

Kentucky
Transportation
Cabinet



State of Ohio Department of Transportation

## BRENT SPENCE BRIDGE REPLACEMENT/REHABILITATION PROJECT

ODOT Project HAM-71/75-0.00/0.22, PID 75119
KYTC PROJECT ITEM NO. 6-17
Project Development Process Step 6

## FINAL - Value Engineering Study Report

October 2009

**Design Engineering Consultant** 



Value Engineering Consultant



Lewis & Zimmerman Associates



Ms. G. Jeanne Braxton
Value Engineering Coordinator,
Management Analyst Supvr. II
State of Ohio, Department of Transportation
1980 West Broad Street
Columbus, Ohio 43223

re:

ODOT Project HAM-71/75-0.00/0.22, PID 75119

KYTC Project Item No. 6-17

Brent Spence Bridge Replacement/Rehabilitation Project

Final Value Engineering Study Report

Dear Ms. Braxton:

Lewis & Zimmerman Associates is pleased to submit 15 copies of the referenced final report on the value engineering (VE) study that took place on 24 - 26 August, 2009. The VE study focused on the project documents being developed by Parsons Brinckerhoff.

During the workshop the team identified and developed several betterments, alternatives, and design suggestions which provide opportunities to improve the value of the project. Of particular interest are those alternatives related to improving access to central business districts and adjacent communities in Covington, KY and Cincinnati, OH; increasing the utilization of the existing Clay Wade Bailey Bridge; reducing impacts to 4(f) and 6(f) resources; and adjusting lane configurations to reduce the width of the new bridge by one lane per deck as detailed in Section Two of this report.

We appreciate this opportunity to work with you and the ODOT, KYTC, and FHWA participants on this important project for the Ohio-Kentucky-Indiana Regional Council of Governments, and the cities of Covington, Kentucky, and Cincinnati, Ohio. Please feel free to contact me should you or any reviewer have questions concerning the information presented.

Sincerely yours,

LEWIS AND ZIMMERMAN ASSOCIATES, INC. an ARCADIS company

Stephen G. Havens, PE, CVS Senior Project Manager

Attachment

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October 23, 2009

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## **EXECUTIVE SUMMARY**

## INTRODUCTION

This value engineering (VE) study report documents the events and results of the VE study conducted by Lewis & Zimmerman Associates, Inc. (LZA) for the Ohio Department of Transportation (ODOT) and the Kentucky Transportation Cabinet (KYTC). The subject of the study was the Brent Spence Bridge Replacement/Rehabilitation Project (ODOT Project HAM-71/75-0.00/0.22, PID 75119 and KYTC Project Item No. 6-17). The project is being planned for ODOT and KYTC by a team led by Parsons Brinckerhoff.

The VE workshop was conducted August 24 - 26, 2009, at the Kentucky Transportation Cabinet District 6 Office in Ft. Mitchell, Kentucky and followed the six-phase VE Job Plan:

- Information Phase
- Function Identification and Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

The multidisciplinary team comprised professionals with highway design, geometrics, structural engineering, traffic control, construction, transportation engineering, and geotechnical engineering experience and a working knowledge of VE procedures. The following is a list of the VE team members:

<u>Participant</u>	<u>Specialization</u>	Affiliation
Stefan Spinosa	Highway Design	ODOT District #8 Project Manager
John Eckler	Highway Design	KYTC District #6 Project Manager
Rob Hans	Highway Design	KYTC District #6 Chief Engineer
John Otis	Highway Design	ODOT District #8 Production
Walter Bernau	Construction/MOT	ODOT District #8 Construction
Reynaldo Stargell	MOT	ODOT C.O. Traffic Engineering
Jay Hamilton	Traffic	ODOT District #8 Planning & Programming
J.C. Pyles	Structures	KYTC Structural Design Office
Chris Howard	Structures	ODOT District #8 Production
Jeff Crace	Structures	ODOT C.O. Structural Engineering
Darrin Beckett	Geotechnical	KYTC C.O. Division of Materials
Joe Smithson	Geotechnical	ODOT District #8 Production
Kevin Rust	Construction	KYTC District #6 Construction
Nasby Stroop	Construction	KYTC C.O. Construction
Keith Smith	Environmental	ODOT District #8 Planning and Programming
Bernadette DuPont	Transportation	Kentucky FHWA
Scott Wolf	Transportation	Kentucky FHWA
Siamak Shafaghi	VE Coordinator	KYTC C.O. Production
Jeanne Braxton	VE Coordinator	ODOT C.O. Office of Production
Stephen Havens, CVS	VE Team Leader	Lewis & Zimmerman Associates

## PROJECT DESCRIPTION

The project is located along a seven mile segment of I-75 within the Commonwealth of Kentucky and the State of Ohio. The southern limit of the project is 2,300 feet south of the midpoint of the interchange of I-75 and Dixie Highway (US 127/US 42/US 25) in Kentucky (KY SLM 187.2 +/-). The northern limit of the project is 1,500 feet north of the midpoint of the interchange of I-75 and the Western Hills Viaduct in Ohio (OH SLM 2.70 +/-). The eastern and western limits of the project follow the existing alignment of I-75. In Kentucky, the project area is a 1,500-ft.-wide corridor centered on I-75 south of the City of Covington. See Figure 1: Project Area below.

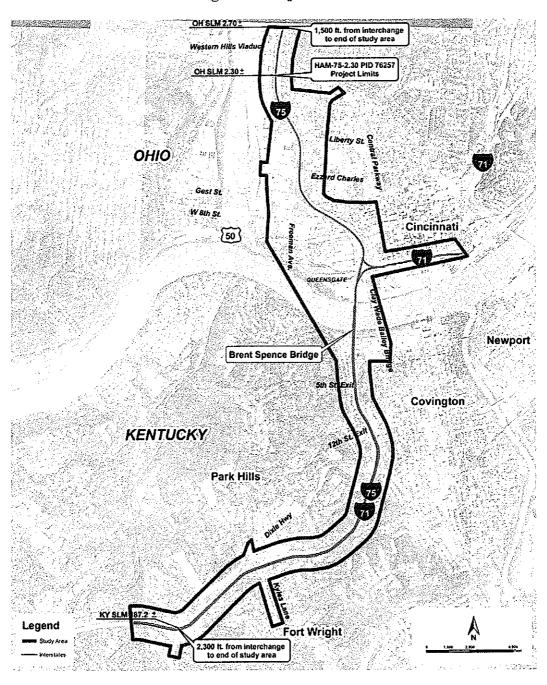


Figure 1: Project Area

The comparative analysis (ODOT Project Development Process Step 5) led to the recommendation of carrying forward two feasible alternatives. The two feasible alternatives consist of Alternative E and a combination of Alternatives C and D (Hybrid Alternative CD). Based on the analysis completed and feedback as part of community input, it was also recommended that certain design elements of Alternative G be incorporated into the two feasible alternatives in Step 6 of the Ohio Department of Transportation's Project Development Process (See Section 7.7 of the Conceptual Alternative Study). Additionally, the two feasible alternatives will be designed to provide three lanes in each direction on I-75.

## HYBRID ALTERNATIVE CD

Hybrid Alternative CD uses the existing I-71/I-75 alignment from the southern project limits at the Dixie Highway Interchange north to the Kyle's Lane Interchange. The Dixie Highway and Kyle's Lane interchanges would be modified slightly to accommodate a collector-distributor roadway, which would be constructed along both sides of I-71/I-75 between the two interchanges. North of the Kyle's Lane Interchange, the alignment shifts to the west to accommodate additional I-71/I-75 travel lanes. Between Kyle's Lane and KY 12th Street, six lanes would be provided in each direction for a total of 12 travel lanes. Near KY 12th Street, the alignment separates into three routes for I-71, I-75 and a local collector-distributor roadway.

Access into Covington from the interstate would be accomplished by the local collector-distributor roadway; at KY 12th Street for northbound traffic and at KY 9th Street for southbound traffic. Direct access to I-71 from Covington would be provided at Pike Street with traffic to I-75 northbound using the collector-distributor roadway through downtown Cincinnati and connecting at the Ezzard Charles merge. Access for southbound interstate traffic is located at KY 12th Street. Bullock Street would be extended north from Pike Street to KY 9th, 5th, and 4th streets and Jillian's Way would be extended north from Pike Street to KY 9th, 5th, 4th, and 3rd streets. A U-turn before the KY 9th Street intersection would allow local southbound traffic to turn and travel northbound to KY 3rd, 4th, and 5th streets.

A new double deck bridge would be built just west of the existing Brent Spence Bridge to carry northbound and southbound I-75 (three lanes in each direction), two lanes for southbound I-71 and two lanes for southbound local traffic. The existing Brent Spence Bridge would be rehabilitated to carry two lanes for northbound I-71 and three lanes for northbound local traffic.

Hybrid Alternative CD reconfigures I-75 through the I-71/I-75/US 50 Interchange and eliminates all direct access to and from I-75 from KY 12th Street to just south of Ezzard Charles Drive in the northbound direction. Hybrid Alternative CD also eliminates direct access to I-75 southbound between KY 9th Street and the Western Hills Viaduct. US 50 would be realigned to provide a parallel roadway and access to and from the interstate would be via the collector-distributor roadway.

In Ohio, the northbound collector-distributor roadway would carry local traffic from the existing bridge and provide access ramps to OH 2nd Street, US 50 westbound, and OH 5th Street before reconnecting to I-75 just south of Ezzard Charles Drive. The northbound ramps from OH 6th, 9th Streets and Freeman Avenue to I-75 would be removed requiring traffic from these three points to utilize a new local roadway parallel to the northbound collector-distributor roadway for access to I-75 just before Ezzard Charles Drive. The southbound collector-distributor roadway would maintain access to I-71, downtown city streets as well as connecting to access ramps from OH 9th Street and US 50 eastbound. The collector-distributor roadway would continue south over the new bridge into Covington. Downtown

Cincinnati traffic would cross over I-75 and run parallel between I-75 northbound and the northbound collector-distributor roadway. The three-lane collector-distributor roadway into Cincinnati would carry traffic to OH 7th Street, OH 2nd Street and I-71 northbound. Access to OH 5th Street would be removed.

Between Ezzard Charles Drive and the Western Hills Viaduct, northbound I-75 would have five lanes, southbound I-75 would have two lanes, and the local southbound collector-distributor roadway would have four lanes, for a total of 11 travel lanes. The northbound ramps from OH 6th and 9th streets to I-75 would be removed requiring traffic from these two points to utilize a new local roadway parallel to the northbound collector-distributor roadway for access to northbound I-75. Ramps from Freeman Avenue, Winchell Avenue just north of Ezzard Charles Drive to the Interstate, and to Western Avenue would be eliminated.

Hybrid Alternative CD also improves Western and Winchell Avenues to facilitate traffic flow and increase capacity. The ramps to Western Avenue and from Winchell Avenue just north of Ezzard Charles Drive would be removed. The Western Hills Viaduct Interchange would be reconfigured to provide a full movement interchange.

See attached sketches in Section Three which show Alternatives C and D.

## ALTERNATIVE E

Alternative E uses the existing I-71/I-75 alignment from the southern project limits at the Dixie Highway Interchange north to the Kyle's Lane Interchange. The Dixie Highway and Kyle's Lane interchanges would be modified slightly to accommodate a collector-distributor roadway, which would be constructed along both sides of I-71/I-75 between the two interchanges. North of the Kyle's Lane Interchange, the alignment shifts to the west to accommodate additional I-71/I-75 travel lanes. Between Kyle's Lane and KY 12th Street, six lanes would be provided in each direction for a total of 12 travel lanes. Near KY 12<sup>th</sup> Street, the northbound alignment separates into two routes; one for interstate traffic and one for a local collector-distributor roadway. Near KY 9th Street, the interstate separates into I-71 and I-75 only routes.

In Alternative E, there are two access points into Covington for both northbound and southbound traffic. In the northbound direction, access would be provided by the local collector-distributor roadway at KY 12th Street and KY 5th Street. In the southbound direction, access would be provided by the local collector-distributor roadway at KY 5th Street, and off of I-71 and I-75 at KY 9th Street. Bullock Street would be extended north from Pike Street to KY 5th and KY 9<sup>th</sup> streets. Jillian's Way would be extended north from Pike Street to KY 9th, 5th, and 4<sup>th</sup> streets and allow for access to the existing Brent Spence Bridge.

Access to the interstate system from Covington would be provided by local city streets. In the northbound direction, access to I-75 would be provided at KY 9th Street, access to I-71 would be provided at KY 5th Street. Access to I-75 northbound would also be provided at KY 4th by the local collector-distributor roadway across the lower deck of the existing Brent Spence Bridge and through downtown Cincinnati before connecting just south of the Linn Street Bridge. In the southbound direction, access to I-75/I-71 would be provided at KY 5th Street and KY 12th Street.

A new double deck bridge would be built just west of the existing Brent Spence Bridge to carry northbound and southbound I-71 and I-75 traffic. On the upper deck, I-71 southbound would have

three lanes and I-71 northbound would have two lanes. On the lower deck, I-75 would have three northbound and three southbound lanes. The existing Brent Spence Bridge would be rehabilitated to carry northbound and southbound local traffic with two lanes in each direction.

In Ohio, Alternative E reconfigures I-75 through the I-71/I-75/US 50 Interchange and eliminates some of the existing access points along I-75. Existing ramps to I-71, US 50 and downtown Cincinnati would be reconfigured. The existing direct connections between I-75 to westbound and from eastbound US 50 would be maintained in Alternative E. US 50 would be reconfigured to eliminate left-hand entrances and exits. The OH 5th Street overpass would be eliminated and the Sixth Street Expressway would be reconfigured as a two-way, six-lane elevated roadway with a new signalized intersection for US 50 access and egress. Access between southbound I-71 (Fort Washington Way) and northbound I-75 would be provided near OH 9th Street as a direct connection. Both I-75 southbound and the local southbound collector-distributor roadway would have access to northbound I-71 (Fort Washington Way).

A local collector-distributor roadway would carry local traffic northbound from the existing Brent Spence Bridge and provide access to OH 2nd, 5th, and 9th streets, Winchell Avenue and access from OH 4th and 6th streets before reconnecting to I-75 just south of the Linn Street overpass. The northbound ramp from OH 9th Street to I-75 would be removed requiring traffic from this point to utilize a new local roadway parallel to I-75 and access the interstate at Bank Street. Southbound I-75 traffic would separate from the local collector-distributor roadway near Ezzard Charles Drive. The southbound collector-distributor roadway would carry traffic over I-75 to OH 7th Street, allowing traffic to either; access downtown at 7th Street, travel south to OH 5th and 2nd streets, or travel across the existing Brent Spence Bridge into Covington. Access to the local southbound collector-distributor roadway would be provided at Western Avenue and at OH 4th and 8th streets.

Alternative E also improves Western and Winchell avenues to facilitate traffic flow and increase capacity. The ramps to Western Avenue and from Winchell Avenue just north of Ezzard Charles Drive would be removed. The northbound ramp from Freeman Avenue to I-75 would remain but the southbound ramp to Freeman would be eliminated. Between Ezzard Charles Drive and the Western Hills Viaduct, southbound I-75 would have six lanes; northbound I-75 would have five lanes, and one auxiliary lane to the Western Hills Viaduct. The Western Hills Viaduct Interchange would be reconfigured to provide a full movement interchange.

See attached sketches in Section Three which show Alternative E.

## PROJECT SCHEDULE AND CONSTRUCTION COSTS

The following is the schedule for the Brent Spence Bridge Replacement/Rehabilitation Project, which follows construction of the Mill Creek Expressway and Thru the Valley projects.

- Completion of preliminary design and NEPA process 2011
- Detailed design 2011
- Right of way acquisition 2012 2014
- Construction begins 2015
- Midpoint of Construction June 2017
- Completion of Construction 2020

The total estimated project costs are construction costs which include a design contingency, a construction inflation factor, right-of-way for roadway and utility relocations, major utility, and total project development costs. The table below summarizes the total estimated project costs.

Total Cost Estimates for Mainline Alternatives in Projected Build Year Dollars

Alternative	Construction Costs (millions)	Construction Costs Inflation (59.5%) (millions)	Real Estate Costs (millions)	Utility Costs (millions)	Real Estate Utility Costs (millions)	Project Development Costs	Total Estimated Costs (millions)
Hybrid Alternative CD	\$1,261.7	\$750.7	\$18.0	\$39.4	\$1.0	\$210.4	\$2,281.2
Alternative E	\$1,431.6	\$851.8	\$15.4	\$39.4	\$1.0	\$236.3	\$2,575.5

## **CONCERNS AND OBJECTIVES**

## Concerns

The following conceptual alternative issues were compiled based upon information provided during the design overview and the Conceptual Alternatives Evaluation Matrix found on pages 173-184 of the Conceptual Alternatives Study (CAS) prepared by Parsons Brinckerhoff, dated April 2009:

## Hybrid Alternative CD

- Would not maintain all existing connections would remove local connections to I-75 by using a collector-distributor system from KY 12<sup>th</sup> Street to just south of Ezzard Charles Drive
- US 50 would remain geometrically deficient in several locations requiring a design exception
- Four acres of floodplain would be impacted by the proposed alignment
- Approximately two acres of Section 6(f) Parks (Goebel Park) would be impacted by the proposed alignment
- Five Section 4(f) resources would be impacted by the proposed alignment including Goebel Park, Lewisburg Historic District, Longworth Hall, Harriet Beecher Stowe Elementary School, and Queensgate Playground

## Alternative E

- The proposed local collector-distributor roadway would be geometrically deficient in several locations requiring a design exception
- 35 businesses would be displaced in Ohio impacting up to 363 employees compared with approximately 30 businesses and 190 to 283 employees impacted by Hybrid Alternative CD

## Both Alternatives (Hybrid Alternative CD and Alternative E)

- I-71 would remain geometrically deficient requiring a design exception
- The proposed alignments would require relocation of a radio tower in Goebel Park in Covington, KY
- Three wetland areas totaling 0.59 acres would be impacted in Kentucky
- Eight woodlots with potential Indiana Bat habitat and two woodlots with marginal Indiana Bat Habitat have been identified which would have an impact on construction start dates in these areas
- Harriet Beecher Stowe Elementary School would have potential visual and noise impacts
- The eastern portion of Longworth Hall would be impacted by the proposed alignment
- Notre Dame Academy School tennis courts would be impacted in Kentucky
- The contractor would have limited space for access and logistics
- The proposed alignments would require impacts to a portion of the Duke Energy Sub-station near Longworth Hall
- The proposed alignments may impact the Willow Run Sewer structure during construction

## **Objectives**

The VE team was tasked with the following objectives:

- Identify betterments to improve the quality and function of the facility
- Identify cost reduction ideas

To meet these objectives, the VE team focused on the key elements associated with the project, paying particular attention to the advantages and disadvantages between the Purpose and Need Elements, Engineering Elements, Section 4(f) and 6(f) Resources, and Business Property Acquisitions identified in the Conceptual Alternatives Evaluation Matrix (pages 173-184) of the Conceptual Alternatives Study (CAS) prepared by Parsons Brinckerhoff, dated April 2009.

Additionally, the VE team focused on the CAS recommendation (page 172) that the following beneficial design features of Alternative G be carried forward for further analysis and incorporated into the feasible alternatives CD and E:

- Access to north end of Clay Wade Bailey Bridge from I-75 southbound using a collectordistributor roadway and US 50 eastbound;
- Two access points into Covington;
- Access from a northbound collector-distributor roadway from KY to I-71 northbound in Ohio; and
- An access ramp just north of Ezzard Charles Drive for Freeman Avenue and local traffic to I-75 northbound.

## RESULTS OF THE STUDY

The VE team developed 11 VE alternatives and 10 design suggestions. The greatest opportunities for improved value centered on the rerouting of traffic to I-471 during construction; improving access to the central business districts and adjacent communities of both Covington, KY and Cincinnati, OH;

increasing the use of the existing Clay Wade Bailey Bridge; reducing impacts to 4(f) and 6(f) resources; and adjusting lane configurations to reduce the width of the new bridge by one lane per deck.

## Rerouting of Traffic to I-471 during Construction

Three VE alternatives provide different lane configurations for adding a fourth lane on I-471 southbound that will support rerouting of traffic during construction of either Hybrid Alternative CD or Alternative E. The alternatives include replacement of the existing outside shoulder with a full depth pavement lane which could be used for future expansion of I-471 to four-lanes (Alt. No. MOT-1A), and two options (Alt. Nos. MOT-1B or MOT-1C) that would provide a temporary fourth lane by using the existing inside shoulder which would be adequate for carrying traffic in its existing condition.

## Improve Access to Central Business Districts and Adjacent Communities

In Hybrid Alternative CD, three VE alternatives are recommended to improve access to central business districts and adjacent communities. Providing a shorter route for emergency response from the Fire Station at 5th Street and Central Avenue to the Fort Washington Way Trench similar to Alternative E would shorten the response distance by nearly one mile (Alt. No. P-7). Providing a direct connection from the southbound collector-distributor to 2nd Street in Ohio and adding an additional connection to the US 42/3rd Street Intersection would increase the use of the Clay Wade Bailey Bridge by local traffic. This alternative would improve local access to Covington, KY from Ohio (Alt. No. P-8). Adding a drop lane from the collector-distributor and merging this with the frontage road between 9th Street and Linn Street would provide a more direct access to the Museum Center and Amtrak railroad from Kentucky and Fort Washington Way (Alt. No. S-1).

In Alternative E, replacing the 5th Street northbound ramp to I-71 in Kentucky with an indirect ramp connection from the collector-distributor roadway to I-71 in Ohio would improve access from KY 12th, Pike, 9th, 5th, and 4th Streets to I-71 northbound (Alt. No. P-3).

## Reduce Impacts to 4(f) and 6(f) Resources

In all options, significant construction and right-of-way cost avoidances may be realized by widening one-half mile of I-71/I-75 on the east side from 2,000 feet south of KY 12th St. to 4,500 feet south of KY 12th St. This would possibly eliminate the need for excavation and/or a proposed retaining wall on the west side of I-71/I-75 in Kentucky in the "Cut in the Hill" Section (Alt. No. R-1). Additionally, the use of tie-back retaining walls in selected areas from Kyle's Lane to approximately 7,000 feet north of Kyle's Lane and other applicable areas on the west side of I-75 southbound in Kentucky would reduce right-of-way acquisition requirements.

## Reduce the Width of the New Bridge by One Lane

Since the proposed new bridge design for Hybrid Alternative CD calls for 10 travel lanes between the two 6-lane decks, adjusting the lane configurations on each deck would save one lane per deck and reduce the overall bridge width by 12 ft. (Alt. No. S-6A).

Since the proposed new bridge design for Alternative E calls for 11 travel lanes between the two 6-lane decks, adjusting the lane configurations on each deck and eliminating the third lane for I-71 southbound would save one lane per deck and reduce the overall bridge width by 12 ft. (Alt. No. S-6B).

## **IMPLEMENTATION**

This VE report is a formalization of the draft materials provided to the project team during the outbriefing discussion which occurred on August 26, 2009. The project team should conduct a formal implementation meeting in which the alternatives and design suggestions are considered and their disposition established in an implementation report. To that end, the Summary of VE Alternatives table should help record the results. An electronic copy of this table is being provided for your convenience.

## I

PROJECT:	ODOT HAM-71/75-0.00/0.22, PID 75119, KYTC Pr	), KYTC Project Item No. 6-17		PRESENT WORTH OF COST SAVINGS	VINGS	
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
	MAINTENANCE OF TRAFFIC (MOT)					
MOT-1A	For all options in Kentucky, replace the outside shoulders on I-471 southbound with full depth pavement to support rerouting of traffic during construction.	\$0	\$2,868,946	(\$2,868,946)		(\$2,868,946)
MOT-1B	For all options in Kentucky, use the inside shoulders on I-471 southbound with 12-ftwide travel lanes and no inside shoulder to support rerouting of traffic during construction.	80	\$843,260	(\$843,260)		(\$843,260)
MOT-1C	For all options in Kentucky, use the inside shoulders on I-471 southbound with 11.5-ftwide travel lanes and a 2-ftwide inside shoulder to support rerouting of traffic during construction.	\$0	\$920,106	(\$920,106)		(\$920,106)
MOT-2	For all options in Ohio, add alternative Newport Exit Signing from I-71 via US27 to reroute traffic during construction.		DESIG	DESIGN SUGGESTION	Z	·
MOT-4A	For all options, use Ohio Option 1 as a contractor laydown area for use during construction of the main river crossing.	. 0\$	\$3,100,000	(\$3,100,000)		(\$3,100,000)
MOT-4B	For all options, use Ohio Option 2 as a contractor laydown area for use during construction of the main river crossing.	\$0	\$789,500	(\$789,500)		(\$789,500)
MOT-4C	For all options, use Kentucky Option 1 as a contractor lay-down area for use during construction of the main river crossing.		DESIG	DESIGN SUGGESTION	Z	
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PROJECT:	ODOT HAM-71/75-0.00/0.22, PID 75119, KYTC Project Item No. 6-17	oject Item No. 6-		PRESENT WORTH OF COST SAVINGS	avings	
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
	ROADWAY (R)					
R-1	For all options, realign Section 1 near the cut in the hill to the east to reduce right-of-way and excavation requirements.		DESI	DESIGN SUGGESTION	N	
R-2	Specify that recycled concrete pavement is acceptable for use as sub-grade stabilization in Kentucky.		DESI	DESIGN SUGGESTION	No	
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PROJECT:	ODOT HAM-71/75-0.00/0.22, PID 75119, KYTC Pi	9, KYTC Project Item No. 6-17		PRESENT WORTH OF COST SAVINGS	VINGS	
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
	STRUCTURES (S)					
S-1	For Hybrid Alternative CD, provide an exit from the northbound collector-distributor roadway to Ezzard Charles Drive similar to that shown in the Alternative E design.		DESI	DESIGN SUGGESTION	Z	
S-2	With all options, use tie-back walls on the west side of southbound KY I-75 and in other applicable areas in Kentucky to reduce excavation and right-of-way requirements.		DESI	DESIGN SUGGESTION	N	
S-4	With all options, provide a means to mitigate potential structural impacts to Willow Run Sewer during construction.		DESI	DESIGN SUGGESTION	Z	
S-6A	For the Hybrid Alternative CD, adjust the lane configurations on each deck on the new bridge to save one lane per deck.	\$567,401,472	\$513,809,472	\$53,592,000		\$53,592,000
S-6B	For Alternative E, make the traffic operations directional on each deck on the new bridge to save one lane per deck.	\$567,401,472	\$513,809,472	\$53,592,000		\$53,592,000

## STUDY RESULTS

## INTRODUCTION

The results of this value engineering study conducted on the Brent Spence Bridge Replacement/
Rehabilitation Project portray the benefits that can be realized by KYTC, ODOT, the Ohio-KentuckyIndiana Regional Council of Governments, and the cities of Covington, Kentucky, and Cincinnati, Ohio.
During the course of the study, many ideas for potential value enhancement were conceived and evaluated
by the team for technical feasibility, applicability to the project, and the ability to meet the owner's
project value objectives. Research performed on those ideas considered to have potential to enhance the
value of the project resulted in the development of individual alternatives identifying specific changes to
the project as a whole, or individual elements that comprise the project. These may be in the form of VE
alternatives (accompanied by cost estimates) or design suggestions (without cost estimates). For each
alternative developed the following information has been provided:

- A summary of the original design;
- A description of the proposed change to the project;
- Sketches and design calculations, if appropriate;
- A capital cost comparison and life cycle discounted present worth cost comparison of the alternative and original design, if appropriate;
- A descriptive evaluation of the advantages and disadvantages of selecting the alternative; and
- A brief narrative to compare the original design and the proposed change and provide a rationale for implementing the change into the project.

A composite markup of 59.5%, as described in Section Four of the report, was used to generate the cost for the construction items being compared.

Each design suggestion contains the same information as the VE alternatives, except that no cost information is included. Design suggestions are presented to bring attention to areas of the design that, in the opinion of the VE team, should be changed or included for reasons other than cost. Examples of these reasons may include improved traffic flow, ease of maintenance, ease of construction, safer working conditions, and reduced project risk. In addition, some ideas cannot be quantified in terms of cost with the design information provided; these are also presented as design suggestions and are intended to improve the quality of the project.

Each alternative or design suggestion developed is identified with an alternative number (Alt. No.) that can be tracked through the value analysis process and facilitate referencing between the Creative Idea Listing and Evaluation worksheets, the alternatives, and the Summary of Value Engineering Alternatives table. The Alt. No. includes a prefix that refers to one of the following major project elements:

PROJECT ELEMENT	PREFIX
Maintenance of Traffic	MOT
Roadway	R
Pavement	P
Structures	S

Summaries of the alternatives are provided on the Summary of Value Engineering Alternatives tables. The tables are divided into project elements for the reviewer's convenience and are used to divide the results section. The complete documentation of the developed alternatives and design suggestions follows the Summary of Value Engineering Alternatives tables.

## **KEY ISSUES**

Two alternatives, including a Hybrid Alternative CD and Alternative E were selected as feasible alternatives for further development as part of the ODOT Project Development Process (PDP) for Major Projects, PDP Step 6. The following conceptual alternative issues were compiled based upon information provided during the design overview and the Conceptual Alternatives Evaluation Matrix found on pages 173-184 of the Conceptual Alternatives Study (CAS) prepared by Parsons Brinckerhoff, dated April 2009:

## Hybrid Alternative CD

- Would not maintain all existing connections would remove local connections to I-75 by using a collector-distributor system from KY 12<sup>th</sup> Street to just south of Ezzard Charles Drive
- US 50 would remain geometrically deficient in several locations requiring a design exception
- Four acres of floodplain would be impacted by the proposed alignment
- Approximately two acres of Section 6(f) Parks (Goebel Park) would be impacted by the proposed alignment
- Five Section 4(f) resources would be impacted by the proposed alignment including Goebel Park, Lewisburg Historic District, Longworth Hall, Harriet Beecher Stowe Elementary School, and Queensgate Playground

## Alternative E

- The proposed local collector-distributor roadway would be geometrically deficient in several locations requiring a design exception
- 35 businesses would be displaced in Ohio impacting up to 363 employees compared with approximately 30 businesses and 190-283 employees impacted by Hybrid Alternative CD

## Both Alternatives (Hybrid Alternative CD and Alternative E)

- I-71 would remain geometrically deficient requiring a design exception
- The proposed alignments would require relocation of a radio tower in Goebel Park in Covington,
   KY
- Three wetland areas totaling 0.59 acres would be impacted in Kentucky

- Eight woodlots with potential Indiana Bat habitat and two woodlots with marginal Indiana Bat Habitat have been identified which would have an impact on construction start dates in these areas
- Harriet Beecher Stowe Elementary School would have potential visual and noise impacts
- The eastern portion of Longworth Hall would be impacted by the proposed alignment
- Notre Dame Academy School tennis courts would be impacted in Kentucky
- The contractor would have limited space for access and logistics
- The proposed alignments would require impacts to a portion of the Duke Energy Sub-station near Longworth Hall
- The proposed alignments may impact the Willow Run Sewer structure during construction

## STUDY OBJECTIVES

The VE team was tasked with the following objectives:

- Identify betterments to improve the quality and function of the facility
- Identify cost reduction ideas

To meet these objectives, the VE team focused on the key elements of the project, paying particular attention to the advantages and disadvantages between the Purpose and Need Elements, Engineering Elements, Section 4(f) and 6(f) Resources, and Business Property Acquisitions identified in the Conceptual Alternatives Evaluation Matrix (pages 173-184) of the CAS.

Additionally, the VE team focused on the CAS recommendation (page 172) that the following beneficial design features of Alternative G be carried forward for further analysis and incorporated into the feasible alternatives CD and E:

- Access to the north end of Clay Wade Bailey Bridge from I-75 southbound using a collectordistributor roadway and US 50 eastbound;
- Two access points into Covington;
- Access from a northbound collector-distributor from KY to I-71 northbound in Ohio; and
- An access ramp just north of Ezzard Charles Drive for Freeman Avenue and local traffic to I-75 northbound.

## RESULTS OF THE STUDY

Research of the ideas identified as having potential for enhancing the value of the project resulted in the development of 11 VE alternatives and 10 design suggestions for consideration by the project team. The greatest opportunities for improved value centered on the rerouting of traffic to I-471 during construction; improving access to central business districts and adjacent communities of both Covington, KY and Cincinnati, OH; increasing the use of the existing Clay Wade Bailey Bridge; reducing impacts to 4(f) and 6(f) resources; and adjusting lane configurations to reduce the width of the new bridge by one lane per deck.

Rerouting of Traffic to I-471 during Construction

Three VE alternatives provide different lane configurations for adding a fourth lane on I-471 southbound that would support rerouting of traffic during construction of either Hybrid Alternative CD or Alternative E. The alternatives include replacement of the existing outside shoulder with a full depth pavement lane

which could be used for future expansion of I-471 to four-lanes (Alt. No. MOT-1A), and two options (Alt. Nos. MOT-1B or MOT-1C) that would provide a temporary fourth lane by using the existing inside shoulder which would be adequate for carrying traffic in its existing condition.

## Improve Access to Central Business Districts and Adjacent Communities

In the Hybrid Alternative CD, three VE alternatives are recommended to improve access to central business districts and adjacent communities. Providing a shorter route for emergency response from the Fire Station at 5th Street and Central Avenue to the Fort Washington Way Trench similar to Alternative E would shorten the response distance by nearly one mile (Alt. No. P-7). Providing a direct connection from the southbound collector-distributor to 2nd Street in Ohio and adding an additional connection to the US 42/3rd Street Intersection would increase the use of the Clay Wade Bailey Bridge by local traffic. This alternative would improve local access to Covington, KY from Ohio (Alt. No. P-8). Adding a drop lane from the collector-distributor and merging this with the frontage road between 9th Street and Linn Street would provide a more direct access to the Museum Center and Amtrak railroad from Kentucky and Fort Washington Way (Alt. No. S-1).

In Alternative E, replacing the 5th Street northbound ramp to I-71 in Kentucky with an indirect ramp connection from the collector-distributor roadway to I-71 in Ohio would improve access from KY 12th, Pike, 9th, 5th, and 4th Streets to I-71 northbound (Alt. No. P-3).

## Reduce Impacts to 4(f) and 6(f) Resources

In all options, significant construction and right-of-way cost avoidance may be realized by widening one-half mile of I-71/I-75 on the east side from 2,000 ft. south of KY 12th St. to 4,500 ft. south of KY 12th Street. This would possibly eliminate the need for excavation and/or a proposed retaining wall on the west side of I-71/I-75 in Kentucky in the "Cut in the Hill" Section (Alt. No. R-1). Additionally, the use of tie-back retaining walls in selected areas from Kyle's Lane to approximately 7,000 feet north of Kyle's lane and other applicable areas on the west side of I-75 southbound in Kentucky would reduce right-of-way acquisition requirements.

## Reduce the Width of the New Bridge by One Lane

Since the proposed new bridge design for Hybrid Alternative CD calls for 10 travel lanes between the two 6-lane decks, adjusting the lane configurations on each deck would save one lane per deck and reduce the overall bridge width by 12 ft. (Alt. No. S-6A).

Since the proposed new bridge design for Alternative E calls for 11 travel lanes between the two 6-lane decks, adjusting the lane configurations on each deck and eliminating the third lane for I-71 southbound would save one lane per deck and reduce the overall bridge width by 12 ft. (Alt. No. S-6B).

## Summary

Each of the aforementioned alternatives should be given careful consideration for the potential cost savings and/or schedule improvement that they offer compared to the tradeoffs which may include additional rerouting of traffic during construction.

## **EVALUATION OF ALTERNATIVES AND DESIGN SUGGESTIONS**

When reviewing the study results, the project team should consider each part of an alternative or design suggestion on its own merit. There may be a tendency to disregard an alternative because of a concern about one part of it. Each area within an alternative or design suggestion that is acceptable should be considered for use in the final design, even if the entire alternative or design suggestion is not implemented. Variations of these alternatives and design suggestions by the owner or designer are encouraged.

All alternatives and design suggestions were developed independently of each other to provide a broad range of options to consider for implementation. Therefore, some of them are "mutually exclusive," so acceptance of one may preclude the acceptance of another. In addition, some of the alternatives may be interrelated, so acceptance of one or more may not yield the total of the cost savings shown for each alternative. Design suggestions could also be interrelated thus precluding a part of one or more suggestions from being implemented if another design suggestion is also implemented.

The project team should evaluate all alternatives carefully in order to select the combination of ideas with the greatest beneficial impact on the project. Once this has been accomplished, the total cost savings resulting from the VE study can be calculated based on implementing a revised, all-inclusive design solution.

PROJECT:	ODOT HAM-71/75-0.00/0.22, PID 75119, KYFC P.	, KYFC Project Item No. 6-17		PRESENT WORTH OF COST SAVINGS	VINGS	
ALT. NO.	DESCRIPTION	ORIGINAL	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
	MAINTENANCE OF TRAFFIC (MOT)					
MOT-1A	For all options in Kentucky, replace the outside shoulders on I-471 southbound with full depth pavement to support rerouting of traffic during construction.	\$0	\$2,868,946	(\$2,868,946)		(\$2,868,946)
MOT-IB	For all options in Kentucky, use the inside shoulders on I-471 southbound with 12-ftwide travel lanes and no inside shoulder to support rerouting of traffic during construction.	\$0	\$843,260	(\$843,260)		(\$843,260)
MOT-1C	For all options in Kentucky, use the inside shoulders on I-471 southbound with 11.5-ft,-wide travel lanes and a 2-ft,-wide inside shoulder to support rerouting of traffic during construction.	0\$	\$920,106	(\$920,106)		(\$920,106)
MOT-2	For all options in Ohio, add alternative Newport Exit Signing from I-71 via US27 to recoute traffic during construction.		DESI	DESIGN SUGGESTION	Z	
MOT-4A	For all options, use Ohio Option 1 as a contractor lay-down area for use during construction of the main river crossing.	.0\$	\$3,100,000	(\$3,100,000)		(\$3,100,000)
MOT-4B	For all options, use Ohio Option 2 as a contractor lay-down area for use during construction of the main river crossing.	\$0	\$789,500	(\$789,500)		(\$789,500)
MOT-4C	For all options, use Kentucky Option 1 as a contractor lay-down area for use during construction of the main river crossing.		DESI	DESIGN SUGGESTION	Z	
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## **VALUE ENGINEERING ALTERNATIVE**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

MOT-1A

DESCRIPTION: FOR ALL OPTIONS IN KENTUCKY, REPLACE THE

OUTSIDE SHOULDER ON I-471 SOUTHBOUND WITH

FULL DEPTH PAVEMENT TO SUPPORT REROUTING OF

TRAFFIC DURING CONSTRUCTION

SHEET NO.:

1 of 5

## **ORIGINAL DESIGN:**

The original design includes the rerouting of traffic to I-471 southbound during construction with no mention of replacing the existing outside shoulders with full-depth pavement.

## **ALTERNATIVE:**

Replace the outside shoulders on I-471 Southbound with full-depth pavement to support rerouting of traffic during construction.

## **ADVANTAGES:**

- Prevents shoulder failure during construction thereby preventing significant traffic delays
- Provides full-depth shoulders for any future construction requirements or detours

## **DISADVANTAGES:**

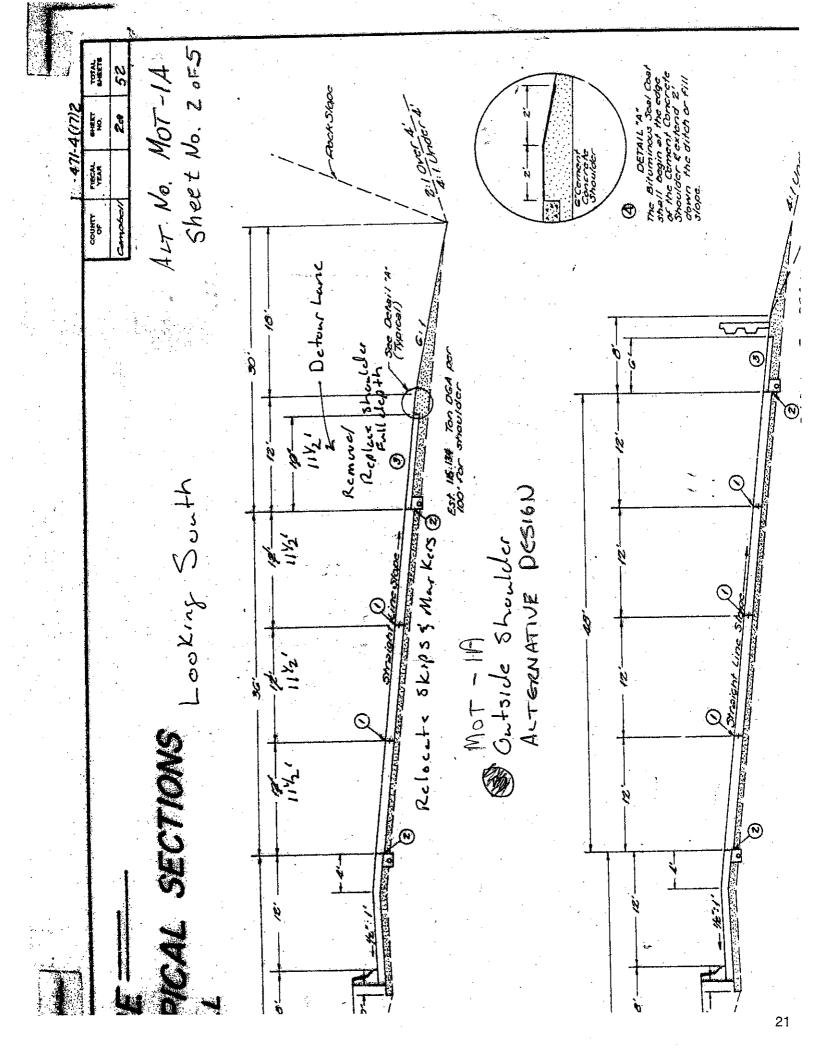
 Added pavement adds cost to the current project for temporary lanes during construction

## **DISCUSSION:**

I-471 crosses over the river running south into I-275 and then to I-75. I-275 has extra capacity available. Only I-471 needs shoulder work. Ramp work will be required at I-71/I-471, I-471/I-275, and I-275/I-75 in Kentucky.

Replacement of the outside shoulders on I-471 Southbound with full-depth pavement will prevent the failure of shoulders during construction as well as provide additional capacity for future construction requirements or detours.

COST SUMMARY	1	NITIAL COST	PRESENT WORTH RECURRING COSTS	,	ESENT WORTH FE-CYCLE COST
ORIGINAL DESIGN	\$	0		\$	0
ALTERNATIVE	\$	2,868,946		\$	2,868,946
SAVINGS (Original minus Alternative)	\$	(2,868,946)		\$	(2,868,946)



PROJECT:

HAM-71/75-0.00/.022, PID 75119 Ohio Department of Transportation

PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

ALT. NO.:

MOT-1A

SHEET NO.: 3 of 5

## Use of outside shoulder on I-471 for travel lane

Use 10 ft. outside shoulder on southbound I-471 for an 11½ ft. travel lane, and reduce the other three southbound travel lanes from 12 ft. down to 11½ ft. This leaves no room for a shoulder on the outside.

- Cost to remove outside shoulders. These shoulders are not full depth and would have to be removed.
- Cost to replace full depth outside shoulders
- Remove white edge line and two lines of skips
- Place three skip lines, edge lines and three lines of pavement markers

## **CALCULATIONS**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO .: MOT- IH

SHEET NO .:

4 of 5

Pavement Removal & Full Depth Pavement Replacement

5 miles x 5280 ft/mile x 10 ft = 264,000 sf x ( sy)

= 29,333 54

Edge Lines (Remove & Replace)

5 miles x 5280 ft/mile = 26, 400 ft.

Skip Lines (Remove & Replace)

26,400 ft x 25% x 3 lines = 19,800 ft.

Pavement Markers (Remove & Replace)

26,400ft x | per 80ft x 3 times = 990 markers

## **COST WORKSHEET**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

**ALTERNATIVE NO.:** 

MOT-1A

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

SHEET NO.:

5 of 5

Kentucky Transp	ortation C	abinet			SHEET NO.:		5 of 5
PROJECT ITEM		О	RIGINAL EST	IMATE	ALT	ERNATIVE ESTI	MATE
ITEM .	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Pavement Removal	SY				29,333	22.96	673,486
Full Depth Pavement	SY				29,333	35.36	1,037,215
Edge Line Removal	LF				26,400	0.47	12,408
Edge Line Replacement	LF	·			26,400	0.31	8,184
Skip Line Removal	LF				19,800	0.47	9,306
Skip Line Replacement	LF				19,800	0.31	6,138
Pavement Markers Removal	EA				990	17.50	17,325
Pavement Markers Replacement	EA				990	35.00	34,650
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			···				
					_		
	1						
Subtota	ı						1,798,712
Markup (%) at 59.50%							1,070,234
TOTA	L						2,868,946

## **VALUE ENGINEERING ALTERNATIVE**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

**ALTERNATIVE NO.:** 

MOT-1B

DESCRIPTION: FOR ALL OPTIONS IN KENTUCKY, USE THE INSIDE

SHOULDER ON I-471 SOUTHBOUND TO SUPPORT

REROUTING OF TRAFFIC DURING CONSTRUCTION

SHEET NO.: 1

1 of 5

## **ORIGINAL DESIGN:**

The original design includes the rerouting of traffic to I-471 southbound during construction.

## **ALTERNATIVE:**

Use the inside shoulder in lieu of the outside shoulder on I-471 southbound to support rerouting of traffic during construction.

## **ADVANTAGES:**

- No full-depth pavement replacement required
- Maintains 12-ft.-wide lanes during construction

## **DISADVANTAGES:**

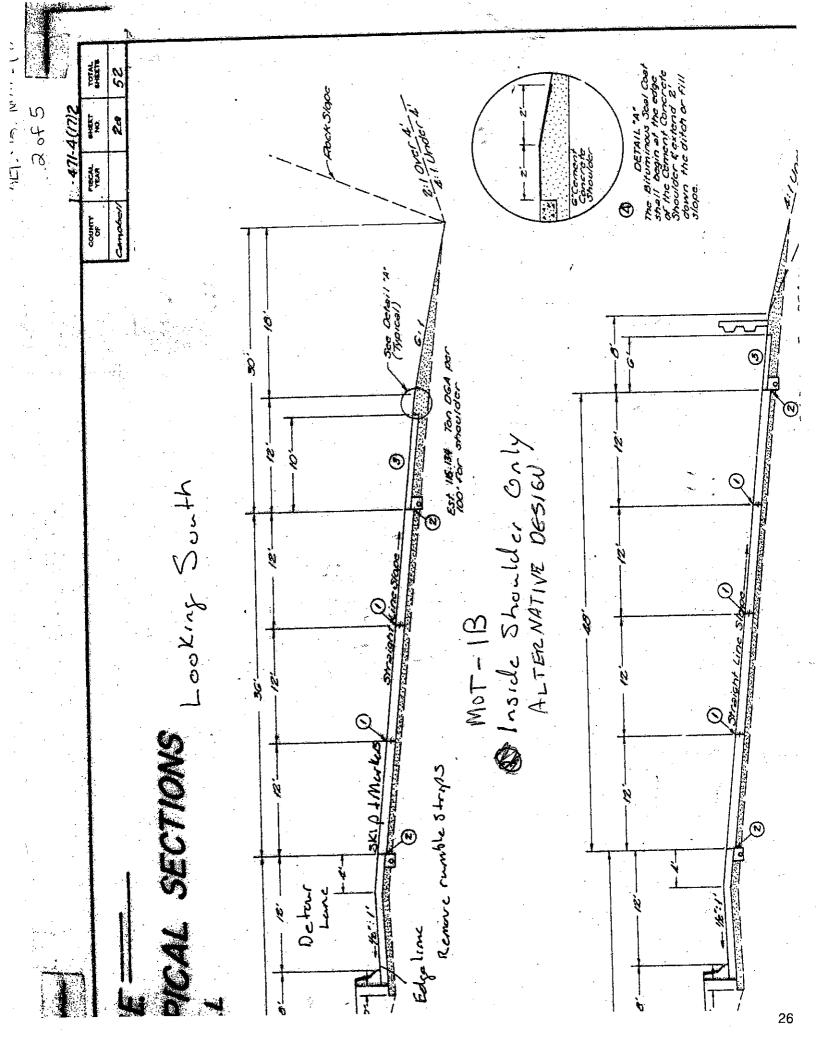
- Requires travel near drainage structures
- No inside shoulder provided during construction

## **DISCUSSION:**

I-471 crosses over the river running south into I-275 and then to I-75. I-275 has extra capacity. Only I-471 needs shoulder work. Ramp work will be required at I-71/I-471, I-471/I-275, and I-275/I-75 in Kentucky.

Therefore, use an inside shoulder/lane shift as a detour during construction to prevent full-depth pavement replacement.

COST SUMMARY	11	IITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$	0		\$	0
ALTERNATIVE	\$	863,260		\$	863,260
SAVINGS (Original minus Alternative)	\$	(863,260)		\$	(863,260)



PROJECT:

HAM-71/75-0.00/.022, PID 75119

Ohio Department of Transportation **PROJECT ITEM NO. 6-17**Kentucky Transportation Cabinet

ALT. NO.:

MOT-1B

SHEET NO.: 3 of 5

## Use of inside shoulder on I-471 for travel lane

Use 12 ft. inside shoulder on southbound I-471 for a 12 ft. travel lane. This option provides no shoulder for this lane.

- Cost to remove rumble strips
- Remove yellow edge line
- Paint a skip line, edge line and place one line of pavement markers

PROJECT: HAM-71/75

HAM-71/75-0.00/0.22, PID 75119 Ohio Department of Transportation PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

MOT-13

SHEET NO .:

4 of 5

Rumble Strip (Remove & Putch)

5 Miles \* 5280 /mile \* 145 # \* 24 5 / rumble
= 14080 Sf

Edge Line (Remove & Replace) 5 Miles X 5280 F/mile = 26,400 LF

Skip Line (Replace)

5 miles x5280 Mmile x25% = 6600 LF

Parement Marker (Remove & Replace)

5 Miles X 5 280 ft/mile X /april = 330 Markers

## COST WORKSHEET

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

MOT-1B

Kentucky Transportation Cabinet

SHEET NO.:

5 of 5

Kentucky Transportation Cabinet				SHEET NO.:	5 of 5		
PROJECT ITEM		ORIGINAL ESTIMATE			ALT	MATE	
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Edge Line Removal	LF				26,400	0.47	12,408
Edge Line Replacement	LF				26,400	0.31	8,184
Skip Line Removal	LF				26,400	0.47	12,408
Skip Line Replacement	LF				6,600	0.31	2,046
Pavement Markers Removal	EA				330	17.50	5,775
Pavement Markers Replacement	EA				330	35.00	11,550
Partial Depth JPC Repair	SF				14,080	34.72	488,858
						"	<del>-</del>
Subtot	al I						541,229
Markup (%) at 59.50°	%						322,031
TOTA	L						863,260
	Mariana e e la Secultira	Paris de la constantida de la constanti					

## VALUE ENGINEERING ALTERNATIVE



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet **ALTERNATIVE NO.:** 

MOT-1C

DESCRIPTION: FOR ALL OPTIONS IN KENTUCKY, USE THE INSIDE

SHOULDER ON I-471 SOUTHBOUND TO SUPPORT REROUTING OF TRAFFIC DURING CONSTRUCTION WITH 11.5-FT.-WIDE TRAVEL LANES AND A 2-FT.-WIDE

INSIDE SHOULDER

SHEET NO.:

1 of 5

ORIGINAL DESIGN: (See attached sketch)

The original design includes the rerouting of traffic to I-471 southbound during construction.

ALTERNATIVE: (See attached sketch)

Use the inside shoulder in lieu of the outside shoulder on I-471 southbound to support rerouting of traffic during construction. Use 11.5-ft.-wide lanes during construction.

## **ADVANTAGES:**

- No full-depth pavement replacement
- Maintains a 2-ft.-wide inside shoulder

## **DISADVANTAGES:**

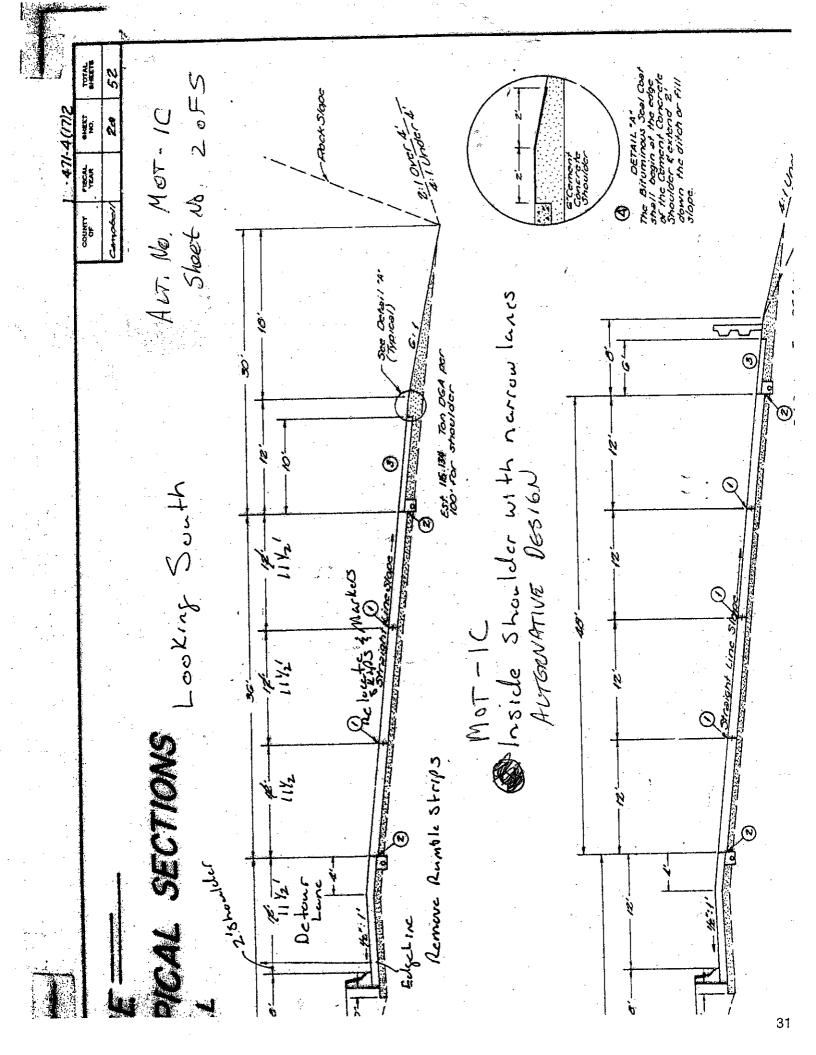
Narrower travel lanes are necessary to accommodate the 2-ft.-wide inside shoulder

## DISCUSSION:

I-471 crosses over the river running south into I-275 then to I-75. I-275 can carry extra capacity. Only I-471 needs shoulder work. Ramp work will be required at I-471/I-71, I-471/I-275, and I-275/I-75 in Kentucky.

Therefore, use an inside shoulder/lane shift as a detour during construction to prevent full-depth pavement replacement.

COST SUMMARY	11	NITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$	0	_	\$	0
ALTERNATIVE	\$	920,106	_	\$	920,106
SAVINGS (Original minus Alternative)	\$	(920,106)		\$	(920,106)



PROJECT:

HAM-71/75-0.00/.022, PID 75119

Ohio Department of Transportation PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet ALT. NO.:

MOT-1C

SHEET NO .: 3 of 5

### Use of inside shoulder on I-471 for travel lane with narrower lane

Use 12 ft. inside shoulder on southbound I-471 for an 11½ ft. travel lane and reduce the other three southbound travel lanes from 12 ft. to 11½ ft. This leaves 2 ft. for a shoulder on the inside.

- Cost to remove rumble strips
- Remove yellow edge line and two lines of skips
- Paint three skip lines, edge lines, and place three lines of pavement markers

PROJECT:

HAM-71/75-0.00/0.22, PID 75119 Ohio Department of Transportation PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

MOT-IC

SHEET NO.:

4 of 5

Rumble Strip (Removel & Patching)

5 miles \* 5280 f/mile \* 1/45++ \* 24 sfrumbk
= 14,080 Sf

Edge Line (Remove & Replace)

5 Miles \* 5280 F/mile = 26, 400 LF

5Kip Line (Remove & Replace)
5Miles \* 5280 Hmile \* 25% \* 3Lines = 19,800 LF

Favement Marker (Remove & Replace)

5 Miles \* 5280 Florise \* Veoft \* 3 Lines = 990 Markers

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

MOT-1C

Kentucky Transportation Cabinet

SHEET NO.:

Edge Line Removal LF   26,400   0.47   12,40  Edge Line Replacement LF   26,400   0.31   8,18  Skip Line Removal LF   19,800   0.47   9,30  Skip Line Replacement LF   19,800   0.31   6,13  Pavement Markers Removal EA   990   17,50   17,32  Pavement Markers Replacement EA   990   35,00   34,65	Kentucky I rans	portation C	avinet			SHEET NO.:		5 of 5	
No.	PROJECT ITEM		o	ORIGINAL ESTIMATE			ALTERNATIVE ESTIMATI		
Edge Line Removal  LIF  Edge Line Replacement  LIF  26,400  0.31  8,18  Skip Line Removal  LIF  19,800  0.47  9,30  Skip Line Replacement  LIF  19,800  0.31  6,13  Pavement Markers Removal  EA  990  17,50  17,32  Pavement Markers Replacement  EA  990  35,00  34,65  34	ITEM	UNITS			TOTAL			TOTAL	
Edge Line Replacement	Rumble Strip Removal	SF				14,080	34.72	488,858	
Skip Line Removal         LF         19,800         0.47         9,30           Skip Line Replacement         LF         19,800         0.31         6,13           Pavement Markers Removal         EA         990         17,50         17,32           Pavement Markers Replacement         EA         990         35,00         34,65           Image: Company of the paper of	Edge Line Removal	LF		<u></u>		26,400	0.47	12,408	
Skip Line Removal LF 19,800 0,47 9,30 Skip Line Replacement LF 19,800 0,31 6,13 Pavement Markers Removal EA 990 17.50 17,32 Pavement Markers Replacement EA 990 35.00 34,65	Edge Line Replacement	LF				26,400	0.31	8,184	
Pavement Markers Removal EA 990 17.50 17.32 Pavement Markers Replacement EA 990 35.00 34.65	Skip Line Removal	LF				19,800	0.47	9,306	
Pavement Markers Replacement EA 990 35.00 34,65	Skip Line Replacement	LF				19,800	0.31	6,138	
Subtotal  Subtotal  Markup (%) at 59.50%  343.23*	Pavement Markers Removal	EA				990	17.50	17,325	
Subtotal Markup (%) at 59.50%  576,869 343,23*	Pavement Markers Replacement	EA				990	35.00	34,650	
Subtotal Markup (%) at 59.50%  576,869 343,23*									
Subtotal Markup (%) at 59.50%  576,869 343,23*									
Subtotal 576,866  Markup (%) at 59.50%	•								
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Markup (%) at 59.50% 343,23°									
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Markup (%) at 59.50% 343,23°	·			· · · · · · · · · · · · · · · · · · ·					
Markup (%) at 59.50% 343,23°	Subtota	1						576.869	
		_				-		343,237	
(0,0) , $(0,0)$ , $(0,0$	TOTA	L					_	920,106	



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

DESCRIPTION: FOR ALL OPTIONS IN OHIO, ADD ALTERNATIVE

**NEWPORT EXIT SIGNING FROM I-71 VIA US 27 TO** REROUTE TRAFFIC DURING CONSTRUCTION

**ALTERNATIVE NO.:** 

SHEET NO .:

MOT-2

1 of 2

### **ORIGINAL DESIGN:**

The original design includes a proposed Maintenance of Traffic (MOT) Scheme for all alternatives which removes 1-71 southbound (SB) traffic (with the potential of also removing 1-71 northbound traffic) from downtown Covington/Cincinnati Brent Spence Bridge via a detour using I-471 and I-275 in Northern Kentucky. The proposed detour will require upgrades to I-471 and I-275 to accommodate the increased traffic.

ALTERNATIVE: (See attached sketch)

Provide alternative signing on I-71 SB in Ohio for traffic bound for Newport, KY and the Newport Entertainment District (NED) to use the Third Street exit in Downtown Cincinnati and access Newport via the Taylor Southgate Bridge (US 27). If I-71 northbound traffic is maintained along the existing corridor, Newport bound traffic on I-71 northbound and I-71 southbound could be signed to use the Second Street Exit as well.

### **ADVANTAGES:**

- Reduces congestion on the I-471/I-71 southbound combined MOT route and I-471/KY 8 interchange by removing Newport bound traffic, especially during peak hour and event traffic scenarios
- Uses available capacity on Taylor Southgate Bridge
- Alternative signing could remain as a permanent installation for I-71 southbound

### **DISADVANTAGES:**

- Additional Newport bound traffic using the Third Street exit in downtown Cincinnati may cause operational issues and increased congestion on the downtown street network
- The alternative Newport/NED signing idea was not very well received by the City of Cincinnati during prior meetings regarding the I-471/KY 8 interchange

### **DISCUSSION:**

The low cost of providing additional signing could have a dramatic impact to traffic flow and safety to the combined I-471/I-71 southbound MOT route by removing Newport bound traffic. This is especially true when considering the backups/congestion at the I-471/KY 8 interchange during peak hour and event traffic scenarios. Additionally, I-71 southbound signing could remain as a permanent installation.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	
SAVINGS (Original minus Alternative)			, , , , , , , , , , , , , , , , , , ,



PROJECT: HAM-71/75-0.00/0.22, PID 75119 ALTERNATIVE NO .: MOT - Z Ohio Department of Transportation PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet вотн 🗌 Z ORIGINAL DESIGN ALTERNATIVE DESIGN of Z SHEET NO .: m × Traffic OKSIGZ かく 用うしょう くろうき つしもつでき へうきゅう みゅうる エチラトのろそろつか できなっと同 いこのであったので、「ちゃかったなっ らつよりを明 1.71 MB 30000 TOR SMESSORF X - SMESSOR THATTIC ROOT 7.0 TO ALLOW LEBY FROM TO BROADWAY FOR GREET 1 なくれま のから 1-44) 1:-71 みててきたシチャンの ERGARMAY (.) Trans. Re-tonderwhite J. DAME. 3 KO ST. Tentor 471 58



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

MOT-4A

DESCRIPTION: FOR ALL OPTIONS, USE OHIO OPTION 1 AS A

CONTRACTOR LAYDOWN AREA FOR USE DURING CONSTRUCTION OF THE MAIN RIVER CROSSING

SHEET NO .:

1 of 3

### **ORIGINAL DESIGN:**

The original designs make no mention of contractor lay-down areas for the bridge construction.

### ALTERNATIVE: (See attached sketch)

Use Ohio Option 1 and designate the hilltop between I-71/75/Mehring Way and the railroad to the east as a potential contractor lay-down area. The contractor would use Mehring Way to access the site.

### **ADVANTAGES:**

- Provides a laydown area near the construction site
- Provides a large area
- Provides a potential green space at completion of project

### **DISADVANTAGES:**

- Requires right-of-way acquisition
- May interfere with traffic along Mehring Way when materials are being moved
- May have to use numerous surface streets to access the lay-down area

### **DISCUSSION:**

The contractor will need a lay-down area when constructing the new I-71/75 bridge over the Ohio River. The hilltop between I-71/I-75/Mehring Way and the railroad was identified as an area close to the site having minimal impact to traffic. This area also has the potential of being reclaimed as green space at the completion of the project.

COST SUMMARY	I	NITIAL COST	PRESENT WORTH RECURRING COSTS	ESENT WORTH E-CYCLE COST
ORIGINAL DESIGN	\$	0		\$ A
ALTERNATIVE	\$	3,100,000	-	\$ 3,100,000
SAVINGS (Original minus Alternative)	\$	(3,100,000)		\$ (3,100,000)



Ohio Depar PROJECT	5-0.00/0.22, PID 75119 rtment of Transportation TITEM NO. 6-17 ransportation Cabinet	·	ALTERNATIVE I	NO.: 4A
ORIGINAL DESIGN	ALTERNATIVE DESIGN 🛛	вотн 🗌	SHEET NO.:	2 of 3
Ew Z-	stins 78	VR .		
Work	Lay down area 600'x500'		Mehrnis Way	
Oh.	io River			

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

MOT-4A

Kentucky Transportation Cabinet

SHEET NO.:

nsportation C	uvinei			SHEET NO.:		3 of 3
· .	0	RIGINAL ESTI	MATE	AL	TERNATIVE ESTI	IMATE
UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Acres				6.9	450,000.00	3,100,000
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otal						3,100,000
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PROIECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kantucky Transportation Cabin

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

MOT-4B

DESCRIPTION: FOR ALL OPTIONS, USE OHIO OPTION 2 AS A

CONTRACTOR LAY-DOWN AREA FOR USE DURING

CONSTRUCTION OF THE MAIN RIVER CROSSING

SHEET NO.: 1 of 3

### **ORIGINAL DESIGN:**

The original designs make no mention of contractor lay-down areas for the bridge construction.

### **ALTERNATIVE:**

Use Ohio Option 2 and designate the east quadrant of the Duke Energy parking lot as a contractor lay-down area. The existing lot is accessible from Mehring Way.

### **ADVANTAGES:**

- Less expensive right-of-way cost
- The new parking area can remain undisturbed
- Near the construction site
- Minimal surface streets to use to access the lay-down area

### **DISADVANTAGES:**

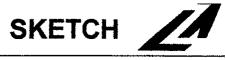
- Requires temporary right-of-way acquisition
- Area to the west of the Duke Energy Substation would require pavement and fencing
- Smaller than other areas proposed

### **DISCUSSION:**

The contractor will need a lay-down area when constructing the new I-71/I-75 bridge over the Ohio River. The east quadrant of the Duke Energy parking lot is smaller than other areas but will have a lower right-of-way cost and will only be needed during construction. Access to the work site is optimal.

If this site is selected, consideration should be given to closing Mehring Way during bridge construction.

COST SUMMARY	·	INITIAL COST	PRESENT WORTH RECURRING COSTS	SENT WORTH C-CYCLE COST
ORIGINAL DESIGN	\$	0	\$	\$ 0
ALTERNATIVE	\$	789,500	\$	\$ 789,500
SAVINGS (Original minus Alternative)	\$	(789,500)	\$	\$ (789,500)



PROJECT: HAM-71/75-0.00/0.22, PID 75119  Ohio Department of Transportation PROJECT ITEM NO. 6-17  Kentucky Transportation Cabinet	ALTERNATIVE NO.: 48
ORIGINAL DESIGN ALTERNATIVE DESIGN X BOTH	SHEET NO.: 2 of 3
300' Temporamy lay down are	Mehanis Way
Tempurary Parkins Lot Substation  Wo	
Ohio Rivir	

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

MOT-4B

Kentucky Transportation Cabinet

SHEET NO.:

Kentucky Tra	nsportation C	abinet			SHEET NO.		3 of 3
PROJECT ITEM		· c	RIGINAL EST	IMATE	ALTERNATIVE EST		IMATE
ITEM	UNITS	no. of units	COST/ UNIT	TOTAL	NO, OF UNITS	COST/ UNIT	TOTAL
Temporary Take	Acres				1.4	450,000.00	630,000
Parking Area & Fence	LS		·		1	100,000.00	100,000
· · · · · · · · · · · · · · · · · · ·			· .				
			<u> </u>				
· · · · · · · · · · · · · · · · · · ·							
Subt	total						730,000
	50%						59,500
то	TAL						789,500



PROIECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

MOT-4C

DESCRIPTION: FOR ALL OPTIONS, USE KENTUCKY OPTION 1 AS A

CONTRACTOR LAY-DOWN AREA FOR USE DURING CONSTRUCTION OF THE MAIN RIVER CROSSING

SHEET NO.:

1 of 2

### **ORIGINAL DESIGN:**

The original designs make no mention of contractor lay-down areas for the bridge construction.

### **ALTERNATIVE:**

Designate the area bordered by Crescent Avenue to the west, 3<sup>rd</sup> Street to the north, I-75 to the east, and 4<sup>th</sup> Street to the south in Kentucky as a contractor lay-down area.

### **ADVANTAGES:**

- Uses existing right-of-way
- Close to the construction site
- Good access to the lay-down area from the interstate

### **DISADVANTAGES:**

Smaller than other areas proposed

### **DISCUSSION:**

The contractor will need a lay-down area when constructing the new I-71/I-75 bridge over the Ohio River. This area is an existing right-of-way owned by KYTC. It is close to the south approach of the new bridge with a short haul distance from the lay-down area to the new bridge.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	I
SAVINGS (Original minus Alternative)			

# SUMMARY OF VALUE ENGINEERING ALTERNATIVES

PROJECT:	ODOT HAM-71/75-0.00/0.22, PID 75119, KYTC Project Item No. 6-17	oject Item No. 6	$\boldsymbol{L}$			
				PRESENT WORTH OF COST SAVINGS	VVINGS	
ALT. NO:	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST SAVINGS	RECURRING COST SAVINGS	TOTAL PW LCC SAVINGS
	PAVEMENT/RAMPS (P)					
F.3	In Alternative E, replace the 5th Street northbound ramp to 1-71 in Kentucky with an indirect ramp connection from the collector-distributor roadway to 1-71 in Ohio.	\$398,710	\$863.892	(\$465,182)		(\$465,182)
P-5	Eliminate the KY 9th Street intersection with the collector-distributor roadway from all options.		DES	DESIGN SUGGESTION	Z	
<b>P.</b> 7	For the Hybrid Alternative CD, identify a shorter route for emergency responses from the Fire Station at 5th Street and Central Avenue to the Fort Washington Way Trench.		DESI	DESIGN SUGGESTION	N	
P-8	For the Hybrid Alternative CD, provide a direct connection from southbound collector-distributor roadway to 2nd Street in Ohio and add an additional connection to the US 42/3rd Street intersection to improve access and increase the use of the Clay Wade Bailey Bridge.	0\$	\$1,437,344	(\$1,437,344)		(\$1,437,344)
P-10	For the Hybrid Alternative CD, provide access from Winchell Avenue just north of Ezzard Charles Drive to northbound 1-75.	80	\$999,433	(\$999,433)		(\$999,433)
<b>.</b>	For the Hybrid Alternative CD, update the cost estimate to reflect the additional lane on the I-75 mainline.		DESI	DESIGN SUGGESTION	N.	
P.13	For Alternative E, shift the collector-distributor roadway to minimize impacts to Goebel Park and avoid relocating the radio station tower.		DES	DESIGN SUGGESTION	Z	
		(1) 10 10 10 10 10 10 10 10 10 10 10 10 10				



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

P-3

DESCRIPTION: IN ALTERNATIVE E, REPLACE THE 5TH STREET

NORTHBOUND RAMP TO I-71 IN KENTUCKY WITH AN

INDIRECT RAMP CONNECTION FROM THE

**CONNECTOR-DISTRIBUTOR ROADWAY TO 1-71 IN OHIO** 

SHEET NO.:

1 of 4

**ORIGINAL DESIGN:** (See attached sketch)

In Alternative E, a loop ramp provides a direct connection from KY 5<sup>th</sup> Street to I-71 northbound.

ALTERNATIVE: (See attached sketch)

Remove the loop ramp at KY 5<sup>th</sup> Street and replace it with a ramp connection from the northbound collectordistributor roadway to I-71 northbound in Ohio.

### ADVANTAGES:

- Provides access for all of Covington including 12th, Pike, 9th, 5th, and 4th Streets
- Excess right-of-way area could be used to mitigate the right-of-way take in Goebel Park

### **DISADVANTAGES:**

Requires additional structural costs

### DISCUSSION:

This alternative removes direct access from KY 5th Street but replaces this access with access from the collectordistributor roadway to I-71 northbound. By moving this access point to the connector distributor system, it will allow access from KY 12<sup>th</sup>, Pike, 9<sup>th</sup>, 5<sup>th</sup>, and 4<sup>th</sup> Streets to I-71 northbound. A secondary benefit would allow excess right-of-way to be given to the city of Covington for an expanded park area.

COST SUMMARY	[1	NITIAL COST	PRESENT WORTH RECURRING COSTS	 SENT WORTH -CYCLE COST
ORIGINAL DESIGN	\$	398,710	and the same of th	\$ 398,710
ALTERNATIVE	\$	863,892		\$ 863,892
SAVINGS (Original minus Alternative)	\$	(465,182)		\$ (465,182)

ALTERNATIVE NO.: P-3

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

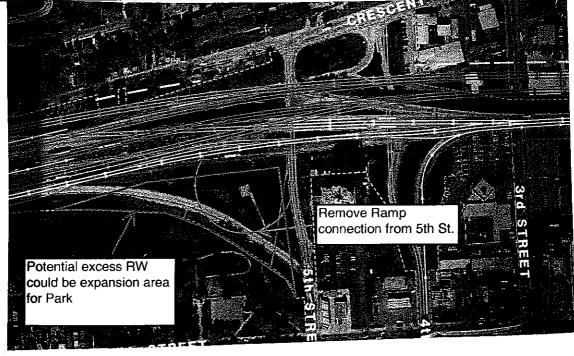
PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

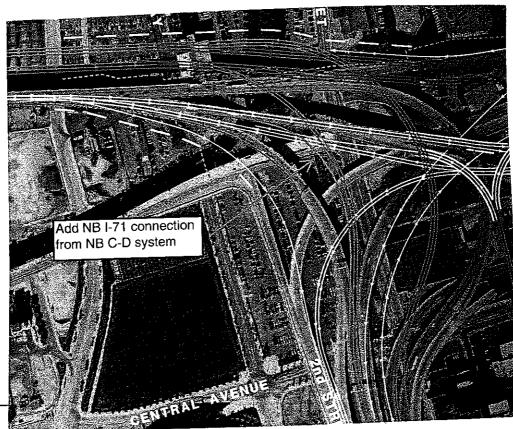
Kentucky Transportation Caome

ORIGINAL DESIGN ALTERNATIVE DESIGN

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SHEET NO.:





# CALCULATIONS

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet ALTERNATIVE NO.: P\_3

SHEET NO.:

3 of 4

Remove Loop Ramp

Assume 1000' total length 325' structure
675' x 26/9 = 1950 sy pavenud anca
325 x 26/9 = 939 sy structure area.

New Concertion from NB C-D to I-71 NB

Assure 1500' length of new + widered structure.

1500' x 26 x/q = 4333 Sy structure cost.

Use 14' travel way 4' left sh, 8' right sh 26' total width Ramp.

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

P-3

Kentucky Transportation Cabinet

SHEET NO .:

Хепіиск	y Transporta	non C	авіпет			SHEET NO.:		4 of 4	
PROJECT	ITEM		C	RIGINAL ESTIM	ATE	ALTERNATIVE EST		FIMATE	
ITEM	U	NITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL	
Ramp Pavement		SY	1,950	68.00	132,600				
Ramp Structure		SY	1939	125.00	117,375	4,333	125.00	541,625	
								· ·	
		,							
	· .								
				-					
				•					
	Subtotal				249,975			541,625	
Markup (%) at	59.50%			_	148,735		_	322,267	
	TOTAL				398,710			863,892	



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

**ALTERNATIVE NO.:** 

P-5

DESCRIPTION: ELIMINATE THE KENTUCKY 9TH STREET

INTERSECTION WITH THE COLLECTOR-DISTRIBUTOR

ROADWAY FROM ALL OPTIONS

SHEET NO.:

1 of 2

### **ORIGINAL DESIGN:**

Currently, Hybrid Alternative CD, and Alternative E show the collector-distributor roadway intersecting with KY 9<sup>th</sup> Street on both sides of I-71/I-75.

ALTERNATIVE: (See attached sketch)

Eliminate the KY 9<sup>th</sup> Street intersection with the collector-distributor roadway from all options.

### **ADVANTAGES:**

- Neighborhood retains its appeal for the residents
- Improves level of service and operation of the collector distributor roadway
- Reduces access along KY 9th Street

### **DISADVANTAGES:**

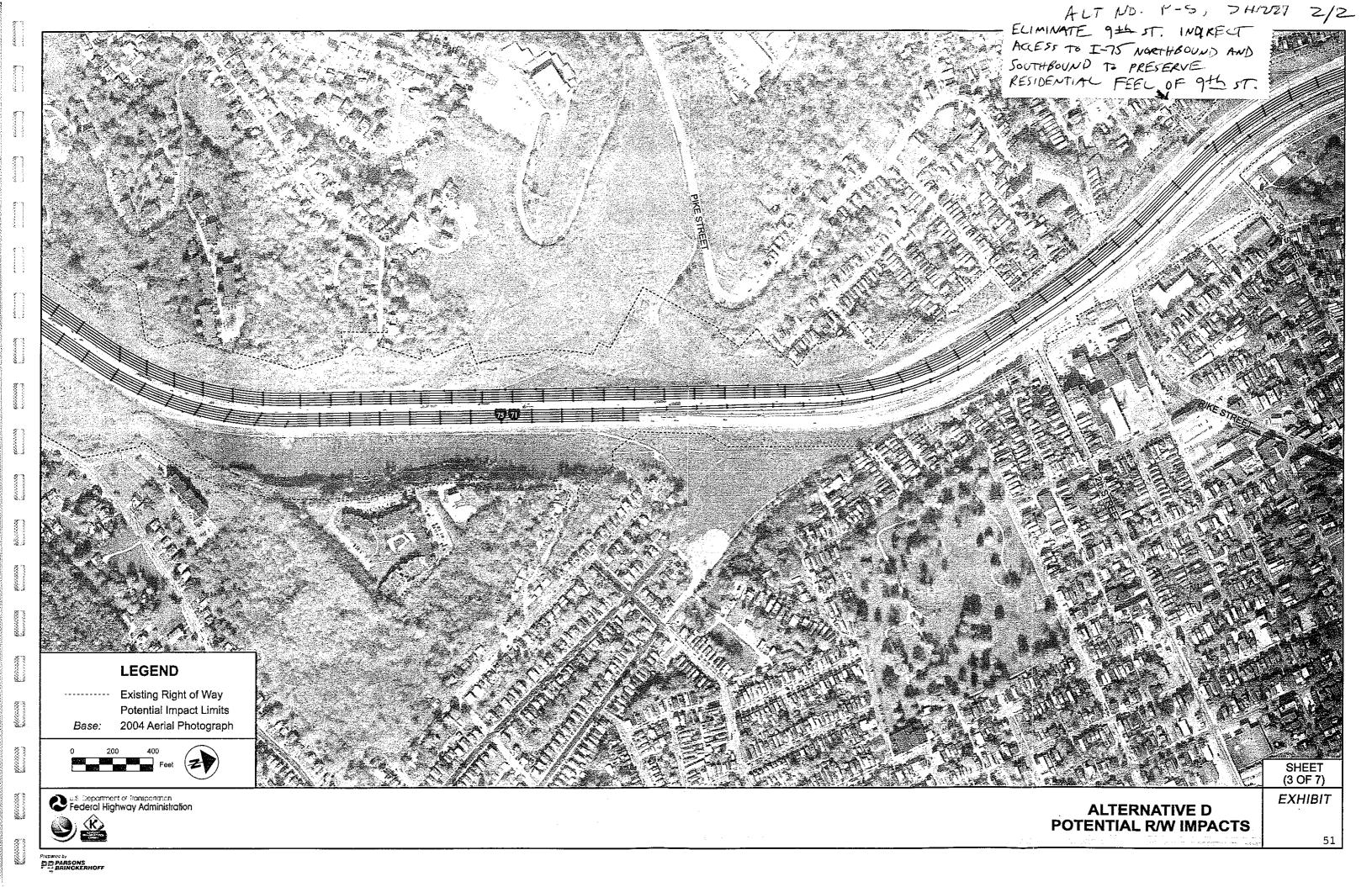
- Eliminates an indirect access point for the City of Covington -
- 9th Street would likely have a dead end on both sides of I-71/I-75

### **DISCUSSION:**

In the past, the residents of the area around 9th Street in Covington did not desire to have this connectivity due to the potential for a significant increase in traffic through the residential neighborhood. If this connection is eliminated, the collector-distributor roadway operation would be improved.

There is a possibility that the profile grade of the collector-distributor roadway could be raised allowing 9th Street to be routed underneath and remain open. This should be investigated.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	1
SAVINGS (Original minus Alternative)			***





PROJECT: **HAM-71/75-0.00/0.22**, **PID 75119** 

Ohio Department of Transportation

PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

ALTERNATIVE NO.:

SHEET NO .:

P-7

DESCRIPTION: IN THE HYBRID ALTERNATIVE CD, IDENTIFY A

SHORTER ROUTE FOR EMERGENCY RESPONSES FROM THE FIRE STATION AT 5TH STREET AND CENTRAL AVENUE TO THE FORT WASHINGTON WAY TRENCH

1 of 1

### **ORIGINAL DESIGN:**

Currently, access to the Fort Washington Way Trench is from the Linn Street/US 50 Interchange.

### **ALTERNATIVE:**

Provide access to the Fort Washington Way Trench via 6th Street as proposed in Alternative E.

### **ADVANTAGES:**

- Provides a quicker response route to incidents
- A two-way connection is provided from Central Avenue/6<sup>th</sup> Street west
- Eliminates US 50 eastbound to 5<sup>th</sup> Street infrastructure

### **DISADVANTAGES:**

- Additional capacity may be needed on Central Avenue
- Additional capacity may be required at the Central Avenue/6<sup>th</sup> Avenue intersection
- The city street grid may not be able to accommodate the traffic pattern changes

### DISCUSSION:

Currently, from 5<sup>th</sup> Street and Central Avenue in downtown Cincinnati, an emergency response unit would need to travel north on Central Avenue to west on 6<sup>th</sup> Street; exit at Linn Street, turn left on Linn Street, then turn left onto 6<sup>th</sup> Street eastbound to the Fort Washington Way Trench. If a solution similar to Alternative E is provided, the response route would be north on Central Avenue to west on 6<sup>th</sup> Street to the south ramp at Fort Washington Way. The distance saved would be approximately 4,800 ft.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN		<u> </u>	
ALTERNATIVE		DESIGN SUGGESTION	Ţ
SAVINGS (Original minus Alternative)			***



PROJECT: HA

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

**PROJECT ITEM NO. 6-17**Kentucky Transportation Cabinet

ALTERNATIVE NO.;

P-8

SHEET NO.: 1 of 6

**DESCRIPTION:** 

FOR THE ALTERNATE CD HYBRID, PROVIDE A DIRECT

CONNECTION FROM THE SOUTHBOUND COLLECTOR -

DISTRIBUTOR ROADWAY TO 2ND STREET IN OHIO AND ADD

AN ADDITIONAL CONNECTION TO US 42/3RD STREET

ORIGINAL DESIGN: (Sketch attached)

The original Alternate CD Hybrid includes a free flow exit ramp from the proposed southbound collector-distributor roadway to 2nd Street in Cincinnati. Alternate CD Hybrid does not include a connection to US 42/3rd Street which provides access to the Clay Wade Bailey Bridge.

### ALTERNATIVE: (Sketch attached)

Construct a ramp from the 2<sup>nd</sup> Street free-flow exit ramp which will terminate at the US 42/3<sup>rd</sup> Street Intersection. The ramp will branch off of the 2<sup>nd</sup> Street ramp near the existing Artimis Building, and continue for approximately 600 ft., terminating at the US 42/3<sup>rd</sup> Street Intersection.

### **ADVANTAGES:**

- Provides access to the Clay Wade Bailey Bridge
- Reduces congestion on the proposed Ohio River Bridge and existing Brent Spence Bridge by allowing traffic to cross the river using the Clay Wade Bailey Bridge
- Improves functionality of the City of Cincinnati street grid
- May have subsequent cost savings in the amount of collector-distributor required per the Conceptual Alternative Study

### **DISADVANTAGES:**

- The proposed ramp will add construction cost to the project
- The US 42/3<sup>rd</sup> Street intersection may need to be reconstructed to support the increased traffic volume
- The intersection on the Kentucky side of the Clay Wade Bailey Bridge may need to be reconstructed to support the increased traffic volume

COST SUMMARY	 NITIAL COST	PRESENT WORTH RECURRING COSTS	1	ESENT WORTH E-CYCLE COST
ORIGINAL DESIGN	\$ 0		\$	0
ALTERNATIVE	\$ \$1,437,344		\$	\$1,437,344
SAVINGS	\$ (1,437,344)	<del></del>	\$	(1,437,344)



PROIECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

**PROJECT ITEM NO. 6-17**Kentucky Transportation Cabinet

DESCRIPTION:

FOR THE ALTERNATE CD HYBRID, PROVIDE A DIRECT

CONNECTION FROM THE SOUTHBOUND COLLECTOR -

DISTRIBUTOR ROADWAY TO 2ND STREET IN OHIO AND ADD

AN ADDITIONAL CONNECTION TO US 42/3RD STREET

SHEET NO.: 2 of 6

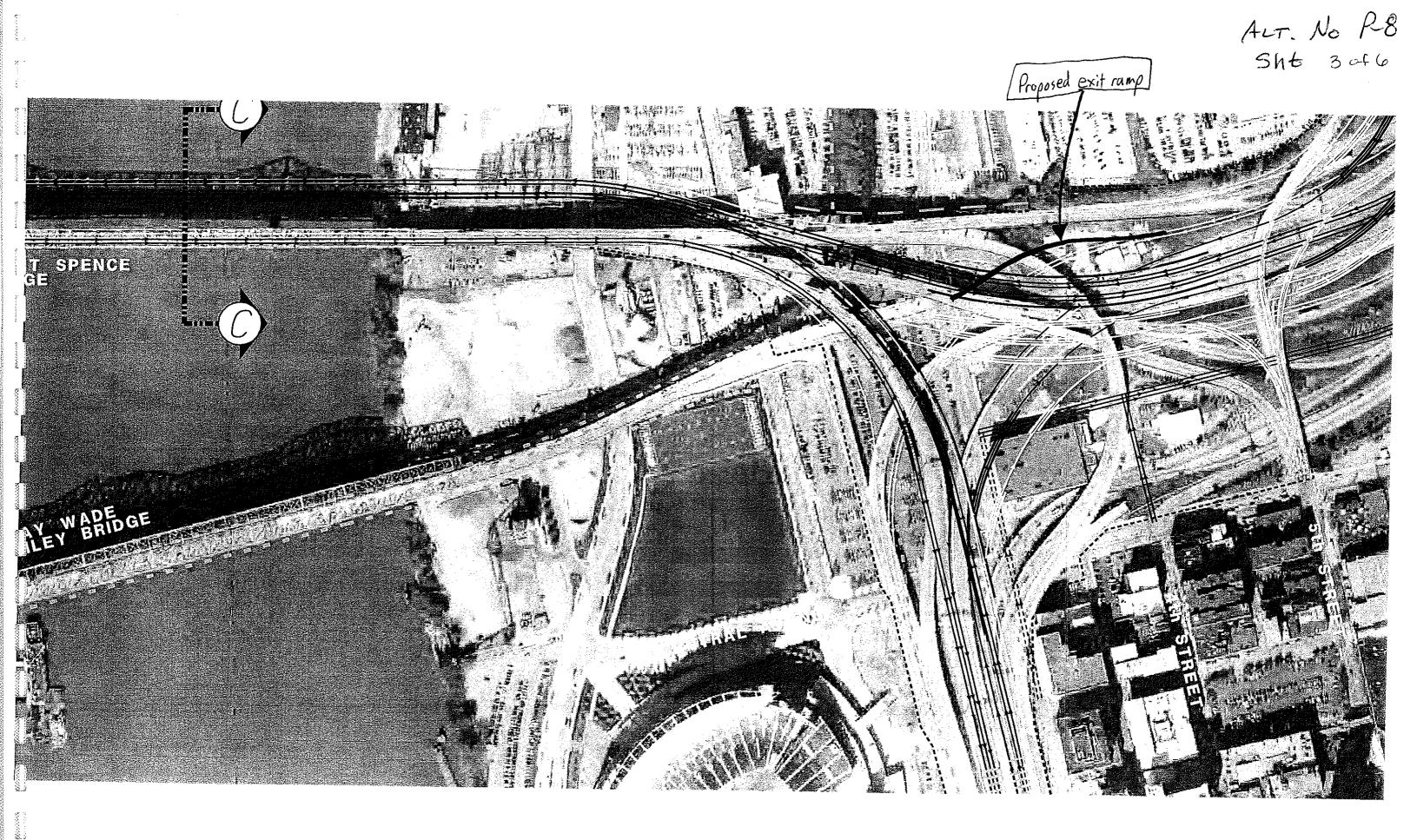
ALTERNATIVE NO .:

P-8

### DISCUSSION:

The main reason for the addition of this ramp is to provide direct access from the southbound collector-distributor to the Clay Wade Bailey Bridge and take advantage of available capacity. Providing an alternative route across the Ohio River could reduce congestion on the existing Brent Spence Bridge as well as the proposed Ohio River Bridge. This ramp can also improve the functionality of the City of Cincinnati street grid.

The design year southbound ADT across the Clay Wade Bailey Bridge is 11,190 vehicles without the additional direct access ramp. The bridge is not currently operating at its full traffic capacity. The VE Team recommends performing a traffic study to determine the impact of this proposed increase in utilization of the Clay Wade Bailey Bridge.



# **CALCULATIONS**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119 Ohio Department of Transportation

PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet ALTERNATIVE NO.: P - 8

SHEET NO .:

4 of 6

Pavement

· Length of proposed ramp = 600'
(Scaled from schematic sheet)

· Lane width of proposed ramp = 16'
(Per ODOT Land & Volume 1)

· Shoulder width of papered ramp = 6 outside + 3 inside = 9'
(for open Land O volume 1)

Pavement area = 600' x (16'+9') = 15,0000 2 1667 Sq. yd.

Cost of ramp pavement = \$68/59. yd.

So cost of 1667/sq.yd. x \$68/sq.yd.

pavement = (\$ 113,000)

Embankment

· Difference in clevation from start of ramp to intersection = 35'
· Approximate embarkment which = 110' (counting a forestopes)

· Length = 600'

Aug. neight = 35'+0' = 17.5'

50 (17.5°)(110°)(600°) = (155,000 x.27 = 43,000 cu.yd.

. Cost per consultant's = \$6/cu.yd. estimate

50 43,000 x \$6 =/\$258,000

Guardrail, Type 5

1 Length = 600' x 2 (both sides) = 1200' Cost per consultant's estimate = \$14/f+ -> (1200')(\$14/f+) \$\$17,000

# **CALCULATIONS**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation **PROJECT ITEM NO. 6-17** 

ALTERNATIVE NO.: P-8

Kentucky Transportation Cabinet

SHEET NO .:

5 of 6

Widered structure to accomodate the new mup

$$area = (2.85)(12)$$

$$= 3420^{2}$$

mainlife speed 250 mph camp speed 240 mph

$$50 \pm 150 \times 3420^{\circ}$$
  
=  $(\pm 513,000)$ 

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

P-8

Kentucky Transportation Cabinet

SHEET NO.:

PROJECT ITEM		C	ORIGINAL EST	IMATE	AL <sup>-</sup>	TERNATIVE ESTI	MATE
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
Ramp Pavement (Includes 13-inch reinforced concrete pavement, 6-inch aggregate base, and subgrade comp.)	SY				1,667	68.00	113,356
Embankment	CY				43,000	6.00	258,000
Guardrail, Type 5	FT				1,200	14.00	16,800
Widened Structure	SF				3,420	150.00	513,000
		·					
	٠						
<u> </u>							
· .							
							<u>-</u>
Subtotal							901,156
Markup (%) at 59.50%							536,188
TOTAL					_	_	1,437,344



PROIECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

**PROJECT ITEM NO. 6-17** 

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

P-10

SHEET NO .:

DESCRIPTION: FOR THE HYBRID ALTERNATIVE CD, PROVIDE ACCESS

FROM WINCHELL AVENUE JUST NORTH OF EZZARD

**CHARLES DRIVE TO NORTHBOUND 1-75** 

1 of 3

### **ORIGINAL DESIGN:**

The Hybrid Alternative CD design does not provide access from Winchell Avenue north of Ezzard Charles Drive to northbound I-75.

### **ALTERNATIVE:**

Provide access from the Winchell Avenue north of Ezzard Charles Drive to northbound I-75.

### **ADVANTAGES:**

Provides quicker access to northbound I-75 directly from Winchell Avenue without having to travel 7,000 ft to the north of the Western Hills Viaduct

### **DISADVANTAGES:**

- Requires design and construction of an additional access ramp
- May require structural work at Liberty Street

### **DISCUSSION:**

Adding a ramp to northbound I-75 from Winchell Avenue north of Ezzard Charles Drive will reduce the amount of traffic on Winchell Avenue and allow quicker access for local traffic to northbound I-75. The current daily hourly vehicles for this movement is 750 at the peak hour. An additional cost of approximately one million dollars must be weighed against the need and benefit achieved by adding this ramp.

This alternative will require a study of potential structural work which may be required at Liberty Street.

COST SUMMARY	IN	IITIAL COST	PRESENT WORTH RECURRING COSTS	SENT WORTH E-CYCLE COST
ORIGINAL DESIGN	\$	0		\$ 0
ALTERNATIVE	\$	999,433	_	\$ 999,433
SAVINGS (Original minus Alternative)	\$	(999,433)	_	\$ (999,433)

PROJECT: HAM-71/75-0.00/0.22, PID 75119 Ohio Department of Transportation PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet	ALTERNATIVE NO.	: P-10
ORIGINAL DESIGN ☐ ALTERNATIVE DESIGN ☑ BOTH	SHEET NO.:	2 of 3
Given:		
D Fristing traffic currently us	ing entrance ramp fo	
NB IR 75, north of Eggar	d Charles Dr. per. 9.	10/08
certified traffic (ODOT, Office	e of Tech. Servicer)	
AHE AM DHV = 510		•
AH E PM DHV = 750	(A) a - 11	
2) Ramp width per ODOT 15	$D = 25^{\circ} H_{\odot}$	
3) Cost estimates per ODOT (1	Estimator	
4) Required ramp length = 1400 f		
Assumption:		
D Structure at Liberty can be additional lane,	widened to accompdate	
2) Additional lane can be built	between IR 75 and W	linchelle
3) Any required relations walks of 4) 16 ft elevation from Winchells Calculation:	e to IR 25 will not cha	nge.
Nadding studere width requir	red over Liberty Street	
12 ft wide x 200 ft long x 123	5.00 1/42 (men 506) = 30000	3 000 C
2) Now camp from just north of	Ezzard Charles to north of	Liberty
1400 A × 25 ft × 14d × 68	8/yd2 (Isen 122) = \$264, 444,00	<i>→</i>
3) Additional needed fill 1400 ft x 25 lt x 16 ft y 27 ft 3	× 6.0 8/yd 3 (Item 345) = 62,2	12

Total Estimate

\$ 626,666

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

P-10

Kentucky Transportation Cabinet

SHEET NO.:

PROJECT ITEM		0	RIGINAL ESTI	MATE	ALT	ERNATIVE ESTI	MATE
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
New Ramp	SY				3,888	68.00	264,384
Embankment	CY				10,370	6.00	62,220
New Structure (added 12-ft lane)	SF				2,400	125.00	300,000
	·						
·							
						· ·	
		-					-
Subtota				·			626,604
Markup (%) at 59.50%					_		372,829
TOTAL	L						999,433



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.: P-11

Ohio Department of Transportation

PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet

DESCRIPTION: FOR THE HYBRID ALTERNATIVE CD, UPDATE THE

SHEET NO .:

1 of 2

COST ESTIMATE TO REFLECT AN ADDITIONAL LANE

ON THE I-75 MAINLINE

### **ORIGINAL DESIGN:**

In the Conceptual Alternative Study (CAS), Alternatives C and D were evaluated with two lanes northbound and two lanes southbound on I-75.

### **ALTERNATIVE:**

Update the cost estimate in the Hybrid Alternative CD to include three lanes northbound and three lanes southbound on I-75 to match Alternative E.

### **ADVANTAGES:**

### **DISADVANTAGES:**

Matches the number of lanes provided with Alternative E

None identified

### **DISCUSSION:**

As a result of recommendations confirmed in the CAS, Alternatives C and D will be combined into a hybrid alternative. The new Hybrid Alternative CD will be further designed and evaluated with three lanes for I-75 in each direction. This update is required to show the change in the base cost for Hybrid Alternative CD.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	<b>Y</b>
SAVINGS (Original minus Alternative)			-



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

P-11

Kentucky Transportation Cabinet

SHEET NO.:

PROJECT ITEM			ORIGINAL ESTIM	ATE	SHEET NO.	······································	Z OI Z
PROJECT HEM				IAIE		TERNATIVE EST	IMATE
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	no. of units	COST/ UNIT	TOTAL
Mainline Travel Lanes	SY				18,292	68.00	1,243,856
Tier 1 Bridge Area	CY				67,531	125.00	8,441,375
Tier 2 Bridge Area	SF				58,555	150.00	8,783,250
Tier 3 Bridge Area	SF				56,232	175.00	9,840,600
Main River (Difference Between Alt. CD and Alt. E)	LS	1	289,036,800	289,036,800	1	355,737,600	355,737,600
					*, *		
				<del>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</del>			·
							<del></del>
		<u>·</u>	· .				<del></del> .
				* /			
					<del>,,</del>		<del></del> .
	·						
Subtotal				289,036,800			384,046,681
Markup (%) at 59.50%				171,976,896		_	228,507,775
TOTAL	1000			461,013,696			612,554,456



PROJECT: HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

SHEET NO.:

P-13

DESCRIPTION: FOR ALTERNATIVE E, SHIFT THE COLLECTOR-

DISTRIBUTOR ROADWAY TO MINIMIZE IMPACTS TO GOEBEL PARK AND AVOID RELOCATING THE RADIO

STATION TOWER

ORIGINAL DESIGN: (See attached sketch)

In the original design for Alternative E, the current local street/collector-distributor roadway just north of 9<sup>th</sup> Street in Kentucky requires the relocation of the radio station tower and encroachment into Goebel Park.

ALTERNATIVE: (See attached sketch)

Shift the local street/collector-distributor roadway to the north in a stacked configuration with the collector-distributor roadway above the local street to avoid impact to the radio tower and Goebel Park.

### **ADVANTAGES:**

- Avoids radio tower relocation
- Minimizes impact to Goebel Park

### **DISADVANTAGES:**

• The intersection of the new local street with 9<sup>th</sup>
Street under an overhead structure may limit sight distance

### **DISCUSSION:**

Shifting the local street/collector distributor roadway to the west to miss the radio tower will avoid a costly and difficult relocation of an AM radio station antenna. The shift may also have a benefit of reducing impacts to Goebel Park, which is a Section 6f resource.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	V.
SAVINGS (Original minus Alternative)			



ALTERNATIVE NO.:  $\rho$ -13

PROJECT: HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

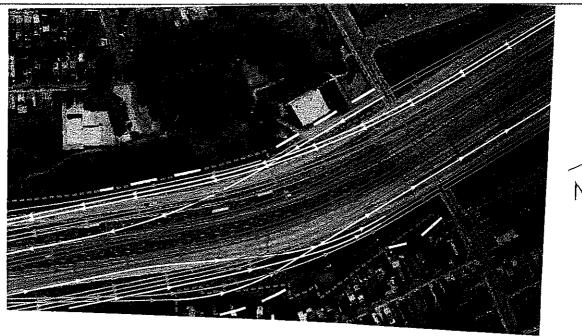
ORIGINAL DESIGN

ALTERNATIVE DESIGN

вотн 🛭

SHEET NO .:

Z of 2





# SUMMARY OF VALUE ENGINEERING ALTERNATIVES

PROJECT:	ODOT HAM-71/75-0.00/0.22, PID 75119, KYTC Pa	, KYTC Project Item No. 6-17		PRESENT WORTH OF COST SAVINGS	
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	INITIAL COST RECURRING SAVINGS COST SAVINGS	TOTAL PW.
	STRUCTURES (S)				
Z	For Hybrid Alternative CD, provide an exit from the northbound collector-distributor roadway to Ezzard Charles Drive similar to that shown in the Alternative E design.		DESI	DESIGN SUGGESTION	
S-S	With all options, use tie-back walls on the west side of southbound KY 1-75 and in other applicable areas in Kentucky to reduce excavation and right-of-way requirements.		DESI	DESIGN SUGGESTION	
<b>S.4</b>	With all options, provide a means to mitigate potential structural impacts to Willow Run Sewer during construction.		DESI	DESIGN SUGGESTION	
S-6A	For the Hybrid Alternative CD, adjust the lane configurations on each deck on the new bridge to save one lane per deck.	\$567,401,472	\$513,809,472	\$53,592,000	\$53,592,000
89-S	For Alternative E, make the traffic operations directional on each deck on the new bridge to save one lane per deck.	\$567,401,472	\$513,809,472	\$53,592,000	\$53,592,000
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PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO.:

**S-1** 

DESCRIPTION: PROVIDE AN EXIT FROM THE NORTHBOUND

COLLECTOR-DISTRIBUTOR ROADWAY TO EZZARD

CHARLES AND INCLUDE IN THE HYBRID ALTERNATIVE

CD DESIGN SIMILAR TO THAT SHOWN IN THE

ALTERNATIVE E DESIGN

SHEET NO .:

1 of 3

## **ORIGINAL DESIGN:**

In the Hybrid Alternative CD design, the collector-distributor roadway carries Northern Kentucky traffic across the Brent Spence Bridge to Ohio exits to 2<sup>nd</sup> Street east and 6<sup>th</sup> Street/US 50 west, and then merges with northbound I-75 below Ezzard Charles Drive. There is no direct access to the Museum Center except to take 6th Street west to Freeman Avenue, travel north on Freeman Avenue to Winchell Avenue, and then cross Ezzard Charles Drive to the Museum Entrance.

## **ALTERNATIVE:**

Add a drop lane from the collector-distributor roadway and merge this with the frontage road between 9<sup>th</sup> Street and Linn Street. This frontage road merges with Freeman Avenue and crosses Ezzard Charles Drive.

## **ADVANTAGES:**

- More direct access to the Museum Center and Amtrak railroad from Kentucky and Fort Washington Way
- A portion of traffic currently exiting at 5<sup>th</sup> Street and 6<sup>th</sup> Street will now use the new exit to access the Museum Center and reduce congestion

## **DISADVANTAGES:**

- This alternative would create a braided merge between the collector-distributor road and oncoming traffic from 6<sup>th</sup> Street and 9<sup>th</sup> Street
- A design exception may be required for the length of the collector-distributor roadway deceleration lane which requires 400 feet minimum

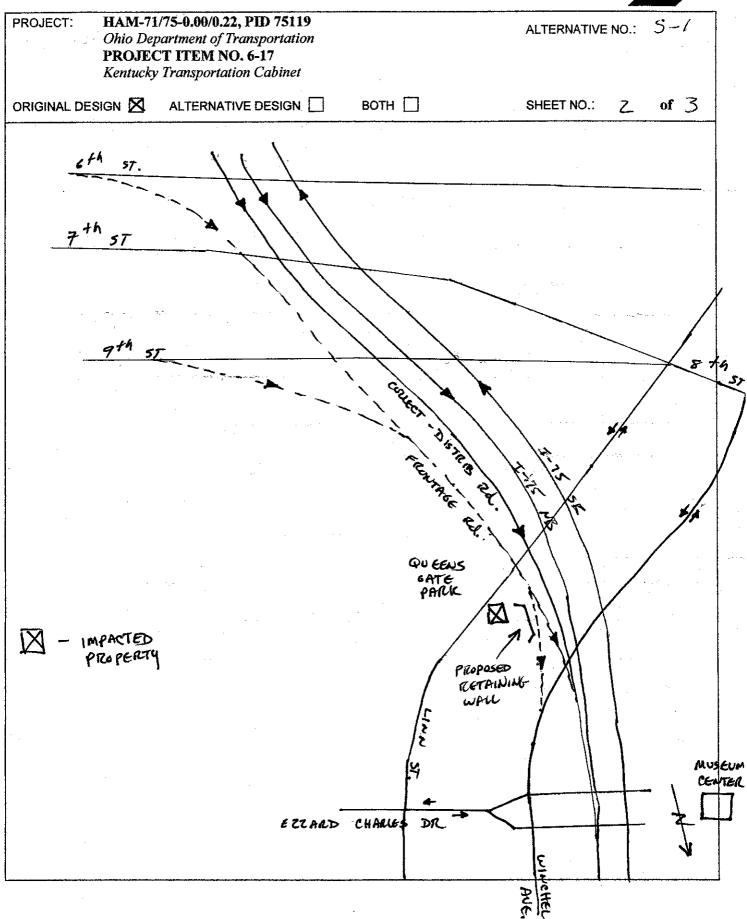
## **DISCUSSION:**

A certified travel analysis is recommended to determine the potential benefit of the proposed new exit. No additional right-of-way or retaining walls will be required other than what is already proposed for the Hybrid Alternative CD Frontage Road (i.e., Queens Gate Park). Utility and cultural impacts would remain unchanged also.

The design year average daily traffic (ADT) for the new collector-distributor roadway is 42,770 based upon Alternative C traffic data. The design year ADT for Winchell Avenue from 9th Street to Freeman Avenue is 10,520. An unknown percentage of collector-distributor traffic will be added to Winchell Avenue.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	N .
SAVINGS (Original minus Alternative)			







PROJECT: HAM-71/75-0.00/0.22, PID 75119 Ohio Department of Transportation PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet		ALTERNATIVE N	10.: S -1
ORIGINAL DESIGN ALTERNATIVE DESIGN	вотн 🗌	SHEET NO.:	3 of 3
6th 55 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			
7 th ST Tilent Ward of 22	3	_	
9th ST			5 th 5T.
	**************************************		
PROVIDE NEW EXIT RA FROM C-D & MERGE WITH FRONTAGE Rd	imp		
	QUEENS GATE PAILL		and remarked
M - IMPACTED PROPERTY	/ «	OPASED THE MINE	4
i	LIND ST.		Museu
e seas	CHARLES DR	A ne	+
		ACE	•



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet **ALTERNATIVE NO.:** 

DESCRIPTION: WITH ALL OPTIONS, USE TIE-BACK RETAINING WALLS

SHEET NO .:

1 of 2

ON THE WEST SIDE OF I-75 SOUTHBOUND AND IN OTHER APPLICABLE AREAS TO REDUCE RIGHT-OF-

WAY ACQUISTION REQUIREMENTS

## **ORIGINAL DESIGN:**

The original design identifies "Potential Impact" areas outside of the existing right-of-way on the west side of I-75 southbound in Kentucky.

## ALTERNATIVE: (See attached sketch)

Use tie-back retaining walls in selected areas from Kyle's Lane to approximately 7,000 ft. north of Kyle's Lane and in other applicable areas on the west side of southbound I-75 in Kentucky to reduce right-of-way acquisition requirements.

## **ADVANTAGES:**

- Reduces right-of-way acquisition
- Improves stability of cut slopes
- Reduces excavation
- Reduces long term maintenance costs
- Reduces potential for damage to adjacent properties

## **DISADVANTAGES:**

- Increases construction costs for tieback walls
- Increases design effort
- May require subterranean easement

## DISCUSSION:

Tieback retaining walls could be used in areas where there is potential for impact outside of existing right-ofway areas. Based upon the "Potential Right-of-Way Impacts" identified in Alternatives CD and E, this would apply to approximately 2,500 linear ft.

		_	
COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	N
SAVINGS (Original minus Alternative)			

PROJECT: HAM-71/75-0.00/0.22, PID 75119  Ohio Department of Transportation PROJECT ITEM NO. 6-17  Kentucky Transportation Cabinet	ALTERNATIVE I	vo.: 5-2
ORIGINAL DESIGN ALTERNATIVE DESIGN BOTH	SHEET NO.:	2 of Z
Existing  RIW  Typical Wall Height  Rock  Rock		
Proposed >		EX I-75
Conceptual Only Not to Scale		



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

Ohio Department of Transportation

PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet S-4

DESCRIPTION: WITH ALL OPTIONS, PROVIDE A MEANS TO MITIGATE

SHEET NO .:

1 of 1

POTENTIAL STRUCTURAL IMPACTS TO THE 12-FT. BY

14-FT. WILLOW RUN COMBINED SEWER DURING

CONSTRUCTION

## **ORIGINAL DESIGN:**

Hybrid Alternative CD shows a mechanically stabilized embankment (MSE) wall located directly above the Willow Run Combined Sewer between 9th Street and 5th Street in Covington, KY. Alternative E has a lesser impact but still has a wall located over the sewer.

## **ALTERNATIVE:**

Considering the age of the Willow Run Combined Sewer, its present condition and poor soil conditions, the project should minimize loading over the sewer to avoid damage and/or replacement of the facility at a cost to the project. Avoid construction over the sewer as much as feasible and consider alternative means to minimize impacts to the facility sewer lining.

## **ADVANTAGES:**

- Eliminates the need to rehabilitate or replace the sewer
- Reduced impact will reduce delays caused by potentially unknown utility issues

## **DISADVANTAGES:**

- May be more costly than conventional construction
- May create vertical and/or horizontal alignment and design issues

## DISCUSSION:

The existing Willow Run Combined Sewer is a brick lined structure in poor condition. The soils in the project area are soft and are anticipated to undergo significant settlement due to the new highway loading. The settlement would be potentially damaging to the sewer.

The design team should avoid construction over the sewer as much as feasible and consider the use of a lightweight fill or structural means to protect the sewer lining where impact is unavoidable.

		PRESENT WORTH	PRESENT WORTH
COST SUMMARY	INITIAL COST	RECURRING COSTS	LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	J
SAVINGS (Original minus Alternative)			



PROIECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet ALTERNATIVE NO.:

**S-6A** 

DESCRIPTION: FOR THE HYBRID ALTERNATE CD, MAKE THE TRAFFIC

OPERATIONS DIRECTIONAL ON EACH DECK ON THE

NEW BRIDGE TO SAVE ONE LANE PER DECK

1 of 5

ORIGINAL DESIGN: (See attached sketch)

The original design calls for a new 127-ft.-wide, two-level bridge including six lanes for I-75 (three lanes for northbound and three lanes for southbound) on the upper deck and four lanes (two lanes for southbound local traffic and two lanes for southbound I-71 traffic on the lower deck).

ALTERNATIVE: (See attached sketch)

Reduce the deck width by 12-feet by providing a new 115-ft.-wide, two-level bridge including five lanes (three lanes for southbound I-75 and two lanes for southbound I-71) on the upper deck and five lanes (two lanes for southbound local traffic and three lanes for northbound I-71).

## **ADVANTAGES:**

- Matches deck width to lane requirements
- Reduces new bridge overall width
- Reduces encroachment into the historic area to the west of the structure

## **DISADVANTAGES:**

- Limits future expansion on the lower deck by converting shoulders to lanes
- Adds complexity to the geometry at the north end of the bridge

## DISCUSSION:

The new two-level bridge may be reconfigured to five lanes per deck to reduce the overall width thus limiting future expansion by converting shoulders to lanes.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST	
ORIGINAL DESIGN	\$ 567, 401,472		\$ 567, 401,472	
ALTERNATIVE	\$ 513,809,472		\$ 513,809,472	
SAVINGS (Original minus Alternative)	\$ 53,592,000		\$ 53,592,000	



PROJECT: HAM-71/75-0.00/0.22, PID 75119 ALTERNATIVE NO.: 5-64 Ohio Department of Transportation **PROJECT ITEM NO. 6-17** Kentucky Transportation Cabinet вотн 📈 SHEET NO .: ALTERNATIVE DESIGN 2 of 5 ORIGINAL DESIGN NB Upper Deck 12' UNO Lower Deck 127 ORIGINAL 25B I71 3 NB 175



ALTERNATIVE NO.: 5-64

PROJECT: HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

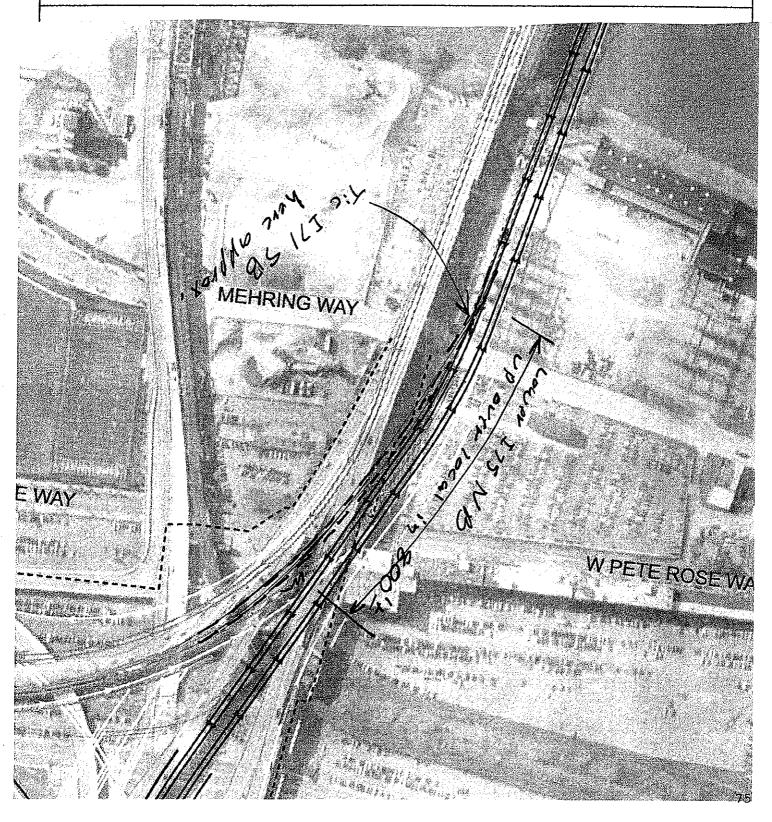
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ORIGINAL DESIGN ALTERNATIVE DESIGN

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SHEET NO .:

3 or \$



# **CALCULATIONS**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

ALTERNATIVE NO.: 5-6A

SHEET NO.:

4 of 5

reduce deck by 12' each level

= 1750 L.F. per level

:. sf reduction = 12' width x 1750' langth x 2 dake = 42,000 s.f.

# COST WORKSHEET

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

S-6A

Kentucky Transportation Cabinet

SHEET NO .:

5 of 5

Kentucky Transp	ortation C	abınet			SHEET NO.:		5 01 5
PROJECT ITEM		0	RIGINAL ESTIN	MATE	AL	TERNATIVE EST	IMATE
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
0514 R-MC-STRC Bridge - Main	SF	444,672	800.00	355,737,600	402,672	800.00	322,137,600
		·					
					·		
·							
· · ·					-		
				-			
Subtota	l			355,737,600			322,137,600
Markup (%) at 59.50%	-			211,663,872			191,671,872
TOTA				567,401,472			513,809,472



PROIECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet ALTERNATIVE NO.:

S-6B

DESCRIPTION: FOR THE HYBRID ALTERNATE CD, MAKE THE TRAFFIC SHEET NO.:

OPERATIONS DIRECTIONAL ON EACH DECK ON THE

NEW BRIDGE TO SAVE ONE LANE PER DECK

1 of 4

ORIGINAL DESIGN: (See attached sketch)

The original design calls for a new 127-ft.-wide, two-level bridge including six lanes for I-71 (two lanes for northbound I-71 and three lanes for southbound I-71 with one unused lane) on the upper deck and six lanes (three lanes for northbound I-75 and three lanes for southbound I-75) on the lower deck.

ALTERNATIVE: (See attached sketch)

Reduce the deck width by 12 ft. by providing a new 115-ft.-wide, two-level bridge including five lanes (three lanes for southbound I-75 and two lanes for southbound I-71) on the upper deck and five lanes (three lanes for northbound I-75 and two lanes for northbound I-71) on the lower deck.

## ADVANTAGES:

- Matches deck width to lane requirements
- Reduces new bridge overall width
- Reduces encroachment into the historic area to the west of the structure
- Uses more existing bridge capacity

## DISADVANTAGES:

- Limits future expansion on the lower deck by converting shoulders to lanes
- Eliminates one lane for I-71 southbound

## DISCUSSION:

The new two-level bridge may be reconfigured to five lanes per deck to reduce the overall width thus limiting future expansion by converting shoulders to lanes.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	1	ESENT WORTH FE-CYCLE COST
ORIGINAL DESIGN	\$ 567, 401,472	<del></del>	\$	567, 401,472
ALTERNATIVE	\$ 513,809,472	-	\$	513,809,472
SAVINGS (Original minus Alternative)	\$ 53,592,000		\$	53,592,000

HAM-71/75-0.00/0.22, PID 75119 PROJECT: ALTERNATIVE NO.: 5-68 Ohio Department of Transportation PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet вотн 📈 SHEET NO .: ORIGINAL DESIGN ALTERNATIVE DESIGN 2 XNBI-71 3-5BITY 3:1755B 127 ORIGINAL 2-NB I71 3 NB I75 rasev Deck Proposed

# **CALCULATIONS**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

ALTERNATIVE NO .: 5-68

SHEET NO .:

3 of4

reduce dock by 12' each level

Longth From all E'estimate 1. 444,6725F AHE /127 purposed deck = 3501 LF in 2 levels = 1750 L.F. par level

is streduction = 12 width x 1750' longth x 2 dake = 42,000 S.F.

# COST WORKSHEET

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

ALTERNATIVE NO.:

State of Ohio, Department of Transportation

PROJECT ITEM NO. 6-17

S-6B

Kentucky Transportation Cabinet

SHEET NO.:

4 of 4

Kentucky T	ransportation C	abinet		т.	SHEET NO.:		4 of 4
PROJECT ITEA	4	0	RIGINAL ESTI	MATE	ALT	ERNATIVE EST	MATE
ITEM	UNITS	NO. OF UNITS	COST/ UNIT	TOTAL	NO. OF UNITS	COST/ UNIT	TOTAL
0514 R-MC-STRC Bridge - M	(ain SF	444,672	800.00	355,737,600	402,672	800.00	322,137,600
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			-			-	
	ıbtotal			355,737,600			322,137,60
	9.50%			211,663,872			191,671,87
٦	TOTAL			567,401,472			513,809,47

# SUMMARY OF VALUE ENGINEERING ALTERNATIVES

PROJECT	ODOT HAM-71/75-0.00/0.22, PID 75119, KYTC Pr	9, KYTC Project Item No. 6-17		PRESENT-WORTH OF COST SAVINGS	VINGS	
ALT. NO.	DESCRIPTION	ORIGINAL COST	ALTERNATIVE COST	initial cosť Savings	RECURRING COST SAVINGS	TOTAL PW. LCC SAVINGS
	ROADWAY (R)					
R-1	For all options, realign Section 1 near the cut in the hill to the east to reduce right-of-way and excavation requirements.		DES	DESIGN SUGGESTION	7	
R-2	Specify that recycled concrete pavement is acceptable for use as sub-grade stabilization in Kentucky.		DES	DESIGN SUGGESTION	7	
						·
						を発生しる
	化多角 计电子记录机 医阿尔尔克勒特人类 医克雷氏试验 爱的现在分词形式 医二甲酚 化石 医光头	ジャがのとしまでしまれること	化新光线机等 化多异磷基甲醇 网络哈拉人	医克里氏 经财政股票 化糖香酸	(2) できるでは、1000年です。	多数年 可以下 出口有人的 人名英



PROIECT:

HAM-71/75-0.00/0.22, PID 75119

**ALTERNATIVE NO.:** 

Ohio Department of Transportation

PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

**R-1** 

1101.

DESCRIPTION: FOR ALL OPTIONS, REALIGN SECTION 1 TO THE EAST

SHEET NO .:

1 of 3

TO REDUCE RIGHT-OF-WAY AND EXCAVATION

REQUIREMENTS

ORIGINAL DESIGN: (see attached sketch)

In the original design, all widening of I-75 is shown to the west side of the existing centerline in the Kentucky "Cut in the Hill" section.

ALTERNATIVE: (see attached sketch)

Construct some of the I-75 widening to the east side of existing centerline; specifically 2,000 ft. south of 12<sup>th</sup> Street to 4,500 ft south of 12<sup>th</sup> Street. Also, explore where I-75 gets close to Highland Avenue. However, it is less desirable here due to slope stability issues.

## **ADVANTAGES:**

- Eliminates expensive walls on west side in "Hill" section
- Better use of existing right-of-way
- · Less disruption to existing storm facilities

## **DISADVANTAGES:**

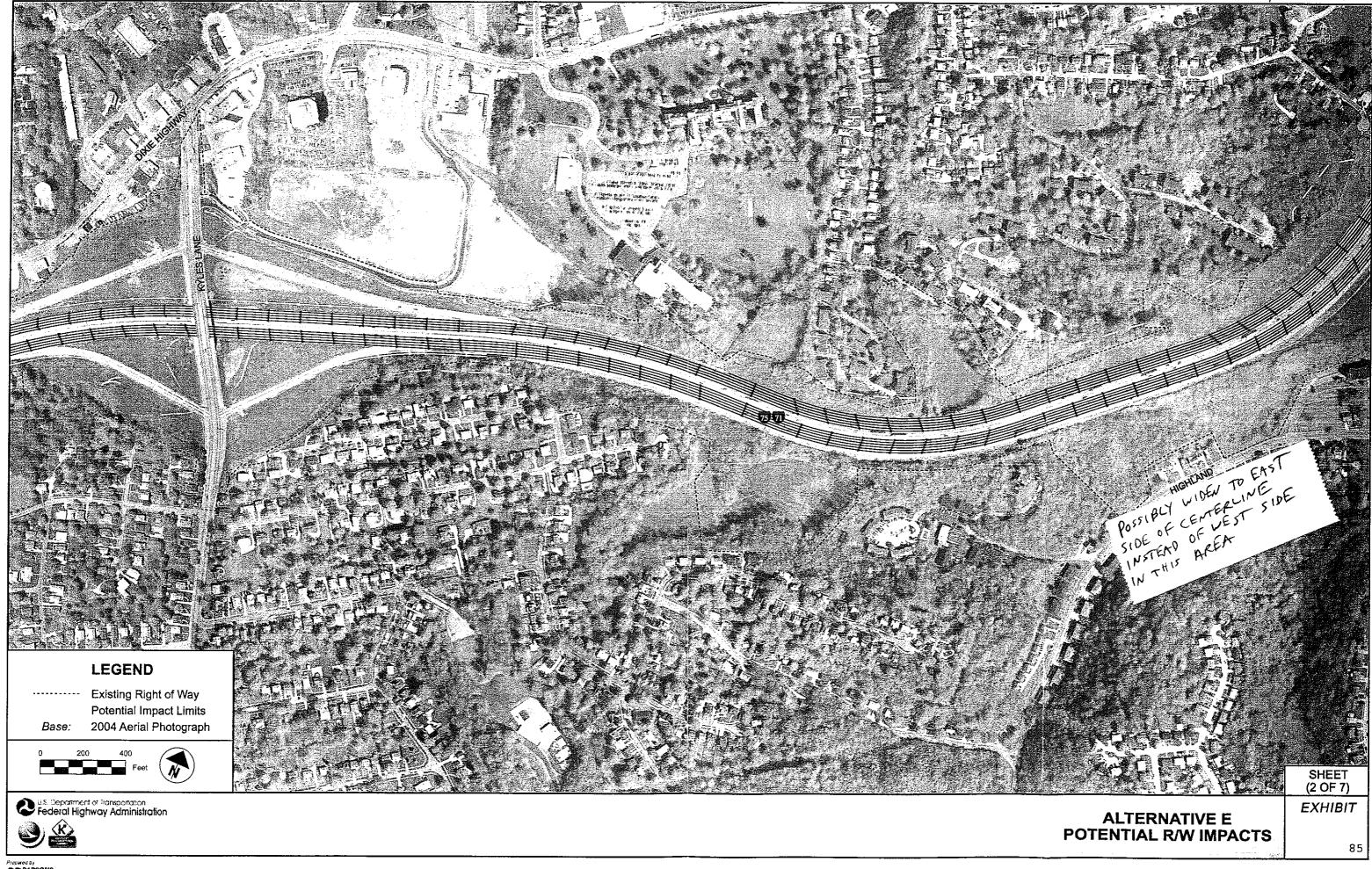
- Maintenance of traffic becomes more complicated because Stage 1 work is now on both sides of the interstate
- Highland Avenue section has slope stability and flooding issues
- Geometry may be less desirable with the new hospital, now a restriction at the northern end
- May interfere with the proposed light rail corridor

## **DISCUSSION:**

This item should be investigated to determine if significant cost avoidance can be realized by eliminating excavation and/or the retaining wall on the west side of I-71/I-75 in Kentucky in the "Cut in the Hill" section. Approximately one-half mile could be widened on the east side which would save construction and right-of way costs. The same principle may apply where I-71/I-75's alignment gets close to Highland Avenue. However, in this location, the costs may be offset because tieback walls would likely be necessary and there are drainage concerns. The centerline of I-71/I-75 could only be shifted here about 40 ft. The centerline could be shifted 200 ft. in "Hill" section. Additionally, in the "Cut in the Hill" section, the centerline could be shifted to preserve the proposed light rail corridor.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	Ň
SAVINGS (Original minus Alternative)			

WIDEN TO EAST SIDE OF GENTERLINE INSTEAD OF WEST SIDE IN THIS AREA (2000' TO 4500' SOUTH OF 12th ST.) **LEGEND** ----- Existing Right of Way Potential Impact Limits 2004 Aerial Photograph SHEET (3 OF 7) U.S. Department of Transportation Federal Highway Administration **EXHIBIT ALTERNATIVE E** POTENTIAL R/W IMPACTS





PROIECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

**PROJECT ITEM NO. 6-17** *Kentucky Transportation Cabinet* 

ALTERNATIVE NO.:

**R-2** 

DESCRIPTION: SPECIFY THAT RECYCLED CONCRETE PAVEMENT IS

ACCEPTABLE FOR USE AS SUB-GRADE STABILIZATION

IN KENTUCKY

SHEET NO .:

1 of 1

## ORIGINAL DESIGN:

Presently, KYTC Standard Specifications do not permit the use of recycled concrete pavement as subgrade stabilization. The ODOT Specifications permit the use of recycled concrete as granular fill provided the contractor processes the material correctly.

## ALTERNATIVE:

Provide a Special Provision for the Kentucky portion of the project allowing the reuse of the concrete pavement as granular fill in subgrade stabilization applications and consider this in the pavement design.

## **ADVANTAGES:**

- Reduces waste generation
- Known availability of material

## **DISADVANTAGES:**

- Large area needed for processing
- Removal of reinforcing steel from the concrete is time consuming
- Potential long-term maintenance issue (drainage clogging)
- Material quality to meet specifications may be difficult
- Limited number of contractors may be available that can process material to a gradation specification

## **DISCUSSION:**

Providing the contractor an option to reuse the concrete pavement permits the contractor to decide the economic advantages of reusing the concrete pavement. However, forcing the contractor to reuse the concrete pavement may result in an increased cost due to processing and material storage issues.

COST SUMMARY	INITIAL COST	PRESENT WORTH RECURRING COSTS	PRESENT WORTH LIFE-CYCLE COST
ORIGINAL DESIGN			
ALTERNATIVE		DESIGN SUGGESTION	Ī
SAVINGS (Original minus Alternative)		,	

## PROJECT DESCRIPTION

## NEED AND PURPOSE

The Brent Spence Bridge Replacement/Rehabilitation Project is needed to improve the operational characteristics within the I-71/I-75 corridor for both local and through traffic. In the Greater Cincinnati, Ohio/Northern Kentucky region, the I-71/I-75 corridor suffers from congestion and safety-related issues as a result of inadequate capacity to accommodate current traffic demand. The purpose of this project is to:

- Improve traffic flow and level of service (LOS),
- Improve safety
- Correct geometric deficiencies, and
- Maintain connections to key regional and national transportation corridors.

## Traffic Flow and Level of Service

Traffic analyses completed for the *Existing and Future Conditions Report* (February 2006) determined that approximately 160,000 vehicles per day use the Brent Spence Bridge and traffic volumes are projected to increase to approximately 200,000 vehicles per day in 2035. A major cause of congestion is the inability of the interstate facility to handle current and future travel demand. In 2005, traffic data and the current and design year 2035 level of service on I-75 were analyzed. For current traffic, during the AM peak hour, 48 percent of the freeway segments analyzed operated at LOS D or worse. During the PM peak hour, 63 percent of the I-75 freeway segments analyzed were at LOS D or worse. For design year 2035, during the AM peak hour, 64 percent of the freeway segments were at LOS D or worse and during the PM peak hour, 95 percent of the freeway segments were at LOS D or worse.

Congestion problems are area wide and not limited to spot locations. These failures are occurring in both Ohio and Kentucky. The level of congestion on I-75 is the primary reason for commuter delays and longer travel times that are currently being experienced within the corridor.

## Safety

Crash rates for the I-71/I-75 corridor exceed the Kentucky and Ohio statewide averages. Within Kenton County, Kentucky, crash rates along I-71/I-75 average 1.30 accidents per million vehicle miles traveled, which is 1.67 times higher than the statewide average. The average crash rate for the Ohio section of I-71 in the study area is 3.22 accidents per million vehicle miles traveled, which is 1.7 times higher than the statewide average. Within the overall study area, I-75 has a crash rate of 2.91 accidents per million vehicle miles, which is approximately 1.5 times higher than the statewide average rate.

The ODOT Highway Safety Program (HSP) identifies and ranks all crash locations on the state system based on crash rate, frequency, density, severity, and other analytical factors. The 2005-2007 HSP list includes two highway segments within the study area which are ranked in the top 100, most notably, the section of I-71 from mile post 0.60 to mile post 1.10 is ranked seventh.

## Geometric Deficiencies

The geometric design features of I-71 and I-75 within the study area do not meet current standards for an interstate highway facility. Design deficiencies include:

- Substandard vertical alignments with limited stopping distances,
- Acceleration and deceleration lanes that are not of sufficient length for anticipated traffic volumes and movements,
- Narrow shoulders that present safety hazards, make maintenance of traffic difficult; and contribute to traffic delays when crashes, vehicle breakdowns, or scheduled roadwork require lane restrictions.

## National, Regional, and Local System Linkage

The I-71/I-75 corridor in the Greater Cincinnati/Northern Kentucky area is a significant transportation corridor, not only for local access and mobility needs, but also for regional, statewide, and national access and mobility needs. This corridor is recognized in county and regional transportation plans, as are the recommendations for needed improvements. In addition, I-71 and I-75 are key links in the national transportation system in terms of people movement, freight movement, and national defense. Transportation plans and recommendations at all levels recognize that these facilities now operate at or below capacity and therefore, need to be upgraded to modern standards to maintain these important transportation links.

## PROJECT LOCATION

The project study area is located along a seven mile segment of I-75 within the Commonwealth of Kentucky and the State of Ohio. The southern limit of the project is 2,300 feet south of the midpoint of the interchange of I-75 and Dixie Highway (US 127/US 42/US 25) in Kentucky (Exit 188). The northern limit of the project is 1,500 feet north of the midpoint of the interchange of I-75 and the Western Hills Viaduct in Ohio (Exit 2B). The eastern and western limits of the study area follow the existing alignment of I-75. In Kentucky, the study area is a 1500-ft.-wide corridor centered on I-75 south of the City of Covington. See Figure 1: Project Area on the following page.

## **EXISTING CONDITIONS**

I-75 connects the Greater Cincinnati/Northern Kentucky region with Detroit, Michigan to the north and Miami, Florida to the south. It also connects with I-74 and US 50 to the east and west. I-75 and the railroads that run parallel to it through this region are among the nation's busiest. This transportation system is the backbone of commerce and travel through the region. According to Federal Highway Administration (FHWA) estimates, I-75 is one of the busiest trucking routes in North America with truck traffic approaching six billion miles annually. In addition, more than 250 freight trains per day pass through or have destinations within the I-75 corridor. The interstate portions of this transportation system are nearly 50 years old and significant safety and capacity problems exist.

The built environment surrounding I-75 and the Brent Spence Bridge is characterized by highly disturbed, dense urban development with historic districts and properties nearby. I-75 in Cincinnati is a typical downtown freeway with closely spaced ramps and poor roadway geometry. Within the past few years several reconstruction and rehabilitation projects were performed in the area.

The National Bridge Inventory lists the Brent Spence Bridge as functionally obsolete due to the capacity, sight distance, and safety concerns associated with its current configuration. These concerns have led to this project being considered a top priority by KYTC, ODOT, the Ohio-Kentucky-Indiana Regional Council of Governments, and the cities of Covington, Kentucky, and Cincinnati, Ohio.

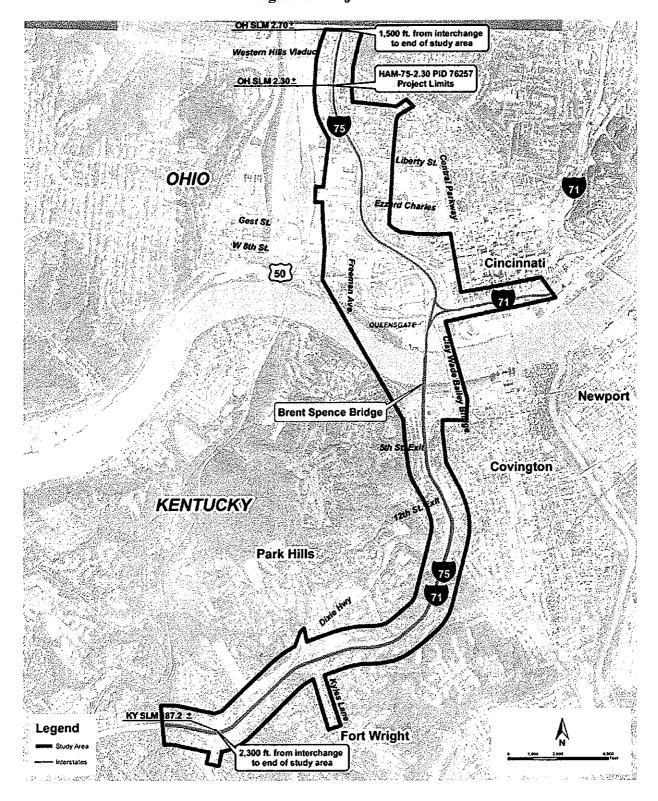


Figure 1: Project Area

## **FEASIBLE ALTERNATIVES**

The comparative analysis led to the recommendation of carrying forward two feasible alternatives. The two feasible alternatives consist of Alternative E and a combination of Alternatives C and D (Hybrid Alternative CD). Based on the analyses completed and feedback as part of community input, it was also recommended that certain design elements of Alternative G be incorporated into the two feasible alternatives in Step 6 of the ODOT's Project Development Process. Additionally, the two feasible alternatives would be designed to provide three lanes in each direction on I-75.

Alternative G was eliminated from further consideration due to the high costs, and residential and business displacements associated with this alternative. However, the following beneficial design features of Alternative G would be carried forward for further analysis and incorporated into Alternative E and Hybrid Alternative CD:

- Access to the north end of Clay Wade Bailey Bridge from I-75 southbound using a collectordistributor roadway and US 50 eastbound;
- Two access points into Covington;
- Access from a northbound collector-distributor roadway from KY to I-71 northbound in Ohio; and
- An access ramp just north of Ezzard Charles Drive for Freeman Avenue and local traffic to I-75 northbound.

## HYBRID ALTERNATIVE CD

Hybrid Alternative CD south of KY 12th Street has six lanes northbound and six lanes southbound. A local collector-distributor roadway is provided from KY 12th Street to the Ohio River. A new double deck bridge would be built just west of the existing Brent Spence Bridge for I-75 (three lanes in each direction), two lanes for southbound I-71 and two lanes for southbound local traffic. The existing Brent Spence Bridge would be rehabilitated to carry two lanes for northbound I-71 and three lanes for northbound local traffic. Hybrid Alternative CD reconfigures I-75 through the I-71/I-75/US 50 Interchange and eliminates all access to and from I-75 from KY 12th Street to just south of Ezzard Charles Drive in the northbound direction. Between Ezzard Charles Drive and the Western Hills Viaduct, northbound I-75 would have five lanes, southbound I-75 would have two lanes, and the local southbound collector-distributor roadway would have four lanes, for a total of 11 travel lanes. Western and Winchell Avenues would be improved to carry local traffic.

Access to downtown Cincinnati would be made through a series of collector-distributor roadways that would require a decision point outside of the downtown area. In the northbound direction just north of the existing Brent Spence Bridge, the collector-distributor roadway lane configuration is combined on a single structure between the Ohio (OH) 2nd Street diverge and the OH 5th Street diverge. Using a single structure in this area simplifies the vertical geometric design, and reduces costs. A negative aspect to combining the lane configuration onto a single structure is that it would introduce a weave movement north of OH 5th Street from traffic coming from I-71 southbound traveling towards the Western Hills Viaduct. Upon analyzing the weave movement, no degradation of level of service was noted.

In the southbound direction, the collector-distributor roadway remains west of I-75. Traffic entering from Western Avenue would have access to I-71 northbound and US 50 eastbound by using a weave condition. The ramp access to OH 5th Street would remain.

Hybrid Alternative CD requires approximately 22.2 acres of additional right-of-way. This is the second least amount of land impacted by the conceptual alternatives. Hybrid Alternative CD would displace 16 residential units and 35 businesses. Approximately 300 employees would be affected by this alternative. Hybrid Alternative CD, as with Alternative E would impact Longworth Hall which includes 21 businesses. Hybrid Alternative CD would impact three wetland areas, 10 woodlots and one potential threatened and endangered species habitat area, four community resources, three historic resources, and five Section 4(f) properties. Hybrid Alternative CD would be compatible with existing land use plans and would not have a negative impact on community cohesion. Hybrid Alternative CD would be constructed within the existing interstate corridor and not bisect neighborhoods in Kentucky or Ohio. Alternative CD would support the Queensgate redevelopment plans and help Cincinnati facilitate its economic renewal goals.

Since the alignment of Hybrid Alternative CD would be located just west of the existing Brent Spence Bridge, it would impact a portion of the Duke Energy West End substation and require the relocation of 52 individual utility facilities. Hybrid Alternative CD would directly impact four Section 4(f) resources: Goebel Park, the Lewisburg Historic District, Longworth Hall, and the Queensgate playground and ballfields. Hybrid Alternative CD could have noise and visual impacts on one Section 4(f) resource, the Harriet Beecher Stowe Elementary School (Fox 19 Television Station).

Alternative C would encroach upon the Lewisburg Historic District along its eastern border and directly impact 0.83 acres of the historic district. It would displace 10 residences adjacent to the west side of I-71/I-75, one of which is a non-contributing property to the historic district. Alternative C would directly impact 0.25 acres of Longworth Hall resource including the building and historic boundary.

## **ALTERNATIVE E**

Alternative E south of KY 12th Street has six lanes northbound and six lanes southbound. It provides two access points into Covington for both northbound and southbound traffic. A local collector-distributor roadway would be provided from KY 12th Street to the Ohio River. A new double deck bridge would be built just west of the existing Brent Spence Bridge to carry northbound and southbound I-71 and I-75 traffic. On the upper deck, I-71 southbound would have three lanes and I-71 northbound would have two lanes. On the lower deck, I-75 would have three northbound and three southbound lanes. The existing Brent Spence Bridge would be rehabilitated to carry northbound and southbound local traffic with two lanes in each direction as this number of lanes provides an acceptable level of service.

In Ohio, Alternative E reconfigures I-75 through the I-71/I-75/US 50 Interchange and eliminates some of the existing access points along I-75. The existing direct connections between I-75 to westbound US 50 and from eastbound US 50 would be maintained in Alternative E. Between Ezzard Charles Drive and Western Hills Viaduct, southbound I-75 would have six lanes, northbound I-75 would have five lanes, and there would be one auxiliary lane to the Western Hills Viaduct. Western and Winchell avenues would be improved to carry local traffic.

The alignment of Alternative E is similar to Hybrid Alternatives CD in that it provides a new bridge alignment just west of the existing Brent Spence Bridge. Alternative E provides two direct access points to Covington in both the northbound and southbound directions. In the northbound direction,

access would be provided by the local collector-distributor roadway at KY 12th Street and KY 5th Street. In the southbound direction, access would be provided by the local collector-distributor roadway at KY 5th Street, and off of I-71 and I-75 at KY 9<sup>th</sup> Street. Access to the interstate system from Covington would be provided by local city streets. In the northbound direction, access to I-75 would be provided at KY 9th Street, access to I-71 would be provided at KY 5th Street. Access to I-75 northbound would also be provided at KY 4th and 5th Streets through the local collector-distributor roadway across the lower deck of the existing Brent Spence Bridge. In the southbound direction, access to I-71/I-75 would be provided at KY 5th Street and KY 12th Street. All access to downtown Cincinnati from I-75 would be provided by a collector-distributor roadway that would require a decision point outside of the downtown area, KY 12th Street for northbound traffic and just south of Ezzard Charles Drive for southbound traffic. Access to I-75 northbound would be provided at OH 4th and 6th streets through the local collector-distributor roadway and at OH 9th Street through Winchell Avenue. Southbound I-75 access would be provided at Western Avenue, OH 8th Street, and OH 4th Street through the local collector-distributor roadway across the upper deck of the existing Brent Spence Bridge.

When compared to Hybrid Alternative CD, Alternative E is expected to have similar environmental impacts. Alternative E would impact three wetland areas, 10 woodlots and one potential threatened and endangered species habitat area. Alternative E would impact three community resources, two historic resources, one historic district, and four Section 4(f) properties. This is slightly fewer impacts than other conceptual alternatives. Alternative E would displace 19 residential units and 39 businesses, which is the fewest number of people displaced among alternatives. Alternative E, as with Hybrid Alternative CD, would impact Longworth Hall which includes 21 businesses. In addition, the 19 residential units estimated to be displaced to build Alternative E is expected to result in the fewest number of people displaced.

Alternative E would be compatible with existing land use plans and would not have a negative impact on community cohesion. Alternative E would be constructed within the existing interstate corridor and not bisect neighborhoods in Kentucky or Ohio. Alternative E would support the Queensgate redevelopment plans and help Cincinnati facilitate its economic renewal goals. Since the alignment of Alternative E would be located just west of the existing Brent Spence Bridge, it would impact a portion of the Duke Energy West End substation and require the relocation of 52 individual utility facilities. Alternative E would directly impact three Section 4(f) resources Goebel Park, the Lewisburg Historic District, and Longworth Hall. It could also have noise and visual impacts on one Section 4(f) resource, the Harriet Beecher Stowe Elementary School (Fox 19 Television Station).

Alternative E would encroach upon the Lewisburg Historic District along its eastern border and impact 0.98 acres of the historic district. It would displace 11 residences adjacent to the west side of I-71/I-75, one of which is a non-contributing property to the historic district. Alternative E would impact 0.54 acres of Longworth Hall resource including the building and historic boundary. The eastern end of the building would be demolished. It is expected that individual Section 4(f) evaluations would be prepared for the Lewisburg Historic District and Longworth Hall due to the adverse effects of Alternative E.

## PROJECT SCHEDULE AND CONSTRUCTION COSTS

The following is the schedule for the Brent Spence Bridge Replacement/Rehabilitation Project, which follows construction of the Mill Creek Expressway and Thru the Valley projects.

- Completion of preliminary design and NEPA process 2011
- Detailed design 2011
- Right-of-way acquisition 2012 2014
- Construction begins 2015
- Midpoint of Construction June 2017
- Completion of Construction 2020

The total estimated project costs are construction costs which include a design contingency, a construction inflation factor, right-of-way for roadway and utility relocations, major utility, and total project development costs. The table below summarizes the total estimated project costs.

## Total Cost Estimates for Mainline Alternatives in Projected Build Year Dollars

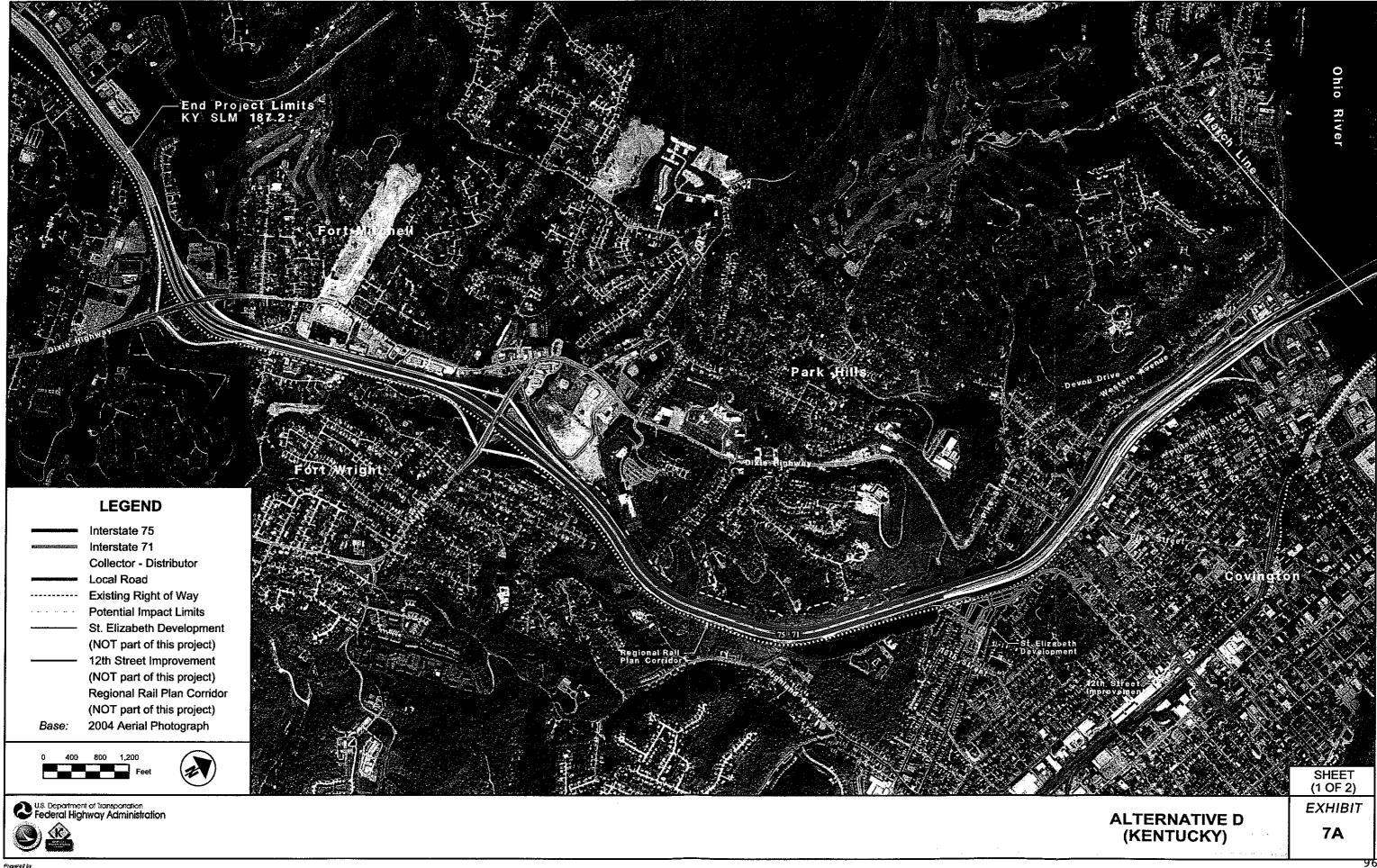
Alternative	Construction Costs (millions)	Construction Costs Inflation (59.5%) (millions)	Real Estate Costs (millions)	Utility Costs (millions)	Real Estate Utility Costs (millions)	Project Development Costs	Total Estimated Costs (millions)
Hybrid Alternative CD	\$1,261.7	\$750.7	\$18.0	\$39.4	\$1.0	\$210.4	\$2,281.2
Alternative E	\$1,431.6	\$851.8	\$15.4	\$39.4	\$1.0	\$236.3	\$2,575.5



Property PARSONS



Prepared by:



Propert by:
PARSONS
P & BRINGKERNOR



Prepared by.

DEP PARSONS

F 4-9 BRINGKERHOFF



Prepared by:
PARSONS
PER PARSONS



## VALUE ANALYSIS AND CONCLUSIONS

## INTRODUCTION

This section describes the value analysis (VA) procedure used during the VE workshop on the Brent Spence Bridge Replacement/Rehabilitation Project facilitated by Lewis & Zimmerman Associates, Inc., for ODOT and KYTC. The workshop was conducted August 24 - 26, 2009 at the Kentucky Transportation Cabinet, District 6 Office in Fort Mitchell, Kentucky. The project team provided the drawings and cost estimates for the workshop.

A systematic approach was used in the VE study, which is divided into three parts: (1) Preparation Effort, (2) Workshop Effort, and (3) Post-Workshop Effort. A task flow diagram outlining each of the procedures included in the VE study is attached for reference.

Following this description of the procedure, separate narratives and supporting documentation identify the following:

- VE workshop agenda
- VE workshop participants
- Economic data
- Cost model
- Function analysis
- Creative ideas and evaluations

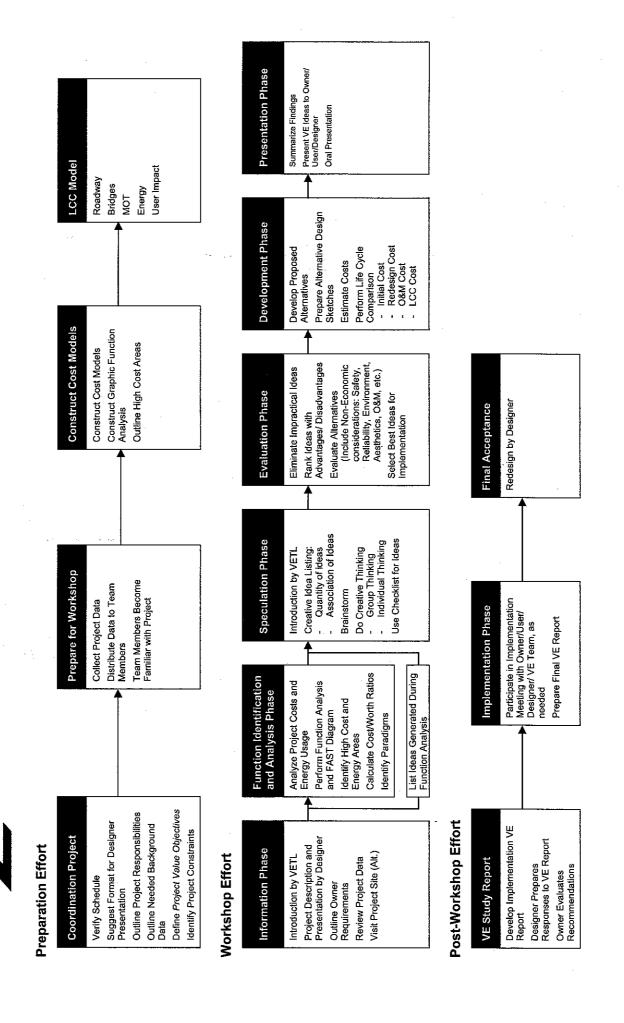
## PREPARATION EFFORT

Preparation for the workshop consisted of scheduling workshop participants and tasks and providing necessary project documents for team members to review before attending the workshop. The study documents listed below and available on the project website

(http://www.brentspencebridgecorridor.com/studydocuments.html) were used as the basis for generating VE alternatives and for determining the cost implications of the selected VE alternatives:

- Brent Spence Bridge Conceptual Alternatives Study, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated April 2009;
- Brent Spence Bridge Conceptual Alternatives C, D, and E with Typical Sections, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated April 2009;
- Brent Spence Bridge Replacement/Rehabilitation Project Advisory Committee Meeting Minutes #5, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated February 25, 2008;
- Brent Spence Bridge MOT/Constructability Report, Stages 1-5, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff;
- Brent Spence Bridge Potential Right-of-Way Impacts Drawings, Alternatives C, D, and E, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff;
- Brent Spence Bridge Potential Utilities Impacts Drawings, ODOT PID 75119, KYTC Project
   Item No. 6-17, prepared by Parsons Brinckerhoff;

# Value Engineering Study Task Flow Diagram



- Brent Spence Bridge Phase I History/Architectural Survey Ohio, ODOT PID 75119, KYTC
   Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated June 2007;
- Brent Spence Bridge Phase I History/Architectural Survey Kentucky, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated June 2007;
- Brent Spence Bridge Travel Lane Evaluation Study, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated April 2007;
- Alternative C and D (Cost) Estimate BSB Sections 1-5, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated 11/05/08;
- Alternative E (Cost) Estimate BSB Sections 1-5, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated 11/05/08;
- Brent Spence Bridge Travel Lane Evaluation Study, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated April 2007;
- Brent Spence Bridge Kentucky Conceptual Stage Relocation Report, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated February 2007;
- Brent Spence Bridge Planning Study Report, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated September 2006;
- Brent Spence Bridge Purpose and Need Report, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated May 2006;
- Brent Spence Bridge Existing and Future Conditions Report, ODOT PID 75119, KYTC
   Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated February 2006;
- Brent Spence Bridge Red Flag Summary, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated December 2005; and
- Brent Spence Bridge Public Involvement Plan, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated October 2005.

Information relating to the project's purpose and need, owner concerns, project stakeholder concerns, design criteria, project constraints, funding sources and availability, regulatory agency approval requirements, and the project's schedule and costs is very important as it provides the VE team with insight about how the project has progressed to its current state.

To prepare for this exercise, the VE team studied the study documents listed above provided by the project team. The VE Team Leader also prepared basic cost models using the Alternative C and D and Alternative E(Cost) Estimates BSB Sections 1-5, prepared by Parsons Brinckerhoff, dated 11/05/08 to distribute the total project cost among the various deliverables. The VE team used the cost models to help identify higher cost elements and elements providing little or no value to the overall project objectives.

# VALUE ENGINEERING WORKSHOP EFFORT

The VE workshop was a 3-day effort beginning with the design overview at 8:00 AM on Monday, August 24, 2009 and concluding with the VE Presentation at 2:00 PM on Wednesday, August 26, 2009. During the workshop, the VE Job Plan was followed in compliance with Federal Highway Administration guidelines for conducting a VE study. The Job Plan guided the search for alternatives to mitigate or eliminate high-cost drivers, secondary functions providing little or no value, and potential project issues or risks. Alternatives to specifically address the project team concerns and enhance value by reducing costs, improving construction schedule, and delivering required functional objectives were also considered. The Job Plan includes six phases:

Information Phase

- Function Identification and Analysis Phase
- Creativity Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

# **Information Phase**

At the beginning of the study, the decisions that have influenced the project's design have to be reviewed and understood. For this reason, the workshop began with a detailed discussion and review of the project documents including an overview by the project team. The overview highlighted the information provided in the documentation reviewed by the VE team before the workshop and expanded on it to include a history of the project's development and any underlying influences that caused the design to develop to its current state. During this presentation, VE team members were given the opportunity to ask questions and obtain clarification about the information provided.

# **Function Identification and Analysis Phase**

Having gained some information on the project, the VE team proceeded to define the functions provided by the project, identifying the costs to provide these functions, and determining whether the value provided by the functions has been optimized. Function analysis is a means of evaluating a project to see if the expenditures actually perform the requirements of the project or if there are disproportionate amounts of money spent on support functions. Elements performing support functions add cost to the project but have a relatively low worth to the basic function.

Function is defined as the intended use of a physical or process element. The team attempted to identify functions in the simplest manner using measurable noun/verb word combinations. To accomplish this, the team first looked at the project in its entirety and randomly listed its functions, which were recorded on Random Function Analysis Worksheets (provided in this section). Then the individual functions of the major components of the project depicted on the cost model were identified.

After identifying the functions, the team classified the functions according to the following:

Abbreviation	Type of Function	<u>Definition</u>
НО	Higher Order	The primary reason the project is being considered or project goal.
В	Basic	A function the must occur for the project to meet its higher order functions.
S	Secondary	A function that occurs because of the concept or process selected and may or may not be necessary.
RS	Required Secondary	A secondary function that may not be necessary to perform the basic function but must be included to satisfy other requirements or the project cannot proceed.
G	Goal	Secondary goal of the project.
O	Objective	Criteria to be met.
LO	Lower Order	A function that serves as a project input.

Higher order and basic functions provide value, while secondary functions tend to reduce value. The goal of the next job phase is to reduce the impact of secondary functions and thereby enhance project value.

The VE team used the cost model previously prepared to seek out the areas where most of the project funds are being applied. Because of the magnitude of these high-cost elements or functions, they also became initial targets for value enhancement.

Overall, these exercises stimulated the VE team members to focus on apparently low value areas and initially channel their creative idea development in these places.

# **Creativity Phase**

This phase involved the creation and listing of ideas. The VE Team began by identifying the highest cost project elements with a high absolute cost compared to other elements in the project, and secondary functions providing little or no value. Then, using the classic brainstorming technique, the VE team began to generate as many ideas as possible to provide the necessary functions at a lower total life cycle cost, or to improve the quality of the project. Innovative ideas for reducing costs and delivering required functional objectives were encouraged. At this stage of the process, the VE team was looking for a large quantity of ideas and free association of ideas. A Creative Idea Listing worksheet was generated and organized by the project element being addressed.

The project team may wish to review these creative lists since they may contain ideas that were not pursued by the VE team but can be further evaluated for potential use in the design.

# **Evaluation Phase**

Since the goal of the Creativity Phase was to conceive as many ideas as possible without regard for technical merit or applicability to the project goals, the Evaluation Phase focused on identifying those ideas that do respond to the project value objectives and are worthy of additional research and development before being presented to the owner. The selection process consisted of the VE team evaluating the ideas originated during the Creativity Phase. The following criteria were identified and used as a basis during the evaluation of each idea.

- No lane shall be over capacity
- No lane shall have substantial unused capacity
- No lane shall have more than two destinations
- No lane shall have more than one merge, diverge, or weave as a result of a local entrance or exit
- Lane endings shall end on the right of through lanes to avoid weaves
- Lane beginnings shall begin on the right of through lanes to avoid weaves
- All lanes could operate as separate, independent roadways relevant to other local roadways
- The new design shall meet FHWA noise abatement criteria (NAC) as outlined in 23 (CFR), Part 772
- The new design shall be developed in accordance with the geometric design criteria requirements of both KYTC and ODOT (See Conceptual Alternatives Study Table 4, pages 33-36)

The VE team rated each idea by consensus according to the following approach. A scale of 1 to 5 was used, with 5 or 4 indicating an idea with the greatest potential to be technically sound and provide cost

savings or improvements in other areas of the project with minimal risk, 3 indicating an idea that provides marginal value but could be used if the project was having budget problems, 2 indicating an idea with a major technical flaw, and 1 indicating an idea that does not respond to project requirements. Generally, ideas rated 4 and 5 are pursued in the next phase and presented to the owner during the Presentation Phase.

The team also used the designation "DS" to indicate a design suggestion, which is an idea that may not have specific quantifiable cost savings but may reduce project risk, improve constructability, help to minimize claims, enhance operability, ease maintenance, reduce schedule time, or enhance project value in other ways. Design suggestions could also increase a project's cost but provide value in areas not currently addressed. These are also developed in the next phase of the VE process.

# **Development Phase**

In this phase, each highly rated idea was expanded into a workable solution designated as a VE alternative. The development consisted of describing the current design and the alternative solution, describing the advantages and disadvantages of the proposed alternative solution, and writing a brief narrative to compare the original design to the proposed change and provide a rationale for implementing the idea into the design. Sketches and design calculations, where appropriate, were also prepared in this part of the study. The VE alternatives are included in Section Two of this report.

### **Presentation Phase**

The presentation was held at 2:00 PM on Wednesday, August 26, 2009. The goal of the presentation was to provide the attendees with an overview of the suggestions for value enhancement resulting from the VE study and afford them the opportunity to ask questions to clarify specific aspects of the alternatives presented.

### POST-WORKSHOP EFFORT

The post-workshop portion of the VE study consisted of the preparation of this VE Study Report. Members of the project team will analyze each alternative and prepare a short response, recommending incorporation of the alternative into the project, offering modifications before implementation, or presenting reasons for rejection. LZA is available at your convenience as you review the alternatives. Please do not hesitate to call on us for clarification or further information as you consider an implementation approach.

# VALUE ENGINEERING WORKSHOP AGENDA

Lewis & Zimmerman Associates, Inc. will conduct a four-day value engineering (VE) workshop August 24-26, 2009 for the Brent Spence Bridge Replacement/Rehabilitation Project (ODOT HAM-71/75-0.00/0.22 PID 75119, KYTC Project Item No. 6-17).

The VE workshop will be conducted at:

Kentucky Transportation Cabinet District 6 Office 421 Buttermilk Pike Ft. Mitchell, Kentucky 41017

Alfred B. Craig and Duane Phelps from Parsons Brinckerhoff will share a detailed presentation of the project at the beginning of the VE workshop and be available by telephone during the workshop to answer any questions.

The following persons shall be in attendance as VE Team Members:

ODOT Project Manager

KYTC Project Manager

KYTC Project Manager

KYTC Project Manager

ODOT Highway Design

ODOT Maintenance of Traffic

Stefan Spinosa, District 8 Production

John Eckler, District 6 Highway Design

Rob Hans, District 6 Chief Engineer

John Otis, District 8 Production

Walter Bernau, District 8 Construction

ODOT Maintenance of Traffic Reynaldo Stargell C. O. Traffic Engineering (1st/4th day)

ODOT Traffic Control Jay Hamilton, District 8 Planning/Programming

KYTC Structures

J.C. Pyles, Structural Design Office
ODOT Structures

Chris Howard, District 8 Production

ODOT Structures Jeff Crace, C.O. Structural Engineering (1st/4th day)

KYTC Geotech Darrin Beckett, C.O. Division of Materials ODOT Geotech Joe Smithson, District 8 Production

KYTC Construction
KYTC Construction
KYTC Construction
CODOT Construction

Kevin Rust, District 6 Construction
Nasby Stroop, C.O. Construction
Joe Bassil, District 8 Construction

ODOT Environmental Keith Smith, District 8 Planning/Programming

Real Estate - TBA

ODOT Program Manager Scott Phinney, C.O. Systems Planning & Prog. Mgmt. (on call)

ODOT Estimating C.O. Office of Estimating (on call)

Ohio FHWA Mark Vonder Embse, Transportation Area Engr. & VE Coordinator

Kentucky FHWA Bernadette DuPont

Kentucky FHWA Scott Wolf

ODOT VE Coordinator Jeanne Braxton, C.O. Office of Production (1st/4th day)

KYTC VE Coordinator Siamak Shafaghi (1st day)

VE Facilitator Steve Havens, P.E., C.V.S., Lewis & Zimmerman Associates

Design Group – Parsons Brinckerhoff Alfred B. Craig (Project Manager)

Duane Phelps (Design Lead)

# **AGENDA**

# Monday, August 24, 2009

7:45 am – 8:00 am

**VE Team Informal Gathering** 

(VE Team)

VE team gathers for informal introductions

VE team prepare questions for Parsons Brinckerhoff

8:00 am - 8:10 am

Welcome, Introduction and Objectives

(All Participants)

Welcome: Opening Remarks and Introduction of Participants Overview of the VE Process, Workshop Organization and Agenda

Review VE Workshop Objectives and Goals

8:10 am - 10:30 am

**Design Team Detailed Presentation** 

(All Participants)

Overview, Scope, and Project Requirements

Key Design Issues for all Disciplines

Development Plan Review and Updated Opinion of Probable Project Cost

Design Team fields VE Team questions

10:30 am - 12:00 pm

**Function Analysis Phase** 

(VE Team)

Identify Project Constraints and Key Issues Identify basic and secondary functions Analyze cost model(s) and worth assignments Identify and Quantify Project Risks

12:00 pm - 1:00 pm

Lunch

1:00 pm - 4:15 pm

**Creative Phase** 

(VE Team)

4:15 pm - 4:30 pm

**Daily Wrap-up Session** 

(VE Team)

# Tuesday, August 25, 2009

8:00 am - 10:00 am

**Complete Creative Phase** 

(VE Team)

Brainstorm to generate ideas through free association. Defer judgment.

10:00 am - 12:00 pm

**Evaluation Phase** 

(VE Team)

Establish the criteria for evaluation and rate each idea on a scale of 1 to 5, identifying the "best" ideas for development. Assign ideas rated 4 or higher to team members for development.

12:00 pm - 1:00 pm

Lunch

1:00 pm - 4:15 pm

**Development Phase** 

(VE Team)

The VE team develops creative ideas into value engineering alternatives with sketches, calculations and written justifications. Initial and life-cycle cost estimates comparing baseline and proposed designs will be prepared

4:15 pm - 4:30 pm

**Daily Wrap-up Session** 

(VE Team)

# Wednesday, August 26, 2009

8:00 am - 12:00 pm

**Development Phase (continued)** 

(VE Team)

The VE team continues developing creative ideas into value engineering alternatives with sketches, calculations and written justifications. Initial and life-cycle cost estimates comparing baseline and proposed designs will be prepared.

12:00 pm - 1:00 pm

Lunch

1:00 pm - 2:00 pm

**Complete Development Phase** 

(VE Team)

The VE team summarizes the findings into the Summary of Potential Savings and prepares for the outbriefing presentation.

2:00 pm - 3:00 pm

**Presentation Phase** 

(All Participants)

The VE team presents the value engineering alternatives to the design team and the ODOT representatives. A draft copy of the Summary of Potential Savings will be distributed.

3:00 pm - 3:30 pm

Wrap-up/Adjourn

(VE Team)

# **OUTLINE FOR VE TEAM PRESENTATION**

The design is influenced by outside input from many sources. In order to perform its work most efficiently, the value engineering team needs to understand the factors that have influenced the RFP development. The object is to avoid duplication of efforts and to aid the team in becoming familiar with the project.

To achieve this objective, the Project Team is asked to give a brief overview at the beginning of the VE workshop session. To assist the Project Team, we have outlined the information that, as a minimum, should be addressed:

- Scope of the Designer's effort
- Existing site conditions
- Design concepts for project (including alignment, right-of-way, maintenance of traffic, environmental mitigation, erosion and sedimentation control, structures, etc).
- Constraints
- Summary of cost estimate
- Construction phasing
- Pertinent information from public participation
- Issues/Concerns/Risks

# VALUE ENGINEERING WORKSHOP PARTICIPANTS

The VE team was organized to provide specific expertise in the unique project elements involved with the Brent Spence Bridge Replacement/Rehabilitation Project. The multidisciplinary team comprised professionals with highway design, geometrics, structural engineering, traffic control, construction, transportation engineering, and cost estimating experience and a working knowledge of VE procedures. The following is a list of the VE team members:

<u>Participant</u>	<b>Specialization</b>	<u>Affiliation</u>
Stefan Spinosa	Highway Design	ODOT District #8 Project Manager
John Eckler	Highway Design	KYTC District #6 Project Manager
Rob Hans	Highway Design	KYTC District #6 Chief Engineer
John Otis	Highway Design	ODOT District #8 Production
Walter Bernau	Construction/MOT	ODOT District #8 Construction
Reynaldo Stargell	MOT	ODOT C.O. Traffic Engineering
Jay Hamilton	Traffic	ODOT District #8 Planning & Programming
J.C. Pyles	Structures	KYTC Structural Design Office
Chris Howard	Structures	ODOT District #8 Production
Jeff Crace	Structures	ODOT C.O. Structural Engineering
Darrin Beckett	Geotechnical	KYTC C.O. Division of Materials
Joe Smithson	Geotechnical	ODOT District #8 Production
Kevin Rust	Construction	KYTC District #6 Construction
Nasby Stroop	Construction	KYTC C.O. Construction
Keith Smith	Environmental	ODOT District #8 Planning and Programming
Bernadette DuPont	FHWA	Kentucky FHWA
Scott Wolf	FHWA	Kentucky FHWA
Siamak Shafaghi	VE Coordinator	KYTC C.O. Production
Jeanne Braxton	VE Coordinator	ODOT C.O. Office of Production
Stephen Havens, CVS	VE Team Leader	Lewis & Zimmerman Associates

# **DESIGNER'S PRESENTATION**

An overview of the project was presented at 8:00 AM on August 24, 2009 by the design team from Parsons Brinckerhoff. The purpose of this design overview, in addition to being an integral part of the Information Phase of the VE study, was to bring the VE team "up to speed" regarding the overall project specifics. Additionally, the overview afforded the project team the opportunity to highlight in greater detail those areas of the project requiring additional or special attention. An attendance list for the design presentation is attached.

# VALUE ENGINEERING TEAM'S PRESENTATION

The VE Team's presentation was held at 2:00 PM on August 26, 2009. The purpose of the meeting was to provide the attendees with an overview of the suggestions for value enhancement resulting from the VE study and afford them the opportunity to ask questions to clarify specific aspects of the alternatives

presented. Copies of the Draft Summary of Value Engineering Alternatives were provided to the attendees. An attendance list for the meeting is attached.

# **DESIGNER'S PRESENTATION**



# **MEETING PARTICIPANTS**

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

DATE: AUGUST 24, 2009

Kentucky Transportation		
NAME & E-MAIL (please print)	ORGANIZATION/TITLE	PHONE/FAX
STEPHEN HAVENS, CVS		ph <i>608-4</i> 38- <i>8</i> 22 <i>7</i> mob
em shavens @ Iza.com	VE TEAM LEADER	fx
Keith Smith	ODOT District 8	ph =13 933 6590 mob
em keith. smith @ dut, state who us	Acting Planning Etnu Eng.	fx
John Otis	OPOT District 8	ph <i>513-933-6199</i> mob
em John. Otis @dot. state. oh. us	Transportation Engineer 2	fx
Walter Berna-	0007 0.26	ph 5/3 933-65/8 mob 5/3 520-0298
em Walter Bernaul dot state oh. u	Post Work Zun. Troffic Gatale	fx
Stefan Spinosa	OPOT Dist 8	ph 513-733-6637 mob
stefan. spinose @ dot. state. oh us	BSB Project Manager	fx
Doug Miller	ODOT Dist. 8	ph 5/3-137-6603 mob \$
em doug millere dot state oh . us	Production Administrator	mob # fx 5/3-933-8252
Joe Smithson	ODOT District 8	ph 513-933-6707 mob
em TOC. Smithsone dot state duns	Geotechnical Engineer	fx 5/3-933-8252
Joe. Smithsove dot. state. on. us	ODOT - C.O. Bridges	ph 614-56-1744
em ; off. crace O dof. state. wh. c	s Design	fx
John Eckler	KYTC - DG Desyi	ph 859 - 341 - 2700 mob
em John. Eckler @ Ky. gov		fx
Reynaldo Stargell	ODOT C.O. Traffic	ph 614-644-8177 mob
em reynaldo.stargell@dot.state.oh.u	Transportation Engineer	fx 614-644-8199

# DESIGNER'S PRESENTATION



# **MEETING PARTICIPANTS**

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

**DATE: AUGUST 24, 2009** 

Ohio Department of Transportation PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

NAME & E-MAIL (please print)	ORGANIZATION/TITLE	PHONE/FAX
FRED CRAIG	PSESONS BEWESPHORE	ph 5136392121 mob
em CRAIG B PBWORLD	on lice president	fx
DUANE PHÉLPS	Parsons BrincherHOFF	ph 513-639-2138 mob
em PHELPSD@PBWORLO.com		fx 513-421-1040
G. JEANNE BRAKTON	ODOT- C.O. PRODUCTION	
em SEANNE BRAXTON @ DOT STATE OH.	s Value Eigeneer Coord.	mob fx 6/4-752-6405
CHRISTOPHER HOWARD	ODUT - D8 PRODUCTION	ph 513-433-6605
em ODUT D-8  CHRUSTOPHER. HARRIDE OH.US		fx ·
Nasby Stroop	KYTC - C.O. Cunstruction	ph 522-564-4780 mob
em nasby, stroop exy-sov		fx
Jc. Pyles	KyTC-Streetows	ph 502.564-4560 mob
em Jc. Ryleso Ky. Gov		fx
Kevin Rust	1	ph 859-341-2700
em Kavin. rust@Ky. gov	KYTC D-6 Construction and Maintenance	mob fx 859 -34/-3661
VALERIE POBBINS	PARSONS BRINCKERHOFF	ph 513.639.2153
em robbins v@poworld. com	PLANNER	mob fx
Beenswette Dupmit		ph 5.2-223-6729
em bernedette dupros edotique	TRANSPORTATION SPECICLY	mob fx
SOTT WOLF	FHW4 -1KY	ph(502) 223 - 6734
em Scott. wolf @ dot.gov	TRANSACTATION ENGINEER	mob (502) 223-6735

# DESIGNER'S PRESENTATION



**MEETING PARTICIPANTS** 

PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

DATE: **AUGUST 24, 2009** 

Kentucky Transportation	Cabinet	
NAME & E-MAIL (please print)	ORGANIZATION/TITLE	PHONE/FAX
Darrin Beckett	KYTC Geotech Branch	ph 502-564-2374 mob
em darrin. Decketta ky.gov	Transportation Eng. Specialist	fx 502-564-4839
ROB HAMS	Kyrc D.6	ph 859 341-2707 x256 mob 859 360-1156
em Robert. Hanse Ky. Gov	Chief District Engineer	fx 559 341-3661
SIAMAK SHAFAGHI	KYTO_VE	ph (502) 564 - 3280 mob
em Siamak. Shafaghi@KY.gov	CENTRAL OFFICE	fx(502)564-3324
JAY HAMILTON	0001 08	ph373 933 C584 mob
emjay, hamiltonedotistate.ch.us	PLANNING	fx573.932.93/L
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# **VE TEAM PRESENTATION**



PROJECT: HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation PROJECT ITEM NO. 6-17

PROJECT ITEM NO. 6-17
Kentucky Transportation Cabinet

DATE: AUGUST 26, 2009

NAME - E:MAIL (please print)	ORGANIZATION: TITLE	PHONE:
JAY HAMILTON	DDOT DIST. 8 PLANNING	ph 573 933 6584 mob
em jay.ham. Honed ot. state. oh. us	TRAFFIC PLANNING ENGL	fx 5739329366
And Fluezemann edot state obus	ODOT D-8 Acting Planning Administrator	ph 373 9336597 mob fx
DOUG MILLER	ODOT D-8	ph 5/3 933-6603
em dang miller a dot. Stak.ok.us	Production Administrator	fx
SIAMAK SHAFAGHI	Acting VE coordinator	ph(502) 564 - 3280 mob
em Siamak. Shafaghi @Ky.gov	KYtC	fx (502) 564-332-4
Keith Smith	000T D-8	ph 513 933 6590 mob
em keith, sm. the edot, state, oh, us	Heting Planning & law. Eng	fx
seff Crace	ODOF C. U.	ph 614-466-2744 mob
G. JEANNE BRAXTON	Structures ODOT-C.O. PRODuction	fx
G. JEANNE BRAXTON  em SEANNE BRAXTONE dot SATE Ch.US		ph 614-466-1373 mob fx 614-752-6405
John Eckler	KYTC D6 Design	ph 859-341-27-00
em John. Eckler & Ky. you	Ki io bo bosqu	mob fx
Stacee Hans	KYTC D6 Environmental	ph(859) 341- 2700
em Stacee. Hans@ky.gov		fx
Bob Yeagen		ph mob
em Robert Yeager EKY. 90 V	KYTC DA ROSSON	fx

# **VE TEAM PRESENTATION**



PROJECT: HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation PROJECT ITEM NO. 6-17

Kentucky Transportation Cabinet

DATE: AUGUST 26, 2009

NAME TARKE /place print	ODOANIZATIONI TITI E	DUANE.
NAME - E:MAIL (please print)	ORGANIZATION: TITLE	PHONE:
Stefan Spinosa	ODOT DB	ph 513-933-6639
em , /		mob fx
5 te fam. Spihosa @dot. Shak.oh.us		
Joe Smithson	ODOT D8	ph 5/3-933-6707
em		mob fx
joe.smithson@dot.state.oh.us		
Walter Bernau		ph 5/3 933-65/8 mob
em	0007 DB	fx
Welter Bernan Codof what who we some	000,00	ph 513-933-6199
Suna UTIA	OPOT 08	mob
em John, Otis @ dot. state. oh. us	0001 08	fx
CHRISTOPHER HOWARD		ph 513-933-6605
CHICISTOP HOLD HOWKING		mob
em Christopher. Howard exot. STATE.	PH.US	fx
SCOTT WOLF		ph (502) 223-6734
	FHWA - KY	mob
em scott. wolf@dot.gov	TRINSPORTATION ENGINEER	fx (502) 223 - 6735
JC Pyles	LTC - Div Str	ph 502 58 \$4560
em ic Quience con	CIC - 210 737	mob
em jc. Pylosok, Ga		fx
Nasby Stroop	KTTC-C.a. Construction	ph 52-564-4786
em nusby. Strong exy. gov	R/12 E.o. Canalization	<u>.</u>
		fx
Kevin Rust	KATE D-6 Construction	ph 359-341-2700 mob 859-380-115-2
em Kavin. rustæky, gov	KYTC US CONSTRUCTION	fx 859 - 341 - 3661
Darrin Beckett	KYTC - C.O.	ph 502-564-2374
em darrin. beckett a kyigou	Geotechnical Branch	mob fx 502-564-4839

# **VE TEAM PRESENTATION**



PROJECT: HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation PROJECT ITEM NO. 6-17 Kentucky Transportation Cabinet

DATE: AUGUST 26, 2009

NAME - E:MAIL (please print)	ORGANIZATION: TITLE	PHONE:
em CRAIG @ PBWORLD.COM	PB	ph 5/3-639-2138 mob fx
FRED CRAIG	P/3	ph 513-639-3131 mob fx
STEPHEN HAVENS	LZA VE TEAM LEADER	ph mob 608-438-8227 fx
em		ph mob fx

# **ECONOMIC DATA**

The comparisons of life cycle costs between the VE alternatives and the current design solutions were performed on the basis of discounted present worth. To accomplish this, the VE team developed economic criteria to use in its calculations based on information gathered from the Alternative C and D, and Alternative E (Cost) Estimates BSB Sections 1-5, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated 11/05/08. The following parameters were used when calculating discounted present worth:

Year of Analysis: 2008

Construction Start Date: 2015

Construction Mid-Point: June 2017

Construction Completion: 2020

Construction Duration: 5 seasons

Contingency (Inflation Cost Percentage): 59.5%

The VE Team used a 59.5% markup as the baseline when preparing VE alternative cost worksheets based upon the Brent Spence Bridge Conceptual Alternatives Study Section 6.4.3.

# **COST MODEL**

The VE team leader prepared Cost Histograms or Pareto charts for the project that follows this page. The Cost Histograms display the major construction elements in descending order of magnitude identified in Alternative C and D, and Alternative E (Cost) Estimate BSB Sections 1-5, ODOT PID 75119, KYTC Project Item No. 6-17, prepared by Parsons Brinckerhoff, dated 11/05/08.

From the Alternative C and D cost models it can be seen that approximately 97.5% of the \$2.28 billion estimated construction cost is represented by the following project elements:

•	Structures	38.85%
•	Roadway	23.20%
•	Design Engineering	18.92%
•	General Conditions	5.39%
•	Pavement	3.98%
•	Maintenance of Traffic	3.02%
•	Noise Barrier	2.13%
•	Retaining Walls	2.06%

From the Alternative E cost models it can be seen that approximately 99.1% of the \$2.58 billion estimated construction cost is represented by the following project elements:

•	Structures	40.43%
•	Roadway	22.19%
•	Design Contingency	18.94%
•	General Conditions	5.30%
•	Pavement	3.79%
•	Maintenance of Traffic	2.66%
•	Retaining Walls	2.48%
•	Noise Barrier	2.01%
•	Drainage	1.31%

This cost model information was used to help prioritize the areas of focus during the creative phase of the workshop.



PROJECT: HAM-71/75-0.00 Ohio Departme Project Item N Kentucky Transj	nt Of Transpo o. 6-17	rtation					•			500
lybrid Alternative CD - Total Projec	t Summary							COST	PERCENT	CUM. PERCENT
Structures								490,109,955	38.85%	38.859
Roadway								292,778,037	23.20%	62.059
Design Contingency								238,729,497	18.92%	80.979
General Conditions .								68,055,079	5.39%	86.379
avement	<u>.</u>						L	50,155,627	3.98%	90.349
Maintenance of Traffic							L	38,050,000	3.02%	93.369
Voise Barrier							<u>L</u>	26,890,905	2.13%	95.499
Retaining Walls							-	25,949,714	2.06%	97.549
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Kentucky Transp	ortation Cabine	et							<del>1</del> 1	C1114
SB Alt CD - Total Project Summary								COST	PERCENT	CUM. PERCENT
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General Conditions				•			_	75,837,20	5.30%	86.86
avement								54,276,70		90.65
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Retaining Walls							_ _	35,494,64		95.78
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# **FUNCTION ANALYSIS**

A random function analysis of the Brent Spence Bridge Replacement/Rehabilitation Project was performed to (1) understand the project purpose and need, (2) define the requirements for each project element, (3) ensure a complete and thorough understanding by the VE team of the basic functions needed to attain the given project purpose and need, (4) identify other goals, and (5) identify secondary functions that should be addressed by the VE team. The Random Function Analysis worksheet completed by the team for the project in its entirety and the various elements follow.

The key opportunity areas for potential value engineering betterments and cost avoidance established during the function analysis session includes the following:

- Maintenance of Traffic
  - Reroute Traffic
  - o Identify Contractor Lay-Down Area
- Roadway
  - Adjust Roadway Alignment
  - o Reduce Right-of-Way
  - o Reduce Excavation Requirements
  - o Protect Slope
- Pavement
  - Improve Emergency Response Vehicle Access
  - o Minimize Impacts to Parks/Historic Areas
  - o Improve Access to Cincinnati/Covington
  - o Increase Utilization of Clay Wade Bailey Bridge
- Structures
  - Use Tie-Back Walls
  - Mitigate Willow Run Sewer Structural Impacts
  - Reduce New Bridge Width

# RANDOM FUNCTION ANALYSIS



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

Project Item No. 6-17

Kentucky Transportation Cabinet

SHEET NO.: 1 of 3

	FUNCTION		
DESCRIPTION	VERB	NOUN	KIND
TOTAL PROJECT (NEEDS & PURPOSE)	Improve	Level of Service	НО
	Improve	Traffic Flow	НО
	Increase	Capacity	В
	Enhance	Safety	НО
	Correct	Geometric Deficiencies	RS
	Meet	Current Design Standards	<b>B</b>
	Reduce	Crash Rates	НО
	Improve	Key Connections	RS
	Improve	Access	G
	Increase	Distance Between Access Points	RS
	Maintain	Local Access Connections	RS
	Increase	Design Speed	0
	Meter	Ramps	S
	Accommodate	Trucks	RS
	Separate	Local Traffic	RS
PAVEMENT	Replace	Damaged Pavement (Full Depth)	RS
	Replace	Ramps	RS
	Add	Lanes	RS

Function defined as:

Action Verb Measurable Noun

Kind:

Basic

Secondary

RS = Required Secondary

LO = Lower Order O = Objective

HO = Higher Order G = Goal

# **RANDOM FUNCTION ANALYSIS**



PROJECT:

HAM-71/75-0.00/0.22, PID 75119

Ohio Department of Transportation

Project Item No. 6-17

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SHEET NO.: 2 of 3

		FUNCTION		
DESCRIPTION	VERB	NOUN	KIND	
STRUCTURES	Separate	Grade	RS	
	Span	Riverway	В	
	Span	Railroad	В	
	Span	Utilities	В	
-	Span	Historic Sites	RS	
	Access	Community	НО	
	Connect	Points	В	
	Convey	Traffic	В	
	Retain	Soil	RS	
	Construct	Facility	RS	
·	Rehabilitate	Existing Facility	G	
ROADWAY	Prepare	Roadway	В	
	Remove	Pavement	RS	
	Excavate	Soil/Rock	RS	
•	Excavate	Hazardous Materials	RS	
	Borrow/Fill	Embankment	RS	
	Install	Permanent Barriers	RS	
	Treat	Sub-grade	RS	
	Salvage	Existing Pavement	G	
DRAINAGE	Tennefor	Ctomm-roto-	D	
VAMINAGE	Transfer	Stormwater	В	
	Control	Discharge	RS	

Function defined as:

Action Verb Measurable Noun Kind:

B = Basic

HO = Higher Order

G = Goal

S = Secondary RS = Required Secondary LO = Lower Order

O = Objective

# **RANDOM FUNCTION ANALYSIS**



PROJECT:

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SHEET NO.: 3 of 3

		FUNCTION		
DESCRIPTION	VERB	NOUN	KIND	
DRAINAGE (Continued)	Separate	Sanitary Sewage	RS	
	Manage	Stormwater Quality	В	
	Manage	Stormwater Quantity	В	
MAINTENANCE OF TRAFFIC	Maintain	Traffic	В	
	Maintain	Interchange Access	RS	
	Reroute	Traffic	RS	
	Assure	Safety	В	
	Maintain	3 lanes in Ohio	RS	
	Maintain	2 lanes in KY	RS	
GENERAL	Reduce	Right-of-Way	G	
	Avoid	Utilities	G	
	Relocate	Utilities	RS	
	Avoid	Gasline	G	

Function defined as:

Action Verb

Kind:

B = Basic

HO = Higher Order

G = Goal

Measurable Noun

S = Secondary LO = Lower Order

# CREATIVE IDEA LISTING AND EVALUATION OF IDEAS

During the Creativity Phase, numerous ideas were generated for the Brent Spence Bridge Replacement/ Rehabilitation Project using conventional brainstorming techniques. These ideas were recorded and are shown with their corresponding ranking on the attached Creative Idea Listing Worksheets. For the convenience of tracking an idea through the VA process, the ideas were grouped according to the following project elements and numbered in the order in which they were conceived. The following letter prefixes were used to identify the project elements.

PROJECT ELEMENT	PREFIX
Maintenance of Traffic	МОТ
Roadway	R
Pavement	P
Structures	S

# **Creative Idea Evaluation**

After discussing each idea, the team evaluated the ideas by consensus. This effort produced 11 ideas rated 4 or 5 to research and develop into VE alternatives and 10 ideas to develop as design suggestions to be included in the Section Two of the report. Ideas that were not developed further may have been combined with another related idea or discarded as a result of additional research indicating the concept as not being cost effective or technically feasible. The project team is encouraged to review the Creative Idea Listing and Evaluation worksheet since it may suggest additional ideas that can be applied to the design.

# **CREATIVE IDEA LISTING**



PROJECT: **HAM-71/75-0.00/0.22, PID 75119** 

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SHEET NO.: 1 of 3

	Kentucky Transportation Cabinet	
NO.	IDEA DESCRIPTION	RATING
	MAINTENANCE OF TRAFFIC (MOT)	
МОТ-1А	For all options in Kentucky, replace the shoulders on I-471 southbound with full depth pavement to support rerouting of traffic during construction.	5
MOT-1B	For all options in Kentucky, replace the shoulders on I-471 southbound with full depth pavement to support rerouting of traffic during construction.	
MOT-1C	For all options in Kentucky, replace the shoulders on I-471 southbound with full depth pavement to support rerouting of traffic during construction.	5
МОТ-2	For all options in Ohio, add alternative Newport exit signing from I-71 via US 27 to reroute traffic during construction.	DS
МОТ-3	For all options, identify northbound and southbound locations for safe pull-off for overweight vehicle enforcement.	2
MOT-4	For all options, indentify acceptable contractor lay-down areas and access routes for use during constructions.	DS
МОТ-5	Develop a staging strategy which would allow the new bridge to be constructed later or as a separate project, if needed.	1
МОТ-6	Consider banning truck access during construction.	2
	ROADWAY (R)	
R-1	For all options, realign Section 1 near the hill to the east to reduce excavation requirements.	
R-2	Specify that recycled concrete pavement is acceptable for use as sub-grade stabilization in Kentucky.	DS
	PAVEMENT/RAMPS (P)	
P-1	For all options, eliminate the braid on northbound I-75 between Kyle's Lane and Dixie Highway.	3
P-2	Incorporate the Alternative E design in Kentucky with the Hybrid Alternative CD design in Ohio to provide two direct interstate access points in Covington.	3
P-3	In Alternative E, replace the 5 <sup>th</sup> Street northbound ramp to I-71 in Kentucky with an indirect ramp connection from the collector-distributor roadway to I-71 in Ohio.	
P-4	For all options, improve access to Covington from I-71/I-75 by changing 4 <sup>th</sup> and 5 <sup>th</sup> streets from one-way pairs to two-way traffic west of Main Street.	2

Rating:  $1 \rightarrow 2$  = Not to be developed  $3 \rightarrow 4$  = Varying degrees of development potential 5 = Most likely to be developed DS = Design suggestion ABD = Already being done

# **CREATIVE IDEA LISTING**



HAM-71/75-0.00/0.22, PID 75119 PROJECT:

Ohio Department of Transportation

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Rating:  $1\rightarrow 2$  = Not to be developed

DS = Design suggestion

SHEET NO .:

2 of 3

NO.	IDEA DESCRIPTION	RATING
	PAVEMENT/RAMPS (Continued)	
P-5	Eliminate the KY 9 <sup>th</sup> Street intersection with the collector-distributor roadway from all options.	DS
P-6	Add a ramp to access northbound I-75 from 6 <sup>th</sup> Street in Ohio in the Hybrid Alternative CD design.	2
P-7	In the Hybrid Alternative CD, identify a shorter route for emergency responses from the Fire Station at 5 <sup>th</sup> Street and Central Avenue to the Fort Washington Way Trench.	DS
P-8	In the Hybrid Alternative CD, provide a direct connection from the southbound collector-distributor to 2 <sup>nd</sup> Street in Ohio and add an additional connection to the US 42/3 <sup>rd</sup> Street Intersection to improve access and increase the utilization of the Clay Wade Bailey Bridge.	4
P-9	Clarify the negative impacts to I-71/I-75 interstate access in Covington by providing collector-distributor roadway access from Kentucky to northbound I-71 in Ohio.	Combine with P-3
P-10	In the Hybrid Alternative CD, provide access from Winchell Avenue just north of Ezzard Charles Drive to northbound I-75.	4
P-11	In the Hybrid Alternative CD, update the cost estimate to reflect the additional lane on the I-75 mainline.	DS
P-12	Use a shorter barrier design or provide short length crossovers for emergency vehicle access on one-way section areas on bridges and mainlines.	2
P-13	In Alternative E, shift the collector-distributor roadway to minimize impacts to Goebel Park and avoid relocating the radio station tower.	
P-14	Provide improvements to Alternative E to reduce business impacts in Ohio.	
P-15	Adjust the profile of the collector-distributor roadways under Kyle's Lane to provide adequate vertical clearance under the haunched girders.	
P-16	Provide an emergency crossover between Ezzard Charles Drive and 12 <sup>th</sup> Street in Kentucky.	2
	STRUCTURES (S)	
S-1	In the Hybrid Alternative CD, provide an exit from northbound I-75 to Ezzard Charles Drive similar to that shown in the Alternative E design.	
S-2	With all options, use tie-back walls on the west side of southbound KY I-75 and in other applicable areas in Kentucky to reduce excavation and right-of-way requirements.	DS

 $3\rightarrow 4$  = Varying degrees of development potential

ABD = Already being done

5 = Most likely to be developed

# **CREATIVE IDEA LISTING**



PROJECT: **HAM-71/75-0.00/0.22, PID 75119** 

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Rating:  $1 \rightarrow 2$  = Not to be developed

DS = Design suggestion

Kentucky Transportation Cabinet

SHEET NO.:

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VO.	IDEA DESCRIPTION	
	STRUCTURES (S) Continued	
S-3	Consider slope stabilization in the area near Crescent Avenue during Stage 2 construction.	ABD
S-4	With all options, provide a means to mitigate potential structural impacts to the Willow Run Sewer during construction.	DS
S-5	For all options, use a single deck bridge for I-75 only in lieu of a double deck bridge and keep I-71 on the existing bridge.	1
S-6A	For the Hybrid Alternative CD, adjust the lane configurations on each deck of the new bridge to save one lane per deck.	4
S-6B	For Alternative E, make the traffic operations directional on each deck of the new bridge to save one lane per deck.	4
S-7	Use drilled shafts or auger cast piles in lieu of driven piles to prevent potential damage to the existing gas line during construction.	2
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 $3\rightarrow 4$  = Varying degrees of development potential

ABD = Already being done

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5 = Most likely to be developed