

Thesis Final Report

Executive Summary

The purpose of this report is to examine a possible alternative structural system for Park Potomac Office Building “E.” This structure is a seven story, roughly 100 feet tall office building located in Potomac, MD. The seven office levels are each roughly 25,000 square feet and sit on top of two large levels of mostly underground parking. For this report, the seismic base level was taken at the top of the parking levels and the wind load on the parking levels was considered negligible.

The original structure was all cast in place post-tensioned concrete. Concrete columns supported a thin floor and moment frames were utilized to resist the majority of the lateral forces in both directions. This system was adequate and efficient; however, the large self weight left room for improvement and cost savings through a redesign of the system.

The office levels of the project were redesigned using composite beams, lightweight concrete on metal deck, and steel supporting columns. Braced frames were used in both directions to resist the lateral forces on the structure.

The steel beams resulted in a deeper floor depth than the original design, so the overall height of the structure needed to be increased. This increase, as well as the change in seismic weight, required the need for recalculation of lateral design forces. After recalculation of the loads, it was determined that $0.9D + 1.6W$ was primarily the controlling load case for the structure. Additionally, overall building torsion was found to be negligible, overturning of the building was not critical (although there were several areas of uplift at the base of the office levels at the braced frames), and all drift limitations were satisfied.

After designing the new structure, the five large mat foundations used in the original design were redesigned as a series of 17' x 17' foundations. This resulted in a 79% cost reduction for foundations and schedule improvements as well.

An architectural study was completed, analyzing the location of the braced frames with the existing floor layout. Also, the design of several connections was completed.

The cost and schedule impacts were compared for the two options and it was determined that the steel structure will cost approximately \$20.69 /SF versus the post-tensioned structure, which cost \$27.83 /SF. This resulted in savings of approximately 25% of the total structure's cost, while the schedule showed duration reduction as well.