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Technical Assignment 3



Construction Option

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November 18th 2013

Executive Summary

The following report details the new construction commercial high rise project and the construction techniques employed to build it. The exact project location and name is to be held confidential but it can be known that the project is located in a major US city. In this technical assignment the schedules critical path, value engineering topics, and critical industry issues will be discussed.

The main risks to the project completion date are the excavation / foundation phase and the concrete core phase. Both of these phases drive the critical path and any delays in these areas would delay the substantial completion of the project as a whole. Some proposed acceleration techniques would be to spend additional costs to speed the fabrication process of the steel members.

Value engineering assesses the goals of the owner and identifies areas where the project can be improved by better aligning the project to these goals of the owner. It cannot be simply reducing cost while also reducing quality because this would be “de-value engineering” and because of this any value engineering item must be implemented cautiously.

The 22nd annual PACE roundtable meeting was held this year at Penn State University. It provided the opportunity for students and industry members to come together to discuss current industry topics. There were two breakout sessions that focused on Information Management for the Workforce and Multi-Trade Prefabrication. Then there was a focus group where students could interact directly with an industry professional in order to generate ideas for the senior thesis analysis.



Figure 1: Image courtesy of Hines

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Project Manager Interview

Schedule Analysis

The project start date is December 12th, 2012, and is scheduled to finish on May 29th 2015. This is roughly twenty six months or 600 working days. Table 1 is reproduced from Technical Assignment 2 and it shows the overview of the project schedule. This section will discuss the main construction sequences that define the critical path of the project and the main risks associated with meeting the project completion date. Also, some schedule acceleration proposals will be discussed.

Table 1: Detailed Project Schedule Overview

Detailed Schedule Overview			
Phase	Start Date	Finish Date	Duration (Days)
Excavation/Foundation	24-Dec-2012	29-Jul-2013	152
Metro Transit	13-Mar-2013	3-Mar-2015	499
Concrete Core	24-Jul-2013	9-May-2014	202
Structural Steel	20-Nov-2013	13-Aug-2014	184
Superstructure Concrete	10-Jan-2014	21-Jul-2014	133
Envelope	24-Mar-2014	20-Feb-2015	232
Building Dried in and Water Tight (Top Down)		29-Oct-2014	1
Core Fit Out	10-Mar-2014	12-Feb-2015	237
Elevators	20-Mar-2014	23-Jan-2015	215
Interiors (Lobby, Loading Dock, Lower Levels)	9-May-2014	7-Jan-2015	170
MEPS	10-Feb-2014	28-Apr-2015	308
Full Building TCO		29-Mar-2012	1
Full Project	24-Dec-2012	29-May-2012	600

Critical Path

The entire project can be considered on the critical path due to the duration it takes per floor for each trade. On average each activity takes about 4 days to complete. These activities can be seen in the table 2 below.

Schedule of Typical Floor			
Activity	Start Date	Finish Date	Duration (Days)
Install Reinf and Pour 4th Floor Core Shear Walls	29-Oct-2013	1-Nov-2013	4
Set 4th Floor Framing	30-Dec-2013	3-Jan-2014	4
Install Deck and Studs 4th Floor	23-Jan-2014	28-Jan-2014	4
4th Floor Reinforce & Pour Concrete Deck	14-Feb-2014	20-Feb-2014	4
Install Spray on Fireproofing 4th Floor	6-Mar-2014	11-Mar-2014	4
Core Fit Out 4th Floor	24-Mar-2014	12-Aug-2014	100
Install Curtainwall 4th Floor	7-Apr-2014	11-Apr-2014	5

The two main phases that drive the schedule are the excavation/foundation and the concrete core. The excavation/foundation phase is very important because no other activity can occur on-site until this phase is complete. The concrete core drives the remaining phases because it is the main component for

each floor. Because of this any unforeseen delays in this phase can set back the steel framing, superstructure and envelope for the building. The mechanical penthouse is another activity that is very important to the schedule because its completion affects the start of the roof enclosure. Any delay in this portion of the project can set back the building from being dried in and water tight

Schedule Acceleration Scenarios

If there proves to be a delay in the schedule, a plan must be in place to identify any areas that could accelerate the schedule in order to make up time. A few areas where this could be possible is to use additional costs to insure the fabrication of the specific steel members used on the project is on time. This can allow for overtime to in the shop to push the schedule and ensuring delivery is ready.

Value Engineering Topics

Value engineering is often a very useful tool for a project team. It assesses the goals of the owner and identifies areas where the project can be improved by better aligning the project to these goals of the owner. Often value engineering is believed to be any ways a project can save money. The goal for this project is to find ways to save cost or schedule that will not infringe on the intent of the design.

The project team had not come up with areas to implement some of value engineering items within the project but there had been various items that had been discussed with the owner but not implemented. It was considered the use of concrete precast panels for the concrete core, but the project team and owner wanted to start the project earlier so further analysis into it was ceased. Another area where the project team considered implementing value engineering was using glass tile from a china manufacturer instead of a domestic manufacturer. The difference in value between the two was significant, but the delay between the shipping of the two items is really what deterred the team from using the china manufacturer.

Critical Industry Issues

This section will focus on The Partnership of Achieving Construction Excellence (PACE) Roundtable event and describe what information was learned during the breakout sessions that were attended.

Breakout Session 1: Information Management for the Workforce

This first session mainly focused on the management of information used on projects and how technology is changing our industry. The first major topic discussed during this session was the use of the various different programs used by companies but are not cross compatible with each other. It is seen now that there is a different program to handle certain aspects of each job such as drawings, submittals, and RFI's and many project teams are becoming familiar with the programs more and more each day but there are also those individuals that stray away from the new technology. This led into discussion of the use of BIM and how it has improved coordination in projects but has also created a gap in communication with the design engineer and the subcontractors.

Education of the workforce was discussed into detail further because of the generation gap that is being seen between new hires and people that have been in the industry for years. It brought in topics of having a pre-qualification for subcontractors in order to bid for jobs, and if a software would be developed for trade specific drawings.

The topic that intrigued me the most was the various software's used on projects. Implementing software that simple for the user is important because of the generation gap and is something that will be further researched. Also the use of RFID tags in order to track work was a topic that was mildly discussed and interested me.

Breakout Session 2: Multi-Trade Prefabrication

The second session focused on the use of prefabrication of different building components or systems in the industry. There are many benefits to the use of prefabrication for a project, such as a decrease in the project schedule, and an increase in quality. During this session the use of different prefabrications were discussed on projects that the people have seen and worked with. It was discussed that prefabrication can be constructed on or offsite and the various different considerations were discussed, such as the tolerances, and how it will be shipped if needed.

When we discussed the multi-trade prefabrication an example being a mechanical penthouse, the topic of how the labor unions being brought together to coordinate was brought to attention. This can be a major issue when it comes to prefabrication due labor contracts. The key to prefabrication is to design the modules to be repetitive. This increases the worker productivity to its maximum level. It is also important to involve contractors early on if this method is to be used in order to design a product that is the best. When shipping these modules, size needs to be considered for transportation purposes. Also how and when deliveries need to take place.

These topics helped me further my interest in analyzing the use of prefabrication on my project.

Feedback from Industry Roundtable

After the breakout sessions were complete we gathered our information and met with an industry profession to discuss research topics for the spring semester. Through discussion with Chuck Tomasco, and the breakout sessions, I was able to come up with a few possible areas of study. These include the use of prefabrication on my project. I would either analyze the concrete core or the mechanical penthouse for this portion. This would allow these items to be delivered to the jobsite and simply placed instead of having to construct onsite. Another topic is the use of RFID tags in order to ease the prefabrication process. The main contacts that I will have to use are the members of the project team, and members of the faculty such as Dr Messner for the use of RFID tags and Ray Sowers for the use of concrete prefabrication.

Appendix A: PACE Roundtable Notes

Session 1 Topic: Information Management for the Workforce
Research Ideas

1. Using one or more software's/ simplifying user interface
2. RFID Tags

Session 2 Topic: Multi-trade Prefabrication
Research Ideas

1. Prefabricated Concrete Core
2. Prefabricated Mechanical Penthouse

Industry Member Discussion

Key Feedback:

Prefabrication: Yes both ideas can be implemented. Chuck advised to remember issues with prefabrication and the tolerances that need to be considered.

Innovation through Design: Chuck advised about possibly changing the contract in order to bring the contractors, GC, owner, and architect early on in the project in order to prevent problems in the future

Suggested Resources

Ray Sowers

John Messner