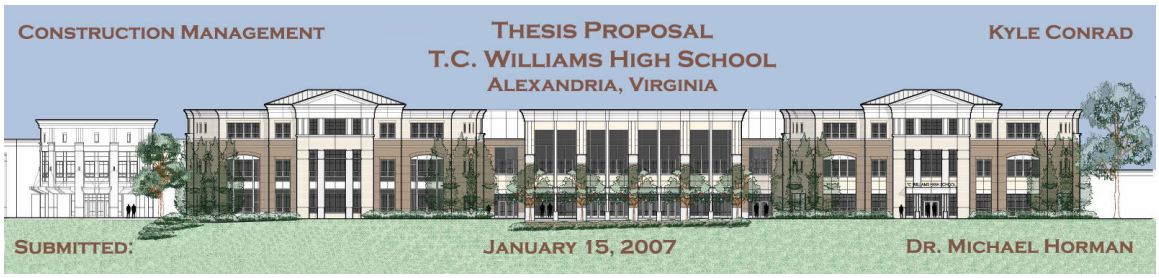

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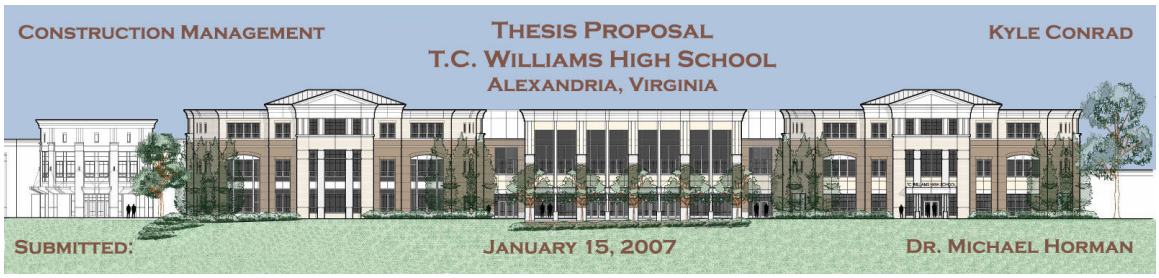


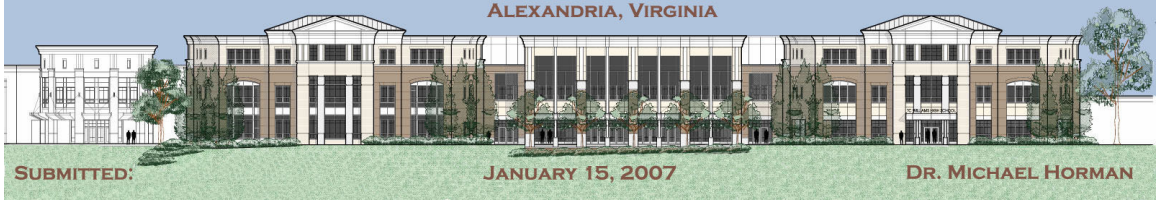
A. Executive Summary:

The thesis proposal details the technical analyses and research that will be performed during the Spring semester.

Acquiring an interest in virtual design, the decision was made to develop a Building Information Model of the T.C. Williams High School and research its effectiveness in value engineering, work sequencing, and site logistics practices. To promote the acceptance of BIM among practitioners in the construction industry, the model will be used to perform and illustrate the technical analyses, revealing a few of the advantages that modeling software has to offer.

The main focus of the analyses will be based on the research and selection of alternative building materials to the durable, yet less than aesthetically pleasing, Concrete Masonry Units [CMU]. The installation of CMU is extremely labor and time intensive and T.C. Williams has an extensive quantity of CMU load bearing and partition walls. Research will focus on the cost, schedule, and performance of the alternative materials in comparison to CMU. The remaining analyses carry the implementation of the alternative materials into the analysis and redesign of the gymnasium acoustics and sequencing of schedule activities to promote less congested site conditions.

The owner's expectations and wishes will weigh heavily in the recommendation for an alternative building material, if one proves to be a better value to the owner when compared to the previously designed CMU walls.



B. Critical Issues Research:

Effectiveness of Building Information Modeling [BIM] in Value Engineering [VE], Work Sequencing, and Site Logistics:

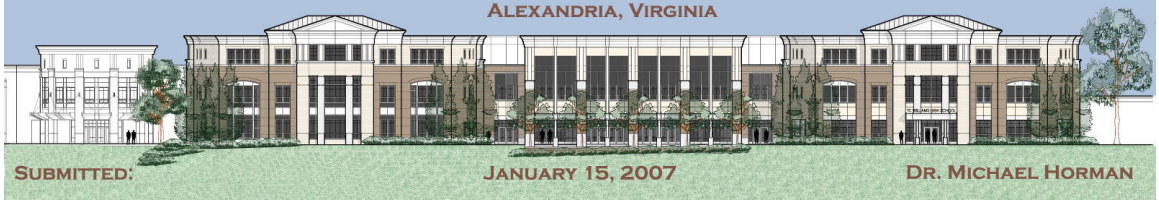
Issue:

The development of Building Information Modeling is slow to gain acceptance into the building construction industry. Recently, the General Services Administration [GSA] has mandated that all the new construction projects designed by its Public Building Services, starting in the 2007 fiscal year, are required to utilize BIM in the design phase of the project. After attending the discussion sessions at the 2006 PACE Roundtable and first hand interviews with prominent companies in the industry, a broad spectrum of company knowledge of BIM has become evident. A few companies have advanced to the point where the majority of their projects capitalize on BIM tools from start to finish while others acted as though they were hearing about BIM for the first time.

Until the benefits of BIM are clearly understood and accepted by industry professionals, hesitation to implement the process will exist and construction projects will continue to incur unnecessary rework costs.

Methods of Analysis:

Harnessing the knowledge of the Penn State Architectural Engineering faculty members, recent graduates, current students, and industry professionals interested in the development of the virtual design of construction projects, a building information model will be developed, with BIM software, in order to perform and present the technical analyses, inevitably expressing the effectiveness of BIM in these construction processes.



Expectations:

By researching, developing, and presenting the potential benefits of BIM in processes of value engineering, work sequencing, and site logistics, the exposure of industry members to the effectiveness of BIM in the construction of a project will aid in alleviating some of the hesitation of implementing BIM into their own projects. While the acceptance of BIM into the construction industry will not come overnight, graduating college students that have had experience with BIM pose to be the greatest source of opportunity for construction industry companies to enter into the new era of construction.

C. Analysis # 1: Alternative Building Materials to CMU

Issue:

School facilities commonly use CMU as a building material due to its durable characteristics and low material cost. However, the installation of CMU is extremely labor and time intensive and is less than aesthetically pleasing. Research into alternative building materials will be performed to obtain suitable selections for value engineering, constructability, and schedule reduction analyses. Value engineering is often confused with cost cutting. In actuality, VE aims to provide the owner with the best product for the amount of money allocated.

Methods of Analysis:

Materials will be analyzed against cost, schedule impacts, heat transfer, sustainability, and quality. Material costs are dependent on initial costs as well as schedule delays due to the availability of the material and labor. Transportation costs may increase the cost of the material if the manufacturer or supplier is removed from the area where the facility is being constructed. The erection speed of the material can have a significant impact on labor savings unless the subcontractors selected to

perform the work are unfamiliar with the material, resulting in a substantial learning curve. Cost savings can be acquired through a reduction of heating costs with materials that have a higher resistance to heat transfer. Since the Alexandria City Public Schools are interested in constructing a building that has a low impact on the environment, the sustainability of the materials will be considered. Interest will be expressed in materials that would improve the quality of the students' learning environment while maintaining the durability obtained with CMU.

BIM will be utilized to demonstrate the ease of performing an alteration to the original contracted model as well as quantity takes-offs for the estimate comparison between materials. Schedule impacts will also be considered and displayed in the model.

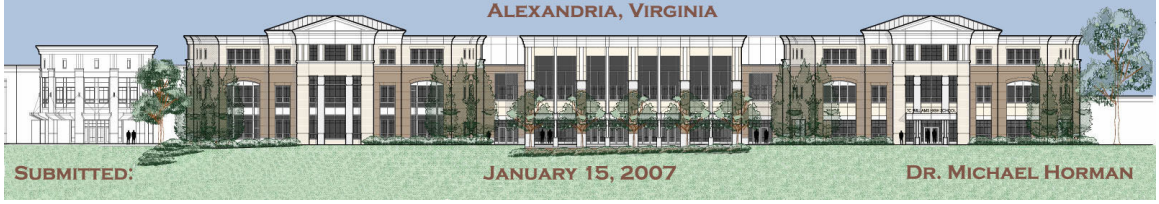
Expectations:

After a detailed investigation into alternative building material, a prefabricated material will be discovered that will promote an elegant, acoustically satisfying gymnasium in which school will be proud to host guests to the school for sporting events and assemblies. The redesigned facility will be within the original contracted budget of the facility. The materials will require less labor and time to erect and provide a more aesthetically pleasing environment to enhance the education of the students while maintaining the durability inherent in CMU.

D. Analysis # 2: Gymnasium Acoustics

Issue:

High quantities of sound absorbing materials were added to reduce the level of noise in the CMU enclosed space.



Methods of Analysis:

In continuation of the analysis performed researching alternative building materials, an acoustical analysis of the gymnasium will be performed. A new acoustical design will be developed and a detailed analysis of the room absorption will be calculated to acquire the optimum reverberation time for a high school gymnasium.

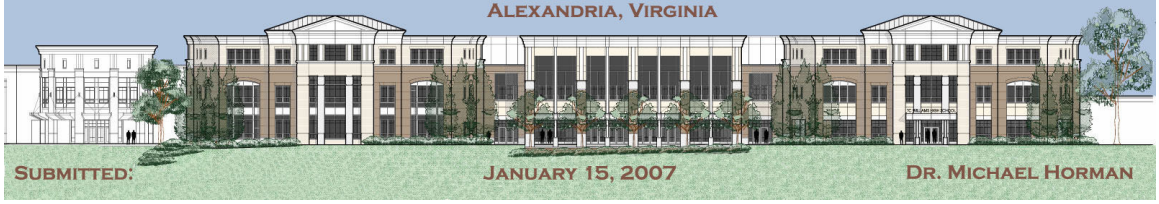
Expectations:

By selecting a material with sound absorbing characteristics, value would be added to the space with the potential of saving money by reducing the need for additional sound panels. However, a material with poorer absorption coefficients may require additional sound absorbing materials to reduce the reverberation time to the initial design, adding cost to the project.

E. Analysis # 3: Work Sequencing and Site Logistics

Issue:

Due to the extensive concrete block work in the gymnasium, automotive strip, kitchen, and auditorium the CMU wall construction begins in the early phases and continues long into the project duration. The material storage and staging area is in the far Southeastern corner of the site and all of the work is progressing in a Southeast to Northwest direction **(described in detail in Section C of Technical Assignment #2)**. The flow of work makes transportation of building materials toward the end of the project more congested.



Methods of Analysis:

Using the alternative building materials selected in analysis #1, the flow of work will be analyzed. BIM software will be used to develop and visualize the re-sequencing of schedule activities by detecting improper sequencing of work activities as the duration of the alternative building materials are integrated into the design of the facility.

Expectations:

With the quicker erection time of prefabricated materials, the work activities in the aforementioned areas will not be require to begin as early in the construction process. Successful re-sequencing of work activities will allow for easier access to the material storage and staging areas. Ultimately, the site congestion due to the transportation of building materials will be alleviated.

F. Weight Matrix:

During the course of the Spring 2007 semester, the technical analyses discussed above will be developed and incorporated with the Building Information Model. The predicted breakdown of my allocation of time and efforts has been provided in **Table 1** below.

DESCRIPTION	RESEARCH	VALUE ENGINEERING	CONSTRUCTABILITY REVIEW	SCHEDULE REDUCTION	TOTAL
Alternative Materials	10 %	10 %	5 %	10 %	35 %
Auditorium Acoustics	5 %	10 %	0 %	0 %	15 %
Sequencing & Site Logistics	0 %	5 %	10 %	5 %	20 %
BIM	5 %	10 %	5 %	10 %	30 %
Total	**20 %**	**35 %**	**20 %**	**25 %**	**100 %**

Table 1. Allocation of Time for the Spring 2007 Semester