

Executive Summary

Louisville Southern Indiana Ohio River Bridges Project

Bridge Type Selection Report



Section 5 East End Bridge

RECOMMENDED
ALTERNATIVE



October 2006

RECOMMENDED
ALTERNATIVE



Submitted by:



RECOMMENDED
ALTERNATIVE



The East End Bridge

This document summarizes the results of a four-step Bridge Type Selection Process (BTSP) to assist the Executive Bridge Selection Committee in selecting one of the bridge alternatives to be constructed across the Ohio River connecting Prospect, Kentucky and Utica, Indiana.

This report contains vital information necessary to make such a decision. The 3 recommended bridge alternatives presented here are the result of public feedback received during the course of the BTSP, combined with the project's mandatory requirements and budget.

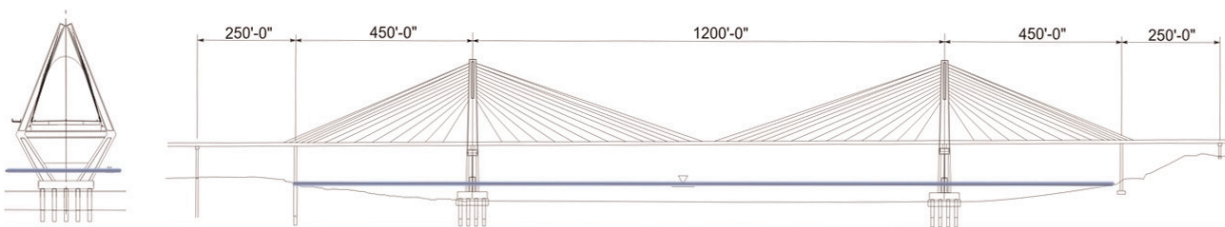
The Ohio River and its shorelines are the most predominant natural and historic features of the East End Bridge site. The location is rural in character with mature native trees framing the shorelines on both sides of the river. A limestone bluff rises steeply from the alluvial plain on the Indiana shore, and a series of historic residential country estates and large historic houses characterize the Kentucky approach.

Within this context, the public feedback demonstrated a clear preference for a structure with the following characteristics:

- Blends in with the landscape
- Fewer / slender piers
- Historic context integration
- Short towers
- Thin deck
- Visual transparency
- Open look
- Low maintenance

Common Bridge Elements

- Alignment Skewed 30-Degrees to the River
- 3 12-Foot Lanes and Inside/Outside Shoulders in both Directions
- Pedestrian and Bicycle Pathway on 1 Side of Bridge
- Minimum 900-Foot Horizontal Clearance for Navigation
- Minimum 71-Foot Vertical Clearance between Water and Deck
- 300-Foot Tall Concrete Towers
- Year 2025 Traffic Projection of 70,000 VPD

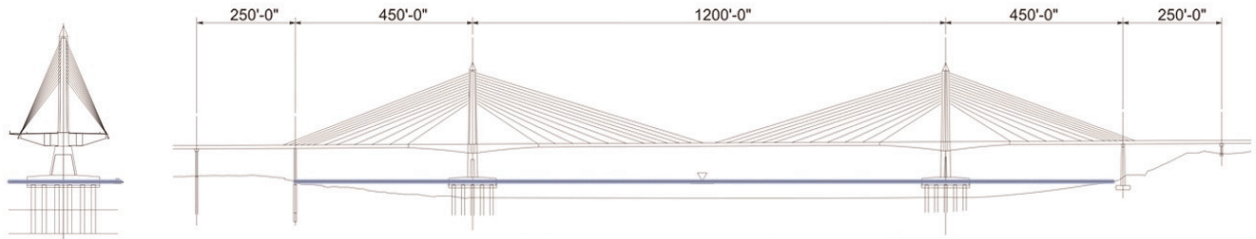


Key Elements

- **Diamond Towers**
300' Above Water
- **Cables from Top of Tower to Outside Edge of Deck**
- **Construction Cost:**
\$245 million (2006 dollars)

**Recommended
Alternative**

Diamond Tower Cable Stayed (Outside Cables)

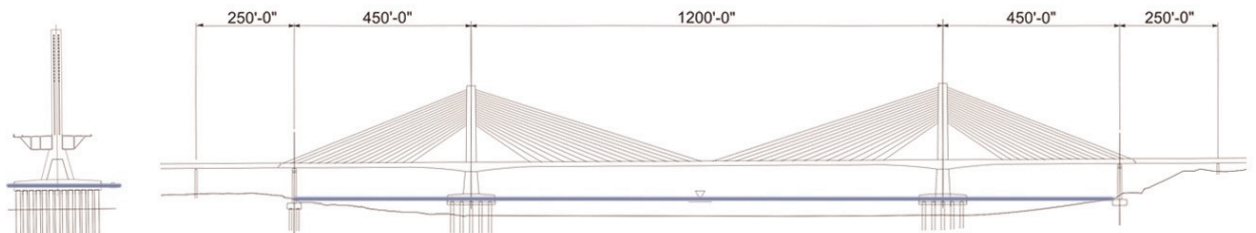


Key Elements

- **Needle Towers 300' Above Water**
- **Cables from Top of Tower to Outside Edge of Deck**
- **Construction Cost: \$250 million (2006 dollars)**

Recommended Alternative 2

Median Tower Cable Stayed (Outside Cables)



Key Elements

- **Needle Towers 300' Above Water**
- **Cables from Top of Tower to Median of Deck**
- **Construction Cost: \$230 million (2006 dollars)**

Recommended Alternative 3

Median Tower Cable Stayed (Median Cables)

About the Project

The overall goal of the **Louisville Southern Indiana Ohio River Bridges Project** is to address long term cross-river transportation needs in the Louisville-Southern Indiana region. The project was authorized by the Federal Highway Administration in September 2003 through a Record of Decision (ROD) and Section 106 Memorandum of Agreement (MOA) after detailed analysis that included extensive public outreach and involvement, culminating in the publication of a Final Environmental Impact Statement (FEIS). These documents specify the key guidelines for the design and development of new bridges spanning the Ohio River.

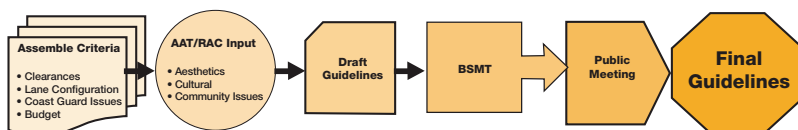
In the spring of 2005, the Section 5 **Bridge Type Selection Process** was initiated. This 4-step process will culminate in the selection of the East End Bridge that will be designed and built crossing the Ohio River between Prospect, Kentucky and Utica, Indiana. This bridge will help complete the I-265 Loop connecting the two states.

The year-long Bridge Type Selection Process involved an extensive public involvement process; preliminary engineering activities; architectural analysis and consideration of the bridge site context; tracking of environmental commitments; and development of an innovative and enduring Kentucky DBE program.

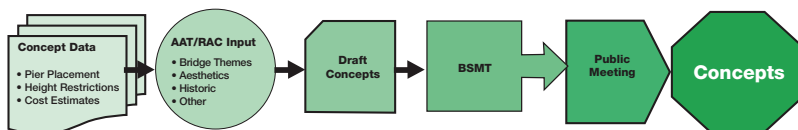


How did we get here?

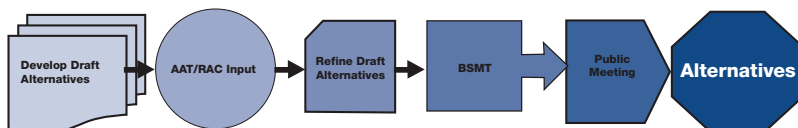
STEP 1 DEVELOP GUIDELINES



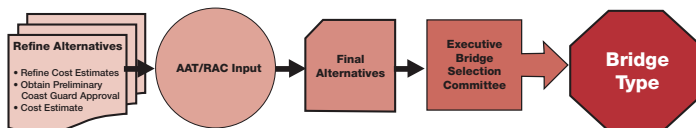
STEP 2 DEVELOP CONCEPTS



STEP 3 DEVELOP ALTERNATIVES



STEP 4 SELECT BRIDGE TYPE



The 3 recommended bridge alternatives shown on the previous pages were arrived at through an extensive 4-step process known as the Bridge Type Selection Process.

On the following pages we describe in detail each one of the steps - highlighting the most critical elements of the process.

STEP 1 DEVELOP GUIDELINES



The Objective

The objective of **Step 1** was to develop the guidelines to be used during the Bridge Type Selection Process and to introduce the concept of how the aesthetics of various bridge elements affect how a bridge fits into its surrounding context.

Step 1 was performed during July, August and September 2005, with the Views from the River Tour and Open Houses held in October of 2005.

The Outcome

The primary deliverables during Step 1 included the Design Parameters, Design Guidelines and Evaluation Matrix, the Step 1 Public Involvement Report, the Environmental Commitments Tracking Table and monthly Disadvantaged Business Enterprise (DBE) Reports. These documents are available in the full Bridge Type Selection Report. The bridge types being considered as we moved forward into Step 2 included Through Arch, Through Truss, and Cable Stayed bridges.

The Process

Some of the guidelines reflected navigational, structural, and highway limitations and physical restrictions that exist with the bridge site, while other guidelines represented environmental commitments and financial constraints necessary to meet budgetary goals. These key evaluation guidelines were used to help select and develop the preliminary bridge concepts.

The guidelines consisted of:

- ❖ Design Parameters (Mandatory Requirements)
- ❖ Design Guidelines (Desirable Objectives)
- ❖ Evaluation Matrix (Pass/Fail Evaluation)

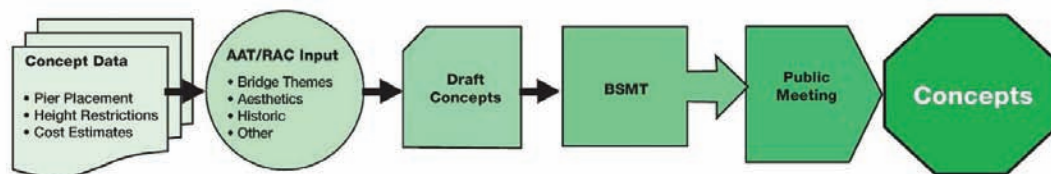
In addition to using the general guidelines developed in Step 1 for concept development, the guidelines identified were also used by Section Design Consultant 5 (SDC5) in our initial public outreach efforts. Working with the Bi-State Management Team (BSMT), SDC5 communicated the rural, historic and scenic context and limitations associated with our Design Section to the project stakeholders. Step 1 followed the general outline of the Bridge Type Selection Process flow chart, and ended with established guidelines for the aforementioned items to be used in Step 2 to develop bridge concepts.

Step 1 included 7 major public meetings, identified in the chart shown above. There was no preference polling of stakeholders at these Step 1 public meetings. SDC5 explained at these stakeholder meetings that there were 4 basic bridge types that are suitable for a long span bridge such as the East End Bridge. These 4 bridge types were Arch Bridges, Truss Bridges, Cable Stayed Bridges, and Suspension Bridges.

Suspension bridges are more expensive than other bridge types, and they are typically used only for extremely long spans. In order to verify the foundation conditions and determine if a long span suspension bridge was required, preliminary geotechnical borings were done at each of the 4 proposed pier locations. The preliminary borings indicated that there was sound rock at each of the proposed pier locations in the river. In light of this, a suspension bridge was eliminated due to the high cost.

Steel deck arch and steel deck truss bridge types were also eliminated in this step because placing the deck on the top of a truss or arch raised the profile grade, resulting in too steep a grade leading down into the tunnel in Section 4.

STEP 2 DEVELOP CONCEPTS



The Objective

The objective of **Step 2** was to use the guidelines established and the public feedback collected during Step 1 to develop the bridge concepts to be used during the Bridge Type Selection Process.

Step 2 was performed during October, November and December 2005.

The Outcome

The primary deliverables from Step 2 included an updated Evaluation Matrix, the Step 2 Public Involvement Report, the Navigation Channel Fact Sheet, the Environmental Commitments Tracking Table, and the monthly DBE Reports. These documents are available in the full Bridge Type Selection Report.

Meetings

11/17/05	SDC5 Area Advisory Teams / Regional Advisory Committee - Jeffersonville
12/13/05	SDC5 Open House - Utica
12/15/05	SDC5 Open House - Prospect
2/15/06 & 2/16/06	HPAT Presentations (Indiana & Kentucky)

These 15 bridge concepts included 4 Steel Arch bridges, 4 Steel Truss Bridges and 7 Cable Stayed Bridges. Working with the BSMT during Step 2, SDC5 made presentations on these 15 bridge concepts to the project stakeholders to determine their preferences. This stakeholder

input was received by preference polling of the attendees at the public meetings and on the project's web site (www.kyinbridges.com).

The chart below shows the results of this preference polling. The 7 most popular bridge concepts were all cable stayed bridge concepts. The 4

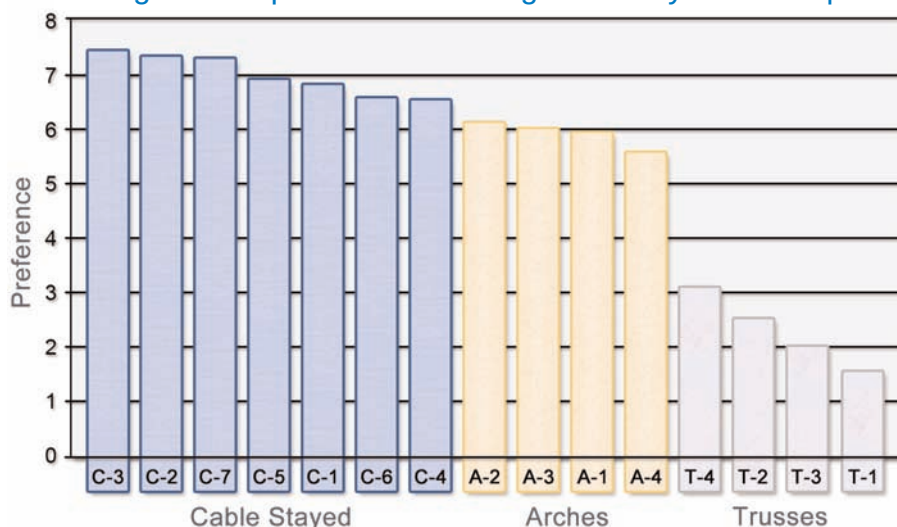
steel arch bridge concepts were ranked next. The 4 steel truss bridge concepts were all the least popular, by a considerable margin. They were subsequently eliminated from further consideration due to consistently low public evaluation of this bridge type.

The Process

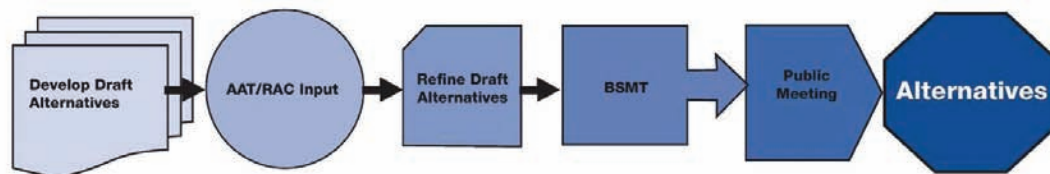
Step 2 began by analyzing the Step 1 feedback, establishing early trends and preferences of the project stakeholders, and assembling the bridge elements presented during Step 1 into 15 concepts, or generic bridge alternatives.

Based on these polling results, the 6 bridge alternatives for Step 3 included 1 Steel Arch Bridge, 2 Diamond Tower Cable Stayed Bridges, and 3 Median Tower Cable Stayed Bridges.

Design Concepts in Order of Avg. Score by All Participants



STEP 3 DEVELOP ALTERNATIVES



The Objective

The objective of **Step 3** was to take the 6 bridge alternatives developed during Step 2 and refine them into the 3 recommended bridge alternatives.

Step 3 was performed during January, February, and March 2006.

The Outcome

SDC5 had several primary deliverables in Step 3. These included an updated Evaluation Matrix; the Step 3 Public Involvement Report; the Bicycle and Pedestrian Fact Sheet; an updated Environmental Commitments Tracking Table; the Bridge Hydraulic and Scour Analysis Report; the Bridge Deck Drainage Report; Noise Mitigation Report; the Navigational Modeling and Simulation Report; and the monthly DBE Reports. These documents are available in the full Bridge Type Selection Report.

The Process

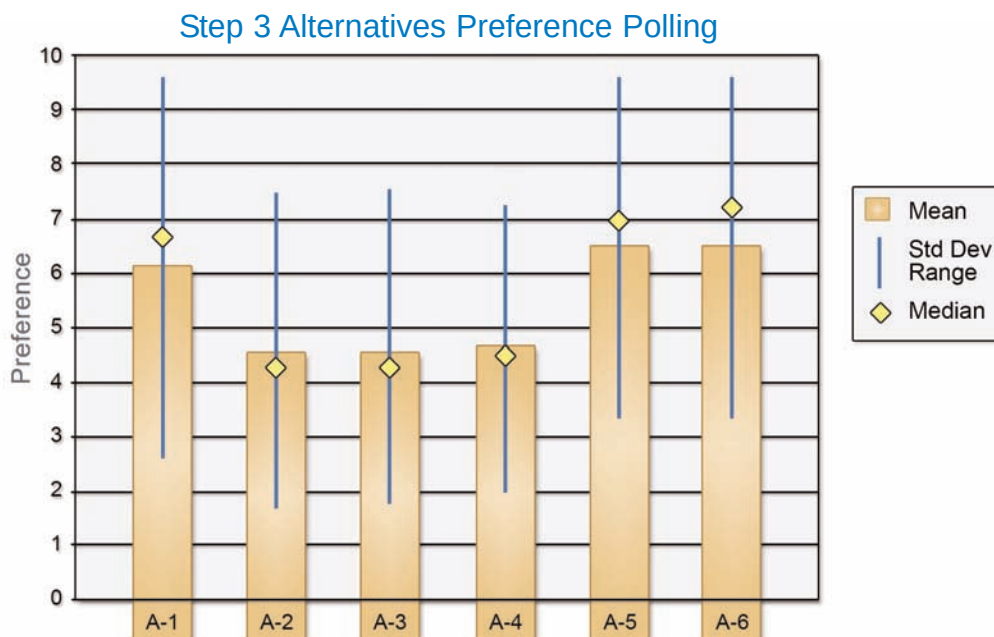
Step 3 began with the refinement of the 6 bridge alternatives developed following Step 2. Working with the BSMT, the alternatives were presented to the project stakeholders and additional public feedback was solicited.

The SDC5 team also contracted with the Seamen's Church Institute in Paducah, KY to develop a computer simulation of barge navigation between the bridge piers.

SDC5 used the feedback from the public presentations, including preference polling, to develop the 3 recommended bridge alternatives to carry into Step 4.

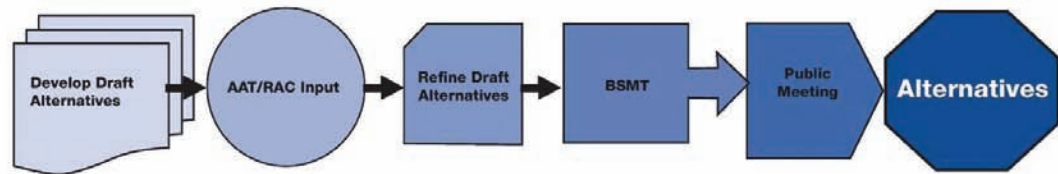
The chart below shows the results of this preference polling for all of the participants. As the data reflect, all 6 of the alternatives scored well. The SDC5 design team heard from the project stakeholders on a number of occasions an enthusiastic "**we like them all!**"

Meetings	
2/16/06	SDC5 Area Advisory Teams / Regional Advisory Committee - Louisville
3/7/06	SDC5 Open House - Utica
3/9/06	SDC5 Open House - Prospect
4/25/06 & 4/27/06	HPAT Presentations (Indiana & Kentucky)



STEP 3 DEVELOP ALTERNATIVES

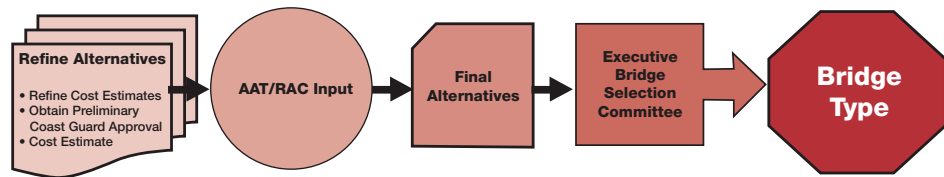
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East End Bridge Step 3 Alternatives				
Alternative	Rendering View (Aerial)	Brief Description	Tower Cross Section	Advanced to Step 4
A-1		Steel Tied Arch with Basket Handle Arch Ribs		No
A-2		Concave Diamond Tower Cable Stayed (Outside Cables)		Yes*
A-3		Convex Diamond Tower Cable Stayed (Outside Cables)		Yes*
A-4		Median Tower Cable Stayed with Variable Depth Deck (Outside Cables)		Yes
A-5		Median Tower Cable Stayed with Variable Depth Deck (Median Cables)		Yes
A-6		Median Tower Cable Stayed with Suspension Cables (Median Cables)		No

* Note: A-2 and A-3 were combined to develop what would become R-1.

STEP 4 SELECT BRIDGE TYPE



The Objective

SDC5's main objectives of **Step 4**, the final step of the Bridge Type Selection Process, were to refine the 3 recommended bridge alternatives to meet all of the key criteria and present them to the Executive Bridge Selection Committee.

Step 4 began in April 2006 and will end with the public announcement of the bridge type to be constructed.

The Outcome

SDC5's primary deliverable of Step 4 was the presentation of the 3 recommended bridge alternatives to the Executive Bridge Selection Committee.

The Process

Step 4 began with the 3 bridge alternatives developed at the end of Step 3. As previously identified, the 3 final bridge alternatives include:

- ❖ **Recommended Alternative 1:** Diamond Tower Cable Stayed (Outside Cables)
- ❖ **Recommended Alternative 2:** Median Tower Cable Stayed (Outside Cables)
- ❖ **Recommended Alternative 3:** Median Tower Cable Stayed (Median Cables)

Working with the BSMT, SDC5 assessed the suitability of these 3 recommended bridge alternatives based on an extensive, detailed

examination of structural, cost, constructibility, environmental, and aesthetic criteria. The final 3 alternatives were presented to the Area Advisory Teams and the Regional Advisory Committee for their information and comment.

The following are similarities between the 3 recommended alternatives:

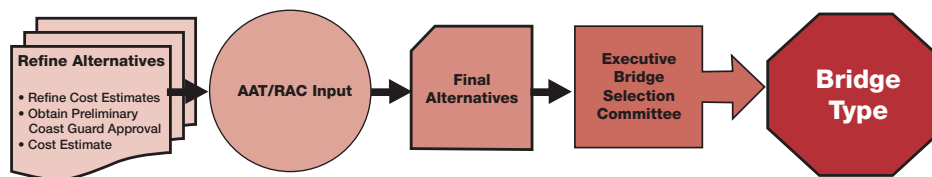
- Bridge alignment (Prospect to Utica)
- Cross-section (3 12-foot lanes and inside/outside shoulders in both directions)
- Bikeway/pedestrian path (17' wide)
- Number and location of piers (2 in water)
- Navigational clearance (minimum 900' horizontal)
- Deck height (minimum 71' above normal water)
- Tower height (300' above normal water)
- Tower material (concrete)
- Cable material (steel strands in polyethylene ducts)
- Deck material (concrete)
- Foundations (concrete footings on drilled shafts into rock)

A comparison of the 3 recommended alternatives is provided on the following page.

SDC5's portion of Step 4 ends with the presentation of the 3 recommended bridge alternatives to the Executive Bridge Selection Committee. They will select the bridge type to be designed and constructed.

STEP 4 SELECT BRIDGE TYPE

(cont'd)



East End Bridge Comparison of the 3 Recommended Alternatives

	Recommended Alternative 1	Recommended Alternative 2	Recommended Alternative 3
			
Towers	300-Foot Concrete Diamond	300-Foot Concrete Needle in Median	300-Foot Concrete Needle in Median
Deck	160-Foot Wide, Concrete	184-Foot Wide, Concrete	155-Foot Wide, Concrete
Superstructure Type	Steel Girder with Concrete Deck	Steel Girder and Steel Box with Concrete Deck	Concrete Box and Steel Box with Concrete Deck
Cables	Located Outside Deck; Sheathed Steel Strands	Located Outside Deck; Sheathed Steel Strands	Located in Median; Sheathed Steel Strands
Shoulder Width at Tower	12 Feet	8 Feet	8 Feet 9 Inches
Deck Openings in Median	None; Wider Shadow under Bridge	Yes; Some Sunlight under Bridge	Yes; Some Sunlight under Bridge
Constructibility	Slightly Simpler with Outside Cables	Slightly Simpler with Outside Cables	Slightly More Difficult with Median Cables
Maintenance	Relatively Low Maintenance	Relatively Low Maintenance	Slightly Less Maintenance than Alternatives 1 and 2
Cost (2006 dollars)	\$245 Million	\$250 Million	\$230 Million

The DBE Program

Included in work on the East End Bridge project to date has been an extensive Disadvantaged Business Enterprise (DBE) program. This program was designed to insure that the minority community had meaningful input into the project from start to finish. Great care has been taken to ensure that all objectives continue to be met.

The main objective was to receive this DBE input both from the public input perspective in developing the bridge type, as well as obtaining significant DBE participation as members of the project design team. Complete details on this DBE program are included in the full Bridge Type Selection Report.

Environmental Commitments

In September 2003, the Federal Highway Administration (FHWA) issued a Record of Decision (ROD) officially approving the construction of two new Ohio River bridges linking Louisville and Southern Indiana, and reconstructing the Kennedy Interchange (Spaghetti Junction) where I-65, I-71 and I-64 converge near downtown Louisville.

The ROD was the final step in the project's environmental review process, and was supported by the Final Environmental Impact Statement (FEIS), issued in April 2003, and the Section 106 Memorandum of Agreement (MOA), adopted in March 2003. The commitments in the ROD, FEIS, and Section 106 MOA are legally binding and necessary to the success of the project. The environmental element of the Bridge Type Selection Process (BTSP) is driven by the commitments made in the project's supporting environmental documentation.

- ❖ **Site Context** - The context of the proposed East End Bridge location is agricultural and rural residential, characterized by its varied topography, scenic vistas, historic elements and pastoral scenery. The Ohio River and its shorelines are the predominant and defining features of the natural landscape of the area. There are no existing bridges across the Ohio River in the vicinity of this site. The predominant historic feature near the Indiana shore is a 19th-20th century lime kiln, and a series of historic residential country estates and large historic houses characterize the Kentucky approach.
- ❖ **Historic Preservation** - Discussions and information related to the historic characteristics of the bridge site were key to the understanding of the context and the development of the bridge alternatives, including: coordination with the Indiana and Kentucky Historic Preservation Advisory Teams (HPATs); the public involvement process; applicable Context Sensitive Design guidelines and parameters; and the

ROD, FEIS and Section 106 MOA commitments.

- ❖ **Context Sensitive Design** - Selection of the recommended alternatives was grounded in Context Sensitive Design, considering the unique and special features of the East End Bridge area, to mitigate and minimize the intrusion of the structure into the landscape and viewshed of the area.
- ❖ **Pier Locations & Navigational Simulation** - Further review of the bridge pier locations, conducted through navigational simulations at the Center for Maritime Education (CME) in Paducah, KY, confirmed that the proposed bridge types had little impact on navigating between the bridge piers.
- ❖ **Permits & Floodplains** - Coordination with local, state and federal permitting agencies was continued through the BTSP in order to minimize potential concerns when the permitting process begins for the bridge.
- ❖ **Noise Mitigation** - Noise attenuation alternatives to traditional concrete barriers were reviewed for the bridge location, with recommended further study of plexi-glass noise walls, bridge joint design and treatments, and quiet pavements.
- ❖ **Bridge Deck Drainage** - Based on the FEIS requirements for carrying the bridge deck runoff to Kentucky, a preliminary Deck Drainage analysis was used to estimate the maximum flow generated by a 10-year storm event as well as a conceptual pipe layout for the underside of the bridge.
- ❖ **Environmental Commitments Tracking Table** - A tracking table was developed to follow the environmental commitments made in the Section 106 MOA, FEIS and ROD for this project. Some commitments have been resolved during the BTSP, while others will be tracked through the design, right-of-way, utilities or construction phases. The Environmental Commitments Tracking Table should be maintained through the next and all future phases of this project.



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