

500 Delaware Ave.

#### 4.0 PROBLEM STATEMENT AND SOLUTION PROPOSAL

An area for redesign was difficult to pinpoint with Gateway Plaza. After the research and analysis performed during Technical Assignments 1-3, it has been determined that the current structural systems--steel framing, concentrically braced frames, and deep foundations--was the best given building type, local conditions and accepted practice. Though no feasible framing alternatives were found during research for *Technical Report 2: Pro-con Study of Alternate Framing Systems*, further research and faculty consultation has suggested that a one-way post-tensioned concrete slab system is worth considering. There are no height restrictions dictated by the architect or zoning ordinances, but the post-tensioned system could add a significant amount of ceiling space. The purpose behind this design is to gain knowledge and experience in the design of post-tensioned concrete systems in buildings.

##### Proposed Problem Solution

As mentioned in the problem statement above, post-tensioned concrete slabs and beams will be designed to replicate the architectural requirements of the building by adhering to the given column grids. To achieve this, cast-in-place columns, post-tensioned beams and slabs, and shearwalls will be designed. Although foundations will not be explicitly designed, they will be sized approximately for end bearing strength. Making an appropriate comparison of the concrete system to the steel system will require the consideration of the following factors: cost, project duration, and impact on foundations.

##### Method for Solution

In order to redesign the building using post-tensioned concrete slabs, research must initially be performed to gain knowledge in how to design such a system. By researching texts, journals, and code manuals, a good deal of technical knowledge should be gained. By talking with students whose thesis buildings use post-tensioned concrete in their existing designs and professionals in the industry, significant knowledge of practical design shall be gained.

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Once a significant amount of information has been gathered, schematic designs will commence. A preliminary framing plan will be laid out and the office floors will be designed using loads obtained in *Technical Report 1: Existing Building Conditions*. The first round of analysis for all members will be performed by hand calculations using ACI 318-05 *Building Code Requirements for Reinforced Concrete* and *The Post-tensioning Manual*. Further analysis will be completed using structural software including: ENERCALC, RAM Structural System, and Concept. Finally, wind and seismic loads will be computed by hand and applied to the structure. A design for the lateral system will be designed and checked in RAM Frame for all possible loading cases and combinations as laid out in Chapter 2 of ASCE 7-02.

Once the design has been finalized, a proper comparison shall be made between the composite steel framing and the post-tensioned concrete framing based on the factors mentioned above.