THE OHIO RIVER BRIDGES

OHIO RIVER BRIDGES PROJECT

Downtown Bridge: Section 2

[Bridge Type Selection Report Executive Summary]

October 2006

Presented to:
Executive Bridge Selection Committee

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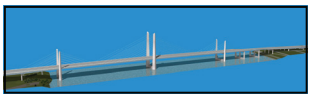
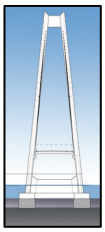
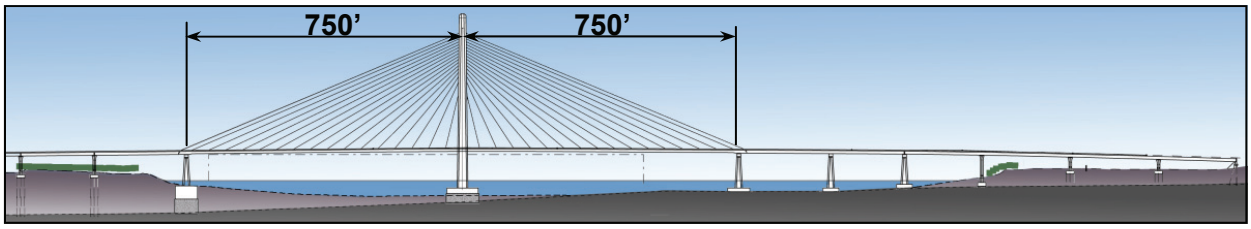
The Downtown Bridge

This document is a summary of the Bridge Type Selection Report and the three recommended bridge alternatives for Section 2, Downtown Bridge, of the Ohio River Bridges Project. The report describes in detail the public involvement process, environmental and historic context considerations, development of alternatives and Disadvantaged Business Enterprise (DBE) activities with findings, conclusions and recommendations for the entire Downtown Bridge Type Selection Process.

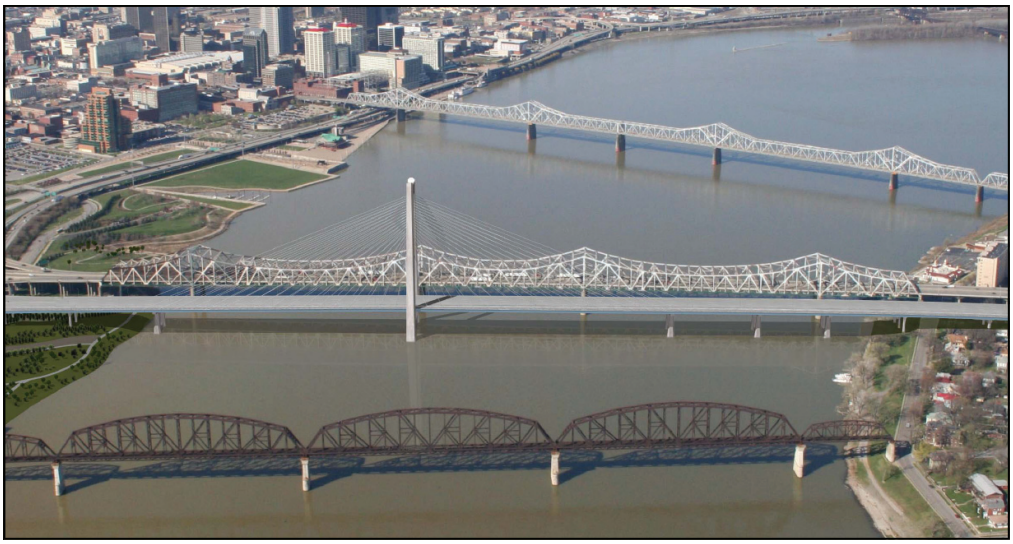
Comparison of 3 Recommended Alternatives	Alternative 1: Single Tower Cable Stayed	Alternative 2: Three Tower Cable Stayed 	Alternative 3: Three Span Thru Arch
Deck Width	128’-9”	127’-4”	117’-5”
Height (Above Deck)	365’	210’ / 125’	120’
Cost (2006 Dollars)	$240 Million	$240 Million	$275 Million
Construction Duration	4-5 Seasons	4-5 Seasons	3-4 Seasons
Maintenance	Low	Low	Moderate
Engineering Criteria	Satisfied	Satisfied	Satisfied
Navigation Criteria	Satisfied	Satisfied	Satisfied
Environmental Criteria	Satisfied	Satisfied	Satisfied



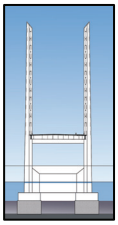


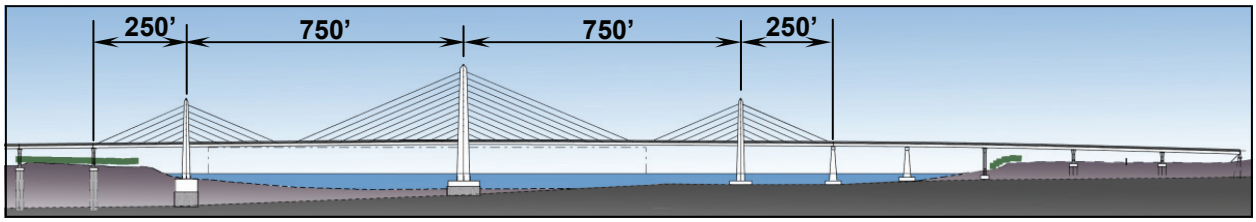
Features:

- *Symmetric about a single “A” Shaped Tower*
- *Semi-Fan Cable Arrangement*
- *Concrete towers and bridge deck supported on steel beams*
- *Steel cables inside a plastic pipe*



Alternative 1: Single Tower Cable Stayed

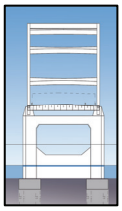


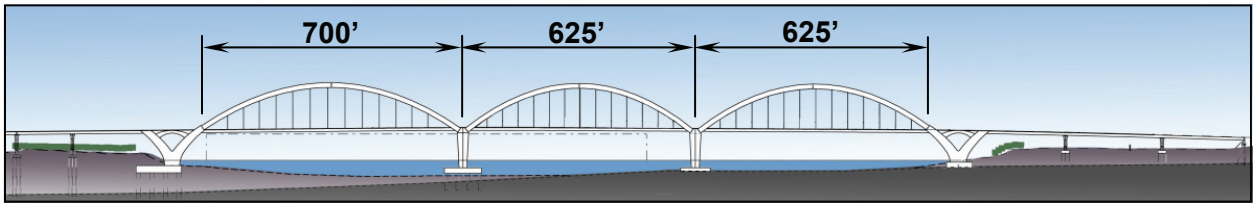


Features:

- Three Pairs of Vertical Towers without Bracing
- Symmetric about Center Tower
- Harped Cable Arrangement
- Concrete towers and bridge deck supported on steel beams
- Steel cables inside a plastic pipe

Alternative 2: Three Tower Cable Stayed





Features:

- Three nearly Equal Arch Spans
- Vertical Arch Ribs with Horizontal Bracing
- “V” Shaped Shoreline Piers
- Steel Arches, Cables and Beams
- Concrete Deck

Alternative 3: Three Span Thru Arch

About the Project

The overall goal of the 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 (FHWA) in September 2003 through a Record of Decision (ROD) after detailed analyses that included extensive public outreach and involvement, culminating in the publication of a Final Environmental Impact Statement (FEIS).

In spring 2005, the Bridge Type Selection Process commenced to select a new Downtown Bridge adjacent to the existing John F. Kennedy (JFK) Bridge spanning from Louisville, Kentucky to Jeffersonville, Indiana. The process has been a year-long, multi-faceted event involving extensive engineering, public outreach, environmental work, context sensitive considerations and development of an innovative and an enduring DBE Program. The process was under the direction of the Bi-State Management Team (BSMT) and managed through the General Engineering Consultant (GEC).

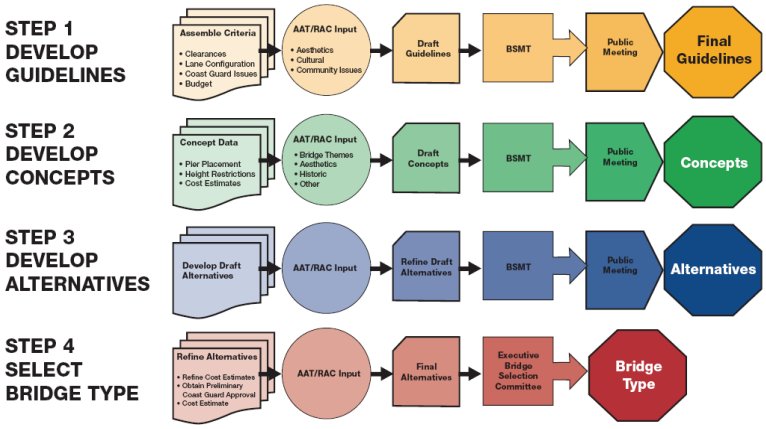
The Bridge Type Selection Process

The Bridge Type Selection Process consisted of four distinct steps.

Step 1: Feedback was solicited from project Area Advisory Teams (AAT) and the Regional Advisory Committee (RAC), from which, aesthetic and context-sensitive design (CSD) guidelines were developed.

Step 2: Feedback from advisory groups and the public on 31 initial bridge images was used with engineering, environmental and CSD considerations to develop 12 bridge concepts.

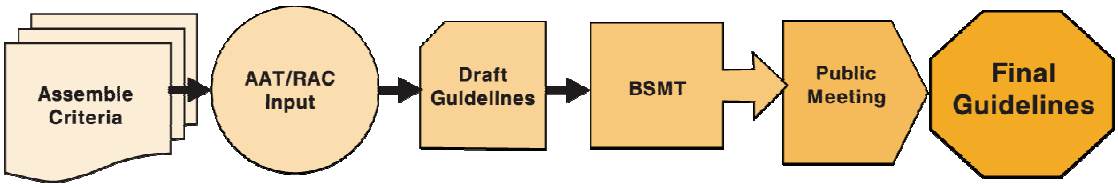
Step 3: From analysis of the 12 bridge concepts, a set of six bridge alternatives were developed and presented to advisory groups and the public for further feedback.



Step 4: These six bridge alternatives were extensively analyzed and developed into three recommended bridge alternatives presented to advisory groups, and recommended to the Executive Bridge Selection Committee for final bridge type selection.

During the Bridge Type Selection Process, the downtown design team also presented their work to the Indiana and Kentucky Historic Preservation Teams (IHPAT and KHPAT) as well as local elected officials. Members of the public could offer input via written comment forms and/or on-line comment forms on the project website (www.kyinbridges.com). The project team used this public feedback throughout the four-step process to ensure that the three recommended bridge types were developed with consideration of community characteristics and wishes.

STEP 1 DEVELOP GUIDELINES



Overall Objective

Inform the stakeholder groups and public about bridge types, bridge elements, and about the design section parameters. Develop a set of design guidelines that represent the aesthetic, environmental and context sensitive considerations desired.

The Process

This first step of the Bridge Type Selection Process involved assembling and presenting constraints and requirements, referred to as parameters. The parameters represent criteria the bridge must fulfill. Example parameters include:

- Straight alignment, immediately east of and nearly parallel to the existing JFK Bridge
- One-way northbound traffic consisting of six 12' lanes and two 12' shoulders
- 17' wide pedestrian walk / bikeway
- 71' minimum vertical clearance above normal river pool
- Maintain existing clearance in primary and secondary navigational channels
- FEIS and ROD's Section 106 Memorandum of Agreement (MOA) commitments

Another important criteria for the bridge was the construction budget. A construction budget of $253 million (2006 Dollars) was identified for the downtown bridge.

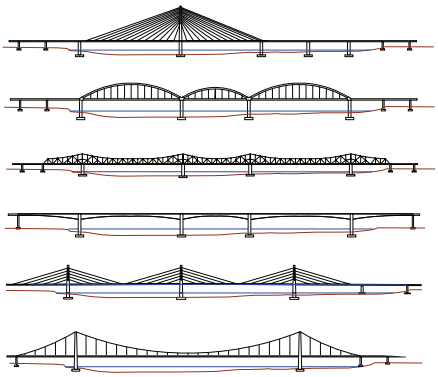
Basic bridge terminology and typical bridge types appropriate for the required spans and location were described during presentations. Photos and graphics were employed to best illustrate these points.

Step 1 Meetings

06/30/05	*AAT Meeting*
07/20/05	*IHPAT Meeting*
07/21/05	*KHPAT Meeting*
08/09/05	*Combined AAT/RAC Meeting*
09/20/05	*Open House, Jeffersonville*
09/22/05	*Open House, Louisville*
10/06/05	*"Views from the River Tour"; a joint Downtown and East End Bridge event*

Bridge types included:

- ***Cable-Stayed***
- ***Arch***
- ***Truss***
- ***Box Girder***
- ***Extradosed***
- ***Suspension***



This introductory step provided key data and fundamental facts about bridge types, existing conditions, safety, fiscal responsibility, engineering, and other technical realities.

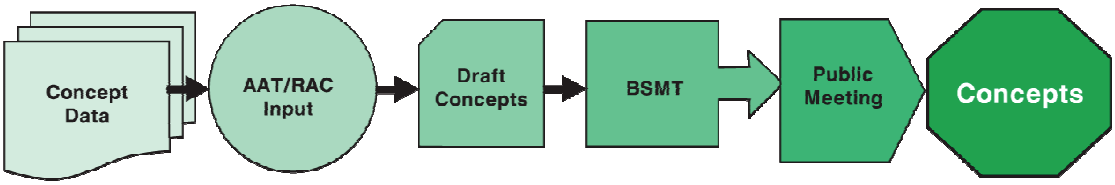
Overall aesthetics and context sensitive considerations, referred to as guidelines, were identified from public input. These guidelines focused on global bridge appearance issues associated with surroundings of the bridge site.

Outcome

Developed guideline examples include:

- Clean, simple and elegant aesthetics
- Avoid overshadowing the surroundings
- Consider long term maintenance costs
- Bridge underside to respect park and river views
- Aesthetics should focus on the river
- Provide an open view from the bridge
- Creative, state-of-the-art design
- Minimize construction impacts
- Compatibility with adjacent Sections 1 and 3
- Provide a friendly pedestrian walk / bikeway

STEP 2 DEVELOP CONCEPTS



Overall Objective

Based upon the guidelines established in Step 1, develop realistic bridge image renderings for use in polling the stakeholders and the public. Determine aesthetic preferences and develop 12 bridge concepts.

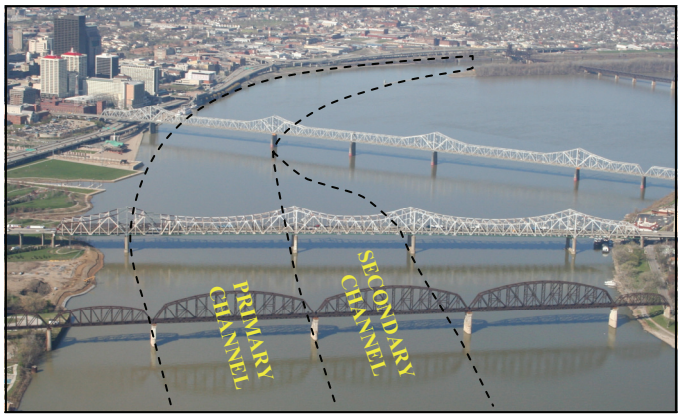
Step 2 Meetings

11/03/05	*Combined AAT/RAC Meeting*
11/29/05	*Open House, Louisville*
12/01/05	*Open House, Jeffersonville*
02/15/06	*IHPAT Meeting*
02/16/06	*KHPAT Meeting*

The Process

This second step in Bridge Type Selection Process involved exploration and consideration of feasible bridge types based upon the design guidelines established in Step 1.

One of the key parameters in developing the bridge images was to maintain both channels dictated by the United States Coast Guard (USCG).



Thirty-one bridge images satisfying the basic bridge parameters were developed. These images represented a wide range of combinations of bridge types, bridge span combinations and aesthetics. Bridge types included in the 31 images were: Arches, Box Girders, Cable Stays, Extradosed, and Trusses. The suspension bridge type was not considered during Step 2 since they are more commonly used for very long spans, and have a higher cost than other bridge types.

"Rule of thumb" bridge sizing was performed to provide realistic images.

The downtown bridge team presented the 31 bridge images and provided opportunities for the public to express their preferences on each bridge image using a hand-held electronic polling device. The information obtained provided designers with general preferences to assist bridge concept development.

Electronic polling analysis showed general preference for the following:

- Visual simplicity
- Compatibility with nearby bridges
- Symmetric bridges
- Lower height bridges
- Open concepts when bridges were higher
- Closed concepts when bridges were lower

Equally important to the electronic polling was the feedback that the team received during the meetings and the comments submitted by mail or through the website. Feedback and historic preservation data influenced the development of the concepts to further compatibility with historic preservation goals.

Outcome

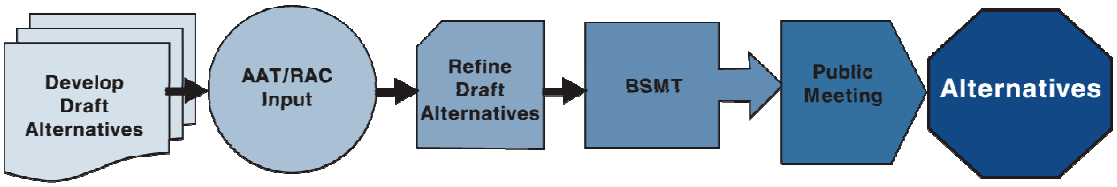
From these preferred bridge characteristics and continued engineering analysis, 12 bridge concepts were developed that satisfied various combinations of engineering, environmental and aesthetic guidelines.

Included in the 12 concepts were:

- 4 Arch Bridges
- 2 Box Girder Bridges
- 4 Cable Stayed Bridges
- 1 Extradosed Bridge
- 1 Truss

A report was prepared which documented the activities and results of the Bridge Type Selection Process through Step 2.

STEP 3 DEVELOP ALTERNATIVES



Overall Objective

Develop six alternatives from the 12 bridge concepts using public input, engineering, context, constructability assessments and budget. Present the six alternatives to the stakeholders and public and gather feedback in order to further refine the alternatives.

The Process

During Step 3, bridge designers performed additional engineering analysis, constructability checks and comparative construction cost estimating.

Alternatives were created by combining the best attributes of similar bridge types. Historically higher maintenance demands kept the truss from being advanced.

Along with the public preference information, the bridge design team analyzed engineering, environmental, and CSD considerations to reduce from 12 bridge concepts to six bridge alternatives.

The downtown bridge team provided an opportunity for members of the public to express their preferences on three sets of views of each of the six alternatives using hand-held electronic polling devices.

Visual animations for each of the six bridge types provided a new perspective for the public that proved very helpful in identifying aesthetic preferences.

The public was also polled on the degree of importance that should be given to:

- Aesthetics
- Construction costs
- Maintenance
- Construction impacts

The feedback obtained during the polling process provided designers with information to assist in finalizing each of the six alternatives.

The 6 Alternatives in Step 3

Alternative 1: *Three-Span Tied Arch*
- Spans of 750'-500'-750'
- Vertical hangers
- Vertical arch ribs
- X-bracing of arch rib
- Piers line up with Kennedy Bridge Piers

Alternative 2: *Three-Span Thru Arch*
- Spans of 750'-650'-650'
- Vertical hangers
- Inclined arch ribs
- Horizontal bracing of arch ribs
- Arch form extends down to water level

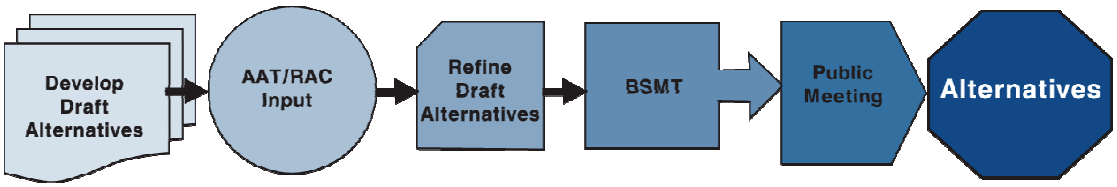
Alternative 3: *Hybrid Box Girder*
- Spans of 750'-500'-750'
- Superstructure below bridge deck
- Piers line up with JFK Bridge
- Raised profile 20 feet above JFK Bridge at peak

Alternative 4: *Single Tower Cable Stayed*
- Spans of 750'-500'-750'
- 350-ft "A" Shaped tower
- Semi-fan cables
- Symmetric about tower

Alternative 5: *Four Tower Cable Stayed*
- Spans of 750'-500'-750'
- Four 180-ft towers
- Towers inclined out
- Semi-fan cables
- Piers align with JFK

Alternative 6: *Three Tower Cable Stayed*
- Spans of 750'-750'
- Three 150-190' towers
- Vertical towers
- Cables in a vertical plane
- Harped cables

STEP 3 DEVELOP ALTERNATIVES *(CONTINUED)*



Step 3 Meetings

03/13/06	*Combined AAT/RAC Meeting*	*04/25/06*	*IHPAT Meeting*
03/21/06	*Open House, Jeffersonville*	*04/27/06*	*KHPAT Meeting*
03/22/06	*Open House, Louisville*		

Outcome

The following considerations are noted for each of the six alternatives:

Alternative 1—Three Span Tied Arch
- Favorable preference polling
- Significant superstructure member sizes required
- Difficult constructability
- High construction cost

Alternative 2—Three Span Thru Arch
- Favorable preference polling
- Significant substructure member sizes required
- Thrust block aesthetics can be improved
- High construction cost

Alternative 3— Hybrid Box Girder
- Very favorable preference polling
- Relatively low construction cost
- Roadway height creates incompatibility with JFK bridge
- Roadway height impacts adjoining project sections

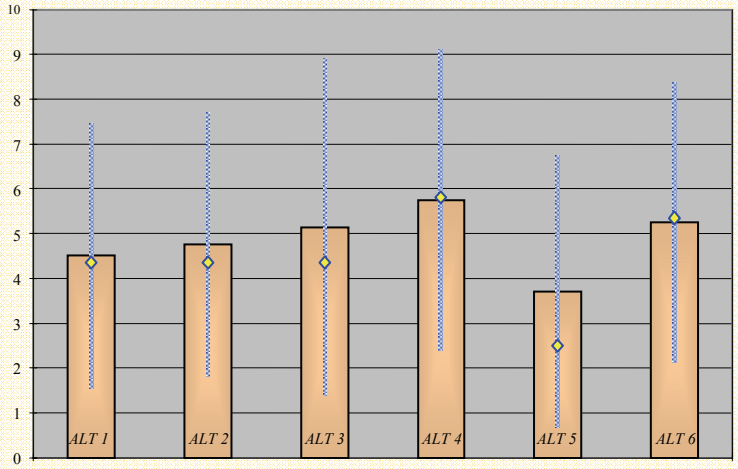
Alternative 4—Single Tower Cable Stayed
- Very favorable preference polling
- Low construction cost
- Favorable constructability
- Visually interesting

Alternative 5—Four Tower Cable Stayed
- Low favorable preference polling
- High construction cost
- Favorable constructability

Alternative 6—Three Tower Cable Stayed
- Very favorable preference polling
- Low construction cost
- Favorable constructability

Electronic Polling Results for Step 3

COMBINED RESULTS FOR ALL VIEWS
AAT/RAC and OPEN HOUSE POLLING



Electronic polling analysis showed general preference for the following:

Aerial Views
All alternatives ranked equally favorable except for the Four Tower Cable-Stayed, the *least preferred alternative.*

Drive-Thru Views
Single Tower Cable-Stayed: *first preference*
Hybrid Box Girder/Three Tower Cable-Stayed: *second preference*
Arch alternatives: *fourth preferred*
Four Tower Cable-Stayed: *least preferred*

Importance Factors
Construction cost, maintenance and aesthetics all ranked as highly important

STEP 4 SELECT BRIDGE TYPE

Overall Objective

Develop three alternatives by using public input from Step 3, context, engineering, constructability assessments and budget. Present the three alternatives to the stakeholders for community input and prepare the Bridge Type Selection Report.

The Process

During Step 4, bridge designers performed additional engineering analysis further refining member sizes and geometry, constructability checks and quantity based construction cost estimating.

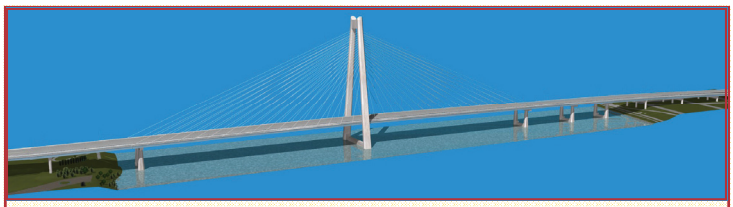
Public preference polling results and feedback from Step 3 were thoroughly analyzed. Alternatives were accessed to identify 'negatives' which could be reduced.

Step 4 Meetings	
07/11/06	*AAT Meeting*
07/18/06	*Combined IHPAT and KHPAT Meeting*
07/18/06	*RAC Meeting*

Outreach efforts during Step 4 allowed members of the AAT, RAC, IHPAT and KHPAT to view and offer feedback on the recommended three bridge types to be presented to the Executive Bridge Selection Committee, and to view physical bridge models of the three recommended Downtown Bridge alternatives. Reaction and feedback from the advisory group meetings was documented for the three recommended bridge alternatives.

Outcome

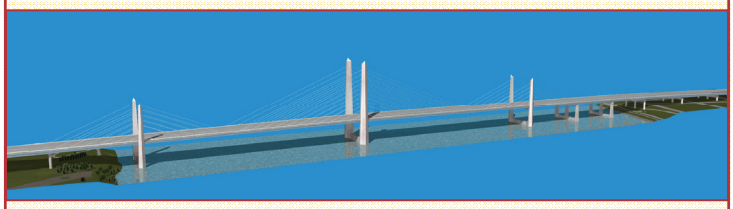
The Three Recommended Alternatives were chosen and the Bridge Type Selection Report was prepared. Analysis results are documented in the report and engineering and environmental matrices.



Alternative 1: Single Tower Cable Stayed

Feedback:

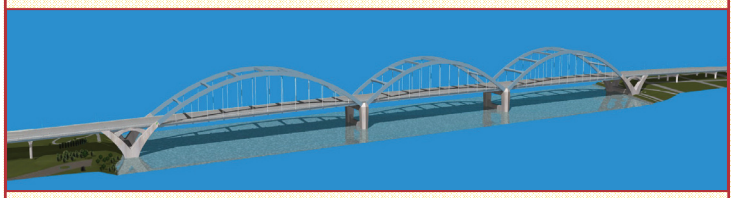
- Provides open, welcome approach
- Establishes its own rhythm
- Don't like the secondary piers in the river
- Dramatic, interesting; good contrast
- Too disparate for surrounding bridges
- Simple and less cluttered
- Frames the city's skyline
- 21st century design



Alternative 2: Three Tower Cable Stayed

Feedback:

- Provides open, welcome approach
- Matches rhythm of the other bridges downtown
- Don't like the secondary piers in the river
- Nice representation of downtown bridges over time
- Looks typical of other downtown bridges



Alternative 3: Three Span Thru Arch

Feedback:

- "V" Pier scale and color are visually intrusive
- Matches the rhythm of the other downtown bridges
- Spans the entire river without secondary piers
- Feels more safe
- Echoes other downtown bridges

Environmental Commitments

The bridge types evaluated meet the environmental requirements as stipulated in the project's FEIS and the ROD. The ROD established the level of allowable impacts and mitigation requirements. These requirements were included in the Bridge Type Selection Process Environmental Matrix. Discussion of the environmental impacts are as follows below.

Context

The context for the new downtown bridge is one of an urban area. While the users of the facility will view the top side of the bridge, residents, park users and office dwellers will view different components of the bridge. Different bridge components were evaluated based on relative views. The overall context is one of several bridges in the downtown area. Aesthetic details will be incorporated into the final bridge design.

Historic

The bridge alternatives were evaluated for impacts to the historic communities in Jeffersonville and Louisville (Butchertown and Phoenix Hill neighborhoods, specifically). The downtown bridge will be separated from the Louisville historic districts by the Section 1 design work, but taller bridge elements (i.e. a single tower cable stayed bridge) may be visible from the historic areas. In Jeffersonville, any of the three recommended bridge alternatives will impact the same five Historic District structures as indicated in the ROD. The potential relocation of these structures to other lots within the historic district will be included in the Section 3 design Scope of Work.

Parks

The new downtown bridge alignment crosses two river parks: Waterfront Park in Kentucky and Riverfront Park in Indiana. The ROD identified approximate ground (use) and aerial (span) bridge covered areas in acres for each park. Based on preliminary engineering, the following chart lists the approximate acreages in each park.

Park Commitments		Alt. 1: Single Tower Cable Stayed	Alt 2: Three Tower Cable Stayed	Alt 3: Three Span Thru Arch
Riverfront park	Span Area (0.4 Acres)	0.4 Acres	0.4 Acres	0.4 Acres
	Pier Use (0.031 Acres)	0.005 Acres	0.005 Acres	0.044 Acres
Waterfront park	Span Area (1.2 Acres)	1.3 Acres	1.3 Acres	1.3 Acres
	Pier Use (0.050 Acres)	0.009 Acres	0.009 Acres	0.009 Acres

Noise

Initial noise evaluations were performed during the FEIS and confirmed in the ROD. The noise level at parks and residential areas adjacent to the bridge on the Indiana side will exceed federal levels (greater than 66 dBA) and the FEIS level of 75 dBA. Noise modeling will be completed by the adjacent section design teams. Final design will include noise mitigation through the use of barriers, railings, pavement, joints, and superstructure.

Water Quality

Water quality impacts during construction will be temporary in nature. Each bridge type will require construction of piers in the Ohio River. Cofferdams and dewatering will be used for the construction of the piers below water level. Work will be performed under federal and state permits as they relate to navigation, dredge and fill in jurisdictional waters, floodplain use and erosion control. Each bridge type will have similar temporary impacts to water quality.

Commitments for the Next Phase

The Downtown Bridge team will continue to coordinate with resource agencies at the federal, state, and local level once the final bridge type has been selected, and assemble the necessary information for ongoing coordination and permit applications. The team will determine environmental mitigation requirements based on the actual impacts and develop appropriate mitigation plans. The team will also develop environmental plan notes and specifications during detailed final design.

The DBE Program

The Ohio River Bridges Project implemented its DBE Program in 2004 throughout all four Kentucky design sections. The DBE Program, through the leadership of the GEC, has experienced successes in the last year and will experience more as the program proceeds. To date, the Ohio River Bridges project DBE program has created and overseen:

- Maintained over 20% collective DBE contracts
- Mentored firms in each project design section
- Created and implemented the Kentucky Engineering Scholars Program to increase minorities in Civil Engineering
- Held open houses in Louisville and Lexington to introduce the project and increase the database of DBE firms
- Created additional opportunities for DBE firms

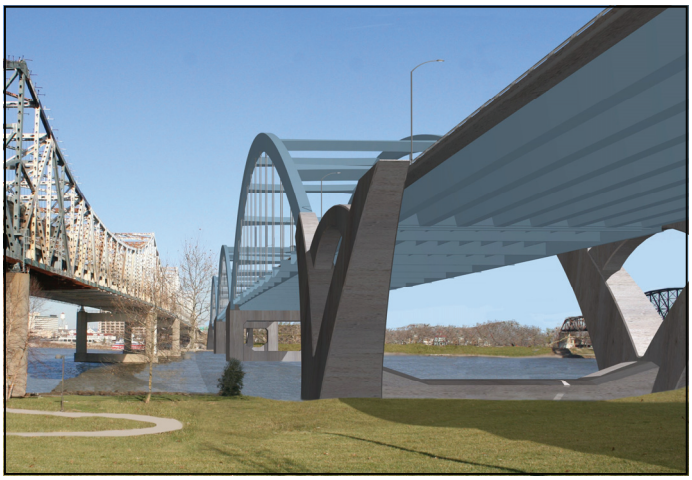
Single Tower Cable Stayed

Three Tower Cable Stayed

Three Span Thru Arch

Single Tower Cable Stayed

Three Tower Cable Stayed



Three Span Thru Arch