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The Investment Building
1501 K Street, NW
Washington, D.C. 20005

Executive Summary

The Investment Building is a 380,000 square feet state-of-the-art office building located in downtown Washington, DC. The building utilizes a two-way, 8" reinforced concrete slab system that is divided into 30' x 30' exterior bays and 30' x 26' interior bays in both the longitudinal and traverse directions. The typical floor-to-floor heights are 10'- 4", excluding the sixth level's 16'-1 ¾" floor-to-floor height, the ground level's 13' – 6 1/8" floor-to-floor height, and the penthouse's 18'-6" floor-to-floor height. The typical exterior and interior column sizes are 24" x 12" and 24" x 24", respectively. All columns are poured monolithically with the concrete slab to resist lateral forces, and they extend to their typical 10' x 10' x 4' spread footings below grade. Also, The Investment Building has a restored 1920s Beaux-Arts façade on the south and east side of the building. In addition, The Investment Building has one level of offices and three level of parking below grade. The building was redeveloped in a little over three years at a final building cost of about $38.1M, $35M of which were actual building costs.

As an alternative superstructure, a composite metal deck with a concrete slab and wide-flange beams was chosen to complete the structural depth work. This system was chosen as an alternative, because it takes less time to erect and is economical. The typical bay spacing of the composite steel system is 30' x 30'. Bays adjacent to the east façade are 24' x 30' and bays that are adjacent to the south façade are 30' x 22'. The system uses a 2" concrete slab and a 2" composite metal deck. All beams, girders, and columns are wide-flanged sections. To resist lateral forces, the composite steel system utilizes rigid a steel braced frames.

In changing the existing two-way reinforced concrete slab system of The Investment Building to a composite metal deck with a concrete slab and wide-flange beam system, several issues regarding the integration of the mechanical system were investigated. Although the composite steel system takes less time to erect and costs less,

one disadvantage of the system is the increase in plenum space due to deep wide-flange beams. As a result, the increase in plenum space decreases the floor-to-ceiling heights in the building. Therefore, alternatives for integrating the superstructure and the mechanical system were investigated. After thoroughly investigating the issue, castellated beams were found to be the best solution for integrating the mechanical and structural system.

In addition to investigating issues regarding the mechanical system, changing the existing
structural system to a composite steel system affects the architecture of The Investment Building. The first architectural issue that was investigated is the integration of building's historic Beaux-Arts façade and the composite steel system. A major element of the composite steel system is its columns, which were placed in locations where they do not block the windows of the façade and where they neither interfere with usable office space nor coincide with the concrete columns supporting the parking garage below grade. It should be noted that floor-to-floor heights of the steel system remain the same as the existing reinforce concrete system, so that the composite floor system would not coincide with window openings in the façade and so that the building remain within height limitations in Washington, DC.

Another issue regarding the building's architecture that was investigated is the increase in plenum space, resulting in lower ceilings. Because the nominal depth of the W10 x 22, which is largest wide-flange beam used in the composite steel system is 10.2", the floor thickness increased from 1'-9" to 2'- 0", which includes the 4" composite metal deck and concrete slab. As a result, the floor-to-ceiling heights decreased.

In addition to the integration the building's historic façade with the composite steel system, the adjustment of column spacing, and the reduction of floor-to-ceiling heights, the geometry of the circular atrium was another architectural issue that was investigated. Diagonal girders were place tangent to the footprint of the circular atrium as a means of support. As a result, the diameter of the atrium decreased from 50 feet, its diameter in the reinforced concrete system, to 42'-5" for the composite steel system.

Finally, integrating the composite steel structure and the existing concrete parking garage below grade was another architectural issue that was investigated. Because the concrete columns in the parking garage cannot support the large axial loads from the steel columns of the main superstructure, the composite steel system is offset 4'-6" west from the center of the west-most columns of the parking garage. The composite steel system is also offset 3'-0" north from the center of the north most columns of the parking garage. As mentioned previously, the composite steel system utilizes rigid steel braced frames to resist lateral loads. It is assumed that the steel braced frames have no impact on the architecture of the building. It should also be noted that the parking garage below grade remains the same as it is in the two-way reinforced concrete system.