



Thesis Proposal

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Emily Couric Clinical Cancer Center Charlottesville, VA

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EXECUTIVE SUMMARY

The proposal below provides a detailed outline that will be used to guide research for the final thesis report for the Emily Couric Clinical Cancer Center project. The topics discussed include critical issues in the industry, value engineering, constructability review, and schedule reduction and/or acceleration. Four different analyses are provided to research in more detail and analyze the different topics.

ANALYSIS TOPIC 1: FAÇADE CONSTRUCTABILITY ANALYZED WITH BIM

Building Information Modeling (BIM) is becoming more and more popular in the industry but was not used on this building. This analysis will research and discover how using BIM technologies could have benefited the construction of the very complex façade that is designed for the cancer center.

ANALYSIS TOPIC 2: ALTERNATE FAÇADE

The cancer center has a very complex façade, with many different materials, which is hard to detail and comprehend all of the connections. A simpler façade will be considered which still meets the architectural design. The effects of a new façade on the structural system and mechanical system of the building will also be contemplated.

ANALYSIS TOPIC 3: FAÇADE SCHEDULE

Lean construction and prefabrication are also becoming more popular and critical in the construction industry and can provide schedule acceleration activities. Because the façade is so complex, prefabrication will be considered to prefabricate the difficult connections and small areas of the façade to accelerate the schedule and possibly complete the project early. This is possible because the façade is on the critical path, which could save money to both the owner and contractors.

ANALYSIS TOPIC 4: ALTERNATE FOUNDATION

A deep foundation system, drilled caissons, is designed for this building. This process is very time consuming and expensive. An alternate foundation system will be analyzed such as the Geopier system to determine the cost and schedule impacts. This alternate could save time and money because it is a simpler process and the drilling and placing of the piers is done all in one step.

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ANALYSIS TOPIC 1: FAÇADE CONSTRUCTABILITY ANALYZED WITH BIM

ISSUE

The façade on the Emily Couric Clinical Cancer Center is a very complex façade including brick, stone, a curtain wall, storefront, punch windows, and three different metals: white, copper, and stainless steel. The details for each of these connections are very hard to understand and difficult to comprehend. The constructability of this façade is very difficult and time consuming. Building Information Modeling (BIM) was not used on this project and may have made the understanding of the façade construction a much easier task.

METHODOLOGY

The first step to analyzing the façade with BIM technologies would be to create a very detailed model of the façade. The materials would need to be researched in order to understand the connections of each material to another.

A comparison of how long it took to detail and construct the façade will be made to how long it would take to detail and understand the connections using BIM technologies.

The materials also need to have similar properties to perform as well as the selected materials. Contacting the manufacturers will be necessary to understand the properties and connections of the different materials. After that is understood, an analysis of the pros and cons, along with the cost of each, will help to make a decision as to whether it would be a viable option. A survey could be developed to give to the different contractors to have their input on the materials and what would work best. It would also be possible to use BIM technology to assist in a number of ways including the visual aspects using a virtual mockup, the cost of the changes using quantity takeoff and the schedule implications using 4D modeling.

EXPECTED RESULTS

The goal of this analysis is to see how BIM could improve the process of the construction of the façade and hopefully result in a schedule reduction.

ANALYSIS TOPIC 2: ALTERNATE FAÇADE

ISSUE

As stated earlier this façade is a very complex façade and includes a variety of materials. Like most construction projects, the façade is on the critical path for the Emily Couric Clinical Cancer Center. It consumes a lot of time on the schedule because of the significant area of hand laid brick and the complicated connections of each different material to other materials. If a simpler façade was chosen, the project schedule could possibly be reduced and costs could be reduced.

METHODOLOGY

This analysis will focus on four different issues including the impact on the architecture, impact on schedule and costs, and possible impacts on the mechanical system.

First, research will have to be done to become aware of the different systems available on the market. One thing that will need to be kept in mind is to try and keep the same properties of the façade that was chosen. The architect designed the project in a specific way for a reason and the materials being selected as alternates should try to match the ones designed by the architect.

To fully understand the feasibility of the impact of an alternate system on the cost and schedule, pricing and durations will be needed. The information for the pricing, schedule durations, labor needs, and equipment needs will be obtained through conversations with the manufacturers of the systems.

An alternate façade will impact two other areas including the structural system and the mechanical system. It is likely the new system will have different loads on the building structure where it is attached and building ties will need to be analyzed to see if they are acceptable for the new façade along with a cost comparison. The mechanical system could be affected by the new façade because of the different thermal properties. The system may need to be resized which could have either a positive or negative impact. A life cycle cost analysis will be conducted to see if it is feasible to substitute the new façade.

EXPECTED RESULTS

The goal of this analysis is to propose a new façade system to reduce the cost and schedule while meeting the architectural needs of the building. The cost and schedule are expected to be reduced by decreasing the labor and complex details of the connections. A decrease in the schedule is to be expected because the new system will be less complicated and easier to understand which allows the construction of the façade to be faster.

ANALYSIS TOPIC 3: FAÇADE SCHEDULE

ISSUE

The façade is on the critical path for the cancer center and is very time consuming due to all of the construction being done on site. Prefabricating parts of the façade could save time and also reduce the number of connections needed to connect the different materials. This could impact the schedule tremendously by reducing the time spent on details and RFI's. Overall by panelizing the assembly of the façade, it could be a much efficient process compared to a stick built assembly.

METHODOLOGY

One topic that is common in the industry is the concept of prefabrication and lean construction. Research will be done on these topics to assist with reducing the façade schedule.

First, the materials will need to be identified and to show how they are connected. Grouping materials together for ease of construction will need to be determined. First, these materials could be grouped by fabricating the connections of the materials. Also, they could be grouped by breaking the façade into areas and fabricating manageable pieces of the façade. It is understood that different equipment will be required to install the façade in pieces. The cost impacts of this will need to be analyzed to determine if it is beneficial to prefabricate the façade. During the analysis of alternate facades, the facades should be considered based on their ability to be prefabricated.

A prefabrication company will need to be contacted and discuss the possibilities. Through conversations with the company, durations, costs and equipment needs can be identified. Another cost impact could be to rent the storage for the prefabricated units while they are being constructed.

EXPECTED RESULTS

Prefabricating units is expected to reduce the schedule of the façade which impacts the entire project since it is on the critical path. It should cost less because the pieces are created in a controlled environment and takes less time because everything will be within reach. A crane or scaffolding may not be needed to construct an area of the façade.

ANALYSIS TOPIC 4: ALTERNATE FOUNDATION SYSTEM

ISSUE

One of the most expensive and most important tasks on the critical path schedule is the foundation system. The system installed was a concrete caisson system that included a large number of caissons. This system is time consuming and expensive. First the holes need to be drilled to place the concrete for the piers. Then the concrete has to be placed and cured. Concrete is expensive, along with the machinery to drill the holes for the caissons. Research needs to be done to see if another system would be suitable for the project site conditions and building. A possible alternative system that could be considered is Geopiers.

METHODOLOGY

First, the soils would need to be studied from the geotechnical report to see if the soil is acceptable to construct Geopiers. Contacting a representative from the Geopier company allows the feasibility of Geopier construction to be discussed. Researching the process and different types of soils that Geopiers can be constructed in will allow me to assess whether or not Geopiers are acceptable.

If the system is feasible, the structural analysis will need to be done to determine the number of Geopiers needed. Geopiers could be cheaper and take less time. They require less labor compared to caissons therefore, the cost and schedule durations will need to be analyzed.

EXPECTED RESULTS

The goal of this analysis is to propose another value engineering idea to save money and time on the schedule. Geopiers are expected to be cheaper because the drilling and piers are being installed together, which would reduce the time needed to complete the foundation.

CONCLUSIONS

This thesis proposal is to provide four topics to analyze discussing four different concepts. These concepts include critical issue research, value engineering, constructability, and schedule reduction and/or acceleration. A weight matrix is provided below to show the amount of time planned for each topic and area.

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Façade Constructability	10	0	15	0	25
Alternate Façade	0	15	0	10	25
Façade Schedule	10	0	0	15	25
Alternate Foundation	0	10	5	10	25
Total	20	25	20	35	100

Table 1: Weight Matrix Representing Time Distribution on Analyses

APPENDIX A: BREADTH AREAS OF STUDY

MECHANICAL

A mechanical analysis will be performed within the alternate façade analysis (Analysis 2) to understand the effects of the façade on the mechanical system. An in depth analysis of the insulation impacts of the façade will be done along with the calculations of how it could impact the current mechanical system.

STRUCTURAL

There are two areas where the structural system can be analyzed. The first takes place in the alternate façade analysis (Analysis 2) of how the façade ties to the building. The structural ties will be evaluated and redesigned if necessary. The loads of the new façade will need to be determined and compared to the current loads of the façade.

The second place a structural analysis can be done is in the alternate foundation analysis (Analysis 4). The calculations of the load of the building will be determined to properly size an alternate foundation. The new foundation system will need to be sized to provide stability to the building.