2010

GLOBAL VASCULAR INSTITUTE
BUFFALO, NY

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CONSTRUCTION MANAGEMENT
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SENIOR THESIS 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: Elimination of Site Congestion Through the use of Prefabrication

Due to minimal material storage and layout space available on site, site congestion has been a major issue during construction on the Global Vascular Institute. The goal of this analysis is to define prefabricated module for a typical operating room and a typical recovery room. A preliminary design of a prefabricated module will be performed and impacts to the schedule, cost, and trade coordination on site will be assessed.

ANALYSIS #2: 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 #3: Re-Develop Curtainwall System

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. Since this design is so different than any other building in the area, it may not be initially welcomed into the community. The goal of this analysis is to investigate the changes in schedule and cost to change the exterior façade from an aluminum panel system to a precast concrete panel system. This analysis will include the second portion of the structural breadth by analyzing and designing additional supports and connections for the precast concrete panel system.

ANALYSIS #4: 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 the categories of Energy and Atmosphere and Materials and Resources.

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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: ELIMATION OF SITE CONGESTION THROUGH USE OF PREFABRICATION

PROBLEM IDENTIFICATION

Site congestion is a major concern identified for the Global Vascular Institute. This issue affects all trades working on the project and has the potential to cause delays in a number of areas. The lack of material storage and layout space can cause inefficiencies, as well as unsafe working conditions. Due to the complexities of the MEP systems of a hospital, the installation of these systems have the potential to cause extensive delays in the schedule due to clashes in the field and congestion of the trades on site.

RESEARCH GOAL

The goal of this analysis is to perform a preliminary design of an operating room and recovery room systems prefabrication module and assess the impacts on schedule, cost, and trade coordination on site.

METHODOLOGY

- Research layout of operating rooms and recovery rooms and determine applicable module of prefabrication
- Research existing layout of MEP systems in determined prefabrication modules
- Contact MEP manufacturers experienced in prefabrication
- Determine transportation and erection requirements for prefabricated units
- Analyze schedule, cost and constructability impacts of prefabricated units
- Analyze site congestion and trade coordination improvements

RESOURCES AND TOOLS TO BE USED

- Industry Professionals
- Turner Project Team – Site coordination/logistics
- Applicable Literature
- MEP Manufacturers/Contractors

EXPECTED OUTCOME

After completing extensive research, it is believed that a prefabricated unit for corridors and patient rooms will effectively reduce the MEP installation schedule and improve the trade coordination to reduce inefficiencies due to site congestion.

ANALYSIS #2: 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 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

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.

ANALYSIS #3: RE-DEVELOP CURTAINWALL SYSTEM

PROBLEM IDENTIFICATION

The architect for the Global Vascular Institute designed a façade that clad the entire exterior with horizontal rows of aluminum metal panels and glass. This design is quite unique to any other building in the general area of this project and may not be initially welcomed into the community. This design has the potential to cause overall schedule delays due to manufacturing issues as well as being very expensive.

RESEARCH GOAL

The goal of this analysis is to investigate the changes in schedule and cost to change the exterior façade from an aluminum panel system to a precast concrete panel system.

METHODOLOGY

- Research precast concrete panel systems and select an applicable manufacturer
- Design preliminary precast system for exterior façade
- Analyze how the precast system impacts the existing structural system
- Analyze schedule, cost, and constructability impacts of precast system

RESOURCES AND TOOLS TO BE USED

- Industry Professionals
- AE faculty – Structural
- Applicable literature

EXPECTED OUTCOME

After through research, it is expected that changing the exterior façade design from an aluminum panel system to a precast concrete panel system will save both time in the overall schedule and in cost savings. It is also expected that the size of the structural members supporting the curtainwall will need to be increased but this cost will be offset by the savings from the precast concrete panel system.

ANALYSIS #4: 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 the categories of Energy and Atmosphere and Materials and Resources.

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
- Determine which LEED points are most financially beneficial for Global Vascular Institute pursue
- 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
PREFABRICATION SYSTEM	-	5%	15%	5%	25%
PHOTOVOLTAIC SYSTEM	10%	10%	10%	-	30%
CURTAINWALL SYSTEM	-	5%	5%	5%	15%
LEED CERTIFICATION	15%	10%	5%	-	30%
TOTAL	**25%**	**30%**	**35%**	**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. It is expected that the prefabricated operating room and recovery room modules will reduce site congestion and overall schedule duration, as well as increasing efficiency between trades. 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 changing of curtainwall system from aluminum panels to precast concrete panels will decrease the schedule and allow the building to match the other buildings in the area. 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.

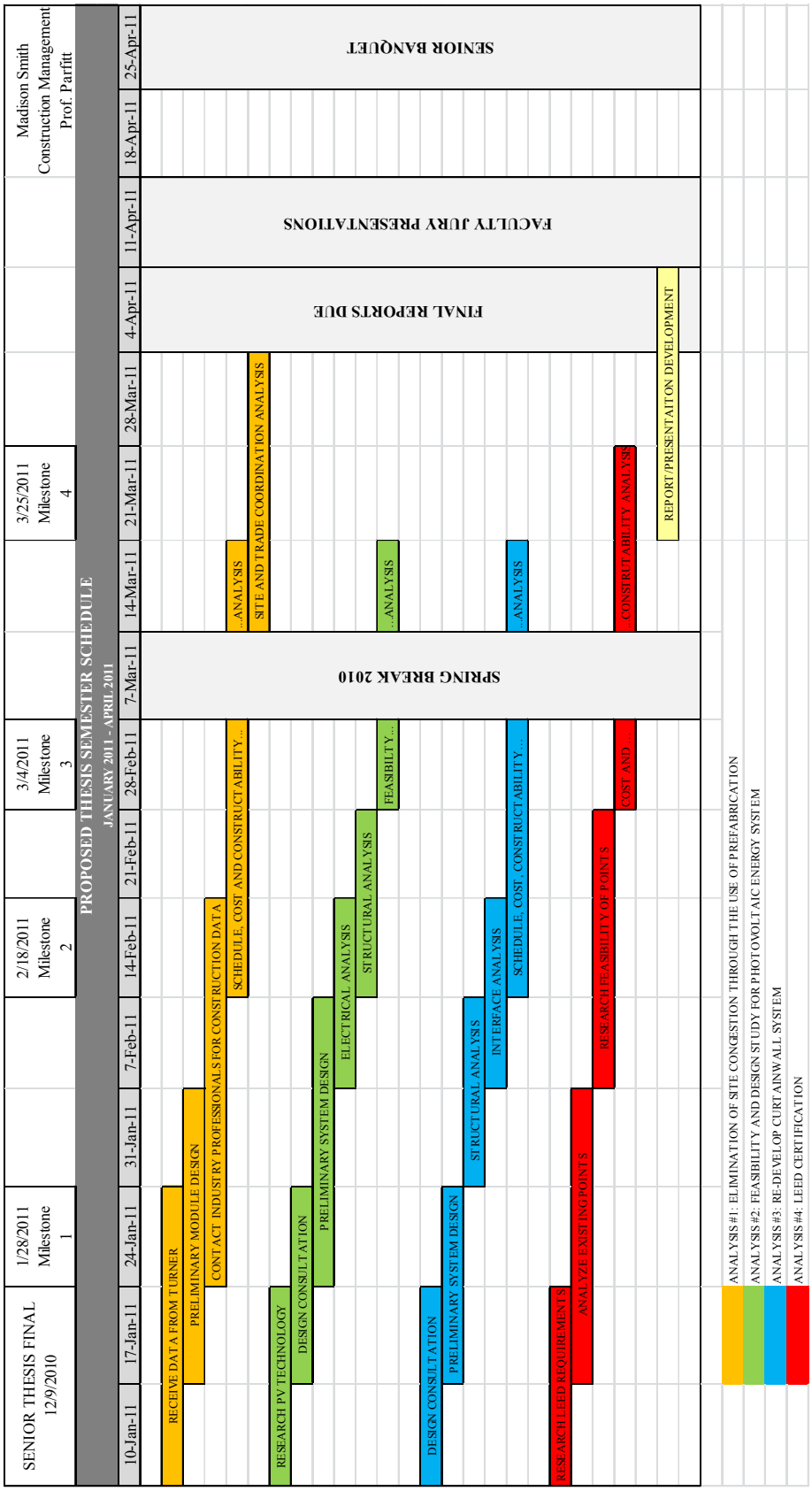
Integrating renewable energy from the photovoltaic panels on the façade of the building will be analyzed to determine the electrical and connection requirements. Also, a constructability review will be performed to ensure that the current electrical system is suitable for the requirements of the photovoltaic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

STRUCTURAL BREADTH: Contributes to both Technical Analysis #2 and Technical Analysis # 3

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 curtainwall 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. The changing of the aluminum panel curtainwall system to precast concrete panels, as proposed in Technical Analysis #3, will be analyzed to determine the effects on the existing structure. Any additional support and connections that are found to be required for both the photovoltaic panels and precast concrete panels will be designed and evaluated for cost and schedule impacts.

APPENDIX B: SPRING SEMESTER PRELIMINARY TIMETABLE


SENIOR THESIS FINAL
12/9/2010
1/28/2011
Milestone
1
2/18/2011
Milestone
2
3/4/2011
Milestone
3
3/25/2011
Milestone
4
Madison Smith
Construction Management
Prof. Parfitt
PROPOSED THESIS SEMESTER SCHEDULE
JANUARY 2011 - APRIL 2011
10-Jan-11
17-Jan-11
24-Jan-11
31-Jan-11
7-Feb-11
14-Feb-11
21-Feb-11
28-Feb-11
7-Mar-11
14-Mar-11
21-Mar-11
28-Mar-11
4-Apr-11
11-Apr-11
18-Apr-11
25-Apr-11
SENIOR BANQUET
FACULTY JURY PRESENTATIONS
FINAL REPORTS DUE
SPRING BREAK 2010
RECEIVE DATA FROM TURNER
PRELIMINARY MODULE DESIGN
CONTACT INDUSTRY PROFESSIONALS FOR CONSTRUCTION DATA
SCHEDULE, COST AND CONSTRUCTABILITY...
...ANALYSIS
SITE AND TRADE COORDINATION ANALYSIS
RESEARCH PV TECHNOLOGY
DESIGN CONSULTATION
PRELIMINARY SYSTEM DESIGN
ELECTRICAL ANALYSIS
STRUCTURAL ANALYSIS
FEASIBILTY...
...ANALYSIS
DESIGN CONSULTATION
PRELIMINARY SYSTEM DESIGN
STRUCTURAL ANALYSIS
INTERFACE ANALYSIS
SCHEDULE, COST, CONSTRUCTABILITY...
...ANALYSIS
RESEARCH LEED REQUIREMENTS
ANALYZE EXISTING POINTS
RESEARCH FEASIBILITY OF POINTS
COST AND...
...CONSTRUTABILITY ANALYSIS
REPORT/PRESENTAITON DEVELOPMENT
ANALYSIS #1: ELIMINATION OF SITE CONGESTION THROUGH THE USE OF PREFABRICATION
ANALYSIS #2: FEASIBILITY AND DESIGN STUDY FOR PHOTOVOLTAIC ENERGY SYSTEM
ANALYSIS #3: RE-DEVELOP CURTAINWALL SYSTEM
ANALYSIS #4: LEED CERTIFICATION