FINAL PROPOSAL – Revision 1

January 26, 2009

BRIDGESIDE BUILDING II

Pittsburgh, PA

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Construction Management

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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 – Building Skin and PV Modules
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. Bridgeside II has a large south facing glass wall therefore I am proposing to use photovoltaic glass to offset the high energy costs. Breadth analysis 1 will focus on the effects of the PV glass on the electrical system.

Analysis 2 – 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 3 – 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 and project teams typically change. Therefore the architect and MEP engineer have to design the building and equipment based on assumptions and experience. This analysis will develop a process for how the BIM model could assist potential tenants in visualizing and planning their future space and how the model needs to be developed so that it is beneficial to the owner and the project teams.

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 building's 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: Building Skin and PV Modules

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. Also I will investigate the use of photovoltaic glass panels to offset some of the high energy costs and to utilize the sun on the south facing glass wall. Breadth analysis 1 will consist of analyzing the effects of the PV glass on the building's electrical system and equipment.

Steps

- Research alternative metal panels and PV glass
- Interview the panel contractor about metal panel selection
- Calculate payback period for PV glass
- Analyze the effects of the PV glass on the electrical system
- 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 2: Deep Foundations

Problem Statement

Bridgeside II sits on 25 to 40 feet of man placed 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 drilled 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 pre-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 the costs for micro piles
- Determine schedule impacts

Expected Outcomes

Since the micro piles can be drilled 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 3: 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. A BIM model would be beneficial to the design of a core and shell project but there must be guidelines for the model so that it can be easily transitioned from the core and shell teams to the fit out teams.

Goal

The goal of this analysis is to determine what it will take for a BIM model to be beneficial to a core and shell project. The biggest differences between a core and shell project and a traditional project are that the tenants are typically unknown and the core and shell teams are different than the fit out teams. My research will focus on the requirements for the BIM model so that it can be transitioned from the core and shell teams to the fit out teams and what the owners are looking for in a BIM model.

Steps

- Develop a survey to be completed by construction industry members and owners
- Analyze the survey results and determine the requirements for the BIM model
- Develop a BIM model
- Develop a process for assisting owners and potential tenants

Expected Outcomes

Building owners are quick to request BIM on their project but they don't always know what they want to achieve by having a model. Core and shell projects have a lot of information to manage because the building is not fit out immediately and sometimes different teams are used. I expect that industry members and owners will accept BIM for core and shell projects but probably will not know how to implement it.

WEIGHT MATRIX

Description	Research	Value Eng.	Constr. Rev.	Sched. Red.	Total
PV Modules	5%	5%	20%	10%	40%
Deep Foundations	-	10%	15%	10%	35%
BIM and Shell Design	25%	-	-	-	25%
Total	30%	15%	35%	20%	**100%**

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 PV glass panels will help save energy and reduce life-cycle costs. The changes to the deep foundation system will create a schedule reduction and 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: Photovoltaic Glass Panels

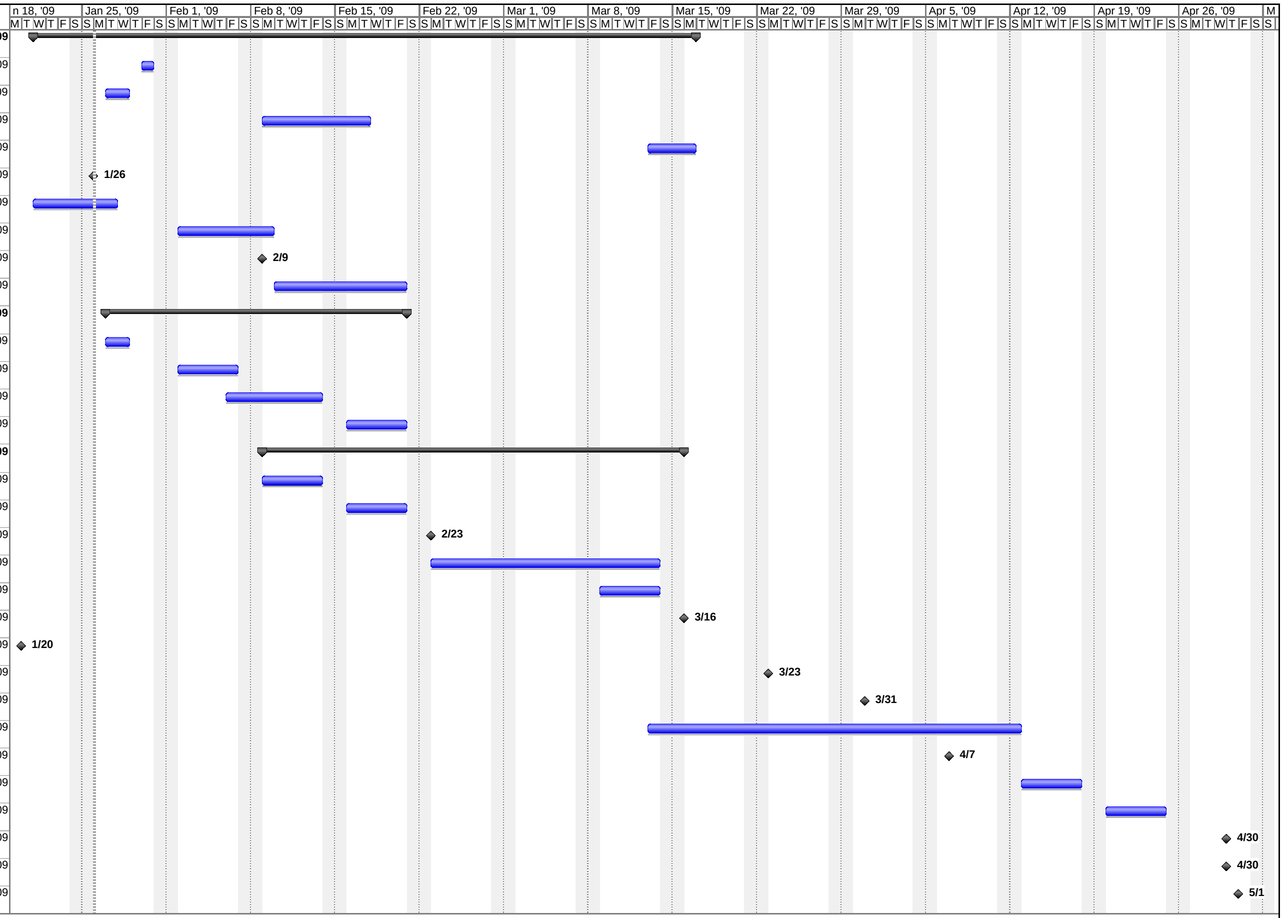
Bridgeside II has a south facing glass wall that overlooks the Monongahela River. Therefore, for breadth 1, I am proposing the use of photovoltaic glass panels. The panels will have unobstructed solar views, however, an analysis will need to be performed to see if Pittsburgh has enough sunny days. Also breadth 1 will analyze the payback period and the necessary changes to the electrical systems and equipment. The PV glass has the potential to reduce energy consumption and lower the life-cycle costs of the building.

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.

APPENDIX B: SEMESTER SCHEDULE

ID	Task Name	Duration	Start	Finish
1	**Analysis 1 - Building Skin (Breadth 1)**	**39 days**	**Wed 1/21/09**	**Mon 3/16/09**
2	Research alt. metal panels	1 day	Fri 1/30/09	Fri 1/30/09
3	Interview metal panel contractor	2 days	Tue 1/27/09	Wed 1/28/09
4	Determine cost/sched effects of new panels and framing	7 days	Mon 2/9/09	Tue 2/17/09
5	Create 4D schedule for comparison	2 days	Fri 3/13/09	Mon 3/16/09
6	Initiate contact with all industry members	0 days	Mon 1/26/09	Mon 1/26/09
7	Research PV glass panels	5 days	Wed 1/21/09	Tue 1/27/09
8	Determine SF of glass and payback period	6 days	Mon 2/2/09	Mon 2/9/09
9	Complete reality check of pv glass panels	0 days	Mon 2/9/09	Mon 2/9/09
10	Analyze adjustments to bldg electrical system/room	9 days	Tue 2/10/09	Fri 2/20/09
11	**Analysis 2 - Deep Foundations (Breadth 2)**	**19 days**	**Tue 1/27/09**	**Fri 2/20/09**
12	Interview geotech eng about micro pile sizing and alt drilling method	2 days	Tue 1/27/09	Wed 1/28/09
13	Consult PSU foundations instructor about structural design	5 days	Mon 2/2/09	Fri 2/6/09
14	Calculate new pile cap size and reinforcement	6 days	Fri 2/6/09	Fri 2/13/09
15	Determine cost and schedule effects of new piles and drilling	5 days	Mon 2/16/09	Fri 2/20/09
16	**Analysis 3 - BIM and Shell Building Design**	**25 days**	**Mon 2/9/09**	**Mon 3/16/09**
17	Develop survey for industry members and owners	5 days	Mon 2/9/09	Fri 2/13/09
18	Analyze survey results and determine BIM model requirements	5 days	Mon 2/16/09	Fri 2/20/09
19	Obtain all survey results and begin BIM model	0 days	Mon 2/23/09	Mon 2/23/09
20	Create BIM model	15 days	Mon 2/23/09	Fri 3/13/09
21	Develop a process for using the model	5 days	Mon 3/9/09	Fri 3/13/09
22	Render BIM model for presentation	0 days	Mon 3/16/09	Mon 3/16/09
23	Post Discussion Board Question	0 days	Tue 1/20/09	Tue 1/20/09
24	Presentation outline due	0 days	Mon 3/23/09	Mon 3/23/09
25	Updated presentation outline due	0 days	Tue 3/31/09	Tue 3/31/09
26	Develop report and presentation	21 days	Fri 3/13/09	Sun 4/12/09
27	Final Report Due	0 days	Tue 4/7/09	Tue 4/7/09
28	Presentations	5 days	Mon 4/13/09	Fri 4/17/09
29	ABET Evaluation and CPEP Update	5 days	Mon 4/20/09	Fri 4/24/09
30	CPEP site finalized	0 days	Thu 4/30/09	Thu 4/30/09
31	Evening Event	0 days	Thu 4/30/09	Thu 4/30/09
32	Awards jury/senior banquet	0 days	Fri 5/1/09	Fri 5/1/09



Project: Erik Carlson - Thesis Schedule
Date: Mon 1/26/09

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline