PROJECT

Rich Street Bridge Project

The Scioto River gets a ribbon for Columbus's 200th birthday

by C. J. Kiner, Ohio Department of Transportation District 6

Just in time for the Columbus Bicentennial celebration, the Ohio Department of Transportation (ODOT) put a ribbon over the Scioto River, which meanders through the 200-year-old city. A ribbon arch bridge, that is. Technically, the Rich Street Bridge is an engineering marvel, but did pose a few challenges. The bridge design required the use of a three-dimensional model using a finite element method to analyze the structure. The bridge is much more than a link between two points. The Rich Street Bridge is designed to support year-round festivals. Electrical and communication facilities are built into the sidewalks and controlled by master panels located within the columns at each corner of the bridge.

Designed by a Columbus-based design firm, the bridge is a transitional art piece that spans the Scioto River, connecting the past, present, and future.

"The Rich Street Bridge will complete the reconnection of Columbus' very first neighborhood 200 years ago, Franklinton, with our downtown," said Mayor Michael B. Coleman. "The Rich Street Bridge provides a link to jobs and will be a catalyst in the revitalization of Franklinton."

The bridge is adorned with decorative lighting, above and below, and completes the recent reconstruction of the city's Bicentennial Park and the Scioto Mile River Walk and Promenade. The area features light shows, a musical amphitheater, and towering water fountains. The bridge was also center stage when Columbus hosted the famed Red, White, and Boom Fourth of July celebration, the largest fireworks display in the Midwest.

Improving Connectivity

The Rich Street Bridge replaces the historic concrete arch Town Street Bridge which was built in 1917.

The Rich Street Bridge was the perfect back-drop to Columbus's famed Red, White, and Boom Fourth of July celebration. Photo: Burgess & Niple.

profile

RICH STREET BRIDGE / COLUMBUS, OHIO

BRIDGE DESIGN ENGINEER: Burgess and Niple, Columbus, Ohio

CONSTRUCTION ENGINEERING: Finley Engineering Group, Tallahassee, Fla.

PRIME CONTRACTOR: Kokosing Construction Company, Fredericktown, Ohio

CONCRETE SUPPLIER: Anderson Concrete, Columbus, Ohio

PRECASTER: Prestress Services Industries LLC, Grove City, Ohio, a PCI-certified producer

POST-TENSIONING CONTRACTOR: Kokosing Construction Company, Columbus, Ohio

After the concrete ribbon arch design was selected, the city shifted the eastern abutment to align with Rich Street, resulting in improved connectivity. The Rich Street Bridge was also designed with wider sidewalks to accommodate more pedestrians.

"I am proud of what ODOT and Columbus [were] able to achieve in the planning and design of both the Rich and Main Street bridges," said Robert Taylor, P.E., ODOT District 6 planning engineer. "I think we ended up with something that serves a basic purpose, but is also unique and spectacular for the people of Columbus, and its visitors."

Structural System

The bridge is a precast and post-tensioned, concrete rib arch, on reinforced concrete piers and abutments. With three full arch sections and two half arches at the abutments, it spans 568 ft across the Scioto River with roadway limits of 37 ft from curb to curb. This allows for three travel lanes and 10-ft-wide sidewalks on either side. The piers are supported by "H" pilings with a bearing value of 258 ton per pile.

The four abutments are each supported by four, 66-in.-diameter drilled shafts with 60-in.-diameter shafts into bedrock sockets of varying length, but none less than 67 ft deep. An independent testing agency inspected each completed shaft using the cross-hole sonic log testing method (sound is emitted in the structure, graphed, and analyzed to test for structural integrity).

Construction

Construction began by installing a rock causeway, drilling the shafts and building the piers, and fabricating and erecting eight temporary support towers. These towers were used to piece together and stabilize the precast concrete segments during erection and post-tensioning operations. While the contractor was erecting the support towers, the precast concrete segments were individually, custom fabricated, just miles from the construction site, in Grove City, Ohio. Once the towers were in place, the contractor created the arches by setting the 52 precast concrete segments. The heaviest of these segments weighed 188,000 lb.

Placing the pier cap closures. Photo: Ohio Department of Transportation District 6.

With the arch segments in place, the contractor installed the bearing pads and arch blocks and placed concrete for the lower closure joints using a 7 ksi concrete. Once the closure joints achieved the prescribed compressive strength of 3.5 ksi, the four sets of outer rib tendons were pulled and stressed to 50% of the required 835 kips. The inner rib segments were then post-tensioned percent to 100%.

Following the inner rib tensioning operations, the eight deck segments closest to the abutments were placed on elastomeric bearing pads, and the outer rib segments were then tensioned the remaining 50%. All arch rib ducts were then grouted. The final eight deck segments spanning the middle two piers were then placed and the upper closure joints were cast using the same

Delivery of the precast, prestressed concrete girders. Photo: Ohio Department of Transportation District 6.

Snow flurries did not stop construction of the top segment of the rib arch on the Rich Street Bridge. Photo: Ohio Department of Transportation District 6.

THE OHIO DEPARTMENT OF TRANSPORTATION, OWNER

BRIDGE DESCRIPTION: A 568-ft span, precast, post-tensioned concrete rib arch, with reinforced concrete piers and abutments

STRUCTURAL COMPONENTS: 52 precast concrete rib sections and 16 precast and pretensioned concrete beam girders; 10-in. reinforced concrete deck on stay-in-place steel forms with 1 ½ in. micro-silica wearing surface; reinforced concrete abutments on H-piling; reinforced concrete piers on drilled shafts; four sets of reinforced concrete piers each on four 60-in.- and 66-in.-diameter drilled shafts; and elastomeric bearing pads

BRIDGE CONSTRUCTION COST: $20,500,000

The fiber reinforced grating conceals all the utilities under the deck of the Rich Street Bridge. Photo: Ohio Department of Transportation District 6.

Placement of the 1½-in.-thick silica fume overlay on the bridge deck. Photo: Ohio Department of Transportation District 6.

7 ksi concrete. After the closure joints were completed, the stay-in-place forms along with the tendon ducts were installed, the reinforcing steel tied, and the deck concrete was placed. When the deck concrete reached 4.5 ksi, the beam tendons were stressed and grouted. More than 240,000 ft of post-tensioning strand was used in the arch and beam segments.

With the beams and arch ribs fully post-tensioned, the temporary support towers were removed. Another 90,000 ft of tendon was used in the deck and stressed to 308 kips. After the post-tensioning operations were complete, the final abutment work was performed, expansion joints were welded and bolted into place, sidewalks and approach slabs were placed, and railings and final lighting were installed.

"The Rich Street Bridge will provide motorists, pedestrians, and bicyclists a safer connection between Franklinton and downtown for many decades to come," said Columbus Department of Public Service Director Mark Kelsey. "This is an investment in the future of Franklinton and the core of Columbus."

Second only to Texas, Ohio has the largest number of bridges. "We build bridges all the time in Ohio," said Ferzan M. Ahmed, ODOT deputy director. "All of them are important, but there is something about this bridge. It carries a roadway and people, connects neighbors and neighborhoods, and is a showpiece for culture and the arts in the Midwest. That makes building the Rich Street Bridge the perfect project."

Aerial photograph after the bridge deck was placed. Photo: Ohio Department of Transportation District 6.

C.J. Kiner is an area engineer with the Ohio Department of Transportation District 6, Columbus, Ohio. Robert Taylor, planning engineer, and Jeff Vance, construction project manager, for the Ohio Department of Transportation District 6, Columbus, Ohio, also contributed to this story.

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