2011 Project of the Year

High-Rise Category

Royal Floridian Resort

Ormand Beach, FL

Submitted by ConTech Construction, LLC

The Royal Floridian Resort is an impressive seven-story concrete and masonry structure 400 ft (122 m) long that sits directly on the Atlantic Ocean shoreline in the small town of Ormond Beach, FL. Originally built in 1973 as a Japanese-themed hotel called the Pagoda, the structure had undergone several alterations over the years. In the late 1990s, the building was converted to a time-share resort with over 4000 interval owners. There are 115 units in the building which, at full occupancy, reaches 404 visitors, and the facility employs 30 full-time and 25 part-time employees. As one of the largest tourist resorts in the area, the Royal Floridian is a huge economic driver for the local economy.

When the balconies stated spalling severely and chunks of concrete fell, it became obvious that the structure was showing signs of serious structural issues that needed to be addressed. The owners hired the construction team of engineer, architect, and contractor over a year and a half before construction would start. That decision by the owners allowed all parties to plan for what would be the largest restoration project in the area.

Severe underside spalling of balconies

Reinforcing steel was extensively corroded

THE VISIBLE PROBLEMS

The balconies had visible underside and topside spalling throughout. Reinforcing steel was exposed in many large areas and was obviously corroded. Water had been penetrating into the units during typical rainstorms. Cracks were visible in balcony edges and at the base of columns. The underground garage suffered water leaching in, creating stalactites hanging from the ceiling, because the waterproofing membrane on the pool deck above had failed. The north and south ends of the structure had cracks and large areas of disbonded stucco. The air-conditioning units on the balconies had rusted and corroded, leaving piles of rust on the floors and orange streaks running down the building. Pavers on the pool deck were efflorescing and discolored.

INSPECTION AND EVALUATION METHODS

The engineering firm reviewed the building plans to determine the design concept and the reinforcement scheme. The balcony, walkway, and exterior walls and columns were sounded with a steel chain and an iron rod to detect the delaminations. A magnetometer was used to detect the location and approximate depth of reinforcing steel. A 1% phenolphthalein solution was sprayed on the concrete to assess the general alkalinity of the concrete. Estimated quantities were recorded as the basis of the budget.

Limited destructive testing was performed to observe the extent of the reinforcing corrosion and obtain core samples for laboratory analysis. Delaminated lath and stucco were removed from the structural steel supports on the north and south ends of the building so that the extent of the corrosion to those members could be determined.

THE FINDINGS

The balcony concrete was found to have over 5 lb of chloride per yd^3 (3 kg/m^3). The alkalinity

Close-up view of corroded reinforcing steel

Corroded beams and columns were not capable of supporting loads much longer

indicated a pH below 9 at the base of the spalls. Concrete and steel damage was extensive on the balconies and walkways. Moderate damage was observed on the columns, seawall garage, and front porte cochere ceiling. Reinforcing steel corrosion was common and generally severe under and along the aluminum storefronts and the concrete spalling extended into the unit interiors. Extensive damage was caused by the aluminum electrical conduit that was in contact with the reinforcing steel. The steel corrosion in these areas was caused by a reaction caused by the galvanic voltage difference between the aluminum (–0.604 volts) and ferric steel (–0.207 volts) embedded in a conductive electrolytic solution-wet concrete.

The plan review showed a disturbing item. The north and south ends were originally designed to be 5 ft (1.5 m) cantilevered elevated slabs, but the top reinforcing had been left out of all these cantilevered areas back in the 1970s during the original concrete placement. Much cracking followed, and the steel beams and columns were added soon after the problem had been discovered. These beams and columns were now corroded and not capable of supporting the loads much longer.

THE OWNERS' FOUR IMPERATIVES

1. All structural deficiencies would be repaired in a fashion that would provide long-term durability to the structure;

Work proceeding on balconies

2. While the structure was being made sound, it would also get a complete architectural aesthetic makeover that would excite the owners and improve property values;
3. The project would be completed for the budgeted price; and
4. The 9.5-month construction schedule would be met so that the facility would be open for business by the start of Biketoberfest.

THE STRUCTURAL SOLUTION

The preconstruction team met regularly for 18 months prior to starting construction. The collegial working relationship allowed the architect to develop different schemes and compare different materials that were priced by the contractor and discussed with the owners. The trust and confidence that was established during this time was crucial once the work started because when unforeseen problems appeared, they were analyzed and discussed and decisions were made in short order without rancor. The schedule was maintained.

The work started on January 4, 2010. The existing windows and doors were removed and wooden barriers were installed in every unit, starting on the top floor. Safety was paramount; safety anchors with attachment rings were installed on all the columns before the demolition started so that workers throughout the duration of the project would have a safe way to access the areas at all times.

Twenty jackhammers were used to remove the balconies to a line 24 in. (610 mm) inside each unit. The broken concrete fell to the balcony below, from which it was then deposited into small dumpsters

Replacement structural steel columns and beams

Coating being applied to new balconies

Finished balcony with new railing

and transported to large dumpsters on the ground. The existing steel was cut out and removed, except for the lap length, which was sandblasted and augmented with additional bars where it had lost 30% of its cross-sectional area. All the old concrete and steel was recycled. The speed of removal was striking—2400 linear ft (731.5 linear m) of balcony was removed in 3 weeks.

The rebuild forming process started from the second floor to the seventh. The formwork was reused on each floor, reducing cost and increasing efficiency. As each 200 linear ft (61 linear m) section of decking was completed, new steel was installed and lapped to the cleaned reinforcing bar. The engineer inspected each area before the steel was covered by concrete. In many areas, the existing steel had been placed irregularly, both in spacing and in the height of the concrete. Many additional bars were drilled and epoxied into place to correct these deficiencies. A corrosion inhibitor was sprayed on the existing concrete to avoid creating a battery effect with the differential between the old and new concrete. The new concrete was a 5000 psi (34.5 MPa) concrete with a water-cement ratio (w/c) of 0.40. All slabs were finished with a light broom to allow for good adherence with coatings that would be applied later.

As the concrete proceeded upward floor by floor, the window installation crew followed from the ground upward as well. All fasteners used were stainless steel and were embedded in a sealant to minimize potential corrosion. All the sealants, coatings, and paints were from the same manufacturer to ensure compatibility between all of the components. Temporary handrails were clamped to the edges of the new concrete, giving workers safe access to every floor after it was poured.

Stucco was applied to all of the new masonry walls and concrete columns. On the south and west sides of the building, the delaminated stucco areas were removed, exposing the existing masonry walls.

Engineered shoring with needle beams was installed in preparation of removing and replacing the structural steel on the cantilevered ends of the building. This was the most challenging and daunting part of the project. A failure here could be catastrophic.

UNEXPECTED OBSTACLES

When the stucco was removed in the delaminated areas, the existing block walls were found to be riddled with gaping holes where mortar was missing in joints. Large voids were present alongside window openings, and large step-down cracks were visible as well. It was now apparent where much of the water intrusion had been coming from. In a meeting with all of the construction team and the owner, it was decided that the best course of action

Work proceeding on new deck and pool area

was to remove all the existing stucco on the south and west sides and apply a skim coat to fill all the holes. Then, the stucco was applied.

It was in the beginning of the structural steel replacement that another obstacle presented itself. It was discovered that when the beams and columns were added back in the 1970s, they were placed on footings that were grossly undersized for the loads imposed by the seven-floor structure. Several of the columns had no footing at all, but instead were resting on the original concrete pavement and concrete stairway. The adjacent concrete columns had severe cracking and bulging as the load shifted to these columns from the steel columns. It appeared that the containment steel ties were failing. To fix the problem, the engineer designed enlarged footings and new footings as required. The existing concrete columns would be removed and enlarged as well.

The contractor excavated around the existing footings, dowelled and epoxied new reinforcing, and poured the enlarged and new footings. The replacement of the structural steel beams and columns went exactly as planned, with no movement or settlement of the building when the supports were removed.

The biggest hurdle thrown at the construction team occurred when the owners announced in March that they wanted to demolish the existing pools and pour three new pools. This was to be done concurrently with the rest of the project, with no time added to the schedule. Just getting the permit from the Department of Environmental Protection, which authorizes all construction in the tidal zone (which this was), took 2 months.

ARCHITECTURAL SOLUTIONS

Challenges often create opportunities, and the new pool design led to a total makeover of the 15,000 ft^2 (1394 m^2) recreation deck. Although the existing deck had an interesting layout of paving and curvilinear planters, the pavers were outdated, and the raised planters were difficult to maintain and allowed water infiltration into the garage below. The architect used this opportunity to delete the existing planters and create additional deck space with a circular paver pattern with a palette of colors that accentuated the building's new color scheme. The new deck and pool renovation creates a spectacular foreground for the ocean view from the unit balconies above.

The architectural aesthetics for this project were just as important as the restoration improvements that are often concealed within the structure. It was important for the owners to see a newly polished jewel that included contemporary updates and fresh design elements upon their return. Some of

New deck and pool area

New recreation deck area

Completed Royal Floridian Resort renovation

these surprises included standard picket railings that were replaced with a modern-style guardrail with glass inserts; waterproof deck walkways with intricate paver details; a new energetic color palette throughout the property; modern window systems tinted the color of sea glass; and a complete renovation of the porte cochere entry, which included new lighting fixtures, cast-in-place stamped concrete ornamentation, and a sleek minimalist entryway free of the previous clutter.

THE RESULTS

The project was completed on time and on budget and delighted the owners. The key to success was the planning and cooperation of the team in advance of the project. The construction team used an open-book buyout system that allowed savings to be reallocated to the unforeseen issues. Because construction prices were falling throughout the planning and construction period, the owner garnered savings of over $500,000, which was reinvested in the project. The new insulated glass and high-efficiency air-conditioning units have combined to reduce electrical bills by 40%. The resort has reclaimed its position as one of the most beautiful structures on the waterfront. As the Resort Operations Manager said, "It looks just like a brand-new building. I can't believe it's the same thing. Thank you for rebuilding the Royal Floridian into something spectacular!"

Royal Floridian Resort

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Spinnaker Resorts
Hilton Head, SC

PROJECT ENGINEER/DESIGNER
United Engineering Consultants, Inc.
Longwood, FL

REPAIR CONTRACTOR
ConTech Construction, LLC
Winter Garden, FL

MATERIAL SUPPLIERS/
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