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Structural Option
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110 Third Avenue
110 Third Avenue
New York, NY 10003
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Final Report

Design and Analysis of 110 Third Avenue

Executive Summary

The requirements set forth by the designers of 110 Third Avenue are basic in that they meet the needs of economy and the future occupants of the building. This report consists of a new design of the structural system and concludes, independently of existing conditions, the best system for the site and conditions impacting 110 Third Avenue.

The new structural system removes columns throughout the building thus opening the floor plan while resisting the same loadings. Increasing the bay sizes to adapt the floor plan impacted all other structural systems in the building, while having little impact on mechanical and lighting issues. Larger bays lent the design of the new building to a post-tensioned system, because PT does not become cost effective until bays reach spans of twenty or more feet. The post-tensioned cast-in-place floor slab can support the larger bay sizes without increasing the overall depth of the slab. The effectiveness of post-tensioning is judged based on the advantages it provides for the building against the costs of both the old and new system.

The lateral system was also evaluated for effectiveness, but it was found that using a combined lateral resisting system consisting of moment frames and shear walls was actually the best system all along. When designing columns initially, it was assumed they were leaning columns and would only take moments created by uneven floor loading patterns. The lateral force resisting system, under this assumption, consisted of only shear walls. After some further investigation, it became clear that shear walls in their original configuration in 110 Third Avenue would not be adequate to prevent large story drifts. Options for developing a proper lateral system were moving the shear walls toward the extremities of the building or reverting back to a combined system and redesigning the columns. From the way architects had intended the floor plan to operate and 110 Third Avenue to look, it was clear that putting shear walls near or on the exterior

of the building would greatly disrupt the architecture. The window wall system had to be kept intact to preserve the original look of the building. As a consequence, the best lateral system was clearly moment frames combined with shear walls. Redesign of the columns simply increased their reinforcing, and the end result was a building that functioned quite effectively.

Cost analysis of the floor slabs proved, unfortunately, that the old system was about 8% cheaper than the new. However, removal of around 50% of the original columns freed up the living spaces a bit and will also cut down on overall formwork costs. The increased cost of the new floor system will be offset by savings in labor and formwork. In the end, both systems are comparable, but the original CIP flat plate system should be used in the New York City setting because of the low availability of PT contractors in the area.