

PROJECT

Design and Construction of the Third Street Peace Bridge in Dayton, Ohio

by Paul Gruner and Joseph Dura, Montgomery County, Ohio, Engineer's Office



The formliner used to create the image of the 1963 Unity March (top) and the image shortly after form removal (bottom). All Photos: Montgomery County Engineer's Office.

In Dayton, Ohio, the new bridge carrying West Third Street (Dr. Martin Luther King Jr. Way) over the Great Miami River links the historic Wright-Dunbar/West Third Street community with the downtown. This bridge, which is officially known as the Peace Bridge, replaces an 80-year-old structure that was supported by 120-year-old abutments. The existing structure had reached the end of its service life, its piers were founded on spread footings making them susceptible to scour, and portions of the structure were severely deteriorated. The new prestressed concrete I-beam bridge accommodates motor vehicles, pedestrians, cyclists, public transit, and river recreational traffic with five 143-ft-long spans and a width of 86 ft. It also incorporates aesthetic treatments reflecting the community's desire for a bridge promoting peace and unity.

The Peace Bridge spans the Great Miami River, which has always been a natural divide through downtown Dayton, splitting the city into an east side and west side. The construction of Interstate 75 in the 1960s, created an additional physical barrier that further emphasized and magnified the separation between the city's two sides. The Montgomery County Engineer's Office (MCEO) specifically

sought to incorporate features that would reflect the bridge's title and promote community unity. Construction began in October 2019, and the bridge was opened to traffic in December 2021.

Concrete Solutions

A structure-type study was performed to compare steel and concrete superstructure options, determine the optimal span arrangements and number of beams per span, and estimate initial and life-cycle costs. Concrete construction was chosen as the most economical solution and because it could include the unique aesthetic treatments desired for the project. Nine 72-in.-deep, wide-flange I-beam prestressed concrete girders (WF72-49) with an 8.5-in.-thick composite cast-in-place concrete deck compose the typical bridge section for each span. The bridge accommodates a 57-ft-wide roadway section, 10-ft-wide sidewalk, and 17-ft-wide multiuse path. The cast-in-place concrete railings were chosen to reflect some of the aesthetic details from the original 1904 concrete arch structure that had been replaced in 1949.

Cast-in-place concrete wall-type abutments and piers provide durable, low-maintenance support to the superstructure. The wall-type

profile

THIRD STREET PEACE BRIDGE / DAYTON, OHIO

BRIDGE DESIGN ENGINEER: Stantec, Cincinnati, Ohio

OTHER CONSULTANTS: Aesthetic design consultant: Creative Design Resolutions, Brentwood, Md.; traffic engineering and surveying: LJB Inc., Miamisburg, Ohio

PRIME CONTRACTOR: Eagle Bridge Company, Sidney, Ohio

SUBCONTRACTORS: Roadway concrete items: Tri-State Concrete Construction Inc., Cincinnati, Ohio; reinforcing bar installation: Black Swamp Steel Inc., Holland, Ohio

CONCRETE SUPPLIER: Ernst Concrete, Dayton, Ohio

PRECASTER: Prestress Services Industries LLC, Mt. Vernon, Ohio—a PCI-certified producer



In accordance with Ohio Department of Transportation (ODOT) standards, epoxy-coated reinforcing steel was used in the cast-in-place concrete elements to enhance durability. Glass-fiber-reinforced polymer reinforcement was used in the concrete railings to control cracking and reduce corrosion potential.

Community Collaboration

The Third Street Bridge project represents extraordinary efforts of community and agency collaboration. MCEO recognized early on the importance of engaging the historic Wright-Dunbar community, a neighborhood with traditionally underserved populations. MCEO brought local and nationally recognized artist Willis “Bing” Davis and an aesthetic transportation designer onto the project to assist with aesthetic enhancements and engage the community.

MCEO held three public involvement meetings to inform the public and seek input on many project considerations, including aesthetic treatments and maintenance of traffic. Davis, as a local leader, encouraged neighborhood participation. The public was encouraged to offer ideas that would

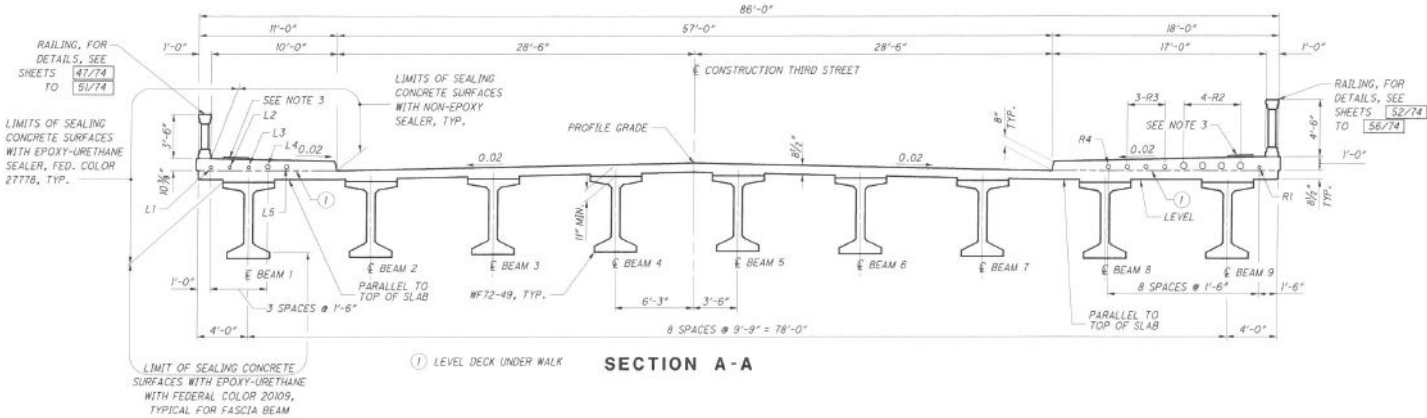
The first I-beam erected was a fascia beam that had been coated with a pigmented sealer at the precaster’s facility. Only the exterior faces and bottoms of the fascia girders were sealed with a pigmented sealer. The colors were chosen through the public involvement process and harmonize with other structures in the area.

configuration also provides a blank canvas for the artwork that was incorporated into the bridge.

Historically, earth-filled concrete arch bridges were often used throughout downtown Dayton at major river

crossings. As these bridges have been replaced, arch components have been incorporated into the new bridges to maintain that appearance. On the Peace Bridge, the concrete arch panels that were added at the piers are strictly architectural and nonstructural.

The bridge accommodates a 57-ft-wide roadway section, 10-ft-wide sidewalk and 17-ft-wide multiuse path. The cast-in-place concrete railings were chosen to reflect some of the aesthetic details from the original 1904 concrete arch structure. Figure: Stantec.



MONTGOMERY COUNTY, OWNER

OTHER MATERIAL SUPPLIERS: Formliners: Architectural Polymers, Palmerton, Pa.; reinforcement: Baseline Supply LLC, Monroe Township, N.J.

BRIDGE DESCRIPTION: Five-span, 720-ft 6-in.-long, 86-ft wide bridge with precast, prestressed concrete girders with cast-in-place concrete substructures, deck, sidewalks, overlooks, and railings

STRUCTURAL COMPONENTS: Nine girder lines of prestressed concrete I-beams (ODOT WF72-49), 142 ft 6 in. or 143 ft 7 in. long and 72 in. deep; 8.5-in.-thick cast-in-place reinforced concrete deck; wall-type reinforced concrete abutments and piers on 16-in.-diameter cast-in-place reinforced concrete piles

BRIDGE CONSTRUCTION COST: \$17.3 million total cost (\$283/ft²)

AWARD: 2021 Outstanding Short Span Roadway Bridge Award, Association of Bridge Construction and Design



Before traditional West African Adinkra symbols were sandblasted and stained into the sidewalk and multiuse path, the contractor created mock-ups (left) for the county to evaluate. The sandblasted symbols, which signify wisdom, humility, strength, advancement, unity, and other qualities, were stained (right) to make them prominent.

“tell *your* story,” so those ideas could be used to develop aesthetic treatments for the structure.

MCEO specifically sought to incorporate features into the bridge that would reflect the “Peace Bridge” concept. Paul Gruner, the Montgomery County engineer, stated that “our Peace Bridge should speak to African American struggles, our city’s rich history, and the legacy of this important structure.” These objectives were achieved through images and tablature developed in conjunction with the Wright-Dunbar community. Concrete formliners were used to include images of the 1963 Unity March, poet Paul Laurence Dunbar, Orville and Wilbur Wright, and the Wright B Flyer, as well as quotations from Dunbar and Dr. Martin Luther King Jr. Information tablatures detailing notable Daytonians and various facets of Dayton’s history are provided along the bridge.

Traditional West African Adinkra symbols have been sandblasted and stained into the sidewalk and multiuse path. Plaques define the symbols, which encompass many traits, including wisdom, humility, strength, advancement, and unity.

Creative Concrete Construction

Other concrete construction techniques that were critical in the aesthetic design included the use of computer-generated formliners for the bas-relief enhancements. Developing the details and specifications to ensure the quality of these images was challenging. Mock-ups of the reliefs allowed the county and design team to ensure that the final product met the project objectives. This method was critical because the liners were limited by 1-in. positive and 1-in. negative casting (primarily due to reinforcing steel cover). Creativity by the contractor resulted in form-tie locations

that do not detract from the aesthetic images and text.

Determining the concrete mixture proportions that would be the best for the aesthetic treatments was also a challenge. The project specified self-consolidating concrete (SCC) for the piers and abutments with images and text. However, because of the calculated hydraulic pressure on the forms using SCC, the contractor submitted a request to use plasticized, 4-ksi design-strength concrete, a material that is typically used for drilled shafts, for these substructure units. The request was approved after the quality of the images and text was proven with the required mock-ups. The four large, wall-type piers were also considered a mass concrete placement per ODOT construction specifications and required a thermal control plan.

The intricate curvilinear shapes of the piers and overlook supports were made possible by using computer-generated expanded polystyrene foam forms. Also of note was the placement of the deck, two-thirds of which was done in one continuous concrete placement of 1400 yd³ between 1:00 a.m. and 2:00 p.m. to avoid the summer afternoon heat.

Multiple Agencies Involved

The Peace Bridge is a county-owned bridge within City of Dayton corporate limits, and the county worked closely with the city government to accommodate its Livable Streets Policy, which was implemented in 2010 to promote the design of surface transportation corridors that balance the needs of users with consideration

Aerial photo of the completed Third Street Peace Bridge. The design of the new bridge not only accommodates motor vehicles but is also inviting to pedestrians, cyclists, and river recreational traffic. Its aesthetic treatments celebrate local history.





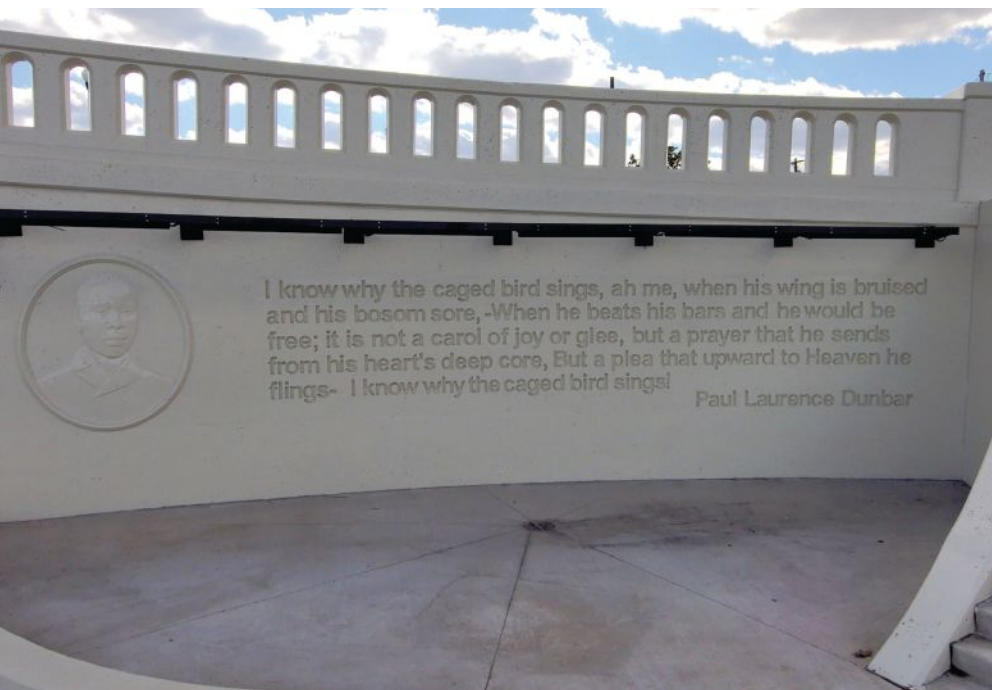
Epoxy-coated reinforcement was placed in the formwork for an overlook support pedestal at a pier. The intricate curvilinear shapes of the piers and overlook supports were made possible by using computer-generated expanded polystyrene foam forms.

to community values, environmental stewardship, safety, aesthetics, and other aspects.

ODOT approved the use of additional federal funding for the project, which allowed the bridge to be widened for the inclusion of a multiuse trail. The additional federal funds were secured through Congestion Mitigation/Air Quality funding and were administered through the local metropolitan planning organization, the Miami Valley Regional Planning Commission.

Bike Miami Valley, a local bicycle advocacy group, participated

A small plaza was created next to the western abutment, where pedestrians can access the Great Miami Recreational Trail. The abutment wingwall features a bas-relief enhancement celebrating the poet Paul Laurence Dunbar, a Dayton native.



The Third Street Peace Bridge design incorporates aesthetic treatments that communicate unity and peace, provide a link to Dayton's history, and help encourage the use of the bridge by pedestrians and cyclists, to the benefit of public health and regional air quality.

throughout the public engagement process. The Greater Dayton Regional Transit Authority requested features to accommodate the bus and trolley lines that also use the Peace Bridge.

Recreation

As noted previously, the Peace Bridge extends over the Great Miami River, which is a recognized water trail. It also extends over the Great Miami Recreation Trail, which runs parallel to and along both sides of the river, and abuts two small parks. The project accommodated a new recreation trail connector to Third Street and inspired the City of Dayton to further improve bicycle connectivity

to the new bridge. Multimodal design solutions were critical to the success of the project. The Peace Bridge serves as a primary connection to downtown Dayton and provides access to the Great Miami Recreation Trail and other local bike/pedestrian facilities.

To accommodate and encourage pedestrians and cyclists and improve air quality, the new bridge's cross section provides a 10-ft-wide sidewalk on the north side, consistent with City of Dayton's Livable Streets Policy, and a 17-ft-wide, design-standard multiuse trail on the south side. MCEO also worked with the Miami Conservancy District, Five Rivers MetroParks, and the City of Dayton to accommodate the many pedestrian and trail connections to Third Street within the project limits. During construction, MCEO maintained access to existing bike and sidewalk facilities, when safe to do so, and provided signed detours with advance notice when bike/pedestrian detours were required.

The project design incorporates aesthetic treatments that communicate unity and peace. Combined with the lookouts and connections to bike/pedestrian facilities, these features encourage the use of the bridge by pedestrians and cyclists, to the benefit of public health and regional air quality. **A**

Paul Gruner is the county engineer and Joseph Dura is a project manager with the Montgomery County Engineer's Office in Dayton, Ohio.