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Structural Option
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Sallie Mae Headquarters
Reston, VA
Proposal

Executive Summary

Sallie Mae HQ is an office building located in Reston, VA. Sallie Mae consists of nine floors of steel tower framing which rests on a five level (mild reinforced concrete) parking garage that is below grade. The lateral resistance for the steel tower is provided by braced frames that are hidden within the stairwell and elevator walls in the central core of the building. The braced frames continue down to the first floor and transfer their loads to shearwalls which extend to the foundation. The area of a typical office floor is approximately 22,000 square feet and consists of structural steel beams with a composite 3¼" lightweight concrete floor slab on 2" deep metal decking (5 ¼" total depth). The tower has three bays along its width (42'-0", 23'-0", 42'-0") and its typical bay in the opposite direction is 28'-0" long. The area of a typical level in the parking garage is approximately 75,000 square feet. The garage is made from a two-way slab system that features drop panels. The drop panels are primarily 3.5" and elevated slab thicknesses vary from 9" to 14". Spans reach 28' and normal column sizes are 30" x 30" concrete columns.

The floor structure must be designed to resist deflection caused by 42' spans. Furthermore, the floor depths must be maintained below 27" to provide an efficient amount of room for mechanical equipment in ceiling envelope. Through my analyses of alternative systems to resist this problem, post-tensioning was the clearly the best alternative. My preliminary design will be as follows; the floor will consist of shallow, wide post-tensioned girders that span the (42'-0", 23'-0", 42'-0") width of the building, and one-way post-tensioned slabs spanning in the opposite direction; the columns will be 24" and 30" square columns; the floor to floor height will remain 14'; the lateral load system will be shear walls at the stairwells and at the elevator shafts in the central core of the building. The design of the one-way slab will be based on the Post Tensioning Manual, Fifth Edition and ACI 318-05. The specific strength and weight will be confirmed after preliminary calculations. The beams spanning the width of the building will be designed as T-beams. A column takedown will be made using rough areas. Preliminary square column sizes will be chosen. Seismic and wind loads on the building will be found using ASCE 7-02. Shearwalls will then be designed. A complete full frame analysis will be made by using the Equivalent Frame Method. The results will be confirmed with the computer program ADAPT.

For my breadth analyses I chose construction management and mechanical due to the following. Construction management is a major issue due to the difficulty of post-tensioning. Scheduling must be carefully implemented, and the design needs to be clear to minimize any possible mistakes in the construction process. Space for the layout of the post-tensioning strands must be planned and the cost must be researched. Mechanical systems and any possible changes in the flow of ductwork will be critical dampened by the use of post-tensioning. Mechanical considerations must be made because post-tensioning doesn't easily allow holes to be made in the floor slab.