

Revised Plaza East Thesis Proposal



Plaza East Chantilly, Virginia

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Executive Summary

This thesis proposal details the research and analysis that will be conducted during the spring semester. First will be a general background of the project and owner.

Building Information Modeling (BIM) is increasing in popularity as years pass, yet it is still not used very often. Research will be done on why BIM modeling can be used to help with the steel erection process. Using BIM software a model of Plaza East's superstructure will be made to show the advantages in value engineering and work sequencing.

An alternative to the precast concrete building envelope will be suggested to save money and energy. With another envelope, further use of the BIM software will also be incorporated in the research of an alternative material for the superstructure (Breadth 1: Steel Superstructure vs Concrete). These two suggestions would be presented to the owner to save money to incorporate the third analysis.

Through the first two analysis money will be saved and suggested to be use to install a green roof (Breadth 2: LEED Green Roof and Energy Savings). This green roof will help with energy efficiency and cost savings in the long run. With the green roof addition further suggestions will be made to increase the LEED ranking of the building.

The owner has final say in all aspects of the building changes. Each idea will be presented to the owner which could be chosen for future projects if proven to be more efficient.

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PLAZA EAST

Chantilly, VA



<http://www.engr.psu.edu/ae/thesis/portfolios/2008/smm475/>

Project Team:

- Owner - Tishman Speyer Properties
- Architect - Hellmuth, Obata + Kassabaum, P.C.
- Mechanical Contractor - GHT Limited
- Structural Contractor -
- Smislova, Kehnemui & Associates, P.C.
- General Contractor: James G. DAVIS Construction Consultants - VIKA, Inc.

Architecture/Design:

- Two office buildings mirroring each other at a 90° angle
- Core and Shell design with the core consisting of 3 elevators, restrooms, mechanical room, and two stairways
- First floor has lobby leading to all aspects of core and 3 exits including loading dock
- Typical floor open for tenant design
- Curtain wall façade consisting of precast concrete, vision and spandrel glass

Basic Project Information:

- 5 stories above grade
- 123,000 sqf per building
- Design-Bid-Build
- Function - General Office Building
- Duration - March 2006 to August 2007
- Cost - \$28 to \$29.5 million



Structural System:

- Spread and/or continuous footings for foundation
- 5" minimum thickness for Slab-on-Grade
- Cast-in-place columns
- Post-tensioned beam and non-post-tensioned one-way slab for each floor
- concrete canopies at second floor only
- Typical I.R.M.A. roof

Mechanical System:

- Mechanical penthouse stores one 17,000 cfm packaged, air cooled thru wall unit, a 16,800 cfm natural gas, outdoor air ventilation unit, and a cooling tower
- This system is combined with 5 fan powered terminals, 8 fans, 3 pumps, 3 water cooled A/C units, and 4 electric heaters

Electrical System:

- Main power delivered at 3 phase 480Y/277 Volts with 150 kW
- Emergency power is supplied through a diesel power unit producing 150 kW, 187.5 kVA at 480Y/277 Volts



Client Information

Tishman Speyer is a very large developer located around the world. Their Headquarters is located at Rockefeller Center in New York, New York. Tishman Speyer builds many office buildings to either rent to tenants and manage or sell them for a profit. Plaza East is a speculative building that which HOK designed in 1999. The building construction was delayed a few years until 2005 and updated to meet the 2003 Business Code. Tishman Speyer wanted to wait for the area around the building to grow economically.

Tishman Speyer is very devoted to their high quality standard. Safety is their number one concern. They also have standard for wanting nothing but the best in their material and in the contractors they work with. They only build Class A buildings and will not downgrade for any reason. It does not matter if the building is put in a Class B or Class C area. With that in mind they made sure to have a Fire Safety Consultant and a Building Code Consultant on the Plaza East project in order to follow the Fairfax, fire, jurisdiction, and building codes. They did not have any sequencing issues. They left that up to the general contractor, DAVIS Construction. As long as their standards are followed their projects such as Plaza East will be built to their satisfaction.

When looking at Plaza East there are a few things that stood out. The architectural precast envelope of the building is quite unique. This precast envelope along with the glazing has set the project back a few months during construction. The precast color was off and had to be retouched and the glazing during the mockup had multiple leaks. If the building envelope were different it could save money and time to be installed. With a different glass and glazing system, the building could be more energy efficient.

This idea leads into the second alternative to the building. Steel instead of concrete could be used to support the structure. It will have a longer lead time but the construction would be quicker if more pieces were prefabricated. These aspects contributed to the analysis and research put forth in this proposal.

Critical Issues Research Method

An important issue facing the construction industry today is the implication of building information modeling (BIM) to projects. It is a growing technology and is not being implemented in the present time as much as it could be. If this software is used more often it can lead to better quality buildings and quicker turnovers.

Problem Statement:

What are the benefits of implementing BIM software into construction projects, particularly with steel lead times? Concrete is often used on a project over steel because of the long lead time steel has. If BIM can be used to lesson steel's lead time it can be used more frequently than concrete, which is worse for the environment.

Research Goal:

BIM is a growing technology and it is getting past its beginning stages of progression. The goal is to speak to a company who has used BIM for its structural steel erection and to explain how it has helped them speed up the process. BIM shall also be incorporated in Plaza East to prove its advantages. Owners and contractors will be the audience and the benefactors of this research.

Research Steps:

Research for this project will begin with reading and reviewing of the subject matter. After becoming completely satisfied with the knowledge base gained, contact will be made with Bob Lipman who has vast data on steel from his research. After the information is obtained, it will be summarized and put into the research. Further use of the model will include steel take offs for comparison and load testing.

Expectations:

During this process a superstructure of Plaza East will be made in Revit to incorporate the advantages in value engineering and work sequencing. If goals are met and if money for the project is saved a summary of the research will be presented.

Analysis 1: Alternative Building Envelope

Issue 1 – Plaza’s East building envelope uses architectural precast concrete which had difficulty matching colors and problems with glazing leaks. If a different building envelope was used, there would be less load put on the superstructure and energy could be saved through different glass and glazing.

Analysis – Research will be done on cost, schedule impacts, energy savings, and quality.

Contacts will be made with both the original building envelope subcontractors on Plaza East and a different subcontractor to compare separate curtain wall systems. Much will be on the lead time change and the structural load differences between the two systems. Transportation cost could differ depending on where each envelope came from. If the architectural precast is no longer used, there will be no more problems with the color matching of the precast. The precast also came from Canada which contributed to long drives to transport the panels. With no precast panels the erection time can be higher and the crane picks could be smaller. Each of these aspects can change the amount of labor needed on the job. A change in the curtain wall glass can also save on heating and cooling of the building adding to energy savings.

Expectations – After detailed research and analysis of at least two alternate building envelope methods one will be recommended to save on cost, labor, and energy efficiency. With this suggestion incorporated, the money saved can go to other aspects of the building.

Analysis 2: Replacing Concrete Structure with Steel

Issue 2 – The project fell behind when changes were made to the lobby and elevator finishes. The cast-in-place concrete involves more laborers and more time to cure than prefabricated steel would.

Analysis – By using steel instead of cast-in-place concrete more of the steel pieces will be able to be fabricated before brought to the site, this will ensure a faster erection time. After changing the building envelope, the building will have a lesser load on the entire structure. With that information, smaller columns and beams can be used to support the entire building. This can affect the size of the crane, which in turn can save money. Research will be put into the cost of steel erection compared to the cast-in-place concrete used. BIM will also be incorporated in the structural design of the steel frame in order to show BIM's value engineering and work sequencing abilities.

Expectations – After constructing a BIM superstructure of Plaza East, the software will be used for take offs and work sequencing to show increases in savings. The money and time saved on the steel erection will be put to other aspects of the building.

Analysis 3: Green Roof Replacement

Issue 3 – There is no real problem with the roof, but with a green roof replacement, Plaza East could benefit in many ways.

Analysis – Green roofs will be researched to be in place of the current built up roof. Adding a green roof to a project can have multiple advantages. It may cost more than the

original roof designed for Plaza East, but the cost savings in the long run will be much better. With a green roof you can have a higher LEED accreditation, reduced energy costs, and extended roof life. A new structural system is already being designed for the building making it easier to add the additional loads a green roof entails.

Expectations – After the analysis of the first two cost and time saving issues, the money and time saved will be put forth to pay for the green roof addition to the building. With the green roof the initial cost will be higher but money will be saved in the future from the green roofs long life capabilities.

Weight Matrix

Below is the table which illustrates how this thesis research process will be distributed over the different analyses given in the previous sections.

Description	Research	Value Engineering	Construction Review	Schedule Reduction	Total
Building Envelope	10	5	5	10	30
Structural	5	5	10		20
Green Roof System	5	10	5		20
BIM	15	5	5	5	30
Total	20	25	25	15	100%