Proposal

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Problem Statement

The Odyssey was designed with consideration of a height restriction by the Code of Virginia zoning ordinances. A minimum floor-to-floor height was required to construct the 16 level residential tower under the height restriction to maximize tenant occupancy. A two-way post-tensioned flat plate floor was designed for these restraints with a design depth of 8". Is there a feasible alternative floor system without post-tensioning? This study will investigate the design implications of an alternative system in a residential scheme. The construction cost and schedule of the systems will also be considered in the study.

Proposed Solution:

The proposed alternative system will be designed as a two-way reinforced flat plate. The similar flat plate design will also allow the existing mechanical soffit designs to remain in residential units so there are limited alterations in MEP systems. The overall architectural design of the Odyssey will, for the most part, remain similar to details found under the existing system. The same number of levels and identical residential unit layouts will result in similar column locations and bay sizes throughout the floor plan. Columns will be designed to effectively maintain the architectural dimensions of the residential units with the concrete strengths adjusted for column uniformity. The lateral system will be analyzed with reinforced concrete shear walls extended through the building at their current locations. The alterations in the floor design will need to be taken into consideration when analyzing lateral effects.

Solution Method:

The design of a 2-way reinforced flat plate will result in an acceptable slab depth to resist gravity loads and limit floor-to-floor height enough to comply with zoning ordinances. The concrete floor system will be designed in accordance with ACI318-05 *Building Code Requirements for Reinforced Concrete*. The minimum slab thickness will be based on design provisions of ACI 318-05 Table 9(c) for flat plate construction. Deflection will be checked for adequacy in accordance with limitations set by ACI 318-05 Table 9(b). The reinforcement will be designed in accordance with provision of ACI 318-05 Chapter 13. Dead loads will be calculated for the self-weight of the slab with superimposed dead loads and live loads from IBC 2003 Table 1606. The resolved dead loads and live loads will be patterned over the frame and analyzed for the resulting controlling design moments distributed to the column and middle strips according to ACI 318-05 Section 13.6. Live load patterns to be investigated and slab deflection will be checked for adequacy in accordance with limitations set by ACI 318-05 Table 9(b). The flat plate will be designed and reinforced to accommodate the design moments resolved from a frame analysis. Column design will accommodate gravity loads in accordance with ACI 318-05.

The shear walls will be analyzed by a 3-D model of the lateral system in the ETABs analysis computer program. Wind and seismic loads will be computed for the building through provisions of ASCE7-02 sections 6 & 9. The building deflection will be limited to H/600 for crack control of the brick veneer making up the majority of the building envelope. Inter-story drift will be checked against the maximum limit of .020hsx by provisions of ASCE7-02.