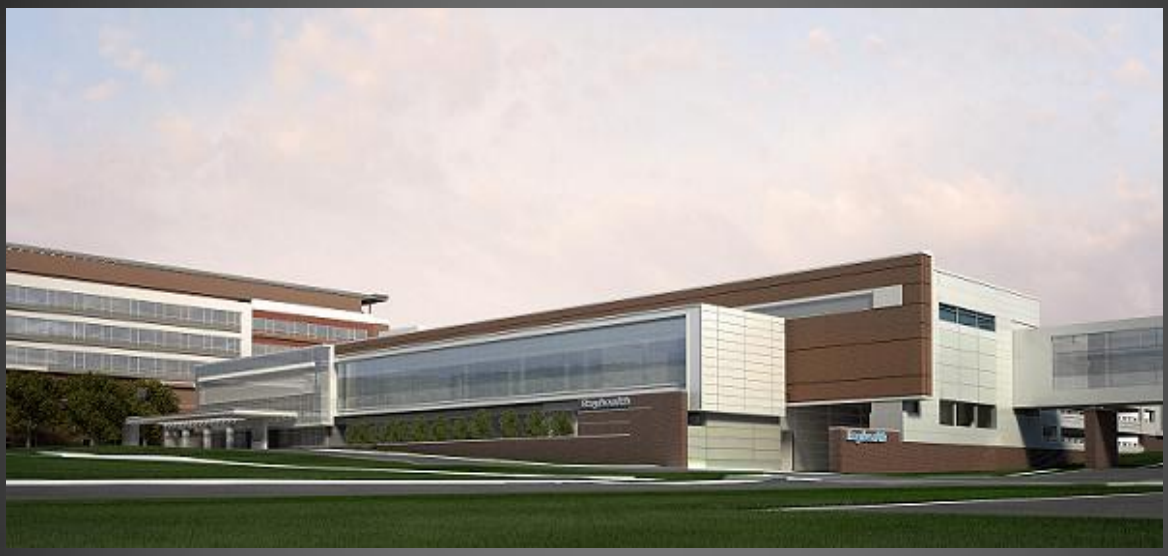
Bayhealth Medical Center



Dover, Delaware

Christopher R Barron

Construction Management

Final Proposal

The Pennsylvania State University

AE Faculty Advisor:Chimay Anumba

Architectural engineering senior thesis

1/14/2011

I. Executive Summary

Senior thesis final proposal is intended to discuss four analyses that will be performed on the bayhealth medical center expansion. Each of the four analyses outlined below were chosen to add quality and value to the building without a large additional cost to the owner. Each analysis will be studied to find their individual impacts to the projects schedule, additional added value to the building, and any constructability issues.

Analysis 1: Overview of issues encountered with curtain wall system

Analysis #1 will be an observation into the issues encountered by the project team getting to get the curtain wall system on the eastern façade watertight. Because of choices made by several key party members the project team came across several issues with getting the current curtain wall system tied into the two other façade systems. This analysis will focus on the events that caused these issues and what could have been done to resolve these issues.

Analysis 2: Sustainability (green roof)

Analysis #2 will be a look into the addition of a green roof system to the Bayhealth medical center. The feasibility of adding a green roof system to the current structural system, and also to the proposed future additions will be discussed. The advantages and disadvantages to the addition of a green roof system will also be discussed.

Analysis 3: Prefabrication of building systems

Analysis #3 will be a study in the implementation of prefabrication on the Bayhealth medical center. This analysis will determine what areas would be the best to implement prefabrication, and its effects on the schedule, overall cost, and quality

Analysis 4: Clash detection / 3D Coordination

Analysis #4 will be a feasibility study of the implementation of clash detection and 3D coordination on the Bayhealth medical center. It will analyze the advantages and disadvantages of using clash detection and 3D coordination, and the possible schedule and cost advantages.

II. Table of Contents

III. Project background

The Bayhealth Medical Center is the largest healthcare system in central and south Delaware. It is comprised of Milford memorial hospital, Middletown medical center, and other satellite facilities. The Bayhealth medical center is an expansion to their current facilities located in Dover Delaware. The expansion consists of a is 215,000 SQ feet pavilion building which will house a 225 bed patient care tower, an emergency department, oncology (both chemo and radiation), heliport, security, pharmacy, Diagnostic imaging, and shell space. The projected cost of construction to the pavilion building is a GMP contract of 65 million. A four level 270 space parking garage is already erected, and is attached to the pavilion building. A central service facility is also being built that houses all new mechanical equipment. Finally, a bridge connecting the central service building and employee parking lots to the pavilion will be erected. Construction was started on December 24, 2007 and is expected to be completed in May 2012. Whiting-Turner was chosen as the General contractor to complete the entire phase 2 expansion. There are currently plans of a future addition of multiple floors to the pavilion building.

Figure 1 courtesy of the Bayhealth medical center

IV. Analysis

A. Analysis 1: Overview of issues encountered with curtain wall

Problem Identification:

The bayhealth medical center expansion's façade is comprised of three different systems: metal panels, masonry brick, and a curtain wall system. The problem that the project team ran into was tying the Eastern curtain wall facades waterproofing into the other two systems efficiently.

Research goals:

The goal for this analysis will be to study the current façade system used and investigate the reason or reasons making it water tight became so problematic. Then, after all these issues have been determined, a timeline will be constructed to portray the events that led up to and eventually caused the problem. These events will be summarized and several workable solutions will be presented

Methodology:

- Analysis of current façade systems
- Contact manufacturers for design consultation of current system
- Interview project team to discover exact problem(s) encountered
- Interview bayhealth medical center owner to determine exact sequence of events
- Interview design team to determine exact sequence of events
- Construct timeline to portray events that caused the problem
- Summarize these events and provided other scenarios that would have avoided problem

Resources that will be used:

- Industry professionals
- Whiting- Turner project team
- AE faculty
- Available literature

- Product manufactures

Expected outcome:

After completing research about the existing curtain wall system, and concluding what changes need to be made, a workable solution will be found and its impacts to cost, quality, and the schedule will be discussed. Also, the solar heat gain of a different curtain wall system will be analyzed and its possible effects on the buildings mechanical system will be determined.

B. Analysis 2: Sustainability (green roof)

Problem Identification:

There were very few sustainable ideas implemented on the bayhealth medical center expansion. Green roof technology is beginning to emerge in the construction industry today as a way to not only make a building more environmentally friendly, but also as a way to provide savings to the owner in the long run. A green roof system is a great way to reduce storm water runoff, reduce the buildings heat island effect, and reduce mechanical loads.

Research goals:

The goals for this analysis will be to study green roof technology, and then determine its cost effectiveness on this project. The buildings steel structure, both current and proposed addition, will also be studied to determine whether it can support the additional weight of a green roof system.

Methodology:

- Analyze current and proposed steel structure
- Research various types of green roof systems
- Redesign current roof structure
- Discuss with owners rep about future additions
- Determine if a green roof system can be removed after installation and installed again
- Decide upon a way to move the green roof system
- Assess the cost and schedule implications of a green roof addition.
- research other possible sustainable ideas to implement (time permitting)

Resources that will be used:

- AE faculty
- Available literature
- Industry professionals
- Structural drawings

Expected outcome:

With the addition of a green roof system, the overall performance of the building is expected to increase. Because of the already oversized steel structure, it is expected that the superstructure will be able to carry the added weight of the green roof system, with minor modifications to the roof structure. But, there will be impacts to the schedule and total cost of the building that will need to be considered. The negative cost and schedule impacts caused by the addition of a green roof will be offset by the extended lifecycle and overall increased thermal efficiency of the building.

C. Analysis 3: Prefabrication of building systems

Problem Identification:

Because of the extensive amount of MEP systems needed in a hospital, a lot of time and money is spent installing these systems. Since these systems are so important to the overall building, their installation is usually on the schedules critical path. Because cost and quality are paramount to the bayhealth medical center expansion owner, the installation of these systems must be watched over diligently. The installation of these systems is not only time consuming and expensive, but can also be very problematic.

Research goals:

The goals for this analysis will be to determine a potential area of the building to implement prefabrication, and to evaluate the possible time and cost savings to the project. Also, what systems can take advantage of prefabrication will be determined.

Methodology:

- Research prefabrication technologies in the industry
- Identify similar projects that have implemented prefabrication
- Contact industry specialists
- Determine the most effective areas for prefabrication
- Determine what systems can be prefabricated
- Calculate the time and cost saved by prefabrication
- Create a 3D mock-up of a prefabricated systems

Resources that will be used:

- AE faculty
- Available literature
- Industry professionals
- Drawings and specifications
- Revit
- Navisworks

Expected outcome:

After completing the research about prefabrication, it is expected that an ideal area to use prefabrication will be discovered. Also, the prefabricated systems are expected to be a higher quality than the originally proposed installation, and be finished in a shorter period of time. A 3D mock-up will be created, visually showing areas that prefabrication could potentially be utilized.

D. Analysis 4: Clash detection / 3D Coordination

Problem Identification:

BIM seems to be one of the most talked about topics in the construction industry today. It is completely revolutionizing how construction projects are being done today. Using even the basic concepts of BIM, like clash detection and 3D coordination, can greatly reduce the time and money it takes to ensure that building systems can be properly installed, and reduce the number of change orders and field problems that occur due to improper coordination.

Research goals:

The goal of this analysis will be to show how the use of clash detection and 3D coordination can help streamline and simplify the coordination process. By identifying areas of MEP construction that could be problematic, A reasonable analysis of the cost and benefits of implementing clash detection and 3D coordination will be determined

Methodology:

- Review the BIM Project Execution Planning Guide created by Penn State
- Identify similar projects that have implemented clash detection – 3D coordination
- Research the cost of creating 3 D drawings
- Evaluate the cost and schedule impacts of clash detection/3D coordination.
- Summarize the advantages and disadvantages of implementing clash detection/3D coordination on a project

Resources that will be used:

- Autodesk Revit & Autodesk Navisworks
- AE faculty
- Available literature
- Industry professionals
- Penn State's BIM Execution Plan

Expected outcome:

The expected outcome will be that BIM can be effectively used on a project of this type, and a cost savings to the owner can be shown. It is also expected that with the use of BIM it can be shown that a project can be streamlined, and a higher quality end product can be achieved.

V. Analysis Weight matrix

The weight matrix shown in figure 2 shows the percentage breakdown of the four core thesis investigation areas. The percentages are an estimate of the work that will be put into each core area.

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Analysis 1	10%	10%		10%	30%
Analysis 2		10%	20%		30%
Analysis 3	10%			10%	20%
Analysis 4	10%			10%	20%
Total	**30%**	**20%**	**20%**	**30%**	**100%**

Figure 2: Weight matrix distribution of core areas of investigation

VI. Time Table

In an effort to follow the progression of the proposed analysis in this report, a time table has been created to track overall progress during the spring semester. A preliminary spring semester time table can be found in appendix B.

VII. Conclusion

This report summarizes the key areas of investigation for the duration of this senior thesis. Each of the four analysis's described above will be thoroughly researched and investigated to improve the bayhealth medical center's quality, while potentially lowering its overall cost. The recreation of the events that caused issues with the façade will provide a several scenarios that could have avoided the issues that the project team encountered. The addition of a green roof system will not only add a sustainability aspect to the building, but will also save the owner money in the long run. The prefabrication of the MEP systems will be a way to save time on the project schedule. The implementation of clash detection and 3D coordination on the project will be a way to streamline the project's design process, and provided the owner with potential cost savings and higher quality.

VIII. Appendix A: Breadth studies

Breadth topics

Structural breadth: contributes to technical analysis #2

The current roof is comprised of a 4.5" thick normal weight concrete slab on an 18 gauge composite metal decking. Roof build up is a tapered 3" rigid insulation covered with a single ply EPDM membrane. As proposed in technical analyze #2, a green roof system will be added to the building's roof.

This analysis will satisfy one breadth requirement, since a structural analysis will be completed for the existing building, and also for the proposed expansion of additional floors. After the structural analysis, any additional support needed will be designed and its added cost and schedule impact will be analyzed. The schedule and cost impact of adding the green roof system to the existing building will also be researched.

Mechanical Breadth: contributes to technical analysis #2

The current roof is comprised of a 4.5" thick normal weight concrete slab on an 18 gauge composite metal decking. Roof build up is a tapered 3" rigid insulation covered with a single ply EPDM membrane. As proposed in technical analyze #2, a green roof system will be added to the building's roof.

This analysis will satisfy one breadth requirement, since a mechanical analysis will be conducted on the existing roof system, and will then be compared to that of a roof comprised of a green roof system. After the impact to heating and cooling loads by the addition of a green roof has been determined, any potential resizing of the mechanical system will be determined.

IX. Appendix B: Preliminary spring semester timetable

senior thesis final proposal
2/25/2011

Bayhealth Medical Center

Christopher Barron
Construction Management
Dr. Anumba

Proposed Thesis Semester Schedule

Current Date

Milestone 1 1/29/11
Go-No Go Check
Milestone 2 2/17/2011
Milestone 3 3/5/2011
Presentation Check
Milestone 4 3/24/2011

1/9/2011 | 1/16/2011 | 1/23/2011 | 1/30/2011 | 2/6/2011 | 2/13/2011 | 2/20/2011 | 2/27/2011 | 3/6/2011 | 3/13/2011 | 3/14/2011 | 3/20/2011 | 3/27/2011 | 4/3/2011 | 4/10/2011 | 4/17/2011 | 4/24/2011

- Analysis of current façade systems
- Contact manufacturers for design consultation
- Interview project team to discover problem encountered
- Interview design team to determine exact sequence of events
- Interview owner to determine sequence of events
- Construct timeline to portray events that caused the problem
- Summarize events/provided other scenarios that would have avoided problem
- Review the BIM Execution Planning Guide by PSU
- Identify similar project that has done clash detection/3D coordination
- Research the cost of creating 3 D drawings
- Evaluate the cost and schedule impacts of clash detection/3D coordination
- Summarize the advantages and disadvantages
- Analyze current steel structure
- Research various types of green roof systems
- Discuss with owners rep about future additions
- Determine feasabilty of moving green roof
- Redesign roof structure
- Find a way to move the green roof
- Find a way to maintain the green roof
- Assess cost/schedule implications of a green roof
- Analyze systems impact to buildings mechanical system
- Analysis of mechanical system
- Research prefabrication technologies in the industry
- find similar projects that have implemented prefabrication
- Contact industry specialists
- Determine the most effective areas for prefabrication
- Calculate time/cost saved
- Create 3D mock-up of prefabricated systems
- Organize and format final report
- Arrange final presenation
- update Proposal

Spring Break

Final Report Due 4/7/11

Faculty Jury Presentations

ABET Analysis / CPEP Update

Senior Banquet, April 29

Milestone Activity list	
1	All parties have been contacted
2	Analysis 1 complete
3	Analysis 2 complete
4	all analysis completed

	Analysis 1: Redesign of building envelope
	Analysis 2: Green roof addition
	Analysis 3: Prefabrication
	Analysis 4: BIM implementation
	Breadth activity