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Thesis Final Proposal

George Mason University PE Building

Renovation & Expansion

Fairfax, Virginia



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Executive Summary

In this final proposal, the four analysis topics for the depth part of my thesis and the two analysis topics for the breadth part of my thesis are discussed. The depth portion of my thesis includes the following topics:

- Best delivery method for University projects
- Schedule acceleration using two cranes
- Alternate site logistics
- Energy & the economy

As mentioned in previous technical assignments, the selected delivery method for GMU's PE Building hindered efficiency and relationships on the job. This was the ultimate factor in selecting this as a research topic. Since time is money in the construction industry, trying to accelerate the schedule by erecting both steel sequences simultaneously seems like a viable option. Going along with this topic, the site logistics would be altered due to the use of two cranes. So research into an efficient site plan to accommodate this idea is necessary for it to run smoothly. A concerning industry issue for American business is the increase in use of foreign products. So this topic has been selected to research what American businesses need to do to compete with these incoming products.

The breadth portion of my thesis includes a look into my understanding of the mechanical and structural options within our major. I have chosen to analyze the following areas on GMU's PE Building regarding these options:

- Changing from a sheet metal duct system to a fabric duct system in the gymnasiums
- Reducing the roof thickness due to decreased loading from the fabric duct system

Fabric ducts systems require much less installation time and effort. They are also very cost efficient. These facts led me to research the cost savings that could be associated with this change. Going along with this change, using fabric duct would also decrease the design loading to the roof system since it is much lighter than sheet metal. In realizing this, I felt that researching this further to see if the roofing system could be thinned out was a viable option. This would result in a cost savings as well from reduced material usage.

Analysis Descriptions

In this section, the three construction management analyses are discussed as well as the critical industry issue. These are the topics I plan to use for the depth part of my thesis proposal.

University Projects Delivery Method

Problem/Opportunity

The delivery method chosen (CM at Risk) may not have been the best choice. This approach may not have been the best choice given that the George Mason staff as well as the Gilbane staff were not used to using this method. As mentioned in technical assignment 1, George Mason is used to working with general contractors not construction management firms. The CM at Risk approach was used as a hybrid between the two methods, which in turn created an “interesting relationship” between the two parties. Further research into what delivery methods work best for university projects would be beneficial to improving relationships between the owner and construction firm.

Research Steps

- Conduct my own independent research by reading various articles about current and past construction projects at George Mason University and The Pennsylvania State University
- Personally interview one or two industry members that have experience working for jobs on which the Owner is a university.
- Handout a brief survey to several construction industry parties that are able to take the time to answer a few questions about their experiences and opinions.

Required Sources

A number of sources will be required to successfully research this topic. The first and most accessible are articles from various construction magazines. I intend to find a couple articles that I can compare to my research and collect information about the overall project schedule / delivery methods. The other sources that this research will require is a few people from the construction industry that have enough experience that they will be able to contribute valuable feedback. I plan to speak to one or two members from the Gilbane project team working on the PE Building at George Mason University. I will also use a couple contacts at The Pennsylvania State University to interview / survey people regarding recent projects on campus.

Sample Survey Questions

- What are some of the university project(s) that you have had experience working on?
- What kinds of project delivery methods (i.e. CM at Risk, Multiple Prime, etc.) were chosen for each of these projects? If these methods were chosen beforehand for a reason, please list the reasons.
- In your opinion, what was the best thing about this kind of project delivery method?
- What was the worst thing about this kind of project delivery method?
- How much of a role did the Owner (the university) play in the project?
- If they played a large role, did you feel that they had too much control over the project?
- Lastly, do you think the project delivery method (especially looking at the relationships with the owner and other contractors) plays an important role in the success / efficiency of the project?

Expected Outcome

I expect to find the best project delivery method that should be used for University projects like George Mason. The delivery method must promote open communication between most parties as to increase project efficiency.

Steel Erection Using Two Cranes

Problem/Opportunity:

The steel sequence for George Mason's PE Building was split into two sequences. Since this project was already behind schedule, I plan on analyzing the option of using two cranes to erect the steel sequences simultaneously. In doing this, the schedule would be accelerated.

Research Steps

- Obtain costs for crane and manpower used to erect the steel
- Calculate costs and durations of using two cranes and the added manpower
- Analyze how this would affect other trades
- Compare the added cost vs. schedule savings

Required Sources

The sources required to perform an in depth analysis of this will be a couple people from the Gilbane staff and possibly RS Means. The Gilbane staff should be able to provide me with the crane and manpower costs or a contact to get this information. If not, I will use RS Means to obtain the closest comparison possible to the crane size that was used.

Expected Outcome

I expect to show that accelerating the schedule by using two cranes to erect both steel sequences simultaneously would result in an overall cost savings for the project.

Alternative Site Logistics

Problem/Opportunity

The use of two cranes to erect the steel would require a different site logistics plan than that for only one crane. Additional staging space would be needed. Other items may need to be relocated as well to avoid the crane radius of the second crane. I plan on showing how implementing two cranes changes the original plans and come up with an efficient site plan to accommodate this change.

Research Steps

- Obtain original site plans for the steel erection sequences
- Analyze the effects of adding a second crane simultaneously
- Change the site plan to accommodate two cranes efficiently

Required Sources

The required sources needed to perform an in depth analysis of this topic will be a couple people from the Gilbane staff. I would rely on them to provide me with their original site plans made for the two steel sequences. If I'm not able to obtain these, I would use the site plans made in technical assignment two and elaborate on them.

Expected Outcome

I expect to show how the addition of another crane to erect the steel sequences simultaneously would affect the original site plans as well as show that the site while being relatively small, could be organized to accommodate the two cranes and not hinder the rest of the work flow.

Critical Industry Issue – Energy & the Economy

Problem/Opportunity

The economy in its current state has taken its toll on the construction industry. Companies are going under and work is becoming hard to find. One trend that has become more prevalent during these tough economic times is the use of more foreign materials and products. The increase is due to these products being more efficient. With this being the case, it is taking away even more work away from U.S. companies and suppliers. I plan on studying what foreign materials and products have become more prevalent and why.

Research Goals

My goals for doing the research on this topic are to find out what American suppliers and companies need to do to compete/keep up with the foreign technologies that are starting to take over.

Research Audience

The audience for this topic will be American construction companies that make/supply the same products as the foreign products that are becoming more popular.

Beneficiaries

The American construction companies will benefit by being provided a better understanding as to why the foreign products are more efficient and more popular. They will learn what foreign technologies are being implemented that maybe the American companies do not have at this point. The construction industry as whole would benefit by seeing the affects of what using foreign products has done to the American business as well as maybe a wakeup call that technology is a good thing and construction practices of the old are becoming obsolete. I would benefit from gaining an understanding of what new technologies are being used which would provide something to try and build on as I enter the workforce.

Research Steps

- Conduct literary research from reputable construction sources such as ENR, etc.
- Research specific foreign products that are being used and look for major differences from American products
- Interview industry experts to find out what effect foreign products has had on their business
- Summarize my research results and findings

Required Sources

The required sources needed to perform an in depth analysis on this topic will be literary engineering resources such as ENR magazine, the internet, and several industry members. ENR and other literary resources will provide what foreign products have become popular and why. The internet will be used to research the specific foreign products to look for differences from American products and what makes them more efficient. Several industry members would be needed to interview and find out what effects the increase in foreign products has had on their business and the construction industry as a whole.

Conclusions

In conclusion, I hope to demonstrate that I have learned the knowledge to become a well rounded engineer upon graduation with this proposal. While studying Architectural Engineering for the past five years I have been exposed to many different aspects of the construction industry. While my selected option is Construction Management, I hope to be able to show that I have the competencies required to communicate effectively and understand the other realms of the engineering world.

Appendix 1

Breadth Studies

In this section, the breadth topics are discussed. The related options are Mechanical and Structural.

Mechanical - Alternative Duct System

Problem/Opportunity

The Cage Gym and Linn Gym renovations included a new duct system. The New Venue Gym had a new duct system installed as well. These duct systems are standard sheet metal and flexible duct. I am proposing fabric duct systems be used in place of the sheet metal duct in the gymnasiums. Fabric duct systems require much less installation time and are more cost efficient. I plan on showing that switching to a fabric duct system would result in a cost and schedule savings.

Research Steps

- Determine quantity of duct in the three gyms
- Calculate costs for installed duct and components
- Find suitable fabric duct system for gymnasium applications
- Obtain prices for fabric duct system and required installation times
- Compare installed system vs. fabric duct system

Required Sources

The sources needed to perform an in depth analysis on this topic will be the Gilbane staff, internet, and a mechanical contractor. The Gilbane staff will be able to provide me with the costs of the duct systems for the gyms or a contact to get this information. The internet would be used to find a suitable fabric duct system to replace the installed system. A mechanical contractor that has experience installing these type of systems would be able to provide me with material costs and installation times.

Expected Outcome

I expect to be able to show that by switching the duct systems in the three gymnasiums to fabric duct, an overall cost savings and schedule savings would be the result.

Structural – Reducing the roof size

Problem/Opportunity

The roofing systems for the three gymnasiums are designed to support the sheet metal duct systems and their required components. By switching to the fabric duct systems in these areas, the roof loads would be significantly reduced. This could result in a thinner required roof system which in turn would result in a cost savings for the project.

Research Steps

- Determine the designed roof loading
- Determine the weight of the installed duct system and its components
- Determine the weight of the fabric duct system and its components
- Calculate the load difference between the two systems
- Calculate the new required roof loading and how much the roof can be reduced

Required Sources

The sources needed to perform an in depth analysis on this topic will include the architectural drawings, a mechanical contractor, and possibly a structural engineer. I will be able to find the designed roof loading in the architectural drawings. I will need the sizes of the installed ducts and their components off of the drawings as well. The weights for these materials will need to be obtained from either the drawings or from either of the engineers. I will need the input of a mechanical contractor to determine what kind of loads the fabric duct system will apply to the roof.

Expected Outcome

I expect to be able to show that implementing the fabric duct system in the gymnasiums will also result in a thinner required roof system due to less loading. This would result in a cost savings for the project.

Weight Matrix

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Analysis 1 - Delivery Method	10%	0%	0%	0%	10%
Analysis 2 - Schedule Acceleration	5%	0%	5%	30%	40%
Analysis 3 - Site Logistics	5%	10%	5%	0%	20%
Critical Issue - Energy & the Economy	10%	10%	10%	0%	30%
Total	30%	20%	20%	30%	100%