

#1

PROJECT: 11th Street Bridges Design-Build

LOCATION: Washington, D.C.

OWNER: District Department of Transportation

DESIGNERS: URS, HNTB Corp.

CONTRACTOR: Skanska/Facchina joint venture

COST: \$390 million

START DATE: July 2009

COMPLETION DATE: June 2015



By Bill Wilson
Editorial Director

Winning mentality

Innovative approach saves time, money in D.C.

In a matter of hours, playoff baseball was about to make a return to Washington, D.C., for the first time in decades.

Less than a mile away, they were slowly dismantling a losing platform and celebrating every minute of it.

Two welders worked vigorously, poking fire through what was left of a steel beam on the old 11th Street Bridges in late September. In a matter of minutes, the chunk was lifted away and out of sight. The operation was as smooth as the best double play baseball could offer, and the overall project is nothing short of a game-changer, providing once and for all a connection between D.C.'s I-295 and the Southeast/Southwest Freeway (I-395/I-695).

The 11th Street Bridges Design-Build project is No. 1 on the ROADS & BRIDGES 2012 Top 10 Bridges list; a triple crown winner if the categories consisted of traffic congestion relief, innovative delivery and environmental stewardship.

The jobsite is the backbone of the Anacostia Waterfront Initiative, a 30-year, \$10 billion multifaceted program to restore and revitalize the Anacostia River and its waterfront. The Navy Yard is just a stone's throw away, and the relocation of the Department of Homeland Security is about to put a charge into a development boom in the Anacostia neighborhood.

Keep them separate

Built in the mid-20th century, the old 11th

Street Bridges had long exceeded their service lives. Listed as structurally deficient and unable to make any kind of transition between I-295 and I-395/I-695 and local routes, the pair of spans had been tagged to be reconstructed for quite some time, but the options, both structural and financial, were complicated. A project of this magnitude was estimated to cost \$460 million, but only \$260 million was available. Due to the budget tightening, some believed reconstructing the existing bridges would factor into the right decision. However, dense urban surroundings added to the degree of difficulty.

Lead designers HNTB and URS and the District Department of Transportation (DDOT) engaged in a design-build-to-budget procurement model. DDOT established a fixed price and delivery deadline, and it was up to the contractor to work within the footprint. It came down to five proposals, with DDOT going with the plan worked up by the Skanska/Facchina joint venture. The winning approach called for the new construction of three 1,000-ft-long bridges—two handling the interstate system and one serving the local community. Most of the work would be handled offline while traffic continued on the existing route, and according to Peter McDonough, associate vice president, SE Division, and a construction services manager for HNTB Corp., "80% of the traffic movements were 60% of the original budget, so that is how the contractor was selected."



“We allowed the contractor to approach it from his best skills set,” he told *ROADS & BRIDGES*. “By actually building the three new river crossings it was easier to get that proper alignment in there.”

Skanska/Facchina also had to be careful with its handling of the Anacostia River, which had been abused for generations. Fish migration also came into play. During a four-month window between March and July, construction is typically restricted in the river to accommodate the activity. Skanska/Facchina decided to move forward without constructing cofferdams, and through the use of innovative precast, post-tensioned, 6-ft-diam. concrete piling they were able to create minimal disturbance to the riverbed by driving the piles through a barge template. The piles were driven approximately 50 ft down to bedrock. Each pier consisted of five columns.

“Because they did that, the moratorium was waived,” said McDonough.

The joint venture also benefitted from the DDOT going against what it normally did in an effort to fit the project in the tight budget and timeline. DDOT does not install stay-in-place forms to help build concrete bridge decks. The practice is done in Virginia, and Skanska/Facchina approached the agency about trying it in Washington, D.C. The move eliminated the need for crews to come in after construction and remove forms, resulting in a cost savings of \$1 million. After pier construction—each bridge has

four in the water—the high-strength, deep-corrugated galvanized steel units were installed on top of the girders.

Crews then placed the rebar before laying down the bridge deck. The first major interstate movement—I-295 to inbound I-395/695—was open to traffic on July 30, and the achievement was a monumental one. Any further delays would have forced the DDOT to place weight restrictions on the original bridges.

DDOT also allowed the contractor to adapt Virginia’s technique when it comes to installing drainage systems, which is geared more toward the interstate system instead of one that is typically used on DDOT’s urban street system. With the urban system, a manhole must be placed at every inlet. The requirement is not as extensive on the interstate system.

With Skanska/Facchina pulling off one innovative move after another, the DDOT agreed to take on utility responsibilities, which were quite extensive due to the fact that the project was directly on top of approximately 200 years of older, now-buried development.

Time cannot be pulled, but it can be chopped. DDOT and Skanska/Facchina worked with the community on a six-month detour that knocked off four months of the work schedule. Access to a bridge that went over the CSX railroad was completely shut off to traffic, reduc-

ing a two-phased plan down to one. The partnership with the CSX railroad is expected to pay off in the future as well. The 11th Street Bridges project was in full swing when the CSX was going through initial planning to upgrade an existing tunnel so it could have double-stack capabilities. To avoid any rework long after project completion, DDOT and Skanska/Facchina made sure the two sets of plans coordinated with each other. For example, instead of installing an MSE

Bridge with a view

The new local bridge that will cross the Anacostia River will have multimodal capabilities. A 15-ft-wide bike/pedestrian path takes up part of the span, and another section is devoted to future streetcar use. Crews have constructed bump-outs to accommodate future track. The streetcar is making a comeback in Washington, D.C. The city is currently executing a 37-mile project that will mark the return of the transportation mode.

“The district is very high on being able to build choices for commuters and residents so that the car is not the only mode of transportation that we look at,” Nick Nicholson of the DDOT told *ROADS & BRIDGES*. “Those have been maintained throughout construction as well.”

The old outbound bridge will not be entirely removed. According to McDonough, two channel piers are going to be repurposed and will be connected to the new local bridge and serve as an observation deck.

“It gives you a view of Anacostia, the Frederick Douglas Bridge, the historic Navy Yard and the landscape of the city,” said McDonough.

At press time, phase one was about 85% complete, and all three of the river

“We allowed the contractor to approach it from his best skills set. By actually building the three new river crossings it was easier to get that proper alignment.”

bridges were finished. Substantial completion will be achieved by the end of this year. Phase two of the local bridge is currently under construction and is set to be finished in December. The old outbound bridge was about 90% demolished and the inbound bridge was currently under demolition. The reconstruction of 11th Street between the north river embankment and M Street also was taking place. When complete it will handle two-way traffic in each direction. **R&B**

#2

PROJECT: Pearl Harbor Memorial Bridge

LOCATION: New Haven, Conn.

OWNER: Connecticut Department of Transportation

DESIGNER: URS Corp.

CONTRACTOR: A joint venture of Walsh Construction and PCL Construction

COST: \$417 million

START DATE: Sept. 14, 2009

COMPLETION DATE: June 30, 2015



By Jeff Zagoudis
Associate Editor

An extra dose of innovation

Connecticut bridge will be first extradosed span in U.S.

Replacement of the “Q” Bridge, as it is known by New Haven, Conn., residents—so named for crossing the Quinnipiac River—is the sixth of seven parts to the I-95 New Haven Harbor Crossing (NHHC) Corridor Improvement Program, one of the largest multimodal transportation improvement initiatives in Connecticut history.

The project team is adding its own bit of history to the proceedings by making the new bridge the first extradosed bridge completed in the U.S., and the third in North America.

Several constraints made the innovative configuration a necessity. First and foremost, the new bridge had to connect with the flyover ramps to I-91; this suggested a cast-in-place segmental box girder design. New Haven Harbor, directly adjacent to the project site, threw a wrench into that plan.

“By the time you have a long-span bridge crossing the structure, the depth of the box girder wouldn’t permit the required navigational clearance,” project manager Sean Bush told *ROADS & BRIDGES*.

The next thought was a traditional cable-stay bridge, featuring higher towers and lifting the whole structure. This was quickly overruled as well, due to FAA regulations surrounding nearby Tweed New Haven Regional Airport.

These conflicting requirements left little doubt that an extradosed approach was needed.

“They looked at a hybrid of the two, keeping a slender box across the river crossing for the navigational clearance and then keeping the towers short for aviation clearance,” Bush said.

At present, construction is in the second of three planned stages. Stage one built the new northbound bridge and shifted traffic over from the old bridge. In stage two, crews are building a temporary bridge to connect new with old and reroute southbound traffic. Stage three—expected to commence sometime next year—will create the new southbound bridge.

Upon completion, 10 lanes will be open to north- and southbound New Haven traffic. Accommodating that many lanes obviously requires a wide expanse; the main span, a cast-in-place segmental box girder, is 108 ft wide at its peak, narrowing to 98 ft.

“To my knowledge it’s one of the widest cast-in-place segmental boxes ever built,” Bush said.

Stage three will provide its own set of challenges, as the schedule is condensed for that portion. As a result, much of that work was done during stage one, consisting of trestle and foundation work beneath the existing southbound bridge.

“We focus on these towers and stay cables, which are impressive,” said Bush, “but a lot of impressive, challenging work is going on underneath the shadow of the existing bridge. **R&B**”

#3

PROJECT:
Wabash River Bridge

LOCATION:
Mount Carmel, Ill.

OWNER: Illinois DOT

DESIGNER:
Alfred Benesch & Co.

CONTRACTOR:
A joint venture of
Midwest Foundation
Corp. and Halverson
Construction Co. Inc.

COST: \$33 million

START DATE: March 3, 2008

COMPLETION DATE:
Dec. 10, 2010



Bridge over flooding water

Active river, seismic activity challenge Ill. bridge project

By Jeff Zagoudis
Associate Editor

The Illinois Department of Transportation knew the bridge over the Wabash River in Mount Carmel, Ill., needed to be replaced. The original 2,800-ft, 12-span steel through-truss structure was too narrow to accommodate modern traffic concerns.

Finding a suitable alternative, however, was problematic due to four factors:

- Uneven bedrock: Levels were close to the surface on the Illinois side and dramatically lower—up to 100 ft deep—beneath the riverbed and over to Indiana;
- Seismic activity: The bridge is located near both the Wabash Valley and New Madrid seismic zones;
- Flooding and scour: Water levels can change upwards of 30 ft in a short period. This can also carry fallen trees; and
- Thermal effects: Temperature variations could affect the integrity of the piers.

“Every time we designed for, say, seismic events and got a foundation that worked, when you go to check it for scour, you find out it doesn’t work for that,” Benesch project manager David Morrill told *ROADS & BRIDGES*. “When we got that right, we checked it for thermal and it wouldn’t work for that.”

Piers four and five were especially a nuisance, as they were in the water over one of the areas of shallow bedrock. “The

rock was so close in those areas that we just couldn’t drive the piles because there was no way we could get a cofferdam around those piles and get the water to build the footing,” Morrill said.

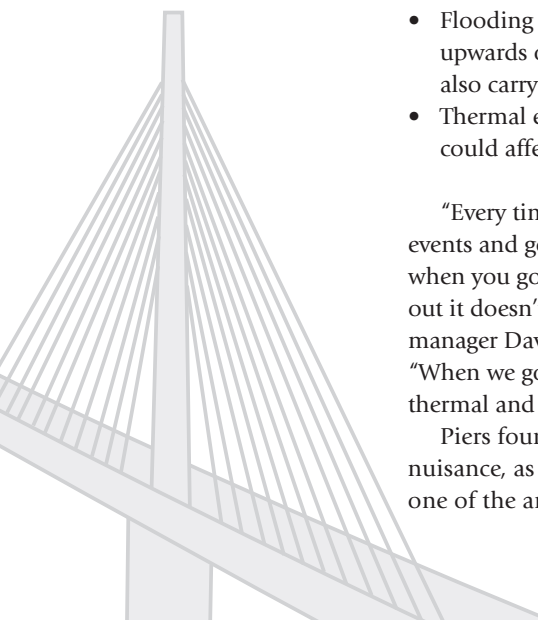
Benesch considered several options to address all four issues, ultimately deciding to build piles beneath the bridge footings to support them. To account for seismic and thermal forces, the piles were driven at an angle instead of vertically. Pile groups were arranged differently for each foundation, addressing the challenges of piers four and five without compromising the rest of the structure.

“Again, we designed it to be economical, but then in field conditions, you find you didn’t quite get the resistance your soil borings and geotechnical analysis would have indicated,” Morrill said.

Access to the Illinois side of the jobsite required navigating around a levee protecting Mount Carmel.

Once the bridge was completed, crews realized the lowest girders—a combination of hybrid steel and precast, prestressed concrete—left little room above the top of the levee, meaning sunlight couldn’t penetrate to nurture grass needed to prevent soil erosion. Instead, Benesch planted several large boulders to keep the soil in place.

Other features of the new bridge include extrawide shoulders for bicyclists. **R&B**



#4

PROJECT: Mississippi River Bridge
LOCATION: St. Louis
OWNERS: Missouri DOT and Illinois DOT
DESIGNER: HNTB Corp.
CONTRACTOR: Joint venture of Massman Construction, Traylor Brothers and Alberici Constructors
COST: \$667 million
START DATE: Feb. 15, 2010
COMPLETION DATE: Aug. 20, 2014



Feat of concrete

Mississippi deltas rise at St. Louis

By Allen Zeyher
 Managing Editor

One of the most challenging tasks in constructing the new Mississippi River Bridge between St. Louis and southwestern Illinois was casting the massive concrete foundations for the towers.

Each of the two tower footings is 24 ft deep, 55 ft wide and 88 ft long. They are the largest of the mass concrete objects on the project. The tower bases sit on top of the footings and rise 70 ft above to the base of the bridge deck. Each massive foundation contains more than 1.9 million lb of closely packed reinforcing steel. The reinforcing steel was nicknamed the “canary cage” by some workers, who joked that even a canary could not fit between the bars.

Pouring the concrete for the first foundation, on the Illinois side of the river, took 43 hours and involved more than 3,600 cu yd of concrete.

Below the two foundations are six 12-ft-diam. drilled shafts sunk through about 30 ft of water, 70 ft of silt and mud and 20 ft of limestone.

The delta-shaped towers for the new Mississippi River Bridge reached their full 400-ft height over the summer. The bridge as a whole reached No. 4 on the ROADS & BRIDGES Top 10 Bridges list.

The bridge is the first bridge built in more than 40 years between downtown St. Louis and southwestern Illinois. The new bridge will carry the rerouted I-70 across the Mississippi River

and give drivers less congestion and less travel delay than they have been experiencing with I-70 sharing the Poplar Street Bridge with I-55, I-64 and U.S. Rte. 40.

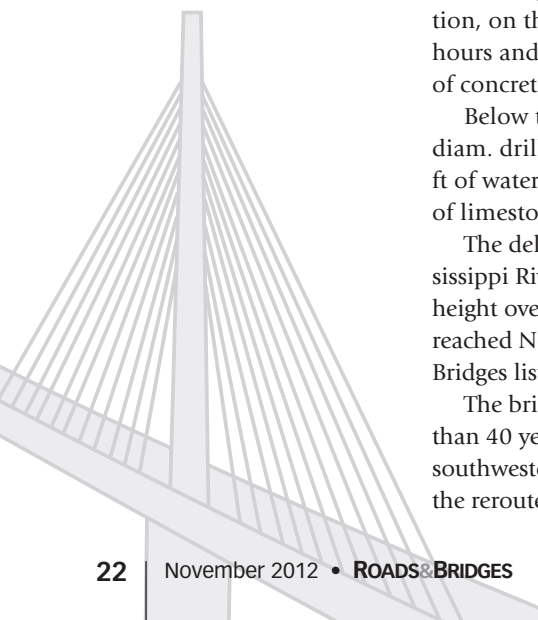
The cable-stayed main span of the bridge will be 1,500 ft long, with a total span of 2,803 ft.

The deck segments and stay cables will be assembled at the same time in balanced-cantilever method.

Construction of the four-lane deck for the bridge has started and workers are connecting the first of more than 600 miles of cable between the towers and the roadway. Construction work for the Illinois approach is proceeding well. Crews have completed installation of all the girders on the Illinois approach and have started the initial work to form up the driving surface. The Missouri approach structure is complete.

Live pictures of the construction site are available on the project’s website at www.newriverbridge.org.

Construction of the bridge is part of the larger project of rerouting I-70, which also involves constructing a roadway connection between the existing I-70 on the Missouri side of the river and the new bridge, a roadway connection between the new bridge and the existing I-55/64/70 Tri-Level Interchange in Illinois and improvements at the I-55/64/70 Tri-Level Interchange. **R&B**



#5

PROJECT: Willis Avenue Swing Bridge
LOCATION: New York, N.Y.
OWNER: N.Y. DOT
DESIGNER: Hardesty & Hanover LLP
CONTRACTOR: Joint venture of Kiewit Constructors/Weeks Marine Inc.
COST: \$652 million
START DATE: August 2007
COMPLETION DATE: December 2012



Lots of swing action

NYC handles complex bridge project over Harlem River

By Bill Wilson
 Editorial Director

As the large vessel crept down the East River, a line of bridges opened wide to let through one of their own.

In a few hours, the final piece of the Willis Avenue Swing Bridge—350-ft-long, 2,500-ton swing span—was in place, and now it was the one clearing a lane for ships and the like.

According to William Nyman, project manager for Hardesty & Hanover LLP, the lead designer during the Willis Avenue gig, which is being called the largest ever undertaken by the Movable Bridge Group of the NYC DOT's Division of Bridges, moving the swing span 160 miles from its point of origin in Albany, N.Y., and lifting it into its final resting place over the Harlem River was one of the most dramatic aspects of the project.

"There were a lot of difficult parts, but that was the most visible," Nyman told *ROADS & BRIDGES*. "We had to pass under a number of bridges that if they were open during rush hour would really mess traffic up. It was a well-orchestrated activity."

Center barges carried the swing span close to the jobsite, then transferred it over to catamaran barges for the final lift. A combination of tidal action and the ballasting of the barges allowed crews to maneuver the 2,500-ton piece to the top of the center pivot pier. The Coast Guard granted the joint venture of Kiewit Constructors/Weeks Marine Inc. a 60-day window to lock the final segment down, and

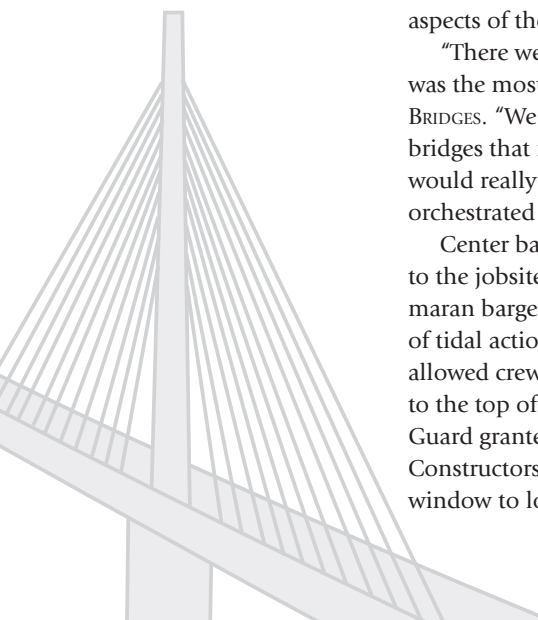
after the bridge deck was placed traffic was moved off the existing bridge over to the new Willis Avenue swing span.

The entire swing span is centrally supported on what is being called the world's largest spherical roller thrust bearing, which can rotate but also supports the weight of the swing span. The thrust bearing sits on a bearing housing with a series of 30 rollers around it to allow the span to rotate. Bridges in New York City are now being designed for seismic load, and the bearings in this system have seismic load resistance and are low friction.

In order to ensure a smooth final maneuver, crews constructed the cast-in-place approaches by using a variety of bridge types, including steel curved girders and trapezoidal box girders, tailored to the site constraints.

The bridge is supported by 271 drilled shafts reaching depths up to 140 ft, and the use of 623 minipiles allowed Kiewit/Weeks to handle the tight working environment. Smaller equipment was used for the minipiles, which came in handy in narrow median areas and when work was done under the existing bridge and the RFK Triborough Bridge.

The bridge's vessel impact protection fender system incorporated more than 800 fiber-reinforced concrete piles. The design also was context sensitive, as plans called for the use of arched pier details reminiscent of the original ones, and granite masonry was repurposed. **R&B**



#6



FOURCHON TO LEEVILLE BRIDGE (PHASE 1A)

Fourchon, La., to Leeville, La.

COST: \$139.1 million

LENGTH: 5.5 miles

DESIGNER: CDM Smith

CONTRACTOR:

James Construction Group LLC

OWNER: LaDOTD

The end-on is just the beginning. In order to prevent any disruption to, or damage of, the sensitive wetlands over which the bridge was built, LaDOTD required the contractor to utilize the end-on construction technique, which meant staging all equipment off the bridge itself rather than from barges. Hurricanes Gustav and Ike also came into play. Despite the weather-related delays, crews still completed work on time.

#7



CLEVELAND'S I-90 INNERBELT BRIDGE

Cleveland

COST: \$290 million

LENGTH: 5,000 ft

DESIGNER: HNTB Corp.

CONTRACTOR:

Walsh Construction Co.

OWNER: Ohio DOT

One thing was clear, crews needed to build support for this bridge, which required deep foundations—more than 160 ft deep in most locations. The final design used the largest pile in the U.S. to date. Drilled shafts were required for the piers on the relatively soft slope of the western bluff. The contractor removed more than 300,000 cu yd of soil to prevent the slope failures that had contributed to previous structural damage on the existing bridge.

#8



AMELIA EARHART BRIDGE

Atchison, Kan.

COST: \$60 million

LENGTH: 2,545 ft

DESIGNERS: HNTB Corp., Mactec, CBB and Kansas DOT

CONTRACTOR:

Archer Western Contractors

OWNERS: Kansas DOT, MoDOT

Amelia Earhart herself would appreciate how this bridge project took flight. The job consists of constructing four units of prestressed concrete girder spans and a 527-ft continuous tied-arch span, and features a unique flooring system and deck. HNTB designed each tie girder to bolt together rather than welding them. The move will make the span more redundant. The stringers also have slotted connections on every other floor beam. A ternary concrete mix was used on the bridge deck.

#9



TRI-STATE TOLLWAY/JANE ADDAMS MEMORIAL TOLLWAY TRI-LEVEL BRIDGE PROJECT

Cook County, Ill.

COST: \$13 million

LENGTH: 3,354 ft

DESIGNER: Alfred Benesch & Co.

CONTRACTOR: Lorig Construction

OWNER: Illinois Tollway

Operating at just the try level was not going to be good enough here. Crews had to be successful on this Illinois Tollway Tri-Level project, which was on one of the most complicated and heavily traveled interchanges on the Illinois Tollway's 286-mile system. Repairs to the flyover ramps included the first full replacement since the interchange opened and replacement of 53-year-old precast prestressed concrete beams in the approach spans.

#10



CUSHING STREET/LUIS G. GUTIERREZ BRIDGE

Tucson, Ariz.

COST: \$4.5 million

LENGTH: 310 ft

DESIGNER: Structural Grace Inc.

CONTRACTOR:

Ashton Contractors & Engineers

OWNER: City of Tucson

People have inhabited Tucson's west side for 5,000 years, but you still have to give them reason to stay. This bridge accomplishes the feat, as it is the first multimodal public works project in the state. Pier shafts are the longest ever built for an AASHTO girder bridge in Arizona, and the deck features 6-in.-deep rail block-outs and a 3-in.-deep block-out down the centerline for a brick paver median. The abutments and end pylons for the balusters are veneered in volcanic rock.