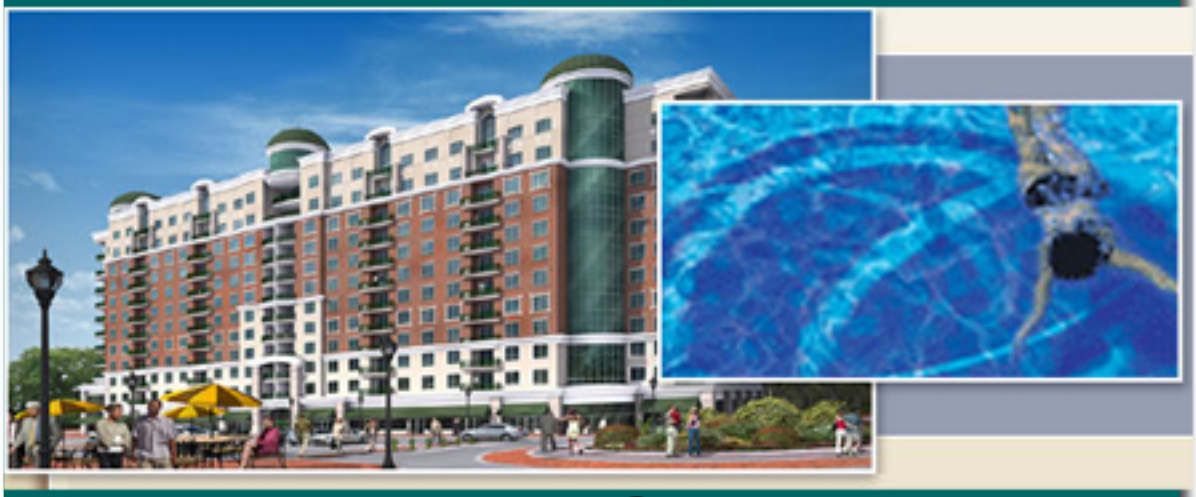
Proposal

Thesis Proposal



Grand View

AT ANNAPOLIS TOWNE CENTRE AT PAROLE

ANNAPOLIS, MD

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Friday, December 12, 2008

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Thesis Proposal

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Executive Summary

The major theme of my thesis will be the building façade and life cycle. GrandView's complex façade provides many aspects that can be analyzed and scrutinized in order to obtain better results in terms of constructability and future cost benefits. I intend to perform detailed research in order to determine the legitimacy of its energy saving potential with the materials and technology we have available to us today.

Critical Industry Issue: Economic Decline and Adaptation

Economic decline is today's most fearful topic. In this section of my thesis, the economic situation and how it is affecting the construction industry will be analyzed. The analysis will be specific to the Washington DC area and will only take into account large scale GC and CM firms. Specific topics will be discussed such as job placement, employment rate, and techniques that companies are employing to stay ahead in the industry. A breakdown of job market sectors will be developed in such a way that shows increasing and decreasing bid activity in the DC region. It is the goal of this section to establish a better understanding as to how the global economy affects working people in the construction industry.

Analysis 1: Re-Design of Current GFRC Cornice Bracket System

As part of my façade research and development, I will re-design the bracketing system for the cornices that surround the building to make them easier to install which will ultimately save time and money. The current technique of installation has had numerous problems that have delayed production and frustrated the workers. The connections between the building and cornice left little room for error and in many cases did not even match up with the units. A new connection detail and for the bracket system along with an installation technique will be developed and overall material and schedule analysis will be performed to determine the feasibility of construction. The structural breath of my thesis will analyze how the introduction of a new support system will affect the current structure as well as the cornices. All of these results will be processed to make a final recommendation of implementing the new design.

Analysis 2: Photovoltaic Glass Implementation

A museum that I visited while in Atlanta, Georgia gave me the idea of adding Photovoltaic glass panels in the building façade in order to harness electricity. It was extremely interesting and actually created a pleasing design when viewed from the inside. Although the PV glass is more expensive than regular glass, the initial investment should be trumped by the cost savings over time. The idea is to implement PV glass panels in the lower half of all the window units. By doing this, a large collection area will be created. An analysis of initial cost versus cost savings will be carried out. The mechanical breadth study will analyze the energy production per year that these panels will create. After taking all of these factors into consideration, I will make a final decision and recommendation for the energy-saving system.

Analysis 3: Substitute High End Thermal Windows

The idea of having a high end thermal and moisture skin on a building with regular windows did not make any sense at the time of my walkthrough of GrandView. Therefore, a systematic analysis of how adding high end thermal windows will be carried out. In this analysis, initial investment, energy savings, and life cycle cost will be looked at. A mechanical breadth consisting of thermal calculations of the windows will serve as one of three breadths. It is the goal that adding these windows will save money in relation to the long life cycle of the building.

Weight Matrix and Workload

A weight matrix depicting areas of concentration within the four research categories is shown at the end of the proposal. The greatest emphasis will be put on cornice design and photovoltaic glass panels because these are the areas of highest interest and also allow for the greatest research in breadth assignments. Also included is a general breakdown of what research will be done in any given month. This will help me to stay on track and achieve my set goals.

Critical Industry: Declining Economy and Adaptation

Problem Statement:

The idea for this topic came to me during a breakout discussion of the 2008 PACE Roundtable conference. During this discussion, the declining economy and how it is currently affecting the construction industry was discussed in depth. Company representatives were saying that they needed to broaden their scope of work if one sector was failing and find new ways to increase profit on the projects they already did have. Adaptation in this industry is the paramount characteristic that sets companies apart from one another.

The economy is directly correlated to my project in that residential housing is at an all time low. Because GrandView falls under the private sector of the construction industry, the economy has a huge impact on how money is raised and what the building will eventually turn out to be; whether it be an aggressive value engineering plan, cut-backs on material, or intense scheduling that saves on time and logistics. Grandview has been having trouble filling the apartments. By the time it is done, it is quite possible that many of the units will be unoccupied. Knowing this makes the owner stingier with money and hence production is affected.

Goals:

The intention of this portion of my thesis presentation is to look at the growing economic decline in the Washington, DC area and analyze how it is affecting construction companies. A comparison between Washington, DC and other areas of the country will be executed by means of interviews with company contacts, construction magazines, and short surveys. The comparison will only take into account large scale GC and CM firms. I understand that smaller scale companies are the ones that are being hit the hardest right now. However, in order to maintain focus on such a broad category, it is necessary that only one section of the industry be analyzed. Furthermore, only specific aspects of each company will be examined. I would like to come up with percentages that reflect what types of jobs companies are going after now and in what sectors, the employment those companies are now resorting too, as well as what techniques they are implementing in order to make sure that their company has a successful future.

Research Steps:

1. Make a list of 5 to 6 large companies in the DC area to contact with relevant questions
2. Use peers in order to make necessary contacts
3. Conduct phone interviews with upper management employees
4. Send out surveys to be completed by lower level employees
5. Research economic impact in Engineering and Management Magazines (ENR, ect)
6. Collect information from peers about where they are looking to work and why
7. Collect cost data and compare to economic charts
8. Compile all findings in a logical and flowing manner

Tools:

a. ENR Magazine
b. Construction and economic polls on the internet
c. Direct phone conversations with company representatives
d. Current geographical statistics

Expected Outcome:

I expect to find that there is indeed a slowing in the construction industry that is directly affecting job placement and shrinking the area of projected growth. New techniques in both management and construction will be found that help firms save money and target new upcoming sectors that they previously may have not been interested in. Insight in both bidding for and obtaining jobs will hopefully be gained through phone interviews with various companies. Finally, an overall perspective of how the industry is adapting in these harsh times will be discussed.

Analysis 1: Re-Design Of Cornice Bracket System

Breadth: *Structural* *(Red indicates areas of Breadth)*

Problem Statement:

During my site visit to GrandView I noticed all kinds of broken and misplaced cornices scattered throughout the project. When I asked about them, I was told that they were the biggest pain of the whole entire project. The GFRC (Glass Fiber Reinforced Concrete) Cornices had been prefabricated four hours away by a small company which then had to be shipped and installed onsite by way of pre-installed brackets in the façade. The pain was matching each piece with the proper hanger and making sure it lined up. The problem was that they rarely ever lined up and small adjustments had to be made by the laborers to compensate for the incompatibility. This hassle was coupled with the fact that they were incredibly hard to install as it is. Time and money was lost through intense labor and overtime hours. The suggestion that having a better bracket system which would allow for easy adjustment and installation would have drastically reduced the amount of time it took to install them and ultimately would have saved money.

Goals:

The overall goal is to re-resign a better bracket system that could be installed in the cornices during the preconstruction phase. A separate system would be designed that would attach to the building structure and provide a stable locking mechanism. The overall idea is to come up with a 'snap-on' installation system that allows for easy installation and adjustment. This analysis would deal with the impacts that a system of this sort would have on the building structure and façade as well as how well it would support the cornices themselves.

A cost evaluation of the addition of these brackets by the cornice manufacturer will be determined along with an estimated cost of the manufacturing of the brackets. In order to do this, a simple quote would be sent to multiple companies asking for a manufacturing cost. Although it might be difficult to determine the labor time required to install the proposed cornices, I will consult with laborers on site and determine what the estimated time lost on fixing mistakes that the current system produced. By doing this, it is my hope that a somewhat accurate installation cost could be determined.

The use of AutoCAD and structural analysis software would be utilized in the design process.

Overall, the design process, structural impact, material cost, and time impact will all be analyzed and compared to the current technique and materials used.

Research Steps:

1. Research the existing bracketing system
2. Interview on-site labor workers and ask what could be improved
3. Contact cornice manufacturer to acquire production process
4. Design new system using AutoCAD 3D
5. Calculate material cost of new brackets
6. Determine structural impact the new system would have on the building
7. Develop an installation procedure
8. Calculate time and cost impact in the installation of the cornices
9. Make an educated recommendation of the implementation of the new system and its feasibility

Tools:

a. RS Means 2009 Edition
b. AutoCAD 3D
c. Revit and 3D Studio
d. Structural Analysis Software
e. Pen and Paper Calculations
f. Gilbane Building Company
g. Steel Pricing Manuals
h. Construction Documents
i. Shop Drawings

Expected Outcome:

Through a quick pre-analysis and past experiences of labor workers, a solid bracket design should yield results that make installation faster and save money. I hope to design a system in AutoCAD 3D that is able to be integrated into the existing structure with minimal effort while still support the cornices with the same or better structural integrity. A 3D video of the installation will be developed using AutoCAD 3D and 3D studio and will be shown during the presentation as a visual aid.

Analysis 2: Photovoltaic Glass Implementation

Breadth: *Mechanical / Electrical* *(Red indicates areas of Breadth)*

Problem Statement:

Everywhere we turn in today's economy it seems that energy is driving all that we do. Between gas prices and electric bills, the cost of energy consumption is overwhelming. There are many technologies out there waiting to be tapped into such as the harnessing of the Sun's power. The use of photovoltaic glass is not new to the industry, just rare. If PV glass were implemented into the window system of GrandView, tenant's bills would be reduced and therefore money would be saved. Although PV glass is more expensive in the initial investment, I believe that the owners/tenants would benefit tremendously in the long run.

GrandView provides large curved glass facades at each corner and the center of the building that would be ideal for placement of PV glass. Since it is a full façade, mirrored glass was needed anyway to cover the spaces between floors. Also, the installed windows could be equipped with foot level glass that would not obstruct views from the apartments and provide the necessary area to collect energy.

*If there is enough time, a brief look at the impact of putting PV panels on the roof will also be carried out. The roof of GrandView is for the most part, unused. There is only a tiny portion of the deck that is used for the social club. The rest is blocked from view. Plus, the glass cylinders with the cupola domes would provide excellent housing for battery storage since they are not in use and empty.

Goals:

It is my intention to determine the feasibility, advantages and disadvantages of implementing photovoltaic glass into the glass façade structure. A quantification of the amount of energy that a standard PV glass panel will be obtained and then translated into power generation that the building could provide as a whole. The analysis will cover the initial costs of production as well as the energy savings and utility costs that would be accrued over a longer period of time.

Research Steps:

1. Research new technologies in PV glass along with their advantages and disadvantages
2. Determine the amount of usable glass area in the window panels and glass façade
3. Compare prices of current glass being used to PV glass panel systems
4. Calculate energy savings from implementation of PV glass
5. Determine life cycle costs
6. Determine if a schedule impact would occur due to the addition of PV glass
7. Show the cost analysis comparison of having the glass pre-fabricated or installed on-site
8. Make an educated recommendation of the implementation of PV glass and its feasibility

Tools:

a. RS Means 2009 Edition
b. National Renewable Energy Laboratory
c. Solarsave Glass
d. Glass on Web Manual
e. Energy 10 software
f. Gilbane Building Company
g. Calls to solar panel companies
h. Bausum and Duckett Electric Company

Expected Outcome:

It is my hope that the implementation of PV glass panels in GrandView Apartment Complex will reduce the energy consumption by the tenants in the long term operation of the building. It is understood that there will be a greater upfront cost of the addition of the panels. However, through analysis, I hope to find that the long term benefits will outweigh the short-term investment and ultimately save the tenants and owner money.

Analysis 3: Thermal Windows

Breadth: *Mechanical / Life Cycle Costs* *(Red indicates areas of Breadth)*

Problem Statement:

Great emphasis was put into the envelope of Grandview regarding moisture and thermal protection. By adding the Henry Air/Moisture Barrier system, the building's envelope was drastically improved compared to the industry standard moisture and insulation protection. I posed the question, "If the skin of the building is so advanced, what type of windows does it have?" The answer given was standard single pane units. Thinking about this I realized that heat in a building is mainly conducted through the windows. It would be a poor design to put such a high end skin on it just to have it neutralized by poor performing windows. Therefore, it would be advantageous to the life of the building as well as to the owner to install low thermal conducive windows in the building to keep heating and cooling costs down. It has been found that windows and doors are typically responsible for about 40 percent of a building's heating bill.

Goals:

The goal of this analysis is to substitute the standard windows that are currently on the building with high end thermal windows that will reduce power consumption of the building. Research will be performed within the top window manufacturer catalogs and a desirable window unit will be selected that is compatible with the current design as to not comprehend any structural aspects of the building. It is my intent to determine whether or not the implementation of high end thermal windows will reduce the overall operating cost of the building through a long period of time. A thermal analysis will be performed for the mechanical breadth study.

- The period of time defined as 'long' is still to be determined.

Research Steps:

1. Research different types of Thermal windows available
2. Consult construction documents for compatibility
3. Select windows and obtain relevant thermal properties
4. Calculate thermal retention of new and existing windows
5. Apply values to overall building façade area
6. Compare savings and life cycle cost of proposed windows
7. Make an educated recommendation of the implementation of thermal windows its feasibility

Tools:

a. RS Means 2009 Edition
b. Thermodynamics manuals
c. Thermal Window manufacture catalogs
d. Calls to glass manufactures
e. Shop Drawings
f. Construction Documents
g. Gilbane
h. Emmittsburg Glass Company
i. Krick Plumbing and Heating

Expected Outcome:

The expected outcome of this analysis will be similar to the addition of PV glass panels. It will have a higher initial cost but will hopefully pay off in the long run. However, I do believe that the addition of thermal windows will have less of an impact than the addition of the PV glass panels. It makes the most sense that the use of a high end thermal and moisture skin barrier should be coupled with high end thermal windows. The savings that the addition of such windows will have will most likely be similar to the initial cost. For this reason, less emphasis will be put into this section of analysis.

Conclusion

The final proposal indicates that a structural analysis and re-design of a key bracket system for the cornices will have an impact on the labor and ease of installation. This in turn will save time and money. A mechanical and electrical analysis of adding photovoltaic glass panels to the façade of the building will show that in the long run, such an addition would be beneficial and save money in electric consumption of the building. The substitution of the regular window units for higher thermal protection windows will save on heating and cooling and help the owner and tenants save on gas and electric bills. Finally, a look at how the current economy will show how companies are adapting to changing economic pressures and how this affects job placement and building sectors.

Overall, the analysis reflect an emphasis on façade manipulation and the effects those changes have on the life cycle saving cost of the building.

Weight Matrix

The following is a weight matrix that indicates that level of emphasis put on each of the four areas of research in my senior thesis.

Description	Research	Value Engineering	Construction Rev	Schedule Reduction	Total
Economic Decline	10%	5%	10%	-	25%
Analysis 1: Cornice Redesign	5%	10%	5%	10%	30%
Analysis 2: PV Panels	5%	10%	5%	5%	25%
Analysis 3: Thermal Windows	5%	5%	5%	5%	20%
Total	25%	30%	20%	25%	100%

Greatest emphasis will be put on Cornice Re-design and PV Glass implementation because these interest me the most and I feel that the most work will need to be done in these areas.

Appendix A: Breadth Topics

Breadth 1: Mechanical/Electrical and Life Cycle Cost of PV Glass Panels

Solar panels are becoming thinner as well as more affordable. Implementation of such panels is the future of the building industry. A detailed analysis of the potential energy production that GrandView will yield with the addition of such PV glass panels on its façade will be carried out. Hand calculations using square foot area and acquired energy production data will be the main source of the breadth. Hopefully, with the help of my peers, I may be able to use energy calculation software to achieve more specific data. Once the information is obtained, it will be used to calculate life cycle costs and potential savings for the building.

Breadth 2: Structural Impact of Re-Designed Cornice Bracket System

Adding a new façade connection system puts new loads on the superstructure and therefore needs to be analyzed in order to determine if it is feasible or not. Once the weight and detail of the connections are produced, a detailed structural takeoff will be done in order to make sure that the cornices will be able to be supported by the brackets themselves and also if the superstructure will allow for these changes. It is unlikely that a small change in the structure would prohibit such actions but it would still be interesting to determine what impact it would have, no matter how slight. The main source of calculation will most likely be by hand. However, loading calculation software will also be used for checking accuracy.

Breadth 3: Thermal Calculations Associated with Implemented Thermal Windows

In this breadth analysis thermal barriers will be analyzed in both the existing and proposed thermal windows. Heat loss throughout a year will be determined and then applied to the cost of operation . This is considered an extra breadth and may or may not be included in my final report.

Appendix B: Workload Breakdown

See Following Pages for a breakdown of activities in calendar form

January

2009

Mon	Tue	Wed	Thu	Fri	Sat	Sun
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Industry: Research and Writing Interview Questions
Come up with short surveys

Analysis 1: Research Bracket System
Send Out Labor Survey for Installation

Analysis 1: Contact Cornice Manufacturer
Start Design of New System

Analysis 1: Begin Breadth Calculations

Analysis 1: Procedure and Cost Impact Analysis

February

2009

Mon	Tue	Wed	Thu	Fri	Sat	Sun
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

Industry: Send Surveys Out

Analysis 2: Begin PV Research

Analysis 2: Façade Calculations and Cost

Analysis 2: Breadth Energy Savings Calculations and Life Cycle

Analysis 3: Thermal Windows Research

March 2009

Mon	Tue	Wed	Thu	Fri	Sat	Sun
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Analysis 3: Develop Method For Calculating Thermal Loads

Industry: Receive Surveys

Analysis 3: Continue Thermal Window Analysis

SPRING BREAK!

Compile Breadth Assignments

Miscellaneous Catch up Work Time

April 2009

Mon	Tue	Wed	Thu	Fri	Sat	Sun
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Industry: Compile Economic Data

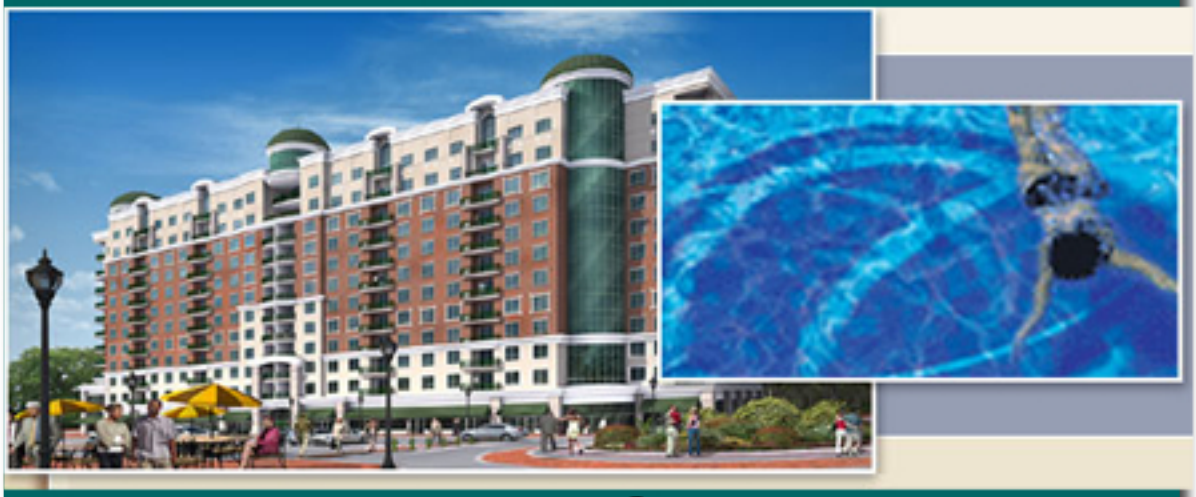
Miscellaneous Catch up Work Time

Put Presentation Together

Practice Presentation

Breadth

Breadth Assignments



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