

2016

Montana Tech Concrete Solutions Final Report

Shawn Tezak

Montana Tech of the University of Montana

Ty Albert

Montana Tech of the University of Montana

Keifer French

Montana Tech of the University of Montana

Teaguean Knudsen

Montana Tech of the University of Montana

Britt Pennell

Montana Tech of the University of Montana

See next page for additional authors

Follow this and additional works at: <http://digitalcommons.mtech.edu/engr-symposium>

Recommended Citation

Tezak, Shawn; Albert, Ty; French, Keifer; Knudsen, Teaguean; Pennell, Britt; and Studiner, Mike, "Montana Tech Concrete Solutions Final Report" (2016). *Proceedings of the Annual Montana Tech Electrical and General Engineering Symposium*. Paper 14.
<http://digitalcommons.mtech.edu/engr-symposium/14>

This Article is brought to you for free and open access by the Student Scholarship at Digital Commons @ Montana Tech. It has been accepted for inclusion in Proceedings of the Annual Montana Tech Electrical and General Engineering Symposium by an authorized administrator of Digital Commons @ Montana Tech. For more information, please contact ccote@mtech.edu.

Authors

Shawn Tezak, Ty Albert, Keifer French, Teaguean Knudsen, Britt Pennell, and Mike Studiner

Montana Tech Concrete Solutions Final Report

Shawn Tezak (Captain)

Ty Albert

Keifer French

Teaguean Knudsen

Britt Pennell

Mike Studiner

Senior Design Final Report



Montana Tech of the University of Montana

2016

Abstract

In partial fulfillment of Senior Design, we formed a group to compete in the Associated Schools of Construction bidding competition in Sparks, Nevada. Our team chose to compete in the Concrete Solution competition, sponsored by Sundt, in the Open Division of the competition. In preparation for the competition, we researched various topics related to concrete construction, gathered resource materials, and practiced our presentation skills.

Our goal was to gain a better understanding of the construction industry and become proficient in estimating, bidding, scheduling, sequencing, safety precautions, and risk management, with respect to the concrete construction field. We also planned to assemble a binder that will aid future teams competing in the Concrete Solutions competition. The binder provides an aid for future teams that might be interested in the Concrete Solutions competition.

Once the competition was finished, we prepared a poster for the Techxpo, developed a binder with all our gathered information for future teams, and prepared a final written report of our senior design project. We also presented to classes at Montana Tech in hopes of generating interest in the competition and construction industry by underclassmen students, and continuing the successful participation in the bidding competition. This report contains a background of the competition, what we did to prepare for it, and what our competition problem and solution was. This report also contains post competition reflections, as well as advice for future Concrete Solutions competitors.

Keywords:

Concrete, Bidding, Competition, Construction

Acknowledgements

We would like to acknowledge the Montana Tech employees who aided us along the way. A special thanks goes to our mentor Larry Hunter as well as the professors and coaches of the General Engineering Department. These individuals provided a learning environment for us to lead tomorrow's engineers. We would also like to acknowledge Sletten and Quest for sharing their knowledge of concrete construction. A special thank you goes to Barnard, Quest, GoodFellow Bros, The Montana Contractors Association, and Northwestern Energy, among other businesses, for donating the funds that allowed us to travel and compete in the competition.

Table of Contents

Abstract	1
1. Project	5
1.1 ASC Bidding Competition	5
1.2 Concrete Solutions	5
2. Preliminary Work.....	6
2.1 Weekly Meetings.....	6
2.2 Team Roles.....	7
2.3 Books and Software	7
2.4 Guest Speakers	8
2.5 Sletten Tour	9
2.6 Fundraising.....	9
3. Competition Event	9
3.1 Project Scope.....	9
3.1.1 Concrete Forming	10
3.1.2 Tilting the Concrete	10
3.1.3 The Solution	10
3.2 Competition Timeline	11
3.3 Project Presentation.....	11
4. Post-Competition Reflections	12
4.1 Beneficial Pre-Competition Exercises	12
4.2 What We Did Best at the Competition.....	12
4.3 What We Could Improve on Pre-Competition.....	13
4.4 What we could have improved on during the competition.	14
4.5 Advice for future teams.....	15
5. Conclusion	15
Appendix A: Weekly Memos	16
Appendix B: Competition Presentation Slides	21

List of Tables

Table 1 Competition Scoring Rubric 11

1. Project

Beginning in September of 2015, our senior design project group chose to compete in the Associated Schools of Construction bidding competition. The ASC bidding competition takes place in February of every year in Sparks, Nevada. After researching the many different competitions offered at this event, we decided to compete in the Concrete Solutions portion of the competition. The six members of the 2016 Concrete Solutions team were Shawn Tezak (Captain), Ty Albert, Keifer French, Teaguean Knudsen, Britt Pennell, and Mike Studiner.

1.1 ASC Bidding Competition

The Associated School of Construction is an association that is dedicated to working with construction educators and the construction industry. The association brings education and industry together to help grow and improve the construction industry. ASC promotes discussion, collaboration, and sharing of knowledge to help forward progress of the construction industry.

The association hosts a bidding competition every year in Sparks, Nevada at the Nugget Casino and Resort. The competition participants consist of schools from the Rocky Mountain Region (Region 6) and the Far West Region (Region 7), as well as open competitions for schools from around the country. The schools assemble teams to participate in problem statements pertaining to certain divisions of the construction industry. The construction industry sponsors and presents these problem statements to the competing teams. Several fields of the industry are used as topics for competition, such as heavy civil, commercial, mixed use, and design build. The problem statements are based off of projects that the sponsors had already completed. The sponsors compare team performances to how they estimated, bid, and completed the project. Teams are judged based on their performance, presentation, creativity, ingenuity, and considerations.

1.2 Concrete Solutions

Sundt Construction Company hosted the Concrete Solutions problem, and open competition event. Sundt chooses projects that they have struggled with or that are not as common in the concrete construction industry. The projects usually consist of traditional construction practices such as bidding, estimating, quantity take offs, and safety. Additionally, Sundt chooses projects with “Concrete Solutions” that are unique to Sundt and the concrete industry.

The competing teams are given 13 hours to collaborate, assemble, and deliver a bid proposal to the judges. The bid-proposals and presentations are judged based on the following criteria.

- Quantity take off of materials pertaining to the scope of the work.

- Cost estimate, including materials, labor, subcontracts, and equipment.
- Means and methods of how the project was completed.
- Safety considerations and site safety plans and protocols.
- Site layout and site logistics.
- Casting and erecting sequences.
- Project schedule.

2. Preliminary Work

After deciding to participate in the Concrete Solutions portion of the bidding competition, we used the time leading up to the event to prepare for the competition. As the second Montana Tech team to compete in the Concrete Solutions bidding competition, we had some leadership from the previous year's team to help guide us. Our goals leading up to the competition were to build great team chemistry, identify each team member's strengths and weaknesses, and become proficient with working as a team. We also wanted to develop great presentation skills, expand our knowledge of the concrete industry, and develop roles that each team member would take on when the competition began.

2.1 Weekly Meetings

In September of 2015, the Concrete Solutions Team (CST) met for the first time and discussed a plan of action. At this meeting, we began to look into previous Sundt Concrete Solutions problems. We were able to obtain previous problem statements dating back to 2012, and we decided to divide these problems amongst group members. Each group member was to go through the complete project described in their problem year and report back to the group with findings. These findings were then compared for similarities and differences amongst project years, so as to get an idea of what might be expected to occur in our competition problem. Also at this first meeting, we decided to meet at least once per week, sometimes more as needed, for the remainder of the time leading up to the competition.

After a couple of meetings on our own, our mentor, Professor Larry Hunter, began attending our weekly meetings. Professor Hunter was very helpful in pointing us in the correct direction for preparing for the competition. Professor Hunter realized that as a group, we didn't have a lot of experience with concrete construction, and that we needed to become familiarized with the different aspects of it. To work on our presentation skills, and to help to improve our knowledge of concrete construction, each week Professor Hunter would come up with three important concepts related to the concrete construction field, and then we would break into groups of two and research these concepts. We would then put together a slideshow presentation about the research knowledge we had acquired, and present it at the following week's meeting.

Not only did the individual groups gain knowledge and presentation skills, but the entire Concrete Solutions Team was able to learn by watching the presentations and asking questions.

Through the research and presentation method of learning, the Concrete Solutions Team was able to gain knowledge in post tensioning, fiber reinforced concrete, rebar crowding in concrete, forming in general, slip forming, water tight forming, structural forming, pump trucks and how they work, hoppers and cranes, cooling concrete, warm and cold weather concrete, finishing concrete, tip-up concrete, and sequencing of concrete construction. These concepts proved to be very important in the competition problem that we were assigned at the bidding competition.

Professor Hunter also took us through an outside example bid for a project done by Quest. We examined the drawings and specifications, and Professor Hunter was able to show us the most important items in these documents. He also showed us what we should look for in the documents presented in the 2016 competition. The Quest project was also very useful in showing us how to divide quantities, and how to estimate those quantities and costs. Weekly meetings, with the help of Professor Hunter, were a very crucial part of our preparation for the Concrete Solutions bidding competition. An in depth look at what was done at each weekly meeting can be found in Appendix A: Weekly Memos.

2.2 Team Roles

Professor Hunter indicated that it would be very beneficial to have specific roles for each team member when going into and participating in the ASC bidding competition. Although each member contributed to just about all aspects of the project, we decided to split up the roles, and we did this before the competition, instead of waiting until we got there. Sundt provided documents online stating what would be the most important items in the competition, and from those documents, we were able to develop roles for each member of the Concrete Solutions Team. It was determined that Teaguean would take on the quantity take-off and estimation role. Mike would take on the specifications and site safety plan role. Ty would take on the specifications and the QA/QC plan. Shawn would work on scheduling, sequencing, and the site logistics. Keifer would help Shawn with scheduling and sequencing, and would also organize all documents created. Britt would take on the green construction, LEEDs, and risk analysis role of the project. Dividing up the roles before the competition allowed each member to practice their role and to become proficient with the aspects of the competition involved with their role.

2.3 Books and Software

Preparing for the 2016 Concrete Solutions competition also meant determining what books, software, and materials we might need for the competition. Over the course of the semester, we were able to narrow our book list and software list down to the most important and

necessary ones. For books, we determined that if we could find pdf versions, then we would save on space for other materials we might want to bring to the competition. We determined that the ACI Specifications book and an add mixture book would be good resources to bring to the competition. We also found that the Civil Engineering Reference manual would make a good reference book to have at the competition. For software, we decided that experience and knowledge of Bluebeam would be crucial for quick and easy takeoff quantity estimations and cost calculations. We also found that Heavy Bid software may be useful for organizing the expenses of our project, and that a scheduling software such as Asta Powerproject or Microsoft Project would be crucial to performing well at the 2016 competition. The scheduling software and expense software was not needed, as Sundt provided both for the competition.

2.4 Guest Speakers

Guest speakers were also a great asset for preparation for the 2016 concrete solutions competition. Guest speakers from Quest were able to talk to us about a project they had performed, and were also able to describe some of the things they look for in the specifications. They also described how to deal with quantity takeoffs and cost estimation. A guest speaker from Barnard, Ron Holden, was also very informational about what to expect for the presentation portion of the competition. He explained what to expect during the presentations, and also described what judges and the audience look for in a successful presentation. The presentation portion of the competition is a very large part of the overall score, and the information provided by the Mr. Holden was very useful in explaining how we should present and what to expect during the presentation.

Because we were the second team to compete in the concrete solutions competition, we had some leadership from the previous year's competitors about how to approach preparation for this competition. Our first meeting of the semester involved a previous concrete solution team member, Wesley Sherman, guest speaking at our meeting. He informed us about what to expect at the competition, and showed us digital copies of the problem they encountered from Sundt, the concrete solution competition sponsor. He also explained that as competitors at this event, we should approach this competition with less of an engineering mentality, and instead more of a construction management mentality. Taking this advice, we decided that focusing more on concrete construction means and methods, estimating, takeoffs, forming, and concepts such as these would be of great value for us at this competition, as it was these types of concepts that the previous team had to attend to.

Also from a previous team member, Cole Moller, we were able to obtain previous Sundt competition problems dating back to 2012, as well as the master copies of all documents that the 2015 Concrete Solutions Team had put together for the competition. This information was very useful for our preparation for the 2016 competition. We were able to take the old competition problems and dissect them for similarities, which allowed us to get an idea of what Sundt might

be looking for at the 2016 competition. The problems from previous years also allowed us to practice for the 2016 competition. Cole was also able to talk to us about preparing for the competition, and what his team could have done differently to better prepare for it.

2.5 Sletten Tour

The Concrete Solutions Team was also lucky enough to do a site tour with Sletten November 5, 2015. Sletten is building the foundation for the new Natural Resource Research Center building on campus. During this site tour, Sletten answered any and all questions we had about the concrete construction process. They talked about forming, sequencing, scheduling, and subcontracting. They also described the process of ordering concrete and getting the concrete to the site and placed in the site. The tour was very informational, and much was learned.

2.6 Fundraising

Fundraising was a crucial part of being able to attend the ASC Bidding Competition. As a team, we were tasked with going to several different businesses around Butte, MT to ask for donations for the trip to Reno, NV. We also sent letters to different companies requesting donations, and were able to receive some donations through this method as well. A big source of our fundraising came from attending the Montana Contractor Association's annual banquet, where we were able to raise a lot of money by auctioning off different items that had been donated to us for the event. The exact amount of money raised for the competition and spent on the competition is unknown to us, but is kept in record with the Treasurer of the AGC Club, Jake Erpenbach.

3. Competition Event

On the morning of February 11, at 7:00 AM, all of the competitors for the concrete solutions event met with Sundt Construction to go over the problem and receive the documents associated with the project. We were to be considered Sundt employees and develop a safety plan, event sequencing, lifting plan, and solution to the concrete problem.

3.1 Project Scope

The project that we received consisted of pouring and placing tip-up concrete walls in a remote location. Sundt wanted us to determine the following information:

- Quantity Takeoffs for concrete, rebar, and brackets
- Labor hours and pay
- A schedule for the tilt up portion of the job
- Picking a crane for the job
- A sequencing plan

- A lifting plan
- The “concrete solution”
- An optional alternative plan

3.1.1 Concrete Forming

Since the project was in a remote location, there were not existing concrete slabs that could be used to pour the walls. We learned that tilt up concrete is best poured on existing concrete. The administrative building already had the floor slab poured and the columns placed, as well as the second and roof floors. We planned to pour a temporary slab on the sides of the building to allow us to pour the walls next to the building.

3.1.2 Tilting the Concrete

When tilting concrete, the crane selected must be able to safely maneuver the heaviest concrete member. Sundt provided us with three cranes with specifications and usage rates. The crane was to be set next to the temporary slabs so that it could lift the concrete walls into position. The walls could then be braced until the edges could be welded together. (Steel edges were cast into the concrete)

3.1.3 The Solution

Because the second and roof floors were already in place, and the grounds surrounding the building were soft and muddy, bracing could not be placed on the inside or outside of the building. The solution to the problem was in the form of figuring out how to brace the walls so the crane could move to the next slab. Two teams came up with the “concrete solution,” and that was to put an angle bracket on the roof that would be secured using nuts and bolts until the welder could connect the two members.

3.2 Competition Timeline

The problem statement was presented at 7:00 AM on Thursday and was to be turned in by 8:00 PM that night. Sundt had a question and answer session at noon for two representatives from each team. At this session, Sundt hosted a trivia competition over basic construction knowledge. These results gave teams the preference of presentation order for Friday. We picked a 10:00 AM presentation time for the next day. The presentation was where the largest amount of points came from for the project. The breakdown is shown below in Table 1.

Table 1 Competition Scoring Rubric

Scoring Component	Points
Pre-Competition Exercise	5
Pre-Construction Wage Calculation	5
Pre-Construction QTO	10
Pre-Construction Budget	10
Operations - Finance Forecasting	10
Operations - Finance Billing	10
Evaluation Meeting - Presentation	20
Evaluation Meeting - Q & A	30
Concrete Solution BONUS	5
Total Points	105

3.3 Project Presentation

Having a 10:00 AM presentation time was about the perfect time to have. It allowed us to get some sleep, but also have some time to practice our presentation the morning before we had to present. After turning in our deliverables at 8:00 PM on Thursday, we started putting our presentation together. We mainly constructed our presentation that night, and saved practicing the presentation until Friday morning.

We rehearsed our presentation for about two hours on Friday morning, and then made our way down to the room where Sundt was waiting for us. We used PowerPoint to present our information. Sundt gave us 15 minutes to present, and then 20 minutes to answer questions that they had for us. Sundt was very big on safety. They wanted a safety share at the beginning of every meeting and they asked a lot about safety in the Q&A portion of the presentation. Other questions asked were mainly pertaining to the use and placement of the crane, sequencing, quality assurance, and the alternative method. It was important for us to come up with an answer to every question asked, rather than telling them we could get back to them later with an answer. That concluded the competition, and we were to wait until the awards banquet to find out the results.

4. Post-Competition Reflections

Following the competition, our group met several times to discuss the outcome of the event and how we felt about our performance. Although things did not go as well as we had hoped, we do believe that we learned a great deal from this experience, and can provide helpful insight to future teams in this category.

4.1 Beneficial Pre-Competition Exercises

Part of our preparation for the competition included weekly meetings with our mentor, Professor Hunter. During our meetings, we would discuss multiple topics relating to concrete construction, and then would decide upon three or four important topics that we could research during the next week in groups of two or individually. This thorough form of research helped immensely in preparation for the competition, but a more direct focus in the construction aspect would have been very beneficial.

Our team was able to get a hold of problem statements from the past five years of the ASC Concrete Solutions competition. We got the original copies from a past Concrete Solution team member, but these old problem statements were also available on the Sundt website for reference. Not all of the statements were helpful in preparing, but there were a few that we felt helped us prepare, including one that had a finished report with remarks from the judges. The most beneficial way we found to use these problem statements was to treat them similarly to the actual competition. We did this by first going through the statement together and then assigning roles within the project to our team members based on what we felt was our strengths. Our team then worked on the problem statement for a week and brought back our findings at the next meeting. If it was needed, we would spend another week on the past problem until everyone was comfortable with our results. One area where we did fall short with respect to the problem statements was that we never did a full presentation of our results. We believe it would have helped our presentation skills as an entire team if we would have done a complete presentation for a mock panel of judges.

4.2 What We Did Best at the Competition

There were many areas our team performed well in. The following bullets describe what we felt we excelled in the most at the competition.

- Our team did very well in the deliverables side of the competition. We scored above average on each document that was due at the end of the 12 hour competition. We were confident in our bidding and estimating skills, as well as our quantity take offs. We worked together in an efficient and friendly manner that allowed us to come up with an accurate bid and supporting documentation.
- Our team worked very well with each and every member. We never had any discrepancies that slowed down our work, and we developed an open environment with

each other so that no one was left out or afraid to voice their opinion. This was one of the most important factors that helped our team be successful. The ability for everyone to contribute in all aspects of the competition maximized our performance. This also taught us the importance of working as a team, because without all six of us, we would not have been able to complete the project on time.

- Lastly, our team did great on time management. We started off strong by having our “office” put together the night before the competition so we did not have to waste any of our 12 hours making desks. We stuck to our plan of going over the problem statement together, and then broke up the deliverable between the team members. As each of us finished our respective documents, we would help each other with different problems and consult one another on questions that we had in our documents. We were able to complete all the necessary documents about 30 minutes before they were due, as well as put together an alternative bid estimate that included a different schedule to the construction. Once the documents were delivered, we took a break and had a team dinner, and then went back to our office to start building our presentation. Because we managed our time so well, we always had time to double check our work and avoid turning in anything we didn’t feel confident in.

4.3 What We Could Improve on Pre-Competition

Although we felt prepared for the competition, there were a number of things that could be improved that would be beneficial in being more competitive. We did receive some help from members of last year’s concrete solution team, but there was much more information that we could have obtained from them. A continuous line of communication with a previous competitor could have potentially increased our success in Reno. The following paragraphs delve into other aspects that we could have done or improved upon during our preparation.

First, our contact with the previous year’s team was far too little. We met with a few members of last year’s team, and only once with those few. We did get some general direction in how we should prepare, but we did not utilize them enough in retrospect. The documents we received from them did help us in our preparation, however, we believe that it would have been a tremendous help to have read their thesis and have continual communication with one of their team members.

Next, our success at the competition could have been increased profoundly if we were more proficient in our presentation. Prior to the competition, we thought we had spent adequate time presenting, and were confident in our presentation skills. However, after receiving results from the competition, it was evident that our presentation did not do well in comparison to the other teams. It is important to practice presenting as much as possible. It would also be beneficial to present to a panel of judges (professionals in the construction industry or similar) to get feedback on what to improve, and on what we were doing well.

The last topic we could have improved during our preparation was addressing safety. Although this seems like a broad topic, it is a very important part of the construction industry. We had taken a very general approach in our safety consideration, but we lacked the in-depth research that this topic needed. In the competition, safety was discussed multiple times, as well as a safety quiz was used to give teams their presentation times based on how well they did on the quiz. We did not do well on the initial quiz, but thanks to the tie breaker rounds, we were able to move up into the top half of the teams.

4.4 What we could have improved on during the competition.

During the competition, a few minor mistakes were made. Many of these mistakes can be contributed to inexperience, poor time management, or poor communication and presenting. While no team is without a few small mistakes here and there, it is believed we would have been much more efficient had we been more experienced in these areas. A better description of these areas with examples are listed below.

- **Inexperience.** Many of the small scale problems we faced came from our direct lack of experience. This is both the lack of experience in the concrete field and the lack of experience with the competition itself. For example, while focusing on costs and lift plans, we overlooked the practicality of actually placing the walls once being lifted. Experience in the field would have helped us by not missing an important part of the puzzle such as this, while experience with the competition would have allowed for better time management. To add, the team also failed to look into the location of the project. After determining it was in North Texas, we made the assumption of hot weather and wind. Had we looked further into it, we may have been able to determine the rapidly changing weather patterns of Northern Texas. Prior competitions would have allowed for better use of time in this regard as well.
- **Poor Resource Management.** While time management and communication were our strong points, we misused our resources. We wasted much of the time we had available to ask questions, believing we had a good idea on the project. This is not to say we did not ask questions, we just feel we did not ask enough. The team forgot to look into the weather and climate factors of the area as well. We did not use computer programs that may have been beneficial such as ASTA or Project.
- **Poor Presentation.** Unfortunately, the majority of the points our team missed came from the presentation itself. After practicing the presentation a handful of times, we felt we were prepared for our judges. The initial presentation went very well we felt. We made it through our slideshow in an appropriate amount of time and without any major fumbles. The judges then asked their questions. We were able to answer several of the questions easily, but there were a few that we had to “get back to them” on. We also missed out on much of the information the judges were looking for, and were unable to answer questions involving the securement of the walls. We also missed the concrete solution,

which would have awarded us bonus points, had we discovered it. Much of the poor communication was seen in the morning when work was slow and we were unsure of what we were doing. Moving towards the afternoon, the communication became flawless and the team excelled.

4.5 Advice for future teams

This competition is tough, and many schools participate in it. In order for a team to perform at a high caliber, they need to know a few things going into the competition. This is a short list of advice and tips that we have for future concrete teams.

- Communicate. Communication is the most valuable skill for any team. That is true with the Concrete Solutions team as well. Team building exercises, doing class work together, and spending time with each other outside of school, all show huge benefits in getting along and communicating. Our team never had difficulty with not getting along due to these activities.
- Relax. Don't spend all day, every day concerned with the project. While it takes a lot of time, it leaves time for fun both during the school year and at the competition. If your team stalls out, take a break. Go get a pizza and have fun with the project. Come back once you've relaxed.
- Get Experience. While field experience isn't required to compete in the competition, it helps immensely. Not everyone has access to field experience however, so the next best thing is to learn from local industry. Butte has many companies that would be willing to show how things are done, and meetings can be set up easily. Tech is also great at setting up info sessions with large construction companies. These info sessions may give an idea on information that team members wouldn't know about. Little things that experienced professionals say can provide valuable information down the road.
- Learn From Other Teams. The other teams are all working on projects to the scale the Concrete Solutions Team is. They all have something to offer. Having a team member sit in on other teams meetings may give valuable information in an area that the concrete team is not knowledgeable in.

5. Conclusion

In conclusion, the Concrete Solutions Team was an amazing experience, and our group strongly encourages participation. Spanning over 8 months, the team worked together to solve problems, advance our knowledge of the construction industry, and build connections with industry leaders. Working with a small team on a large project provided us with invaluable experience that will help us move forward with our careers.

After all the votes were tallied, the Montana Tech Concrete Solutions Team ended in 9th place overall. While we didn't receive an award, we gained invaluable bidding and estimating experience, learned how to work in a high stress situation with short time constraints, learned

how to work as a group, developed better presentation skills, and made connections with industry leaders. Our hopes are that our experience will help future Concrete Solutions teams from Montana Tech compete at a high level at the ASC bidding competition.

Appendix A: Weekly Memos

Weekly Memos:

Week of 8/31 – 9/6

- First meeting as a group: Tuesday, September 1, 2015
- Looked through previous CST Binders.
- Wesley Sherman guest spoke out at our meeting.
 - Told us what to expect to encounter at the competition.
 - Showed us digital copies of material from Sundt.
 - Advised going into the competition with less of an engineering mentality and more of a construction management type mentality.
- Decided our focuses should be on researching concrete construction, means and methods, estimating, takeoffs, forming, etc.
- Decided to brainstorm books, software, and anything else we might need that would be beneficial come competition time for our next meeting.

Week of 9/7 – 9/13

- The CST met Thursday, September 10, 2015.
- We received digital copies of previous Sundt problem documents from previous years, back to 2012.
- Each team member was assigned a problem document from a certain year.
 - Each problem was to be dissected, studied, and analyzed for trends and conditions that Sundt typically requires of competitors.
 - The goal was to understand what we might encounter, and to start preparing for what we might see in Reno.
- Team members were to perform these tasks and present their findings at the next week's meeting, which would generate questions to seek answers to.

Week of 9/14 – 9/20

- The CST met Wednesday, September, 16, 2015.
- Gathered driver's licenses and W-9 forms.
- Divided up companies given to us by Avery for fundraising letters.
- The team discussed some findings from the old projects.
- Also discussed some books that would be useful to have in Reno, and presented this list to Professor Hunter.

- Decided to get contact information for the companies we were assigned, and to put together the letters and envelopes to be sent out to these companies for the next meeting.

Week of 9/28 – 10/4

- The CST met Tuesday, September 29, 2015.
- The AGC fundraising letters were completed, and certain tasks that were needed done for the AGC Club were divided up between group members that needed to be done.
- The book list was also added to and organized and presented to Professor Hunter.
- We also went into more detail about what we found in our competition problems from previous years.
- For the next meeting, group members were to work on their specific tasks, as well as to take another look at their assigned competition problem, and bring questions.

Week of 10/5 – 10/11

- The CST met Tuesday, October 6, 2015.
- Shawn discussed shipping options for getting the AGC Club's materials down to Reno.
- The posters had been finished in the AGC room.
- Discussed any remaining items that needed to be finished for the AGC Club.
- Discussed findings from each individual's project year that they addressed.
- Put together new list of items to look at and research:
 - Site safety
 - QA/QC
 - Sequencing
 - Forming
 - ACI Specifications
 - Scheduling
- Each item was divided amongst each team member, and each team member was to present on their item at the next weekend with a PowerPoint presentation.

Week of 10/12 – 10/18

- The CST met Tuesday, October 13, 2015.
- Met with Larry at noon.
 - Decided our weekly meeting time for the rest of the semester would be Tuesdays at 12:00pm, and that Larry would attend them with us.
- Discussed LEEDs and sustainability.
- Decided to break up into groups of two and put together a PowerPoint presentation on research of three different items pertaining to concrete:
 - Post Tensioning Concrete.
 - Fiber Reinforced Concrete.
 - Rebar Crowding in Concrete.

- The presentation was to be made at the following Tuesday meeting.

Week of 10/19 – 10/25

- The CST met Tuesday, October 20, 2015.
- Talked about people's experience with Bluebeam and Heavy Bid, and got Bluebeam installed on the CST laptop.
 - Practice with both software's would be crucial for success in Reno.
- Each team of 2 people presented on their findings from their research of post tensioning, fiber reinforced concrete, and rebar crowding in concrete.
- Forming was the next research item.
- Members were to break into teams and research forming and bring findings and questions to the next meeting.
 - Slip forming
 - Water tight forming
 - Structural forms

Week of 10/26 – 11/1

- The CST met Tuesday, October 27, 2015.
- Discussed fundraising.
 - Divided the CST into groups to talk to local companies about fundraising.
- We discussed everyone's findings from researching concrete forming.
- Professor Hunter recommended we break into groups of 2 and put together presentations about pump trucks, hoppers, and cooling concrete for the next meeting.
- Shawn and Professor Hunter also contacted the Sletten guys about doing a site tour, where we could ask questions we might have about concrete, forming, sequencing, etc.

Week of 11/2 -11/8

- The CST met Tuesday, November 3, 2015.
- Presented research of pump trucks, hoppers, and cooling concrete.
 - Recorded each team's presentation for critiquing.
- Decided to divide into team's and do another presentation due next week on:
 - Finishing
 - Tip-up concrete
 - Sequencing

Week of 11/9 – 11/15

- The CST met Tuesday, November 10, 2015.
- Made list of top 7 things to get done within the next week.
- With the help of Professor Hunter, we looked through addendums and plan documents from Quest.

- Team members were to look more thoroughly through these documents for the next meeting, and prepare to put together an estimate.
- Team members were also to put together their autobiographies, resumes, and be ready for a headshot picture for the next meeting.

Week of 11/16 – 11/22

- The CST met Tuesday, November 17, 2015.
- Talked about different aspects of the Quest project we had investigated.
- Put together a list of supplies necessary for the competition.
- Talked about fundraising, and what we had obtained from local companies.
- Individual pictures were taken.
- The 2015 Concrete Solutions Competition problem was to be analyzed for discussion at the next meeting, and with people leaving early, we decided not to meet until the Tuesday after Thanksgiving break.

Week of 11/30 – 12/06

- The CST met Tuesday, December 1, 2015.
- Divided the team into different roles for Reno.
 - Teaguean: Quantity takeoff and estimation.
 - Mike: Specifications and Site Safety Plan
 - Ty: Specifications and QA/QC Plan
 - Shawn: Scheduling/Sequencing and Site Logistics Plan
 - Keifer: Scheduling/Sequencing and Help Shawn
 - Britt: Green Construction/Leeds and Risk Analysis
- Talked about the importance of RFIs, as well as zoning and building codes.
- Each member was to work on the written progress report and presentation for Friday as part of senior design.
- The team wouldn't meet again until after Christmas break, but each member was to work hard over break practicing and preparing for the competition.

Week of 1/11 – 1/17

- The CST met Monday, January 11, 2016.
- Discussed fundraising and the MCA banquet.
- Briefly discussed what we did over Christmas break.
- Discussed the pre-competition problem.

Week of 1/18 – 1/24

- The CST met Wednesday, January 20, 2016.
- Organized our supplies that we needed for the competition.
 - Made sure that everything would fit into a tote and that we would not forget anything.

Week of 1/25 – 1/31

- The CST met Monday, January 25, 2016.

- Went over some house keeping with the club and went on to review our pre competition exercise.
- Addressed the questions and the requirements for the submittal.
- Juggled around some ideas about how we would find workers to perform project.
- Worked on documentation and formatting for this exercise.

Week of 2/1 – 2/7

- The CST met Thursday, February 4, 2016.
- Completed the Concrete Solutions pre-competition problem.

Week of 2/22 – 2/28

- The CST met Friday, February 26, 2016.
- Discussed the following topics:
 - Techxpo
 - Poster
 - Binder
 - Presentation to Classes (PowerPoint)
 - Symposium
 - Shipping Binder
 - Thank You Cards
- Discussed the presentations to classes and agreed that we need to focus on getting the younger students interested in Civil Engineering and the excellent opportunities that students have in the General Engineering field, such as the AGC club.
- Discussed the shipping binder, which Shawn said he would put together.

Week of 3/21 – 3/27

- The CST met Monday, March 21, 2016.
- Started a power point presentation describing what we did and how we placed this year in Reno.
- Organized all material and documents received from the sponsor during the competition.
- Week of 3/28 – 4/3
- The CST met Tuesday, March 29, 2016.
- Discussed the requirements for symposium and Techxpo.
- Completed the abstract in full and the final report was started.
- The poster was also looked into and planned to be started. We prioritized based on the deadline for each item. We elected for work to be done individually on the final report after our initial meeting.
- Decided the member who would help present to the freshman engineering class on Tuesday, April 5.

Appendix B: Competition Presentation Slides



McKee Refinery Admin Building Tilt Walls

Captain Shawn Tezak
Britt Pennell
Teaguean Knudsen

Mike Studiner
Ty Albert
Keifer French

Project

Valero's McKee Refinery
Administration Building,
10 miles north of Dumas, Texas.
Focus on tilt up walls



Overall Totals and Breakdown

Total Tilt Up Cost	\$ 1,075,783.03	
Labor Cost	\$ 312,925.80	
Labor Time	2070 Man Hours	
Material Cost	\$ 280,485.46	
Concrete Quantity	500 cubic yards	
Equipment Cost	\$ 80,363.32	
Subcontracts	\$ 118,277.00	
Fee		\$ 119,531.45



Aggregate Crew Rates

Forming Crew	\$324.75/hr
3 Carpenters	
6 Laborers	
Concrete Crew	\$143.56/hr
2 Concrete Foremen	
4 Laborers	
Placing Crew	\$153.95/hr
1 Foreman	
1 Crane Operator	
4 Laborers	



Unit Prices

Concrete In Place Price	\$2151.57
Concrete	\$123.23/cu yd
Rebar	\$0.51/lb
Forming	\$6.90/linear foot



Crane Selection

Manitowoc 999
Hourly Rate Operated: \$200.00/hr
Move In: \$31,000
Move Out: \$31,000
Crew Size: Two

With a 150 ft-boom, the 999 can carry up to
138,800 lbs at a max distance of 50 feet



Overhead and Profit

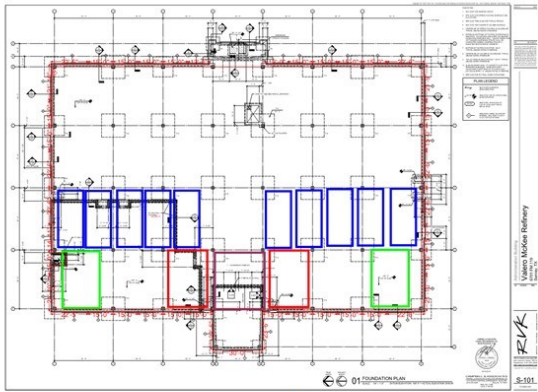
12.5% profit

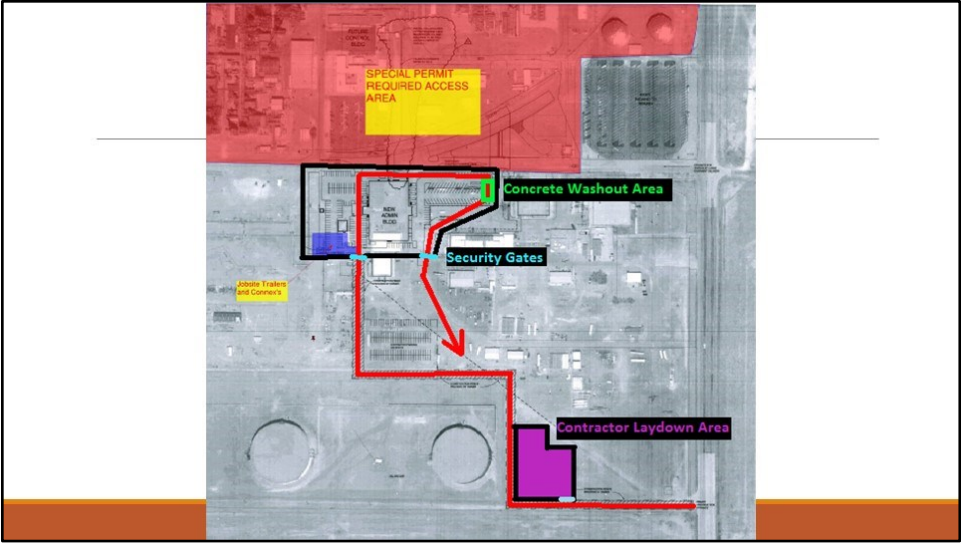
- Considerable risk incurred during project
- Crane operation
- Tilt wall erection
- Required access area avoidance

Voluntary Alternatives

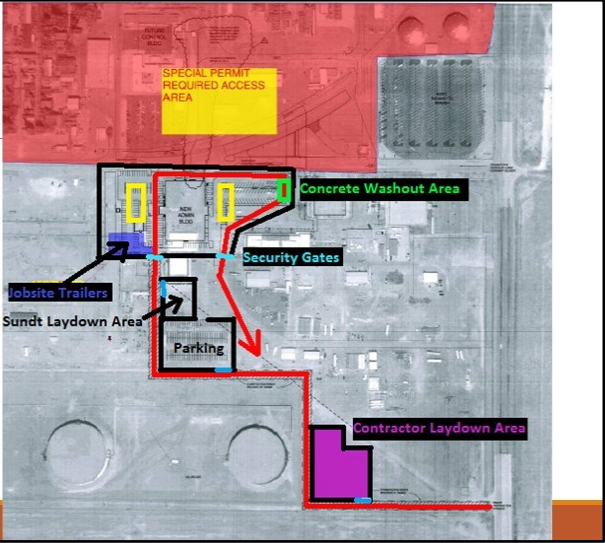
1. Place walls prior to 2nd floor and roof
2. Rapid strength concrete
3. Casting panels underneath the second floor

Alternative Method

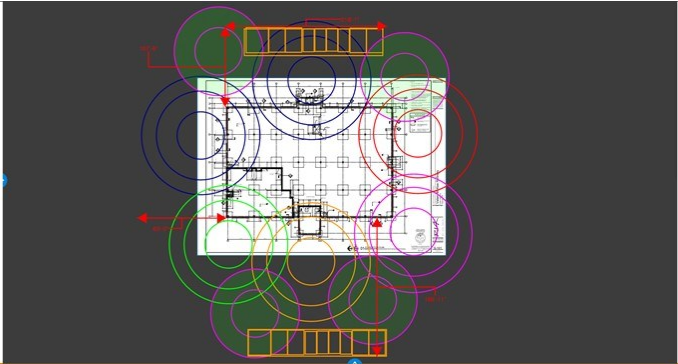




Site Logistics



Panel Casting & Erecting Plans



Safety & Risk Mitigation

RISK

	High	Medium	Low
PROBABLE	Congested Location	Traffic Control	Severe Weather
FAIR	Tilt Up Panel Erecting	Unsatisfactory Material	Wind
UNLIKELY	Earthquake	Concrete Finish	Fire

Questions?

