



Senior Thesis Final Report
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Construction Management Option

EXECUTIVE SUMMARY

This Senior Thesis Final Report includes the process development and outcomes derived through the analysis of the New Regional Medical Center. This facility is a new construction, 5 floors, 366,780 square foot hospital in East Norriton, Pennsylvania, and is associated with the Einstein Healthcare Network.

Through the four areas of technical analysis, investigation and applications have identified construction efficiency through information exchange. BIM utilization will streamline the construction estimating and planning processes on this project. An effective curtain wall modularization and architectural redesign of the atrium, in addition to a structural redesign of the concrete pour strips, will provide a strong comparison of the benefits in early designer and builder communication. Finally, the development of a facility management interface for building operation will identify innovative solutions and provide substantial benefits of a project-based document interface.

BIM IN PRECONSTRUCTION:

Model-based estimating is a growing VDC concept within construction firms. Over the past few years, industry leaders have begun developing internal processes in order to identify and understand the capabilities of this method. This analysis investigated the implementation of this strategy for estimating the structural bid packages -- identifying strengths, weaknesses, and industry growth. The structural steel Revit-based estimate produced a cost of \$7,710,326, which is 0.50% above the schedule of values logged for this system. The cast-in-place concrete estimate was not as successful, resulting in a 10.70% deviation for the schedule of. It has been recommended that implementation of 5D estimating for a structural steel system is effective.

As VDC gains speed within the industry in traditional applications, developments were made to identify a logical workflow, extracting data from the structural steel model to identify the most cost effective erection process. It was recognized that the workflow of the structural erection of the New Regional Medical Center contained an oversize crane for 77% of the duration. Through this visual analysis of Revit-based data, it was recognized that construction by sector is a more efficient process. This analysis identified a new VDC method in order to highlight trending data within a structural steel model, and resulted in a savings of two weeks on the construction schedule, in addition to \$315,727 of the project cost.

REDESIGN OF ATRIUM ENCLOSURE PROCESS

Prefabrication and unitization of glazing systems have been recognized for developing higher quality, faster installation, and a safer working environment. This analysis investigates the consideration of unitization of the atrium's curtain wall and a related architectural redesign to improve construction logistics and enhance the utilization of open space in the facility. At \$123,455, the architectural redesign included the addition of floor levels and corridor access along the curtain wall at the 1st and 3rd levels. The cost savings are minor for the unitization of the curtain wall; however, it would provide a safer work environment, higher quality, and a tighter work schedule.

This analysis created an aesthetically pleasing space to improve constructability and eliminate a high-risk construction process on the site, while also providing a space for patient and visitors to enjoy the greenfield



landscape surrounding the hospital. It was recognized that the unitization of the curtain wall system would reduce field assembly duration; however, require a 20-week lead-time to procure and assemble the units. Unitization would have only been logical if the glazing subcontractor was brought into the project earlier to assist with design development.

REDESIGN OF STRUCTURAL POUR STRIP

Constructability issues versus design decisions are consistently reviewed in order to understand the implication of a chosen system. This analysis performs a cost comparison of the expansion system of the facility to identify if the selected system is the best option for the owner. It has been identified that the building's pour strip system is a more cost effective design decision. The choice to utilize the pour strips over expansion joints saved the project approximately \$57,800. The analysis also clarified that the building's pour strip system is a more aesthetically pleasing system and is preferred by the Owner.

It is recommended that other design teams and Owners investigate the implications of a pour strip within their facility in lieu of an expansion joint. Although the expansion joint provides a simpler construction method, the aesthetic results and additional costs may not be worthwhile. Through the utilization of design alternative in Autodesk Revit, the design team or construction management firm can quickly analyze the cost benefits and cross-reference these outcomes with the intentions and goals of the Owner and facility user group.

DOCUMENT MANAGEMENT FOR THE OWNER

This analysis focused on the research into the development of an accessible, easy to use, and updatable, document management system for the facility management team after the construction of the building. Through industry discussion, interface development, and continued feedback from the user group, it was identified that this system is critical to streamlining the workflow of a facility management team.

This analysis confirms the capabilities of new approaches to document controls and turnover packages for an owner. Although a digital turnover interface is not included with the original package of the New Regional Medical Center, with development, the concepts shared through this research will permit the Owner to incorporate the ideas into their new healthcare campus in East Norriton, PA. By providing new methods such as an FM Dashboard and FM Interact to host BIM packages and construction documents in a simple interface, the user group can easily sort through great quantities of documents to find applicable items.

It is recommended that Owners, notably from Universities and Healthcare Systems, need to develop their internal goals of document management. Although construction companies will be capable of developing a web based interface and document controls for turnover, larger Owners should outline their own method in order to streamline and combine all of this facilities into a common system.