

# Technical Assignment 3

Taylor Hall – George Mason University



## Executive Summary

Within this report, a variety of topics are discussed that will encourage creative thoughts when choosing topics to research with Taylor Hall this upcoming spring. After conducting an interview with a representative of the project team, specific issues with the façade of the building and BCOM approval are analyzed on how they affect the schedule and critical path of the building. With each issue comes an area for improvement and ideas on how the schedule can be accelerated if needed.

Since cost is a key concern for the owner, value engineering methods used on Taylor Hall were discussed. Furthermore, the ideas not implemented will provide good bases to spur my research and add value to the project for the owner. One peculiar area of research could be the controversial and troublesome Infinity Structural System.

Lastly, this report contains information gathered from the PACE roundtable on November 6<sup>th</sup>. Breakout sessions involving “Prevention through Design” and “Efficient Delivery of Facility Management Information” provided insight on how we can better our designs to improve safety and how we create an effective vehicle to house pertinent information for the owner’s facility maintenance personnel. Concluding the PACE roundtable was a small group discussion on specific ideas we could potentially look at for the next thesis segment, the presentation of research topics.

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## Project Manager Interview

Having learned that my Project Manager and point-of-contact is no longer with the company, I interviewed the most senior leadership on the jobsite available. The Assistant Project Manager that I contacted will remain my contact for the entirety of the project, although he had admitted that he was not on the job at the time when the following issues were discussed.

In the following sections of the paper, I will discuss issues critical to the Taylor Hall project specifically pertaining to the schedule and value engineered items. These issues may, and hopefully will, lead to potential study areas that could be used for depth studies and further breadth studies in non-construction management related areas.

### Project Schedule

When examining the schedule, it is clear that building dry-in is a critical issue after the structural system is in place. Without building dry-in, interior trades and finishes can't be completed in a timely manner. Current plans show the façade work rotating around the building for each floor up to the roof with several material types.

Via my interview with APM Ben, he had mentioned specific concern for the metal panel system on the façade. The metal panels are located above window height on the top floor and the entire elevation of a small area near the building entrance. This has apparently caused problems with BCOM (Bureau of Capital Outlay Management) design approval, which is needed to continue with the building since George Mason University is a public institution and there are tight restrictions on appearance. Ben had mentioned that this delay in approval is partially due to the Design-Build delivery method chosen and the loss of key team members.

The biggest risks to not completing the project on time are delaying the building dry-in. As the project enters the winter months, weather delays will become more prevalent and could damage the schedule. Although the façade brings the biggest schedule risk, it also leaves room for improvement and optimization.

Acceleration of the façade completion could potentially lead to quicker installation of finishes in the building. One area of focus may be the implementation of a short interval production schedule (SIPS) to ensure this is done as quickly as possible. As mentioned above, the jobsite can only operate as fast as BCOM approves the designs, so there is also a potential to accelerate in areas where designs are approved and straightforward.

Risks associated with the above mentioned ideas are having too many trades work in the same area and running into stagnant periods waiting for design approval. If the façade is closed in quicker than expected and a space utilization plan by trade is not established, there is a potential for conflicts with work flow. It was also mentioned that accelerating the schedule might lead to a point of construction where designs have yet to be approved by BCOM.

In conclusion, it was clear in my interview that the primary concerns for the schedule included BCOM design approval delays and the closing-in of the façade. The BCOM design approval delays can potentially be combated with a different project delivery method and the façade schedule could be optimized with the utilization of a short interval production schedule due to the repetitiveness of the façade around the building.

## Value Engineering

Because each of the projects presented to George Mason University were over budget, value engineering played a key role in bringing down the cost of the building. Balfour Beatty Construction presented a total of 77 value engineering and value added ideas to George Mason with 20 of them being accepted and several of which were implemented in the job.

The primary value engineering move was the removal of the concrete structural system and the implementation of the Infinity Structural System (discussed in previous reports). At first this move was a great idea because it was apparently less expensive when compared to the concrete structural system. Another implemented VE was the removal of closet doors in each unit, leading to significant price reductions. Both of these topics help to reduce the cost of the building without reducing the value, a primary concern for the owner.

The following is a list of value engineering items that were discussed but not implemented in the project for one reason or another. Each of these has potential to reduce costs and/or schedule of the building and can be looked into for a research topic.

<u>Value Engineering Idea</u>	<u>Reason for not implementing it</u>
• Increasing the beds to SF ratio	- Site space limitations
• 4 pipe mechanical system to 2 pipe	- Easier maintenance since campus already used a 4 pipe system
• Stick-built structural system	- Emerging trend and lack of experience
• Green roof above multi-purpose room	- To be completed by students later on
• Rainwater harvesting	- No grey water lines/Campus irrigation already in place
• Cement board instead of metal panels	- BCOM wanted metal panels
• Flat roof instead of pitched roof	- BCOM wanted a pitched roof

In conclusion, most of the value engineering topics that were considered were minor so the design of the building was not altered in any major way. This is due to BCOM's strict overseeing that the façade looks the same as the surrounding buildings. Because of this, any value engineering issues I propose to look into should be on the interior of the building unless it doesn't dramatically alter the façade.

Due to the project being over budget, a major value engineering idea would be beneficial to the owner. Personally, I think the potential value may be hidden within changing the Infinity Structural System due the complications with BCOM approval and the questionable application of such a system on a building of this scale.

## Critical Industry Issues

### Prevention through Design

The idea of prevention through design revolves around encouraging and educating architects to the needs of a safe work environment for the construction phases of a building. Secondly, the consideration of the safety of future maintenance personnel should be implemented early in the design phase. The goal is to reduce the risk of a building, from the construction phase to occupation.

Some examples of prevention through design include sill heights of 48" to reduce fall hazards during construction, the lowering of control panels so that future maintenance personnel won't need large ladders to access them, and smart design when looking at slopes and directions of roof pitches to mitigate potential ice fall locations.

It was determined during the roundtable discussion that it should be added to the contract that architects consider these safety criteria in their designs and that we have dedicated, third party, reviewers to assess the safety of a building. One idea even mentioned the integration of a checklist similar to LEED so that common areas of improvement become so standard that they are second nature to architects.

Implementing PTD on the Taylor Hall project could simply include the altering of window sill heights to 48” and a re-configuration of the schedule to place exterior cold formed frames sooner to prevent fall hazards. Other considerations may include incorporation of tie-off locations in the roof to allow for safe maintenance, prefabrication of duct work, or lower access to HVAC controls.

Key contacts from the roundtable who displayed exceeding knowledge in the field were Professor Leicht from Penn State University and Jason Reece from Balfour Beatty. Both exhibited interesting ideas on how to bring PTD into the industry in an efficient way.

### [Efficient Delivery of Facility Management Information](#)

This roundtable discussed the various ways we handover project closeout information and documents to the owners. Current methods of doing this include programs such as New Forma and Cobie, as well as BIM models. The issue resides in knowing what information is valuable to the owner and will the owner’s maintenance personnel know how to use the current technologies.

Due to the variety of different perspectives at the roundtable, the discussions brought up very important information about the problems at this stage of construction. Currently, project teams assemble bundles of information digitally, most of which isn’t needed by the owner. Furthermore, it was brought to the roundtables attention that many maintenance workers still prefer hard copy plans and specs in comparison to digital copies.



Two key solutions were discussed, both of which will lead to easier turnover of material when construction phase closes. The main goal is to find information that is needed/wanted by the owner and then to find an affective vehicle to deliver that information in a useful and simple way. This can be done on the part of the owner by requiring specific information that they know will be useful in the future, reducing the amount of clutter material that will never be referenced. Secondly, it would be optimum to hand over an easy to use program that helps maintenance find the required information as quickly as possible, being much easier than giving them a BIM model with links to different things.

This can be applied specifically to the Taylor Hall project by looking into what the owner's O&M, close-out, and warranty specifications are so that the project team can deliver the necessary information in clear and concise fashion. Since the owner is an established university, there are already very standard requirements regarding these documents. In this case, a BIM model will be handed over and has been proven valuable to the university.

Key contacts that gained from this discussion were Ed Gannon and Craig Dubler, being the facilitators of the roundtable as well as having knowledge of what is needed from the owner's perspective. Mike Arnold, from the Diocese of Pittsburgh, also had valuable information regarding what is valuable to the owner's facility management personnel.

## Feedback from Industry Roundtable

Following the industry roundtable, the breakout session helped each student gain a one-on-one opinion about their thesis projects from industry professionals. I sat with Jason Reece with Balfour Beatty Construction and discussed potential areas of research.

The first topic of research mentioned was the value of the Infinity Structural System. The depth would analyze if this specific structural system was appropriate for a building of this scale and if the cost/schedule benefits were substantially better than a concrete system. Jason also mentioned that it could be valuable to do an energy analysis to see if any of the mechanical or electrical systems could be optimized with green techniques (like daylighting) without altering the façade and involving BCOM design review.

Other topic ideas mentioned were looking into the benefit of a PPP (Public-Private Partnership), which was recently used on another George Mason University project, and the implementation of a SIPS schedule to drive the critical path items on the building.

Suggested resources for the project would be Jason Reece and Andreas Phelps, both from the research and development department of Balfour Beatty Construction. They would be able to provide valuable information on emerging industry trends and would have the knowledge to determine if they are useful on a project such as Taylor Hall.

*(Please see Appendix for PACE Roundtable forms)*

# Appendix

The 22<sup>nd</sup> Annual PACE Roundtable

## Session 1-A:

### Prevention through Design

Facilitator: Leicht

Room 203

#### Questions

- How aware is the design community of the impact they have on construction safety?
- How is safety typically approached during the design and preconstruction process?
- What examples of improving safety during design have you seen?
- What opportunities exist to improve / increase the focus of design on safety issues?
- What concerns or issues might prevent designers or owners from considering safety in the design process?
- What could be done to begin influencing this process?

#### Notes

(PTD)

- Design community not aware
  - Construction needs to influence design
  - Permanent Safety
    - Building Process Safety
      - Design-Build projects do it better
      - Get Safety Staff involved
      - Cranes
      - Vacuum/Extinguisher tube riser for construction
      - Construction Egress needs emphasis
  - Contractor's Safety Program helps a lot because it works above what the owner values (it goes down ours)
  - Design changes to influence safety during
    - Avoidance Tower made more accessible so less ladders are used.
    - Awnings over entrance sloped to avoid ice falling.
    - window washing system that adds to a more efficient design by bracing curtain wall.
    - window sill being 48" off floor
    - Preparation of benefits in design for Facility Mgmt and construction
    - Prefabricating
  - Architect is liable for safety issues during occupancy but don't read much about during construction
  - Not engaged in safety conversations.
- \*\* Contractual language is key - less PTD is there and describe collaboration requirements
- early costs could save/will save in the long run

- UK - Possible design safety review - required in Europe
- Risk assessment/Regulation
- can regulate process (cover/walkthrough)
- can't usually regulate design (every design is unique)

Design Firms need to hire safety review specialists because knowledge base isn't there

Positive	Negative
- Quality	- Heavier lifts
- Less time	- Dangerous lifts
- Shop is safer than site	- More logistics
- fast	

Total Value Design

Make safety a design evaluation point

7

Scoring System

Session ends at 10:30 am

**Session 2-B:**

*Efficient Delivery of Facility Management Information*

**Facilitator:** Gannon / Dubler  
211

**Room**

Questions

- What inefficiencies exist now for transferring information between phases effectively
- What information needs to be turned over for facility management?
- What takes the most time and effort to compile and transfer?
- What relationships or contracts may be hampering the process for efficient transfer of information?
- What workflows would be high value to define more clearly and make repeatable?
- What infrastructure or tool support is needed to make these workflows consistent and interoperable?

Notes

- New Forma
- Cobie
- FM Info needs to be collected during design
- Define owner
- "Maximize" defining work needed to be done.
- Best Possible thing is BIM model with O&M's attached with live statistics. Complete Bkgs. Pgs.
- Find Info that's wanted then find effective vehicle
- Look into long term owner issues
- "Total Cost of ownership" Capex vs. Trazzro example.  
(Initial cost + Maintenance cost + Replacement cost) Life Cycle

FM

- Asset Management
- Space Management
- Building Automation System/controls
- Reservations
- Energy
- Engineering
- Maps GIS

**Session ends at 2:30 pm**

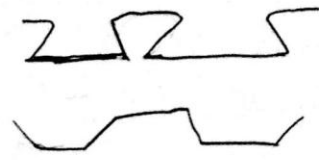
The 22<sup>nd</sup> Annual PACE Roundtable

Industry Member: Jason Reece

**Key Feedback:**

Which research topic is most relevant to industry? What is the scope of the

- \* - Value of Infinity System
  - Is it appropriate
  - Schedule / Cost / Safety
  - Ability to alter design
  - Why did they choose it?
  - Cost / Benefit analysis



- \* - Energy Analysis
  - BCOM requirements
  - What Value Engineerings could save on budget / Not change design
- \* - Public Private Partnership to increase # of Beds
- \* - Energy Reduction vs. Daylighting
  - optimization
  - peak load / shifting
- \* - Crew Planning / SIPS / Phasing
  - Schedule Driven

**Suggested Resources:**

What industry contacts are needed? Is the information available?

- GMU Maintenance personnel
- Andreas Phelps > Research/Development BBC
- Jason Reece