EXECUTIVE SUMMARY

Senior Thesis Final Report is intended to discuss the findings and conclusions of the three analyses that were performed on the Penn State Milton S. Hershey Medical Center's Support Services Building. The 42,796SF facility started construction on June 1st 2010 and is schedule for completion by September 2011. Each of first two analyses were selected in order to add value, decrease schedule duration, or fix a constructability issue within the project. Analysis three was selected in order to incorporate renewable energy sources and increase the sustainability of the Support Services Building. This will help make it a platform for Penn State to conduct further research into operating techniques of buildings with this technology and develop the best way to incorporate renewable energy sources into their new building projects in the future.

ANALYSIS 1: ***RE-DESIGN OF FOUNDATION SYSTEM***

PSUHMC's Support Services Building was set on a micropile foundation system based on the recommendations of the Geotechnical Report. The report however was based on column loads that far exceed actual column loads for almost two-thirds of the structure. This analysis took a further look into the soil conditions, actual loading conditions, and a new foundation for two-thirds of the building was designed utilizing Geopier Rammed Aggregate Pier and larger spread footings. To replace the micropile foundation for two thirds of the building required the addition of an additional column line to account for differential settlement between the two different foundation systems. Looking at the project's schedule, the re-design of the foundation saved two weeks off the initial project schedule. In total, the re-design of the foundation system saved almost $123,000.00 off the original cost of the project.

ANALYSIS 2: ***ROOFING COMPARISON & ELIMINATION OF OFFSET ROOF***

The Support Services Building utilized HMC's standard cold-applied BUR roofing system. This system is expensive and can have major schedule implications. Also, a 3,600 SF section of the main roof was offset 5' to hide the RTU's. This analysis was broken down into two parts. Part I researched and compared several different roofing types with a pros and cons comparison, with the RoofPoint rating system by the Center for Environmental Innovation in Roofing, and with a schedule and cost comparison. It was discovered that when compared on a sustainability aspect, virtually all of the roofing types were the same and that owners are no longer limited when selecting a sustainable roof. It was determined that the cold-applied BUR was the correct choice; however it was calculated that a TRO roof could have saved the project $87,000.00 and a week on the projects schedule. Part II analyzed the elimination of the offset roof. It was found that the $55,000.00 cost savings to eliminate the offset roof would have been worth exposing the RTU's.

ANALYSIS 3: ***DESIGN TO INCREASE SUSTAINABLE FEATURES USING RENEWABLE ENERGY SOURCES***

Under the original design, the building is on track to achieve a LEED Certified rating upon completion. However the project has utilized very few sustainable techniques that could provide financial benefits to Hershey Medical Center or to Penn State. The focus of this analysis was to increase the sustainability of the SSB by adding renewable energy sources. Part I of this analysis looked into replacing the original air-to-air system with a geothermal system. It was found that the added cost to go with a geothermal system would have been approximately $478,000.00. In Part II of this analysis, a 71.68kW photovoltaic system was designed for the building. Two options for installation of the system were given. Option one simply relocated the RTU's and would cost just under $500,000.00. Option 2, included the installation of the geothermal system and would cost $967,000.00. Total operating savings from the two systems were shown to be $10,000/year in electric costs for the PV array and 40-50% in total energy savings for the geothermal system. Installation of these systems will provide Penn State a larger platform to research the operating techniques of buildings with these systems and help them develop a way to incorporate this type of technology into their new building projects in the future.