



Technical Assignment #3

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Alternative Methods and Research

Executive Summary

Technical Assignment 3 demonstrates Alternative Methods and Research for the thesis proposal. This Assignment discusses the Critical Industry Issues, Critical Issues Research Method, Problem Identification, Technical Analysis Methods, and a Weighted Matrix. Each topic displays important ideas that could be used to improve the Outpatient Medical Center project.

The Critical Industry Issues is referring to the PACE Roundtable Meeting that was held at the Nittany Lion Inn on Oct. 24, 2007. This section of technical assignment 3 gives an overview of the meeting and the key issues discussed during that time. The Key issues are prefabrication, building information modeling, and workforce development. These are issues that are critical to the construction industry at the present time.

Critical Issues Research Method takes one of the ideas from the PACE Roundtable meetings and finds a way of using it to better my thesis project. I felt that building information modeling would greatly help with coordination and communication on the job site at my thesis project. I want to show this through extensive research by showing how building information modeling will benefit everyone involved on the project.

Problem Identification and Technical Analysis Methods looks at areas that could be changed to the Outpatient Medical Center to better improve the schedule, cost, and constructability. Problem Identification is a breakdown of several different ideas while Technical Analysis Methods looks more at 4 specific ideas and goes into a more in depth explanation.



Critical Industry Issues

Introduction

On October 24, 2007 a PACE Roundtable meeting was held at the Nittany Lion Inn. The PACE Roundtable was a valuable experience where AE senior thesis students got a chance to interact with construction industry members. The meeting was broken up into three sessions and was set up with three industry members and one AE professor taking seats at the front of the room. For each session a different team of panel members would take their seats at the front. The three sessions that were discussed during the roundtable were prefabrication, BIM, and workforce development. Questions would be asked to the panelists from the remaining industry members and students. The following is a breakdown of what was discussed during each session.

Prefabrication

- Discussion summary: Why are construction industries not using more prefabricated items?
 - Advantages of using prefabricated items
 - Disadvantages of using prefabricated items
 - The difference of using prefabricated items on residential and commercial projects
 - What are the issues with for example code requirements
 - What are the disadvantages
 - How does prefabrication effect “green Building”

The construction industry is dependent on three important items; TIME, COST, and PERFORMANCE. These items are dependent on each other, in that if anyone one item is changed it will directly affect the other two items. With this important concept, the idea of incorporating more prefabricated items could lead to a reduced cost, better work performance and a shorter more efficient schedule. Prefabrication means a quality product that is sent to site and put directly into place. This leads to certain construction methods greatly benefiting from using prefabricated items. One such construction method is design –build because the design has already been approved and agreed upon.

Although with all advantages of using prefabricated items there are also disadvantages. A disadvantage would be changing the design in the middle construction. Prefabrication takes a longer lead time for production before it is sent to



site, therefore if the design changes it could set the project behind schedule, cost more money to fix and change the already made items. Another disadvantage is the location of where the prefabricated items are being made. Are they being made out of state? Do the items meet all the code requirements? Are the out of state items meeting in state requirements? What actions are being taken to have the items inspected and transported? These are questions that could cause a great disadvantage of using prefabrication. It could lead to more time and money.

Prefabrication in residential construction is a good deal different then commercial construction. Using prefabrication in residential construction allows for “cookie cutter houses” meaning similar house design. When constructing houses in this matter it could be very beneficial to use prefabrication. Interior and exterior walls can be constructed off site and shipped to the location and put together like large building blocks. The down side to prefabrication of residential structures is the lack of custom design. Other such disadvantages are code requirements and the location of the prefabrication plant. If the distance between the two is too great the cost of shipping would be the determining factor whether it is effective to use the prefabrication. When it comes to constructing commercial buildings prefabrication could be a good asset. Using pre-cast concrete for parking structures, or using pre-cast concrete floor slabs could increase productivity on site. Another idea would be to use prefabricated mechanical duct work which could result in more float time and increase quality and cleanliness. Disadvantages would be in the transportation of the items. With most commercial buildings being located in the city, transportation could be a big issue. The difference between residential construction and the commercial construction with the use of prefabrication is location and type of construction materials that are used.

With the world turning to more sustainable “Green Buildings”, prefabrication would be a great method for enhancing building quality and energy efficiency. Items are tested and inspected at prefabrication plant and tested and inspected once on site and put into place.

BIM

- Discussion Summary: What can BIM do for the construction industry?
 - What is BIM and what are the benefits?
 - Who would benefit most from BIM?



- Why would it be a good thing to use in the construction industry and why aren't many construction companies using it?

BIM is building information modeling and its benefits are better analysis of designs and improvements in communication through visualization. Displaying a three dimensional image allows all project team members to see what the finished product should look like and it will show problems areas. An example of such would be with the mechanical, electrical, plumbing trades. If there was a sanitary pipe going through mechanical duct work. The areas in question will be highlighted and brought to attention so that the area can be re-coordinated. Using BIM improves mechanical, electrical, plumbing coordination with a fast and easy click of the computer mouse. Using BIM will work with many other trades in the same manner as with the mechanical electrical, plumbing trades.

Building Information Modeling also improves and accuracy of the data side of quantity takeoffs. The visualization of the building structure creates an easy way to inform owners of possible problems and can show them what can be done to fix the problem.

Building Information Modeling's benefits can be easy and straightforward to measure. If used on the project it will reduce the number of Requests For Information by half, promote a quicker response time with issues, and would save time with the schedule, construction, and number of meetings. It is a good way for superintendent to communicate with subcontractors and construction workers.

Using Building Information Modeling's is a great tool to use on projects for all the reasons given above. It creates a better sense of communication between all of the project team members and the owner. It is good at identifying coordination issues and helps in estimating by using it for quantity takeoffs. Although this technology system is a great way to have a productive project, some construction management companies, subcontractors, and owner know little about such system or they don't have the finical assets to provide team members with the programs and education. Though with the increase in technology in the twenty-one century, I believe more construction industry companies will be looking at Building Information Modeling's as a good future investment.



Workforce Development

- Discussion Summary
 - What is problem with the workforce development in the construction industry?
 - How does this affect the construction industry?

This part of the PACE discussion talked about the construction workers, who they are and how they are being treated and what is being done to correct this. As it is, a large majority of construction workers are of the Latino ethnicity and the construction industry is wondering why there are not more American workers in the construction field. This lack of American workers is because of older generation of construction workers influencing the young generation by informing them that they could do better in life if they went to college and stayed away from the construction industry. This influence is leaving larger openings for construction workers. When this happens, subcontractors need to look into taking on union/nonunion Latino workers who are in need of a job. These workers can become very skilled and good workers who make a good salary.

Since now a large majority of construction workers are Latino, there becomes a problem with communicate, which a language barrier. Construction companies and subcontractors are doing their best to keep good communication between workers and the managers. They are doing this by offering the workers free education in learning English and giving their mangers free education in learning Spanish. The workers are also given benefits so that they have opportunities in life and feel like they have a career not just a job. Workers are being treated with more respect and are working in better and cleaner environments. Companies may want to hire more American workers, but with the lack of Americans wanting a construction job they take on workers that are wanting and willing to do the job and they treat them like they would if they were Americans.



PACE ROUNDTABLE Overview and Personal Thoughts:

I thought that the PACE roundtable was a great way to interact with industry members and to discuss with them critical construction industry issues. I learned a lot for interest ideas that I want to incorporate in my thesis. Two of the areas I feel would be great for my thesis are the Prefabrication and the use of BIM on the project. The Prefabrication and BIM could greatly impact the project according to constructability, cost and schedule impacts. I hope to take some of the knowledge I gained for this experience and use it to enhance my thesis project. I met several people at the PACE roundtable, one of which is Ted Border. Ted is a Project Manager with Whiting Turner. He had some really good comments about the use of Prefabrication and BIM on some of the projects he has worked on. I feel that he is a very knowledgeable man and would be a great resource to use for my thesis project.



Critical Issues Research Method:

The mechanical, electrical, and plumbing systems in the Outpatient Medical Center are vital systems and therefore the design and construction is essential to achieve a quality product and to ensure a sanitary environment. With these systems being so important I feel that the use of the Building Information Modeling would reduce the number of the mechanical, electrical, and plumbing coordination meetings and coordination issues. The meetings at the current time consist of the three trades gathering in a conference room and discussing/arguing over the coordination drawings. Issues continue to arise and the design continues to be reviewed and drawings are being revised.

The construction industry is becoming faster paced and more technological. Although technology is growing, a lot of trade constructors and construction management teams are still using old construction methods when designing, implementing, and constructing buildings. These old methods are becoming less efficient and are producing more issues and unnecessary paperwork. The construction industry is lacking ways to increase the technology on construction projects because of the cost and education that is needed to use and understand the newest technology.

The solution to the mechanical, electrical, and plumbing coordination issues is the use of Building Information Modeling. The use of the Building Information Modeling would benefit the different trades by easily allowing them to coordinate the design, the construction management by reducing the number of issues and amount of paperwork, and the owner by giving the owner a quality product in the end. It also aids the team members to easily understand where the issues are and where they could arise. The visualization of the Building Information Modeling allows any member of the team, owner, or third party to understand clear what is going on in the design of the building. Building Information Modeling is also great for other trades in designing, coordinating, and solving issues. It also helps the contractor to communicate with the workers on site.

Research in this area would be done by contacting the construction management team on the project and ask questions relating to Building Information Modeling and why they chose not to use it on the project. Another step that would be taken would be contacting subcontractors and asking them if they use Building Information Modeling and if they use it a lot on projects or if they don't use it, why? I would also search for



information about Building Information Modeling and see what it costs and what type of education is needed to use or work with this type of technology. This will help with the understanding of why or why not contractors do or do not use such programs.

Research/interview questions?

- Does your company use Building Information Modeling? Why or Why not?
- If your company does use Building Information Modeling do you think it is cost effective and easy to understand?
- How much training was needed to work with this type of programming system?
- What do you think is the most beneficial thing about using Building Information Modeling on construction projects?
- What do you think is a downfall of using Building Information Modeling, if there is any at all?
- With the owners you have worked with, have they known what Building Information Modeling was before the project started? If they did not know did you inform them of the benefits of it? And if you did not tell them about it why?



Problem Identification

Some problems with the Outpatient Medical Center will be broken up with the following three categories; Value Engineering, Constructability Review, and Schedule Reduction/ Acceleration Proposal.

- Value Engineering
 - Use of pre-cast concrete instead of cast in place concrete. Or even the use of more pre-cast items of use all the same system.
 - Use of alternative material for the overhead canopies, this will reduce the amount of concrete and reinforcing being used.
 - Use of an alternative more cost effective E.I.F.S. for the basement instead of the bituminous layer and felt over lay that kept falling off and getting ruined during construction.

- Constructability Review
 - Use of a second crane instead of using only one for all trades.
 - Implement a better way of connecting all the different types of exterior façades. The façade consists of architectural pre-cast concrete panels, glass and metal panels, but also taking into account the many curves of the building.

- Schedule Reduction/ Acceleration Proposal
 - The use of second crane would help to accelerate the schedule.
 - Use prefabricated MEP systems to acceleration installation.
 - Having more aerial lifts for the installation of the curtain wall and the metal and architectural pre-cast concrete panels.



Technical Analysis Methods

- Structural System

This analysis will look into switching out the cast-in-place concrete structure with a structural steel superstructure. The analysis will look at the overall cost difference of using the structural steel compared to using the cast-in-place concrete. It will also look at effects it has on the schedule if the structural steel is chosen instead of the cast-in-place concrete.

- Pre-Cast Floor Slabs

This analysis will look changing the cast-in-place flooring system with pre-cast concrete floor slabs. The analysis will look at the effects this has on the cost and schedule of the project and check to see if this could be a good place of value engineering. The analysis will also compare the constructability of the two different types of flooring system to see which one would be the best one to improve the quality and productivity of the project.

- Acoustical Investigation

This analysis will look at the inside of the main entrance lobby area, which is located at the north end of the building. The lobby area is opened up to the second floor. The analysis will consist of evaluating the space and openness of the area along with the types of materials being used to find a way of reducing the noise level. The Outpatient Medical is a development and disabilities center for young children. The large open space could create enough noise to affect the mental health of the young children who enter the building. The analysis will look for ways of reducing the noise level by finding more suitable materials. Once alternative materials are found a constructability value engineering review will be created to see if it provides a better environment without costing much more money.

Katie Sennett
Adviser: Dr. Messner
Dec. 3, 2007



The Kennedy Krieger Institute
Outpatient Medical Center
Baltimore, Maryland

Weighted Matrix

Description	Research	Value. Eng	Const. Rev.	Sched. Rev.	Total
Analysis 1 - Structural System	5%	10%	10%	10%	35%
Analysis 2 -Pre-Cast Floor Slabs	5%	10%	10%	10%	35%
Analysis 3 - Acoustical Investigation	10%	0%	0%	0%	10%
Analysis 4 - BIM	10%	0%	5%	5 %	20%
Total	30%	20%	25%	25%	100%