

EXECUTIVE SUMMARY

This Senior Thesis Report will evaluate the St. Joseph's Women's Hospital NICU addition from several aspects of the construction process to address any opportunities for a redesign, process improvement, schedule acceleration, implementation of critical industry trends, value engineering of systems and constructability review. The following three depth analyses will be supplemented with two breadth analyses, demonstrating several areas where these opportunities exist, how they can be implemented, and the benefits of making these changes.

ANALYSIS #1-FAÇADE REDESIGN

The current façade of the St. Joseph's NICU has run into several challenges, mainly stemming from a FAA height restriction that has caused crane height changes to affect precast panel composition, which in turn affected window connection methods and design. This analysis will provide an alternative façade design layout to facilitate a repeatable panel composition that will allow the integration of glazing and window frames into the prefabrication process. To do this, the connection method was revised, the prefabrication process was refined, and the resultant design was analyzed for any potential cost and schedule savings that may have resulted. The results were positive, and the content accounts for the largest contribution to the report.

ANALYSIS #2-STRUCTURAL SLAB SYSTEM CHANGE

St. Joseph's Hospital is being constructed using a 12" two-way flat plate slab with concrete columns and shear walls as the main structure. This system requires a large amount of reinforcing and structural concrete. Other slab systems were analyzed to determine if there was an equivalent system that could both satisfy the owner's needs and reduce material costs. This was done by creating a weighted matrix that analyzed six different slab construction types, weighting cost as the main determinant. A post-tensioned slab was chosen and a basic design was created to analyze the cost savings available as a result of the change. This reported an overall savings of over \$438,000.

ANALYSIS #3-IMPLEMENTATION OF BIM FOR CONCRETE REINFORCING

With the advent of BIM in the construction industry, there appears to be room for this process to be permeated into the concrete detailing field. This analysis uses the BIM Execution Planning Guide developed by Penn State to identify critical areas where this technology should be focused. Three software packages were selected for analysis based on their performance against the criteria identified in the BIM Execution Planning Guide. The barriers to usage and some recommendations were made regarding what projects would best benefit from these programs.

BREADTH #1-ANALYSIS OF PUNCHING SHEAR AT COLUMN SUPPORTS

Analysis #2 reduced the slab thickness by 4 ½" which will in turn reduce the slab's resistance to punching shear. Punching shear was evaluated, and extra reinforcing was designed to provide the additional resistance needed.

BREADTH #2-PRESERVING THE CHARACTERISTICS OF THE FAÇADE

Analysis #1 changed the layout of the majority of the façade's precast panels. This section provides insight on how to maintain the original design intent and finding a balance between design and construction methods.