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Technical Assignment 3:

Alternative Methods and Research

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Executive Summary

Technical Assignment #3 consists of Critical Industry Issues, Critical Issues Research Method, Problem Identification, and Technical Analysis Methods. The following document is intended to give the audience an initial look at the issues that I will be researching for my Thesis Proposal. From this document the audience will understand the background behind my proposal, as well as the methods I used to research and analyze the issues.

The Critical Industry Issues portion of the document is a direct result of the knowledge I gained at the PACE Roundtable. A brief synopsis is provided of the three breakout sessions I attended, Mechanical and Electrical Building Systems, Education and Workforce Issues for BIM, and Building Respect with…Specialty Contractors. The education I got on industry issues from the roundtable gave me the ideas for my proposal topics.

The Critical Issues Research Method section is the initial proposal of the industry wide issue that I will be proposing a solution to. I will be developing an online LEED® guide for commercial developers. The idea of the guide is that if implemented early in the design phase of development projects, the development team can help to earn LEED® ratings for the buildings in the development. The goals and methods I have for the research and proposal of the guide are listed in the document.

In the Problem Identification section I listed several items that became issues during the construction of the Canton Crossing Tower. Through discussions with the design and construction team, I have also provided preliminary solution ideas. From these problems I have chosen two to do my technical proposals on. In the Technical Analysis Methods the audience can view the ways I will analyze my two topics, cast in place caisson foundation system and making the tower an independent system. Attached at the end of the document is a weight matrix that shows the way my efforts will be broken up during the next semester.

Critical Industry Issues

On October 12th, 2006 I attended the PACE Roundtable at the Penn Stater Conference Center. Below are the important industry issues that came up during each of my three breakout sessions.

Session I – *Mechanical and Electrical Building Systems*

The first session of the morning I attended at the roundtable was the Mechanical and Electrical Building Systems breakout. The most interesting topic to me was when Bob from Barton Malow began the breakout by bringing up the issue of prefabrication of systems at an offsite location. The issue had a lot of good discussion, especially from Mike of Southland. The challenges discussed ranged from field labor issues to the effects architectural and structural have on the topic. I did not realize how important the completion of the architectural and structural designs would be to the prefab of the MEP systems. The discussion also got into issues about connectors and the current industry standards. The issue of prefab is something that I would like to look into applying to my project. I noticed this opportunity because of the Canton Crossing Tower being 17 typical floors. This repetitive design may allow for a benefit of prefabrication of mechanical and electrical systems. Towards the end of the discussion we briefly mentioned mechanical systems flexibility. The discussion was diverted to the topic of under floor air distribution systems. I personally was anxious to discuss system's flexibility. Even though the session did not get into detail on this, I made it a point to get contact information of Mike from Southland so that I can get in touch with him and discuss it at a later date. I am interested to see if mechanical flexibility was an issue with the tenant fit-out of the tower.

Session II – *Education and Workforce issues for BIM*

The second session of the morning dealt with Building Information Modeling and how to educate individuals in the industry about it. The discussion went as I expected with all of the interaction with the students. The ideas being shared from the industry members were rather interesting. I was surprised that none of the members had any idea

themselves how to utilize the use of BIM's in our industry. Actually, most members did not feel that BIM's are worth the hassle they seem to cause. I expected that answer to a certain degree, but these individuals have seen BIM's used in the work force and have even been beaten on a proposal by a BIM based proposal. It was somewhat discouraging the reaction BIM's are getting in the industry. I would like to see how members of the Canton Crossing Tower team would accept the use of a BIM; hopefully they would see it as a positive addition. The steel erection of the building could possibly be shown through a BIM, which would be interesting to see how the team would react to such advancement.

Session III – *Building Respect…with Specialty Contractors*

The final session of the day was a little more specific in its topic, and I found it to be the most intriguing. The industry members gave excellent tips to us as students on how to gain the respect of trade contractors. I personally found this an important issue due to experiences from previous summer internships. I was somewhat taken aback when one of the industry members gave the main reason for losing respect was simply to lie. As specific as our discussion was to be, it all came down to that simple wrongdoing. The industry members there made me understand that the respect factor on a construction site is an attainable thing, with a bit of common courtesy. It was also interesting to watch the industry members from different trades discuss among one another how respect can be gained or lost. Overall, even though this session probably was not the most important to my thesis project I found it the most helpful for a young engineer getting ready to enter the workforce.

Critical Issues Research Method

Problem Statement

Despite the ever-growing participation of development teams to the LEED® classification system, these individuals are not equipped with a user friendly guide for the successful implementation of LEED® points on their building(s). Making this type of guide or tutorial available to both inexperience and experienced development teams would not only gain interest into LEED®, but also set the team up for success in the LEED® system.

Research Goal

The goal of the next few months of research is to provide a developer a guide that, if used from the start of design, can help them to understand the LEED® classification system and to develop buildings and areas that excel under LEED® criterion. I gained an interest in this because of my direct involvement with Hale Properties, who is the developer for Canton Crossing, which is the 60+ acre area in which the Canton Crossing Tower was built. Hale Properties just built the first building of 14+ from the Planned Unit Development (PUD) of Canton Crossing. If the LEED® system could have been introduced to them at the design phase, they could have implemented it into their entire PUD. The guide I am developing will be a user friendly way for developers to be educated about the LEED® system and how to use it on their projects. I would like the guide to be an online guide that is interactive, where many different developers can share their lessons learned throughout the development of LEED® rated projects.

Research Steps

1. Before I can develop a guide to educate individuals on the LEED® system, I must first gain an in-depth knowledge of the subject matter. Therefore, time must first be spent learning the system thoroughly.
2. Interview successful developers and find out what their interests, concerns, and ideas about using LEED® for their developments.
3. Compile the results from the previously mentioned discussions and get a basis of the direction I need to put my research into. For instance, if an overwhelming

concern from the developers is the financial positives and negatives, then I understand this would be the issue my research would need to focus on.

4. Contact individuals who have developed similar online guides, as well as individuals who have had success implementing LEED® into their projects and find out what they feel is crucial to the success of LEED® buildings.
5. Compile the information from the discussions and develop an in depth goals sheet for what I want the guide to teach the audience.
6. Develop the guide, paying attention to the idea of keeping it user friendly. A difficult guide would automatically turn the developers away from the LEED® system without realizing its benefits.
7. Test the guide by asking both LEED® experienced individuals and individuals completely new to LEED® to use the guide and answer survey questions about its effectiveness based on the goals sheet I created during the development stage. (Sample Survey shown later in this document)
8. From here, make any corrections needed as learned through the feedback surveys to finalize the guide.

Sample Survey

- Was the online guide straightforward with respect to computer and navigating issues?
- Did the guide help gain knowledge of the LEED® system?
- Are the items discussed and shown on the guide directed toward their intended audience, the developer?
- Were the topics highlighted the most important ones with respect to developing areas with LEED®?
- Do you feel the guide would be beneficial to a developer no matter what their LEED® experience?
- Do you have any suggestions to help make the guide better based on technology issues, i.e. site navigation issues, etc.?
- Do you have any suggestions about the LEED® content provided on the guide?

Problem Identification

Listed below are some of the issues that arose during the construction of the Canton Crossing Tower. Through discussion with the construction team, these items have been noted as the most significant problematic features of the building systems. From this list, proposal topics will be chosen.

- **Foundation System**
  - **Cast-in-place concrete caissons vs. Precast Concrete Piles**
    - The building's foundation was constructed using precast piles but the use of caissons could have potentially been a better option. The main issue during the foundation work was getting the piles driven to the engineered depth. At times, steel piles had to be used to get the correct depth. The Central Plant that was built across the street from the tower used caissons as its foundation system and it went quicker and less problematic than the piles.
    - A more in-depth analysis would take a look at the actual schedule changes, cost comparison, performance comparison, and the availability of materials, etc.
- **Structural**
  - **Precast Panels vs. Masonry**
    - The use of precast panels brought about issues with lead times, night work for crane erection, storage of panels, etc. The implementation of a masonry curtain wall and its advantages could be researched.
  - **Cast-in-place concrete framing vs. structural steel**
    - The steel was initially designed to maximize the spans in the tower. With the extremely high cost of steel at the time the cost advantage could be rather great with concrete. Also, with lead time the concrete could have impacted the start of the schedule.
- **Mechanical Systems**
  - **Tenant fit out areas looped into main system**

        - The design of the loop system on each floor was torn out and replaced with each tenant's own system. If the tenant areas were not done in the core and shell phase of construction it could have saved the time and money of removal and reconstruction.
    - **MEP Equipment located on top floor**
        - The top three floors of the tower are equipment floors. This caused each tenant contractor to run over 300 feet of feed each way to reach to equipment. Possibly, if this was located in the center of the tower it would have eased some of the problems.
- **Central Plant Design**
    - **Could the Tower be constructed and function without the Central Plant?**
        - The boilers, chillers, generators, emergency generators, etc are all installed in the Central Plant located across the street. Research could be done about the schedule, design, and cost impacts for all of this equipment being located inside the tower. Also, many of the financing issues that arose on the project were caused by the construction of the Central Plant.

Technical Analysis Methods

From the initial Problem Identification section that was shown previously in this document, two of the problems have been chosen for further research in the proposal portion of my thesis. Shown below are the technical analysis methods that will be used to research the two topics, which are the tower as an independent system as well as a caisson vs. piles foundation system.

Value Engineering Analysis

Canton Crossing Tower as an independent system

The Canton Crossing Central Plant currently houses the mechanical and electrical equipment for the tower. The Central Plant is an $8.7 million dollar one story concrete building that is located across South Clinton Street from the tower. A value engineering idea is to look into doing away with the Central Plant and making the tower an independent, stand alone system. The cost of the building itself, along with financing issues that arose with the tower due to the Central Plant made the thought of value engineering arise. Not only will the cost impact of the proposal be looked at, but also the tower's capacity for the change. For example, where the equipment will be housed and whether or not the structural integrity of the tower will be in jeopardy by the addition of all the equipment are items that will need to be checked before the cost impact of implementation can be checked.

Constructability Review

Cast in place caissons vs. Precast piles

The precast piles in the foundation of the tower had issues with constructability that could have been avoided by choosing another type of system. Many of the concrete piles could not be driven to the engineered depth, causing them to be replaced by steel piles. Also, there were difficulties with the transportation of the piles by ships. The idea for the use of cast in place caissons came from the Canton Crossing Central Plant across the street from the tower. Gilbane also built the Central Plant and had great success with the construction of the foundation system. The review is going to require an analysis of

the performance of the caissons to be sure they can be equivalent to the piles. Also, since actual values of schedule and budget are already available for the Central Plant, the change in system for the tower will be analyzed with these two factors as well.

Schedule Reduction/Acceleration Proposal

The cast in place caissons discussed above are potentially going to reduce the schedule for the foundation portion of the tower. Avoiding issues similar to inadequate driving depth and inefficient material delivery will allow the foundation system's construction to accelerate. The actual durations that the piles took, because of problems that arose throughout construction, will be compared to calculated values for the caissons. The plant's soil conditions and construction conditions are the same as the tower; therefore the values can be implemented into the proposal with confidence.

Weight Matrix

Shown below in table form is a weight matrix of how I plan to distribute my workload while analyzing the issues I am proposing.

Description	Research	Value Eng.	Const. Rev.	Sched. Rev.	Total
Cast-in place caissons		5%	15%	13%	33%
Independent System		10%	18%	5%	33%
LEED Guide	34%				34%
Total	34%	15%	33%	18%	100%