



Thesis Proposal

Industry Issue Research

Analysis 1: 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 Virginia projects. Research will also include looking into peer reviewed journal articles that have been published on the topic

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 use 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

Analysis 2: 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 erected the steel out of the sequence that was originally planned for financial reasons. 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. The scheduling of this new phasing will include the foundation work as well as the steel erection because many of the steel erection activities are ultimately determined by the concrete schedule. A SIPS schedule will be developed and applied to the building through a 4D model this issue will cover all three core investigations, with the most focus on schedule reduction.

Analysis 2 Planned Research Solution

- Review the As Planned phasing/erection of the steel for feasibility
- Review the As Built drawings for the error of sequence
- Re-sequence the phasing/erection
 - Plan which phases can/cannot be erected simultaneously
 - Review cash flow impact on the project and sub contractors
 - Design feasibility for sequencing/layout/delivery for two cranes
 - Review schedule and cost impacts
 - Use 4-D Modeling of the new sequencing of the erection process.
 - Select most appropriate method based on project goals

Analysis 3: Beam Analysis for structural integrity of punches

The main focus of the structural breadth will be on beam design. There is a section of the building where a lintel had to be lowered due to two HVAC ducts. An analysis of the beam will be calculated to see if the ducts can punch through the web of the beam. If not another analysis will be determined if one larger duct can go through the mid span of the beam and have the ducts branch of that.



Analysis 3 Planned Research Solution

- Analyze beam for structural integrity in both cases.
- Determine which system will not fail.
- Plan re-route for duct if both systems fail.

Analysis 4: Coordination of the HVAC system

An investigation of the HVAC system will be necessary to review the conflict with lintel height. The area in conflict is the location of a lintel for the sandstone wall, an area where the duct was bent around a superstructure beam. The ducts involved will require a rerouting path, as well as resizing of the ducts themselves if needed. The effects on the air loads/pressure will be reviewed when making any changes to the ducts.

Analysis 4 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
- Calculate effects of new ducts on the HVAC system loads