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TECHNICAL REPORT 3 – PART 2

*UNIVERSITY BUILDING
UNIVERSITY, MID ATLANTIC REGION, UNITED STATES*

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Problem Identification and Technical Analysis

Over the course of three technical reports, the University Engineering Building (UEB) has been researched and analyzed, which has led to the identification of problematic areas on the project. The project has already encountered problems, but there are other areas as well that have the ability for improvement. This report outlines those problematic areas and also proposes areas for technical analyses.

One of the first problem areas that affected the UEB project were schedule delays early in the construction process. These tie directly into another problem area, excavation/de-watering issues. During the excavation phase an underground spring was found and along with multiple heavy rain storms over a short period of time affected the installation of the foundation. Delays in the schedule occurred and the owner approved a change order for adding more work days.

Two more issues were fleshed out during the PACE Roundtable, which focused on facility management information delivery and student/general population safety. Since the UEB is a MEP complicated building, with high-tech equipment, the need for a smooth transition of information from the CM to the FM is necessary. Also, since this is a university, the need for student safety is top priority and since the project is in close proximity to multiple occupied buildings, the university in conjunction with Massaro can plan to ensure the safest work environment possible for all involved.

The final group of problem areas focuses on constructability and value engineering. The first involves the possibility of prefabrication of the MEP runs in the vertical shafts of the laboratory spaces. Since all three lab floors are the same, the runs could be prefabricated and racked for each floor, installed and connected at each floor, saving time and cost. The next is clean room coordination, which involves MEP tie-ins to the rest of the building and keeping the area sealed and completely separate from the outside environment. Finally the idea was proposed of using a built-up roof system vs. the single ply TPO system that was chosen. The roofing system is affected by both weather and cost and time to install.

CM to FM Transition

The key to a successful project is to leave the owner with a building that they can easily manage and fix any problems that could occur. One of the breakout sessions at the PACE Roundtable focused on the delivery of information from CM to FM on projects. Since the UEB is foremost a research/laboratory building, the amount of information regarding equipment, systems and other areas is detailed and at times difficult to understand and interpret by the facility managers. Also with the inclusion of technology, 3D models and other computer generated information, not all facility managers and operations personnel have the training to navigate these models.

The research proposal for the spring would include analyzing the information that Massaro has and what information the university will need in order to successfully manage the building. This will be accomplished through meetings with both the construction team and the owner representatives to gain a better understanding of any guidelines the university has in regards to delivered information and how they plan on using that information. From there, research would be conducted on different types of

delivery methods, training that would be needed for operations and maintenance personnel and methods for ways to find the information and understand it.

Some early ideas for information management include utilizing the 3D model that was created as a means of information storage and easy retrieval for operations and maintenance. For example the air-handling units are all custom and extremely detailed and unique. All of the necessary maintenance information could be stored in the model and when the personnel click on a specific unit all the information is displayed. Also takeaways from the PACE Roundtable and meeting with John O'Keefe will be used along with consulting with Dr. Craig Dubler and Dr. Ed Gannon to gain a better perspective on facility management.

Built-Up Roof System vs. Self-Adhered TPO Membrane System

One problem currently affecting the project is the construction of the roof system prior to the New Year to have the top of the building enclosed prior to the extreme winter weather. The system being used on the UEB is a single-ply self-adhered TPO membrane, but after discussions with the project manager for Massaro, he stated how they would have preferred using a built-up roof system. The reasons for using the built-up system included easier installation in cold weather and at times faster than the TPO membrane in order to protect the air-handling units that are located at the penthouse.

This analysis will be completed to determine which system is more cost-effective and impacts both make on the schedule and how the penthouse air-handling units would be affected by not having proper cover during the cold weather months. Meetings with Massaro will be used to determine constructability issues that come with both systems and the pros and cons to using one over the other. Prices and cost information will be gathered from different manufacturers to perform a cost comparison. The schedule would also be adjusted to fit the reduced or additional time based on the system. Using knowledge on different roof systems discussed in AE 475 will be used to help with all aspects of this analysis.

Clean Room Coordination & Prefabrication of MEP

The clean room is the key feature of the building, but also is one of the most complicated due to the requirements for it. The room itself is used to specific research that must be completely sealed from its outside environment. MEP tie-ins and the constructability of the room are areas where the integrity could be compromised. This also relates to prefabrication of certain MEP runs. While not limited to just the clean room, MEP prefab could also be used for the vertical chases located in the laboratory floors.

The analysis would be comprised of researching the processes involved with the construction of the clean room itself and how the MEP systems tie into it. The connections would be analyzed to see whether any of the components could be prefabricated, products that could be used to ensure a 100% seal from the outside. The costs and time required to construct the clean room and specific components would be researched and compared to the original clean room cost and project schedule. Meetings with Hodess Construction, the clean room contractor, will also be conducted to gain more information on the construction process. For the laboratory prefabrication, researching manufacturers

while doing cost comparisons will be performed along with investigating the constructability and how using prefabrication affects the schedule.

Schedule Acceleration – Linear Scheduling

Early during construction the project was hit by delays caused during excavation and foundation. Weather and an underground spring caused foundation pours to be delayed, thus delaying the overall schedule. One remedy that was approved was a change order to the owner that added twenty extra work days to the original completion date. Since the structural phase is completed and building enclosure and interior phases will soon begin, the need to make up time and to avoid further delays is necessary. The use of linear scheduling for the MEP and interior finishes would allow for constant work to be done at faster paces due to the lack of congestion in areas.

A linear schedule will be made based on durations for rough-ins and finishes, while also re-sequencing the original schedule as needed to fit the linear schedule in without affecting the critical path. Discussions with Massaro and possibly subcontractors will be used to determine how the schedule would be impacted and how the work could be accomplished in a given time frame and how the trades should be sequenced. Knowledge on linear scheduling gained in AE 476 will be used to help create the linear schedule.

Potential Breadths

Along with performing analyses focusing on construction aspects, breadths will be performed to demonstrate understanding in areas outside of construction. One potential breadth idea involves clean room coordination. Since the clean room must be completed sealed from the outside environment, air leakage and energy usage tests can be performed to determine whether the extra steps need to be taken to ensure a 100% air tight barrier. This will be done by creating a 3D model of the clean room and running it in programs that can determine air leakage and energy usage. Also the materials that make up the wall assembly will be analyzed to determine their characteristics and whether any problems would occur. Also knowledge gained in AE 310 will be used.

Another potential breadth(s) involve the built-up roof system vs. the TPO membrane system. A structural breadth can be performed to analyze structural loads on the roof members caused by the built-up and how the steel members might have to be resized. This will be done using knowledge gained in AE 404 to size structural members and decking required for the roof system. The potential change in roof system also leads to another mechanical breadth that would focus on drainage and waste water collection. Investigations will be performed for potential issues with drainage and water collection based on the roof system along with measuring the drainage for each system.