Tech Assignment 3

University Medical Center of Princeton

Plainsboro Road, Township of Plainsboro, New Jersey

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Executive Summary

In an interview with the project manger of the University Medical Center of Princeton for Turner we discussed on topics of constructability challenges, schedule acceleration scenarios, and value engineering topics. Some of the challenges where the geometry of the bed tower, the coordination with the third party mechanical contractor for the mechanical room in the CUP building, and some of the issues with Building #2 still being occupied during the beginning of construction. Schedule acceleration scenarios where talked about including working extra hours and hiring more contractors. The critical path was discussed which was like any other project being foundation, steel, deck, exterior, roof, interior, mechanical. Some of the things that could hold up the schedule are the soil contaminates on site and getting the proper permits on time. The last thing that I talked to the project manger about is value engineering ideas which where third party mechanical contractor for the CUP building and the uses of different materials that didn't have much effect on the project. Some of the value engineering ideas that were not used where emergency power monitoring, groove parking with clamps vs. screwed parking in the mechanical room, and clean steam generator.

I did my own observation on potential problematic features on the project. Them being MEP coordination, rain water runoff, Building #2 occupancy during construction, and last being the geometry of the Bed Tower. Technical analysis methods where looked at for each one then on what would be done to control each problem and what research and analysis would need to be done, also for almost all of them cost and schedule implications have to be taken into effect.

Constructability Challenges

With the University Medical Center of Princeton being such a big project there are many different constriction challenges with this project. From the coordination of work with five phases to the overall size of the project there are many construction challenges. There a three constructability challenges that stand out the most though, first is the geometry of the bed tower building, a third party mechanical contractor for the CUP building, and Building #2 being occupied during the beginning of construction.

Geometry of Building

The geometry of the bed towers caused some difficulties with construction for the

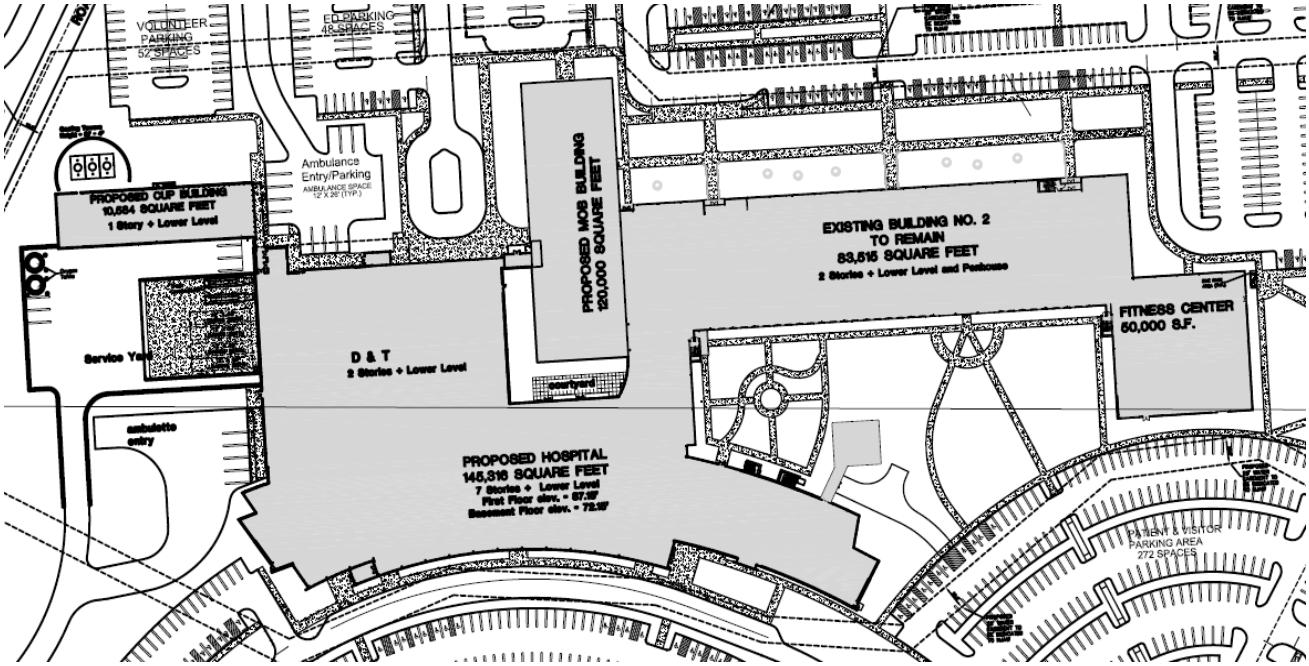

Figure 1

construction team. As you can see in figure 1 and in figure 2 the bed tower's foundation, steel, and exterior are in a circular form. This makes it a more difficult to construct because it is not liner and there is no typical size beams and girders as you see in figure 2. There is also the potential for trouble with the foundations since they must be placed in the right spot to create the right circular geometry for the building. To make sure that everything is done right the contractor hired a third party surveyor to make sure that the foundations where in the proper place. There is also excessive coordination done with the construction team to make sure that the steel is being place in its right spot.

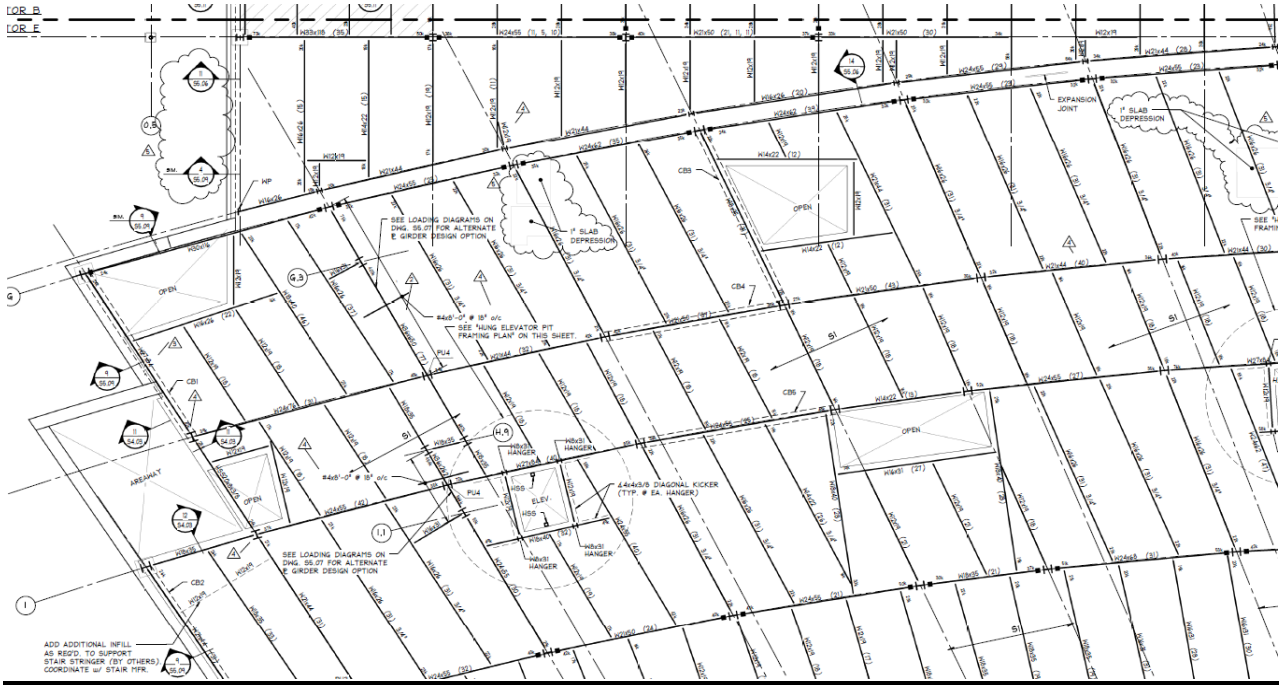

Figure 2

Third Party Mechanical Contractor for CUP Building

The CUP (Central Utility Plant) building has a third party mechanical contractor come into installs all of the equipment and fit-ins. The construction team did this because of cost savings with using a third party mechanical contractor due to time. The biggest challenge that the construction team has with this though is having the utilities available on time so that the MEP can be done on time. In order to make sure that the work would be completed on time the contraction team consistently monitored the coordination and MEP progress of the Mechanical work in the CUP building.

Building #2 Occupied During Beginning of Construction

Another major constructability challenge that the construction team had to deal with was that Building #2 was going to still be on occupancy when construction on the site is to begin. Work is to start on the site in March of 2009 and Building #2 will not be vacant till November of 2009, by that time all of the foundation and excavation work for the CUP (Central Utility Plant) Building, D&T (Diagnostic and Testing) Building, and the Bed Tower will be done. The main construction challenge with this is keeping a barrier between the construction work and Building #2 while the building is still in use. Site soils from around Building #2 also needed to be contained and examined while this building was in use, because of this the construction

team had a contract with a third party environmentalist to watch over and test soils in the area around Building #2. The construction team also put a fence around Building #2 as seen in figure 3 that worked as a divider between Building #2 and the work zone.

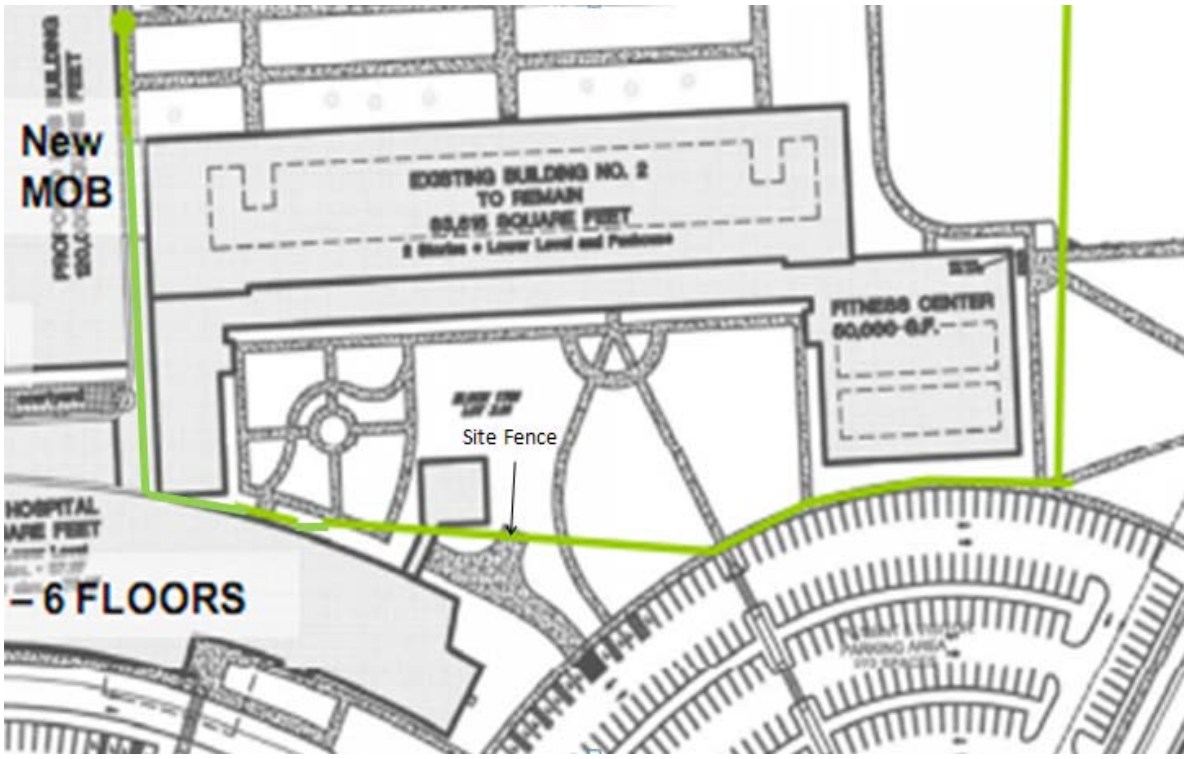

Figure 3

Schedule Acceleration Scenarios

The critical path of the schedule was mostly like any typical project with it being foundations-steel-deck-exterior-roof-interior-mechanical. Most of the free float for the project was on interior and MEP. For example there is free float on the low voltage system between the rough in to the trim out.

There are two big things that can affect the project completion date of the project. First is that the site had some soils contaminates that need to be cleaned up that could hold back the work on the site. The other major thing that could affect the schedule is getting the permits for the different stages of work. One of the ways that the project got off the ground quick was for there to be separate plans completed for each stage. For example the foundation and steel plans where done before the rest of the building so that applications for permits could be submitted early so that particular stage can start work. The reason this is done is because in New Jersey where the building is being built the law is that a permit must be untamed for different stages of work like interior work needs and interior permit and exterior work needs an exterior permit. This could hold up the job because if the drawings aren't done on time or the application process is moving off schedule it could hold up the whole job. If the project is to go off schedule the construction team plans to work on weekends and hire multiple contractors for certain jobs, like two drywall contractors instated of one and have multiple electrical contractors for fit ins. The biggest affect to the construction team if the project where to go off schedule for the project would be related to general conditions and liquidated damages which could cost the construction team tons of money.

Value Engineering Topics

The major value engineering idea that was used on the project is to hire a third party mechanical contractor for the CUP (Central Utility Plant) building as talked about above. The reason for this is for the cost savings on time with there being a different mechanical contractor on this job than on the rest of the project due to the complexity of the CUP mechanical room. There were some small things like different materials being used, but the big one is the hiring of a third party mechanical contractor for the CUP building. None of this affected the owner's goals for the project and if the value engineering ideas happened to free up money the money was then used to add things that the owner wanted to add to the building but the money was not there in the beginning. Some of the value engineering ideas that where thought of by the construction team but not used where emergency power monitoring, groove parking with clamps vs. screwed parking in the mechanical room, and clean steam generator.

Problem Identification

There are many potential problems that could develop on this job. Here a few that I personally feel could have effect on cost and/or time of the overall project.

Clashes with MEP

One of the major features that I think could cause problems for the construction team is the coordination of the MEP work. A majority of the work on the project is MEP work and has a big impact on the schedule if things do not go smoothly. Since the coordination of the MEP work is very important to the overall completion of the project a model should be designed to test for clashes in the MEP and with the steel. To me with the time frame on this project and the large amount of MEP work to be done this is one potential problem that should be addressed.

Rain Water Run-off

The construction team looked into many different sustainability ideas but one idea that they did not look into is the uses of recycling site water. With the site being so big (approx 80 acres) storm water runoff could be a potential problem. Even though the owner is not going for a specific LEED rating there is still plenty on savings and uses for using gray water. Although the installation of a system could cause potential problems with the system it is a great benefit to the owner in savings overtime on storm drainage cost and water cost.

Building #2 Occupancy

One of the biggest safety hazards on the site will be that Building #2 will be in used while site work is to begin on the project. The site work for the new buildings will begin in March of 2009 and Building #2 will not be vacant till November of 2009 which by this time a lot of the foundation and excavation will be done and steel will begin to be put in place. As you can see in figure 4 the site work is right around Building #2. Because of the work being so close to the occupied building there needs to be extra caution on barriers between the work zone and Building #2.

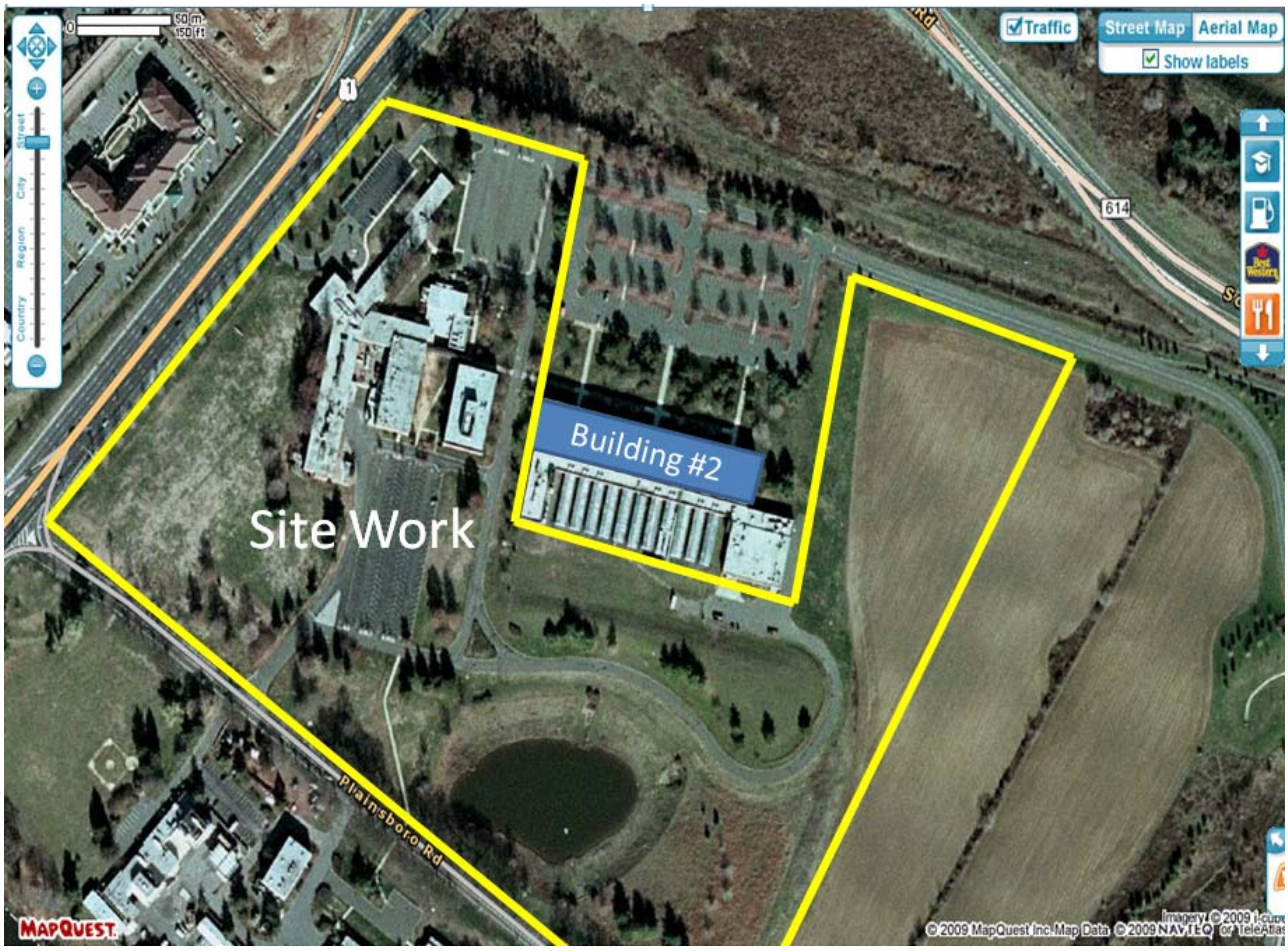

Figure 4

Geometry of Bed Tower

As seen in figure 1 above the geometry of the buildings can be very problematic since it is in a circular form and could create some difficulties for the construction team. The odd shape of the building requires different footing placements for the foundation and the use on different types of steel beams and girders for the project. One mistake in the layout of the foundation or of the steel could greatly affect the cost and time of the completion of the project. There is also the potential for difficulties in the placements of the exterior masonry and curtain wall system.

Technical Analysis Methods

This is a look at some of the solutions to a few of the problems on site and what research and analysis would need to be done on these topics. Most of them will have schedule and cost effects that could benefit or drawback on the project.

3-D Clash Detection for MEP Systems

Using a 3-D model of the building would allow the construction team to do clash detection on the MEP system. This would be at great benefit for cost savings on time, and change orders. A 3-D model would be need of all of the MEP systems (Lighting/Electrical, Plumbing, HVAC Duct, and all Low Voltage Systems) so that most clashes could be detected. Detecting clashes early will take away from change orders and make the MEP coordination on the project move a lot more smoothly.

Reuse of Gray Water

The use of gray water recycling is an effective way of saving money in the future and controlling storm water runoff on site. Rainfall amounts for Princeton, NJ would be needed to calculate the amount of water that accumulates on site. There would also have to be research done into finding out how much water is need in the building. The cost saving on water in the long run could pay off the system but the impact on the schedule will need to be examined for the effect it might have on time to install. There will also be design implications on the size of the system and as to where the system will be placed due to space.

Separation of Work Zone to Building #2

Since there is the possibility of potential safety hazards with work being done in the work zone while Building #2 is still in occupancy this is an area that could be looked into. Some of the things that are to be looked into are the traffic control for people that are working in Building #2 so that it does not clash with construction traffic. An area that should also be examined with this is the barrier between the work zone and Building #2 to control sediments from getting off site. Coordination of the schedule can also be changed so that work is not going on near Building #2 is vacant without effecting the schedule.

Geometry of the Bed Tower

One of the most complicated parts on the project is the coordination of the foundations with the Bed Tower being in a circular form as opposed to it being liner. There are also difficulties with the steel coordination since there are many different sizes of steel that are to

be used in the building. Some of the ideas to make this easier would be to look at different foundation systems that might be more efficient for a none liner buildings as opposed to using square footings. Cost and schedule implication are two big factors in this that would need to be considered. There is also the possibility of looking into having a typical type of beam in the building which would require test for load and cost impact would have to be looked at.