Wilkes-Barre/Scranton International Airport
Avoca, Pennsylvania
Final Thesis Proposal
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Executive Summary

The final senior thesis assignment is to formulate a solid way that a student will be spending his or her time next semester. The final thesis proposal will give a layout of how a student plans to research issues in his or her particular option as well as two or three other “breath” topics. This assignment will seem very much like technical assignment #3.

Within this document, there will be a description of issues that have been identified within the Wilkes-Barre/Scranton International Airport. These topics will focus mainly on three core analysis ideas dealing with value engineering, constructability review and schedule reduction. These areas to be researched are known as “Breaths.” The use of these breaths is to demonstrate that the student can apply what he or she has learned from them over the years from two options outside of the chosen focus. The two other fields outside of construction will be the structural and mechanical fields. In addition to these breaths, a research topic will also be studied. This topic is to be a current issue within the industry that is causing problems. The topic selected for this assignment and next semester is 4-dimensional CAD modeling.

Industry Issue Research

Research Analysis: 4 Dimensional CAD in Preconstruction

This is an interesting topic and needs to be researched further in how it is applied and where it can be best applied in the industry. Many companies and firms want to use the software but are too afraid of the risk involved. 4D CAD and modeling are important tools which can be used in construction but, due to the reluctance of the construction industry to try new things, have gone unrefined. Proving the effectiveness of 4D CAD would be most helpful to bring the development and application of this technology further into the construction industry. The proposed thesis research topic

is an in-depth look at how 4D CAD can be used in the pre-construction process — and even during construction — to solve conflicts between trades.

Research foci will include the kind of jobs that would best be outfitted for this kind of program and a look into whether there is a most effective company or firm to use it, such as an architectural firm or design-build firm. By looking at each kind of pre-construction company or firm and how it operates, a “best fit” will be determined as to where 4D CAD will best operate. Research will include many views from different industry members. Design firms, construction managers, and architectural firms will need to be interviewed to determine their opinions and applications of 4D CAD.

The best way to gather information is to talk to the people who are actively using 4D CAD and taking the risks involved with using it. Trammel Crow will be the first company to research; they have actively used 4D CAD in one of their Washington, D.C. projects. Research will also include looking into any related journal articles that have been published by legitimate authors.

A survey will also help gather information. The survey will be set up by targeting different positions in the industry and their involvement in 4D; there also may be a pre-survey to determine how the survey should be modified according to each particular party. The survey will provide clues of what is holding back or pushing 4D CAD in the industry, and from that, a conclusion will be drawn.

Research Methodology

- Review any current or related material dealing with the effectiveness of 4D CAD modeling
- Design a survey for industry members who deal with 4D CAD
- Analyze surveys and interpret them for informational value
- Determine what is keeping the industry from advancing its use of 4D CAD
- Determine where 4D CAD is best applied in terms of contract format or company usage

Sample Survey Questions:

-Have you been involved with 4D CAD or modeling?

If yes:

-What programs did you use?

-In what stages did you use it?

-Were there any risks or added expenditures involved?

-If you used 4D CAD or Modeling midway through construction, did you save time and/or money?

-Is there anywhere you would like to see an improvement in the soft/hardware?

-Were your employers or subcontractors open to using it as an aid in construction?

If no:

-What is the main reason for any reluctance to use 4D CAD/Modeling?

-Do you feel that it would be beneficial to your company/job?

-Would your employees be open to trying it on certain jobs?

-To what kind of jobs would you most likely apply it?

-Would you like to see opportunities for training in 4D CAD/Modeling?

-Would you like to see the development of a professional 4D Modeling Firm as a buffer between the Architect and CM/GC?

-Would you use such a firm on your projects or jobs?

Breath Analyses

Problem 1: Steel Erection Phasing

The steel erection on this job was a critical issue with the overall timing and phasing of this project. Due to the steel erectors' preference, they raised the steel out of the sequence that was originally planned for financial issues. This set back the overall project by approximately three months and caused further complications by pushing typical seasonal construction phases into different times of the year. Analysis of this issue will determine the time that would have been saved if the schedule

was followed, along with a new phasing of steel. Additional research will be conducted to determine the early loading of the slab on deck for storage of finishing materials. This issue will cover all three core investigations, with the most focus on schedule reduction.

Problem 1 Planned Research Solution

- Review the As Planned phasing/erection of the steel for feasibility
- Review the As Build drawing for the error
- Re-sequence the phasing/erection
    - Plan which phases can/cannot be erected simultaneously
    - Review cash flow impact on subs
    - Design feasibility for sequencing/layout/delivery for two cranes
    - Review schedule and cost impacts
    - Calculate impact of early storage/loading on slab on deck for loading of interior stonework

Problem 2: Installation of the HVAC system

An investigation of the HVAC system will be necessary to review the conflict with ceiling height. Areas in conflict were the location of a lintel for the sandstone wall, an area where the duct was bent around a superstructure beam, and the coiling overhead gate at the security checkpoint. The ducts which involved possible rerouting paths will be investigated, as well as resizing of the ducts themselves. The effects on the air loads/pressure and turbulence will be reviewed when making any changes to the ducts. For the duct that bends around the main supporting beam, an analysis will determine if a portion of the web can be cut out to have the duct run through the beam's web. If it fails, a redesign of the beam will be conducted and resized to handle the load with a hole in the web.

Problem 2 Planned Research Solution

- Review above ceiling plan and coordination
- Review As-Built plans and compare
- Review possible routes new duct work could take around obstacles or restrictions
- Redesign the construction sequence to fit the ceilings
- Calculate effects of new ducts on the HVAC system loads
- Make a structural analysis of a possible duct rerouting through a major structural member

Problem 3: Early Installation of the Freight Elevator

If the freight elevator were installed earlier, there would have been a better flow of site traffic for deliveries of materials. The installation of the elevator also would have helped with the early completion of building enclosure. If combined with early installation of the overhead doors, the installation of the wood ceilings could have occurred at an earlier date. This is purely a construction review of how the site would be impacted and schedule compressed or accelerated. This topic will be directed at the constructability and the schedule reduction of the project.

- Review current site traffic patterns
- Define congested areas
- Redesign delivery routes
- Define impact on schedule and costs with new traffic routes in place
- Determine if early enclosure is feasible
- Review/reduce the finishing schedule for interior items which are sensitive to humidity and temperature

Weight Matrix

Description	Research	Value Engineering	Constructability Review	Sechedule Reduction	Total
STEEL	0	5	5	15	25
HVAC	0	10	15	5	30
ELEVATOR	0	0	10	10	20
Issues Research	20	5	0	0	25
Total	20	20	30	30	100