

Preconstruction Services for the Simpson Strong-Tie Lab Crane

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For several years the Construction Management Department faculty have discussed implementing a better system of lifting heavy items in the Simpson Strong-Tie Lab. Currently, student assistants and faculty use a forklift to perform heavy lifting, there are definitely more safe and efficient alternatives available. An under running single girder crane system is in the process of being built in the Simpson Strong Tie lab. A full structural analysis has been calculated assuring the crane can lift up to two tons. This crane will help students and faculty use the lab to build the tiny house as well as other projects in need of lifting heavy items. In order to facilitate this project various preconstruction services are required to get the concept from a good idea, to a viable project. The items I am responsible for are a full construction risk analysis, construction schedule, and an in depth vendor buy out analysis.

Keywords: Crane, Risk Analysis, Bid Analysis, Construction Schedule, Preconstruction, Construction, Construction Management Department

Introduction

Heading into the latter stages of my college experience, there were two main factors influencing my senior project proposal. In the summer of 2017 I interned with Webcor Builders on the new Cal Poly Student Housing South project. My experience there was a unique one, as many of my coworkers were Cal Poly graduates and because of that were supremely motivated to leave a lasting legacy at their school. This motivated me to choose a senior project that not only fulfilled the requirements necessary for graduation, but to give back to and leave a lasting impact on my alma mater. In addition, it was obvious to me that I was not very comfortable with the preconstruction aspects of the construction industry. The preconstruction class that the Construction Management Department offers helped give me an introduction to the topic, but I felt like I needed more knowledge on the matter before the start of my career. Performing a construction risk analysis, construction schedule, and crane vendor bid analysis not only satisfied my desire to learn more about preconstruction services, but also gave me the opportunity to work on a project at Cal Poly. Leaving a lasting legacy at Cal Poly gave me that much more motivation to do a great job on the project just as the Webcor employees are on the Student Housing South Project.

To fully understand the deliverables of this project it is essential to understand what is actually being built. The crane being installed in the Simpson Strong-Tie Lab (SST) is an underrunning single girder system. A full structural analysis was previously performed assuring that the crane will be able to lift up to two tons. Tracks will be fastened to the transfer girders running the length of the SST. Running on the tracks is a single bridge girder that will be remotely operated with a full remote control system. My project, along with several others in the future, will turn the SST crane project from a viable project, to a product that will benefit the Construction Management Department for years to come.

Process

Each deliverable had its own specific set of steps for its successful completion. For the vendor bid analysis, I first determined that in order to conduct a proper analysis I would need at least three bids. With that in mind, I began reaching out to crane vendors in request for a bid proposal, giving them the dimensions of the area of operation of the crane along with necessary load requirements. An inclusions/ exclusions list was also created. Once the vendors

sent me their proposals, I inputted the specific scopes of each proposal into a bid analysis spreadsheet. This tool transferred information from the proposals into specific line items. Comparing which vendor included what and for how much then comparing that to the other vendors. Overall dollar amounts were not the only criteria in this bid analysis. Full project scope, quality, performance and reputation were all taken into account. Once all the proposals were analyzed the most qualified vendor was able to be chosen with confidence.

The construction schedule associated with the SST crane includes all activities in the construction process. Going into the project, I viewed that understanding the full scope of the crane construction would be a big challenge. However, the crane vendors went into great detail into what it takes to build the single girder cranes. Dan Yeakey, a crane salesman at Dearborn Crane & Hoist, sent me a document containing all line items pertaining to the construction of an under running crane. He also elaborated on typical durations and what things to look out for when constructing a crane. I implemented information I received from him in all deliverables in this project. The main activities associated with the crane's construction are the assembly of the crane's runways and obtaining adequate power to the crane. Material procurement is also important to take into consideration as crane lead time can take up to fourteen weeks. I used MS Project to create an activity based construction schedule using the information I gathered from the vendors.

The risk analysis was the least straight forward to complete. I started by researching what risk analyses are comprised of and what risk management plans actually look like (I have never done one before). In my research I found that Caltrans's *Project Risk Management Handbook* is a great source to reference. In addition, the Director of Risk and Compliance of the Pacific Gas and Electric Company (PG&E), Maureen Zawalick, gave me valuable information on how PG&E identifies and mitigates risk. The procedures of Caltrans and PG&E were the driving force in my risk management plan. The plan includes roles and responsibilities of each team member, risk categories, probability and impact matrix, and a risk register. The risk register identifies risks and assesses their causes, areas it affects the project, the likelihood that they may occur, and response strategies for each risk. More importantly, each risk is assigned to a specific team member. The probability and impact matrix sorts each risk by probability and impact scores of high, medium, or low (*Project Risk Management Handbook*, 2003). This is used to give a better idea of what risks are major concerns to the success of the project and which ones are minor. All aspects listed above go into the overall risk management plan (Zawalick, 2017).

New Knowledge

After evaluating and analyzing all bid proposals I determined that **Pacific Crane & Hoist be awarded the aforementioned scope**. Precision's proposal most aligned with the expectations of the crane being built. There overall price (\$90,100.00) is competitive with the other bids, but also includes a push button control system. This system is intuitive to use, which I value immensely since student assistants will be operating this equipment regularly. Also, the reputation of Pacific Crane and Hoist was a deciding factor in this selection process. The company has been in business since the 1960's and has built a reputable base of clients including Toyota, The City of Long Beach, and Rubber craft.

A total duration of 5 weeks (24 working days) has been determined to reflect the entire time necessary to complete the construction of the overhead crane, along with additional testing and training relevant to the use of the crane. In order to expedite the construction process and limit student interference. Construction is to commence during Summer Quarter, on July 3, 2018 and end on August 6, 2018.

Critical Milestones are identified as,

- Funding Approval, Permits Approval: March 2, 2018
- Down Payment, Drawings Approval: April 2, 2018
- Materials on Site: (no later than) July 2, 2018
- SST Overhead Crane Start: July 3, 2018
- Crane Runways Complete: July 13, 2018
- Crane Electrification Complete: July 30, 2018
- Crane Ready for Daily Use: August 6, 2018

Key construction risks and mitigation plans have been identified as a part of the Risk Management Plan for the SST Crane. Key risks and their mitigation plans are as follows

Risk	Mitigation Plan	Risk	Mitigation Plan
Incomplete Design	BIM coordination, coordination between the crane design team and university so all expectations are met.	Student Interference	Set up signage around the site, tape off areas where students could be in danger, clean up jobsite daily.
Labor Shortage	Hiring the crane supplier to bring guys out to install the crane.	Unable to obtain required permits	Research city codes and specific Cal Poly procedures. Coordinate with university and city to establish what permits are needed for the project.
Unforeseen aesthetic requirements	OAC meeting ahead of crane fabrication laying out all the requirements and expectations of each team member.	Staging areas are not adequate	Logistics plan to be created/ implemented before crane crew arrives for install, available space is clear at crew arrival time.
Temporary Structures do not meet OSHA requirements	Daily inspections of any rigging, tie off points, false work, and scaffolding accompanied by proper training for any worker expected to work on said structures.	Nuclear Emergency	Out of our control, all city nuclear emergency procedures must be followed.
Unforeseen agreements required	Being thorough in the permitting process, all team members are on the same page.	Rainy Season	Schedule project in the dry season to avoid rain if possible.
Decrease in funding from the CM department	Keep costs to a minimum to attain the proper funding necessary.	Seismic Emergency	Out of our control, all city seismic emergency procedures must be followed.

Table 1. Shows major risks involved in the construction process with respective mitigations plans.

Deliverables

As mentioned earlier in the report, a vendor bid analysis, construction schedule, and risk management plan were delivered on for the construction of the SST crane. In addition, summaries of each deliverable have been created in the form of professional memorandums. I thought the summaries would be a clever way to efficiently get the information across to the reader. This project lays the ground work for future senior projects involving the crane.

Lesson's Learned

I learned more than I expected during the process of my senior project. First of all, I learned how to better communicate professionally. I was constantly emailing, calling, and reaching out to crane vendors, how I worded things definitely influenced the response rate. Some vendors would not give me the time of day because I was a student working on a school project, I had to work around that challenge to get the information I needed and I am better for it. Secondly, I learned how deliver a construction risk analysis. At the start of the project the risk analysis was the one aspect I was least comfortable with. I now am confident that I can create a credible risk management plan once I start my career. Lastly, I learned the process of creating a formal document. The formatting and steps to publish the project I thought was very satisfying and not something I was expecting at the beginning of the project.

Application

The risk management plan can be used as a reference during the construction process. It also is a binding legal document which can be used to hold team members accountable for the duties. Staying proactive is key in the construction industry and the risk management plan will keep the team a step ahead of potential issues, and even if something happens there are procedures in place to combat those issues.

The construction schedule is a critical aspect of the construction process. If the job team decides to use my schedule, it will be the driving force of the project and will be used as a beacon of jobsite success. If the deadlines are met the the job could be seen as going well and vice versa.

The vendor bid analysis will give the Cm faculty a great understanding of what is included and excluded from each bid proposal and give direction on which crane vendor to officially choose.

Future Research

There is not a lot of future research possible due to the style of my senior project. However, quality control work could be done to ensure my deliverables are to proper standards. For the bid analysis, going through all the bids for scope completeness as well as re-evaluating the line items in the bid analysis itself would be beneficial. For the schedule, evaluating all line items and durations could change the overall timeline of the schedule. Depending on who is looking at the schedule (and how much relevant experience they have), it could reflect a very different time table. Finally, for the risk analysis, someone could make an additional risk list for other aspects of the project and implement it into the register and matrix. Quality control is key to the success of any construction project, this project is no different. In addition, as mentioned earlier in the report, future senior projects would benefit from the deliverables in this project.

References

Project Risk Management Handbook. (2003). Sacramento, CA: Caltrans Office of Statewide Project Management Improvement.

Yeakey, D. (2017, October 12). Phone Conversation with Dan Yeakey [Telephone interview].
Conversation with Dearborn Crane & Hoist salesman Dan Yeakey.

Zawalick, M. (2017, November 20). 11.20.2017.PGE_Risk Assessment Cal Poly Project Request [E-mail].
Collaboration with Maureen Zawalick regarding risk assessment.