Longevity Category

2100 Towers Condominium Restoration

Cocoa Beach, FL

Submitted by Cathodic Protection Technology

2100 Towers is no different than any other condominium on the Florida coast. The environment is harsh—full of salt, moisture, wave action, and humidity. If not properly waterproofed, coated, and maintained on an annual basis, structures exposed to this environment will begin to have concrete deterioration issues.

2100 Towers, built in 1973, is a 13-story, 121 unit, conventionally reinforced oceanfront condominium. Prior to management choosing an impressed current cathodic protection (ICCP) system, the building had gone through two major restoration cycles, costing just under $2 million. Beginning in the mid-1980s, both restorations were extensive, disruptive, major concrete repairs, causing great challenges for the homeowners on a daily basis. Fast forward to 1997—2100 Towers was facing its third major restoration cycle. This time around, the owners were very motivated and proactive in finding a solution that would stop the vicious restoration cycles that were costing them millions of dollars every 5 years.

During a 1992 restoration cycle, management, which was very concerned about the condition of the balcony slabs, was informed that full tear-off was inevitable in 4 to 6 years. Based on the unique design of the structure (2100 Towers is a flat-plate system), if the balconies had to be torn off, a contractor would have to go inside the units to install shoring to support the interior slabs while the exterior slabs were removed. Not only would this have been an expensive endeavor (estimated at $8 to $10 million), but it also would have shut down the condominium.

The Board of Directors (BOD) voted to hire an engineer to survey the damage and make recommendations for repairs with the objective of eliminating the cycle of deterioration caused by corrosion of reinforcing steel. 2100 Towers had also learned over the years that the salt/chloride contamination that drives the steel corrosion was in the surrounding concrete (concrete that wasn't repaired), and that rehabilitation methods that stop the corrosion must either include the complete removal of the contaminated concrete or an ICCP system.

The two options considered were ICCP and sacrificial zinc. After weighing the merits of those two solutions, the BOD elected to implement the ICCP system on the eastern third of the building as a test to see if the solution would work. The ICCP solution was a more proven technology; it was predictable and came with a long-term no-corrosion warranty. The east side of the building was completed

View of the stack and edge repair needed

in 1997. After this fairly seamless installation, inspection reports showed that corrosion of reinforcing steel on the areas covered had stopped and it was decided the ICCP solution would be implemented on the remaining two-thirds of the structure.

Methodology

The first part of the installation of the ICCP system was to determine electrical continuity of the reinforcing steel and to prepare the surface for coating application. Electrical continuity is an important part of the system installation. All reinforcing steel that is electrically continuous is made the cathode of the system and is hence cathodically protected from corrosion.

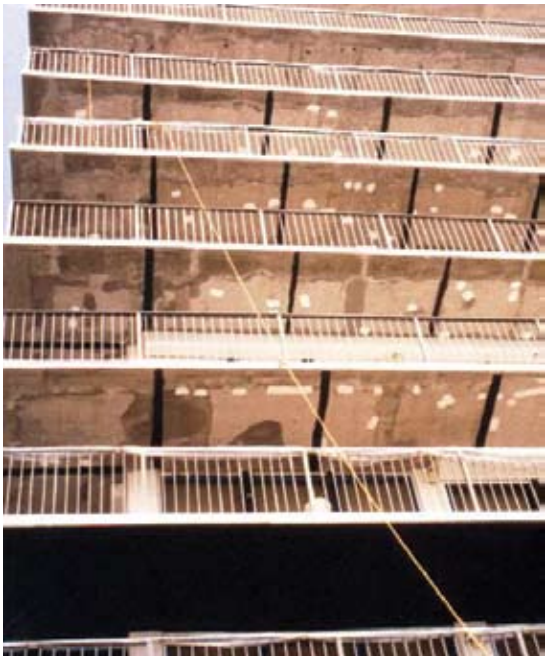
Typically, the reference electrodes and the system negative cables are installed and embedded in the concrete. The reference electrode is used in monitoring the performance of the cathodic protection system. By measuring the voltage potential of the reference electrode to the reinforcing steel (the negative), with the system off and with the system on (at various current outputs), the level of cathodic protection can be determined. The location of the reference electrodes is made in the most anodic area (active corrosion) by adding sufficient amounts of chloride to the patch material. The cathodic protection system is set at a level where the reference electrodes indicate, according to National Association of Corrosion Engineers (NACE) criteria, that cathodic protection is being achieved.

After all concrete repairs are completed and all coatings are removed from the surface, the concrete is cleaned per ASTM standards to prepare the surface for coating. A high-voltage instrument is used in a sweeping motion across the concrete surface, which detects stray steel close to the surface. If surface steel is detected, the instrument gives off an audible alarm. The location is found and marked and then coated with a highly resistant dielectric material to isolate the surface steel from the system. This procedure prevents any shorts that could occur between the stray surface steel and the secondary anode (conductive coating).

After the concrete surface preparation is completed, the installation of the primary anode is conducted. Platinum anodes, with factory attached connections to the cable, are installed to the concrete surface by securing the anode to the surface and applying the conductive coating over the platinum anode. Then, once the anodes are installed and flush to the concrete surface, the entire surface is coated with two coats of the conductive coating. After the appropriate cure times, the conductive coating is covered with a cosmetic overcoat.

Considering the cosmetic overcoat and the fact that one-third of the building repair was complete, the contractor had to take design and integration into consideration with the other two-thirds of the

A view of the edges and balcony work



Anode installation on soffit side

Typical balcony corrosion

Close-up of balcony edge in 2008

Complete building in 2008

building. Condominium owners spend a lot of time on their balconies, and it is very important that the system appear seamless to the structure. For the most part, the system is applied within other materials such as concrete and coatings. The external wiring for the system, however, can be accomplished via conduit or imbedded into the structure. More recently, the external wiring of the system has been embedded into the structure to achieve a transparent aesthetic, whereby the owner cannot visibly see the ICCP system. Furthermore, it is absolutely critical that the cosmetic overcoat options are attractive.

Cost Effectiveness

If 2100 Towers Condominium had gone down the path that was predicted in 1992, it would have spent $8 to $10 million in 1997 to rip out and replace the balconies. This does not factor in the incremental costs associated with the rip-out-and-replace mentality, such as replacing rails, sliding doors, and shutters that may be out of code; rental income; and livable space. This also doesn't factor in the green mentality of condominiums going through extensive repair as well as a potential rip-out-and-replace scenario where the environment is truly impacted. When condominium management looks at bottom-line options for conventional repair with no ICCP or conventional repair with ICCP, the cost is usually 0 to 15% more. The decision seems to be a no-brainer; however, it is still difficult for management to think long-term.

In the end, the ICCP system was installed on 50,000 ft^2 (4645 m^2) of cantilevered balconies. The total restoration including installation of the ICCP system was roughly $1.7 million. Looking at the history of this structure and the three restoration cycles described previously, 2100 Towers Condominium spent roughly $3.5 million over that period of time. The ICCP supplier's 13-year track record of 45 installations with zero failures up and down the Florida coast proves that had the condominium implemented an ICCP solution back in the mid-1980s, at least $3 million probably would have been saved. Today, over 10 years later, this building is in pristine shape and corrosion free. This 10+-year period also represents at least two restoration cycles that were prevented—a conservative savings estimate of $2 million. It is anticipated that the system will go well beyond the 15-year guarantee, and the ICCP supplier is working on a service-plan to extend the 15-year warranty once it expires. To date, other than routine maintenance and reapplication of wear coat, the condominium has not had to spend any additional dollars on major concrete repair due to corrosion of reinforcing steel.

2100 Towers Condominium

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