



## **1.0 EXECUTIVE SUMMARY**

The Senior Thesis Final Report discusses the research and findings of the three analyses proposed in the proposal for the Penn State Milton S. Hershey Medical Center's new Children's Hospital. The newest addition to the Hershey Medical Center is the state of the art 262,587 SF Children's Hospital serving the Children of central Pennsylvania. The \$115 Million facility broke ground on 4/12/2010 and is scheduled to be completed on 8/20/2012. The central focus of the three following analyses will be to improve efficiency in the construction industry as well as studying new sustainable technologies. This thesis report has satisfied the four core requirements of: Critical Issues Research, Value Engineering Analysis, Constructability Review, and Schedule Reduction.

### **Analysis # 1: Schedule Acceleration through Multi Trade Prefabrication**

With the increased congestion inside the building, the potential for accidents, conflicts between trades, and reduction in productivity will be highly likely. The usage of BIM on this project has not been utilized beyond the limits of 3D coordination. This analysis showed that a prefabrication effort of the patient bathroom pods, the patient headwalls, and patient footwalls are very possible. In fact the analysis has shown that 58 days can be saved from prefabricating the units in an off-site facility helping recovering from any potential delays or even completing the project ahead of schedule. Thorough research has been conducted to determine savings in General Conditions, additional costs to be considered, and even the benefits for the owner and the entire project team.

### **Analysis # 2: Eliminating Inefficiency of Cost Estimating Through 3D Modeling**

During the Design and Development of the Children's Hospital project, a total of three 3<sup>rd</sup> party estimators were hired to estimate the costs of the project as the Architects progressed through the design. In addition, to the three 3<sup>rd</sup> parties involved, each contractor bidding for the project had to develop and estimate the project costs. The Children's Hospital is a large project with many systems to be estimated and evaluated. The lengthy process of conducting manual hand take-offs on 2D drawings could negatively impact the entire project team during construction. This analysis went in depth in methods of utilizing BIM to reduce the time to estimate to provide more time for constructability review. A survey sent out to industry professionals has supported the advantages of utilizing BIM based estimating methods on a construction project. The most important finding was that although BIM can expedite the time to conduct quantity take-offs, it however cannot be completely relied on as models are not designed the way the building is built.

### **Analysis # 3: Viability of Incorporating Solar Photovoltaic Systems**

The new facility will require enormous amount of electric loads to run the building. Diesel powered generators provide backup power in the case of power loss. The new project is on the borderline of achieving a LEED Silver Rating and the diesel powered generators are not providing any points to help out. The intent of this study was to eliminate at least one diesel generator; however, this was not possible due to insufficient roof space for PV-Panels. The analysis shifted to an effort to sustainably power the office equipments which compromise 1% of the total electric demand. A system layout was designed, structural load calculations proved building can sustain additional loads, and an energy analysis proved the system will work. The total system cost came out to be \$269,000 with a payback period of approximately 11 years.