

## **EXECUTIVE SUMMARY**

This report is a detailed examination of the redesign of National Harbor Building M located in Oxon Hill, Maryland. Building M is being constructed as part of a large scale development on the banks of the Potomac River which will be known as National Harbor. It is a rectangular building in shape with exterior dimensions of 243'-8"x 60'-5 1/2" for approximately 14,000 square feet per floor. This five story building was originally designed as a steel based structure with steel moment and braced frames and masonry shear walls providing lateral support. The redesign investigated in this report replaces the steel system with a post-tension concrete system supported laterally with concrete shear walls. Additionally, the report includes breadths topics focused on the construction impacts of the redesign and a façade study of the rear wall of Building M.

While conducting the structural depth of this report, a number of computer building models were used for analysis including an ETABS model of the Lateral system and a RAM Concept model of the post-tensioned slabs. The post-tensioned slab was designed as an eight inch slab with unbounded reinforcing tendons running banded across column lines in the longitudinal direction and distributed in the transverse direction. Controlling lateral loads of 730 kips from wind in the transverse direction and 369 kips from seismic in the longitudinal direction were calculated and used in the design of the lateral members. The lateral system comprised of four L-shaped reinforced concrete shear walls, gave the building a period of 0.6678 seconds and a maximum displacement of 1.36 inches. Supporting the gravity loads of Building M is transferred to the foundation through typical 24"x24" interior and 20"x20" exterior columns.

A façade study of cast-in-place concrete, CMU, and Architectural Precast wall systems was performed to select the appropriate system to enclose the rear face of the building. The study showed the precast system most efficiently fulfilled the investigated criteria. A full design of the architectural precast system lead to the selection of a direct bearing panel system comprised of 30'-8 1/8" x 20' and 30'-8 1/8" x 13'-8" four inch thick panels. These panels were designed to connect to the structure laterally with two different types of welded tie-back connections. A construction investigation was performed to compare the financial and schedule ramifications of the switch from a steel-based design to a concrete-based design. The investigation concluded the redesign could be accomplished at a lower cost while being completed in roughly the same period of time.

Evaluating all data calculated and analyzed it can be said that the post-tensioned concrete proposed building design can be considered an effective alternative for National Harbor Building M.