Executive Summary

This thesis final report will provide an in-depth analysis of the Geisinger Grays Woods Ambulatory Care Campus, Phase II project. Throughout extensive research performed in the Fall Semester, I identified three analyses that focus on problems or opportunities faced during the construction of this facility. They are based on areas of critical industry issues, value engineering, constructability review, and schedule reduction. Analysis topics include the feasibility of implementing virtual mockups for the construction of the facility's operating and endoscopy rooms, prefabricating the building's façade, and re-evaluating the structural composite slab for this project.

Analysis 1 - Virtual Mockups on Operating/Endoscopy Rooms:

The 'In-Place Mockups' used for the construction of the facility's operating and endoscopy rooms resulted in a costly and time-consuming process which obstructed the construction in these areas. Virtual mockups could provide faster, cheaper, and more effective means for reviewing the design of the spaces prior to construction. This analysis focused on evaluating the implementation of virtual mockups for the construction of this facility's operating and endoscopy rooms. The criteria and workflow of the mockup development were captured to better understand whether this tool would be beneficial for the Grays Woods Project. The facility model was developed using Autodesk Revit and Unity Software. It took a total of 20.5 hours to develop a mockup for both rooms, and could potentially cost over $4,000 if implemented on this project. Implementation of virtual mockups was highly recommended as it could potentially save cost, time, reduce risk, and solve design and constructability issues in advance of construction.

Analysis 2 – Brick Façade Prefabrication:

The goal of this analysis was to determine whether prefabricating the building's façade would decrease the project duration and cost, while maintaining similar aesthetics and building performance. A complete analysis of the building façade was performed using Nitterhouse's 'Architectural Precast Panels'. The design required a total of 74 precast panels spanning the building's height. Implementing precast panels costs an additional $112,000 to the project budget, although it could reduce the project schedule by 3 weeks. Through a mechanical analysis, it was determined that the proposed panel would improve heat gain and heat loss by 20%. Nevertheless, prefabricating the exterior façade was not recommended as the increase in cost and additional planning required for implementation outweigh the savings in schedule and improved building performance.

Analysis 3 - Reevaluation of Structural Composite Slabs:

The third analysis looked into reducing the total building costs through value engineering efforts on the composite slabs. With over 38,000SF of lightweight concrete being used for the slabs, the lower material costs of normal weight concrete could have substantial impacts on the project. It was determined through a structural analysis that the proposed design would require over 6.5 tons of additional structural steel to support the increased load of normal concrete. This would increase the assembly's cost by $27,000, or 3% to that of the original design. Throughout the research, many of the risks of using lightweight concrete were exposed. Even though using normal weight concrete would increase project costs, it is recommended as it provides much more reliable performance than lightweight concrete upon placement.