THIRD AVENUE BRIDGE

Steel Bridge Barges in
to Replace its Predecessor

When Hardesty & Hanover, LLP Engineering undertook the $118.8 million reconstruction of the Third Avenue Swing Bridge, they were faced with a number of challenges, not least of which was to devise a plan to replace the structure with minimal disruption to the flow of 72,000 vehicles that use it daily. Their time saving solution was to fabricate a new bridge off-site and float it to the site on a barge.

One of seven vehicular Harlem River drawbridges owned and operated by the New York City Department of Transportation (DOT), the Third Avenue Bridge has been a vital part of New York City's infrastructure since its construction in 1897. The bridge, which opened to vehicular traffic in 1898, was originally designed to carry trolley cars and horse-drawn carriages. Now, more than 100 years later, the bridge is the second most heavily used bridge span across the Harlem River.

To replace the aging structure, the engineers divided the project into six phases. The complete substructure and superstructure were to be rebuilt and the ramps, approach spans, and swing span replaced. Overall the reconstruction comprised 3,500 square feet. The swing span was fabricated in Russellville and erected in Mobile, Alabama, by G&G Steel, Inc. Then, once the site work neared completion, it was barged 1,800 miles to New York via the Atlantic Ocean. A key factor in the solution was the choice of building material.

LEFT The new bridge is barged in along the Harlem River.

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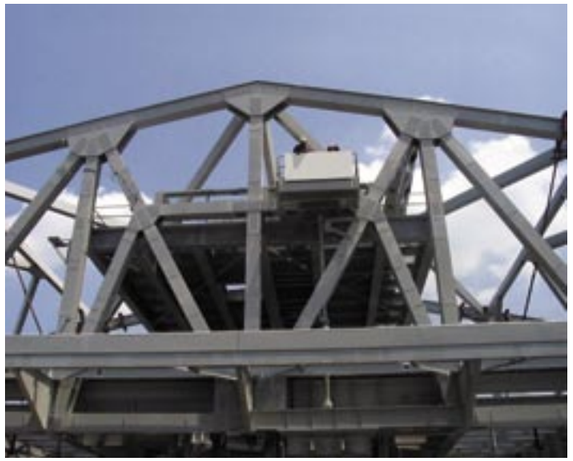

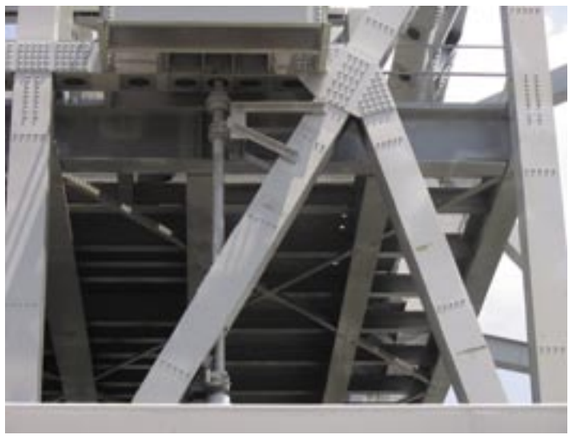

TOP, MIDDLE, BOTTOM Parallel Warren trusses support the swing span.

OPPOSITE LEFT Welded boxes compose individual steel truss members.

OPPOSITE RIGHT The bridge span provides 26 feet six inches of clearance.

"In order for the structure to function in swing mode it couldn't be too heavy. At the same time, it had to be strong enough to support a double cantilever whose total weight was six million pounds. We needed the strength of steel..."

According to Paul Connolly, an Associate at Hardesty & Hanover and project manager during the construction of the bridge, "In order for the structure to function in swing mode it couldn't be too heavy. At the same time, it had to be strong enough to support a double cantilever whose total weight was six million pounds. We needed the strength of steel, something which we couldn't get in another material."

The new Third Avenue Bridge is a significant improvement over its predecessor. Traffic flow has been improved by increasing four to five 12-foot-wide traffic lanes. Pedestrian walkways now measure eight feet in width and the horizontal clearance of each of the navigation channels has increased from 100 to 116 feet. In the closed position, the span provides a minimum vertical clearance of 26 feet six inches, an eight-inch improvement over the old structure.

The main feature of the new bridge is the 350-foot-long, 88-foot-wide, out-to-out steel truss swing span, for which AASHTO M270 Grade 345 Steel was used. Two parallel Warren trusses make up the main load-carrying members of the superstructure. Welded steel boxes, ranging in dimension from 20 by 20 inches to 20 by 24 inches, make up the individual truss members with hand holes for bolting provided only at critical connection locations to reduce future maintenance efforts. Internal, solid diaphragms beyond connection limits seal the truss members against water intrusion. To maintain category B fatigue details throughout the trusses, all connections between and within members are bolted.

The bridge's steel floor system, which consists of parallel stringers spaced at just over six feet with floor beams at each panel point that span between the trusses, directly supports the concrete-filled steel grating bridge deck. The key element of the swing span is the pivot girder. The five-foot-wide, 15-foot-deep box girder not only serves as the floor beam at the truss center panel point, but, more importantly, carries the full cantilevered load of roughly three million pounds at each of its ends. In order to accomplish this, the connection of the pivot girder to the truss utilizes over 400 one-inch-diameter high strength bolts. The steel comprising the pivot girder weighs over 100 tons.

Three main players completed the fabrication and erection of the truss in Alabama. Hardesty & Hanover brought their experience in long span movable bridges to the group. The DOT Fabrication Management Services had a strong background in fabrication and proved essential in the welding details. G&G Steel from Alabama, whose experience in machine work and high degree of precision, completed the team. As Connolly states, "They [G&G Steel] were measuring things out to thousandths of an inch. The erection was easy because everything fit so well together."

The Third Avenue Bridge Reconstruction project represents an innovative and successful renovation project in which steel was a key component. As Connolly points out, "By using steel we were able to minimize the weight of the span while maximizing the strength of the structure. Steel box members for the truss simplified fabrication and met the client's requirement for high quality."

On October 29, 2004, the new bridge was floated into its final position on the Harlem River. By utilizing the strength and efficiency of steel, engineers were able to complete the rehabilitation with only a two and a half year impact on traffic, a very short amount of time for any New York City transportation project, but paramount to the project's success. The completion of the project marks the restoration of one of the city's historical and most highly utilized bridges, guaranteeing its use for future generations of commuters. ■

THIRD AVENUE BRIDGE

Owner **NYC Department of Transportation** *New York, NY*
Architect/Engineer **B. Thayer Associates** *New York, NY*
Structural Engineers **Hardesty & Hanover, LLP** *New York, NY*
General Contractor **KiSKA Construction Corp.** *New York, NY*
Structural Steel Erector **KiSKA Construction Corp.** *New York, NY*