Project of the Year Submissions

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Score: _____

Title: **Brent Spence Bridge Fire & Rehabilitation Project**

Company / Owner: Kentucky Transportation Cabinet
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Category

☐ Commercial	☐ Education	☐ Energy	☐ Environment
☐ Industrial	☐ Innovation	☐ Medical	☐ Modernization
☐ Sustainable	☑ Transportation	☐ Water / Wastewater	Other:

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KENTUCKY TRANSPORTATION CABINET

OHIO DEPARTMENT OF TRANSPORTATION

Brent Spence Bridge Fire & Rehabilitation Project

ESWP Project of the Year

Submitted by Michael Baker International

Project Description

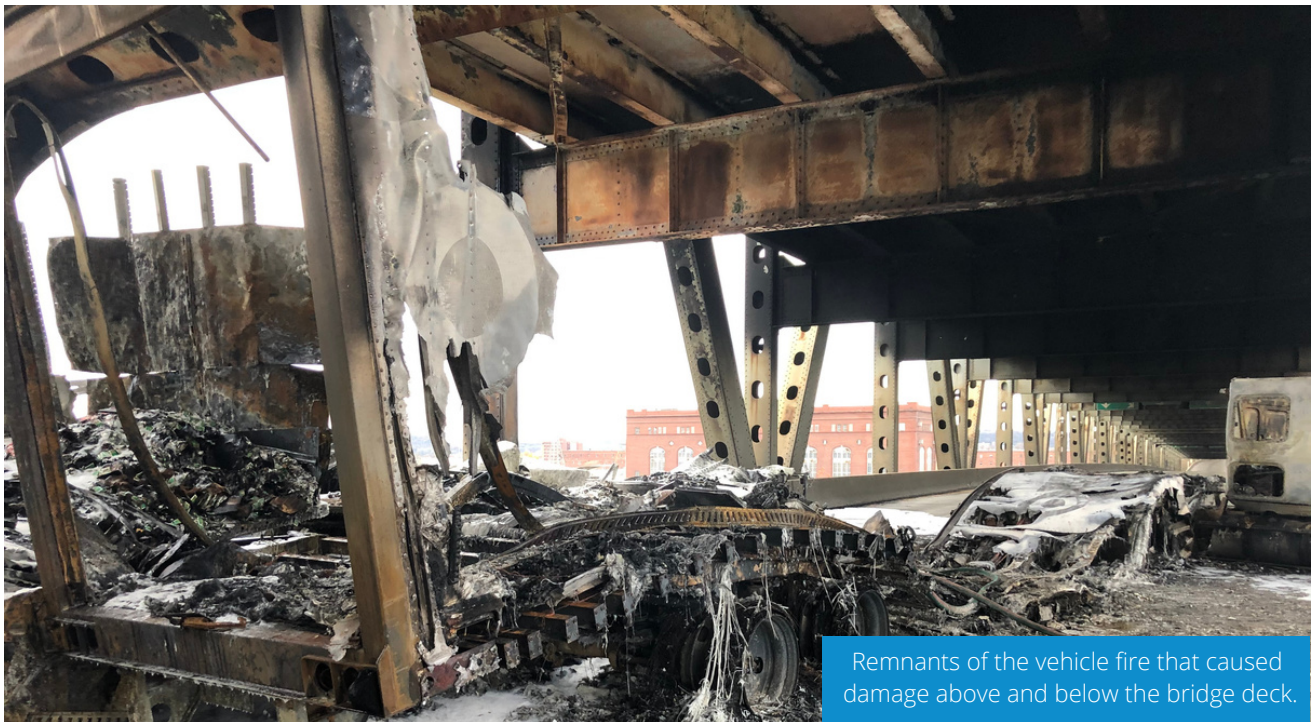
The Brent Spence Bridge is a double-decker, cantilevered truss that carries Interstates 71 and 75 across the Ohio River between Covington, Kentucky, and Cincinnati, Ohio. A major thoroughfare for both local and national traffic with an ADT of 160,000, the bridge's northbound traffic is carried by the lower deck while southbound traffic is carried by the upper deck.

In the early morning of November 11, 2020, traffic on the bridge came to a screeching halt: a truck accident occurred between panel points P17' and P18' on the northbound lower deck, which is the start of the 453' suspended span on the Kentucky side, and fire erupted and raged to temperatures of approximately 1,500 degrees Fahrenheit, causing damage to the bridge's upper deck floor system steel, drainage, deck, barriers, and electrical components and the lower deck's overlay, barriers, and electrical components. Mark Policinski, CEO of the Ohio Kentucky Indiana Regional Council of Governments, commented on the initial closure: "If you can imagine the worst thing happening to our transportation system in this region, it just happened."

The Kentucky Transportation Cabinet (KYTC) and the Ohio Department of Transportation (ODOT) quickly mobilized to shut down the bridge, while the U.S. Coast Guard ceased river traffic. Kentucky Governor Andy Beshear clearly laid out the objective: "We want to get this job done and we want to get it done quickly, but it has to be done safely."

Michael Baker International worked alongside KYTC to perform an emergency inspection to determine the extent of damage on the bridge. The Michael Baker team then helped safely return the bridge to service by providing engineering services, inspection, inspection report preparation and fast-paced design to deliver the contract package for repairs within five days.

The Brent Spence Bridge Fire & Rehabilitation project garnered both local and national interest. Its closure had significant impacts on the traveling public. KYTC launched a transparent public awareness campaign to define project goals, provide a clear and consistent message and update the public on the project schedule and daily activities.



Remnants of the vehicle fire that caused damage above and below the bridge deck.

Project Description (continued)

The bridge reopened on December 22, 2020, just 41 days after the initial incident. The project finished under budget, ahead of schedule and with overwhelming positive support from the community. The Brent Spence Bridge Fire & Rehabilitation serves as a model for DOTs on how to effectively respond to an emergency closure of a critical infrastructure asset. Of the successful project, Governor Beshear noted: "The Brent Spence Bridge is a crucial link in our interstate system…The reopening of the Brent Spence Bridge is a welcome Christmas gift to everyone this season."

The project repairs included:

- Replacing upper concrete deck, wearing surface and concrete barriers between PP 16' to PP 20'
- Replacing upper steel stringers and lateral bracing between PP 17' to PP 19'
- Replacing miscellaneous steel on finger joints
- Removing, cleaning and resetting finger joints and drainage scuppers
- Replacing upper deck electrical wiring, junction boxes and conduit
- Replacing lower deck wearing surface between PP 16' to PP 21'
- Replacing lower deck concrete barriers between PP 17' to PP 19'
- Replacing fixtures, electrical wiring, junction boxes and conduit on the lower and upper decks

Technical Design Process and Construction

In order to expedite the award of a construction contract, project team members from KYTC, Federal Highway Administration (FHWA), the consultant design team from Michael Baker and other project partners looked for creative efficiencies in the design process.

Real-time information was relayed directly from the inspection teams to the design team, including the identification of the heat affected zone (HAZ). To offset supply delays, KYTC even secured steel beams anticipated to be needed for the repairs.

The Michael Baker team quickly decided that the most efficient way to repair the bridge would be to replace all damaged components in-kind when possible or design them to be equal or better than the current bridge. The mindset was to keep the actual design and repair documents as simple as possible and only make modifications where necessary, allowing the team to use existing design plan sheets/shop drawings for much of the design. Components were also reused if they were not damaged.

Stringers of the upper deck and the associated concrete deck were visibly damaged. Additional obvious damage was to the lower bridge deck, which was spalled in divots up to 3 inches deep. One of the most critical elements of the bridge was the built-up box section vertical hanger that supports the 453-foot suspended span over the river. Each of these four members supported more than 5 million pounds of load.

To ensure due diligence, Michael Baker performed an internal redundancy analysis. The study concluded that even with consideration of the full fracture of the thickest of the six plates that comprised the vertical member at PP 17', it could still be categorized as redundant and carry the full load of the original design without overstress.

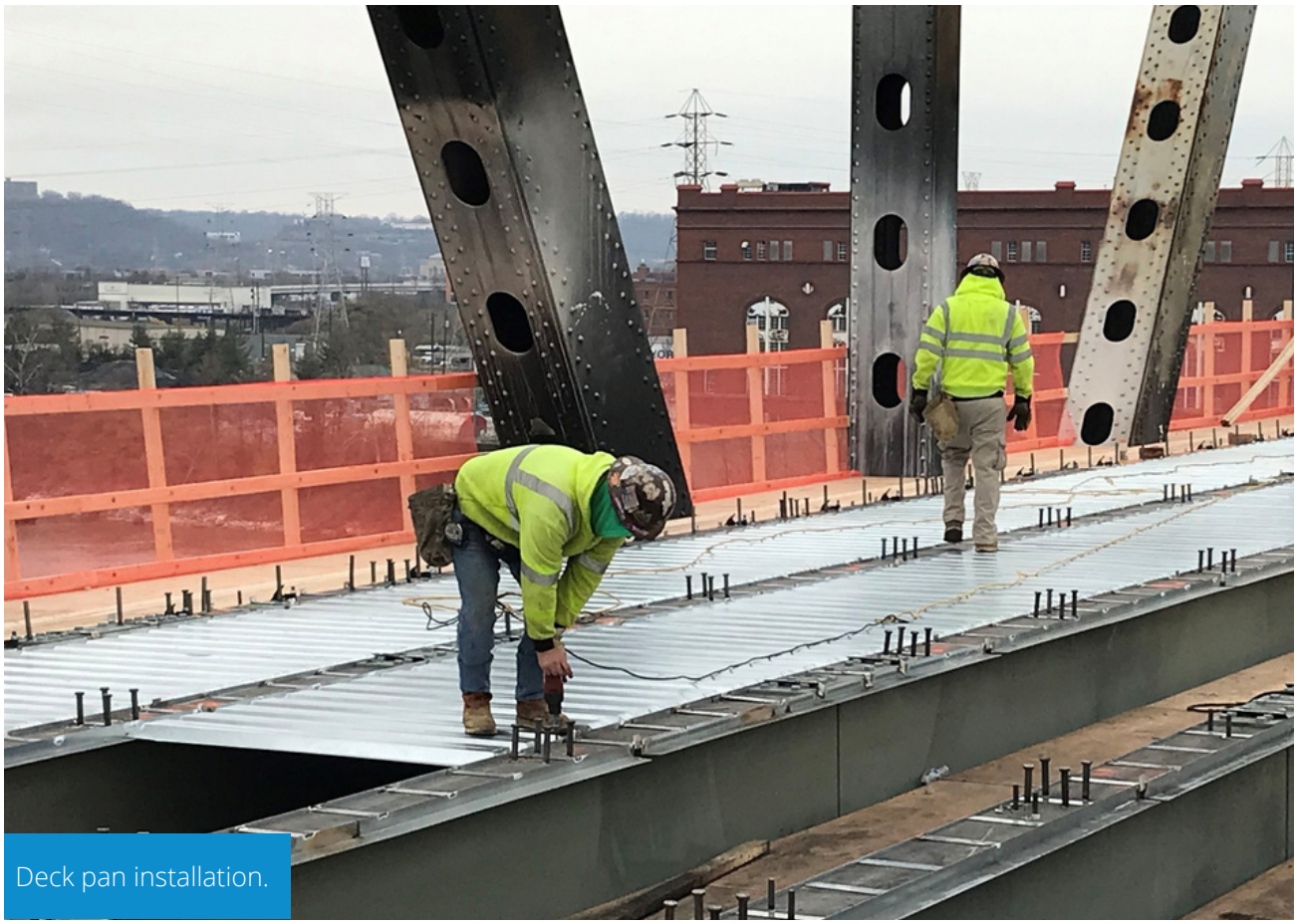
Material testing was also performed on this vertical member. After the lab confirmed the material properties, along with an internal member redundancy analysis as an extra precaution, the Ohio River reopened to traffic.

Technical Design Process and Construction (continued)

The final "Released For Construction" plans were provided to KYTC at 11:00 a.m. on November 16, a mere five days after the initial incident. The plans also included 13 sheets of joint repairs that were already developed to repair the finger joints. Not-for-construction document packages had been shared with bidding contractors throughout the previous two days, allowing the final set to be shared at 11:00 and project bids to be received at noon. The construction contract was awarded later that afternoon to Kokosing Construction Co. (Kokosing).

Shortly after Kokosing was selected as the project's contractor, Governor Beshear announced a target completion date of December 23, 2020. KYTC established three construction inspection teams to cover 24-hour inspection operations, each led by a seasoned construction engineer which allowed for clear decisions to be made in the field. KYTC also established a "back-up" inspection crew that would be ready to step into action should any of the crews have to quarantine due to COVID-19 exposure. Daily update meetings between the KYTC Construction Project Manager, Construction Team Leads, Project Coordinator and Contractor Project Manager were established to ensure constant communication and coordination.

On November 25, the demolition of the upper deck began. The same day, the first shipment of steel stringer beams for the upper deck was delivered to the site. Within days, the deck and affected stringers were removed and stringers were replaced. Following the erection of an upper deck shielding platform, deck pans were installed on the upper deck followed by reinforcing steel and deck/barrier replacement. The lower deck overlay was removed and replaced. Other maintenance repairs to the bridge and approach roadways were performed while the bridge was closed and access was safely and easily obtained.



Deck pan installation.

Maintenance of Traffic

Initial MOT was installed based on the emergency nature of the incident but then transitioned to project-specific MOT. Unlike a typical KYTC construction project, MOT responsibility for this project was addressed outside of construction, both contractually and physically. There was no live traffic in the construction area of the project, allowing the construction contractor to focus only on construction aspects of the project. MOT responsibility was a clean break at the Ohio River; KYTC handled the MOT approach in Kentucky and ODOT oversaw the MOT in Ohio, with coordination between the states.

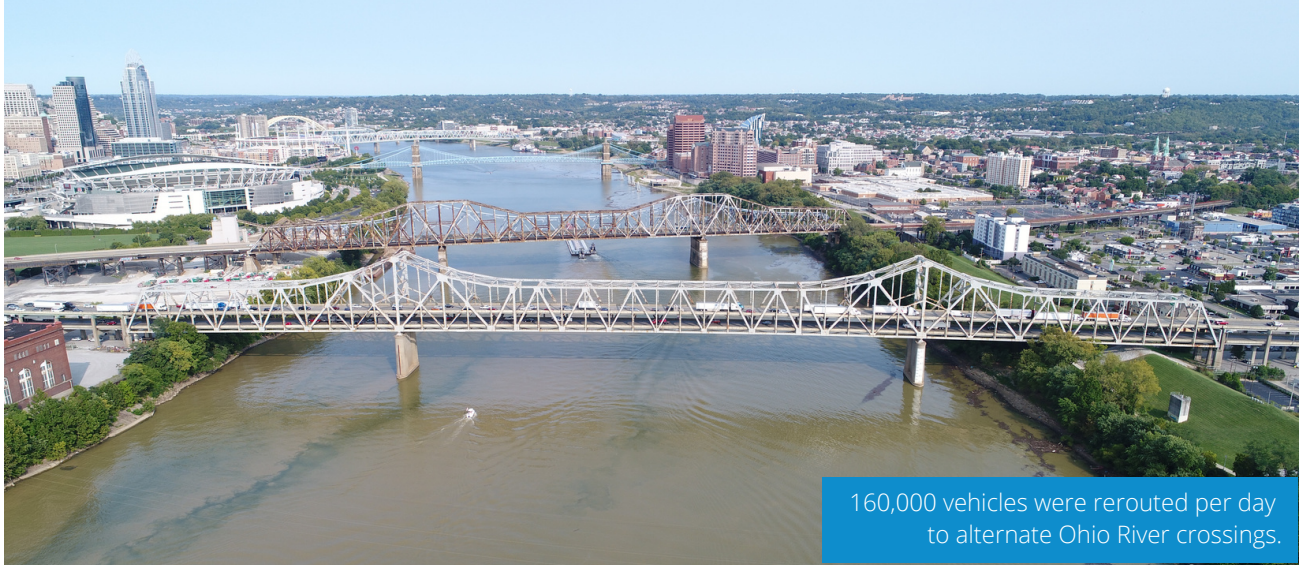
The MOT team was making real-time decisions and adjustments in the field based on observations and comments from local law enforcement partners and the public. Rerouting 160,000 vehicles per day required messaging to be extended outside of northern Kentucky and into the Lexington, Louisville, Indianapolis, Columbus and Dayton markets. The MOT team also coordinated with outside groups and mapping agencies to ensure that the bridge closure was being shared through multiple channels.

Public Awareness

Due to the impact of the bridge closure, the project team identified early the importance of keeping the public informed on project progress and detour suggestions. A project-specific website was created and shared across multiple media platforms. KYTC Secretary Jim Gray and his staff hosted weekly virtual press conferences and daily social media updates established a social media presence. This interaction created a transparency with the public and emphasized the people doing the work, not just the technical details of the work being completed.

Commercial Implications

The Brent Spence Bridge is major thoroughfare for both local and national traffic with an average daily traffic (ADT) of 160,000. The bridge and its approaches are key elements of the nation's interstate system, connecting to 10 states from as far north as Michigan to as far South as Florida and serving as one of the busiest truck routes in the U.S. Almost 3% of the nation's gross domestic product (GDP) annually crosses the bridge and a significant maritime presence operates under the bridge on the Ohio River. Restoring traffic flow to the Brent Spence Bridge was critically important to the local and national economy.



160,000 vehicles were rerouted per day to alternate Ohio River crossings.

Budget and Schedule

On December 21, Michael Baker and KYTC performed a final bridge and construction inspection and on December 22, both decks of the bridge were reopened. This incredible repair timeline included a mere five-day turnaround from the initial incident to construction letting and 41-days to return the bridge to service from the closure. The team was even able to open the bridge one day ahead of schedule, with overwhelmingly positive support from the community. This was due, in large part, to the comprehensive and transparent public awareness campaign that clearly identified the project goals, provided a clear and consistent message and updated the public on the project schedule and daily activities.

The U.S. DOT authorized up to $12 million in Emergency Relief Reimbursement to assist the project. The efforts of the team allowed the project to come in at less than half of this allotted money including costs for inspection, design, public awareness and construction. This unfortunate incident now serves as a model for DOTs on how to effectively respond to an emergency closure of a critical infrastructure asset.

Completion/Use Dates:
Scheduled: 12/23/ 2020 / Actual: 12/22/2020
Construction Costs:
Total Project Budgeted: $12,000,000 / Total Project Actual: <$5,000,000
Entrant's Portion of Total Project Budgeted: $12,000,000 / Entrant's Portion of Total Project Budgeted: <$5,000,000

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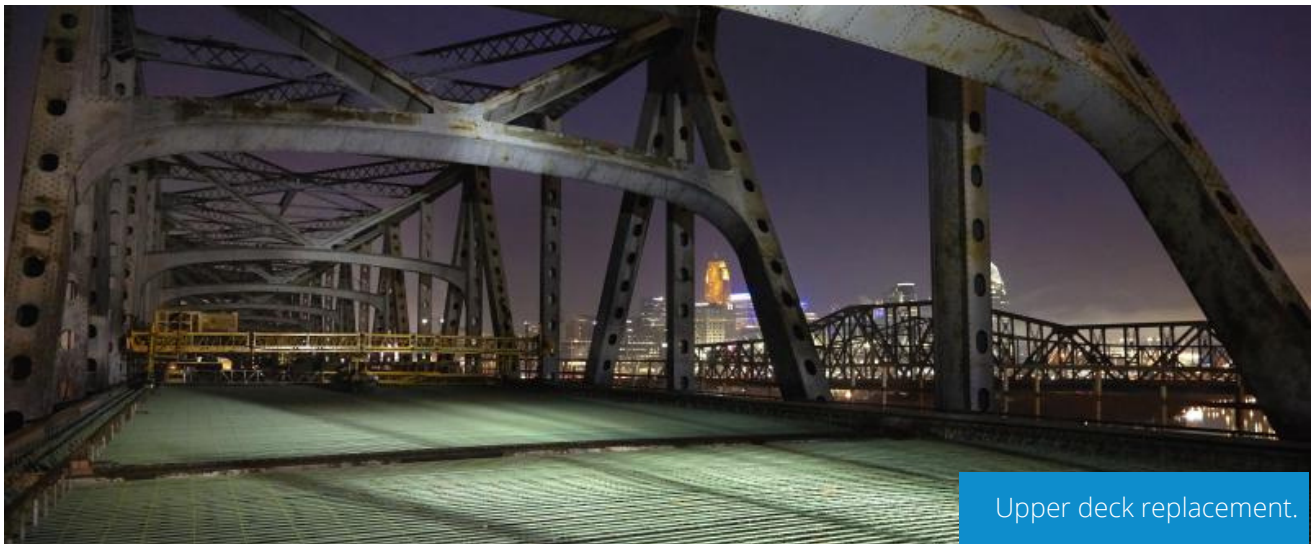
Awards

The project was named the #9 bridge in Roads and Bridges Top 10 Bridges Awards 2021. It also received the Best Bridge/Highway honor from ENR's Best Regional Projects and the APWA National Project of the Year. Additionally, it has received Improvement Awards from ASHE's Bluegrass and Derby City sections, and ASHE's Great Lakes Region's Project of the Year, all in the $5 Million and Under category. Currently, the Brent Spence Bridge Fire & Rehabilitation Project is also a AASHTO Top 12 Finalist for National Grand Prize, the People's Choice Transportation Award.



Upper deck replacement.