Hudson River Park Repairs

By Tait Pirkle and Marcus Jeffreys

Hudson River Park (HRP) is a waterside park located along the Hudson River that is operated by Hudson River Park Trust. The trust was formed jointly by New York City and the state of New York. The 550 acre (223 ha) park spans 4.5 miles (7.2 km), from 59th Street to Battery Park. Notable piers in HRP include Pier 57 (Super Pier), Piers 59-62 (Chelsea Pier), and Pier 86 (Intrepid). Pier 40 at HRP is approximately 14 acres (6 ha) and is shaped like "a square donut." The center of the pier is a 400 x 400 ft (120 x 120 m) sports facility for soccer, baseball, lacrosse, and other sports. Surrounding the sports field is a 1700-car parking facility that is open to the public. There is another sports field and a trapeze located on the second level of the pier.

Fig. 1: A Type 3 repair after deteriorated concrete was removed

PIER 40 PHASE 2

Pier 40 extends 810 ft (247 m) into the Hudson River and was built on 3500 concrete-reinforced steel H-piles. Due to the large size of the pier, the work was broken into multiple phases. Trevcon Construction Co., Inc. was awarded Phase 2, which included piling and underdeck repairs. Eastco Shotcrete LLC, a subsidiary of Trevcon, was contracted to perform the underdeck work, which included beam, pile cap, underdeck, and crack injection repairs. Eastco Shotcrete performed 132 total repairs over the entire project. Most of the repairs were Type 2 (underdeck), Type 3 (beams), and Type 4 (pile caps).

The underdeck repairs required deteriorated concrete to be removed back to sound concrete. Any corroded reinforcement was removed and replaced with epoxy-coated reinforcement with the proper lap splice. Welded-wire reinforcement (2 x 2 in. [50 x 50 mm]) was installed using J-bolts and tie wire. After inspector approval, shotcrete was applied to the repair area with a minimum of a 2 in. cover over the reinforcement. The Type 2 repairs were difficult to reach from the stage floats and crews could typically access them for an hour or two each day due to the tides. Access normally occurred right after or right before high tide.

The Type 3 repairs, or beam repairs, called for the bottom and bottom corners of each beam to be repaired. The deteriorated beams were chipped back to sound concrete with a requirement to remove 1 in. (25 mm) around the reinforcement. The reinforcement was cleaned by abrasive blasting. All reinforcing stirrups that were deteriorated 25% or more were replaced using EZ-lock epoxy-coated couplers. A total of

Fig. 2: A Type 3 repair with preparation completed. The repair is awaiting the application of shotcrete

Fig. 3: An ACI Certified Nozzleman applying shotcrete to a Type 3 repair

approximately 200 couplers were installed on the job. A natural gun finish was applied to the final surface. Any overspray was cut back to the saw-cut line around the repaired area.

The Type 4 repair, or pile cap repairs, also required deteriorated concrete to be removed back to sound concrete. New reinforcement was required to be installed to form a new reinforcement cage. Epoxy-coated No. 5 bar was epoxy embedded 6 in. (150 mm) on center into the existing concrete. A bottom "U-bar" was installed with a 1 in. overlap of the vertical bars. Welded-wire reinforcement was installed and shotcrete was applied using a natural gun finish.

EASTCO ACCESS

To access the work, Eastco worked off stage floats. We used three different stage floats. The first type of stage float was a simple "bobber"—polystyrene roughly 6 in. thick was covered by 1/2 in. (13 mm) plywood and bolted together to create a lightweight, easily maneuverable float that could be operated by one person. The second stage float used was a 20 x 5 ft (6 x 2 m) stage float positioned at the base of a ladder so the crew could safely climb down the ladder to access the work. It was also used to access tough-to-reach work areas, as it was smaller than the working stage float. The third and final type of stage float was a 20 x 4 ft (6 x 1 m) float banded together to create a 20 x 8 ft stage float. This provided the crew plenty of work space and helped to accommodate the aggressive wake conditions of the Hudson River.

A common issue with marine construction is the necessity to work by the tides. The underdeck repairs could only

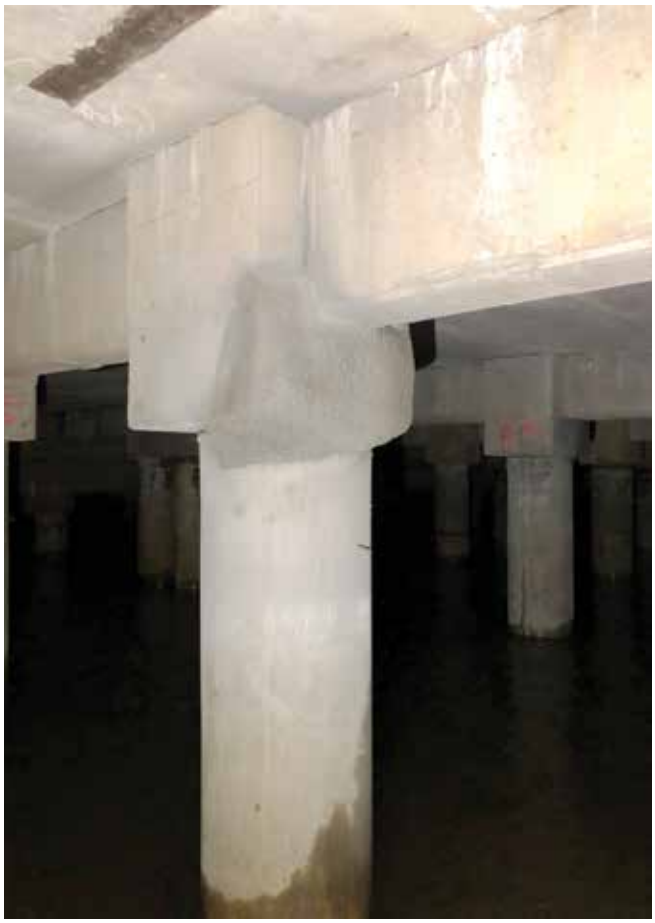

Fig. 4: A completed Type 4 repair

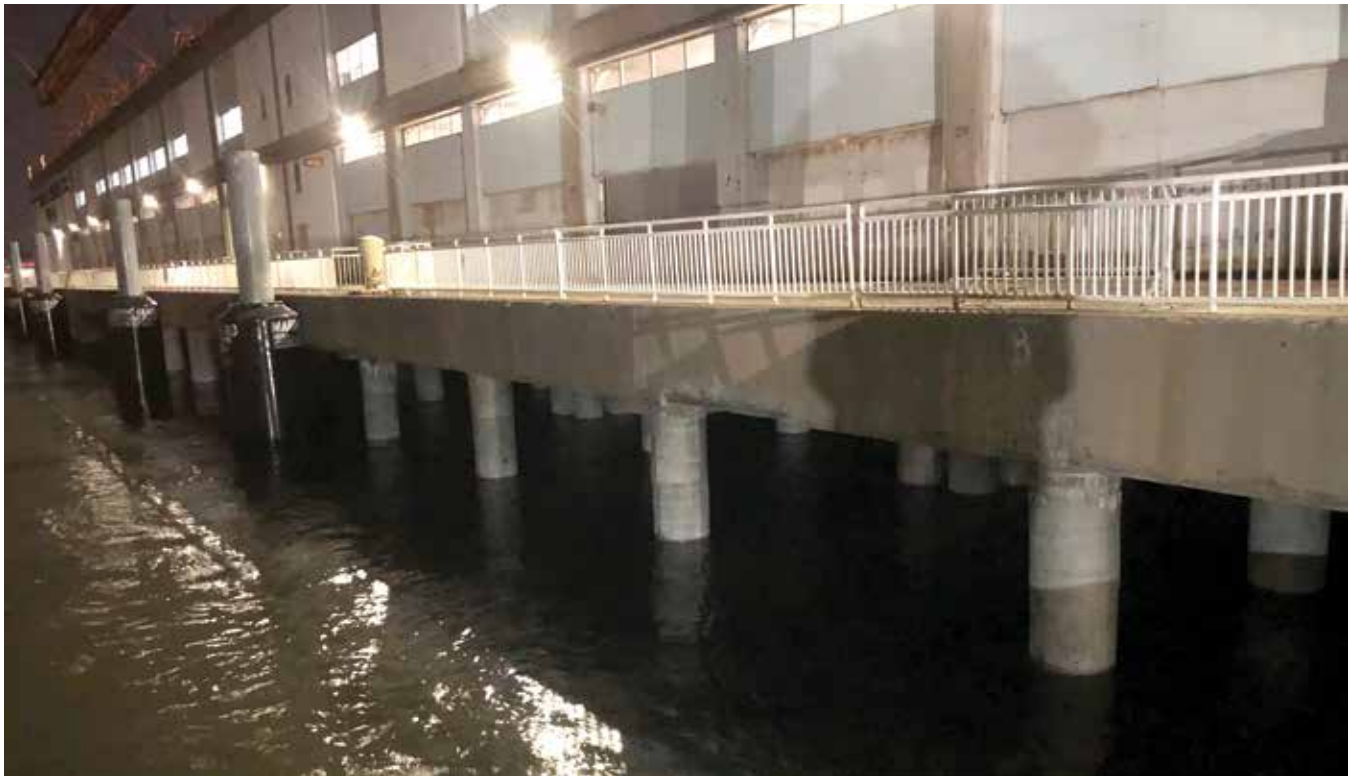

Fig. 5: Pier 40 as the tide shifts from low tide to high tide

be accessed 2 hours before low tide and 2 hours after low tide. This created a narrow window for the crew to be underneath the pier. These constraints necessitated that the crew operate at a high level of efficiency in that limited work time window to remain on schedule.

The inherent nature of the Hudson River contributed another powerful inhibiting factor to accessing the work. Eastco's work was located on the southwest corner of Pier 40, at the farthest point out of the pier. This left the crew exposed to not only the strong current of the Hudson but also to the wake of other vessels passing Pier 40. During ferry rush hour (8:00 to 10:00 a.m. and 5:00 p.m. to 7:00 p.m.), the wake was very strong and created hazardous conditions for our crew. Storms in the vicinity would also intensify the wake effects. To mitigate the hazardous wake and current of the Hudson, Eastco made the decision to work nights. This, for the most part, eliminated any wake from other vessels. The elimination of the wake and overall hazardous conditions was important on this project because most of the demolition and preparation were performed during the winter. The water temperature and ambient temperature on most nights were well below freezing and falling in the water could lead to hypothermia. The crew was required to wear dry diving suits to slow the development of hypothermia if an employee were to fall in the water. All jobsite actions were planned and implemented with the safety of the employees as the top priority.

Fig. 6: A part of Eastco's laydown on the apron of Pier 40

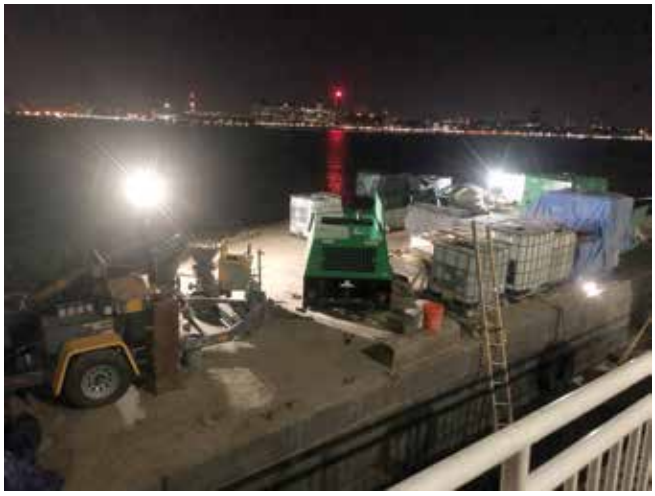

Fig. 7: Eastco's barge used to access Pier 40

EASTCO EQUIPMENT LAYDOWN

For most of the job, Eastco had an air compressor, a dry-mix gun, water tanks, air lines, shotcrete hose, generators, and other equipment staged on the apron of the pier. With 3 weeks left to finish the job, Eastco was requested to remove all the equipment from the apron and return to the site with all the equipment staged on a barge. Within 2 days of receiving this request, a 30 x 80 ft (9 x 24 m) barge was loaded down with all the equipment and material needed to finish the job. A major issue that arose from using the barge was having all the material needed to finish the project onboard. This eliminated having to tug the barge back to Trevcon's yard to have it restocked with material. Each movement of the barge is extremely expensive and would have greatly increased the job costs.

SUCCESS OF PIER 40

Throughout the 4-month project, Eastco faced ups and downs, but overall the project was successful. Consisting of approximately 1200 ft^2 (110 m^2) of placed concrete, this project demonstrated the versatility, effectiveness, and efficiency shotcrete has over form-and-pour concrete. At no point in the project were forms required or used. This fact alone greatly reduced the costs for the owner. Hopefully, the hard, efficient work from Trevcon, Eastco, and Eastco's crew made a lasting impression on the Hudson River Park Trust and it will continue to see the benefits of marine facility shotcrete.

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