

# Sea Colony Promenade Repairs

By Brian Daley

The Sea Colony Condominium Complex, a community of eight high-rise residential buildings, is one of the most prominent landmarks in the resort town of Bethany Beach, Delaware. Stretching along almost a half mile of Atlantic Ocean frontage, the eight buildings are surrounded by a massive elevated concrete promenade. The promenade includes several swimming pools, provides acres of sun deck area to vacationing residents, and allows protected parking underneath for hundreds of cars. In 2001 and 2002, the complex underwent a major concrete repair and coatings project to upgrade the promenade's condition, improve its appearance, and extend its function.

The Sea Colony Promenade was built in sections over a period of several years in the late 1970s and early 1980s as the residential towers it surrounds were constructed. The first sections (comprising the northern half of the structure) are conventionally reinforced concrete construction, while the later (southern half) portions are post-tension construction. The eight sections together total over 160,000 ft<sup>2</sup> of top surface area, with an even greater amount of underside concrete surface when beams and columns are included.



Promenade parapet panels



Bottom view of through-bolted angles

Along both ocean-facing and west-facing perimeters of the conventionally reinforced portion of the promenade, vertically mounted precast concrete panels had been installed as part of the original construction to serve as parapet walls for safety and for appearance. These panels were mounted by welding their embed plates to angles welded on the promenade deck.

## Corrosion Damage

When these attachments started to fail due to corrosion from exposure during the 1990s, bolts and restraining bars were drilled through and mounted on the panels to secure them to the angles.

The angles were also bolted through the deck slab to secure them to the concrete structure. The metal strap bars mounted on the panels significantly detracted from their original appearance.

A greater problem was that the ferrous metal hardware used to make these attachment configurations soon began to rust in the humid, salty beach air. This rusting metal, in turn, caused concrete cracking and spalling around the bolt hole penetrations in the promenade. At the same time, areas of unprotected concrete slab top, underside, beams, and columns in both the reinforced and post-tension areas had deteriorated and failed over the years. In some cases, this was due to inadequate concrete cover over the reinforcing steel or PT cables when the project was first constructed. In other areas, it was due to shrinkage cracks expanding from freezing-and-thawing cycles, which allowed water penetration to reach the reinforcing steel, causing cracking and spalling from rust. A third cause of concrete failure was the railing around the perimeter of the post-tension half of the promenade, whose embedded posts rusted, causing cracking and spalling of the deck around them.



Rail embed spall

Recognizing the failing condition of their promenade, the Sea Colony Recreation Association hired a qualified restoration engineer. The design engineer prepared specifications and plans to repair deterioration that had already occurred, to eliminate or mitigate the major causes of the failures, and to protect the promenade to inhibit and slow future deterioration.

The major tasks in the repair project were:

- Removal of all parapet panels and anchorage, and patching of failed concrete around the anchorage;
- Removal of perimeter and interior railings and patching of rail post embed holes;
- Other selective concrete top surface, vertical, and soffit repairs as identified by sounding the concrete;

- Repair/replacement of post-tension anchor grout pockets;
- Installation of new mechanical expansion joints, including concrete demolition and construction to create channels to seat the joint wings;
- Preparation for coating of promenade top and exterior edge surfaces, and application of urethane pedestrian coatings over the entire promenade;
- Preparation for coating of bottom concrete surfaces and application of elastomeric coatings on underside beams and columns;
- Installation of new surface-mounted aluminum rail systems around the entire promenade perimeter, replacing both parapet panels and previous rails;
- Construction of several new concrete ramps to facilitate movement of handicapped residents and guests from buildings to the promenade and between promenade sections; and
- Construction of new large concrete planters so residents could make the vast finished concrete areas less stark and more attractive.

## Project Commences

Bids were solicited from restoration contractors in the summer of 2000, and in November of that year, an experienced repair contractor was selected and was directed to proceed with repairs to the promenade around one building. This was to be a test area to confirm the contractor's capabilities, as well as to evaluate the function and appearance of the repairs as designed.

Using shooting boom forklifts to support the parapet panels, the restoration contractor released all panel anchor bolts and removed all perimeter parapet panels. Railings were removed from interior locations where they were to be replaced. Failing concrete at all parapet angle locations and at all rail post embed locations was demolished to prepare for new concrete patch construction.

In cooperation with the engineer's inspector, the contractor located all additional hollow and spalled concrete in the main field of the promenade section and demolished it with chipping hammers to reach sound material. The exposed reinforcing steel was cleaned and coated. Concrete patching was then performed. Appropriate bag-mix repair concrete was used for top surface patches, for slab edge reconstructions, and for vertical and soffit repairs. Wing-gland mechanical expansion joints were installed at junctions between the test area and surrounding promenade sections. As weather improved in the spring, beams and columns on the undersides of the promenade were coated with elastomeric coating to protect the concrete and inhibit corrosion from the salt air.

On the top of the promenade, the deck was first prepared by a high-pressure power wash to open

concrete pores for adequate bond, then a primer and multi-coat urethane pedestrian coating system was applied to the top surface, edges, and planter exteriors. Finally, sections of stainless steel all-thread were epoxy-anchored in the promenade slab, and new anodized aluminum rails were bolted onto the all-thread anchors, surface-mounting the rails at the perimeter of the promenade, along an elevation change within the promenade, and at all stair transitions between levels. Following completion of the test area, the restoration contractor demobilized from the site through the summer of 2001 to allow summer residents and vacationers use of the property without disturbance from construction.



*Parapet panels off and slab demolished*

## Phase II

Satisfied with work on the test area, the Sea Colony Recreation Association negotiated with the contractor to continue the program of concrete repairs for all the remaining sections of the promenade. The contractor was released in September 2001 to proceed, with the stipulation that (like the test area) all repairs must be complete prior to the return of summer residents the following spring (2002). While the basic scope of repair tasks was the same as had been executed in the test section, the huge area remaining to be repaired meant the volumes of each repair task would be much greater. Complicating planning, both the size and configuration of remaining

promenade sections varied. While some tasks in each area could be identified, such as coating and new rails, the concrete repair quantities and type were not known until work actually started on each section. Therefore, the contractor had to remain flexible enough to focus manpower and equipment when larger quantities of concrete repairs were identified, and to efficiently disperse the work crew to different areas and work tasks when smaller quantities of concrete repairs were found. The repair crew, which eventually numbered over 40 restoration technicians, needed to be experienced and broadly skilled, equally capable of both demolition and patching back concrete, correctly applying



*Slab and edge repairs complete*



*Applying urethane coating*

sealants and coatings, and installing rails so they are anchored straight and level.

The contractor's superintendent needed to become a combination weatherman, computer, and track star all in one. With so much of the work weather-dependent, he had to be constantly aware of each day's forecast and be ready to respond to the quickly changing beachfront conditions not covered by the generic weather reports. Keeping track of the activities of 40 workers each day, while at the same time planning the next day's and next week's progress for several work areas and work tasks concurrently, brought new meaning to the term multitasking. When the superintendent inspected the top of the promenade from end to end, then reversed direction to review the work on the underside, the trip involved a trek of nearly a mile.

## Advantages and Complications

During the repair process, the contractor both benefitted from unforeseen advantages and dealt with unexpected complications. Concrete repairs executed largely during the winter months were completed with very little delay from inclement weather, due to the unusually dry and warm winter the East Coast enjoyed in early 2002. This allowed efficient concrete repairs executed in conformance with ICRI guidelines. There was no need to use cold-weather curing additives or localized heating to aid concrete curing. In early spring, however, applications of urethane pedestrian coating were impacted and delayed by huge volumes of pollen expelled from trees growing adjacent to the promenade. After several days, a covering of pollen

thick enough to make the light brown urethane coating appear green had to be hosed off the primer or base coats of a 50,000 ft<sup>2</sup> work area, postponing application of the next layer of urethane coating by hours or a full day until the water had dried off. More pollen the next morning would mean more postponement and a scramble to reassign the applicators to other work. Another unexpected complication involved the post-tension cabling. When delaminated concrete was removed from over the PT cables, broken cable tendons were evident in several locations. Prior to patching back the concrete, a PT specialty subcontractor had to be brought in to repair the tendons and to repack the sheathing.



*Promenade coated with planters finished*



*Sea Colony Promenade*

A logistical issue that was expected, but which required close attention to successfully manage, was the installation of perimeter rails on the four post-tension sections of the promenade. The rails had to be planned and fabricated to meet Federal rail safety/strength requirements and to maintain uniform rail post spacing for proper appearance, while making sure rail posts did not end up having to be mounted directly over PT cable ends. First, existing PT cable spacing had to be identified. Cable anchor grout pockets were visible on the slab edges, but spacing of all holes had to be checked to confirm the cable pattern. Once the pattern was established, the rails could be engineered in code-compliant, uniform configuration that would still miss the embedded post-tension system.

Despite the size of the project, its complexity, and weather challenges, the restoration contractor finished within the owner's aggressive schedule. Now complete, the Sea Colony Promenade repairs were not only achieved but exceeded all the owner's goals. Nearly 400,000 ft<sup>2</sup> of top and underside concrete had been inspected, with substantial quantities of failed and deteriorated concrete replaced by new sound patching concrete. The entire complex's appearance was significantly improved. Hundreds of deteriorating and strapped-on parapet panels that blocked views of the beach and ocean and a quarter-mile of faded, dilapidated rails whose posts caused concrete cracking are all now replaced by over 6,000 linear feet of clean, new, and durable full-height aluminum rail systems, unifying the appearance of the north and south halves of the promenade and fully exposing the beautiful dunes and shoreline to all residents. Finally, over 200,000 ft<sup>2</sup> of top and bottom concrete surfaces were protected from harsh beachfront sun, sand, and salt conditions by attractive and long-lasting protective coatings. Now free of concern for the condition of their promenade, the owners and residents of Sea Colony Condominiums can fully enjoy their summer fun.



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