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Thesis Proposal

Doctors Community Hospital | Lanham, MD

January 20, 2008

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EXECUTIVE SUMMARY

The proposal that follows is an outline that will guide research for the Spring 2009 semester of Daniel Alexander's Senior Thesis. It identifies 3 areas of analysis. The first analysis is Building Information Modeling Implementation and it will focus on the construction process and how this process can be mapped. Defining information exchange needs and work flow characteristics and how these items can be impacted by BIM will be the primary objective. Second, an analysis of current site conditions and the impact of adding the adjacent property will be studied to determine schedule and cost impacts. Lastly, a study of alternative façade systems will be conducted. Schedule acceleration and cost will be the primary areas focus. Two breadth topics, specifically outlined in Appendix 1, will also be performed for this analysis. The structure will be checked and possibly redesigned to ensure that it is adequate for any difference in loads that this alternative façade may impose. The mechanical impacts of the new façade system will also be investigated to determine its impact on the chillers, boilers, and airhandlers. A weight matrix establishing the expected distribution of time is also included.

ANALYSIS 1: BIM IMPLEMENTATION

ISSUE

Building Information Modeling (BIM) is beginning to be more widely accepted and understood in the construction industry, but still has many question marks surrounding its implementation. Project teams and companies can know that they want to use BIM, but may not understand how to best implement it on their projects or in their company. Critical understanding as to the processes of construction and the required information transfers at each step can help to improve this understanding and create process models to help increase the effectiveness of BIM on projects. A project specific map for DCH relating to BIM processes and information could prove to be a valuable step in understanding and identifying how BIM can best be implemented on this project.

METHODOLOGY

The first step of this analysis will be to accurately model the current construction process as it is being performed at DCH. This endeavor will require information from all project team members to ensure that accurate and pertinent information is incorporated into the process model. Information for this model will be gathered through interviews with key project participants. Gilbane project managers and foreman, owner's representatives, and subcontractor project managers will be the target for these interviews. The key information that will be sought out in these discussion pertains to how current processes on the jobsite are handled such as MEP coordination, schedule review, and as-builts. As the process of the construction in its current form is modeled, this can then be expanded to incorporate BIM information requirements and processes into the process. As these process models are developed and incorporated together, steps for developing a BIM execution plan can be derived. Business Process Modeling using TIBCO software will be the method by which the models are developed. Through interviews and use of the BIM Execution Planning Wikipedia, an execution plan that is fully integrated with the current project processes will be developed.

EXPECTED RESULTS

Interfaces between companies, people, and different information sources will be the areas that can be expected to have the most knowledge to be gained. At these points, transfer of information is critical, and has the biggest opportunity to be lost. Through incorporation of BIM, an intelligent

model, and a targeted execution plan, a process model that can help simplify BIM implementation will begin to emerge. The final deliverable from this endeavor will be a process model that illustrates the opportunities for implementing BIM with the greatest impact at DCH.

ANALYSIS 2: SITE DEVELOPMENT

ISSUE

The amount of space at Doctor's Community Hospital is extremely limited. Site access is extremely restrictive; one way in and one way out. Laydown and material storage area for the expansion is also very limited. Added space to help ease the site congestion could prove to be a very beneficial item. The adjoining property, shown in figure 1 at right, was offered for sale, but the hospital declined to purchase the property. Analyzing possible impacts of purchasing this land to aide in the construction would be a worthwhile venture.

FIGURE 1- PLAN VIEW OF ADJOINING PROPERTY PROPOSED FOR PURCHASE AND ITS RELATION TO THE EXISTING SITE

METHODOLOGY

Proving that an expanded site will increase productivity can be a difficult task. Site storage and laydown space is not a metric that is commonly tracked as part of construction data, so quantitative proof may be hard to establish. The information that will best help to determine the added benefits will be gained through interviews conducted with project managers and the foremen from the various trades on site. This portion of the analysis will have to rely on the experience and the perception of the people putting the work in place. Using semi-structured interviews, with questions from Table 1 as a guide, a perceived impact can be established in terms of efficiency and duration. As these effects are established, various situations can be calculated that relate projected revenue vs. extended overhead costs and purchase price to see if there is a positive cost to benefit correlation.

TABLE 1- DISCUSSION QUESTIONS FOR SEMI-STRUCTURED INTERVIEWS

Discussion Questions
Is the laydown/storage space provided on site adequate?
Has the amount of laydown/storage impacted productivity?
Could a cost savings be realized if more space were provided for your trade? **-**If so, as a rough percentage of your current contract, how much money could be saved?
Could a schedule savings be realized if more space were provided for your trade? **-**If so, as a rough percentage of your current duration, how much time could be saved?

EXPECTED RESULTS

Based on commonly expressed views through AE classes, industry professionals, and members of the DCH project, it is to be expected that a less congested site will be more effective and return positive results. Through this analysis, I hope to quantify that impact, and try to place a dollar value on those efficiencies gained through decreased schedule and increased production that one can expect to gain from more space on a construction project.

ANALYSIS 3: FAÇADE CONSTRUCTABILITY

ISSUE

Building envelopes, and their construction, are critical elements in almost every construction project. Their completion is often on the critical path, and the Doctors Community Hospital is no exception. The hand laid brick façade has proven to be a time consuming process that has required the need of increased man power and resources to help meet the schedule on the project. If an alternative façade system was used, schedule savings could be realized. Furthermore, there could be added benefits from a structural and a mechanical aspect as well.

METHODOLOGY

The analysis for this issue will focus on 5 areas; impact on architecture, impact on schedule, impact on cost, impact on the structural system, and impact on the mechanical system.

First, an investigation in to available systems on the market, and their ability to match existing brick is warranted. This project is a renovation, and tying into the architectural elements already existing is a critical piece. Also, based on previous insight from the faculty, I would like to incorporate aspects of Dr. Memari's work with pre-assembled brick facades into my thesis.

Cost and schedule impacts will be analyzed as well. Information regarding pricing, schedule durations, labor needs, and equipment needs will be weighed into the feasibility of altering the façade system. Through discussions with manufacturer's and possibly contractors who have used the system, the information will be collected and analyzed to assess the impact of a new system on the current project. Key areas of focus during the discussions will be connection details (complex vs. simple), labor needs, space required on site, schedule, and price.

Changing the façade will also impact two breadth areas: structural and mechanical. The new façade will likely have different loads that it imposes on the structure to which it is attached. An analysis of the structure will be conducted to verify if the current system is adequate, and what steel member sizes must be utilized to meet the needs. This analysis will also tie back into the cost affects, either positively or negatively depending on member size. The new façade will also have different thermal qualities which can impact the mechanical system, specifically the sizing of the rooftop equipment. An investigation into the new thermal loads based on the insulation provided by the façade will be needed and a look a lifecycle costs will also be warranted.

EXPECTATIONS

The goal of this analysis will be to propose an alternate system that can reduce the schedule and the cost and still meet the architectural needs of the owner. It is expected that cost will be reduced through decreased labor and breaking even on the cost of the system. A shorter schedule will help the overall project and also transform into schedule savings by decreasing overhead costs.

WEIGHT MATRIX

The weight matrix serves as a visual representation of how time and effort will be distributed among the core investigation areas for the Senior Thesis. In table 2 below, shown as percentages, these values are illustrated.

TABLE 2- WEIGHT MATRIX REPRESENTING TIME DISTRIBUTION ON ANALYSES

Weight Matrix					
Description	**Research**	**Value Eng.**	**Const. Rev.**	**Sched. Red.**	**Total**
BIM Implementation	20	-	5	10	**35**
Site Logistics	0	-	15	10	**30**
Alternative Façade	10	10	10	10	**40**
Total	**30**	**10**	**30**	**30**	**100**

APPENDIX 1: BREADTH AREAS OF STUDY

MECHANICAL

In conjunction with the new façade system (Analysis 3), I will be performing mechanical calculations to help assess the full impact of the alternative envelopes. Specifically, I will be investigating the affects of the different insulation values and how this could impact the current equipment specified for the boilers and the chillers in terms of loads.

STRUCTURAL

New façade systems will place different gravity loads on the superstructure, either lighter or heavier depending on the system. In this breadth, I will analyze the dead loads that are associated with changing the envelopes and determine the necessary structural member sizes to accomadate the changing loads.