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Thesis Proposal

Doctors Community Hospital | Lanham, MD

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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. First, BIM Implementation, where the construction process will be mapped and incorporated with BIM uses and information transfer needs to create a project specific BIM execution plan. 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 to and possibly redesigned to ensure that it can support the loads. 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 a 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 as high a level as accuracy as is feasible and practical is incorporated into the model. Information for this model will be gathered through interviews with project participants. As the process of the construction in its current form is modeled, this can then be expanded to incorporate BIM information and processes into the model. As these models are developed and incorporated together, steps for developing a BIM execution plan can be derived. The most likely candidates for modeling form are either Business Process Modeling or Integrated Building Process Modeling. 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 carefully laid out execution tips, a process that can help simplify BIM implementation will begin to emerge.

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 or help 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 research that will best help to determine the added benefits will be surveys conducted with project managers and the foremen from the various trades on site. This portion of the research will have to rely on the experience and the perception of the people putting the work in place. Through surveys, with sample questions shown in Table 1, 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- SAMPLE SURVEY QUESTIONS TO ESTABLISH IMPACT OF STORAGE SPACE

Sample Survey Questions
Is the laydown/storage space provided on site adequate? Rate between 1 and 5 1-Extremely Inadequate 2 3- Adequate 4 5-More than Adequate
Has the amount of laydown/storage impacted productivity? Rate between 1 and 5 1- Very Negative Impact 2 3- No Impact 4 5- Very Positive Impact
Could a cost savings be realized if more space were provided for your trade? Yes No 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? Yes No If so, as a rough percentage of your current duration, how much time could be saved?

Another aspect of research that may help with this portion would be a review of studies that have already been conducted that link site layout and space with efficiencies. With a review of previously conducted studies, the goal would be to provide a wider pool of data to help establish the possible effects of site size as they would pertain to the DCH project.

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 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.

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.

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	5	-	15	10	**30**
Alternative Façade	5	10	10	10	**35**
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.