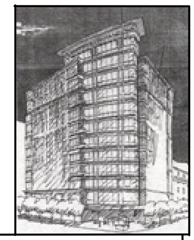

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EXECUTIVE SUMMARY

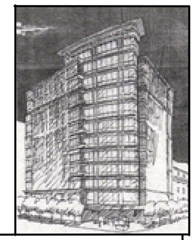
The Executive Tower is an 11 story office building in downtown Washington DC; just two block North East of the White House. In the middle of a high land valued city, the Executive Tower is one of the highest rents per square foot office building in DC. Owned and Managed by the Kaempfer Company, the Executive Tower was constructed in December of 2000 by Tompkins Building and designed by the international group Hellmuth, Obata + Kassabaum (HOK).

Due to regulation set by the Washington DC area, the Executive Tower was designed 8" short of it maximum building height, 130'. The Executive Tower was designed with a two-way concrete flat slab with drop panels to maximize the number of floor within in its limits.

This proposal describes the uses of three methods to lower the building further under its current building to ultimately construct a 12th story.

An in depth study of the building's framing system as a two-way concrete flat slab with drop panels and post tensioning. The new system will decrease the floor thicknesses of up to 4" per floor.

Two breadth studies of alternative mechanical systems and an architectural redesign of the building 1st floor area will be analyzed; both will have the common goal of decrease the total building height to add a 12th floor to the overall building.



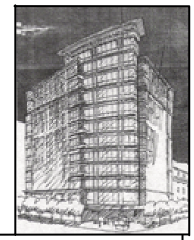
BUILDING INTRODUCTION

The Executive Tower quietly rests in its elegance at the intersection of New York and 14th St in Downtown Washington DC. The Executive Tower is a class A office structure located only two blocks N.W. from the White House. This 12 story building houses such firms as Bloomberg Financial, Merrill Lynch, and AIG satisfying their needs by supplying permanent office and open plan floors. The Executive Tower was completed in December of 2000. Since then, it has remained one of the highest rental rates per square foot of office space in all of Washington. The Executive Tower's prestige is most noted from atop its roof that overlooking the Capitol dome, Washington Monument and the White House (Figure 1).

Figure 1

The Executive Tower was designed by the international group Hellmuth, Obata + Kassabaum, Inc. (HOK). The Executive Tower (Figure 2) supplies 11 spacious 11,500 square foot rentable floors, totaling 132,000 square feet with finished 9' ceilings. The four elevators supply access to all 11 stories and below grade to the three parking decks. The 11th floors ceiling elevation is 186' – 11". The north side 1st floor grade elevation is 57' – 7". These to elevations are used in the calculation of the building total height that is used to compare to the building maximum height of 130'. The executive Tower tops out at 129' – 4" only 8" shy of the maximum height.

Figure 2



BUILDING STRUCTURE

A mat slab foundation is utilized to maximize ground contact and distribution of the buildings loads. There are additional 13'x13'x1' spread footings at column locations to counter punching shear. The mat slab is a 42" thick slab fully reinforced with #10@12" O.C. each way bottom steel and #7@12" O.C. each way top steel.

The floor system of the Executive Tower is a two-way concrete flat slab with 8" drop panels, a typical system used in and around the DC area to allow a maximum number of floors to be constructed in a region with specific height restrictions. The typical thickness for this slab is 8" with #4 at 12" O.C. typical reinforcement plus extra steel bars at critical locations. The slab around the exterior of the building has an additional 3½" thickness acting as wide exterior beams.

The columns of the Executive Tower consist of all cast-in-place concrete, mostly rectangular spread out variably throughout the floor system as seen on the following page in Figure 5. The flat slab concrete allows the column location to be irregular making the presence of a typical bay is virtually non-existent in the Executive Tower. However, the typical column consists of 20"x20" with roughly 10 #11 bars of reinforcement distributed evenly around the perimeter.

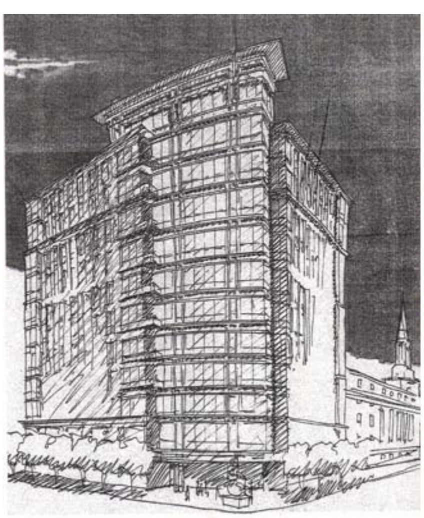


Figure 3

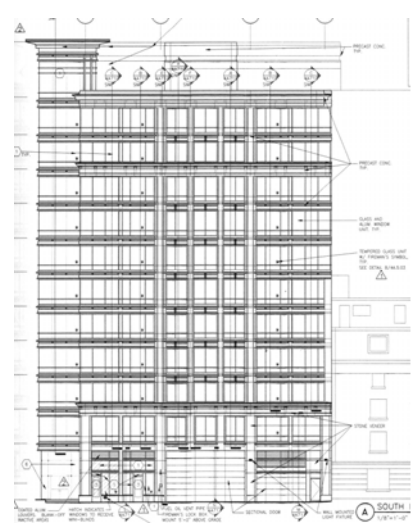
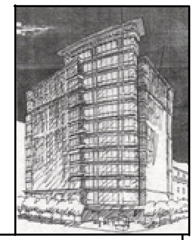


Figure 4 – South Elevation



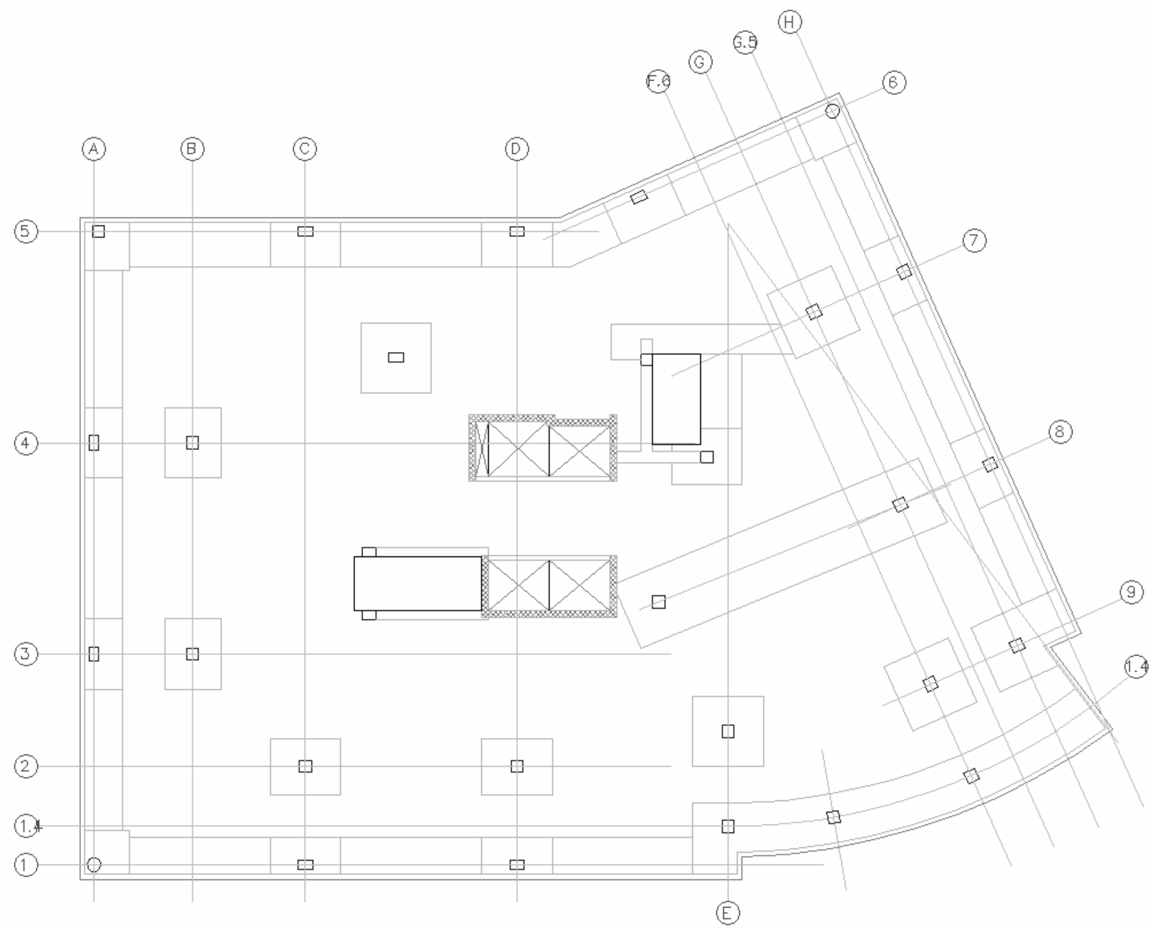
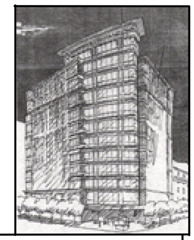


Figure 5 – Typical Structural Floor Plan



PROBLEM STATEMENT

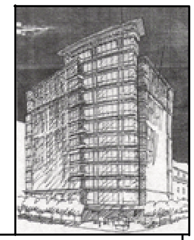
The Executive Tower rests in the downtown area of Washington DC. As with most buildings in this district, the Executive Tower is restricted to a maximum height based on DC regulations. These standards are put in place to insure the District of Columbia skyline does not bleed out the view of the national landmarks such as the Washington Monument and the Capitol dome. As a result of these ordinances, building owners in the DC area have come accustom to requesting buildings with as many rentable floors within the limits as possible. To accommodate this, most buildings in Washington are concrete structure utilizing various floor framing systems. The engineers of the Executive Tower used a concrete flat slab system to accommodate DC's ordinances.

The Executive Tower is surrounded on three sides with H, 14^{th} and New York Ave. Adjacent to its east is the New York Ave Presbyterian Church. Limited to the defined area of 13,278.58 sqft, the Executive Tower built up to 129' – 4" just under its maximum height restriction of 130 ft.

PROBLEM SOLUTION

It is due to the high land value in Washington DC that building owners go to great lengths in order to get the maximum number of floors within their limits. In the case of the Executive Tower, the building tops out at 11 stories, 8" short of the maximum building height.

In Technical Report 2, alternative framing systems that could be used for the Executive Tower were studied. It was found that the two steel systems would be inefficient at meeting floor depth requires and impossible to create 11 floor under the 130' height limit. Two concrete systems, flat plate and flat slab post tensioning, were purposed and found to be adequate to meet height limits. However, the post tensioning system proved to provide the most advantages by decreasing the depth of the floor slab.



Complying to the DC regulations regarding height of the building, a redesign of the building framing system and other methods will be performed to trim floor depths in efforts to construction a 12th floor under the 130' height restriction. Three components will be analyzed and redesigned to achieve this goal: First a conversion of framing systems from flat slab to post tension, second a study of alternate MEP duct systems that will contribute to a thinner floor thickness, and third a redesign of the 1st floor of the north side (Figure 6) to drop the whole building lower under its limits.

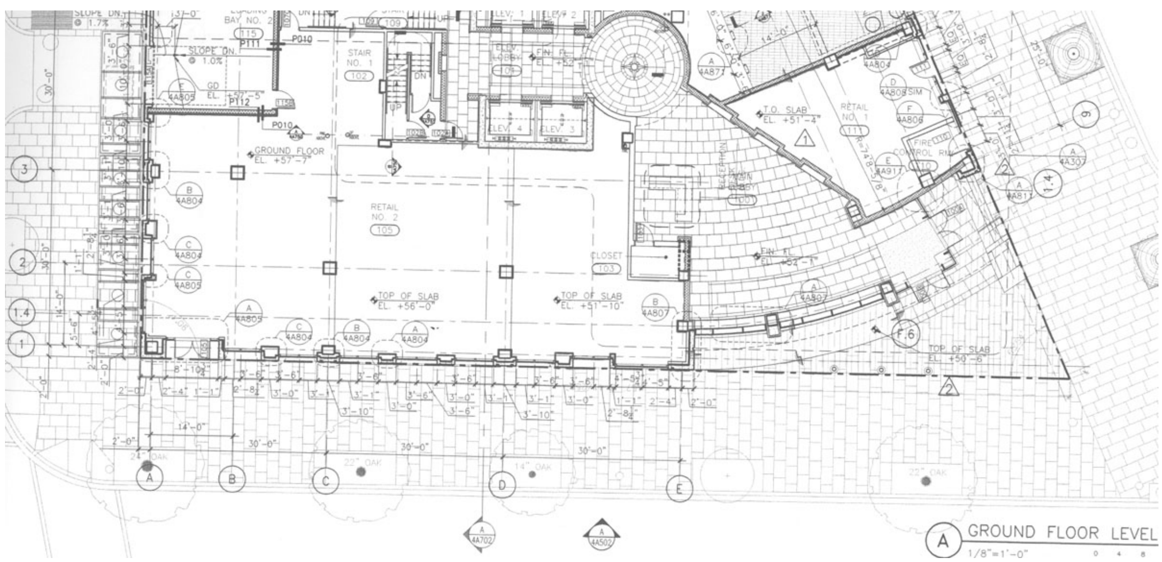
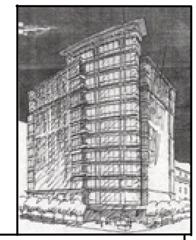


Figure 6 – ground floor plan

PROBLEM METHOD

The findings from Technical Report 2 concluded that post tensioning provided the most advantages such as a lighter structure and reducing the floor depths. The result from a post tensioning analysis found the slab could be trimmed by ½". Upon further review, if a post tensioning system with drop panel were used would result in thinner slab than the previous study. The two-way post tension slab will comply with ACI 318-05 and DC regulations. Through this analysis it is predicted the typical slab thickness can be reduce up to 3" contributing to the goal of 2' – 9" of total slab savings through out total building's height.



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Two additional breadth studies will be performed; both methods will contribute to thinning the floor thicknesses, and lowering the building under the 130' height to add an additional floor.

The first study is of the mechanical system ducts used in the Executive Tower. The typical floor depth is 2' – 6" construct from the 8" floor slab, typical duct height of 12", MEP units, recessed lighting fixtures and sprinkler systems. In studying different MEP systems, it is a goal for the total floor thickness to be reduced by 3" totaling 2' – 9" to be used to construct the 12th story.

A second study will be an architectural redesign of the landscape and structure on the south end of the building. The landscaping grade slopes of the north side to the south side creating a difference of 5' – 6" (Figure 7). The Executive Tower's height restriction is determined by using the top of slab elevation above the 11th story and the ground elevation at the 1st floor on the south end. By redesign the building at this area to be recess, the Executive Tower can subtract up 5' – 6" from its total height to be used in creating a 12th story.

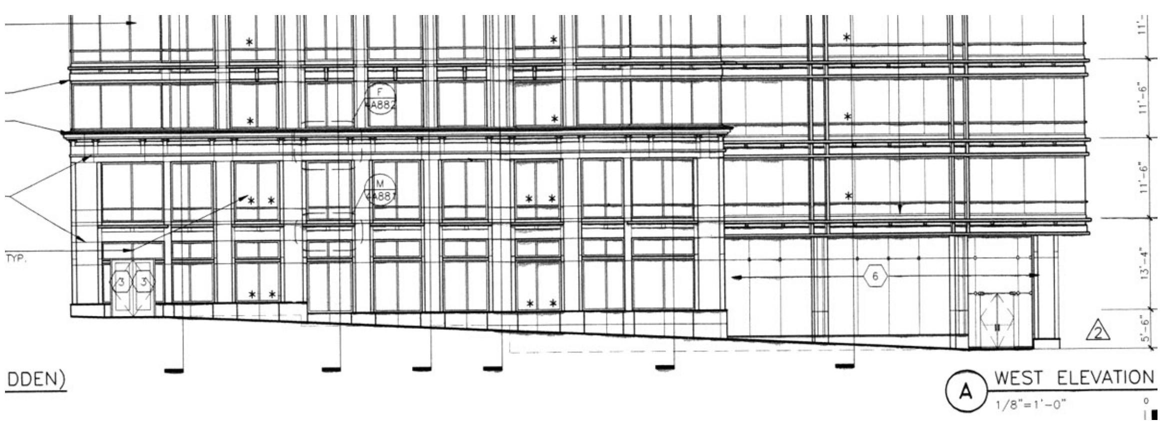
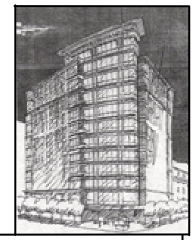


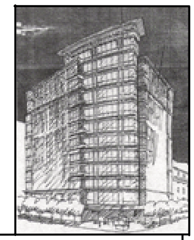
Figure 7



TASKS AND TOOLS

The First step in proceeding with carrying out this proposal is a detailed reexamination of the gravity loads present, excluding structure self weight. The second step is the design of the Post Tensioning system for critical spans factoring in the new gravity loads and self weights. After redesigning the framing system, a study of more efficient Mechanical systems that have the advantage of thinner duct sections will be performed. Once the all the components in the flooring system are analyzed, a detailed evaluation of the new floor thickness can be determined. After calculating the floor thick, a review of DC code literature will determine minimum floor to ceiling heights and landscaping requirements for a redesign of the Executive Tower's north 1st floor area in efforts to lower the building further under is height restriction. Once complete, an evaluation of the Building new total height will determine if adding a new floor to the structure is still feasible. After determining, verification of the building wind and seismic loads is performed that are used to then resize the Executive Tower's concrete columns.

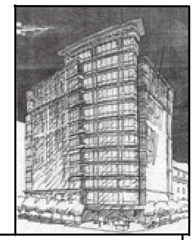
1) Verify Loads
    a) Superimposed Dead Loads
    b) Live Loads
    c) Snow Loads + Drifts
2) Design Post Tensioning Slab for Typical Floor
3) Mechanical Breadth Study
4) Evaluate Floor Thickness
    a) Reduced slab thickness
    b) Reduced MEP equipment thicknesses
5) Architectural Redesign of 1st Floor Landscaping
    a) Review of DC area code literature
    b) Design building to rest ~2' – 6" lower than current elevation
6) Evaluate Total Building Height
    a) Reduced floor thicknesses
    b) Reduced building height from Arch. Redesign
7) Wind and Seismic Verification for New Building Height and Weight
8) Load Analysis and Design of Columns
    a) New loads from column analysis
    b) Load combinations from wind and seismic
    c) Moment frames and Shear walls



SCHEDULE

1	2	3	4	5	6	7
1/09-1/15	1/16-1/22	1/23-1/29	1/30-2/05	2/06-2/12	2/13-2/19	2/20-2/26
Verify loads						
	Mechanical breadth study					
		Architectural redesign of first floor				
				Evaluate floor thickness		
					Wind and seismic verification	

8	9	10	11	12	13
2/27-3/05	3/06-3/12	3/13-3/19	3/20-3/26	3/27-4/02	4/03-4/05
	SPRING BREAK				
PT designing		Design post tensioning slab for typical floor			
			Load analysis and design of columns		
					final prep work



CONCLUSION

The Executive Tower is stands at 129' – 4" from its North West corner measuring at 8" below its maximum building allowed by the Washington DC zoning regulations. It will be the final goal of this continued study of the Executive Tower to thin floor thicknesses and shorten overall building to construct a 12th floor typical in layout of floors 3-9. In order to accomplish this, an in depth study of a two-way post tensioning slab with drop panels as an alternative will be designed to utilize a system with a thinner slab section. Two breadth studies will also be reviewed; first, a study of alternative mechanical systems and primarily mechanical duct with thinner profiles to decrease floor thicknesses. A second study of the architectural of the building and landscape around the North West corner of the building and a redesign of this area to recess the entire building lower under the critical elevations used to determine the buildings maximum height.