Pedestrians in Memphis now have an attractive and innovative way to wind up at the Mississippi riverfront.

Ramping UP

BY ANDY KIZZEE, P.E., LEE SCHULZ, P.E., AND DANIEL SOURS, S.E., P.E.

Aerial Innovations

Andy Kizzee was a structural engineer with Smith Seckman Reid, Inc., in Memphis and is now serving as an Engineering Ministries International director in India. **Lee Schulz** (engineer of record) was a senior structural engineer with SSR and is now enjoying retirement after a 40-year career with the company. **Daniel Sours** (**dsours@ssr-inc.com**) is currently a senior structural engineer with SSR.

MEMPHIS VISITORS USED TO be able to stroll west down Beale Street past the bronze statue of Elvis Presley until they encountered scenic Riverside Drive at the mighty Mississippi River.

The sprawling Tom Lee Park, with 4,500 ft of river frontage lies, just to the south of the intersection while pre-Civil War cobblestones pave the riverbank north of the site. But right at the intersection, the neglected seven-acre riverbank was covered in broken concrete revetment and overgrown vegetation—not an attractive transition.

In 2003, Riverfront Development Corporation, under authority from the City of Memphis, decided to develop this prime location. An international competition was held for a design solution to highlight the intersection where Beale Street meets the river and where Tom Lee Park connects to the cobblestone riverbank. The resulting Beale Street Landing, which is now open, serves as the port for riverboat traffic as well as a high-profile public park.

A Roundabout Solution

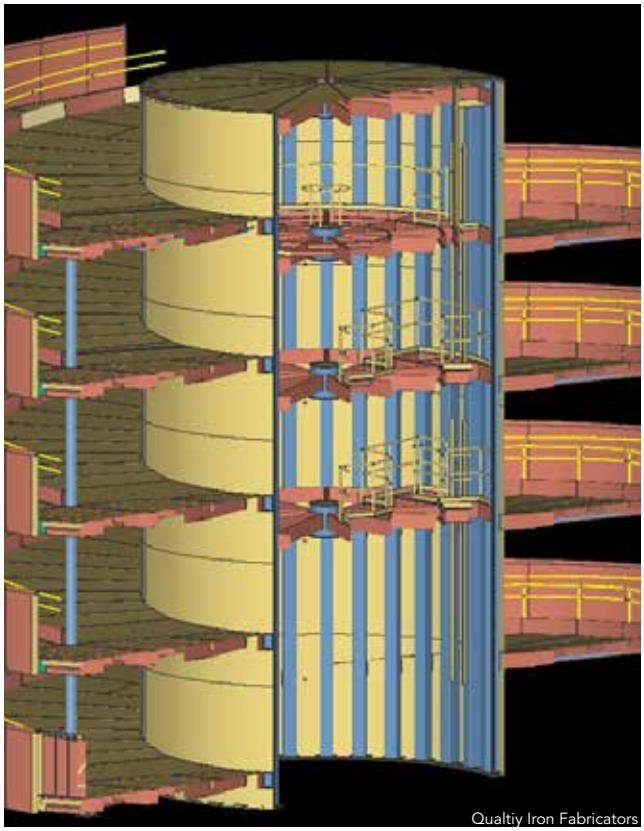
The structures include a floating dock accessed by a helical ramp, which helps the facility handle river fluctuation, and a grass-covered terminal building that provides pedestrians a link between the park and the cobblestones. Visitors access the riverboats tied up at the floating dock by a helical ramp and a connector walkway—both completely steel-framed structures. The connecter walkway is 16 ft wide and spans 130 ft between the terminal building and the helical ramp and is framed with an upturned W40×183 girder on each side, while the bridge is supported on two 48-in. hollow structural steel (HSS) columns; the girders are covered in light-gage steel panels for a cleaner look.

The new terrace park descends into the Mississippi, and at high water levels the river floods the park while permanent structures dubbed "islands" remain above the 100-year flood level (these pile-supported concrete slab structures appear as islands during periods of high water).

◀ ▼ Visitors access the floating dock by a helical ramp and a connector walkway. The connecter walkway is 16 ft wide and spans 130 ft between the terminal building and the ramp.

Andy Kizzee

▼ A 3D look inside the steel-framed helical ramp.


Qualtiy Iron Fabricators

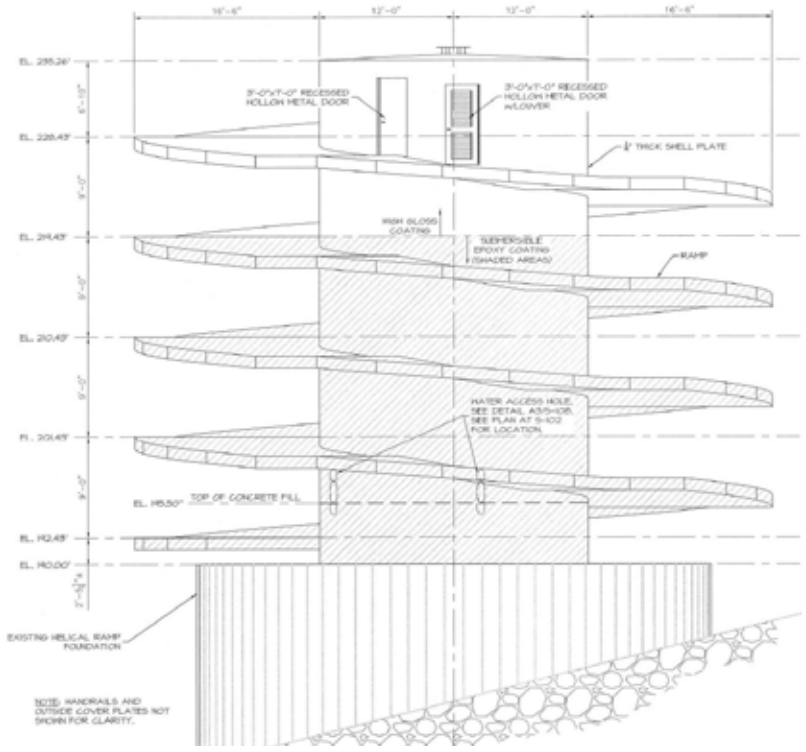
The bridge is supported on two 48-in. HSS columns.

The helical ramp accommodates elevation changes of the floating dock.

High Water

The dock is designed to operate during river level changes of more than 45 ft. It operates in all but the extremes of low and high water when it is neither safe nor possible to navigate the Mississippi. To give an idea of just how much the Mississippi's water level can fluctuate in this area, the spring floods of 2011 to the drought of 2012 saw the water change by nearly 60 ft.

Most floating docks on the lower Mississippi are accessed by relatively short gangways, which, along with the floating dock, accommodate the river's elevation change by being pulled in or pushed out along the sloping riverbank. The designers for the Beale Street Landing wanted a floating dock moored by large arms anchored to pile caps set at the edge of the channel. A stationary connector walkway connects the terminal building to the helical ramp, which accommodates the elevation changes from the connector walkway to the floating dock. The helical ramp provides five access gates that vary in elevation by 9 ft (one complete circumferential turn of the ramp), and a hydraulic ramp on the first floating barge accommodates the elevation difference between the gates). At high water levels, access to the floating dock will be from the highest level of the helical ramp. At lower water levels, pedestrians walk down the spiral to the lower levels to access the dock. When one of the gates is opened for access to the floating dock, it blocks the access for pedestrians and cart service at lower levels, which would be underwater.



▲▼ Framing for the helical ramp consists of 55 HSS12×10×½ columns at the perimeter of a 24-ft-diameter core with ¼-in. steel plate forming the steel cylinder surface.

The heart of the river access is a helical ramp that accommodates elevation changes of the floating dock. During design, the requirements for the helical ramp seemed daunting. The ramp had to be ADA-compliant but also able to provide access for electric carts to carry luggage and supplies. And it would be located not just *on* the river but also *in* the river. Also, the helical ramp and its foundation work had to be installed during a short period of low water. The design solution was to use 480 tons of HSS and steel plates.

Framing for the helical ramp consists of 55 HSS12×10×½ columns at the perimeter of a 24-ft diameter core with ¼-in. steel plate forming the steel cylinder surface. Outrigger HSS12×8×½ beams cantilever 16.5 ft from the HSS columns, and infill HSS6×2×¼ members support the ⅜-in. floor plate. The steel plate elements, as well as two exposed inboard columns supporting the dock access landings, are intended to help the structure survive debris build-up from eddy currents.

The sloping walkway of the helical ramp is divided into two parts. The first is an approximately 12-ft-wide continuous slope adjacent to the core that is dedicated to the electric carts since it is too steep for pedestrians; the outer 5-ft-wide walkway is separate from the cart access. The handicap-accessible pedestrian access is a series of ramps and landings, with the perimeter wall serving as a guard rail winding around the ramp at a constant slope and disguising the broken slope of the pedestrian ramp.

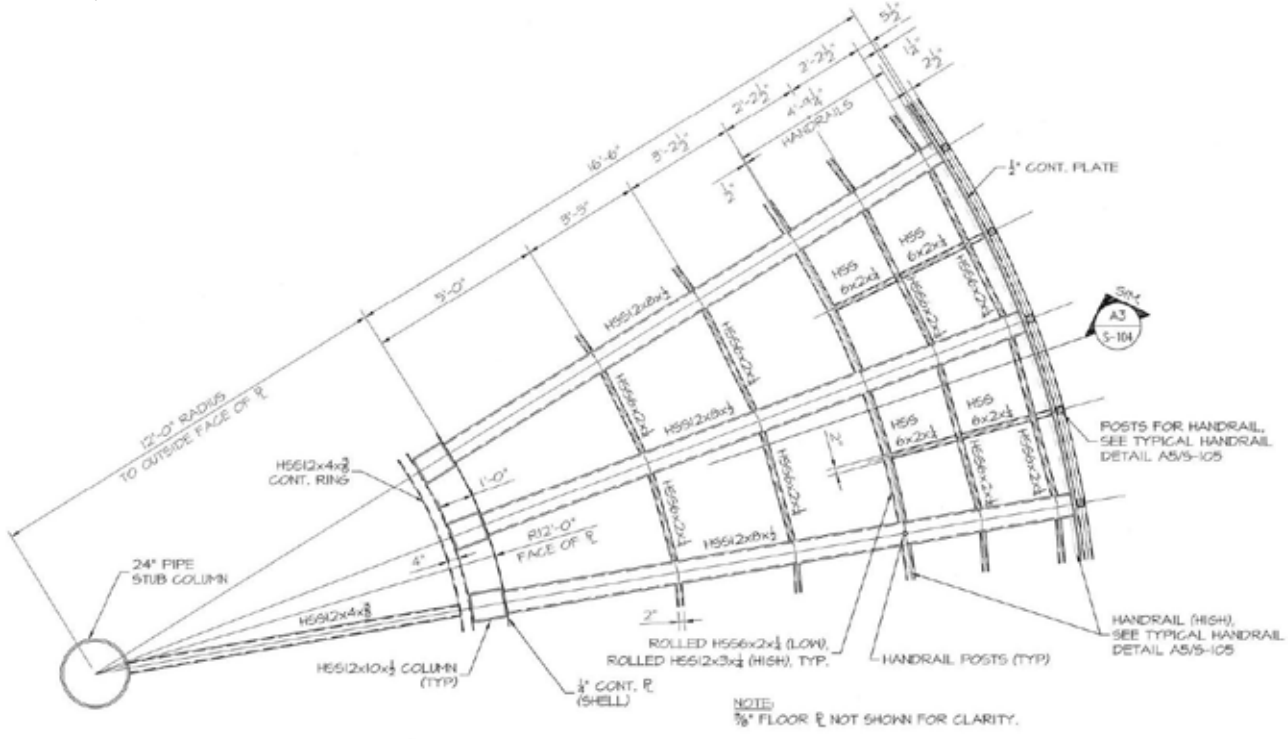
The framing for the multiple levels of the helix resembles a series of wagon wheels. The horizontal members tie the columns together to resist the horizontal forces resulting from the bending moments applied by the floor beams. Access into the core is at the highest framing level, the only level with grating and where the electrical panels are located, and ladders provide access to the levels below for inspection


Jason Fox


Jason Fox

▲ The framing for the multiple levels of the helix resembles a series of wagon wheels. The horizontal members tie the columns together to resist the horizontal forces resulting from the bending moments applied by the floor beams.

▼ A sample section of one of the wagon wheel assemblies.



and maintenance. Two openings just above the core's base allow for water pressure equalization while an opening in the center of the roof serves as a relief air vent. The ramp is anchored to a concrete pile cap, which bears on 16 48-in.-diameter steel piles.

Since the steel structure is exposed inside and out to river water, a polysiloxane marine coating was used on the exterior surfaces and floating docks. The inside of the structure is protected by a high-build epoxy coating, and the HSS members were injected with expanding polyurethane foam to prevent water infiltration, which could freeze and damage the structure.

The Beale Street Landing project was built in phases over several years. The contractor had two low-water opportunities to drive piles and pour concrete pile cap foundations. There is no guarantee that the river will cooperate or fall to any specific level for any length of time, but luckily the water level remained low enough for the ramp foundation to be installed in the first low-water season. In the next construction phase, the erector of the helical ramp placed all 55 HSS columns and was able to pour the infill concrete base, and the pie-shaped walkway sections were erected as the river rose throughout the year. ■

Owner
City of Memphis Riverfront Development Corporation

General Contractors
LCI Construction
Webb Building Corporation

Architects
Bounds and Gillespie Architects, PLLC
RTN Architects

Structural Engineer
Smith Seckman Reid, Inc.

Steel Fabricator and Detailer
Quality Iron Fabricators, Inc.