Sorry, Charley!

By Joseph C. Kosinski, P.E.

The Lighthouse Resort in Fort Myers Beach, FL was "high and dry" in Hurricane Charley's aftermath—thanks to a renovation and hurricane-rated structural steel retrofit.

The first floor of the original cottages was demolished *(above)* before raising the remaining structure and inserting a new two-level steel frame underneath *(below)*.

Fort Myers Beach, FL has a history of damage from destructive hurricanes. Wind, storm surges, and flooding have taken their toll on this barrier island, located near the southwest corner of Florida in the Gulf of Mexico. Over the years, the Lighthouse Resort Inn and Suites in Fort Myers Beach had experienced its share of damages—and damage claims—caused by flooding and hurricanes.

The adoption of the 2001 *Florida Building Code* incorporated strict and restrictive building requirements into design codes in an attempt to minimize the loss of life and damage caused by the destructiveness of hurricanes, flooding, and hurricane-force winds. With the Lighthouse's history of damage claims resulting from these forces of nature, the Federal Emergency Management Agency (FEMA) awarded the resort a grant through the Flood Mitigation Assistance (FMA) program in 2003 to begin a renovation that would attempt to mitigate the claims.

Because the area was prone to flooding during tropical storms, hurricanes, and heavy rains, the project objective was to elevate the resort's ground level cottages to a third level above the projected flood and surge plane. Additionally, the existing wooden structures were to be reinforced with light gauge steel hurricane straps (clips) and upgraded to the new building code.

The project was divided into three phases. Each phase would take selected two-story cottages, located around the resort site, and elevate the units above flood elevation. The second story would be elevated to a third level, while a new hurricane-rated structural steel building would be constructed underneath. The existing first story of each cottage would be demolished. Phase one would elevate three connected cottages, phase two would elevate a single cottage, and phase three would elevate two connected cottages while relocating another to the same site.

Due to site restrictions and the size of the phase one cottages, they could not be temporarily relocated. The cottages were hydraulically lifted and temporarily supported to allow for the building underneath to be constructed. All three cottages were elevated at one time, without removing the connecting breezeways.

Prior to renovation, each of the cottages was supported by exterior and interior bearing walls framed with dimensional lumber. The existing roof framing consisted of wood trusses spaced at 24" on center. The units were gutted and stripped of interior non-bearing walls and gypsum board.

A new structural steel frame was chosen for its strength and ease of construction. Structural steel, with its individual members, was quick and easy to assemble below the cottages. Openings were provided within the steel frame to allow lifting jacks to remain in place until the cottages could be placed on the new structure.

The lower level of each unit was opened up to allow the insertion of three heavy steel support beams installed beneath the second floor bearing wall locations. The 18"-deep "carry beams" served as the main support for the second levels while the cottages were being hoisted up. The carry beams were oversized to allow flexibility for placement of the hydraulic jacks, minimize deflection of the carry beams, and increase connection requirements for the beams onto the structural steel frames. The beams also would serve as permanent supports for the cottages on the new structural frame.

When the carry beams were correctly positioned below the second floor, hydraulic jacks were inserted at selected locations along the length of each lift beam. Galvanized, light gauge steel hurricane straps were installed to secure the wood floor joists to each steel lift beam. Additional hurricane straps were attached to each stud within the bearing walls, top and bottom, to anchor the studs to the floor joists. Each roof truss hurricane tie-down was reinforced and upgraded to the new 2001 *Florida Building Code*. This approach provided a continuous load-resisting path from the existing cottage roof and walls to the new structural steel frame below, and down to the new anchoring foundations.

After that, the first floor-bearing walls were demolished. The cottages were then gradually and uniformly hoisted to the third level. Heavy-duty timber blocking was installed to provide a backup support for the carry beams in the event of loss of hydraulic pressure in the jacks.

Next, deep foundations, to minimize washout from the storm surge action, were placed below grade. All anchor rods were uniform in size and placement for ease of construction. The structural steel columns were designed to be the same size and shape for ease of ordering, detailing, fabrication, and installation. The columns were sized to provide increased lateral resistance to hurricane-force winds. Each steel column base was encased within a 24" concrete jacket. The concrete jacket extended from the foundations to 48" above the adjacent grade. The jacket would protect the steel from rusting and from damage by cars and floating debris during rushing storm surge action. With only a 2' wide base, the columns would provide little resistance to rushing water.

The new second floor was a 5" concrete slab on 2" metal deck. Steel studs welded to the top flanges provided a positive anchorage from the steel to the concrete slab. Beam and girder connections were a combination of welded and bolted semi-rigid connections. This connection provided increased stiffness to lateral wind loads.

The second level was raised 2' above the required flood level for added protection. The cottages' new first stories were built on this level with light gauge steel studs anchored and strapped to the concrete slab and steel frame.

Once the building was complete, the original cottages were set at the third level, thereby minimizing future damage and insurance claims to the property. Existing windows and doors were removed and replaced with hurricane-rated assemblies. The ground level remained open for parking and to allow storm surges and flooding to pass unobstructed under the units. This would minimize damage to the resort rental units and prevent scouring and washout of the soil around the buildings.

The second floor of the original cottages became the third floor after the renovation. All new infill construction used light gage steel. "Hurricane clips" and straps were added to all existing wood framing.

When Hurricane Charley struck southwest Florida in August of 2004, Fort Myers Beach was directly adjacent to the eye of the storm. Wind gusts exceeded the required 130 mph wind code, and the island was covered by 3' to 4' of rushing water. Despite extreme wind forces and the rushing storm surge, the newly renovated Lighthouse Resort cottages sustained no damage. ★

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