

Gouverneur Healthcare Services

New York, NY

Final Report



Scott Rabold

Structural

Consultant: Dr. Ali Memari

4.7.2008

EXECUTIVE SUMMARY

The Gouverneur Healthcare Facility is a 75,000 sq. ft. addition to an existing, 13 story hospital. The addition is comprised of two portions; the lower five floors contain an ambulatory care center, while the upper floors are an expansion to the current long-term care residences. The existing hospital is a cast-in-place concrete structure with a tight, 11' floor-to-floor height. Due to the constraints imposed by this height, all gravity members of the addition's structure are cellular beams. Furthermore, moment frames comprise the majority of the lateral load resisting system. In order to save cost, and increase the ease of design and construction for all trades, a concrete structural system has been proposed to replace the existing steel frame design.

The proposed design utilizes a two-way flat plate floor system. The flat plate construction allows for unobstructed space between the ceiling and the slab above. This will allow significant freedom of design for all other systems, something that was lacking in the original design.

The slab is 12" thick and has a compressive strength, f'_c , of 6000psi. Typical bays for the lower portion are 22'x24' with 16" square columns. Columns supporting the upper portion of the building are 20" square. Deflections are typically limited to 0.80" (L/360) for immediate deflections, and 0.60" (L/480) for long term deflections in areas where large deflections would damage non-structural elements.

The column layout is shifted for the upper floors in order to control deflection and coordinate with the room layouts of the long-term care dormitories. At the 6th floor, a 60" transfer beam is designed to transmit the load of the shifted, upper column to the typical columns below. Otherwise the shifted column would extend through the center of the 4 story atrium in the lower portion of the building.

The lateral load resisting system is comprised of six shearwalls in total, three in each orthogonal direction, with an $f'_c = 6000$ psi. Shearwalls that extend from the foundation to the lower roof on the 6th floor are 16" thick to match the adjacent columns. Shearwalls that extend the full height of the building are 20" thick. Coupling beams that adjoin two piers of a shearwall are 36" deep and match the thickness of the shearwalls.

Wind and seismic loading were investigated in order to design the LFRS for strength and drift requirements per code, but also to limit deflections of the floors to half the distance between the existing and proposed structures. This design choice was made in order to conservatively limit the overall deflection of the structure to an "upper limit" that is an attempt to prevent damage to the structures during wind and, more critically, seismic events.

Although wind loading created the highest design forces in the shearwalls, the design of the LFRS was governed by seismic loading in order to meet the upper limit requirement for deflection. Therefore, the size and location of shearwall were designed to limit seismic deflections while also coordinating as best as possible with the room layouts of each floor.

Because the change in structural system created a potentially large impact on the room layout of the Gouverneur Healthcare Facility, an architectural investigation was conducted. Floors were redesigned to account for the added columns and the addition of shearwalls. Special care was taken to retain the same functional relationship between rooms. For example, spaces like the Sterile Prep Room and the Operation Procedure Rooms were kept adjacent. Furthermore, the long-term care residences for the upper floors were designed based off the layout of the rooms in the existing building.

In order to have a complete comparison of the viability of the proposed structure, a cost and schedule impact study was conducted. It was determined that the proposed structure saved \$570,000 of the cost of the structure. However, when considering the total cost of the project, this savings is less than 1% saving. The proposed structure will also take longer to construct, with estimated construction time of 12 months, compared to 6.5 months for the existing addition. Because the Gouverneur Healthcare Facility is a hospital owned by the NYC HHC, immediate revenue generation is not an issue, and the longer estimated schedule time does not negatively affect the feasibility of the proposed design.