

Eden Roc Hotel

Miami Beach, Florida

Submitted by Tadjer-Cohen-Edelson Associates, Inc.



Eden Roc Hotel entrance with its two tiled towers in their full glory

The Eden Roc Hotel, designed by renowned architect Morris Lapidus and constructed in 1955, was a favorite Miami Beach resort hotel for the rich and famous. Hollywood stars such as Elizabeth Taylor, Lucille Ball, Desi Arnaz, Jerry Lewis, Milton Berle, and Frank Sinatra were frequent guests. Rumors abound that a specially built balcony even allowed nude sunbathing for the stars.

Two 30 ft (9 m) wide by 140 ft (43 m) tall towers inlaid with imported Italian ceramic tiles are the center stage for the front elevation of the hotel. Over a million colored tiles were hand-laid with a design to reflect ocean waves and are believed to be the largest exterior mosaics of this type in North America. The tile pattern consists of six colors from dark green to light blue mimicking the waves of the Atlantic Ocean, which are only a few yards behind the hotel. Unfortunately, years of brutal Florida heat, wind, and rain caused the tile and the

tile setting bed to debond from the masonry backup support system. A preliminary evaluation indicated massive debonding with a severe potential of falling from the building. There appeared to be only one solution: complete removal and replacement with a cost of over \$1,600,000 and many months of disruptive reconstruction.

Hotel ownership sought a more thorough evaluation and hoped for a less costly and less disruptive option. The original construction drawings indicate that the two towers are 8 in. (20 cm) concrete masonry units (CMU) with the exterior façade being comprised of a setting bed overlaid with ceramic tile. The plans indicate that the tile setting bed should be 5/8 in. (1.6 cm) thick portland-cement-based grout. Test results using impact echo on a 48 in. (122 cm) pattern over the entire façade found that the actual setting bed varies from 1.7 to 2.7 in. (4.3 to 6.9 cm) thick, and that approximately 35% of the tile and/or

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setting bed were debonded. Close examination of the walls also revealed many broken, or improperly restored tiles, and numerous missing tiles.

Selective core samples were also extracted to examine the grout itself. Both the impact echo testing and selective core samples indicated that the debonding occurred throughout the wall cross section. Debonding occurred at the tile/grout interface, within the grout, and at the grout/CMU interface. The testing revealed that portions of the grout matrix was compromised and disintegrated. The grout joints were also severely

weathered resulting in missing, disintegrated, and friable grout joints. The conclusion was that severe exposure to the harsh sun and moisture of the southern Florida environment caused the degradation of the tile support system.

Although the hotel itself is not on the national historic register, it is designated to be within the historic district of South Beach. Thus, not only did ownership have a desire not to remove and replace the tile, the city of Miami had a strong desire to keep the historic influence. With this in mind, a nondestructive method of reestablishing the bond and structural integrity was essential. Conventional epoxy injection was considered, however, the pressure of the injection process could have pushed the tile further away. Gravity feed epoxy injection would not have adequate coverage. Thus, the engineers pursued a unique technique utilizing a combination of vacuum injection enhanced with direct pinning.

The engineer's design reestablished the structural integrity of both the tile and the grout by pinning the tile/grout component to the backup CMU component, with vacuum injection filling all voids with a portland cement enriched methylmethacrylate (MMA). The filler not only fills all voids, recreating full contact, it "glues" the tile and grout back together, thus reestablishing full bonding. This unique procedure is capable of reestablishing the full bonding regardless of its location. Vacuum pumps create negative pressure completely across the grout system between the tile face of the wall and the plane of the CMU. With the negative pressure being established deep inside the wall, the MMA is drawn into all voids and cavities anywhere within the wall.

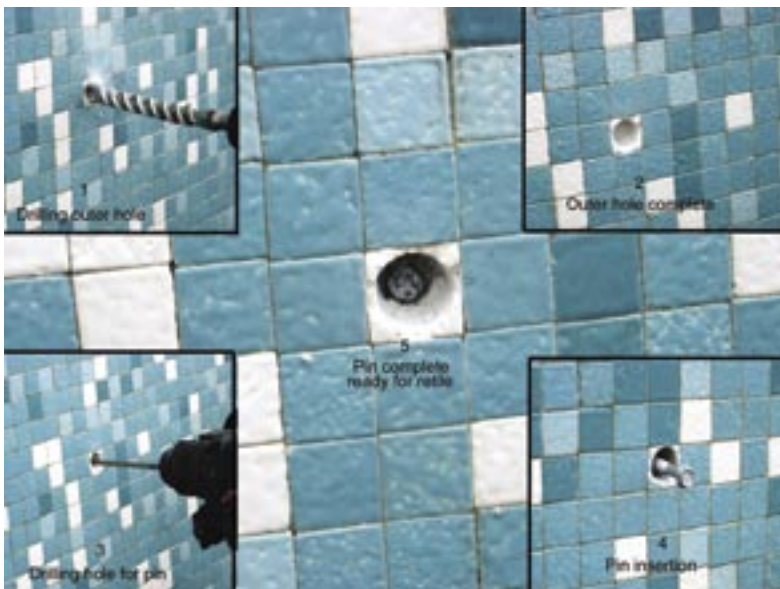
After pinning the entire tile surface on a 24 in. (61 cm) grid with self tapping masonry screws, the vacuum/injection access was established by drilling 3/8 in. (1 cm) holes through the tile in areas of the delaminations. The holes were drilled through the face of the tile intersecting the various levels of the delaminations. Due to the numerous areas of damaged and missing tile all openings and voids in the tile were first grouted flush to the tile surface as a temporary means of sealing the surface to accommodate the vacuum process. Additionally, missing and deteriorated grout in the tile joints was regouted to assist in providing a seal where the joints were porous or friable.

Ports were inserted into the holes that served as both a vacuum exit and an entry to introduce the MMA. The vacuum lines were attached at the top or above the delaminations and MMA feed lines were attached at the bottom and middle of the areas to be filled. MMA was introduced from 0.26 gal. (1 L) closed containers. In the many of the delaminated areas, the MMA was mixed with portland cement to accommodate the larger cavities and voids.

In addition to the tile debonding, several areas of significant wall cracking also required repair. Impact



The impact echo testing in operation. The device demonstrated is the hammer sounding and transducer. Note the portion of the wall above the area being examined. The Xs on the wall indicate areas of delamination



The complete process of pin insertion. Step 1 in the upper left shows the outer hole being drilled with Step 2 in the upper right showing the completion of the outer hole. Drilling for the self tapping screws is shown in Step 3 in the lower left with a partially inserted pin shown in Step 4. The middle of the photo shows Step 5, a full inserted and screwed down pin. The hole is then grouted and a new tile set



The layout of the MMA vacuum injection process. Note the clear tube inserted into the red port at the top of the photo. This hose is attached to the vacuum pump creating the vacuum at the top of the delamination. The bottle hanging from the railing contains a portland cement enhanced mixture of MMA that is being drawn into the wall at the white port. The process required hundreds of ports



A worker monitors the injection process. The vacuum port is above, out of view from the camera

echo testing revealed that the CMU was intact, thus a technique of pin stitching was utilized to tie the cracked tile to the CMU prior to vacuum injection along the length of each crack.

Upon completion of the vacuum injection, tile repair commenced. Over 24,000 new tiles were installed. With the completion of the tile replacement and restoration, the entire face of both mosaics was cleaned and hand polished with compounds and lambs wool buffers. Lastly, the walls were retested with impact echo to verify establishment of full contact, all of which was completed in two months and at a cost of \$550,000—less than half the cost of the originally proposed removal and replacement!



The vacuum process being performed at ground level. The vacuum pump is seen in the right center of the photo under the swing stage. A spare pump is seen at the bottom of the photo

Eden Roc Hotel

Owner

Capital Hotel Management
Beverly, Massachusetts

Project Engineer/Designer

Tadger-Cohen-Edelson Associates, Inc.
Silver Spring, Maryland

Repair Contractors

Balvac, Inc.
East Aurora, New York
C.A. Lindman Inc.
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Material Supplier

Fox Industries
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Layout of additional pins inserted for crack stitching