15 of 16 DOCUMENTS

Engineering News-Record

February 4, 2013

NERVES AND TONS OF STEEL

BYLINE: BY AILEEN CHO

SECTION: Cover Story; Pg. 28 Vol. 271 No. 3

LENGTH: 1729 words

The 1,485-ft-long steel arch bridge, with a 505-ft-long main span, forms a crucial crossroad: It carries eight lanes of Interstate 95 across the Harlem River, linking, with a swirling medley of eight ramps, the Cross Bronx Expressway with other key arteries, such as the George Washington Bridge and the Major Deegan Expressway, or Interstate 87. Two parallel steel arches on concrete foundations cross the river with a 135-ft clearance and concrete-and-steel-girder approach viaducts. The rehabilitation project is the largest in the history of the New York State Dept. of Transportation (NYSDOT), says Commissioner Joan McDonald. It involves replacing the deck, retrofitting the steel arch span and support beams, and repairing or replacing support piers and foundations--all while maintaining passage of 200,000 daily vehicles.

«It's like riding a bicycle while changing the tires,» says Phillip Eng, assistant commissioner for NYSDOT. «How do you reconstruct it while keeping 200,000 vehicles a day flowing?»

The question was tough enough that when NYSDOT first solicited bids in 2007, it received no submittals. «We heard from the contracting industry that we needed to address how to reconstruct the ramps, maintain traffic and be able to work over the parks,» Eng says. «We went back to the drawing board. We had our designers take another look and put together a plan of action upon which contractors could bid.»

Five teams bid in January 2009. The winning team was a joint venture of the Chinese contractor CCA Civil Inc.--a Jersey City, N.J.-based subsidiary of the China State Construction Engineering Corp.--and Halmar International, Nanuet, N.Y. The contractors had recently begun to work together and were fresh off a successful design-build project to construct a new rail station near Yankee Stadium, not far from the Alexander Hamilton Bridge, or AHB (ENR 5/18/09 p. 25).

«We dedicated a staff of 40 to this job,» says Chris Larsen, Halmar principal. «It is the most complicated steel rehabilitation job I've ever seen.»

The contract called for four temporary ramps, made up of eight bridge structures, to carry traffic while the original ramps were refurbished. CCA-Halmar decided it could revise the plan to reduce steel and speed up erection to ensure schedule adherence. «We undertook redesigning all the temporary supports and ramps--work worth an estimated $100 million,» says Larsen. «We spent $5 million out of our own pockets and reduced the steel required by at least half.»

The joint venture procured 450 tons of steel for the temporary structures in Shanghai. While this saved money and time because the fabricator provided a single source of supply, it presented additional challenges. «We had to figure out how to completely satisfy state specs,» says Peter Wu, CCA executive vice president. «It was a learning curve on how to procure quality steel in China. We had to do our own quality assurance,» adds Larsen. The team tested and certified 100 Chinese welders. Moreover, the fabricated components had to fit into 40-ft containers for shipping across the ocean.

The team also redesigned the temporary shoring towers. «We weren't confident that the [originally designed] towers would be adequate,» says Larsen. «The original temporary structures incorporated jacking towers, much like a beefed-up scaffold tower,» adds Jesse Jameson, CCA-Halmar project manager.

In order to minimize time and maximize space, «we came up with an idea to utilize the existing concrete columns as part of the shoring itself,» says Larsen. «We tied these 30-in.-diameter pipe columns to the existing columns.» The tubular towers, which vary in height from 15 ft to 90 ft, reduced the steel required and created more workspace underneath the bridge, which is squeezed between parks, the river and a commuter railroad.

Moreover, says Jameson, «there was a big concern about differential settlement of the [original] temporary towers. Each had four foundation points. If one leg settles differently than another, we have a problem.» Now, each tower has just one point load, eliminating the risk of uneven settlement.

More challenges were to come. «Because the floor beams from the arch side were so close to those on the approach side, design engineers couldn't get in to see the actual conditions,» says Manuel Silva, NYSDOT construction area supervisor. Early in the project, crews found worse-than-expected deterioration of the now 50-year-old bridge's floor beams, spandrel girders and related connections.

«That was a huge problem. Those floor beams go across the whole bridge,» says Silva. NYSDOT's designers drew up new plan sheets, which the contractor reviewed, offering suggestions. «When we agreed on a final design, [the contractor] had to do shop drawings and obtain approvals,» Silva says. «They did a 3D model of the interface of the floor beams with the spandrel girders. They suggested assembling elements at the fabricator, so they could be brought to the site and dropped in one piece.»

Jameson adds, «You have these four big arch ribs, and spandrel girders that support the floor beams and stringers. At the very end of each of those girders--at eight locations--there was deterioration no inspector could ever see because there was so much steel there. When we took the deck off--whoa.»

Designers with Jacobs Engineering, based in Albany, had to come up with new designs to replace the deteriorated parts. «They took on an intimate relationship with this job,» says Jameson. «They stepped up to the plate and asked us how to fix the deterioration problem. Their new designs incorporated our ideas.»

Noting that NYSDOT went through budget cuts a couple of years ago, Jameson adds, «Things were in turmoil from what I understand. And then we went through a period of massive submittals. But the designers kept pumping them out.»

As the owner, designer and contractor figured out the revised plan, NYSDOT estimates the project fell behind by almost 11 months, says Silva. Since then, the team has made up all the lost time. It helped that Johnny Ho, Jacobs senior project manager, is situated in the field office. «This is the first project for NYSDOT where the original designer is in the field office,» Ho says. «This bridge is so important. They were concerned about anything technical holding up the schedule. Normally, when the contractor has questions, they send in a request for information to the field-office engineer, who sends it to the designer. But we skipped that protocol. The contractor drops by my office or gives me a call and often gets an answer right away.»

Bruce Ogurek, NYSDOT acting director of construction, says, «There was unprecedented devotion» to construction progress monitoring all around, noting weekly and sometimes daily meetings with the contractor and resident engineer **M&J Engineering.** «This was basically our first project where we used electronic tools for an almost paperless environment. All the work inspection reports, engineer diaries, meeting minutes, change orders and estimated payments are electronic,» adds Silva. Frequent personal trips by designers between Albany and the site office include weekly exchanges of priority-action items that are submitted by the contractor, says Silva.

Value-engineering proposals also saved about $5 million. One of the biggest, put forth at the start of work, addressed the truss-girder installation inside the existing structural-steel main span, says Jameson. «That truss was a worry from the beginning of the job. We got the installation of the temporary structures moving along, then attacked this issue» of replacing the truss, he says. «We saved about $3 million by eliminating almost 550 tons of steel out of some 1,040 tons.»

The contract has six stages. In stage one, crews removed median barriers, installed temporary decks, and widened and strengthened existing substructure pier caps and abutments. In stage two, crews demolished the bridge's northern exterior 15-ft-wide deck overhang, installed new plate girders, brackets and floor beams, then installed a new 30-ft-wide deck

with new concrete parapets and replaced all the bearings. In stage three, crews repeated the process for the southern side.

By the end of last year, crews completed stage four, replacing the deck for the northbound bridge's middle section. Stages four and five are the two milestones that carry heavy incentives and disincentives. The team finished stage four about five weeks early, earning an approximately $1.9-million maximum bonus. «Thanks to innovation and open-minded dialogue, we've made up the delays and are back on schedule,» says Eng.

Work is now under way on stage five, which will replace the southbound span's middle section. The team could win a maximum incentive of $875,000. In the final stage, crews will remove all temporary decking and complete the installation of the new stringers and deck. The project is set for a December completion.

While the new structural steel will be painted for better resistance to corrosion, the new deck includes shoulders in both directions, new elastomeric bearings to meet seismic standards, new drainage components, and improved overhead sign structures and highway lighting. Four new main girders will add redundancy. Crews also are completing $20 million worth of work reconstructing two playgrounds and building a skateboard park near the bridge plus a day-care center, says Michael McCotter, NYSDOT engineer in charge.

The revamped structure is expected to have a design life of at least 75 years, says Eng. The addition of stainless steel reinforcing bars in the new cast-in-place concrete deck will help achieve that. «The extra cost upfront is insignificant compared to the extra life we'll get out of it,» he notes.

The rehabilitation of the Alexander Hamilton Bridge seemed destined for woe more than once. Zero bids. A delay estimated by the owner to be almost 11 months. Unexpectedly high levels of deterioration. And a spaghetti bowl of dizzying ramps carrying thousands of vehicles daily between Manhattan and the Bronx and to points beyond. But thanks to a construction team's aggressively proactive approach, intensive partnering with the owner and a variety of value-engineering solutions, the $407-million rehabilitation of a crucial New York City artery is now sailing steadily toward completion.

LOAD-DATE: February 11, 2013

LANGUAGE: ENGLISH

GRAPHIC: map
photograph, crossroad link The bridge links I-95 between Manhattan and the Bronx in New York City. crucial artery The Alexander Hamilton Bridge has eight ramps that had to be replaced with temporary structures while undergoing repair or replacement., Photo Courtesy of Ammann & Whitney Consulting Engineers, P.C.
photograph, photos BY LUKE ABAFFY / ENR
photograph, working closely The project's progress is inspected by (from left) NYSDOT officials McDonald, Eng and McCotter and CCA's Wu. A redesign created more workspace under the bridge (above)., photos BY LUKE ABAFFY / ENR
photograph, ramping up Four ramps consisting of eight bridge structures were rehabilitated, while traffic shifted onto temporary ramps., photo COURTESY OF NEW YORK STATE DOT

PUBLICATION-TYPE: Magazine

JOURNAL-CODE: EN