Katie Ritter

Structural Option

Advisor: Dr. Ali Memari

December 12, 2008

Proposal

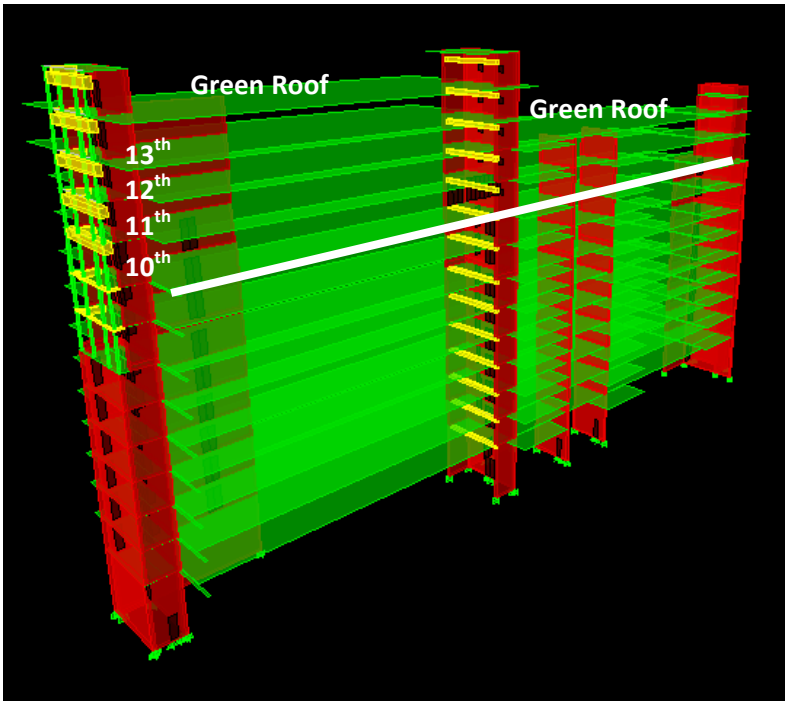
Executive Summary

EXECUTIVE SUMMARY

The originally-designed Residence Inn by Marriott will be situated in a lively downtown Norfolk, Virginia area, surrounded on all sides by busy streets. The hotel will serve as an upscale temporary residence with extensive amenities for its extended stay patrons. There will be 160 guest suites on eight upper floors, with public functions, such as lobbies, gathering areas, and an indoor swimming pool, located on the first floor. The upper floors generally have the same layout; only minor differences exist to accommodate various room types. A main corridor connecting the emergency stairwells at either end of the building separates 10 guest suites each on the North and South sides of the building. A pair of elevators is located at a central core along this corridor.

While some of these accommodations that are exclusively designed for the extended-stay business traveler have in-room desks and workspace, none of these provides a separate residence and office space in the same building. Frequently, companies who relocate business professionals temporarily also acquire temporary office space. It can be difficult to find space that can be leased for short-term use. It is also very costly to set up these spaces, in terms of furnishing and getting technicians to set up phone and internet access. Assuming Marriott pursued this concept of residence and office space in the same building, renting rooms for each on a day-to-day basis, the building would need to increase in size to maintain the desired residence space, while adding office space. Due to the nature of the confined site, the only way to do this is to expand vertically.

To address the needs for vertical expansion and to reinforce Marriott's dedication to the planet by providing green space, the proposed Residence Inn & "Executive Suites" will feature four additional floors (above the white line shown in the 3-D view) and two separate green roof spaces, as illustrated in the figure below.



(FIGURE 1) 3-D View of Proposed Additional Floors & Green Roofs

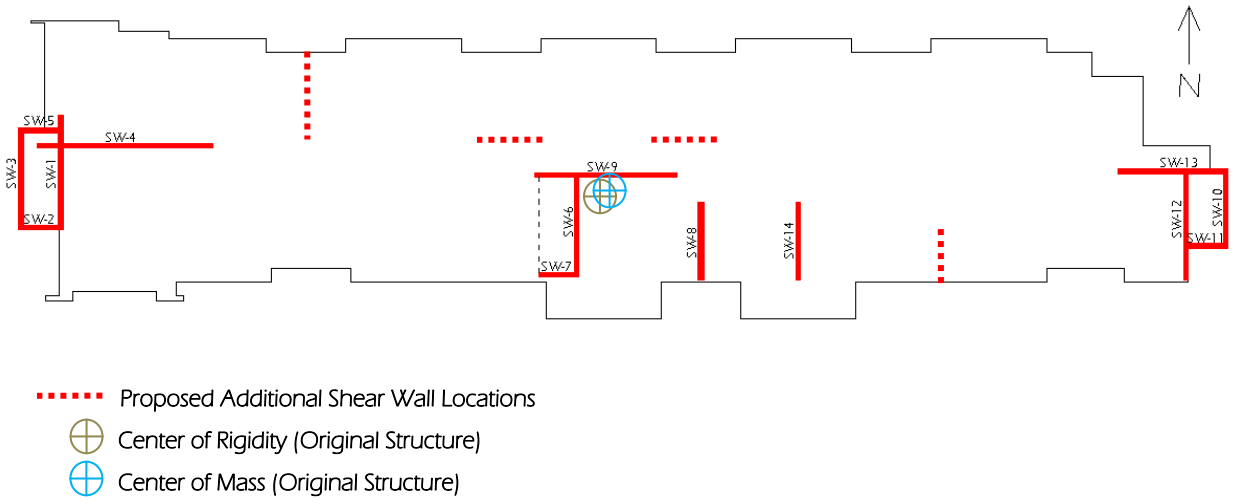
Since Marriott's network of lodging is so expansive and constantly growing, it would be beneficial to have a prototypical structure that could be used in a number of different locations throughout the United States. This would reduce the amount of re-engineering of similar buildings required. The current location of the Residence Inn by Marriott is downtown Norfolk, Virginia, where seismic activity is relatively low. In order to develop a prototype for the structural systems for more locations across the United States, the structure would need to be designed for additional seismic loads. Increased mapped spectral response acceleration parameters of 50% and 15% of gravity for the short and long period accelerations respectively and a more severe Seismic Design Category C shall be used as criteria for the design to ensure that the structure is capable of being located in the most locations.

With the addition of four floors and increased seismic loading, both the existing gravity and lateral resisting systems will require analysis and re-design. The discontinuation of shear walls where the upper two floors project on the West side will create additional structural issues that will also need to be addressed, such as torsional and shear-related issues.

The basic layout of structural elements, such as column and core area locations that provide the necessary vertical transportation, shall remain as originally designed. Since it was determined that the flat plate floor system is one of the most economical choices for this type

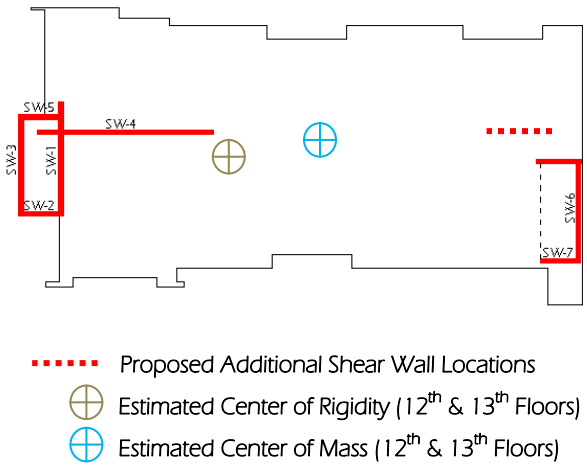
of building, the proposed solution will include the use of this.

One design solution for the increased lateral loads is illustrated below, where the dotted lines represent additional shear walls at all levels. These can be easily incorporated into the existing structure hidden at partition locations such that the guest room floors do not need to be re-designed architecturally.



(FIGURE 2) Proposed Design Solution for Lateral Force Resistance (Typical Floor)

Since the estimated locations of centers of mass and rigidity do not coincide at the upper floors (12th & 13th, as shown below), torsion could be an issue here and will need to be addressed once the severity of the issue is determined.



(FIGURE 3) Proposed Design Solution for Lateral Force Resistance (12th & 13th Floors)

A number of methods, codes, design guides, and design aides shall be used in the re-design and analysis of gravity and lateral structural elements. Both hand calculations and computer modeling will be used simultaneously to avoid errors. RAM Structural shall be used to construct and evaluate mainly the lateral system, but will be used also as a spot check for gravity load elements. PCA Slab will be used for two-way flat-plate design to verify hand calculations.

The introduction of a new concept in merging hotel and temporary office space, which will add four additional floors, lends itself naturally to a need to design these new spaces architecturally. Individual offices shall be designed to accommodate various types of professionals and be equipped with all the necessary furnishings, printers, fax machines, telephones, basic office supplies, and even a small kitchenette for preparing lunch and brewing coffee. The concept is based on the idea that the business traveler can come into town, get a good night's rest in his/her hotel room, travel a short distance down the hall and up the elevator to work, plug his/her laptop into the internet connection, and "voila!" he/she is ready to begin a productive day. Plans, elevations, building sections, and a 3-D Revit model of the interior spaces and green roof shall be the deliverables for this breadth.

Since an important aspect of the re-design is separation of work and personal spaces, the new office space shall exhibit lighting characteristics that is both efficient and fosters productivity. As part of the design solution, the proposed research shall include consideration of natural daylight and a selection of fixture types for one of the typical offices, as well as either a conference room or corridor. In addition to providing a design that meets code requirements for a minimum number of footcandles, Luxicon will be used to portray the design in 3-D.

The ultimate goal of the proposed research will be to gain experience in seismic design and lateral load-resisting systems, while also becoming more adept at gravity systems, such as the two-way flat plate. In conjunction with these goals, this research shall serve as a practical exercise in meeting the architectural requirements for luxurious spaces and working to achieve a solution that satisfies both design parties, and ultimately the owner(s) and end occupants.