State College Area High School

Revised Final Proposal for Spring Thesis Project

Senior Thesis

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Project Location: State College, PA

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Final Proposal

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Executive Summary

This proposal includes opportunities available for analysis on the State College Area High School project located in State College, Pennsylvania. These analyses will be performed to decrease costs, accelerate the schedule, and provide a better quality building for all the stakeholders. This proposal includes four different analyses and they are as follows; design of interior walls/partitions, existing roof design, SIP schedule for interior finishes on Pods A-D, and safety provisions during construction while school is in session. The Master Class, AE 570, will help in developing the SIP Schedule for PODs A-D. This class incorporated concepts of lean construction tools and how to minimize waste on a project.

Analysis 1: Design of Interior Walls/Partitions

Most of the interior walls are structural bearing CMU walls. In order to save time and money the interior walls should be redesigned to structural metal studs. This in turn will increase productivity of the structure and allow for cost and schedule savings. The mason trade will have a hard enough time keeping up with the exterior walls let alone the interior walls. In order to accelerate the schedule there needs to be a trade devoted to the interior structural walls.

Analysis 2: Roof Redesign

Saving time on this project is crucial. The existing one story roof will have to be redesigned due to the additional snow load it will be experiencing from the new adjacent 3 story building. The existing plan right now is to add in the same size joists next to the existing ones. This is a logistical problem, maneuvering them through the building and installing the joists in place. To save time the roof should be demolished and new steel joists should be set. This in turn would accelerate the activity and provide a better quality project in the long run.

Analysis 3: SIPS- Interior Finishes Pods A-D

The interior finishes for the State College Area High School project will play a very crucial part in the buildings completion. The schedule for the project cannot be deviated from because it has to meet the deadlines for the school calendar schedule. To ensure the deadlines are met, a SIP Schedule will be developed for the interior finishes in PODs A-D. This will accelerate the schedule and if any delays were accrued earlier in the project, they will be made up here.

Analysis 4: Safety Provisions during Construction while School is in Session

Construction safety is always a top concern on any project. This research into this critical issue involving safety will explore different safety provisions and mechanisms to ensure the jobsite is safe while working concurrently when school is in session Also, interviews will help aid what additional safety provisions and mechanisms need to be in place to ensure safety is at the top of the priority list.

Analysis 1: Design of Interior Walls/Partitions

Problem Identification

The interior & exterior walls are CMU bearing walls supporting steel joists. The CMU walls account for much of the masonry work on the job. The mason contractor will have the exterior and interior CMU walls and brick veneer to erect. The mason should only have to concentrate on the exterior CMU walls with brick veneer. From the research developed thus far CMU walls are lengthy tasks to construct and can be more costly to other alternatives like structural metal studs. If the masons could focus on the exterior walls while another contractor could focus on the interior walls then the structure would go up quicker.

Background Research

Initial background research consisted of how the CMU walls affected the budget and the timeframe it would take to erect the bearing CMU walls. Creating a wall with the same fire rating, structural performance, and acoustical performance can be created. Understanding material costs, crew sizes, productivity rates at which masons can construct a CMU wall will be valuable in determining whether or not it will be more efficient to change the wall. Researched potential solutions are discussed in the next section.

Potential Solutions

Project teams are always looking for the most efficient and cost effective way to do an activity. Structural metal studs would provide the project that opportunity. In saving costs and time the structural metal studs would allow the mason trade to focus on the exterior walls while the interior walls can be focus on by another sub-contractor

Analysis Steps

In order to complete this analysis the following items must be investigated and complete:

- Gather all the information on what would be affected on the interior wall change
- Determine material costs, crew sizes, and productivity rates for the CMU interior walls
- Calculate time and costs savings from new interior wall system
- Compare CMU bearing wall system to structural metal stud system

Expected Outcome

After the analysis it is expected that the effects of changing the interior wall system will benefit the cost and schedule of the project. Analysis 1 will show that the mason contractor will be able to construct the exterior walls faster while another trade contractor will focus on the interior walls. This will allow the joists to be placed earlier in the schedule leading to topping out earlier in the schedule.

Analysis 2: Roof Redesign

Problem Identification

The State College Area High School is comprised of demolition, renovation, and new construction. There are areas that will experience additional snow loads on the roof. The South Building is between 1 and 3 floors and where the 1st floor is being renovated the adjacent parts of the building are new construction which is 3 stories tall. While the old steel joists were not designed to carry additional snow load from the adjacent stories there needs to be additional joists install. Installing additional joists that are the same size will increase the load the roof can bear.

Background Research

Preliminary research on this issue was performed to understand the effects of installing additional steel joists. Installing these additional joists is necessary because of the additional load the roof will be experiencing in the winter. There is MEP work throughout the joists which would have to be taken down and reinstalled after new joists were added. There will be a lot of time spent maneuvering the new joists between the old ones.

Potential Solutions

Understanding the way the additional joists will be installed and the effects it will have on the MEP work will allow for a better understanding to develop a budget and schedule savings with the new system. Instead of taking the time to add additional joists in where the existing ones are now, it would save time to demolish the roof and add in new joists. This will also ensure the roof is constructed the correct way for the additional snow load the roof will be experiencing.

Analysis Steps

In order to complete this analysis the following items must be investigated and complete:

- Analyze existing roof design
- Collect crew sizes and productivity rates required for demolition of existing roof and installation of new steel joists
- Determine costs to demolish roof and new steel joists
- Identify schedule savings
- Compare two alternative methods

Expected Outcome

The research topic is expected to show that instead of adding additional joists to the roof structure, it would save time to demolish the roof and install larger joists. This in turn will cost more money to demolish the roof and apply new rubber roofing. Construction a new roof will allow the project team to maintain the schedule and update areas that need it.

Analysis 3: SIPS- Interior Finishes Pods A-D

Problem Identification

Interior finishes is where a project can pick up lost time. Creating a schedule that is effective and efficient will allow the interior finishes to flow in a sequence with less errors and a better quality of work. Construction projects always face delays, whether it is from unforeseen conditions or from contractor errors. Unforeseen conditions could happen in this project because of the demolition, renovation, and new construction all in the same building. This will cause the schedule to be delayed and lengthen. In order to prepare for these delays there needs to be an Short Interval Production Schedule developed for the interior trades, where time can be made up. Since this is a school project, the schedule has to align with the school calendar so the students are not disrupted in the middle of the school year.

Background Research

Preliminary background research on Short Interval Production Scheduling was performed to ensure that State College Area High School was a good candidate for this type of scheduling. In order for SIPS to be advantageous a building must have repetitive elements that can be implemented into the schedule. Also the project team has to be willing to make the SIPS work during construction. Other entities that are needed to make this work are the general contractor, subcontractors, suppliers, and laborers working on the project.

The analysis will investigate which trades will be able to work in the same room with limited amount of congestion as possible. In order to do this, the trades' crew sizes and productivity rates will have to be evaluated. Furthermore, sequencing different trades that are able to work in the same area but not conflict with each other will be very important. Trades that can work together but not impede on each other will be able to be in the same space.

Potential Solutions

After additional research on similar situations using SIPS and deciding which trades will work effectively and efficiently together, a SIP Schedule will be generated. This schedule will sequence trades room to room in an organized matter. The trades that can work together will work clockwise around the room until it is finished allowing the next trades to move in. This type of schedule will increase productivity resulting in schedule savings.

Analysis Steps

In order to complete this analysis the following items must be investigated and complete:

- Research prior projects that developed a SIP Schedule for the same type of project
- Research what trades will be involved in the finishing process
- Examine crew sizes and productivity rates
- Investigate which trades can work together in a room with minimal disruption
- Develop a Short Interval Production Schedule

Expected Outcome

Following this analysis the expected outcome is to develop a Short Interval Production Schedule with logically thought out sequence where a room can be finish in the most efficient matter. The result from creating this SIP Schedule will be schedule savings with potential cost savings for the general contractor and sub- contractor.

Analysis 4: Safety Provisions during Construction while School is in Session

Problem Identification

The construction industry is known as one of the most dangerous and deadliest industries you can work in. Many industry members say safety is their main priority, but can a company actually prove that safety is at the top of their priority list. While construction takes place in an existing building where occupants are still using the space during construction, are there safety provisions that exist to ensure the safety of the building occupants and the workers in the building. Building occupants need to be just as aware of the workers as do the workers need to be aware of the building occupants. For a school project there needs to be safety provisions in place for the workers working on the project to ensure they are safe to be around kids. Students also need to understand the dangers that are around them. Having safety provisions for the students and making them aware of the situation around them will allow for a more knowledgeable occupant while working in the same space.

Research Goals

The research goals of this analysis will entail what safety provisions already exist. What mechanisms are in place when hiring a worker to ensure he or she is safe to be on the job. Technology is evolving throughout the industry every day. Another research goal is determining how technology can be used in the industry today to improve safety and making absent minded kids more aware of their surroundings. The end goal is to determine what additional provisions need to exists to ensure the safest site possible.

Execution

In order to complete this analysis the following items must be investigated and complete:

- Research safety provisions and mechanisms that exist in the industry
- After researching what exist in the industry there will be interviews conducted with safety experts, students, teachers, project team members, and workers on what they believe needs to happen in the industry to create a safer environment
- Analyze what provisions need to be active in the industry today and present them to the State College Area High School project team to implement

Final Proposal

Research Questions

Questions:

- What critical safety issues aids in school activities around construction?
- What are the safety risks on the worker and student side of construction?
- How is new construction different from renovation and demolition?
- How can technology be incorporated into creating a safer environment on the jobsite?
- Other items: public safety and absent minded kids

Conclusions

The analyses in this proposal are intended to provide opportunities for improvement on the State College Area High School project. Each analysis will be performed to decrease costs, accelerate the schedule, and provide a better quality building for all the stakeholders. The schedule acceleration and cost savings are the main ideas and driving factors behind each analysis. Due to the project being publicly funded it is imperative to use the public's money in the most efficient matter possible. Also since the schedule has to stay on track with the school calendar, it is very important to foresee where time can be saved on the project. Thorough investigations and analyzes will be performed over the period of the 2016 Spring Semester to determine their applicability as solutions for the State College Area High School.

Appendix A: Breadth Studies

Along with the four construction management analyses that are proposed in this report, there is an additional requirement to demonstrate lessons learned through the Architectural Engineering curriculum. To accomplish this requirement it is necessary to choose breadths outside of the construction option. For this thesis project those two breadths will consist of an acoustical performance breadth and a structural breadth.

Analysis 1: Acoustical Performance Breadth

An acoustical breadth will be performed to determine the acoustical implications resulting from the redesigned interior walls. The new structural metal stud system will need additional materials to ensure the STC rating is achieved between classrooms. One spot in particular is the interior wall partition between the band room and music classroom. The necessary STC value will be determine and the wall will be design to the STC rating.

Analysis 2: Structural Breadth

A structural breadth will be performed to determine the new steel joist needed in the roof redesign. The existing one story roof needs to be redesigned because of the additional snow load it will be experiencing. Due to the additional weight, a new steel joists will need to be determine. The additional weight the roof will be experiencing will be determined by how much drift load it will receive from the adjacent 3 story roof.

Appendix B: Spring 2016 Semester Projected Time Line

Spring 2016 Semester Projected Time Line
January 2016- April 2016

State College Area High School

Bryce Burkentine- Construction Management
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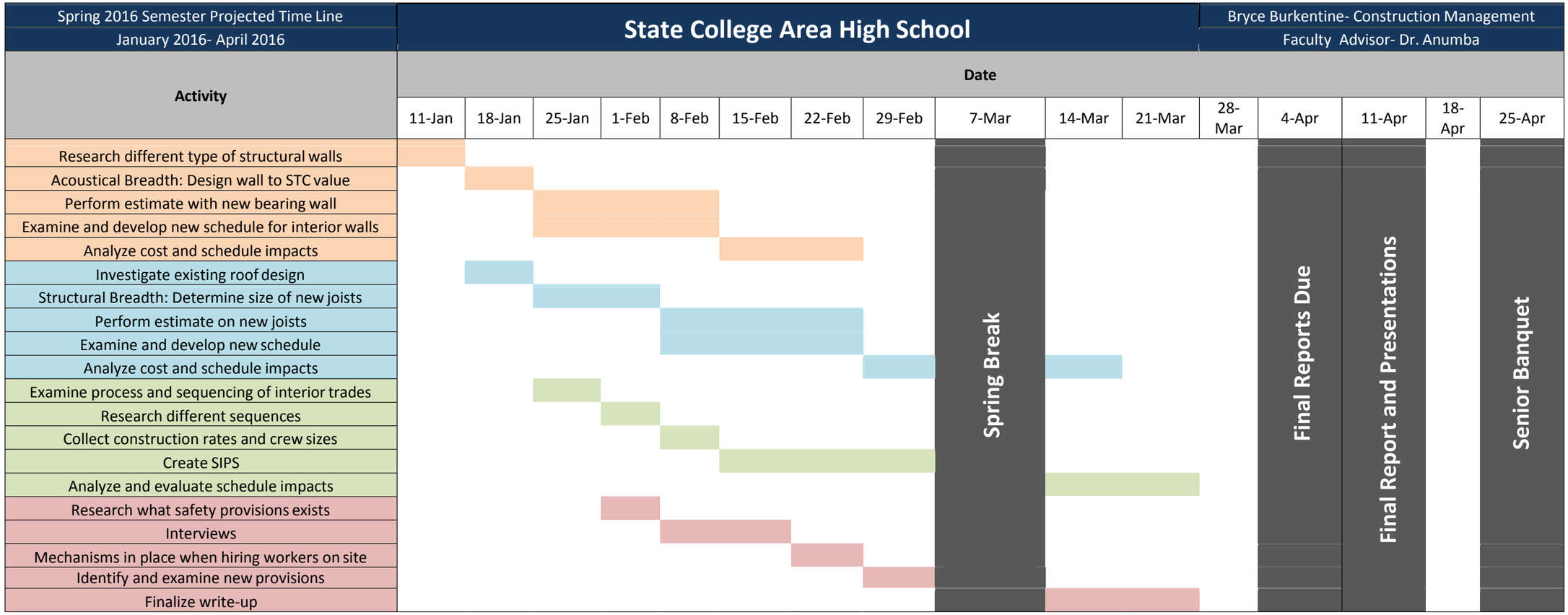

Analysis Description
Analysis 1: Design of Interior Walls/Partitions
Analysis 2: Existing Roof Design
Analysis 3: SIPS-Interior Finishes Pod A-D
Analysis 4: Safety Provisions during Construction while School is in Session