

Park Hudson Garage Restoration

North Bergen, NJ

Submitted by Structural Preservation Systems, LLC

It's rare that a project completed under dangerous conditions is celebrated for the failure that did not happen; the absence of incident is often overlooked as a measure of success. The existing Park Hudson Garage was in imminent danger of collapse. Catastrophe was avoided through focused preplanning to implement unique means and methods to ensure safety, quality, production, and, ultimately, a safe, sound, and revitalized structure for the benefit of the residents.

The four-story structure in North Bergen, NJ, sits along the Palisade Cliff, a long bluff that runs along the Hudson River. Erected in the late 1960s, the garage slab was composed of 3 in. (76 mm) thick precast concrete panels with embedded structural steel joists supported by structural steel framing anchored to concrete footings. Four parking levels are accessible via one ramp located on the west side of the structure. Vehicular access is limited to one entry drive at the northwest corner, while pedestrian access is provided by a masonry stair tower and elevator.

EXISTING CONDITIONS

The structure stood 40 years with very minimal preventative maintenance. Nearly all of the structural steel had been left bare with no protective coating, and the steel bar joists embedded in the slab provided an avenue for chloride contamination.



The underside of the existing ramp prior to repair

Severe corrosion and structural decay developed as a result of humidity from the nearby river, harsh weather, and chlorides from deicing salts.

Because most of the deck floor drains were clogged and the slab had little pitch to facilitate drainage, water would pool on the deck for long periods of time. The combination of pooling water and high chloride content from deicing salts contributed to the decay of concrete and structural steel. Finally, erosion of the steep hillside on the west side of the structure had buried several column bases and beams, causing the soil to hold moisture and cause decay.

Several structural elements had reached the point of failure, including steel members and spalled concrete slabs. The entire structure had been condemned and was not suitable for use. While complete demolition and the construction of a new garage may have seemed a logical choice, the location of the structure made it a near-impossible undertaking. Instead, the engineer proposed replacing the deteriorated concrete and developed a plan with the repair contractor to repair the garage.

TESTING AND EVALUATION

As part of the initial investigation, the engineer performed testing that revealed high chloride content and extensive carbonation of the concrete. Additionally, cylinders were drilled from the slab to determine concrete strength.

During the repair process, the contractor also collected steel coupon samples from the existing structural steel framing which, when tested, revealed high phosphorus content. Ultrasound analysis of existing welds also revealed that an improper welding rod was used during construction. The test results were a cause for concern for the integrity and safety of the structure because the existing welded connections would provide paths of least resistance for a potential structural collapse.

BASE SCOPE

The scope developed for the project was essentially a complete reconstruction. Work items included

demolition and replacement of nearly 100,000 ft² (9290 m²) of concrete, installation of new structural steel framing, a traffic-bearing waterproof membrane, sheet membrane waterproofing, and asphalt. Plumbing replacement and installation of new floor drains, masonry repairs at the stair tower, painting of all steel members, installation of a new fence and guardrails, and new lighting and electrical were also included.

UNFORESEEN CONDITIONS

Several new and unexpected conditions were exposed throughout the project and resulted in numerous scope changes and additions, three of which were very significant. Changes involving the ramp included the complete replacement of the all-steel framing at the ramp, as well as the removal and replacement of the area at the west side in between the first and second floors. Additional steel work included supplementary details to address extensive corrosion at the base plates and almost 3000 linear ft (915 linear m) of structural steel to replace existing steel framing at the interior levels.

Additionally, the base scope only included minor brick replacement and joint repairs at the masonry stair tower. Ultimately, it was determined that none of the existing structure was salvageable. The amended repair scope included steel beam replacement, as well as complete replacement of the existing steel stairs, masonry, doors, and elevator.

Finally, the original repair design eliminated the steel bar joists from beneath the structure's bottom floor but did not provide an alternate means for hanging the existing pipelines. The change order addressed this concern and the unexpected replacement of several sections of pipe.

PRECONSTRUCTION PLANNING

A thorough phasing plan was critical for completion within the allotted time period. Because the only entrance into the garage for vehicular traffic was the ramp, it was replaced prior to any demolition at the interior levels.

Phasing of the interior levels was dictated by concrete curing time and accessibility. The fourth (bottom) level was the only level accessible without the ramp, allowing it to be replaced at the same time as the ramp. As such, it was demolished first. The second was demolished next, with debris falling to the third level one floor below. New concrete at the fourth level was given 28 days to cure while demolition proceeded at the second level. The third level was used to access the structural steel at the second level and once steel repairs were completed, the third level could be demolished, with debris falling to the now fully cured fourth level. Similarly, demolition at the first level did not begin until the second level had fully cured.



Erosion of the steep hillside on the west side of the structure had buried several column bases and beams, causing the soil to hold moisture and cause deterioration



Looking down the ramp after new structural steel was placed



At the interior levels, debris was removed from the scaffold platform using conveyor belts and hauled to dumpsters using a small skid steer

Because the first level was the only floor exposed to weather, it was the last to be demolished. The repair contractor was able to work on the interior levels through the cold and wet winter and spring months, saving the exposed top deck (first level) for the summer months.

MEANS AND METHODS

Construction began in July 2009. Within the first month of construction, a failure occurred at the existing connection between a girder and column. The incident occurred over the weekend with no human provocation and served as a warning that

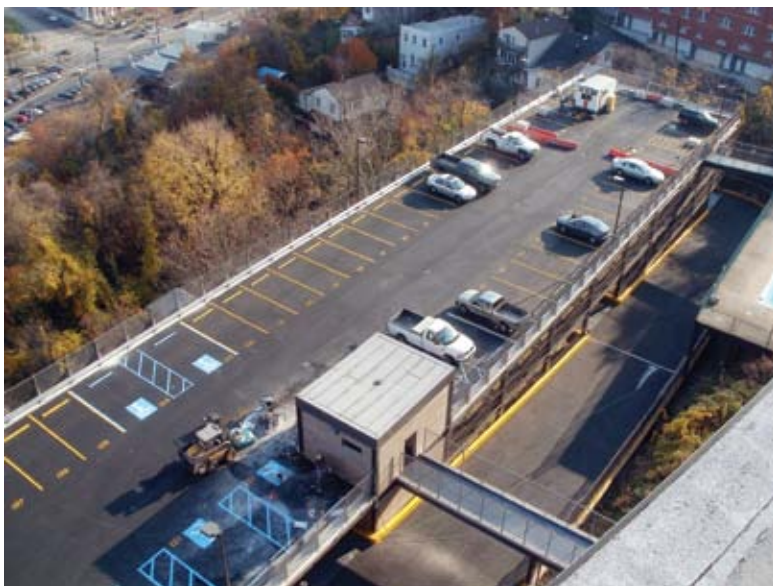
the stability and integrity of the existing structure would be a constant concern. To ensure structural stability, all connection and baseplate reinforcing, as well as installation of lateral bracing, was completed prior to concrete demolition.

Because the garage sits along the cliffside, using a crane for the structural steel construction was not feasible. Existing steel members were cut into 4 ft (1.2 m) pieces and removed by hand. New steel beams were transported using dollies and placed by hand. The new steel was sandblasted and painted in the field. A composite membrane waterproofing system was also installed at the baseplates.

Stair tower masonry demolition began shortly after first-level concrete demolition was finished. Then, the stair tower steel and stair replacement was performed following the completion of bulkhead demolition. After the stair tower steel was blasted and painted, the bulkhead masonry was erected.



One of the completed interior levels



A view of the completely repaired/rebuilt garage from the top of the adjacent condominium complex

A traffic-bearing waterproof membrane was installed at the second, third, and fourth levels. At the first level and ramp, sheet membrane waterproofing and asphalt were installed. Drainage matting was placed between the membrane and asphalt and then asphalt were installed in three phases: one phase for the ramp and two phases for the first level.

SAFETY

Safety on the project was an essential and integral component. Features of the safety program included a subcontractor orientation plan and all workers on site were required to watch a site safety video. In addition, a site safety plan was developed and all workers were asked to sign documentation addressing expectations.

A daily sign-in sheet was used and every worker on site signed in with their name, company, identification number, and trade. Tasks, challenges, and incidents were all recorded on the repair contractor's daily field report.

An evacuation plan was developed and a map showing the most appropriate exit route was posted at multiple locations. Air horns were also posted at each work area. In the event of an emergency, the air horns would be blown to notify the rest of the site. Two meeting areas were designated and the daily sign-in sheet would be used to account for all workers on site.

PROJECT SUCCESS

The work performed at the Park Hudson Parking Garage took 19 months to complete. It pulled the structure back from the brink of a possible complete structural failure, serving as an excellent reminder and valuable example of the importance of property maintenance and responsible contracting. The project demonstrated how detailed planning, project management, and attention to safety to address several unique logistical challenges and a structure on the verge of collapse can lead to a beautifully restored, fully functional structure.

Park Hudson Garage

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