Chris Glinski
Construction Management
Faculty Advisor: Dr. Messner
Columbia Heights Community Center
1480 Girard St. NW
Washington, DC 20009
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North Elevation

Technical Assignment 3

Table of Contents

Executive Summary

In Technical Assignment 3, you will find Critical Industry Issues, Critical Issues Research Method, Problem Identification, and Technical Analysis Methods. This report is intended to give the reader a preview of my research topic and building systems analyses. The reader will also be given a description of my research methods that I plan to use to address these issues.

The Critical Industry Issues section provides a summary of the sessions that I attended at the PACE (Partnership for Achieving Construction Excellence) Research Seminar. At the PACE seminar, students were given the opportunity to converse with leading industry professionals about these topics, which included Integrated Design Management, Innovation, Healthcare Facilities, and Team Building. I attended sessions that discussed "Healthcare Facility Design and Delivery" and "Integrated Design Management" so that I could explore different research topics and gather information and questions that were generated.

In the Critical Issues Research Method section, a topic was identified that I wish to research in the upcoming semester. Research will include looking into aligning the building owner's goals with corresponding LEED® points for their construction project. The results of this will hopefully aid building owners, design teams, and construction managers in the planning and construction phases of their project. My goal through this research is to produce a tool that generates a list of LEED® points that are based on a set of goal-oriented questions.

The Problem Identification and Technical Analysis Methods address several potential problems on the Columbia Heights Community Center that can be analyzed using different methods such as constructability review, value engineering analysis, and schedule reduction. The three issues that were identified look at using a precast brick façade on the south wall, using open-web steel joists above the gymnasium area in lieu of the large steel I-beams, and an alternative method of constructing the foundation system.

Critical Industry Issues

At the PACE Roundtable, students interacted with industry members to discuss current issues facing the construction industry. Here, I was able to attend the "Healthcare Facility Design and Delivery I" session as well as "Integrated Design Management II". My intent was to obtain ideas for a research topic as well as learn more about several others that could aid me in my research.

Healthcare Facility Design and Delivery was intended to identify barriers to the delivery of these high performance buildings. The main barriers found to be detrimental to the industry were cost/schedule, infection control, and building funding. Generally, the contractor is constructing the building for technologies that are yet to be developed. This has an impact on cost and schedule once the technology is selected, such as if the equipment were unable to fit inside the newly constructed room. Change orders are not uncommon, and affect both cost and schedule. Infection control is crucial to a successful Healthcare project. We found in our discussion that it is important to have a person in charge of this system, because it is very complex and must be maintained. These healthcare projects were also found to be minimally funded by the owner due to their focus on emerging technologies, not the building that houses them. Therefore, achieving a LEED® rating is not practical in their eyes due to the increased initial cost.

Also in this session, I learned that 90% of Healthcare projects are delivered using a GMP contract with a Construction Manager (CM). The CM normally enlists the help of Design/Build Subcontractors because they tend to be more knowledgeable about the individual systems. Recently, the industry has been seeing a balance shift from the specialty subcontractors / consultants to the construction manager, who is becoming more familiar with these projects. Many of the industry members feel that the owners need to be more educated on these delivery methods. In the past, a program manager was used to start the project and oversee the construction manager. In the market today, communication is becoming difficult when these two entities are enlisted. In fact, most construction managers agreed that they are rapidly becoming more of a communication channel than a manager.

Integrated Design Management II covered a wide variety of topics. First, we discussed the implications of the increasing use of Design-Build-Operate-Maintain (DBOM). The intention of DBOM is to construct facilities and then lease them to a client who will eventually buy back the building. This delivery method is frequently applied in the school market, highway sector, and public sector. The main disadvantage of this system is the fear of unknown future events because this method involves long-term relationships.

Second, we discussed the affect of urban condominiums on the building market. The main points of this topic were found to be the ill reaction of surety companies and subcontractor failure. With the huge boom in the condo market, contractors are taking on an extremely large amount of work, which takes away from their bonding capacity. Despite this large demand, the number of subcontractor companies has not increased. Smaller subcontractors are now attempting to perform work above their capabilities, and are thus failing.

Plan-check (or peer-review) was the next point we discussed. This involves a third party's review of an architect/engineer's design before they are issued for bid. The review is intended to catch any mistakes or constructability issues to reduce the number of change orders. I was surprised to learn that the impact on change orders has not *yet* been determined and there is *no* shift of liability from the A/E to the plan reviewer.

Lastly, in this session, we briefly discussed the affects of Prefabrication. We found that speed of delivery (lead-time) was a major barrier to the use of prefabrication. The typical systems that prefabrication has been used on in the past included the building skin, some lighting, and some mechanical (plumbing) systems. Change orders have a huge impact on prefabrication and are very costly.

Since my thesis building is LEED® Rated, I was hoping to attend a discussion that would cover LEED® topics. The only instance that the topic of LEED® arose was in the Healthcare Facility Design and Delivery. Industry members indicated that it was tough to apply a green aspect to a building that is not well defined. Systems are frequently not entirely designed until the new technology / machine is selected for the space. As stated earlier, owners are more concerned with future technology than current construction. Therefore, it is more difficult to convince the owner to spend more money up-front. I do

not think the discussion from this topic can be applied to my thesis building because my building is intended to be LEED® rated, as well as my building type (community center) is not very comparable with healthcare facilities.

Having worked with a general contractor over the summer on my thesis building, I am very interested in this topic of LEED®. Columbia Heights Community Center was designed to be Silver Rated and during this seminar, I met some key contacts that I believe could help me in my research. When I carry out my research, I will be able to contact a senior purchaser, project manager, superintendent, and even several project personnel that were staffed to jobs which were LEED® Rated. Details about my research topic can be found in the following section, *Critical Issues Research Method.*

Critical Issues Research Method

Problem Statement

Despite the initial goal and investment for certain level of LEED® certification, it is very difficult to maintain that level and achieve each point throughout the construction process. Aligning the owner's goals with corresponding LEED® points can result in a better quality building for its intended use and a more structured approach towards obtaining the initial LEED® certification level.

Research Goal

The goal of the proposed research would be to identify LEED® points that are associated with the owner's initial goals for the project. For example, the goal of maximizing day lighting in a school for better reading conditions can best be aligned with the LEED® credit *EQ 8.1 Daylight & Views*. The results of this research can provide a resource with which building owners, architects, and construction managers can develop a list of LEED® points that can optimize the performance of their building and that are achievable. Ideally, from the research findings, I would like to produce a tool that generates a list of LEED® points that are based on a set of goal-oriented questions. Also, this research could yield results that can be used to identify a typical set of LEED® points for each building type (educational, office, residential, etc.).

Research Methodology

1. Develop a list of interview questions (see *Table 1 – Draft Interview* Questions for an example).
2. Identify and interview 10 different owners on 10 different LEED® Rated projects to determine the owner's goals for the construction, function, operation, and maintenance of their building. The U.S. Green Building Council website will be the main resource I intend to use in order to identify LEED® Rated projects and their points achieved.
3. Compare the owner's goals with the LEED® points that were achieved on that project.
4. Compile the results and generate a set of goal-oriented questions. These questions, when answered, will align the goals of the owner with a set of LEED® points.

Data Collection Tool Draft

The following table is a preliminary list of questions that I intend to ask during the interview. This list will be revised / expanded prior to the start of my research.

	Name of Person, Company, Project
	LEED® Rating (Certified, Silver, Gold, Platinum)
	Name of Project
1	What is the intended use of your building?
2	Do you plan to occupy or lease the building?
3	Who will be using the building?
4	What type of tasks are the users performing?
5	What type of area is your building in (urban, suburban, rural)?
6	Is operation and maintenance cost important to you?
7	Is minimizing environmental impact a priority?
8	Is a healthy indoor environment a priority?
9	Do you intend to have green space on your property?
10	When will this building be used (day, night, or both)?

TABLE 1 – DRAFT INTERVIEW QUESTIONS

Problem Identification

The following section lists several potential problems that can be analyzed and addressed in order to improve the constructability, reduce costs, or reduce the schedule for the Columbia Heights Community Center.

- Use Precast Architectural Brick Façade in lieu of Norman Bricks on South Wall
    - Most of the south wall of Columbia Heights Community Center is extremely close to the adjacent apartment complex
    - Approximately ¼ of the wall lies directly alongside the apartment complex
    - Delivery of material (bricks and CMU's) to this location is limited and the staging of the material must be inside the community center
    - Much time will be used to pass bricks from the inside to the outside mason
    - While the crane is still onsite, the precast panels can be easily lifted into place, saving time and material staging area

- Use Open-Web Steel Joists above gymnasium in lieu of the large steel I-beams
    - Structural members in this area are extremely large and heavy
    - Removing the existing, large steel beams (i.e. W40x215x60') could reduce steel costs
    - Crane size could be reduced if open-web joists are significantly lighter

- Analyze the option of pouring the foundations into excavated pits instead of excavating to the bottom elevation, using forms, and then backfilling around them (see "Project Summary Schedule – Foundations" in the *Existing Conditions Report* for a brief explanation of the installation of the foundation)
    - More time will be used to excavate every footing and grade beam, but there will be a savings in labor from eliminating the forming
    - This analysis will tell whether forming or excavating the individual footings is a longer task

Technical Analysis Methods

The following section outlines the problems that were identified in the previous section and describes how my research will be conducted on the building systems as well as what types of design and construction analyses will be required.

Problem 1

Use Precast Architectural Brick Façade in lieu of Norman Bricks on South Wall

My research will target the impacts to cost, schedule, and quality of the proposed wall system. Contacts with a precast manufacturer will be established in order to conduct a more thorough investigation. I will also focus on impacts to the structural system loads and details of connection. The types of analyses that will be used include a structural analysis and constructability review to address the method of erection and cost / schedule impacts.

Problem 2

Use Open-Web Steel Joists above gymnasium in lieu of the large steel I-beams

A structural analysis will have to be performed to determine if the open-web steel joists can span the gymnasium as well as support loads from the office floor above. I will also inspect connection details to determine if labor time and costs will be impacted. Finally, I will research whether steel costs and crane size are reduced due to the lighter steel members. If savings can be obtained from a reduction in crane size, this will lower the general conditions cost.

Problem 3

Pouring foundations into excavated pits, removing any forming needed

Research will be conducted to see if pouring the foundation system into excavated pits can reduce labor costs and schedule since this eliminates the need for forming. Originally, the general contractor proposed that the entire footprint be excavated to the bottom elevation of the foundation system and then forming will be used for the pour. After the concrete pour, the footings will be stripped and then the area will be backfilled with stone. My analysis will look at the impact to the use of the excavator, the amount of soils removed, and the savings from removing the formwork.

Weight Matrix

The following table is designed to illustrate how I plan to distribute my effort among the different analyses that were proposed.

Description	Research	Value Eng.	Constr. Rev.	Sched. Red.	Total
Precast Brick Façade		5%	15%	5%	25%
Open-web Joists		10%	10%	5%	25%
Foundation Construction			15%	10%	25%
LEED® Point Alignment	25%				25%
Total	25%	15%	40%	20%	100%

Table 2 – Weight Matrix