This paper will explain the preconstruction process for an observation deck in the San Luis Obispo Botanical Gardens, specifically the children’s garden. The children’s garden is a subsection of the botanical gardens dedicated to educating children through outdoor learning. The San Luis Obispo Botanical Gardens reached out to the Cal Poly Construction Management department in need of a team to create an outdoor learning space. Four students were interested in the project and decided to pursue it. The team for this senior project is an interdisciplinary group consisting of three construction management students and one architectural engineering student. The team designed the deck to fit the needs of the botanical gardens. The project received donations from supporting alumni organizations to fund the deck’s construction. The project team communicated with industry professionals and suppliers to gather information for the estimate and material quantity take-off. The team also needed to permit the deck through the county permitting office. The project team encountered many hurdles throughout this project. Communication issues during the design and permitting phase of the deck resulted in rework and delays. In the end, the team delivered a preconstruction package for the construction of the deck.

Key Words: Deck, Design, Estimate, Permitting, Interdisciplinary

Background

This project-based senior project is located in the San Luis Obispo Botanical Gardens. The San Luis Obispo Botanical Gardens are located in San Luis Obispo County, and more specifically, El Chorro regional park. El Chorro regional park is located between San Luis Obispo and Morro Bay in Central California. The SLO Botanical Gardens is a nonprofit organization that started as a Cal Poly senior project in 1989. The 150-acre garden displays the plants and ecosystems found in the five
Mediterranean climates found throughout the world. The SLO Botanical Gardens strives to inspire and educate the community about these plants and ecosystems.

The executive director of the SLO Botanical Gardens is currently in the process of developing a children’s garden just north of the botanical gardens main building. She reached out to the Cal Poly Construction Management department to find a team of construction management students to design and build a deck on the northern end of the children’s garden. The proposed area in the children’s garden is currently an undeveloped space at a slightly higher elevation than the path, making it an ideal spot for a deck.

**Design**

The design process started with the team presenting the idea of a deck in the children’s garden to the SLO Botanical Gardens board. The Botanical Gardens board approved the project and gave the team feedback. Much of the feedback consisted of requests to design the deck to be as minimal maintenance as possible. After receiving this approval, the project team set up a meeting with the botanical garden’s executive director, Chenda Lor. She showed the team the proposed location and the team staked out a rough footprint of the deck and also took a rough estimate of the slope. From the rough layout, the team found the deck would be between 450 and 650 square feet. The initial staked out footprint had many untraditional angles. The team agreed these untraditional angles would make the deck difficult to design and construct. The team simplified the design by making the deck a trapezoid shape. This trapezoid shaped design is shown in Figure 1. The team decided on a post and beam construction with stack-framed joists. To keep the deck minimal maintenance, composite decking with a higher wear resistance to traditional lumber, would be used.

The architectural engineer on the team wanted to add in an interesting structural aspect. He produced the idea of cantilevering the acute angle of the deck so the end would appear as if it were floating. The team visited the gardens to stake out the new design and update the gardens with the team’s progress. The gardens liked the design but was hoping the deck would be wider. Because of this, the team adjusted the design from twelve feet wide to sixteen feet wide. The four extra feet was made possible by cantilevering the stack-framed joists over the beams by two feet on either side. An issue with this design occurs at the tip of the triangle, particularly the last four feet. In this section, the deck would not be structurally sound due to the 2-foot cantilever. The team decided to remove the acute end of the triangle and thus the cantilevered end associated with it. Referencing Figure 1, 4 feet down from the
acute angle, the team made a perpendicular line across the deck from line B. This is the section removed from the design. After a few other minor revisions, the project team had reached their final design as seen in Figure 2. The team submitted the design to Chenda, and she approved.

**Funding**

The team started the search for funding by looking into funding resources affiliated with Cal Poly. The team found out about the Construction Management Advisory Council or CMAC for short. CMAC provides routes of interaction between industry professional alumni and current students. Students in the construction management program at Cal Poly SLO are encouraged to apply to CMAC for their senior project funding. The team applied to CMAC and received a $3,000 donation. Three thousand dollars is a huge help to the project however according to the team’s rough estimate, the deck was going to need more funding.

The team decided to apply to another organization called the Alliance. The Alliance is a foundation built to support the students in the College of Architecture and Environmental Design at Cal Poly and encourage a “Learn by Doing” education. The Alliance will only grant funding to senior projects that are cross disciplinary. The team is cross disciplinary making them eligible for a donation. The project team applied to the Alliance and received $2500.

**Estimating and Quantity Take-off**

After a design had been created and significant funding was received the team could begin working on the material quantity take-off and estimate. For the estimate, the team used excel spreadsheets, similar to the ones created in residential and commercial construction courses at Cal Poly. The team members often referred to the spreadsheets made in those past classes. The team needed the quantity take off to be as detailed as possible. This way the team would know exactly what materials would be needed, down to last nail. To achieve this level of detail, the team consulted companies and licensed contractors to get their feedback. The companies and contractors advised the team on lumber pricing, the necessary connection hardware and constructability. After countless phone calls and emails, the team produced a final estimate and quantity take-off.

**Permitting**

The permitting process began as the team grew closer to finalizing the design of the deck. The project team arranged an appointment with the county permitting office to
get a better understanding of what documents will be required for the building permit application. The county permitting office informed the team of the required documents needed for the application as well as the ADA requirements that apply to this project. These ADA guidelines required an ADA accessible walkway from the parking lot to the deck. ADA requirements to this extent were not something the project team had anticipated. The team scheduled a meeting with Chenda to go over the information learned at the permitting office and explore the teams’ options to fulfill the ADA requirements. Chenda was already aware of the ADA pathway requirements. Her and her team were in the process of grading the pathway in the children’s garden to meet ADA considerations. With an answer for the ADA considerations, the team was able to move forward and prepare the other documents needed for permitting.

**Lessons Learned**

This senior project had its fair share of bumps in the road. Reflecting on this project the team quickly realized how vital communication is to any construction project. During the deck design phase, the team stayed in close communication with each other, however the team wasn’t communicating as much as they should have with the botanical gardens. The team initially designed the deck to be twelve feet wide but did not double check with the gardens to see if that width would be acceptable before finalizing the calculations. After meeting with Chenda, the team learned the botanical gardens wanted the deck to wider. The team needed go back, redesign the deck, and redo the load calculations. This extra work could have been avoided if the team kept in closer contact with the botanical gardens during the design phase to ensure they were happy with the design before the calculations were finalized.

Visiting the permitting office sooner would have been beneficial to the project as well. The permitting office informed the team of the needed documents for the building application along with the codes applicable to the deck. The team was so focused on creating the deck that the ADA requirements for the pathway to the deck were overlooked. Having been aware of the ADA requirements and other applicable codes, the team could have referenced the code book while designing the deck to ensure the deck would comply. The permitting department also informed the team that the building plans must be signed off by a licensed architect or structural engineer for the county to accept them. Again, if the team knew this sooner, the team could have made arrangements with a licensed professional to check up on our design during the design phase.
Communicating with the permitting office early on would have also informed the team of how long the permitting process for the deck would take. The team was under the impression that permitting would take only a few weeks. Upon talking with the permitting department, the team was informed that a building permit would take anywhere from 5 to 8 weeks to be approved. The team was initially planning to build the deck as part of the project, however after learning this information the team shifted to creating a preconstruction package for the deck.

**Deliverables**

This project started as being a preconstruction and construction project. The team was a little ambitious with the schedule and the team faced many delays. These delays make it unrealistic for the team to finish preconstruction and construction before graduation. The team decided to shift the scope of work and make a preconstruction package for the deck. This preconstruction package includes a finished design, construction schedule, estimate, quantity take-off, contact list, and funding. The team will be submitting the permit to the San Luis Obispo County permitting office for the next project team to pick up and begin construction.

**Conclusion**

In conclusion, this project was a fantastic learning experience. Navigating issues and producing solutions for this project is very reflective of the issues and problem solving that occurs on a regular basis in the construction industry. From this project, the team learned many valuable lessons. With help from teammates, botanical gardens staff, and advisors, the project team was able to overcome challenges and create a preconstruction package for the next team to use to construct the deck.
Figure 1: Original Deck Design
Figure 2: Final Deck Design
Figure 4: Site plan 2