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Construction Management Option

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TECHNICAL ASSIGNMENT #3
ALTERNATIVE METHODS AND RESEARCH

Fairfax High School Renovation & Addition
3500 Old Lee Highway
Fairfax, VA 22030

Table of Contents

A. EXECUTIVE SUMMARY

This technical assignment explores the areas of the Fairfax High School renovation and addition that are good candidates for research, alternative methods, value engineering, and schedule compression which will be used in my final proposal. 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 Research Seminar. At the PACE seminar, students were given the opportunity to converse with leading industry professionals about these topics, which included green design, BIM modeling, and gaining respect in the industry so that I could explore different research topics and gather information and questions that were generated.

The problem identification section identifies several areas for future analysis as part of my senior thesis project. These areas include value engineering analysis, constructability review, and schedule reduction / acceleration.

Lastly, I have briefly outlined the methods that will be used to help analyze each technical area. The Fairfax High School project will be studied to address how these topics will affect the value, schedule and constructability of the job.

B. 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 throughout the day.

Going Green

Sustainable design or building "green" is an opportunity to use our resources efficiently while creating healthier buildings. It provides cost savings to all through improved human health and productivity, lower cost building operations, and resource efficiency--and it moves us closer to a sustainable future. Many of the discussions of the panel included all of the benefits of a LEED certified building as well as how important the procurement of materials is.

Green building practices involve siting, energy efficiency, materials efficiency, and water efficiency. These go along with several other keys to construction and obtaining LEED certification. As with anything in life, it starts with an understanding and working knowledge of LEED design and what it means to obtain a certain LEED rating. Recycled and local materials and all of the geo-thermal design for efficiencies are also key factors in green buildings.

With the increase in awareness and desire to build and renovate projects with a certain LEED rating, it has resulted in an increase in the availability of LEED materials and places to find them. At times it can be difficult to obtain materials on time, especially when they can only be shipped from a location in a very small radius to the project site. They also mentioned that on several occasions owners can be "in bed" with certain distributors, and receive breaks on costs of materials.

When planning a LEED project, it is important to develop a clear statement of the project's vision, goals, design criteria, and priorities. Also develop a project budget that covers green building measures. Allocate contingencies for additional research and analysis of specific options and be sure to select a design and construction team that is committed to the project vision. The entire project team must know and understand the goals of the project, especially the sub-contractors.

Green building design has evolved over the years. It was initially used to spread awareness of sustainability, but is now becoming the rating system for design. With the growth in the interest for green design, I think it is important to refine the standards and ratings, and push that all projects that want to use green materials and design for sustainability should utilize the LEED system.

BIM: Model Development and Responsibilities

BIM modeling is what we expected computer-aided design (CAD) to be, but now we know it requires information standards to be productive. Fortunately, we now have both information standards and software companies that support and empower them. It is significantly more than transferring electronic versions of paper documents. It is more than pretty 3D renderings with construction documents as a separate function. It is about information use, reuse, and exchange, of which electronic documents are just a single component.

When integrated 3D-2D model-based technology is linked with information, design firms have a faster, higher-quality, richer design process. Risk is reduced, design intent is maintained, quality control is streamlined, communication is clearer, and higher analytic tools are more accessible. Lower-level tasks such as drafting, view coordination, document generation, and schedule creation are automated. Drawings that represent different views of the same building object are automatically updated when modified. The power of computers can be harnessed in a real value-added design process that doesn't just mimic drafting.

BIM models differ from architectural models because they are information tools, specifically built to visually communicate the construction information associated with the structures they represent. The 3D models give an idea of how the interior and exterior spaces feel in three dimensions. Interactivity and visual "play" deepens the information experience for the reader. These computer models are a separate resource that gives readers the ability to use and explore the potential of small houses on their own. The models can be shaped, shadowed and oriented to any place on earth.

With all the benefits of a BIM process, why are some firms hesitant to change from electronic drafting to a model-based process? It may be the software they use. Certainly the software a firm uses defines and shapes its process options. Other firms may have a painful recollection of transitioning from paper to CAD without information standards and support from the CAD companies. Some software companies have already been incorporating accepted graphic and information standards into their software.

In integrated model-based software, the NCS and IAI IFC represent the graphic and model foundation for BIM to work as a design process. BIM without these standards is proprietary and ultimately not interoperable. The BIM process is both vision and reality for many organizations and firms. In 2002, .dwg was taken out of the NCS, and the USCG modified its software to support NCS/IAI-compliant software. "ArchiCAD is thus far the only CAD product to incorporate support for both the NCS and the IAI IFC in the same program," Jerry Laiserin stated in the April 2002 issue of *Architectural Record*.

More software companies should explore how to make their software support these standards. If they want to provide maximum productivity and align with design's changing business models, they will make the evolving IAI and NCS standards part of their core systems.

There are many possibilities presented by BIM modeling. The Fairfax High School project did not utilize BIM modeling though. With it being such a complicated project and lots of change orders occurring, the BIM model could have helped avoid a lot of issues. BIM modeling definitely has a future, but it will be up to the industry to learn and maximize its potential.

Specialty Contractors: Forming Respect

They are crucial to every project, large or small. Without a strong relationship, it is easy for a project to suffer. It is critical that the roles and responsibilities are laid out on the table from the start, and all parties involved understand the vision of the project as a whole. In the end, everyone wants to complete the project to the best of their ability and make a profit.

General Contractors need to make sure that they are treating all of the sub-contractors fairly, and providing them the opportunity to succeed and do great work. In turn, sub-contractors should not need a change order for every little change or amendment to the drawings, or try to add a high mark-up to their work. This can easily cause delays on a project, as change orders add up fast.

The main key to any project is D.W.Y.S.Y.W.D. Do what you say you will do! This is the easiest way to be honest and gain respect of everyone on the project. When deadlines are set, it is important that they are met. If a sub-contractor thinks they may not be able to make the deadline, it is important to have an open relationship with them that they can come to you and you can work out a feasible solution to the problem rather then letting get out of hand. A firm but fair approach helps set the tone on the job site. It is important to be

as personable as possible also. With ever increasing technology in this day and age, email tends to be over used. Personal contacts form great relationships fast and are always greatly appreciated.

It also helps for the General Contractor to provide the sub-contractors with as much flexibility as possible. With solid sub-contractors on board, they will be able to get on a roll and pound out a lot of work in a short period of time. It is important to always keep a watch on them, but they will respect and honor the flexibility given to them. Although the flexibility is nice, it's important to not give them too much room to operate without supervision. Minor mistakes can cause major delays and large increased costs. Another level that can't be overlooked is the relationships between all of the sub-contractors. With the level of coordination involved in scheduling trades and getting spaces turned over in a timely fashion, how sub-contractors work together plays a huge role in that.

With the extreme coordination effort that is going into the Fairfax High School renovation and addition, all of these points are key to the success of the project. The school has to continue to be operational throughout the entire project, so the turning over of spaces is absolutely critical. The respect and work relations between all parties involved directly relates to the end result of the project.

Contacts

ONCORE Construction – Ray Sowers
Gilbane Building Co. – Marilyn Juban
Centex Construction – Jason Reece

C. CRITICAL ISSUES RESEARCH METHOD

Problem Statement

While there is more focus on green design and obtaining a certain level of LEED® certification, it is still difficult to pursue the various points throughout the construction process as well ass maintain the certification over the years. 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. Developing a tutorial guide for achieving the various points will enable more projects to not only pursue the certification, but it would make the process itself much easier.

Research Goal

My research will be focused on developing a user-friendly guide that can be utilized from the very beginning of the project. It will be used from the very start of the design process, which will initially help them gain a working knowledge of the LEED® classification system and what type of building to design based on the certification they are looking to obtain. I am pursuing this topic based on my intern experiences the past two summers. I

worked for Grunley Construction on the Eisenhower Executive Office Building project, which is looking to obtain a LEED-EB rating. I worked with a Project Manager to develop an excel spreadsheet of all of the points that we were going for and the status of what still needed to be done. This guide will allow everyone on the project to be educated on the system and how to best utilize it on their own respective projects. An open forum will be included to allow everyone to give and receive open feedback and lessons learned from various projects.

Research Steps

Although I have some work related experience on the LEED® system, before I can compile a comprehensive guide, I will need to get an in-depth knowledge of the system. I will start researching the criteria for the various certifications. Throughout my research, I will meet with and interview Project Managers that have worked on LEED® projects to receive their input and suggestions. Once this information is collected, I will begin to develop a core outline of the guide. With the feedback from individuals knowledgeable in the area, I will develop an in-depth guide. Once finished, I will have several key individuals test out the guide. A survey will be provided so that I can obtain positive and negative feedback on the LEED® guide. Finally, I will adjust the guide accordingly based on the feedback I receive from the surveys.

Data Collection Sample Survey

Below is the sample survey that will be handed out with the LEED® guide.

Name of Person
Company
Project

LEED® Rating - Certified, Silver, Gold, Platinum (Circle One)

Please rate the ease of use of the guide.
1 2 3 4 5

Please rate how useful the guide was in gaining knowledge of the LEED® system.
1 2 3 4 5

Please rate the usefulness of the guide regardless of an individual's LEED® experience.
1 2 3 4 5

Please rate the topics highlighted as the most important ones with respect to developing areas with LEED®.
1 2 3 4 5

Please rate the items discussed and shown on the guide. Are they directed toward their intended audience?
1 2 3 4 5

Please include any ideas or suggestions for improvement of the LEED® guide.

D. 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 Fairfax High School renovation and addition.

Project Phasing/Scheduling

The Fairfax High School renovation and addition was an extremely complex project due to the phasing issues with the school having to remain operational during the school year. The project is working around an occupied, operational school, and every September the kids return to school. There is no other building for the kids to attend, so the site must be ready for them. Safety is also a big issue with all the students occupying the school during construction. The contract requires building a floor to deck, drywall partition between all work areas, and occupied school areas. Area G will have a construction fence surrounding the area, and there is a full partition with no entrance into the school up between the school and Area G. The project was split up into thirteen (13) areas, A through M. The sectioning of the building into thirteen zones caused the project schedule to be quite complicated. The areas could have been grouped together in smaller spheres, with 2 or 3 rooms in each respective sphere. This would eliminate numerous areas of the schedule that are repetitive and expedite the construction sequence.

Contingency/Cost Issues

The two major factors on this project are schedule and cost. The contract for this project is $45 million, which included $ 1.2 million in contingency allowance for change order work. To date, almost $650,000 in changes have been settled. Once the allowance runs out, the school board has to somehow come up with more money. This makes changes a constant struggle. The fact that 54% of the contingency allowance has been used shows that there were numerous problems with performance as well as unforeseen conditions. The difficulty in receiving more contingency money from the school board increases the impact that those problems could potentially have on the project long term. There needs to be a quality control manager with a team of inspectors doing weekly, if not daily walkthroughs of the job site. This will ensure that quality work is being completed in a timely fashion. If there are any problems, you could then have the sub-contractor incur those costs.

Concrete

Both cast-in-place and pre-cast concrete are utilized on this project. A structural plant cast is pre-cast to be used on site. Although the project does utilize pre-cast concrete, it would have been beneficial to the project sequence and coordination to increase the amount used throughout the job. The more pre-cast sections are completed off site and coordinated to be delivered on the necessary days, the less the superintendent needs to worry about getting concrete trucks and workers in unison. Concrete construction has been the most practical form of construction, and the labor force in the area truly reflects that trend.

E. 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. Shown below are the technical analysis methods that will be used to research the two topics, which are the utilization of pre-cast vs. cast in place concrete and an analysis of the contingencies put in place for the project.

Pre-Cast versus Cast in Place Concrete

My research will target the impacts to cost, schedule, and quality of pre-cast concrete versus cast in place. Contacts with a pre-cast and cast in place manufacturers 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 review is going to require an analysis of the performance of the various types of concrete utilized. 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.

Contingencies

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F. 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 Engineering	Constructability Review	Schedule Red.	Total
Pre-Cast vs. CIP		5%	14%	14%	33%
Contingencies		13%		20%	33%
LEED® Guide	34%				34%
Total					100%