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GLOBAL VASCULAR INSTITUTE BUFFALO, NY

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SENIOR THESIS REVISED FINAL PROPOSAL

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MADISON SMITH – CM

EXECUTIVE SUMMARY

Senior Thesis Final Proposal is designed to discuss the four analyses that will be performed for the final thesis report on the Global Vascular Institute. All of the analyses are intended to focus on the critical industry issue of improving efficiency in the construction industry.

ANALYSIS #1: Feasibility and Design Study for Photovoltaic Energy System

Due to the complexities of the function of the Global Vascular Institute, extremely high amounts of energy are needed to keep this building fully functional. The goal of this analysis is to perform a preliminary design of a building integrated PV energy system and determine the financial feasibility to incorporate the system into the existing power plan to reduce energy costs for the owner. An electrical breadth study will be performed to determine a system tie-in location along with electrical equipment and connection requirements for the renewable energy system. This analysis will include a portion of the structural breadth by analyzing load requirements and additional structural support for the PV panels.

ANALYSIS #2: ELMINIATION OF INEFFICIENCY THROUGH THE USE OF FAÇADE PREFABRICATION

The design of the Global Vascular Institute is quite unique to any other building in the general area of this project. Its façade is designed so that the entire exterior is clad with horizontal rows of aluminum metal panels and glass. To construct this system, each panel is individually installed which is a very time intensive process. The goal of this analysis is to determine the schedule savings and reduction in site congestion by utilizing a prefabricated system.

ANALYSIS #3: LEED Certification

At the completion of the Global Vascular Institute project, a LEED Certification will not be pursued. This decision was made during the schematic phase because of budgetary reasons. The goal of this analysis is to perform an in-depth study into the criteria required for the Global Vascular Institute to become at least LEED certified. In-depth research will be focused on each credit of the LEED rating system.



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PROJECT BACKGROUND

The Global Vascular Institute is a 450,000 square foot medical research/hospital facility located in Buffalo, NY. Substantial completion of the project is set for December 2012. The Global Vascular Institute is an extension of the existing Buffalo General Hospital located on High Street in Buffalo. The new medical facility consists of four floors of Kaleida Health's heart, vascular, and neurosurgery operations. It also has four floors of University of Buffalo's clinical translational research center. An expanded emergency room is also included.



Figure 1: Architect's rendering of Global Vascular Institute

Compared to the usual "Buffalo beige" box shape of most downtown Buffalo high rise buildings, the Global Vascular Institute has a more modern design consisting of curved edges, glass curtain walls and metallic grey painted aluminum panels. The design also can be described as being made up of blocks of space. Figure 1.1 below shows that the building is comprised of 3 separate blocks connected by glass panels, as well as the curvature of the edges of the building.



ANALYSIS #1: FEASIBILITY AND DESIGN STUDY FOR PHOTOVOLTAIC ENERGY SYSTEM

PROBLEM IDENTIFICATION

For the Global Vascular Institute to become fully functional, renovations must be completed to the adjacent central plant that will power the building. Overall, the energy costs for this project are very high due to the function of the building being a research facility as well as a hospital. The budget for this project was one on the major limiting factors in the design and scope of the building, so sustainable features were not thoroughly researched for incorporation into the design.

RESEARCH GOAL

The goal of this analysis is to perform a preliminary design of a building integrated PV energy system into the façade of the building and determine the financial feasibility to incorporate the system into the existing power plan to reduce energy costs for the owner.

METHODOLOGY

- Research PV panel technologies
- Contact PV panel manufacturers for design consultation
- Determine quantity and arrangement of panels on façade and amount of kWh able to be produced
- Analyze how the existing structure will be affected with added PV panels loads
- Analyze how the PV system will connect to the existing electrical power system
- Perform feasibility analysis on lifecycle cost and payback period
- Compare façade PV system to a roof mounted system in terms of energy output and payback period

RESOURCES AND TOOLS TO BE USED

- Industry Professionals
- AE faculty Structural, Electrical
- Cannon Design MEP Engineers/Designers
- Applicable literature

EXPECTED OUTCOME

By the use of extensive research and design, it is expected that a building integrated photovoltaic energy system will have a financial benefit through reduction in power grid dependency. The use of PV panels will not be able to produce all of the Global Vascular Institute's energy loads, but it should account for a significant portion. It is believed that the PV system will prove affordable and financially beneficial due to government incentives, rebates, and life-cycle cost considerations.

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ANALYSIS #2: ELMINIATION OF INEFFICIENCY THROUGH THE USE OF FAÇADE PREFABRICATION

PROBLEM IDENTIFICATION

Site congestion is a major concern facing the construction management team on this project. This issue affects all trades working on the project and has the potential to cause delays in a number of areas. The lack of space available for material storage and layout has caused the installation of the curtain wall to be a slow process. The longer it takes to enclose the building, the longer it will take to begin the interior work on the building.

RESEARCH GOAL

The goal of this analysis is to perform a preliminary design of larger prefabricated façade panels compared to the current system of individual panels, and assess the impacts on the schedule, cost, and site congestion.

METHODOLOGY

- Design preliminary prefabricated panel modules for the façade of Global Vascular Institute
- Determine transportation and erection requirements for the prefabricated panels
- Analyze schedule and cost impacts of the prefabricated system
- Analyze constructability of the prefabricated system
- Analyze site congestion improvements

RESOURCES AND TOOLS TO BE USED

- Industry Professionals
- AE faculty Structural
- Applicable literature

EXPECTED OUTCOME

After through research, it is expected that using a prefabricated curtain wall system will greatly reduce the congestion of the site during the construction of the Global Vascular Institute. It is also expected that the overall schedule will be greatly reduced which will allow for earlier finishes work to begin as well as saving on-site labor costs.

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ANALYSIS #3: LEED CERTIFICATION

PROBLEM IDENTIFICATION

The Global Vascular Institute project is not pursuing LEED Certification once it is completed. Due to budgetary issues, becoming LEED Certified did not seem plausible or beneficial. Although initially a study was not done to determine if LEED should be pursued, becoming LEED Certified could have multiple advantages to the project, including energy savings, cost savings, as well as the prestige of being certified by LEED.

RESEARCH GOAL

The goal of this analysis is to perform an in-depth study into the criteria required for the Global Vascular Institute to become at least LEED certified. In-depth research will be focused on each of the LEED credits to determine their feasibility.

METHODOLOGY

- Research LEED certification and the points required to achieve LEED certification
- Analyze the Global Vascular Institute for LEED points already included in the design
- Analyze each LEED Credit for feasibility in obtaining it
- Determine the cost to implement LEED points not already included in the current design
- Analyze lifecycle costs of implementing new LEED ideas into the building and ensure that each idea is able to be constructed
- Determine potential payback period of implementing new LEED ideas

RESOURCES AND TOOLS TO BE USED

- Industry Professionals
- Turner Construction Team
- Applicable literature

EXPECTED OUTCOME

After thorough research, it is expected that there will be numerous LEED points already included in the design of the Global Vascular Institute. Along with this, it is expected that for the Global Vascular Institute to be LEED certified, minimal additions will need to be added into the design which will not have too much of an impact in cost to the project.



ANALYSIS WEIGHT MATRIX

As shown below in Table 1, the weight matrix depicts how each analysis is broken down in the four core areas of investigation. The percentages represent effort and expected time that will be allocated for the core areas in each investigation.

ANALYSIS DESCRIPTION	RESEARCH	VALUE ENGINEERING	CONSTRUCTIBILITY REVIEW	SCHEDULE REDUCTION	TOTAL
PHOTOVOLTAIC SYSTEM	15%	10%	10%	-	35%
CURTAINWALL SYSTEM	5%	10%	10%	10%	35%
LEED CERTIFICATION	15%	10%	5%	-	30%
TOTAL	35%	30%	25%	10%	100%

Table 1: Weight Matrix for Distribution of Core Areas of Investigation

TIMETABLE

To stay on track and meet all project goals, a preliminary semester timetable has been developed to layout work progression status for each technical analysis. See **APPENDIX B** for the spring semester preliminary schedule.

CONCLUSIONS

Through in-depth research and study, the proposed technical analyses will provide a comprehensive review of improving efficiency in the construction industry. The integration of a photovoltaic energy system in to the design of the building will reduce energy costs for the owner as well as adding to the sustainable features of the project. The use of prefabrication for the curtain wall façade will both save time in installation and reduce the site congestion for the project. Finally, the determination of the additional requirements for the Global Vascular Institute to become at least LEED Certified will add both sustainable features to the building, as well as prestige.

This proposal is intended to be a working submission that may have revisions based on feedback from thesis advisors.



APPENDIX A: BREADTH TOPICS





BREADTH TOPICS

The following topics involve a more in-depth in analysis into distinct disciplines with the Architectural Engineering major. Each of these topics contributes to one of the previously mentioned analyses.

ELECTRICAL BREADTH: Contributes to Technical Analysis #2

The current power distribution system for the Global Vascular Institute is 480Y/277, 3-phase, and 5-wire system supplied by NGrid Power Company. Energy is also being pulled from the adjacent central power plant.

Integrating renewable energy from the photovoltaic panels on the façade of the building will be analyzed to determine the electrical and connection requirements. Also, a constructability review will be performed to ensure that the current electrical system is suitable for the requirements of the photovoltaic panels. The savings in energy will be determined as well as the cost impact on the project.

STRUCTURAL BREADTH: Contributes to Technical Analysis #2

The current superstructure of the Global Vascular Institute is steel columns, beams, and composite metal deck floor slabs. The enclosure of the building consists of an aluminum panel curtain wall system.

As proposed in Technical Analysis #2, the addition of photovoltaic panels on the façade will require a structural analysis to determine loading and support requirements. Any additional support and connections that are found to be required for the photovoltaic panels will be designed and evaluated for cost and schedule impacts.