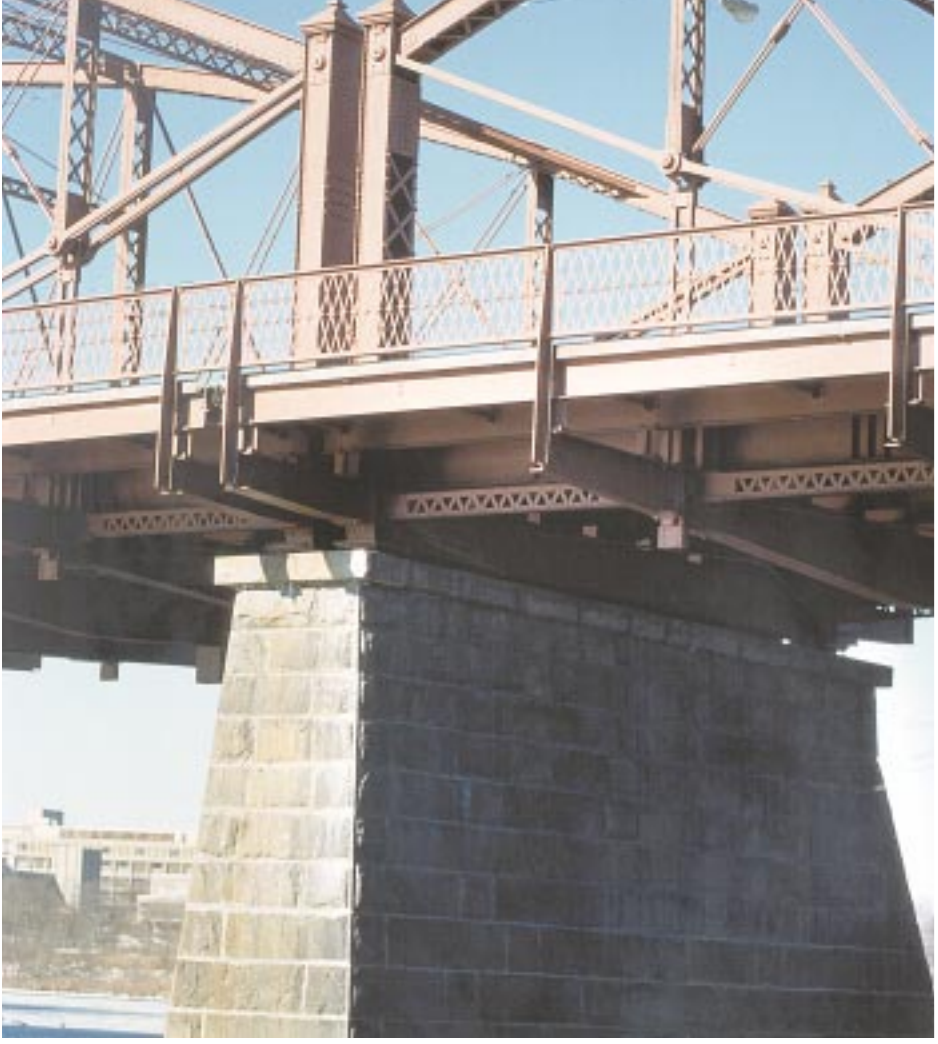

NATIONAL STEEL BRIDGE ALLIANCE

2001 Prize Bridge Award

merit award: RECONSTRUCTED

Aiken Street

Over Merrimack River, Lowell, MA

Built in 1883, the Aiken Street Bridge crosses the Merrimack River in the City of Lowell, MA. After more than a century of service, the bridge had deteriorated to the point of having a reduced live load rating and was in need of frequent maintenance and repairs. Rehabilitation was favored over complete bridge replacement based on an evaluation of cost, feasibility and the preference to reuse and preserve the bridge.

Deck Reconstruction

The poor condition of the existing open grid deck, purlins and stringers defined the need for a complete replacement of the roadway and sidewalk deck system. The preliminary design efforts considered both open and closed deck systems.

A closed deck system was favored to improve skid resistance, eliminate runoff on to the structural members and provide a more durable deck structure. A 5-1/2″ deep steel grid deck half filled with lightweight concrete was selected to provide the desired closed deck benefits with the least amount of additional dead load. A 3/8″ epoxy overlay system placed flush with the grid was specified to provide a durable wearing surface. Galvanized grid was specified for added corrosion resistance.

Floorbeam Strengthening

The floorbeam members, built up with riveted plates and angles, presented the opportunity to repair and strengthen the beams with replacement sections allowing reuse of portions of the existing beams. The final design details called for complete replacement of the bottom flange angles with a slightly larger section and the addition of a

bolted top cover plate. High strength bolts were used to replace rivets as required. The construction sequence allowed unloading of the floorbeams, since the entire stringer and deck system was to be removed. Therefore, replacement of beam members was performed in the field considering only the beam self-weight loading condition with minimal effects of existing member stress.

Truss-Reuse

The proposed rehabilitation included reuse of the existing truss members, local repairs to deteriorated or damaged members and replacement of the floorbeam hangers. The development of cost effective bridge rehabilitation schemes was limited to concepts that would allow reuse of the truss without the need for extensive truss member replacement or strengthening. Since the proposed deck reconstruction would significantly increase the dead load, a complete dead plus live load analysis was performed to determine maximum truss member stresses. This analysis was used to define the permissible upper limit of the proposed dead load and indicated that reserve capacity was available for the closed deck reconstruction scheme.

Seismic Retrofit

The preferred retrofit scheme featured improved seismic performance through force reduction with seismic isolation bearings, pier strengthening with internal vertical post-tensioned steel reinforcement and abutment strengthening and stabilization with vertical post-tensioned steel reinforcement and tie back anchors. The preferred scheme, which incorporated force reduction with seismic isolation, offered significant advantages over other retrofit options that considered more costly strengthening methods alone. The preferred scheme also satisfied the important goals of minimizing aesthetic impacts to the existing structures and eliminated the need for retrofit work in the river.

Owner
City of Lowell, Dept. of Public Works, Engineering Division, Lowell, MA

Structural Engineer
HNTB Corporation, Boston, MA

General Contractor
The Middlesex Corporation, Littleton, MA

Software
GT Strudl and in-house software