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2016 ASC Bidding Competition – Heavy Civil

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by

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Senior Design Final Report

Montana Tech of The University of Montana

2016

Abstract

We represent the 2016 Montana Tech Heavy Civil team. Our senior design project consisted of competing in the Region 6 ASC (Associated Schools of Construction) Heavy Civil Bidding Competition in Reno, Nevada. The competition required a full year of preparation. The Fall semester was dedicated to planning, practicing, and gathering resources, while the second semester involved traveling to Reno and performing in the competition.

Our preparation involved performing practice bids where various aspects of heavy civil construction were studied. We also devoted a significant amount of time developing our presentation skills, and team building exercises were implemented to encourage unit cohesion. Industry professionals were consulted to enhance our knowledge base and give us new perspective on how to look at a project. Finally, our preparation culminated with a simulated competition where we estimated a project and presented our solution to a mock panel of judges.

The competition involved a 16-hour time-frame where we developed our bid and solution for the given problem statement. We were then given 8 hours to prepare for a 20 minute presentation which was followed by a 10 minute Q&A session. Our efforts placed us 5th out of 12 teams.

Keywords: heavy civil, bidding, Reno, Associated Schools of Construction, senior design, construction, estimating

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1. Introduction

The purpose of this report is to detail the process by which we completed our senior design project and discuss the results of our efforts. The scope of our project involved preparing for and competing in the Heavy Civil category of the Region 6 ASC (Associated Schools of Construction) Bidding Competition held in Reno, Nevada. We segmented our approach into two phases: (1) Planning-Phase and (2) Competition-Phase. The methodology employed during each phase is discussed throughout the following pages.

2. Planning-Phase

Our preparation was centered on weekly workshops with our mentor, Sonya Rosenthal. Sonya was the driving force behind improving our public speaking skills and directing our focus regarding heavy civil topics. We devoted our time to performing practice bids, speaking in front of each other, talking with industry professionals, and studying the various aspects of heavy civil construction.

2.1. First Semester

We began the semester by taking a general look at the Makapu'u Retaining Wall project in Honolulu, HI. Each team member was assigned a topic such as safety, risk analysis, environmental, QA/QC, etc. The Makapu'u exercise served mainly to gain a general understanding of the non-technical (or "soft") topics involved in heavy civil construction.

The next project we looked at was the Tillamook Jetty in Oregon where we performed a more detailed analysis. In addition to soft topics, technical aspects of the project such as equipment, staging, scheduling, materials, etc. were added to the exercise. We presented our findings to each other during one of the team workshops.

The Cottonwood Pass project in California was the third heavy civil job we looked at and was also the first where we attempted to bid some of the items on the bid sheet. We also made our first PowerPoint presentation during this exercise. A video recorder was used during the presentation for the purpose of reviewing and critiquing our performance.

In addition to the three practice bids, we also completed individual research on heavy civil areas including clearing and grubbing, excavation, dam construction, pavement removal, demolition, bridge construction, and concrete work. Each team member developed an Excel spreadsheet designed to streamline the process of calculating production rates of equipment and hours required to perform various tasks. Templates were developed for all soft topics that we expected to address in Reno. The templates were created to simplify the process of developing our bid binder during competition. Permanent assignments were also identified for each team member so everyone clearly knew their roles.

2.2. Second Semester

Individually, over the holiday break, we each completed a practice bid and presentation for a road and bridge project named Squaw Creek. The Squaw Creek project was the Region 7 Heavy Civil problem statement from 2015. The job was located along Highway 70 in North Central California in the Plumas National Forest. The scope of the project comprised 13 miles of removal and replacement of roadway between Graeagle and Spring Garden. The existing roadway was a 24 foot wide asphalt surface with a failed foundation and had to be replaced with a 30 foot wide asphaltic concrete surface. Four corrugated steel pipe culverts were also to be installed in place of existing culverts. Finally, a 100 foot historic wooden bridge spanning Squaw Creek was to be removed and replaced with a 200 foot concrete bridge.

We had to develop a method of construction to begin the bidding process. Next, we calculated material and labor costs to perform the work. Additionally, we had to develop strategies to mitigate major risks, environmental hazards, safety concerns, etc. The templates, created earlier, were utilized for sake of practice and proved to be important products of the practice bid. Skills using Bluebeam, MS Project, and RS Means were polished by team members with those particular assignments. Microsoft Project was utilized to create a detailed project schedule.

The Squaw Creek project showed us how critical hauling material can be for certain heavy civil jobs. For that particular project, the majority of material for the road construction required a haul distance of approximately 130 miles. The bid was also an effective exercise in the coordination of crafts because it took place along a high traffic area of CA-70.

We collectively pieced together a team presentation from our individual bids and presented our solution to a panel of judges. The judges were engineering professionals from the Butte, Montana area. The time-frame mirrored that of the competition to simulate the competition environment as closely as possible. The simulated competition was a great learning tool that instilled a lot of confidence in our team.

3. Competition-Phase

The competition process took place over the span of several days in Reno, Nevada. We arrived on the afternoon of February 10, 2016. Our primary goal that first evening was to organize our workspace in one of our rooms, aiming to maintain an “open” set-up so we could maximize streams of communication during bid day.

The following morning, competition began at 6:00 a.m. where all twelve heavy civil teams met with Kiewit. Plans, specifications, pictures, bid documents, etc. were provided to each

team via thumb drives. We then had approximately two hours to return to our rooms and familiarize ourselves with the problem statement and all associated documents. Following the first two hours, all teams returned to the designated Kiewit room for an “Owner’s Meeting.” This was when Kiewit provided a general overview of the project, discussing various aspects of the job and possible options for each. We then returned to our room to begin the bidding process.

The project was located at the Kodiak Island Airport in Alaska and consisted of the following items:

- Installing two 600 foot Runway Safety Area (RSA) extensions
- Installing two Engineered Material Arrestor Systems (EMAS)
- Paving service roads
- Culvert rehab and construction of a dike

Figure 1 shows an overview of the job location.



Figure 1: Plan view of Project Site.

The areas of construction are called out by the white arrows shown above. The paving of the service roads took place at each of the RSA sites. As part of our solution, we utilized the two staging areas designated above, one for rock material and the other for equipment. An empty building on the airport grounds was used as our office location. We chose to access the airfield via D-Gate (location shown by the red arrow).

We approached the bidding process by breaking the project into segments with each team member assuming responsibility for their respective area. The schedule took shape as we arrived at costs and timeframes for each bid item. The templates for our Environmental, Safety, Risk, QA/QC, and Traffic Control plans were adjusted to cover the specific needs of the project.

Throughout the day, the judges checked on our progress by stopping at our room to ask and answer questions. We submitted Requests for Information (RFIs) several times when we found ourselves needing more information or answers to certain questions they weren't willing to directly answer in our rooms. We wrapped up the bid process by submitting our bid binder to the judges by the 10:00 p.m. deadline that night. Table 1 below summarizes the major work items and the associated costs that we estimated.

Table 1: Major Bid Items and Final Costs.

Top 5 Costs	
Borrow	\$ 14,456,000.00
Stone Work/Core-Locs	\$ 8,384,800.00
Hot Mix Asphalt	\$ 7,210,000.00
EMAS Beds	\$ 4,600,000.00
Mob/Demob	\$ 3,795,000.00
Total Project Cost	\$ 53,374,000.00

Importing the borrow material for the runway foundations was a significant part of the project. Various sizes of stone had to be placed around the ends of the extensions for protection against waves. The asphalt work and EMAS installs accounted for two of the top five costs. Mobilization and demobilization were also significant costs because equipment and supplies had to be transported via barge from Vancouver, Washington to the Kodiak Airport. After all required bid items were estimated, our total project cost was around 53 million dollars.

Following submission of our bid binder at 10:00 p.m., we then had an 8-hour time limit to create a presentation which had to be ready by 6:00 a.m. the following morning. After a couple hours of sleep, the presentation was completed and submitted by the required deadline. We received our designated time to present which, fortunately, was not until 1:00 p.m. (Feb. 12th at this point). After getting some breakfast and much needed rest, we practiced our presentation several times. Each person had to speak for approximately 3 minutes; the time limit was 20 minutes. The presentation was followed by 10 minutes of questions from the judges. We delivered our solution to the judges within the specified time and handled the Q&A session relatively well. Ultimately, our performance placed us 5th out of 12 teams.

4. Lessons Learned

4.1. Teamwork

During the competition, we found that communicating with each other was a major key to our performance. The room set-up was very well thought out and worked well for us; we were all facing each other, which made it easier to communicate and share ideas.

Time management was also a huge factor and we wished we would have made a more detailed schedule of our day with deadlines to organize our 16 hours, along with a designated

person in charge of enforcing those deadlines. We should have re-grouped and came up with a plan of attack when a deadline was missed, instead of pushing the deadline back further.

As a team we discussed which RFI's should be submitted and which ones we could possibly ask when the judges came into our room. Sometimes we saved time by simply going to Kiewit's room and asking them questions directly. If they felt they could answer, they would. If not, they would request that we submit a formal RFI.

4.2. Pricing

A beneficial part of our preparation was the templates we made for quantity take-offs. These worked well for us and each team member knew how to use all of them. Something we missed in our preparation, however, was that we should have started crunching numbers and putting prices on things earlier in the year. We shied away from doing this and in the end realized we would have had a much stronger grasp of what things cost in the construction industry. In hindsight, we should have gotten to a point where we were able to ball-park the cost of a construction operation just by looking at it. Another valuable lesson is to adjust unit prices to meet the bid schedule volumes if their (Kiewit's) volumes are mandated. Understanding what over- and under-runs are, making sure to document where and when they occur, and identifying possible ways to fix them is important as well.

Since the bid review was "internal," the Kiewit judges were interested in how we came up with our quantities and prices and said they would have liked to see more documentation of our thought process. We needed to use our take-offs and quantities in the calculations and not the engineer's estimates. When guessing on a price, we needed to document it and substantiate it with a sentence saying whose guess it was and the reasoning behind it. We should have been better about documenting when using the CAT handbook and other sources as well.

Double checking each other's numbers should also have been a priority for us; sixteen hours is a long day, and mistakes will be made eventually. Something we nearly forgot, but fortunately completed, was adding profit to given lump-sum values in the bid sheet. This step is crucial in correctly arriving at your total bid price. Always add profit to the unit price and not the total item price. We should have double checked our math by hand with a calculator and documented what profit we decided to add to particular bid items. To make the bid sheet look better we rounded the unit prices and was told from Kiewit that it made the sheet easier to read.

Additionally, we should have had someone whose job was addressing addendums and quotes as they came in. We fell behind on this which resulted in costly mistakes. We should have also plugged numbers into the bid schedule early in the day (in pencil and in Excel) and replaced them with calculated values or quotes later. We waited until the end of the day and rushed through the pricing.

4.3. Construction Documents

When preparing for the competition, we should have started with learning how to read project plans and understanding bid documents. In Reno, we struggled to read plans and get the information that was needed. We also wasted some of our precious time filling out bid documents that were not needed and completely missed one that was needed. We should have understood what each document was, and its importance in each phase of procuring a job, before the competition.

4.4. Non-Technical Roles

We found that it would have been more valuable if we had chosen soft topic roles in the beginning and stuck to them rather than switching roles with every practice bid on which we worked. We should have kept each team member on a specific topic as soon as we were

comfortable so that we became “experts” in our fields rather than a “jack of all trades.” A positive result, however, was each person was able to help their teammates within the various roles.

4.5. Presentation

We did not start the presentation until the bid had been submitted, and although we had to work through the night, we felt we had ample time to complete it; we arrived at the competition with a ready-made template which streamlined the process. We found that standing in front of the table and having each person step forward when it was their turn to speak worked really well. Also, having a single designated person with the laser pointer and slide clicker made for a seamless presentation. As a team we were complemented on looking directly at the judges during the presentation and not paying any attention to the audience, however, we could have been more personable with the judges.

5. Conclusion

This year’s competition taught us all many things, and by detailing our experience now we hope next year’s team will be able to utilize our hindsight to their advantage. The first step is to have a meeting for next year’s AGC club this spring where we can talk to interested students about getting industry experience, learning from internships, and being able to bring something beneficial to the table. This will help for when next year’s students actually sign up for the class and help them understand the required work load. We also need to let them know that they will get more out of the class and be more of an asset to their team if they can devote a significant amount of time toward preparation, which means taking the class with a light credit load. There are also a couple recommended classes to take before signing up for the competition (i.e. Bidding & Estimating and Planning & Scheduling) which proved helpful in Reno.

Overall, we learned so much from this experience, and while some of the mistakes we made were important for our personal and professional growth, there were some hard-learned lessons we would have avoided if we could do it again. We hope that this report can serve as a guide to help future teams as they prepare for the heavy civil category.