AMBRIDGE
AREA HIGH SCHOOL

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EXECUTIVE SUMMARY

In Technical Assignment 3, you will find Critical Industry Issues, Critical Issues Research Method, Problem Identification, and Technical Analysis Methods. This report will aid to introduce my research topic and systems analysis. Also included are the research methods I plan to use to address these issues.

The Critical Industry Issues section provides a summary to the PACE (Partnership for Achieving Construction Excellence) Research Seminar held annually at The Pennsylvania State University. There, students are given the chance to interact with industry members in formal discussion sessions posing and answering questions about industry topics. I attended the "Building Systems Challenges - *Start-up, Operations and Maintenance*", "Building Information Modeling – *Model Development and Maintenance",* and "Building Respect – *With Design Professionals"* sessions, where I gained insight to these aspects of the industry from the professionals whom experience it everyday.

In the Critical Issues Research Method, I will look to identify a topic, which I will research throughout the spring semester. My research will look to identify the barriers that public school districts have to building green and along LEED® design criteria. My goal is to examine the issue from the school district side as well as the design professional side to show green design principles that could easily be included in school design if districts realized their reduction in life-cycle costs of operating the building.

The Problem Identification and Technical Analysis Methods sections aim to identify potential problems with the Ambridge Area High School, which can be analyzed using different methods including constructability review, value engineering analysis and schedule reduction. I look to address three issues including precast brick façade, steel erection sequencing, and incorporating a green roof system to the design.

CRITICAL INDUSTRY ISSUES

At the PACE roundtable students get a chance to interact and share ideas with industry professionals from different areas of the construction industry. These individuals have varying levels of experience and differing areas of expertise. This year's roundtable entitled "Building Respect", consisted of three discussion sessions providing the students with an opportunity to meet and interact with various members of industry, and focused on identifying critical industry topics, which will become future research focuses for the students. A teambuilding exercise performed in groups composed of a mix of industry members and students demonstrated the usefulness of teamwork and planning in completing an assigned task.

Session 1-D Building Systems Challenges

Start-up, Operations and Maintenance

Architectural Engineering Graduate Students Leidy Klotz and Russell Manning led the first session jointly. They maintained progress through the associated questions and facilitated discussion between industry members and students. Three main questions were posed and discussed upon in detail.

- What are the most common forms of callbacks and maintenance problems in recently completed buildings?
  - Building zones too hot or too cold, a result of fewer zones in HVAC system or inadequate balancing.
  - Leaks of roof, walls, windows, and other penetrations through building envelope.
  - Problems with operation of equipment due to lack of knowledge of operations staff.
- What best practices can be applied during project start-up?
  - Starting commissioning as early as possible in the project/ during prior to design.
  - Allow specialty contractors to get involved earlier in the process to help reduce constructability issues.
  - Showing the importance of system commissioning to owners
- How can owners best prepare O and M teams on new building projects?
  - Allow end maintenance users to gather system knowledge from construction personnel rather than passing knowledge down through owner chain of command.
  - Insist on maintenance friendly designs but be prepared to spend funds toward scheduled maintenance.

- Provided teams with accurate as built drawings and ensure they are updated if any changes occur.

Session 2-A Building Information Modeling Technology

Model Development & Responsibilities

Architectural Engineering Faculty Member Dr. Michael Horman led the second session. The following questions were posed.

- Who should take the lead in initiating the use of BIM?
  - The designer as they are the initial contact to the owner and facilitate design from start to finish.
  - Will additional designer fees attributed with BIM outweigh the time saved by implementing their use?
- Who should develop the models, and how should responsibility shift throughout the project?
  - The specialty contractors should provide their designs in 3-D and incorporate them into the BIM model.
  - Responsibility should shift from the designer to the project management team and contractors in updating and ensuring the model reflects what is build on the project.
  - A reduction in change orders is possible to the owner if the model utilizes collision detection and reduces field engineering work and additional time and effort expended.
- Who should maintain and oversee the model once it is developed?
  - The Designer.
  - Construction Manager.
  - Owners Operations and Maintenance Representative.
- What new risks or liabilities does BIM present? How should these be addressed in the contracts?
  - Liabilities with using 3-D drawings in general.
  - The use of BIM's will alter the errors and omissions section of the specifications.
  - The usefulness to the owner for tracking maintenance and future construction projects must be carried out correctly.
- What level of detail should the model include?
  - Enough detail to show possible collisions and problems with construction and management of trades.

- Possibly linking maintenance schedules to aid O&M Staff in providing necessary maintenance.

Session 3-B Building Respect

-with Design Professionals

Architectural Engineering Faculty Member Dr. John Messner led the final session. The following questions were posed.

- How can builders best earn the respect of design professionals?
  - Pose a potential solution when submitting an RFI, to guide the designer to a solution.
  - Engage the entire team in conversations including the designer and owner.
  - Establish a positive report and personal relationships early and maintain them throughout the duration of the project.
  - Problems may be solved at the project level and out of the hands of the legal system.
- What are the indicators of respect by design professionals? How does this affect projects?
  - The designer will call to ask the CM/GC for advice on the design.
  - The indication of respect will show in the ease of dealing with members of the design team, as they will be more likely to work collectively toward solutions that benefit all parties.
- What are the most common ways to loose respect of design professionals?
  - Going behind the designer's back or directly to the owner.
  - Holding meeting with those contracted by CM and not including the designer who likely holds a contract only with the owner.

In participating in the PACE Roundtable I earned a new respect for the industry members who in day to day business often act as each other's competition but through this conference join together to exchange ideas and suggestions to better the industry as a whole. I was impressed at the level of knowledge about using BIM as this is a relatively new approach at managing and tracking construction processes. Also, the questions posed by both industry members and students related to the topics of discussion generally added to the content covered in the sessions.

I look to further explore the use of green building techniques and LEED® accreditation in design and construction, particularly in public school projects as they often are built for

lowest first cost rather than low life cycle cost. Since Ambridge Area High School was not designed or built to satisfy LEED® requirements I am very interested in researching what barriers stand in the way of accreditation. I would like to examine from both the owner and architect side contrasting the opinions of both.

CRITICAL ISSUES RESEARCH METHOD

Problem Statement

The new Ambridge Area High School will replace a building over 80 years old and will certainly provide the school district with lower operating costs. LEED® accreditation was not sought after on this and many other public school projects because of their desire to provide low first costs to satisfy tax-paying citizens. Aiming at providing a public school district with a green and efficient building at a minimal additional cost is of major concern.

Research Goal

The goal of the proposed research would be to identify the barriers public school districts have to designing LEED® rated buildings and discover items, which are aligned with the green building ideals and help to lower the life-cycle costs of the building. Items such as green roofs aim to lower cooling loads in a building as well as serving as an educational feature to the educational center it tops. I aim to identify the LEED points available to the project with the current design and suggest additional points and contrast the additional costs versus the savings in operating costs. I will identify the barriers from both sides of the school design table, collecting information from both public school districts as well as architects involved in the design of new school buildings.

Research Methodology

1. Develop a list of interview questions to be asked to public school owners with recent or ongoing school construction projects.
2. Develop a list of interview questions to be asked to design professionals involved in new school design.
3. Identify and interview 10 different owners and architects of school construction projects both determining the owners desires and whether the design professionals incorporated green ideals in the design.
4. Compare the expectations of the school district versus the suggestions and design intent of the architect to use LEED® principles.
5. Construct a list of LEED points desired to owners and suggested by designers, generating a list of combined points desired.

6. Calculate LEED rating from supplied points and comparing additional cost to savings in operation cost.

Data Collection Tool Draft

The following are tables of questions to be asked to public school owners (Table 1) and designers of public school projects (Table 2) during an interview. The list will be revised and expanded if necessary before conducting research.

For School District	
	Name of Person, Position in District, School District
	Name of Project
1	Is lifecycle cost more important than first cost?
2	What complaints were there with the building the new school replaces?
3	How were these items addressed in a new school design?
4	Is a healthy indoor environment a priority?
5	Are operation and maintenance costs important to you?
6	What type of area is your building in? (Urban, Suburban, Rural)
7	How many students will it house?
8	What expected operation and maintenance costs are associated with the building?
9	Is education about green building to students desired?

Table 1 - Draft interview questions to school district

For Design Professionals	
	Name of Person, Position in Firm, Firm
	Name of Project Designed
1	Has your firm suggested LEED accreditation on a school project?
2	Has your firm incorporated green ideas without seeking certification?
3	Which ideals were suggested?
4	What complaints did the district have about the building being replaced?
5	How were these items addressed in the new design?
6	Are school districts interested in life cost saving items if they increase first cost?
7	What barriers do school districts have to green design?
8	
9	

Table 2 - Draft interview questions to designers

PROBLEM IDENTIFICATION

The following is several problematic features of the Ambridge Area High School that could be pursued through a detailed analysis of building systems and construction methods aiming to increase constructability, reduce construction cost, and accelerate or reduce the construction schedule.

- Use precast brick panels to replace the Norman brick with CMU backup on the exterior façade.
    - Mason scaffolding was erected around the entire building footprint, 6 levels at the highest point
    - Crane is already on site for steel erection
    - Examine if placement time of precast is shorter than conventional brick construction methods
    - If precast erection duration is shorter than conventional methods building enclosure may occur at an earlier date allowing finish trades to begin earlier.
- Examine the possibility of reducing or accelerating the schedule by several months focusing primarily on the steel erection sequence and crane positioning. The project schedule allows for turnover in late August 2007 and occupancy by the owner after the holiday break in January 2008. This will allow turnover to occur in May 2007 so occupancy occurs Sept 2007, at the start of the school year to reduce impact on students. The schedule reduction should decrease general conditions costs but may force increased costs in structural steel work.
- Use a green roof in place of the designed EPDM membrane and study the effects this has on reducing the HVAC loads and operating costs. This addition may also force additional structural sizes as it places an increased load on the roof.

TECHNICAL ANALYSIS METHODS

Problem 1

Use precast brick panels to replace the Norman brick with CMU backup on the exterior façade.

My research will target the potential reduction in cost and schedule as well as an increase in quality of the different wall systems. I plan to make contacts with precast suppliers to discover if the lead-time associated with precast will meet the schedule for erection. I plan to also examine the benefit using precast has on LEED®.

Problem 2

Examine the possibility of reducing or accelerating the schedule by several months focusing primarily on the steel erection sequence and crane positioning.

A reduction in steel erection and sequencing will help to reduce general conditions costs due to an overall schedule reduction. This reduction may come with increased costs for steel work on the project. The AAHS was originally planed to be complete for occupancy in September 2007, as a 24-month schedule but delays in funding procurement from the state pushed the starting date back by several months. Increasing the schedule for earlier occupancy will reduce the effect on students transitioning from the existing building to the new one.

Problem 3

Use a green roof in place of the designed EPDM membrane.

Utilizing a green roof will allow for a higher LEED® level of accreditation as well as help to reduce the heating and cooling loads required to condition the interior space. This addition will also affect the structural members supporting the roof as green roof systems typically account to significantly higher loads than the traditional roofing system. I will study the increase in structural sizes and the effect on the HVAC equipment, pertaining to benefits versus costs.

WEIGHT MATRIX

Table 3 below illustrates how I plan to distribute my effort among the different analyses proposed.

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Precast Brick Façade	----	5%	10%	10%	25%
Steel Erection Sequencing	----	----	10%	15%	25%
Green Roof System	----	10%	15%	----	25%
Green School Delivery	25%	----	----	----	25%
Total	25%	15%	35%	25%	100%

Table 3 - Weight Matrix