Replacement of Elevated Rail Structures (Under Traffic)

Date: 2011 (Posted 2016)

Project Name: MTA Long Island Railroad (LIRR) Capital Projects

Abstract: By effectively utilizing the construction techniques described in this lesson, the LIRR provided a methodology to replace an elevated commuter rail structure, in a timely, cost-effective manner, with minimal disruption to the riding public.

Project Phase(s): Design and Construction

Category: Cost, Management, and Schedule

1. Background

The MTA Long Island Rail Road (LIRR) is the busiest commuter rail in North America, with operations dating back to 1834. The LIRR system includes 11 rail lines stretching from Montauk, on the eastern tip of Long Island, to Penn Station in the heart of Manhattan, approximately 120 miles away. Due to the age of the system, the LIRR continuously modernizes its assets to maintain a State of Good Repair. A recent project provided for the replacement of the Atlantic Avenue Viaduct (AAV) in Brooklyn, New York. The structural steel viaduct was constructed circa 1901 and has two tracks. The viaduct is approximately 8,100 feet long and has 199 spans, varying in length from 30 to 43 feet. It is approximately 26 feet wide and is an open girder-type super structure and structural steel columns.

Issue:
The rehabilitation of the LIRR's AAV was implemented, due to deficiencies in both the viaduct columns and the superstructure. The superstructure girders exhibited a large number of top flange cracks, discovered during a structural assessment performed in 2007. The primary issue with the columns was loss of the steel section at the base, just above street level, due to corrosion. A Consulting Engineering firm provided a corrosion damage assessment of the viaduct to the LIRR on August 8, 2007. This study ranked and prioritized the girder replacements. Rehabilitation work had to be phased and scheduled in a way to minimize service disruptions and to avoid impacts to peak period commuters.

Solution:
Construction Methodology:
The design philosophy to rehabilitate the viaduct was to salvage and repair the columns and replace the superstructure in its entirety. A key to the rehabilitation effort was that the foundations would be able to be continued in use. The columns were repaired by encapsulating the vertical steel members with a reinforced concrete cage. The column work was able to be performed without service disruptions. The superstructure

replacement occurred in windows of outages in the weekends. The process is as follows:

- The bases of the columns are encapsulated with a reinforced concrete cage, approximately three-feet high. This work was performed during normal working hours.
- Working on the eastbound side of the viaduct at the start of the weekend outage, the existing structural spans are cut out of place. The superstructure span is also separated from the columns by cutting the columns approximately five feet below the superstructure. Generally, six to eight structural spans are removed in one weekend outage.
- Once the existing spans are removed, new, prefabricated spans are installed. Transition pieces are installed to temporarily mate the new structure to the existing structure. The prefabricated spans include a mating column section.
- Once the structure is in place, the LIRR Force Account (F/A) labor is mobilized to install the track and to reconnect any power and signal cables that were temporarily removed from the old structure.
- The process is repeated on the westbound side of the viaduct in the following weekend outage.
- Detailed Weekend work plans were developed to coordinate the activity of the third party contractor and the LIRR F/A labor. The coordination proved effective as the team was able to meet all weekend outage schedules, without any service disruption.

2. The Lesson

By effectively utilizing this construction technique, the LIRR provided a methodology to replace an elevated commuter rail structure, in a timely, cost-effective manner, with minimal disruption to the riding public. Some of the critical success factors included the reuse of the column foundations, avoiding the need for excavation and utility disruption, and the construction contractor’s use of a jig to fabricate the spans at a nearby staging yard and then trucking them to the site.

Other factors that made for a successful project were the coordination and collaboration between the Railroad Construction Management and Transportation Department and the coordination and collaboration between the LIRR F/A track, signal and communications groups and the third-party contractor.

The project is nearly complete (2011), only four years following the structural engineering assessment.

3. Applicability

The lessons learned by the LIRR are applicable to all transit properties that must replace elevated rail structures.

4. Contact Person/Info

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