

Construction Management

Critical Industry Issues***Session 1***

The first session I attended at the 14th Annual PACE Roundtable was the Frontiers for Innovation I. I attended this session in order to learn how the advances in technology are affecting the construction industry's actions and ways of thinking. I found this session to be very beneficial as many of the topics I was able to relate to the project I am using for thesis. The main focus of all discussion was on B.I.M.'s, Building Information Models. Early in the session we discovered most of the industry professionals were inexperienced with and unaware of this type of technology, while most of the students attending the session were informed and had used at least one type of B.I.M. Due to this lack of experience with Building Information Models, the industry professionals were limited in the experiences they were able to share with the group. This caused the session to take a path of focusing on three main questions:

What types of projects are B.I.M.s appropriate for?

An industry professional made the suggestion of using risk management by experimenting with Business Information Models on small projects. I found this idea to be very interesting as it was offered by Mark Bodenschatz who is employed by Penn State, a very experienced owner. I feel this statement illustrates the willingness of owners to test these models, even though it will require additional expenses.

The industry professionals also conveyed reluctance to use this type of technology on renovation projects. The reason for these feelings is that when the as-built drawings are available, they are often not a true representative of the existing conditions. This causes a problem when interpreting the building conditions into 3D and 4D modeling. A solution that was offered to this problem is laser scanning. An industry professional suggested this method for obtaining a true representative of the building and using the information to construct Building Information Models.

A comment was made to avoid using B.I.M.s on government jobs. The reason for not using these tools on government jobs is that there are defects in the programming that causes the software to send information to various remote locations. Therefore using these models on high security government jobs could result in the wrong people attaining the wrong information, which is a great fear during an age that has seen a rise in terrorism.

Who/How to train?

Many industry professionals felt it was important to train not only construction managers but also subcontractors. This would prove beneficial in the use of 3D and 4D models for MEP coordination. If subcontractors were able to use such software, it may improve the MEP coordination process as well as reduce the number of problems encountered during MEP installation. Although the training of subs would be an excellent step in the advancement of the construction industry, it may cause difficulties as many construction material suppliers are from different countries. This causes the problem of producing an industry standard that would be understood by both companies in the U.S. but also all countries worldwide.

What are the benefits of using this technology?

This phase of the session allowed the students to inform industry professionals of the many advantages of using B.I.M.s. The students informed professionals of the ability to use the models for many tasks such as recording life cycle data. This option would allow owners as well as construction managers to record the quality of certain products, which could improve the quality of buildings. The ability to use the software Revit for estimating was also discussed. Although this software is not advanced enough to use for exact estimates it is a good tool to check that detailed estimates are in the appropriate range.

Session 2

During the second session I attended the Healthcare Facility Design and Delivery II session. This session focused on two main topics:

Who has input in the design?

This question was raised due to a side conversation on the constant changing of the design of healthcare facilities due to the many user groups. The industry professionals were very eager to provide advice when dealing with this type of construction. The idea that was focused on the most was the involvement of users early in the process. The industry members agreed that the building users should participate in the design of the building. This early involvement of the users can help reduce the number of change orders and disappointed users throughout the process. The professionals also emphasized the importance of the construction manager knowing and understanding the user's requirements for the final product. These needs should also be documented, as the user's committees often change throughout the project which causes a shift in the vision for the end product.

What knowledge is beneficial in Healthcare Facility construction?

One point was stressed during this discussion; knowing and understanding the end product. An understanding of what type of activities that will take place in a room and the equipment required for those activities allows the architect and construction manager to design and build the space to accommodate these needs. This is very beneficial when the drawings are not 100% complete, as it allows the CM firm to anticipate the needs and provide the appropriate design to fulfill those needs.

Topics of Interest and Applying to Thesis Project

The two topics that I was most interested in and feel I will be able to use for my thesis project are; the use of 4D models and the importance of input from the building users. The use of 4D models is very interesting because I feel it can not only provide a clear vision of the building construction but also help to determine possible conflicts with the drawings or method of construction. I feel I can apply this to my thesis project due to the fact that the site for Rec Hall is very constricted which required a large amount of

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thought when phasing steel erection and concrete placement. I would like to develop a 4D model that could illustrate these tasks which may help in spotting problems.

The importance of user input is important to me as I have already seen the effects of late user input on the project I am using for thesis. I would like to incorporate this idea into my thesis project, showing the effects as well as the possible outcome if the input steps had been different during design.

Key Contacts

I had the opportunity to meet many industry professionals at the PACE Roundtable. These professionals were very outgoing and willing to offer advice, which I gladly took. These contacts include Jack Brown and Glenn Erb with Skanska USA. These gentlemen provided me with their business cards and the instructions to call if I had questions involving thesis. I also had a discussion with Mark Konchar of Centex Construction who shared experiences he had and also informed me of scope writing methods. I also had a long discussion with Eric Tievy of Forrester Construction Company whom I also teamed with for the group activity. He also gave me his business card and offered help with any questions with thesis or the industry in general.

Conclusion

In conclusion the PACE Roundtable was a very beneficial experience. I hope when I become a member of the industry I will be able to return to the PACE Roundtable and offer my advice and experiences to students. I feel I am much more aware of the activities affecting the industry and am now able to focus on correcting these issues.

Critical Issues Research Method

The construction industry continues to see large advancements in the technology involved in building systems. These advancements include high tech teledata systems, security systems, smart lighting systems and higher quality mechanical systems. These MEP advancements often require additional materials, such as wire and duct. This additional material calls for extra space, which is often unlikely as the owners' needs are to maximize the amount of usable space while minimizing the overall area of the building. This spatial issue leads to MEP trades packing their material and equipment into the spaces anyway possible. This frequently causes coordination issues. Although most construction managers hold coordination meetings, where the system of overlapping the MEP drawings on a light table and looking for problems is used, many issues are overlooked until they are encountered in the field. The problem facing the industry is that many construction management and general contractor firms either do not know enough about Building Information Models, BIM, or do not have faith in these models. The fear to use BIMs needs to be overcome, as this tool could greatly improve the coordination of all trades.

The primary audience for this research is construction management personnel, specifically project managers and superintendents. Since PMs and superintendents usually initiate the coordination meetings, they would be the persons who could encourage the use of 3D and 4D models by either developing the models themselves or asking the subcontractors to do so. This encouragement of subcontractors to use BIMs allows me to also focus my research towards trade Project Managers and Superintendents.

The benefits of using such tools are numerous, as well as the individuals who will be affected by the benefits. Although there is the possibility of additional costs to the owner for the development of such models, they will see benefits in the form of time. These tools have the ability to increase productivity therefore decreasing the schedule.

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This decrease in schedule is also a benefit to the construction manager. Construction managers who could use BIMs would be at an advantage, as the number of coordination issues encountered during construction could be greatly reduced. This reduction of “in the field” problems would also cut down on the number of schedule delays therefore, allowing the CM to complete construction in a quicker time. MEP trades would also profit from the use of BIMs. Good coordination of the trades, results in less troubles found during construction. This improved coordination cuts down on the work and stress tradesmen must tackle during the completion of their respected work.

I will use three main methods of research for this study, surveys, interviews and literature review. The survey that will be developed, a basic copy is located in Appendix B, will be distributed to the mechanical/plumbing and electrical subcontractor foremen on the Recreation Hall Project. The interviews will be held with Gilbane’s project manager and superintendent to obtain their feelings and knowledge of BIMs. The questions that will be asked during these interviews can be found in Appendix B. I will also research articles discussing the use of Building Information Models in various engineering magazines such as ENR. Along with the review of literature discussing these tools, I will also study the procedure of developing these models as well as the many uses of the models. I hope these research methods will allow me to acquire an overview of the feelings of all persons involved in the coordination process. This will allow me to better understand the steps that need to be taken to increase the use of such technological tools in the construction industry.

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Problem Identification

Many problems were identified throughout the construction and design phases of the Recreation Hall project. Alternative solutions were proposed for some of these problems, but many were left unattended causing either additional cost or additional time to be added to the project. This paper will list the problems I have witnessed with this project, and discuss how I propose to address the problems in my thesis presentation.

Reinforced Fill System

The backfill for the interior of the building, under the slab on grade, for the Recreation Hall project required a high strength reinforced fill system. This system, known as a Tensar system, uses geo-textile fabric to connect wire baskets, containing 2B limestone, to the surrounding earth. This system was put into place to remove the lateral load from the concrete foundation wall at the perimeter of the building. I would like to investigate the possibility of removing the reinforced fill system and replace it with a normal compacted backfill system and, if required, increasing the size of the concrete foundation wall. I would like to compare the difference in cost and manpower required for these two systems.

Pro-press Fittings

A large amount of the plumbing work required for the Recreation Hall project involves connecting new water lines to existing water lines. I would like to look into the use of pro-press fittings for all plumbing work. I believe this system would decrease the amount of man-hours for these procedures, which would decrease the cost for the plumbing work as well as reduce the amount of time the plumbing systems will be shut down for tie ins.

LEED Certification

I would like to explore different designs, alternative materials and construction methods that would encourage a higher LEED rating. Such design ideas may be different mechanical and electrical systems. Possible changes in materials could be metal panels in place of the brick façade or the implementation of a garden on the roof of the building. Construction method improvements could focus on the recycling of more materials as well as purchasing materials that are manufactured in close proximity to State College.

Value Engineering

I would like to study the advantages of alternate flooring systems. The flooring systems for the building consist of terrazzo tile, resilient sports flooring, ceramic tile and carpet. I would like to study the advantages or disadvantages of possibly using only resilient sports flooring and ceramic tile. I would like to focus on the cost savings in material and cost savings of manpower that may result from the development of a learning curve with the material.

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Technical Analysis Methods

The following discussion describes the methods that will be conducted to perform each analysis as well as gives an overview of the construction topics that will be involved in each. See appendix A for a detailed breakdown of the amount of work in each topic that the analyses will require.

Analysis 1 – Reinforced Fill System

The first analysis I will investigate is the replacement of the reinforced fill system under the slab on grade on the South East corner of the building. I would like to look into the possibility of replacing the reinforced fill system with a typical compacted fill system and possibly a larger grade beam and retaining wall. This analysis will involve value engineering, schedule reduction, constructability review and structural research.

The first step that I will have to do for this analysis is to perform a structural analysis to determine if the typical compact fill can hold the lateral load placed on it. I feel I will have to redesign the grade beam and retaining wall at this location in order to help retain the lateral load in place. I will also perform a cost analysis on the system. I will need to acquire the actual cost, including labor and material, and duration required to construct the reinforced system from Gilbane. I will then calculate the cost and time required to construct the alternate system I am proposing by using R.S. Means. After completing the previously mentioned calculations I hope to find that the proposed system is much faster as well as cheaper. Along with comparing the impacts the alternate system will have on the cost and schedule, I will also review constructability issues. This alternate system may require a change in the sequence of the placement of the foundation system. It may require a grade beam be left out in order to allow the larger equipment, such as a roller, into the building footprint to complete the work. After this comparison of the two systems I will determine if the alternate system is beneficial to the owner.

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Analysis 2 – LEED Credits

The second analysis I will perform is a study on the LEED credits accounted for in the initial design of Recreation Hall and establish four to five additional credits that could be obtained that would raise the certification from a LEED Silver Rating to a LEED Gold Rating. This analysis will require a large amount of research, and will impact the schedule as well as the cost, therefore involves schedule reduction and value engineering.

In order to assure I choose credits that can be realistically achieved on the Recreation Hall Project I will consult with the project manager on this project, whom has taken many courses on LEED projects, as well as Dr. Horman. I hope my discussions with these two individuals will allow me to decide on the credits I would like to achieve and how to achieve them. The research into the obtainment of these credits may cause me to find that the schedule will be impacted due to long lead times for the materials. Along with the possible increase in the schedule, I may find that the initial cost to pursue these credits is greater than the cost determined for the initial design. I will compare the required schedule and cost for the proposed LEED credits with that of the original design. Along with the comparison of the initial cost I will also conduct research into the long term savings that could be seen due to the addition of the LEED credited items to the design. I will factor in these savings into the comparison and determine if the building should stay at a silver rating or strive for a gold rating.

Analysis 3 – Pro-Press Fittings

The third analysis I will research is the implementation of pro-press fittings in place of the typical soldering together of pipe sections. This analysis will mostly impact constructability, but will also affect schedule reduction and value engineering. This proposal could be very beneficial as the Recreation Hall Project is part renovation and the less time required for shut down of building spaces the better.

In order to conduct this analysis I will need to obtain the cost to install the entire pipe for the project from the plumbing project manager. I will also need to discuss with him the typical cost, including material and labor, to install a pro-press fitting as this

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number cannot be found in R.S. Means. I will also need to obtain the man-hours required for the installation of pro-press fittings from the plumbing project manager. I will then calculate the time that would be needed for the completion of the piping using pro-press fittings and compare it to the scheduled duration for the plumbing installation using the typical soldering method. I will also need to review the drawings to determine if it is feasible to use this system for the majority of the work, as it tends to require more room than the typical method. Along with these comparisons I will also need to factor in the owners desire to be affected as little as possible. In order to fulfill the owners wants, the renovation phase must occur in a very quick manner. I will determine if the pro-press fitting system will aid in a speedy renovation process.

Appendix A

Description	Research	Value Engineering	Constructability Review	Schedule Reduction	Total
Reinforced Fill System	20	35	20	25	100
LEED Certification	30	40	--	30	100
Pro-Press Fittings	--	25	5	25	100
Building Information Models	50	--	30	20	100
Total	100	100	100	100	

Appendix B

Building Information Model Survey

Name: _____

Trade: _____

Position: _____

1.) Do you know what a Building Information Model is? If so please explain where you learned from this tool.

2.) What is the most common problem you encounter during Rough-In?

3.) Do you feel the coordination of MEP work is sufficient? If not explain the shortcomings of the coordination process.

4.) Do you feel the coordination process would be improved through the use of 3 dimensional models developed through computer software?

Building Information Model Interview

Name:_____

Trade:_____

Position:_____

- 1.) Do you know what a Building Information Model is?

- 2.) Have you ever seen a Building Information Model used for MEP coordination? Do you feel the use of this tool was more beneficial than the method of overlapping drawings?

- 3.) What do you think the biggest barrier is for the integration of 3D and 4D models into the construction process?

- 4.) Who needs to initiate the use of BIMs for coordination?

- 5.) If there is an additional cost involved to develop this model, what is the best way to persuade the owner to use it?