

# **Thesis Proposal**

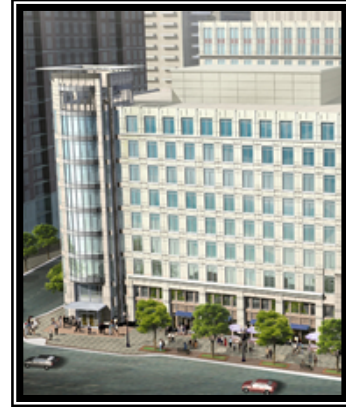
**Nathanael Paist**

**Construction Management**

**Faculty Adviser: Dr. Messner**

**Two Liberty Center**

**Arlington, VA**



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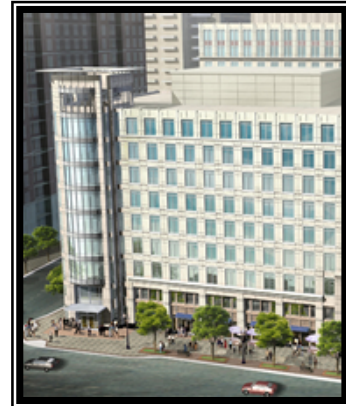
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## Executive Summary

### **Analysis 1 – Development Options and Building Efficiency**

This analysis will be an investigation into the relationship between the types of leasing options that developers use and the consideration towards building efficiency. This analysis will also identify the effects of recent changes in energy costs on the decisions that developers are making on new construction projects, as well as guidelines for making these decisions.

### **Analysis 2 – Centralized HVAC System**

This will be a proposed redesign of the mechanical system of Two Liberty Center to utilize a centralized air-side mechanical system. This type of change could have cost and schedule savings for construction. A structural redesign will be necessary to support the larger roof-top equipment. This proposed change could also necessitate changes to the leasing agreements use for the tenants of Two Liberty Center. A recommendation will be made based on the results of this analysis.

### **Analysis 3 – Façade Construction**

This analysis will examine the façade construction process and sequencing for Two Liberty Center. A reevaluation of the façade construction process could have potential benefits to the construction schedule and/or the occupancy schedule which is most critical to the owner. Reduction of these schedules could also lead to construction savings. A recommendation will be made for the method used to erect the façade of Two Liberty Center.

## **Analysis 1 – Development Options and Building Efficiency**

### **Problem Statement:**

During the PACE Roundtable, there was a discussion during one of the sessions about the effect that energy costs, and the unpredictability of those costs, are having on the decisions that owners are making about building efficiency. Developers in particular are faced with difficult decisions relating to the building efficiency and the effects that those decisions will have on their business models.

### **Research Goals:**

The goal of this research analysis will be to identify the relationships between the leasing models used by a developer and the decisions that they make regarding building efficiency. Construction projects for developers are driven by business models and the optimization of profit. The decisions that are made for a building being built for a developer rely heavily on the intended use for that facility and the types of leasing agreements to be used for the tenants of that building. This analysis will provide insight into the effects that energy costs are having on the decisions that developers are making about their building systems.

### **Research Method:**

The following steps will be taken to achieve the research goals set forth above:

- Interview three leading developers in the Washington, DC market
  - o Identify the three most typical development options being used in the current DC market
  - o Identify the most common business model being used for each of the top three development options
  - o Identify the most common leasing agreement being used for each of the top three development options
- Develop a survey to identify the types of building efficiency decisions made for each development option with accompanying business models and leasing agreements

- Distribute the survey to development professionals in the Washington, DC market
- Compile information from the collected surveys
- Identify the relationships between the development options and the decisions made regarding building efficiency
- Make recommendations about managing building efficiency for developers facing a variety of development options

**Research Product:**

This analysis will serve two main purposes. The first will be an identification of the trends in building efficiency decisions for developers dealing with the current escalation and unpredictability of energy costs. Developers have a unique task in managing the effects that energy costs will have on the business models that they use for new construction projects. The findings of this research analysis will provide guidelines for developers to make building efficiency decisions when facing common development options.

## **Analysis 2 – Centralized HVAC System**

### **Problem Statement:**

The current mechanical system for Two Liberty Center an individual air handling unit for each office floor, as well as several units to serve retail spaces and common areas. This mechanical setup adds significant construction costs for this project as well as complicating the submittal and purchasing process for HVAC equipment.

### **Analysis Goals:**

The goal of this analysis is to centralize the HVAC system of Two Liberty Center by placing one or two larger units on the roof. The new unit or units used for the HVAC system would need to be sized to maintain the current design conditions. These changes would facilitate a reduction in the construction costs and potential reductions to the construction schedule. The changes to the loading on the roof of Two Liberty Center due to the large equipment needed would require some structural redesign of the current structural system. This type of change may also require changes to the leasing agreements of the tenants to manage the utility costs for the building.

### **Analysis Methods:**

The following steps will be taken to centralize the HVAC system of Two Liberty Center, analyze the construction changes, and redesign for the structural impacts.

- Determine the current total system load for the current HVAC system
- Size an air handling unit or two for the total heating and cooling loads required for Two Liberty Center
- Determine the necessary changes in site logistics to facilitate the placement and installation of the larger air handling unit/s.
- Reevaluate the construction budget based on the centralized HVAC system
- Reevaluate the construction schedule based on the centralized HVAC system
- Determine the structural loading from the roof-top units
- Redesign the supporting structural system to handle the new roof loading

- Report the results of all of the above analyses and assess the value of this redesign
- Determine the necessary changes, if any, to the leasing agreements for the tenants of Two Liberty Center

**Breadth Coverage:**

This analysis will provide the opportunity to cover two major breadth areas. Competency in mechanical and structural evaluation and design will be necessary for the successful completion of this analysis.

**Analysis Product:**

This analysis will provide an alternative design for the air-side mechanical system of Two Liberty Center. The report of this analysis will contain details of the mechanical, construction, structural, and business changes necessary to incorporate this system alternative. A recommendation will be made as to whether or not the proposed change would benefit the Two Liberty Center project.

## **Analysis 3 – Façade Construction**

### **Problem Statement:**

As a developer catering to Class-A tenants, the owners of Two Liberty Center are placing a strong emphasis on the occupancy schedule for the office space. The interior work that must be completed prior to the turnover of each office floor is a successor of the building enclosure. The building enclosure section of the construction schedule is elongated due the methods used for façade construction, and this elongation of the schedule extends the potential occupancy dates for each office floor. This problem was identified through inspection of the project schedule, analysis of the needs of the owner, and conversations with management from the Two Liberty Center contractor.

### **Analysis Goals:**

This analysis will develop and compare multiple options for the construction processes and sequences for the building façade. The current methods used are to erect pre-cast concrete panels on each face of the building in succession, then upon the completion of the final face the window installation will begin from the ground floor working upwards per floor. The proposed methods and sequences should provide and opportunity for schedule and cost savings on this project.

### **Alternative Façade Construction Methods:**

1. Utilizing the tower crane, erect each floor of façade in succession. This method would facilitate the trialing of the window installation by floor as each level of façade is complete.
2. Utilizing a crawler crane, erect half of each exterior face of the building followed by the erection of the top halves of each face. This method would facilitate the installation of the windows to commence following the erection of the first half of all four façade faces.

**Analysis Methods:**

The following steps will be taken to reevaluate the façade construction of Two Liberty Center:

- Evaluate the resources available to complete the proposed sequences
- Examine and reassess the pre-cast concrete panel details and erection methods to accommodate new sequencing
- Analyze the effects of the new sequencing on the construction schedule, occupancy schedule, and the accompanying cost impacts
- Develop a 4-Dimensional model for the original method and the two proposed methods to illustrate the sequencing of the construction and assist in the justification of potential changes

**Analysis Products:**

The final product of this analysis will present options for the construction of the façade on Two Liberty Center. These options will be detailed construction processes and sequences for the pre-cast concrete panels and windows that comprise the building façade. Each option will be accompanied by a 4D model, a detail of the impacts on the construction schedule, occupancy schedule, and the associated cost impacts of those schedule changes. A recommendation will be made for the façade construction method which best suits the Two Liberty Center project.



## Weight Matrix for Proposal

<b>Description</b>	<b>Mech. Breadth</b>	<b>Struct. Breadth</b>	<b>Research</b>	<b>VE</b>	<b>CR</b>	<b>SR</b>	<b>Total</b>
Analysis 1: Development options and the effects on systems selection and building efficiency	0	0	40%	0	0	0	<b>40%</b>
Analysis 2: Centralized HVAC System	XX	XX	0	10%	10%	10%	<b>30%</b>
Analysis 3: Re-sequencing of façade construction	0	0	0	0	10%	20%	<b>30%</b>
<b>Total</b>			<b>40%</b>	<b>10%</b>	<b>20%</b>	<b>30%</b>	<b>100%</b>