

Technical Assignment 3

Construction Project Management

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Table of Contents

1. Executive Summary.....	3
2. Constructability Challenges	4
3. Schedule Acceleration	6
4. Value Engineering Topics	8
5. Problem Identification	9
6. Technical Analysis Methods.....	11

1. Executive Summary

Constructability Challenges

After interviewing the project manager of 700 6th Street he came up with 3 challenges the construction team faced; erecting precast pieces over an operating parking entrance, installing Precast cornice 12 stories up with a ~10 foot cant (overhang), and using a Magic Arm to load curtain wall and punch window systems into a building.

Schedule Acceleration

The project had two main risks to the project completion date. They were the excavation and the skin of the building phases. The excavation phase had unforeseen conditions that led to delays and the skin of building was very complicated which also led to schedule delays. There are 3 areas that have potential for schedule acceleration; cast in place, precast, and the curtain wall.

Value Engineering Topics

The owner accepted 6 VE items which led to a savings of \$78,263. Item number 16 could have had a huge savings if implemented. Handset stone is very expensive and time consuming to install. If it was replaced with precast with limestone casted into place, time on the schedule and money could have been saved.

Problem Identification

After interviewing the project manager I came up with 6 problems that could be looked into for a detailed analysis; Erecting Precast pieces over an operating parking entrance, installing Precast cornice 12 stories up with a ~10 foot cant (overhang), complicated skin of building, handset stone vs. precast, elimination of glass bridge and glass floors or increased protection, site layout and congestion, and project labor agreement.

Technical Analysis Methods

Of the 6 problems I chose 4 to possibly research. These items that I chose to research are; complicated skin of building, handset stone vs. precast, elimination of Glass Bridge and glass floors or increased protection, and project labor agreements.

2. Constructability Challenges

I. Erecting Precast pieces over an operating parking entrance

One challenge this project had was erecting precast pieces over an operating parking entrance. The precast pieces weighed thousands of pounds and could easily crush a car. One solution was to close the parking garage during the precast erection but, Balfour Beatty was contractually obligated to leave parking entrance open. There were many pieces that needed to be erected above the entrance so it was not a one day job. The parking garage only had one entrance, so traffic could not be rerouted to another entrance.

Solutions

- Work at night
- Communicate with gallery place garage personnel
- Overhead protection at entrance
 - Tarps
 - Big sand area
- Traffic would be held until precast piece was installed
- Scheduled times when traffic could enter building
- Fliers that say when entrance could be shut down/open for traffic
- Never install precast over cars entering parking garage

Communication and coordination helped Balfour Beatty overcome this problem. Without it serious injuries or death could have occurred.

II. Installing Precast cornice 12 stories up with a ~10 foot cant (overhang)

Another obstacle that needed to be overcome was installing precast cornice 12 stories up with a ~10 foot cant (overhang). Refer to Picture 2.1. These precast pieces were some of the largest pieces erected. Special permits were needed for the crane because it was so large. The concrete was already poured before the precast cornice was hung.



Picture 2.1-Concrete Superstructure

Solutions

- Had to design slots in cast in place concrete cant (cant becomes cantilever with slots)
 - Structural engineer needed to be brought in to design cant
 1. The rebar had to be redesigned
- Have to coordinate slot placement with cables erecting precast pieces
 - Location of slots
 - How deep slots
 - How wide
 - Tolerances

III. Used Magic Arm to load curtain wall and punch window systems into building

The site for 700 6th Street was very tight and congested. At the time the curtain wall and punch window systems needed to be installed there was not an operating elevator or a material hoist. The reason there wasn't a material hoist was because of the tight sight and they wanted to building to be water tight as soon as possible. There were almost no lay down areas for the curtain wall and punch window systems.

Solutions

- Using magic arm rather than material hoist



Picture 2.2-Magic Arm



Picture 2.3-Magic Arm w/ Load

Magic Arm Description

The Magic Arm features a lifting hook and C-shape double pulley to allow operators to deliver construction loads directly to workers on elevated floors without the use of scaffolding or platforms. The Magic Arm can position a loaded pallet directly onto any floor by enabling the crane operator to maneuver the top arm onto the upper floor until it lies flush. The load is then gently lowered onto the floor below. With its sophisticated pulley structure attached to the crane cable, the Magic Arm ensures load weight is carried by the crane's cable and not by the arm itself.

- Better solution than building a cantilever platform
 - A lot quicker
 - Can go anywhere
 - Picks material right off truck
 - More room on site because of this
 - Building was water tight a lot sooner because of magic arm

3. Schedule Acceleration

Critical path:

Major items on the project's critical path include excavation, foundation, cast in place concrete, MEP equipment installation, exterior enclosure and granite finishes to the main lobby. These items take up a lot of the schedule time and are crucial to the project being completed on time.

Risk to project completion date:

The biggest risk to the project completion date was the excavation and the skin of the building.

- Excavation
 - Lost a lot of time with subsurface
 - Piles took longer than expected
 - A lot of sheathing was needed for this project
 - Unforeseen conditions
 - Water table higher than calculated
 - Had to redesign pumping system
 - Poor soil



Picture 3.1-Excavation

Getting this job out of the ground was difficult to do with the poor soil and the unforeseen conditions. Time was lost during this phase but that time and then some was made up later in the project through schedule accelerations.

- Skin of building
 - Many different materials on building
 - The exterior of 700 6th Street is made of 8 different materials.
 - EIFS
 - Curtain Wall
 - Punch Windows
 - Decorative Concrete Masonry Unit
 - Limestone hand set
 - Pre-cast with Alabama Limestone casted into pre-cast
 - Pre-cast
 - Metal spandrel panels

The construction of the skin of the building was very complex. There were 8 different materials used to enclose the building. This increased the complexity of the project and special care had to be taken to make sure the project was on schedule. A lot of coordination was needed in order to make sure workers were not working on top of each other. Hand set limestone was on floors 1-4 and the precast was on floors 5-12. No one can be working underneath the precast when it is being set; because of this the hand set limestone had to wait until the precast was done. The site did not have a lot of room so deliveries had to come in when materials were needed.

Key areas that have potential to accelerate the schedule:

- Cast in place concrete
 - Incentives were given to concrete subcontractor to hit key dates
 - Overtime
 - Pour sequences were changed
 - Saved time/saved money
 - Owner paid for schedule acceleration
- Precast Erection
 - Made up 4 weeks of schedule time
 - Erection went better than expected
 - Erector beat schedule
- Curtain wall
 - 4 crews working on both north and south elevations rather than 1 elevation at a time
 - Both sides the same rather than one side going up at once

4. Value Engineering Topics

Value Engineering Item Spreadsheet

Item #	VE Item	Cost Savings	Remarks
1	Remove paint in garage	\$42,000	Not Accepted
2	Aluminum panel system with zinc paint		Not Accepted
3	Exterior misc metal column covers		Refer VE Item #15
4	Plumbing pipe material (PVC in chases for waste vs no hub cast iron 'spec')		Not Accepted
5	Garage floor sealer (Hydrozo Enviroseal 100)	\$10,000	Accepted
6	Garage floor sealer (Hydrozo 40% silane sealer vs 100% silane Dayton Weather worker S-100)	\$20,000	Accepted
7	Bulletin 30 Urinals (Zurn waterless vs Sloan spec)	\$4,344	Accepted
8	Bulletin 30 Urinals (Zurn .125 gpf vs Sloan spec)	\$1,919	Accepted
9	Faucets (Zurn vs Toto 'spec')		Not Accepted
10	Delete double line of caulk at precast	\$10,411	Not Accepted
11	Change 3rd floor precast to arch masonry North & South elevations col 4-9		Not Accepted
12	RFI 0087:VCT flooring @stair landings		Not Accepted
13	Thinset ILO Thickset @bathrooms above garage levels	\$27,000	Accepted
14	Deletion of recessed slab @ core bathrooms concourse to PH		Not Accepted
15	High perf Zinc coating @ column covers ILO powercoat	15,000	Accepted
16	Eliminating handset stone and only using precast		Not Accepted

The VE items approved and not accepted by the owner are listed in the spreadsheet above. The owner accepted 6 VE items which led to a savings of \$78,263. Item number 16 could have had a huge savings if implemented. Handset stone is very expensive and time consuming to install. If it was replaced with precast with limestone casted into place, time on the schedule and money could have been saved. The owner declined to use item number 16 because he thought the hand set would look better than the precast. The handset stone is only on floors 1-4 so the owner felt it was important to sacrifice time and money to make sure the stone came out right. If the precast is done correctly it is hard to tell the difference. This would have been a great VE item because it would have saved time on the schedule and a significant amount of money.

5. Problem Identification

From the interview with my project manager I observed several things that could have been pursued through a detailed analysis.

I. Erecting Precast pieces over an operating parking entrance

This was a big problem for the construction team to figure out. Precast cannot be hung over cars pulling into a garage, but the garage had to stay open during construction. It was written into the contract that the garage had to stay open. One solution that was implemented was working at night. This is not a great solution because hanging precast is a very dangerous work and doing it at night increases the danger dramatically.

II. Installing Precast cornice 12 stories up with a ~10 foot cant (overhang)

Another obstacle that needed to be overcome was installing precast cornice 12 stories up with a ~10 foot cant (overhang). These precast pieces were some of the largest pieces erected. Special permits were needed for the crane because it was so large. The concrete was already poured before the precast cornice was hung.

III. Complicated Skin of Building

The construction of the skin of the building was very complex. There were 8 different materials used to enclose the building. This increased the complexity of the project and special care had to be taken to make sure the project was on schedule. A lot of coordination was needed in order to make sure workers were not working on top of each other.

IV. Handset Stone vs. Precast

Handset stone is very expensive and time consuming to install. If it was replaced with precast with limestone casted into place, time on the schedule and money could have been saved.

V. Elimination of Glass Bridge and Glass Floors or Increased Protection

In the main lobby there is a glass bridge and glass floors. The problem with having a glass floor is it is very delicate. A week after the glass floor was installed a screw driver was dropped on the glass causing it to spider crack all the way through the glass. The screw driver was dropped from a distance of 4 feet, which should show you how delicate the glass is. Each glass panel is approximately 10 feet x 4 feet. These panels are

20,000 dollars each and are only produced by 2 manufacturers. The lead time for these panels is months and is not easy to replace. These panels need extra protection so they are not damaged during everyday use or they could be replaced with another material. Refer to picture-5.1.



Picture-5.1

VI. Site Layout and Congestion

The building is located in downtown DC. The site was very congested and did not leave a lot of room for lay down areas. The site consists of the building footprint, barely leaving room for storage. The site must also be fenced off due to a high volume of pedestrian traffic.

VII. Project Labor Agreement

The project labor agreement mandated that all work is performed by union workers. Some members of Balfour Beatty believe that a union workforce results in decreased productivity and lower quality than that of non union workforce. This statement is an opinion and many people in the industry disagree.

6. Technical Analysis Methods

I. Complicated Skin of Building

The building has a very complicated skin which consists of 8 different materials. This is a coordination nightmare from a project manager's perspective. Decreasing the amount of different materials on the façade would be something to look into. With fewer materials it should decrease the amount of trades working on the building. This should increase productivity because there is less of a learning curve and less coordination between subs. I will complete this analysis by comparing the different façade materials. I will compare how long it will take to install each type and compare the cost for each type of material. To conduct this research I will use construction data for example R.S Means. I will also research how much money will be saved on general conditions.

II. Handset Stone vs. Precast

Handset stone is very expensive. In this analysis I will look into the cost and schedule savings of using precast instead of hand set stone. I will conduct this analysis by interviewing a precast subcontractor, masonry contractor, and the project manager. I will use construction data to estimate the savings in time and money. This research should show a significant savings in money and schedule time. The building will be water tight sooner because of this. With the elimination of hand set stone also eliminates the flashing which also saves time and money.

III. Elimination of Glass Bridge and Glass Floors or Increased Protection

The glass bridge built in 700 6th Street was very expensive because of the large sheets of glass. My research would consist of possibly decreasing the size of each glass panel. Instead of 1 large piece 2 could be used. This should decrease the cost of the glass significantly and should also decrease the shipping and installation costs. Another research area could be changing the material of the bridge to something stronger and less likely to break or researching a material to cover the glass and make it stronger. The glass bridge is not a critical item on the schedule so a comparison in how long each method would take would not be effective. A cost comparison of each method would be most appropriate.

IV. Project Labor Agreement

A study could be conducted to determine the effect of a union vs. non union workforce on the outcome of projects. Research would be conducted on labor rates, productivity, and overall performance of each workforce. This research would consist of interviews

and surveys. The research would have to be done in all geographic areas because some are more prone to union and others are not.