The Route 7 Bridge over the Passaic River

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The Route 7 Bridge over the Passaic River was presented a Merit Award (Bridges and Transportation Structures) in the NCSEA 2004 Excellence in Structural Engineering Awards program.

This project replaced a 330-foot long, 59-foot wide bridge on-line with a new 320-foot long tower driven vertical lift bridge. The bridge, owned by the New Jersey Department of Transportation, was designed by Hardesty & Hanover, LLP. M.J. Paquet, Inc. constructed the bridge.

The former Route 7 Bridge over the Passaic River had a 115-foot long single leaf heel trunnion bascule span, was built in 1915 by the Strauss Bascule Bridge Company of Chicago, Illinois, and was eligible for the National Register of Historic Places. The bridge was in poor condition, including steel members and operator's house. The lanes were less than 10 feet wide. The bridge was closed often for repairs.

The new Route 7 Lift Bridge includes two approach spans; two tower spans; and a 125-foot lift span, carrying four lanes and two sidewalks. The towers, approach span, lift span, and tower span superstructure are A709, Grade 345 structural steel.

The 72-foot 7-inch wide lift span superstructure consists of a 54-foot roadway and two sidewalks inboard of 7.5-foot deep, 3.5-foot wide box girders. Rolled stringers at 6.75-foot centers frame into floorbeams at a spacing of 25 feet. The through girder superstructure with floorbeams and stringers was chosen for the lift span because the roadway profile, the vertical underclearance, and river hydraulics required a shallow superstructure. The lifting girders are 4-foot 1-inch deep, 2-foot 2-inch wide boxes.

The deck consists of 5-inch steel grating half filled with silica fume concrete with a 1.5-inch overfill. The sidewalks are 2-inch steel grating with silica fume concrete fill.

Each tower comprises eight 100-foot (+/-) tall box section columns; four on either side of the roadway. They support machinery houses containing mechanical components. The bridge lifting weight is approximately 1,200,000 pounds. Machinery is housed within each tower; the control house is located in the west tower above the roadway. The lift span is counterbalanced by wire ropes that wrap counterweight sheaves and connect to two counterweights. Two concrete tower piers on 4-foot diameter drilled shafts support the towers. Each drilled shaft, socketed 7 feet into rock, has a 450 ton design capacity.

Innovative Design Elements

The Route 7 Lift Bridge has several innovative features:

1. It has NJDOT's first movable span designed using AASHTO LRFD specification.

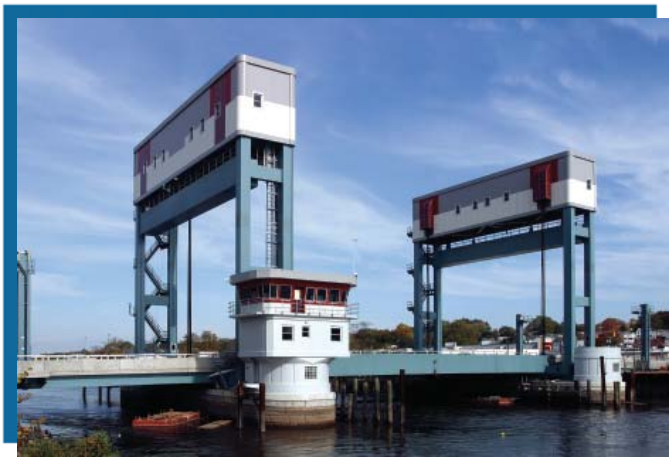
2. The design specified that the deck and sidewalk grating, and all structural steel, including lift span, towers, and approach spans, be metalized (200-250mm thick zinc alloy coating), and then painted with a urethane finish coat. The interiors of the box members were metalized only. This is the first application of metalizing on a New Jersey movable bridge. Metalizing improves steel's corrosion resistance. Studies indicate that metalizing coatings on steel structures will endure 4 to 8 times longer than a conventional paint system. The cost of structural steel was $9,600,000. It is estimated that using a metalized coating vs. paint added $800,000 to this project. However, it is estimated that during its design life the bridge would need four repaintings, at an approximate total present cost of $1,600,000.

3. Silica fume concrete was used on sidewalk and deck gratings as an anti-corrosion measure (NJDOT's first use of this material on a movable bridge). It reduces chloride propagation through the concrete, and is expected to double the deck life. The cost increase due to silica fume is estimated to be less than 10%.

4. Steel details were simplified and refined for ease of fabrication and maintenance. The towers were designed as rigid frames to eliminate bracing. The box member welding details and specified procedures simplified fabrication while meeting AASHTO fracture critical weld requirements. The box members were detailed so that tension-flange-to-web-groove welds were made first, forming U-sections, and allowing back-gouging of tension flange welds. The compression flange welds that close the box were made using back-up bars. Thus, all welds were made from outside the box.

5. Integral Abutments were used to eliminate deck joint maintenance issues.

6. Tower pier widths were minimized to meet stream encroachment limits. To meet seismic requirements, piers were designed with hollow sections to reduce mass. The 100-year-storm analysis indicated that movable bridge piers must be designed with rounded faces, and specified a maximum width in the waterway of 85 feet.



Completion of Project

The Route 7 Lift Bridge opened on August 24, 2002. The construction costs were within 5% of budgeted costs. The new bridge provides users of Route 7 a crossing that meets current design standards, improves safety, and minimizes travel delays. The owner's and designer's willingness to use new materials and techniques, and to examine both the initial cost of the structure and the life cycle costs, resulted in a bridge that should encounter few significant maintenance problems during its design life.▪

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