FINAL PROPOSAL

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BRIDGESIDE BUILDING II

Pittsburgh, PA

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EXECUTIVE SUMMARY

This document proposes topics for my thesis research next semester. The four analyses include LEED components, metal panels and exterior framing, deep foundation system, and applying BIM to shell building designs. Each topic is analyzed in the areas of critical issues research, value engineering, constructability, and schedule reduction.

Analysis 1 – LEED Components

This analysis focuses on adding LEED components that will reduce energy consumption and reduce building life-cycle costs. Two components that are being investigated are a heat recovery loop and a white EPDM roof. Sunshades are already incorporated into the design. Breadth 1 will analyze the new mechanical loads and the current mechanical system to determine the possibility of downsizing the equipment.

Analysis 2 – Metal Panels and Framing

This analysis focuses on the metal panel configurations and the exterior framing. I am proposing to reduce the number of metal panels and implement platform framing rather than balloon framing. This analysis should provide a schedule and cost reduction.

Analysis 3 – Deep Foundations

Since the current deep foundation system experienced issues when driving the piles, this analysis will propose micro piles instead of steel h-piles. The micro piles can be driven at a greater speed and will eliminate the need for some of the pre-drilling. The current deep foundation system created schedule delays and added costs. This analysis should create a schedule reduction and remove the added costs. Breadth 2 will analyze the structural capacity of the micro piles and pile caps so they can be sized accordingly.

Analysis 4 – BIM and Shell Building Design

Designing a shell office and lab building can be difficult because a tenant has not been arranged to guide the design team. Therefore the architect and MEP engineer have to design the building and equipment based on assumptions and experience. This analysis will investigate how BIM could be beneficial during the design stage for a shell building. It will also develop a process for how the BIM model could assist potential tenants in visualizing and planning their future space.

INTRODUCTION

Bridgeside Building II is a 5 story shell building located in Pittsburgh, PA. The intended use for the building is to be occupied by 80% laboratory space and 20% office space. Bridgeside II is being built to answer the local demand for additional laboratory space; however, a tenant has not yet been determined. The goal of the owner is to lease the entire building to a local university. The structure of Bridgeside II is structural steel with composite slabs and the exterior is constructed of balloon framing and metal panels. Storefront windows and cast stone are also utilized on the buildings exterior. Bridgeside II is located in the Technology Center which previously was the site of J&L Steel. Existing foundations and steel debris created a constructability issue when installing the deep foundation system. Currently the project team is working to get the building enclosed so the interior finishes can be installed.

Building Statistics

- Building Size: 162,000 SF
- Project Cost: $18 Million
- Project Duration: 14 months
- Project Completion: January 2009

Figure 1 – Progress Photo

ANALYSIS 1: LEED Components

Problem Statement

The initial design for Bridgeside II included several LEED components that were cut from the design for cost reasons. Earning a LEED certification was not considered for this project. The LEED items considered for this project were a heat recovery loop, a white EPDM roof, and sunshades. Only the sunshades were left in the design. These LEED components have the potential to reduce life-cycle costs for the owner and future tenants. With energy costs rising, this is a selling point for future tenants that have not yet been determined. The heat recovery loop was removed from the design because the initial costs ranged from $400k to $500k; however, the costs savings were not taken into consideration. Laboratory buildings are heavy energy consumers due to the constant conditioning needed in the labs. The heat recovery loop would reduce the amount of heating energy consumed by the lab spaces.

Goal

I believe that implementing a few LEED components into the design of Bridgeside II will help reduce life-cycle costs and make the building more attractive to clients. The heat recovery loop, white EPDM roof, and sunshades all have the potential to reduce the mechanical loads resulting in lower energy consumption. The goal of this analysis will be to analyze the LEED components and determine their cost and cost savings potential. A constructability analysis will need to accompany this analysis to determine the feasibility. This analysis encompasses breadth 1 by investigating the mechanical benefits of the three LEED components.

Steps

- Research the construction requirements for each of the LEED components
- Determine schedule impacts
- Compare buildings with similar systems
- Interview the MEP engineer about energy savings
- Determine the costs of the two new LEED components
- Determine the energy savings potential
- Convert the energy savings into a life-cycle cost savings
- Calculate the pay back period for each LEED component
- Analyze the current mechanical systems for size reductions

Expected Outcomes

Incorporating a heat recovery loop and the white EPDM roof will increase the initial costs but will also provide significant energy savings. This will make the building more valuable and allow the owner to increase the cost per square foot when leasing the space.

ANALYSIS 2: Metal Panels and Framing

Problem Statement

The exterior of Bridgeside II is on the schedule's critical path and required the most coordination. Any delays to the building exterior affected the project completion date. Incidentally the east side of Bridgeside II was shut down for 2 to 3 months while Technology Drive was constructed which caused delays to the completion date. The building exterior was complicated because 4 different types of metal panels were utilized and the exterior framing was balloon framing rather than platform framing. The 4 panel types include soffit panels, insulated metal panels, ribbed profile panels, and composite panels that had a separate manufacturer than the other panels. The balloon framing required the installation of continuous metal studs 30 feet in length. This process was slower and more labor intensive than platform framing because the work was performed from multiple levels and the studs had to be tied together with tracks. For platform framing all the work is performed on one level and the studs are fastened to the slabs.

Goal

The goal of simplifying the building exterior is to create a schedule reduction and limit its risk to the critical path. This will be accomplished by reducing the panels to 1 or 2 types and implementing platform framing rather than balloon framing. It is also important to select panels from one manufacturer so that all the schedule and lead time information is dependant on one source. The goal of implementing platform framing is to expedite the framing installation so the metal panels can begin at an earlier date.

Steps

- Research alternative metal panels
- Interview the architect about metal panel selection
- Select panel configuration
- Obtain cost data from metal panel manufacturer
- Determine cost of new panel configuration and framing
- Determine schedule information for new panel configuration and framing
- Compare the results with a 4D schedule

Expected Outcomes

Reducing the number of panels and implementing platform framing will create a schedule reduction and possibly a cost reduction. The reduced panels will require less coordination and the platform framing will be less complex and time consuming. I also expect that the 4D model will be a beneficial resource for planning the panel installation.

ANALYSIS 3: Deep Foundations

Problem Statement

Bridgeside II sits on 25 to 40 feet of man place fill that is unsuitable to support the building loads with a shallow foundation system. Therefore a deep foundation system had to be utilized to reach bedrock. Steel H-piles were selected; however, due to existing foundations and steel debris they could not be driven. Each pile had to be pre-drilled with a rotary hydraulic drill. The drill was able to break through concrete but was not effective with the steel debris. Some of the shallow debris had to be excavated out of the site. The extensive amount of drilling created schedule delays and increased the foundation costs.

Goal

The geotechnical report specifies that h-piles, micro piles, or drilled caissons can be used for the Bridgeside II site. Micro piles can be driven at a higher speed which means that fewer obstructions will be an issue. I believe that if micro piles are used for the deep foundation system then fewer areas will need to be drilled. In order to keep the drilling from falling behind the driving crew they had to work overtime and Saturday shifts. I believe that using micro piles would create a schedule reduction and a cost reduction since fewer overtime hours will be worked. Also if an alternative drilling method is used such as an auger then the obstructions will be drilled through with greater ease. This analysis will encompass breadth 2 when determining the structural requirements of the micro piles.

Steps

- Interview the geotechnical engineer about the structural requirements
- Calculate the pile cap requirements and sizes
- Interview the pile subcontractor about costs for micro piles
- Determine an alternate drilling method
- Determine the costs for micro piles and new drilling method
- Determine schedule impacts

Expected Outcomes

Since the micro piles can be driven without the need for pre-drilling I expect this analysis to result in a schedule reduction. Also since fewer crews are needed I expect there to be a cost reduction. In the areas that do need drilling the alternative drilling method should be able to provide an additional schedule reduction since the debris will be drilled through quicker.

ANALYSIS 4: BIM and Shell Building Design

Problem Statement

Designing a shell building can be challenging because there are no tenants to guide the design and tell the architect what kind of spaces they are expecting. Also the MEP systems had to be designed off of assumptions and experience. Bridgeside Building II is designed for lab and office spaces. To accomplish this, the architect had to design each floor to accommodate one tenant or multiple. Also the spaces had to be flexible to allow for laboratories or offices. The building core, stair towers, and fume hoods were placed strategically to accommodate various layouts. Some of the MEP features such as wet stacks and receptacles were over-estimated to be safe. Also the Watt per square foot ratio and mechanical loads were assumed at a higher than typical level. Safety factors are built into the design but it is still the responsibility of the owner to understand the building's limitations.

Goal

BIM can be beneficial during any phase of a construction project. The goal of this analysis is to determine how BIM can be implemented on the Bridgeside II project focusing mainly on the design phase. I believe that BIM has the potential to benefit the architect and MEP engineers when designing a shell building. Also BIM can be a tool to assist potential tenants in planning and visualizing their new space before it is complete.

Steps

- Interview the architect and MEP engineer about the difficulties of designing a shell space and how the process can be improved
- Research BIM and its various uses on a construction project
- Develop a BIM model
- Determine how BIM can improve the design stage
- Develop a process for assisting potential tenants

Expected Outcomes

Based on information from classes and presentations I expect that BIM can be implemented into any stage of the project. However, focusing on the design stage I expect it to be beneficial for design reviews, constructability, and engineering analyses. I expect the architect and MEP engineer to find BIM useful when placing structures such as stair cases and sizing equipment. In addition BIM can be applied when developing energy models for predicted tenant arrangements and when assisting potential tenants in designing and planning spaces.

WEIGHT MATRIX

Description	Research	Value Eng.	Constr. Rev.	Sched. Red.	Total
LEED Components	10%	5%	10%	-	25%
Metal Panels	-	10%	5%	10%	25%
Deep Foundations	-	10%	10%	10%	30%
BIM and Shell Design	20%	-	-	-	20%
Total	30%	25%	25%	20%	**100%**

TIME TABLE

Dates	Description
1/12 – 1/31	Research LEED component benefits and constructability
1/26 – 1/30	Determine LEED component costs and energy savings
1/28 – 2/3	Calculate Pay back period
2/2 – 2/5	Interview architect about metal panels and shell building designs
2/2 – 2/16	Determine metal panel configuration
2/10 – 2/16	Calculate cost and schedule reductions for metal panels and balloon framing
2/2 – 2/27	Create 3D model
3/2 – 3/13	Develop 4D models
2/16 – 2/19	Interview geotechnical engineer about micro pile sizing and alternative drilling methods
2/19 – 2/24	Determine costs of new deep foundation system
2/24 – 3/3	Calculate schedule reductions
3/3 – 3/16	Research BIM uses during the design stage
3/11 – 3/18	Develop process for developing designs for potential tenants
4/13 – 4/17	Presentations

CONCLUSION

One of the primary goals of the owner is to lease at least 50% of Bridgeside II as quickly as possible so that he can start his next project in the Pittsburgh Technology Center. With the economy in its current state speculative office buildings are a declining market. Preferably Bridgeside II would be leased to a University to fulfill a need for additional laboratory space; however, this has not occurred yet. The owner is welcoming tenants before construction is complete but once it is completed in a month there will be greater pressure to find a tenant.

The goal of each analysis is to either create a schedule reduction or make the building more attractive to future tenants. The LEED components will help save energy and reduce life-cycle costs. The changes to the metal panels and exterior framing system will create a schedule reduction as well as the alternative deep foundation and drilling systems. Research on BIM modeling is being conducted to assist the architect and MEP engineer in designing a shell building and the model will also be used to help tenants visualize and plan their future space.

APPENDIX A: BREADTH STUDIES

Breadth 1: Mechanical Analysis

In addition to the sunshades currently in the design, analysis 1 is proposing to incorporate the use of a heat recovery loop and a white EPDM roof. These LEED components will push Bridgeside II toward earning a LEED certification. However, the main reason for incorporating them is to reduce energy consumption and reduce the building's life cycle costs. This will hopefully attract potential tenant's interest. The heat recovery loop will reduce the heating loads, which requires an analysis of the current mechanical system to determine if the equipment can be down sized.

Breadth 2: Foundation Analysis

One of the issues when installing the deep foundation system was that existing foundations and steel debris prevented the steel h-piles from driving into the ground. Therefore each pile had to be pre-drilled which created schedule delays and cost increases. Analysis 2 proposes the idea to use micro piles and an alternative drilling method such as an auger. The micro piles were recommended by the geotechnical engineer because they can be driven faster and will require less drilling. An analysis will be required to determine the necessary size of the micro piles and how many are needed. Also the pile caps will have to be analyzed for any necessary changes in size and reinforcing.