

Baltimore Washington Medical Center

Women's Center and Inpatient Tower *Glen Burnie, MD*



Thesis Proposal





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Executive Summary

The Thesis Proposal addresses the various technical areas that I have proposed to research and analyze in more detail. The following report gives a brief summary of the four topics that I plan to focus on for my thesis project. For each analysis, a brief description is provided about the topic and how it relates to the Women's Center and Inpatient Tower. Along with the issues that I have identified, there is also a stated goal for the analysis, techniques for how I plan to develop this topic, and the results that I expect from the analysis. The Weight Matrix at the end of this report shows the breakdown of how I plan to investigate each of these issues.

The first technical analysis looks at developing a guide about BIM that can be accessible to anyone within the building industry. The research will focus on basic definitions of BIM, the benefits of BIM, and case studies that have incorporated BIM. The guide is intended to assist people with the beginning stages of incorporating BIM into projects.

The second technical analysis focuses on using an alternative structural system for the area above the existing mechanical room. The proposed change for this area of the building is to replace the precast concrete panel flooring with a composite metal decking and concrete slab flooring system. The analysis will look at the structural design, the cost impact of the change, and the schedule impacts.

The third technical analysis looks at using mechanical interstitial spaces to house the air-handling units. The change includes creating spaces for these air-handling units, redesigning the units and ductwork, and looking at the difference with plenum space. For this analysis, the cost impact for the spaces will also be determined.

The fourth technical analysis concentrates on using an alternate façade system for the building. The proposed idea is to look at replacing the EIFS Panels with the original design using GFRC Panels. The analysis will focus on the quality of the two systems along with the cost comparison of the two systems.



Technical Analysis 1 BIM Guide

Problem Statement

Even though BIM is becoming more prevalent in the building industry, there are still many obstacles for implementing BIM. Because BIM is a fairly new term used in the industry, many are still learning the basics about what BIM is. As more of the industry becomes familiar with the term, the next step will be how to begin implementing BIM. By creating a guide that provides a clear description of what BIM is and the benefits of using BIM, many people will have understanding of BIM and will become more interested in the topic.

Goal

The goal of this research is to develop a clear and concise understanding of BIM and what it has to offer. My research will focus on basic definitions of BIM, the benefits of BIM, and case studies that have incorporated BIM. I became very interested in this topic through an independent study focusing on BIM that I completed last semester. This is the new topic that all industry members are now talking about; therefore, I feel that many people will be interested in learning more about this topic. I think this topic is great for my thesis project because BIM can provide a variety of benefits that will provide a smoother construction process. Most of the project team for the Women's Center and Inpatient Tower was at least familiar with the term BIM; however, very few knew about what BIM had to offer. If BIM was incorporated into this project, it could have made a huge impact on the project schedule, constructability, and cost. If the project team was familiar with BIM, it would have made some processes easier such as material quantity takeoffs. I would like to make this guide available to any company or project team that wants to incorporate BIM in their projects.

Research Steps:

1. In order to develop a clear and concise description of BIM, I must first research the topic in depth so that I have a good grasp of the subject. The research will consist of finding the definition of BIM, the benefits of BIM, and the constraints of BIM. I will look at various case studies that deal with BIM to find some of this information.
2. I will then send out a survey that asks a variety of questions dealing with BIM. The survey will be given to project managers, trades' foremen, and project executives.



Technical Analysis 1 BIM Guide

3. The results will then be compiled, and I will focus my research based on the areas where the group appeared to know the least amount about BIM. From the results, I will also look at the various constraints that prevent the industry from implementing BIM.
4. I will continue to research this topic in more depth by asking professionals who know a great deal about BIM.
5. Compile all of the research and survey results, and develop a guide that informs all industry members about BIM.
6. Then, I will test this guide by sending the guide along with a second survey to a variety of industry members.
7. I will revise the guide based on the feedback that I receive from these members.
8. This guide will then be made available to anyone interested in learning more about BIM and how to implement it into projects.

1st Set of Survey Questions:

- Are you aware of what BIM is?
 - If so, please provide a description of BIM.
- What do you feel are some of the benefits for using BIM?
- What are some of the constraints that prevent BIM from being implemented into the construction industry?
- What would you like to learn about BIM?
- Are you interested in implementing BIM into your company?
- Have you ever worked with BIM or have you ever used BIM on a project?
 - If so, what did you use BIM for (ex. MEP coordination, visualization, etc.)?



Technical Analysis 1 BIM Guide

2nd Set of Survey Questions:

- Was the guide helpful in understanding what BIM is?
- Was the guide easy to understand?
- What did you learn the most about in this guide?
- What surprised you/ interested you about BIM?
- Was some of the information provided new to you or was most of it common knowledge?
- Is there anything missing from the guide that you would like to see? If so, please list items that you are interested in.)
- After reading the guide, do you have a better understanding of BIM?
- After reading the guide, are you more interested in implementing BIM?
- If you have any comments or suggestions for this guide, please list them below.

Expected Outcome

The expected results of this research is to provide an easy-to-follow guide that will assist higher-level project managers and project executives in the process of implementing BIM within their company. Because BIM is an evolving technology, there is no set way for implementing BIM. Therefore, this guide is not meant to be a magical solution for BIM implementation, but rather a guide that will aid companies in the beginning stages of the BIM process. The most difficult part of the research will be finding simple ways to begin implementing BIM. Many companies do not know where to begin with this technology; therefore, companies become frustrated with the technology, and BIM gets put on the back burner. By finding easy ways that companies can begin implementing BIM, the process will be much smoother for companies.



Technical Analysis 2

Precast Concrete Planks vs. Cast-in-Place Concrete

Problem

The structure for the Women's Center and Inpatient Tower is primarily a cast-in-place concrete system; however, part of the structural system is composed of structural steel framing with precast hollowcore concrete panels. Because part of the new patient tower is being built over-top of an existing mechanical room, a structural steel truss system was used in this area to support the patient tower. The steel framed truss supports the area above the existing mechanical room for levels three through eight and the penthouse level. For this area, precast hollowcore concrete planks were used for the flooring of the structure. The technical analysis will look at eliminating precast hollowcore concrete planks from this area, and using composite metal deck with cast-in-place concrete for the flooring system. This analysis will focus on the cost impact, schedule impact, and constructability. To determine the cost impact of changing the structural flooring system, the cost of using cast-in-place concrete would be compared to the cost of precast concrete planks. Along with the cost impact, a constructability review will be performed to ensure that the change in flooring will be structurally sound. The review will consist of an analysis of the structural performance of the composite decking and slab. This analysis will then be compared to the precast concrete planks performance. The review will also look at the various challenges that may exist for constructing each of the structural systems. The change from precast concrete planks composite metal decking and slab may also have an impact on the project schedule. The change from precast hollowcore concrete planks to composite metal decking with concrete slab will potentially reduce the project schedule duration for the structural system of the patient tower. Because cast-in-place concrete is used for the rest of the tower, the time required to get the concrete is minimum. By using cast-in-place concrete, the concrete planks will be eliminated; therefore, the time needed to order and deliver the planks can be reduced. With cast-in-place concrete, the slabs in this area can be poured with the rest of the slabs for the tower whereas the precast planks would only be placed later in the process.



Technical Analysis 2

Precast Concrete Planks vs. Cast-in-Place Concrete

Goal

The goal of this technical analysis is to demonstrate that cast-in-place concrete flooring can be used as a viable option for the area above the existing mechanical room. By using the cast-in-place concrete, the precast concrete can be eliminated from the entire project. The costs of the precast panels will be removed from the project budget, and the costs of the metal decking and additional concrete will be added to the budget. The costs of the composite metal decking and slab will be somewhat lower than the cost of precast panels; therefore, the overall project budget will be somewhat reduced. Because the cast-in-place concrete will be placed along with the rest of the levels, the schedule will be simplified, and hopefully reduced. In order to illustrate the schedule for the cast-in-place system, a 4D model will be created. This technical analysis will be used as my structural breadth for my thesis research.

Analysis Steps:

1. Compile all information that corresponds to the steel truss and precast concrete panel structural system. This information will include the original budget and the project schedule.
2. Details pertaining to the construction of the precast panels and a description of the precast panels will also be reviewed. This may include any issues that occurred with placing the precast concrete panels.
3. Discuss the structural design with structural professors and students.
4. Design and analyze the composite metal decking and concrete slab system.
5. Create a schedule and budget for the alternate system.
6. Develop a 4D model to illustrate the schedule sequencing.
7. Compare the costs and durations of the alternate system to the original system.

Expected Outcome

The expected results for this technical analysis is to show the many advantages of using composite metal decking and concrete slab over the precast concrete panels. For this analysis, the composite slab system is expected to be a lower cost alternate to the precast panels. The time duration for procuring and placing the alternate system is also predicted to be less than the original system. These advantages will be demonstrated through the budget and schedule comparison. The 4D model will also display the scheduling advantage of the composite slab verses the precast panels. Through this analysis, hopefully it will be apparent that the alternate system is the best solution for this particular area of the building.



Technical Analysis 3 Mechanical Interstitial Spaces

Problem

For the Women's Center and Inpatient Tower, a mechanical penthouse was designed to house most of the mechanical equipment. In the penthouse, there are three air-handling units that serve the patient tower area. The fourth air-handling unit, which serves the West Lobby area, is located on the roof of the West Lobby. Because the air-handling units are located in the penthouse, the ductwork that runs throughout the building is very large and takes up a lot of ceiling space. With the large ductwork, there is less room to run piping, conduit, or any other MEP equipment. Another issue with the air-handling units being housed in the penthouse is that there is less room to expand or renovate the penthouse area. Because the seventh and eighth floors in the Patient Tower are core and shell floors, there needs to be extra space for the MEP equipment that will service these floors.

Goal

The goal of this analysis is to illustrate the benefits of having mechanical interstitial spaces for the air-handling units. Because interstitial spaces are often used for hospitals and buildings that are designed for future expansion, this seems to be a great analysis for the Women's Center and Inpatient Tower. These mechanical interstitial spaces would require more, smaller units to serve the patient tower. By including interstitial spaces throughout the tower, the size of ductwork required would be much smaller. Also, more space would be provided for the additional equipment that will be installed for the seventh and eighth floors. A cost analysis will be performed to determine the costs for creating these interstitial spaces. The analysis will include costs of air-handling units and ductwork along with costs for constructing these spaces. The size of ductwork needed for these spaces will also be determined, and the difference in plenum space between the large ductwork and small ductwork will also be looked at. The objective for this study is to determine if mechanical interstitial spaces would be beneficial for the patient tower. BIM could also be used for this analysis by using the clash detection tool to show the number of cases where ductwork interferes with other MEP equipment such as plumbing pipes or electrical conduit.



Technical Analysis 3 Mechanical Interstitial Spaces

Analysis Steps:

1. Compile all information for the mechanical air-handling units and ductwork.
2. Develop a quantity take off of the ductwork that serves one air-handling unit.
3. Discuss the mechanical design with mechanical professors and students.
4. Design the areas for these interstitial spaces.
5. Design and analyze the air-handling units and ductwork that will exist in the interstitial spaces.
6. Create a budget for the alternate system.
7. Develop a 4D model and perform a clash detection to show clashes with ductwork and other MEP runs.
8. Compare the costs and benefits of the mechanical interstitial spaces to the penthouse system.

Expected Outcome

The expected result for this technical analysis is that the mechanical interstitial spaces will provide a better alternative for housing the air-handling units. For this analysis, the ductwork needed with the interstitial spaces is expected to be smaller than the ductwork needed with the penthouse; therefore, the plenum space will be larger. This will allow more room for other trades to install their MEP runs. It is also predicted that there may be fewer clashes between the ductwork and various MEP runs with the mechanical interstitial spaces. These interstitial spaces will also provide more room to expand and renovate the mechanical air-handling units. Through this analysis, hopefully it will be apparent that the mechanical interstitial spaces provide the areas to house the air-handling units.



Technical Analysis 4 EIFS Panels vs. GFRC Panels

Problem

The original design of the Women's Center and Inpatient Tower included Glass-Fiber Reinforced Concrete (GFRC) Panels for the majority of the façade. During the value engineering process, these panels were replaced with Exterior Insulation Finishing System (EIFS) Panels. During the construction of the building façade, there have been a few problems with EIFS Panels. The problems with the EIFS have delayed the project schedule, which may have an impact on the project cost. Along with this issue, there is also concern about the quality of the EIFS system. If EIFS is not properly installed, there is the potential that water will seep into the building, and there will be mold issues. Because this building is a hospital, it is crucial that the building is of the highest quality; therefore, any health issues such as mold need to be avoided at all costs.

Goal

The goal of this technical analysis is to prove that the advantages of the original design far outweigh the advantages of the EIFS Panels. Because the highest quality needs to be maintained for hospitals, this analysis will look at the quality of the two façade systems. The analysis will also look at the constructability of the two systems, which will ultimately affect the durations. The advantages of the GFRC Panels will be demonstrated by improving the installation process of the façade system, which will decrease the schedule duration and also by improving the indoor quality of the hospital.

Analysis Steps:

1. Compile all information that corresponds to the EIFS Panels. This information will include the original budget, project schedule, and any issues with the EIFS System.
2. Obtain information about the GFRC Panels and also the EIFS Panels from various manufacturers.
3. Compile and compare the information for the two systems.
4. Analyze the structure and support system for the GFRC Panels.
5. Create a schedule and budget for the alternate façade system.
6. Compare the costs and durations of the GFRC Panels to the EIFS Panels.



Technical Analysis 4 EIFS Panels vs. GFRC Panels

Expected Outcome

Through this analysis, it is expected that the GFRC Panels will be the best solution for the façade system. Even though the GFRC Panels may prove to be a more expensive alternative, it is predicted that the system will still be the best value system for the hospital. The quality of these panels will outweigh the extra costs that may be incurred for the GFRC system. The schedule duration for the GFRC Panels is also predicted to be shorter than the EIFS Panels. Through the comparison of the two systems, hopefully it will be obvious that the GFRC Panels are the best alternative for the façade system.



Weight Matrix

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
BIM	20%			10%	30%
CIP vs. Precast		10%	10%	10%	30%
Interstitial Spaces	10%		10%		20%
EIFS vs. GFRC		10%		10%	20%
Total	30%	20%	20%	30%	100%



Appendix A Thesis Breadths

The Thesis Proposal addresses the two breadths that I have proposed to research and analyze in more detail. A brief description is provided for each breadth that I plan to analyze for my thesis project on the Women's Center and Inpatient Tower.

Structural Breadth

The first breadth is to use an alternative structural system for the area above the existing mechanical room. The proposed change for this area of the building is to replace the precast concrete panel flooring with composite metal decking and concrete slab flooring system. The breadth will focus on redesigning the structural flooring system for this area.

Building Enclosure Breadth

The second breadth is to use an alternate façade system for the building. The proposed idea is to look at replacing the EIFS Panels with the original design using GFRC Panels. The breadth will look at the quality of the system to protect against weathering and also the architectural appearance of the GFRC Panels.