Replacement of Timber Pile Bridge Structures

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

Abstract: Timber Pile Bridges, which were a common means of railroad construction in the early twentieth century, may require extra precautions during replacement, especially when all or part of the existing structure must remain in service during the construction period

Project Phase(s): Design and Construction

Category: 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 bridge project provided for the replacement of the Powell Creek and Hog Island Channel Bridges on the Long Beach Branch in Oceanside and Island Park (Nassau County), New York. The Powell Creek and Hog Island Channel Bridges are over 80 years old and were built on timber piles. Work completed under this project included the replacement of the timber piles and associated structure with concrete-filled pipe pile supports, prestressed concrete bridge decks, piers and abutments, safety walkways, track improvements, and creek and channel bed improvements. Powell Creek was constructed approximately one foot higher than the existing bridge elevation, due to flooding at extreme high tide.

<u>The Issue:</u>
The LIRR faced the challenge of replacing the bridge while maintaining train service. Installing new piles within and under the area of an existing bridge would be very difficult, since the pipe piles had to be driven through the deck of the in-service tracks during weekend outages. The LIRR created half-ties on the bridge deck, which enabled pile installation through the existing track and bridge structure. This avoided disruption of the pile-driving operation during weekend outages. However, because the timber piles were old, there was concern that the installation of the new piles would affect the integrity of the existing piles and bridge structure. The PMOC identified this as a project risk.

The LIRR addressed the construction challenge by installing vibration and movement monitors to record any movement or settlement in the timber piles on a real-time basis.

Any variance of one-quarter inch sent an alert to the Project Team. To avoid nuisance alarms, the devices must be properly calibrated.

2. The Lesson

Timber Pile Bridges, which were a common means of railroad construction in the early twentieth century, may require some extra precaution during replacement, especially when all or part of the existing structure must remain in service during the construction period. One solution is to install monitoring equipment to identify, in real time, whether the bridge's structural integrity is being maintained. Motion sensors, inclinometers, and other electronic devices should be used to detect movement on existing structures when pile driving work is to occur immediately adjacent to existing piers, especially timber piles.

In addition, it is recommended that existing timber pile bents be accurately located and that adjacent pile driving take into consideration the geometrics of the existing pile bents. Where the outside piles are battered (angled), the below-surface proximity between the new and existing piles may be very close and driving of the new piles can cause subsidence around the existing timber piles. This may especially be the case with friction piles in sandy soils.

Good geotechnical data obtained by subsurface soils exploration may be helpful in assessing the potential of movement of existing piles and, if there is a high probability of existing pile movement during adjacent pile driving, then appropriate countermeasures can be considered. For example, it may be necessary to provide added support to existing piles or to consider alternate methods of installing the new piles, such as drilled shafts in lieu of pile driving.

3. Applicability

The lessons learned by the LIRR are applicable to all transit properties that must drive piles adjacent to existing bridge structures.

4. Contact Person/Info

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