Technical Assignment 3

Voorhees Replacement Facility | Voorhees, NJ

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Executive Summary

This technical assignment will summarize the interview that I had with the Project Manager of the Voorhees Replacement Hospital project and address constructability challenges, schedule acceleration scenarios, and value engineering topics. Additionally, this report will identify several problematic features of the building that could be researched and introduce construction management techniques that could be used for my thesis project.

The constructability challenges facing the Turner Construction team included the limited mechanical design during bidding, the exterior open joint wall systems, and material and manpower. When bidding the project the mechanical design was incomplete therefore a lot of assumptions were made to bid the project as well as meetings with subcontractors to design the systems and to meet the owners budget. The exterior open joint wall systems including the stone veneer and phenolic panels are hung using a grid system which is screwed into the backup wall creating a waterproofing issue. In order to make sure the building was watertight an additional layer of vapor barrier and mastic tape was used as well as the addition of 3 superintendents to oversee the exterior wall installation.

The critical path of the project was determined to be site work including the installation of geo-piles, structure, exterior wall, roof, MEP distribution, temporary heat, building systems and finally finishes. The major milestones that could delay the schedule were determined to be temporary heat and temporary elevators. It was also determined that the only major way to accelerate the schedule would be to work overtime.

Some of the value engineering ideas put in place include adding the central utility plant to the main building instead of it having be a separate structure, and allowing the curtain wall system to be bid using alternate manufacturers to reduce cost at the same quality.

The problematic features that were identified included the exterior open joint wall system, the stick built curtain wall system, sustainability, lighting in the patient rooms and finally the manpower and productivity of the construction.

Constructability Challenges

1. Mechanical Design of Building

During the CM bidding process there wasn't a completed set of mechanical design drawings for use. This included the HVAC system, plumbing and medical gas. In order to provide a bid for the project Turner had to make a lot of assumptions when speaking with their mechanical subs during the bid process.

Challenges

- Incomplete mechanical design of building including the HVAC system, plumbing and medical gas.
- Unknown owner's budget during CM bidding.

Solutions

- Worked with subcontractors to create assumptions for the CM bidding process.
- Subcontractors met with mechanical designers after awarded the project to meet owners budget and create an efficient design.

2. Exterior Open Joint Systems

A majority of the non-curtain wall walls are made up of stone or phenolic panels and are constructed per Figure 1 & 2 Below.

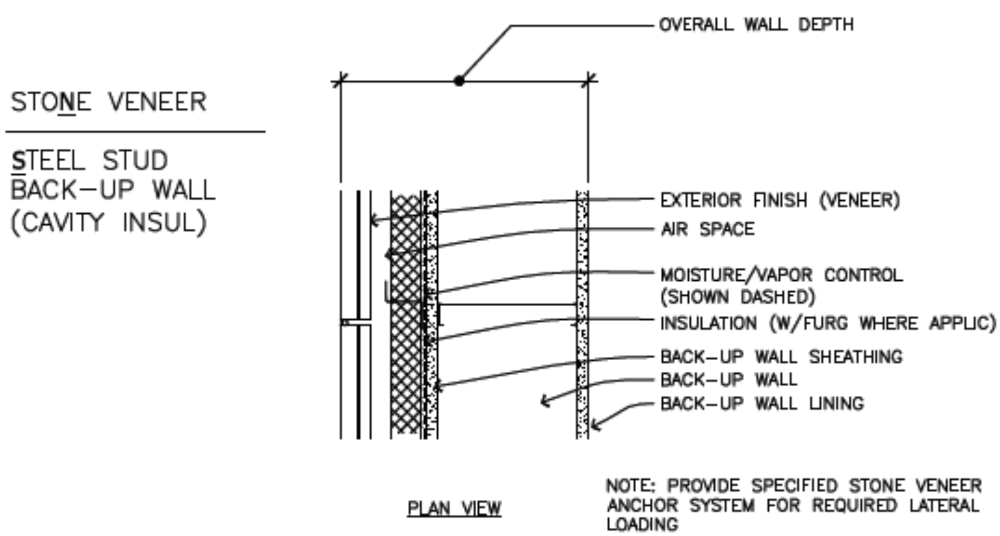

Figure 1

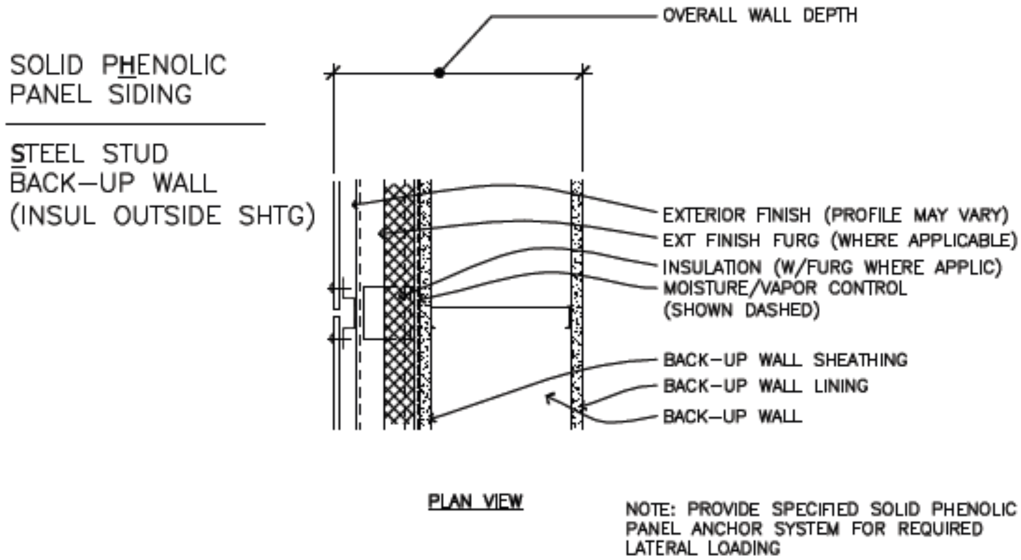

Figure 2

Challenges

- Grid system holding the stone and phenolic panels in place is screwed to the backup wall penetrating the waterproofing.
- How can the grid system be installed without sacrificing the quality of the waterproofing?

Solutions

- In order to maintain a watertight building in the locations where the stone veneer was installed an additional layer of vapor barrier was installed in a crossing pattern over the original layer. This prevented water to enter around the screws from the grid system to the metal studs.
- To maintain a watertight building in the locations where the phenolic panels were installed mastic tape was utilized. The mastic tape was placed over the vapor barrier in locations that screws were going to be installed. When screws broke through the mastic tape the tape would excrete a liquid that hardened and sealed around the screw waterproofing the penetration.
- Lastly to make sure that these methods were running properly and smoothly Turner took on 3 additional superintendents to ensure the quality of the exterior wall. The cost for the additional superintendents was taken out of the project contingency.

3. Material & Manpower

The Voorhees Replacement Facility is 675,000 square foot hospital and during construction there could be as many as 700 persons working in and outside of the building.

Challenges

- Managing 700 persons so that trades do not get in the way of each other.
- Managing material and material distribution throughout the building.

Solutions

- Detailed work patterns on each floor.
- Daily subcontractor meetings to ensure foremen know where they are working each day.
- Hoists on either end of bed tower.

Schedule Acceleration Scenarios

Critical Path

The general critical path of the building is as follows.

1. Earthwork including installation of geo-piles
2. Structure
3. Exterior Wall
4. Roof
5. MEP Distribution
6. Temporary Heat
7. Building Systems
8. Finishes

Schedule Risks

The major areas that could impact the project completion date include temporary heat, temporary elevators, and long lead-time items such as large mechanical equipment or millwork.

Temporary heat is essential to the project completion date because once the building is heated the bed tower and ancillary space fit-out of MEP systems and finishes can begin. Since the schedule currently has the fit-out of the first few floors

starting near the end of 2009 it is vital that temporary heat be turned on to allow the fit-out to start on schedule.

Temporary elevators are also crucial to the project completion date because they allow for the hoists on both ends of the bed tower to be taken down and the exterior wall can be completed at those locations. Completion of the exterior wall where the hoists were removed allows for 100% water-tightness.

Lastly long lead items such as millwork can delay the critical path of the project and need to be bought out early to ensure an on time delivery. Especially on a hospital project of this size with a millwork package of over 7 million dollars a delay could cause a major project setback.

Acceleration Opportunities

After discussion with the Project Manager he concluded that the major areas that has potential for schedule acceleration would be during the MEP system and finish phase. It would be possible to have subcontractors work 10-hour days or work on Saturdays. However it should be noted that working 10-hour days or on Saturdays would incur overtime labor hours and would be extremely expensive to the project and should only be used if needed. It should also be noted that working 10-hour days or on Saturdays could also be setting the CM up for a claim by a subcontractor regarding the quality of their work or if something is not installed properly.

Value Engineering Topics

VE Implementations

- Originally the Central Utility Plant was designed as a separate building but Turner worked with the Architect to incorporate the C.U.P. as part of the hospital. This in turn saved money by the reduction of exterior wall square footage as well as a reduction in MEP piping to travel from the proposed C.U.P. to the Hospital.
- In the original specifications sent out with the request for proposal Turner noticed that the specified curtain-wall system was extremely expensive. Speaking with the architect and changing the specified spec to a performance spec allowing subcontractors to use the manufacturer of their choice, in turn saving money.
- The high-pressure steam units were changed to low-pressure boilers.

- The 7th floor of the Bed Tower was left as a shell for future expansion instead of completing the fit-out.

VE Rejections

- At the time of the interview the only value engineering idea that came up was the resizing of the MEP systems to adjust for the removal of the 7th floor fit-out. This was rejected because the owner does plan in the future to fit-out the space for use.

Problem Identification

Exterior Open Joint Wall Systems

As discussed in the constructability challenges the exterior open joint wall systems posed watertight problems and required additional materials as well as labor. This cost was taken out of the contingency and could pose an additional cost to the owner down the road if more extra costs are found. Is there a way to design the wall more efficiently while keeping the same look?

Curtain Wall

The 8-story bed tower is a curved structure made up primarily of a glass curtain wall. The curtain wall was stick built and was along the critical path of the schedule. With new technologies available to prefabricate wall systems, would it be cost efficient to prefabricate the curtain wall? Would it allow for schedule reduction?

Sustainability

The Voorhees Replacement Facility although does have some sustainable elements is not trying to achieve a LEED rating. Is this because the schedule of the project did not allow for LEED coordination with the design? How early in the design process should LEED be addressed? Are there different requirements for healthcare buildings?

Lighting in Patient Rooms

The current lighting in each patient room consists of a recessed 2'x4' light fixture which is fitted with 2 T8's and 2 T5 high output's for patient and exam level lighting. In the family area of the room there are dimmable compact fluorescent down lights. With the current trends pushing towards a more energy efficient building I wonder if there are more cost efficient ways of lighting the patient rooms.

Manpower/Productivity

The Voorhees Replacement Facility is a 675,000 square foot hospital, which means that at its busiest times in construction there will be about 700 persons working inside and out of the building. It is important to manage these persons so that they produce quality work, safely, on time and on budget. I would like to see if the

current work flow plan put in place is obtaining the highest productivity levels possible.

Technical Analysis Methods

In this section, construction management analysis activities for the problems identified above are discussed.

Exterior Open Joint Wall Systems

Hypothesis

As described in the earlier sections the stone and phenolic panel exterior wall systems required a grid system fastened to the metal studs in order to hold the veneer material. This in turn required extra materials and manpower for the construction manager. I will investigate if there are alternative ways to attach the stone and phenolic panels to the exterior wall. This should both reduce the schedule and cost of the project.

Research/Analysis

In order to complete this analysis I will need to do research into the stone and phenolic panels used on the project and determine if there are any products that are available that can be fastened a different way. I will also conduct a follow up interview with the project manager to collect ideas regarding the exterior wall system.

Curtain Wall

Hypothesis

As described in the earlier section the curtain wall system of the bed tower was stick built and along the critical path of the project schedule. I will investigate if there is an alternate method to install the curtain wall system and determine if there are any cost savings as well as a schedule reduction.

Research/Analysis

In order to complete this analysis I will need to do research into the difference between stick built and prefabricated curtain wall systems and determine the cost to install each as well as the difference in installation time. A constructability

review will also be required to ensure that the current structure can support the prefabricated system.

Sustainability

Hypothesis

Although the Voorhees Replacement Hospital does incorporate some green design it is not attempting to achieve a sustainable rating of any kind. In a continuously growing green market is there a way to push the hospitals design to incorporate more sustainable ideas and possibly achieve a LEED rating? I will investigate where the building currently is incorporating green aspects and determine where the hospital can include new green ideas.

Research/Analysis

In order to complete this analysis I will need to familiarize myself more with sustainable design as well as the LEED rating system. From my preliminary research I have also discovered that there is a separate green group involved in creating the best practices for creating high performance healing environments called the Green Guide for Health Care. I will do research into this guide and determine if it is appropriate for this particular building.

Critical Industry Issue

This analysis will cover a current issue facing the construction industry. In this analysis the industry issue that will be covered is green buildings.

Lighting in Patient Rooms

Hypothesis

The patient rooms currently are designed around the use of fluorescent lights. I will investigate and attempt to redesign the patient room lighting using LED lighting.

Research/Analysis

In order to complete this analysis I will need to familiarize myself with LED lighting technology and the difference between it and fluorescent lighting. I will need to determine if it is economically feasible to replace the fluorescent lighting with LED lighting through both initial cost data and a set life cycle. I will also determine if the

switch from fluorescent lighting to LED lighting would create less of a HVAC demand.

Critical Industry Issue

This analysis will cover a current issue facing the construction industry. In this analysis the industry issue that will be covered is patient health in health care facilities. I will research if LED lighting might help the patients health over the course of the stay.

Breadth – Mechanical

This analysis will include a mechanical breadth analysis. The breadth analysis will be determining the current HVAC loads in the patient room before and after the lighting change to see if there could be a reduction in equipment or duct size.

Breadth – Lighting

This analysis will include a lighting breadth analysis. The breadth analysis will be the redesign of a patient room from fluorescent lighting to LED lighting.