastern crossing

Potential Cost Avoidance: $50M

Questions

Next Steps

- Draft Report due March 28, 2019

Value Engineering (VE) Study Agenda

Dates/Time: March 12-14, 2019, 8:00 AM – 5:00 PM EST
Study Location: Parsons Indianapolis Office
101 W Ohio St, Suite 2121
Indianapolis, IN 46204

Day 1: Tuesday, March 12, 2019

Time	VE Study Activity	Participants	Comments
8:00 AM	Welcome & Introductions	All	
8:10 AM	Brief Overview of VE Process (Pat Miller)	All	
INFORMATION PHASE			
8:15 AM	Presentation by Design Team (Parsons)	All	
9:15 AM	Review Project Goals, VE Study Objectives & Constraints Identify, Rate & Rank Project Performance Attributes	All	
10:00 AM	Break	All	
10:15 AM	Review Cost Model, Schedule, Project Risks	VE Study Team	
FUNCTION ANALYSIS PHASE			
11:15 AM	Function Identification of Project Elements • Identify/Classify Project Functions • Apply Risks/Resources to Functions • Select Specific Functions for Study	VE Study Team	
Noon	Lunch	VE Study Team	
CREATIVE PHASE			
1:00 PM	Brainstorm Ideas / Alternatives	VE Study Team	
3:00 PM	Break	VE Study Team	
3:15 PM	Brainstorm Ideas / Alternatives	VE Study Team	
5:00 PM	Adjourn	VE Study Team	

Day 2: Wednesday, March 13, 2019

Time	VE Study Activity	Participants	Comments
8:00 AM	Check-in	VE Study Team	
CREATIVE PHASE (continued)			
8:05 AM	Brainstorm Ideas / Alternatives	VE Study Team	
10:00 AM	Break	VE Study Team	
EVALUATION PHASE			
10:15 AM	Two-step Evaluation Process (Shortlist Ideas for Development)	VE Study Team	
Noon	Lunch	VE Study Team	

Time	VE Study Activity	Participants	Comments
EVALUATION PHASE (continued)			
1:00 PM	Team Assignments for Development, Review Workbook	VE Study Team	
DEVELOPMENT PHASE			
1:30 PM	Develop / Cost Alternatives Mid-point Review	VE Study Team Mid-point Review Team	
3:00 PM	Break	VE Study Team	
5:00 PM	Adjourn	VE Study Team	

Day 3: Thursday, March 14, 2019

Time	VE Study Activity	Participants	Comments
8:00 AM	Check-in	VE Study Team	
DEVELOPMENT PHASE (continued)			
8:05 AM	Develop / Cost Alternatives	VE Study Team	
10:00 AM	Break	VE Study Team	
DEVELOPMENT PHASE (continued)			
10:15 AM	Develop / Cost Alternatives	VE Study Team	
Noon	Lunch	VE Study Team	
DEVELOPMENT PHASE (continued) **/ PRESENTATION PHASE**			
1:00 PM	Group Review of VE Alternatives Prepare Presentation	VE Study Team	
PRESENTATION PHASE			
3:30 PM	Presentation of Key Finding/VE Alternatives to Stakeholders/Decision-makers	All	
4:30 PM	Workshop Close-out	VE Study Team	
5:00 PM	Adjourn	VE Study Team	

VALUE ENGINEERING STUDY ATTENDEES

I-69 Ohio River Crossing

Indiana Department of Transporttion and Kentucky Transporation Cabinet

(In alphabetical order according to last name.)

March 12	March 13	March 14	Name	Organization	Position	Office (O) Phone Mobile (M) Phone	Email
BA		W	Aldrige, Brian	Stantec	Traffic Lead	O: 502.212.5013	brian.aldridge@stantec.com
MA		W	Aydemir, Murat	Parsons	Main Bridge Engineer	O: 312.930.5183	murat.aydemir@parsons.com
MC			Carrier, Marshall	KYTC	States PM Team	O: 502.782.4872	marshall.carrier@ky.gov
			Furrer, Martin	Parsons	Main Bridge Lead	O: 312.930.5126 M: 773.680.0662	martin.furrer@parsons.com
AG	AG	AG	Ghofrani, Andy	Parsons	Contractor	O: 408.823.1247	andy.ghofrani@parsons.com
YH	YH	YH	He, Eddie	Parsons	Major River Bridge Engineer	O: 312.930.5152	eddie.he@parsons.com
RH	RH	RH	Hein, Richard	Parsons	Associate Value Specialist	O: 289.294.6404	richard.hein@parsons.com
			Hutton, Hans	HNTB	Major River Bridge Engineer	O: 816.527.2613	hhutton@hntb.com
			Jackson, Michael	Parsons	Estimating Lead		michael.jackson@parsons.com
			Loyselle, Michael	FHWA	Major Projects	O: 502.223.6748	michael.loyselle@dot.gov

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VALUE ENGINEERING STUDY ATTENDEES

I-69 Ohio River Crossing

Indiana Department of Transporttion and Kentucky Transporation Cabinet

(In alphabetical order according to last name.)

March 12	March 13	March 14	Name	Organization	Position	Office (O) Phone Mobile (M) Phone	Email
AM	AM	AM	McLain, Adam	Stantec	Senior Roadway Designer	O: 859.422.1836	adam.mclain@stantec.com
BDM	BDM	BDM	Miller, Brandon	INDOT	Environmental Planner	O: 317.234.5108	bramiller1@indot.in.gov
PM	PM	PM	Miller, Patrice	RHA, LLC	Certified Value Specialist	O: 602.493.1947	patrice@teamrha.com
SN	SN		Nicaise, Steven	Parsons	Consultant PM	O: 502.653.6622 M: 502.439.1023	steven.nicaise@parsons.com
MO	MO	MO	Orton, Mark	INDOT	Senior Roadway Designer	O: 317.233.3840	morton@indot.in.gov
			Palahnuk, Andy	Parsons	Contractor	O: 919.720.2314	andy.palahnuk@parsons.com
JMP			Poturalski, Jim	INDOT	States PM Team	O: 317.234.0410 M: 317.908.6437	jpoturalski@indot.in.gov
DP		W	Prevost, Dan	Parsons	Environmental Lead	O: 513.552.7013 M: 513.368.0514	daniel.prevost@parsons.com
TRR		✓	Randolph, Toby	Parsons	Roadway Lead	O: 317.616.4676	tobias.randolph@parsons.com
			Rounds, Katie	INDOT	States PM Team		

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VALUE ENGINEERING STUDY ATTENDEES

I-69 Ohio River Crossing

Indiana Department of Transporttion and Kentucky Transporation Cabinet

(In alphabetical order according to last name.)

March 12	March 13	March 14	Name	Organization	Position	Office (O) Phone Mobile (M) Phone	Email
ARS	ARS		Schuler, Anthony	INDOT	Engineer		
ELS	ELS	ELS	Spahr, Ed	INDOT	Highway Bridge Engineer	O: 317 232.0675	espahr@indot.in.gov
KSB		W	Sperry, Ken	HMB	Engineering Lead	O: 502.229.9019	ksperry@hmbpe.com
KS	KS	KS	Stewart, Kaitlyn	RHA, LLC	Value Workshop Admin	O: 602.493.1947	kaitlyn@teamrha.com
BFK		W	Sweger, Brent	KYTC	States VE Leads		
SDT	SDT	TS	Tyler, Stuart	Parsons	Environmental Planner	O: 202.469.6481	stuart.tyler@parsons.com
G.V.			Valentine, Gary	KYTC	States PM Team	O: 270.766.7622	gvalentine@ky.gov
RW	R.W.	RW	Wahr, Rob	HNTB	Estimator	O: 317.917.5237	rwahr@hntb.com
JKW	JKW	JKW	Ward, Jason	KYTC	Contractor	O: 270.824.7080 M: 270-577-9913	jason.ward@ky.gov
MCW	MCW	MCW	Wolfe, Marvin	KYTC	Highway Bridge Engineer	O: 502.564.4560	marvin.wolfe@ky.gov

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VALUE ENGINEERING STUDY ATTENDEES

I-69 Ohio River Crossing

Indiana Department of Transporttion and Kentucky Transporation Cabinet

(In alphabetical order according to last name.)

March 12	March 13	March 14	Name	Organization	Position	Office (O) Phone Mobile (M) Phone	Email
~~F~~	~~F~~	~~F~~	~~Zoli~~ III, Ted	HNTB	Major River Bridge Engineer	O: 212.915.9588	tzoli@hntb.com
DMA			Ayala, Dave	PARSONS	Project PRINCIPAL	3175039217	dave.ayala@parsons.com
LH		W	Laura Hilden	INDOT	Director of Envtl. Services	317-232-5018	lhilden@indot.in.gov
	JLF		Janette Fulkerson	Parsons	Hydraulic Engineer	317-616-4664	janette.fulkerson@parsons.com
	KG		~~Corinna~~ Goodwin Corinna	Parsons	"	480-208-4435	Corinna.Goodwin@parsons.com
		ER	Eric Rothermel	FHWA	Environmental Specialist	502-223-6742	eric.rothermel@dot.gov
		✓	Erin Fletcher	FHWA	TE	317-226-7495	erin.fletcher@dot.gov

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SECTION 5: IMPLEMENTATION

Section 5: Implementation

Introduction

Members of the project team met to decide upon the status of the VE alternatives; summary results are shown below and details are provided on the following pages on the VE Alternatives Initial Assessment/Comment Form.

Disposition	Meaning	Number of Alternatives
Accept (A)	The VE proposal will be accepted and the original design concept will be modified accordingly.	0
Accept with Modifications (AM)	Portions of the VE recommendation will be accepted and/or the proposal will be modified.	0
Further Study (FS)	The VE proposal disposition will be decided at a future date.	12
Reject (R)	The VE Proposal will not be accepted and the original design concept will be implemented.	8

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTION SCHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS	DISPOSITION OF ALTERNATIVE	
							A=ACCEPT; AM=ACCEPT WITH MODIFICATIONS; FS=FURTHER STUDY; R=REJECT	COMMENTS
SR	**Support Redundancy**							
SR-02	Build a four-lane (two lanes in each direction) bridge (I-69) with minimum shoulders	$24.5M	No perceived impact to schedule	MINIMAL	YES	YES	FS	Benefit bullet #3 ("…three 11-foot lanes…" appears to contradict Challenges bullet #2 ("Future widening to 6-lane section would require more construction"). This option is dependent upon the decision on whether to keep only 1 US 41 bridge. VE study indicated minimum shoulder width greater than Interstate standard, which is 4 foot on bridges over 200 feet. The VE recommendation is still desirable for future MOT purposes.
SR-06	Remove US 60 interchange	$5M	Reduce 3 MONTHS	MINIMAL	YES	YES	FS	Further study is required to determine the impact of not including this interchange.
SR-07	Remove US 41 interchange	$45M	Reduce 5-7 MONTHS	PUBLIC PERCEPTION (-); EIS (-)	NO	YES	R	Project Team considers this not feasible due to the need to provide direct access to the US 41 strip.
SR-08	Modify Veterans Memorial Parkway interchange	$37M	No perceived impact to schedule	PUBLIC PERCEPTION (-); EIS (-)	NO	YES	R	Project Team considers this not feasible due to the potential traffic impacts on City of Evansville, downtown, as the VMP is heavy commuter route. See AC-05, which will be studied further to simplify movements and reduce costs.
SR-09	Remove KY2084 ramp southbound	$5M	Reduce 2 MONTHS	MINIMAL	YES	YES	FS	
SR-10	Reduce median width	Minimal cost impact	Reduce 8 MONTHS	MINIMAL	YES	YES	FS	The VE Workshop Report also suggests 2:1 side slopes to reduce the quantity of fill or cut. 2:1 slopes are not desirable as they can be difficult to maintain.

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTION SCHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS	DISPOSITION OF ALTERNATIVE	
							A=ACCEPT; AM=ACCEPT WITH MODIFICATIONS; FS=FURTHER STUDY; R=REJECT	COMMENTS
	Investigate alternate location for eastern crossing	$50M	Reduce 6 MONTHS	EIS (++); CONSTRUCTION (--)	NO	YES	R	Project Team believes there are additional development and construction costs that would exceed potential savings. The project team will evaluate the seismic/liquefaction concerns raised by the VE workshop, as well as any seismic retrofits that may be needed for the US 41 bridges.
MF	**Maintain Facility**							
MF-08	Add community betterment (ped crossing, bike/ped path, waterfront) for enhancements	*DESIGN SUGGESTION*		MINIMAL	NO	YES	FS	This may be considered in the ROD as an environmental commitment if US 41 bridges are tolled.
AC	**Access Community**							
AC-01	Optimize interchanges in terms of connectivity and priority of access (US 60)	$5M	Reduce 3 MONTHS	MINIMAL	YES	YES	FS	Removing the US 60 interchange would have measurable traffic impacts and possible financial impacts that require further study.
AC-02	Collapse/combine US 41/US 60 interchanges	$21M	Reduce 3 MONTHS	EIS (--)	NO	YES	R	Project Team considers this not feasible due to the need to provide direct access to the US 41 strip. Further study of SR-06 will determine the potential for removing or delaying the US-60 interchange.
AC-03	Relocate Parcel 627 access	$1.06M	Reduce 3 MONTHS	MINIMAL	YES	YES	FS	
AC-05	Simplify/minimize I-69 interchange at Veterans Memorial Parkway	$30M	Reduce 9 MONTHS	MINIMAL	YES	YES	FS	
AC-07	Reconfigure the US 41 interchange to reduce structure requirements	$20M	Increase 6 MONTHS	MINIMAL	YES	YES	FS	
AC-08	Reduce the amount of structure on the US 41 interchange by a more detailed hydraulic analysis	$23.6M++	No perceived impact to schedule	FLOODWAY DESIGNATION (-)	MAYBE	YES	FS	
SS	**Span Space**							
SS-01	In lieu of bridge/fill, use prefabricated culvert (BEBO)	$17.2M	Reduce 6 MONTHS	FLOODPLAIN (-); MAINTENANCE (-)	YES	YES	R	Project Team considers this not feasible due to the number and sizes of culverts needed, as well as the potential for scour or erosion.

IDEA NO.	IDEA TITLE	COST AVOIDANCE	CONSTRUCTION SCHEDULE IMPACT (Reduce or Increase)	RISK IMPACT (-) Threat (+) Opportunity	EASY TO IMPLEMENT?	VE TEAM RECOMMENDS	DISPOSITION OF ALTERNATIVE	
							A=ACCEPT; AM=ACCEPT WITH MODIFICATIONS; FS=FURTHER STUDY; R=REJECT	COMMENTS
SS-05	Use cut and cover or trench section in lieu of bridges on floodplain	$9.4M	Reduce 2-3 MONTHS	MAINTENANCE (-); EIS (-)	NO	YES	R	Project Team considers this not feasible due to the high flood levels and the potential need for pumping through the trench section.
M	**Miscellaneous**							
M-01	Allow temporary hydraulic surge during construction	$6M	Reduce 3 MONTHS	UPSTREAM FLOODING (--)	YES	YES	FS	
M-04	Use federal aid for project, except river spans, to reduce cost of materials	$25-35M	No perceived impact to schedule	LEGAL (--); PUBLIC PERCEPTION (--)	NO	NO	R	The VE Team did not recommend this and Project Team considers this not feasible.
M-07	Phase project in two construction packages: (1) direct connection, (2) build out interchanges and existing US 41	*DESIGN SUGGESTION*		PUBLIC (-)	YES	YES	FS	
M-08	In lieu of pier support islands, build roadway embankment on the north to shorten bridge	No perceived impact to cost	No perceived impact to schedule	HYDRAULICS (--)	NO	NO	R	The VE Team did not recommend this and Project Team considers this not feasible.