Final Report

Executive Summary

The 8th Street Office Building is a government office building located in Richmond, Virginia whose main purpose is to serve the needs of the Virginia General Assembly during renovations to the Virginia Capitol. Once the renovations are completed, it is expected that the office building will be utilized by various Virginia government agencies. The 8th Street Office Building consists of four underground parking garage levels, ten floors above grade, and a mechanical penthouse. The building is approximately 307,000 square feet in size and 176'-5" in height, with floor to floor heights ranging from 10'-0" for the parking garage levels to 18'-10" for the second floor.

The structural system of the 8th Street Office Building is comprised of composite steel framing and a lightweight concrete slab on metal deck floor system. A typical bay through the interior of the building is 20'-0" by 30'-0", and a typical bay around the perimeter of the building is 20'-0" by 40'-6". However, several variations on these dimensions exist throughout the building due to façade and floor plan irregularities. The lateral system consists of sixteen reinforced concrete shear walls located around four transportation cores within the building.

Unfortunately, the 8th Street Office Building is not currently scheduled for construction due to a deficit in the Virginia state budget. In fact, the design of the building has been stalled since 2008 at approximately 85-90% completion until funds are allocated for the remainder of the project. Through discussions with the structural design engineers, it was discovered that the design for the current lateral system for the 8th Street Office Building has not been finalized. Therefore, this final thesis report investigates several steel lateral systems as alternative options to the reinforced concrete shear walls.

Steel plate shear walls were eliminated as a feasible system for the 8th Street Office building due to their incompatibility with openings, despite having many advantages similar to those of braced frames. Therefore, the first steel lateral that was designed in depth for the 8th Street Office Building consists of braced frames. However, it was discovered that seismic drift limitations significantly governed the design of the braced frames. For example, it was necessary to increase column sizes at the ground level from W14x283 to W14x255 in order meet drift requirements. Moment frames were also evaluated for feasibility since they do not obstruct openings. Unfortunately, a schematic design of the moment frames indicated that slenderness issues resulting from large floor to floor heights could not be resolved. Finally, two dual steel systems of braced frames and moment frames were analyzed in order to evaluate drift control. Ultimately, one of the dual systems was chosen as the optimal steel lateral system for the 8th Street Office Building. The computer modeling program RAM Structural System was utilized extensively in the designs of the various steel lateral systems.

The architectural breadth study involves a redesign of the overall service core in order to maximize the amount of useable space for the tenants. Ultimately, 1,440 square feet were gained as a result of eliminating a corridor. The sustainable breadth study involves the selection of an extensive green roof as well as the sizing of three 1,000 gallon collection tanks for greywater use within the 8th Street Office Building.