NEW YORK MARRIOTT FINANCIAL CENTER FAÇADE REPAIRS

BY MATTHEW NACHMAN

The New York Marriott Financial Center is located in the heart of Manhattan's Financial District at 85 West Street in New York, NY. Construction of the building is estimated to have been completed in 1990 and contains 497 guest rooms.

The structure is a 40-story conventionally-reinforced concrete frame with conventionally-reinforced concrete flat plate floor slabs and columns. Façade construction is 4 in. (100 mm) brick and 4 in. (100 mm) concrete masonry unit (CMU) backup. Floor slab edges are exposed at each floor level on the north, east, and south elevations. On the west and a small portion of the north and south elevations, steel shelf angles are attached to the slab edges that carry the load of the single wythe of brick masonry, which is outboard of the slab edge. Aluminum framed insulated glass windows are present on all elevations.

INVESTIGATION

The project engineer was retained by the owner in January 2006 to perform a full façade condition survey of the structure, including the exposed concrete floor slab edges. The condition survey consisted of a review of the original architectural and structural building drawings and previous condition survey reports. It also included inspections of the façade, including two full building height swing stage drops to closely observe the condition of the exposed concrete slab edges and overall façade.

Exposed concrete slab edges as observed during engineering survey

The primary condition of concern was corrosion-induced spalling of the concrete slab edges at each floor level. This high level of deterioration was particularly unique because the building has only been in service for 16 years and concrete spalling on the slab edges was first identified in 2002, only 12 years into the building's service life. Quality assurance during the reinforced concrete floor slab placement appeared to be deficient during original construction. The project engineer discovered numerous concrete spalls that had fallen to the lower roof levels from the upper floor levels of the hotel. This was also a major concern because of danger to pedestrians on the sidewalks below.

The concrete spalling was occurring due to a combination of carbonation of the concrete slab edges and very little (1/16 to 1/8 in. [0.16 to 3.2 mm] in many cases) concrete cover over the reinforcing steel at the edge and bottom edge of the slab. Exposure to moisture and the high levels of carbon dioxide in the Manhattan area caused spalling of over 35% of the exposed concrete slab edges. Corrosion-induced concrete spalling was also occurring on the north and east elevation exposed structural concrete shear walls that provide resistance against wind and seismic lateral forces for the entire building. In addition, numerous façade problems were also identified, including open and cracked mortar joints, cracked brick, failed façade sealants, corroding shelf angles, and failed spandrel glass gaskets that were allowing excessive air infiltration into the building.

SPECIFICATIONS

The project engineer prepared repair specifications and drawings and bid the project out to multiple repair contractors. The repair system specified for the concrete slab edge spalling included concrete demolition of the slab edge to expose all corroded reinforcing bars to a depth of 5 in. (130 mm). Repair specifications were based on ICRI Technical Guideline No. 03730, "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion." Concrete demolition was performed with electric chipping guns to minimize microcracking of the remaining concrete substrate. Sandblast surface preparation of the

concrete surface, however, is difficult to perform in a downtown city environment due to dust control regulations and the ability to contain the sandblasting aggregate while performing the work. Wire wheel grinding was allowed by the project engineer to prepare the exposed reinforcing steel and to remove microcracking from the exposed concrete substrate.

A surface saturated dry (SSD) concrete substrate was specified prior to concrete placement. Existing through-wall flashing was adhered to the top of the slab edges, so repairs to the concrete also included removal and replacement of three courses of brick above the slab edge repair areas and installation of new through-wall flashing. A protective acrylic coating was specified by the project engineer to protect the slab edges and shear wall against moisture. The coating also had anti-carbonation qualities to provide protection to the steel reinforcing that had not yet corroded, but likely had less-than-desired concrete cover.

CONSTRUCTION

The repair project was awarded in August 2006. The site was prepared by installing sidewalk bridges around the entire perimeter of the building to ensure pedestrian safety while performing repairs. The downtown city location made the logistics of the repairs very difficult for the repair contractor. The West Side Highway, a very high traffic, multi-lane road in New York City, was within 6 ft (2 m) of the north elevation of the building and presented many coordination issues. Site storage was very difficult for the contractor because there was very little usable space within the hotel. Site deliveries had to be scheduled regularly to replenish the supply of repair materials. Up to 10 swing stages were used by the repair contractor to complete repairs to the exposed concrete slab edges and façade.

Another major challenge with this repair project was that concrete slab edge repair work was supposed to be completed by February 21, 2007, as required by the New York City Department of Buildings. This is because the concrete spalling was identified in 2002 by the New York City Local Law 11-98 inspection, which requires periodic façade inspections by licensed professionals. The concrete spalling was identified as a life safety hazard and had to be repaired within 5 years. If it was not repaired, the owner faced fines and legal action by the city. The project engineer and owner worked closely with the city regulatory agencies and the city was convinced that because a continuous sidewalk bridge was in place to provide public safety and all loose concrete spalls were removed from the façade upon mobilization, the owner would not be fined if work was not completed by February 21, 2007, as long as the contracted repair work continued and met schedule deadlines.

Concrete demolition at exposed slab edge; demolition is nearly complete, surface preparation to follow

Concrete placement at exposed slab edge. Note the galvanized metal forms fabricated by the repair contractor and shimmed to the brick below to optimize stripping and reforming operations

The repair contractor devised a reusable galvanized steel form that slid between the bottom of the slab edge and the brick below. The forms were fabricated to match the existing slab thickness and chamfer features. This allowed for reduced forming time and minimized form material waste that is typical when forming with wood materials.

Prior to concrete placement, the project engineer performed a surface preparation inspection on the entire swing stage drop and approved the preparation for concrete placement. All existing reinforcing bar ends were cut back 1.5 in. (38 mm) from the form surface, horizontal edge bars were tied back to existing reinforcing steel to maximize concrete cover, and hook bars were bent back into the repair area to provide 1.5 in. (38 mm) concrete cover.

Prepackaged concrete repair material was used for repairs because ready mixed concrete delivery to the placement location would be very slow. Repair material consisted of a pea gravel concrete mixture with integral corrosion inhibitor and a low water-cement ratio that has a proven track record of performance in similar repair scenarios. Concrete mixing was performed on the swing stages with hand-held mechanical mixers. All stages were also

Concrete shear wall coating surface preparation and bond test prototypes

Flashing installation is complete. Brick installation in progress along with cavity netting protecting brick ties and weeps

required to be equipped with measuring cups to control the amount of water used to mix the concrete and ensure quality control. Repairs were wet-cured for 72 hours and covered with burlap and polyethylene sheets to retain moisture. The project engineer required mockups of the concrete demolition, surface preparation, and placement procedures to establish a required level of quality. The concrete bag mixture material representative was on site several times to review procedures and check placement methods.

Aesthetics was of particular importance due to the high visibility of the building in New York City's Financial District. Numerous brick and mortar mockups were performed to match the existing two brick colors and mortar color as close as possible. Extensive research by the repair contractor resulted in finding the exact brick that was used for the original construction. Many mockups of coating colors were done using several coatings by different manufacturers. The owner took this opportunity to upgrade the look of the building by using a dark bronze coating color to accent the original look of the slab edges and shear wall, which was originally exposed concrete. The mockups included various types of surface preparation, including high-pressure water blasting and

East and south elevations of building under repair in August 2007. Up to 10 swing stages were used during the course of repairs

grinding. High-pressure water blasting at 3500 psi (24.1 MPa) was the selected surface preparation method for the coating and bond was verified by numerous bond tests performed by the coating manufacturer on the mockups. Testing continued throughout the construction process to verify bond.

Concrete slab edge and brick demolition were the primary work activities performed from November 2006 through February 2007 because cold temperatures in the northeast did not allow for concrete placement or masonry work to be performed. In February 2007, as concrete demolition of the slab edges continued, there was a problem with the fiscal year 2007 anticipated project funding from the owner and all work had to be stopped immediately to ensure that the quantity of slab edges and brick that were demolished did not exceed the current budget that the owner had on hand. The contractor stopped work immediately; however, the contractor was entitled to ongoing project costs including sidewalk bridge rental costs, the costs for swing stage equipment on site, and other fixed monthly costs while the project was shut down. The owner resolved the funding issues after a 6-week shutdown. But the race was on to complete the project, which included all the remaining concrete repairs and coating installation at the slab edges and concrete shear wall, before cold temperatures shut down the job again in late 2007 and additional costs would be incurred by the owner.

In addition to the shutdown delays, repair work could only be performed from 9:00 am through 6:00 pm because of the hotel guests. There are, however, also a large number of meeting rooms on the lower floor levels of the hotel that required the contractor to carefully coordinate with hotel

management to perform the lower floor slab repairs at times where limited meetings were occurring. In addition, the hotel regularly hosted pilots and flight attendants from a major international airline company as part of a long-standing ongoing contract agreement. These guests slept during the day because they work primarily on overnight international flights. This also required coordination between the hotel front desk staff, the building management, and the contractor to make sure these guests were put into rooms as far as possible from the concrete demolition areas.

As the project neared completion in fall 2007, the contractor was on schedule to complete work just before cold weather arrived in November. A deadly fire and construction accident at the nearby Deutchebank building demolition, however, prompted a stop work order by the New York City Department of Buildings. The New York City Office of Emergency Management set up a staging trailer for 4 weeks on Albany Street at the north side of the building and ordered the contractor to stop all work on the north elevation of the building while the trailer was present. Work on the other elevations was allowed to restart within 1 week. After weeks of negotiation with the City of New York, the staging trailer was moved and work was accelerated on the north elevation, finishing coating work several days before cold winter weather set in. Due to the high media attention of the fatal accident at the adjacent construction, the New York City Department of Buildings and Office of Emergency Management conducted regular, rigorous inspections of the project near the completion stage. Attention to detail and safety by the contractor prevented any shutdown by these authorities in the final weeks of this project.

East elevation and shear wall elevation after completion of repairs

PROJECT SUCCESS

This project presented numerous challenges from the original investigation through the tight completion deadline. There were several reasons for the project's success, including the continued and regular communication between the owner, hotel management, contractor, and project engineer, and regular quality assurance oversight by the project engineer combined with the high quality of repairs performed by the repair contractor. A teamwork approach led to agreements and compromises by all parties to achieve a high-quality repair project in the end.

New York Marriott Financial Center

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Bethesda, MD

PROJECT ENGINEER
Tadjer Cohen Edelson Associates
Silver Spring, MD

REPAIR CONTRACTOR
Deerpath Construction Corporation
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MATERIAL SUPPLIERS
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