

Executive Summary:

Lexington II is a residential tower located as part of the Market Square North building complex in downtown Washington D.C. Due to strict height controls in the area, the structural design of Lexington II was dictated by its need to contain maximum usable floor levels and thin floor sandwiches. The structural system chosen was flat plate slab spanning small bays. Lateral load is resisted by a core of shear walls located at the building's center.

In designing Lexington II, the structural system was chosen following the common practice of using a flat plate slab or pre-cast systems when designing for the D.C. area. Other systems, such as steel and composite, are often overlooked although they have advantages. This report compares the benefits of a steel system versus a concrete flat plate slab in the design of Lexington II had height requirements not been a factor. The building systems are evaluated on their structural advantages, construction ease, ability to integrate mechanical systems, and most importantly economy of the design.

After a brief evaluation of several systems, the final alternative system designed was composite deck on steel beams and columns. 2"-Lok decking with 2.5" slab (total depth of 4.5") was chosen from a decking manual and catalog. The remainder of the gravity system was designed using the finite element software RAM and resulted in W 12's. The total floor sandwich was 16 inches; double that of the flat plate slab.

The lateral system which would work best in Lexington II with composite flooring was braced frames. The braced frames had to be designed around the existing architecture. Chevron frames were used at the building core in both the N-S and W-E directions. Some member sizes were greatly increased from that needed to support the lateral load including columns in biaxial bending.

Other structural considerations to complete a total design were also evaluated. To better withstand subterranean conditions, the sub-grade structure was designed as cast in place joist floors with shear walls. Connections details for typical column to beam connections as well as heavy braced connections were calculated.

A construction management study verified that a composite system was feasible. A site layout was completed with ample area for all necessary spaces. Scheduling had no major conflicts, and most importantly there was no cost increase in the composite system.

Mechanical integration was also possible with a composite structural system. Fresh air requirements are met by the new window layout associated with the column grid, and simple redesign of the ductwork allows HVAC to reach all spaces. Similarly, simple changes in the sprinkler layout can be made to ensure adequate fire suppression within Lexington II. Acoustical differences between a concrete and steel system may require some greater attention to detailing but do not present any major problems.

There are several benefits to each type of structural system. In the design of Lexington II no system prevails greatly over the other. The small scale of the Lexington II prevents the full economy associated with most steel systems to be reached. Using flat plate slab enables Lexington II to meet the required height restriction without the tradeoff of compromising other building systems.