Going BIG in Ohio

The largest project in Ohio DOT history replaces an historic Cleveland crossing with a new delta girder bridge.

BY STEVE HAGUE, S.E., P.E., AND JOEL HALTERMAN

Photos: Brad Feinknopf

CLEVELAND IS A STEEL TOWN.

Steel mills have provided jobs for generations of Cleveland families. One of the most popular shopping areas is even called Steelyard Commons, and nearly every major bridge in the area is steel, including the Interstate 90 Innerbelt Bridge.

Interstate 90 provides major east-west access over the Cuyahoga River and through downtown Cleveland via what has become a functionally obsolete 1959 deck truss, thanks to a nearly 40% increase in vehicular traffic. Originally designed to carry a maximum of 100,000 vehicles daily, it now handles more than 138,000 cars a day.

When it came time to replace the historic structure, citizens were asked to vote on three steel alternatives: a cable arch scheme; a design with the deck supported on a series of slender, parallel beams spanning from pier to pier; and a delta girder scheme (the latter won). According to Dave Lastovka, project manager for the Ohio Department of Transportation (ODOT), the design is intended to complement Cleveland's historic collection of steel river bridges while honoring steel's role in the region's economy.

"It is forward-looking but without clashing with the existing design vocabulary of the river valley," he said.

ODOT's Biggest

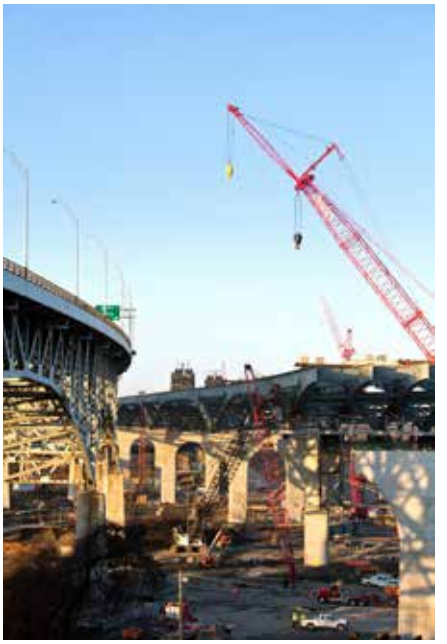
At $640 million, which includes $79.4 million in American Recovery and Reinvestment Act funds, replacing the I-90 Innerbelt Bridge is the largest single infrastructure investment in ODOT history. And because the project is so large, ODOT broke it in two: a westbound bridge, which is under construction, and an eastbound bridge, scheduled to begin later this year.

Splitting the bridge into two "smaller" projects as opposed to one mega-job offered two advantages. First, it allowed for a more competitive bidding environment; it kept the projects from being so large that only a few firms could bid on it. ODOT believed generating more competition could result in a better price. Second, it didn't close down the entire existing bridge all at once. Doing so would have significantly reduced access to downtown. Building the project in phases allows traffic to continue using a portion of the existing bridge while the westbound bridge is built. Then, both directions of traffic will be moved onto the new bridge while the old bridge is demolished and the eastbound bridge is built.

The design-build team of Walsh Construction and HNTB Corporation (the latter also designed the original Innerbelt

▲ The new westbound portion of the Innerbelt Bridge under construction next to the existing 1959 bridge.

▲ The new bridge will replace a crossing that currently carries 40% more traffic than it was designed to.



▲ The crossing is the biggest project in ODOT history.

Steve Hague is a project director and vice president in HNTB's national bridge practice. With nearly 30 years of experience in complex bridge design, Hague is widely recognized as a leader in the design of cable-stayed and other complex bridges. You can reach him at **shague@hntb.com**. **Joel Halterman** serves as the Section 2 project manager for the I-90 Cleveland Innerbelt Bridge for Walsh Construction Company, where he supervises on-site teams and manages daily field operations for Section 2 with an emphasis on structural components. You can reach him at **jhalterman@walshgroup.com**.

The westbound bridge will use 20,000 tons of structural steel in all.

Bridge) was awarded the westbound bridge contract in September 2010. Their winning bid of $287.4 million was significantly lower than the engineer's estimate of $400 million and other competitors' bids.

The design-build team also reused materials whenever possible and placed the new bridge's alignment as close to the existing alignment as possible, saving the expense of purchasing adjacent urban real estate; at the narrowest point, the existing bridge and the westbound bridge are only a few feet apart.

The I-90 Innerbelt Bridge replacement also marks the first time ODOT has issued a value-based design-build contract, which combines the technical scores of each proposal with the bid scores to determine the overall best value. According to Lastovka, using design-build procurement saved ODOT approximately $100 million and reduced the project delivery schedule by eight months.

The eastbound portion of the bridge will mark another first for ODOT: It will be delivered using a design-build-finance model, where a private sector venture funds and builds the bridge and ODOT pays the team back with interest.

Steel Knuckles

Construction on the westbound bridge began in 2011 and many project milestones went largely unnoticed by the traveling public. But when the first steel knuckle girder elbowed its way into downtown Cleveland on a flatbed semi last June, motorists couldn't help but do a double-take. A critical piece of the bridge's delta girders, the 50-ton, 67-ft-long knuckle took up two lanes of traffic and required a highway patrol escort. The main bridge section requires 80 of these knuckles; collectively they weigh 4,000 tons.

Each of the new bridge's 40 signature delta girder assemblies is made up of six steel components: two knuckles, two delta legs, one top girder and one "V" portion. Each delta assembly is connected to the next with a straight girder and the knuckle connects the delta legs with the top girders.

Supported by 14 piers—some eight stories tall with pier caps 143 ft long—the new five-lane westbound bridge will soar 120 ft over the Cuyahoga River at its highest point. In all, it will use 20,000 tons of structural steel, 5,500 tons of rebar and 8,000 tons of steel piling (80,000 linear feet) and will have a life expectancy of 75 years.

While the Cuyahoga River is only about 200 ft wide at the point of the bridge's crossing, the main viaduct is nearly a mile long because it must clear an industrial/rail area known as the Flats. To meet this specification, one span alone will leap 380 ft over a Norfolk Southern Railroad trestle to avoid disrupting train traffic.

"Concrete girders aren't practical for bridge spans of such length," noted Tom Hyland, Innerbelt project construction manager for ODOT.

For the foundations, steel H-piles (supplied by Skyline Steel, a Nucor Company) were driven with a pile hammer as far as 220 ft into the ground to the point of refusal. This process was repeated 12 to 16 times for each leg of each bridge pier. To support the westbound bridge's massive foundations, design specifications called for HP18×204 sections, the largest H-pile section ever rolled by a U.S. steel mill. Made of ASTM A572 grade 60 steel, the H-piles measure 50 ft to 65 ft long with 1-in.-thick webs and flanges; 1 ft of pile weighs 204 lbs. The flanges of the H-shape are 18 in. wide and the depth of the section is also 18 in., forming the H.

"Using larger piles actually saved ODOT money," said Hyland. "Pound for pound, the larger H-pile proved to be less expensive and required less total steel than using more H-piles of a smaller size."

Downtown Link

The westbound bridge is set to be completed this fall and, along with the eastbound bridge, it will connect downtown Cleveland to Interstates 71, 77, 90 and 490, as well as State Route 176, and will improve access to the Cleveland Port Authority, Burke Lakefront Airport, sports and entertainment venues and Cleveland's Amtrak station. MSC

Owner
Ohio Department of Transportation

General Contractor
Walsh Construction, Chicago

Structural Engineer
HNTB Corporation, Cleveland

Steel Fabricator
High Steel Structures, Inc., Lancaster, Pa. (AISC Member/NSBA Member/AISC Certified Fabricator and Advanced Certified Erector)

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