The Construction of Elevated Decks and Safari-Style Glamping Tents for Zoo to You

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This paper will outline and discuss the construction process of two elevated decks accompanied by the assembly of two safari-style glamping tents, built for the non-profit organization Zoo to You located in Paso Robles. Zoo to You provides rehabilitation and housing for endangered, injured, or otherwise illegal animals. The goal of the project was to create a new housing facility for guests to stay overnight on zoo grounds, in an immersive wildlife encounter experience. The housing facility was created using concrete and lumber construction followed by the assembly of premanufactured tents. Concrete was used to build the strong foundations required for the project. Lumber was utilized to construct the elevated decks. Metal conduit was utilized to form the skeletal structure of the tents, which themselves were made of durable canvas. By creating this new facility, the objective was to rebound the non-profit from the loss of revenue it incurred during the onset of the COVID-19 pandemic. The construction project team was comprised of two graduating Cal Poly construction management seniors, each splitting roles along the lines that a project manager and superintendent would on a typical larger scale project. The construction itself was completed with equal efforts of both students.

Key Words: Constructability, Sustainability, Collaboration, Innovation, Decks

Background

In the concluding chapter of the Construction Management program offered through Cal Poly, it is required that students complete a capstone experience in the form of a senior project. The senior project that will be discussed in this paper is project-based, converting theory from courses into physical application. For this project, two students from the program collaborated to complete the design and construction of two elevated decks suitable to serve as flooring platforms for two safari-style glamping tents. These decks were built for the non-profit organization *Zoo to You* located just north of the university in Paso Robles. The inspiration for this project came from the non-profit's desire to raise revenues as well as the students' desires to build a project voluntarily that contributed to a wholesome cause.

Zoo to You operates as a sanctuary for endangered, injured, or otherwise illegal animals to call home. Exhibits and enclosures are provided to see through that animals are capable of living peaceful, healthy lives. Although this mission of the zoo seems simple and sweet, there are substantial costs associated with running an organization of this type. Funding for the zoo comes from gracious donors, animal encounters, and educational programs. Animal encounters involve guests paying to visit onsite for an immersive experience with the wildlife. The educational programs are done by traveling with select animals to schools across the state to teach young students about the wildlife and the importance of conservation. Of these three measures of funding, the COVID-19 pandemic halted both animal encounters and educational programs. As a result, funding dwindled and the non-profit fell behind. Looking to bounce back, the idea of adding a facility to allow guests to stay overnight on zoo grounds was created. From this idea to boost funding, arose the concept of the senior project.

Construction Process and Methodology

The project began with a visual inspection of the land selected to be the site of construction. The location had previously been graded and upon analysis it was concluded that the dirt for which the decks were to be built was suitable with regards to soil settlement and eventual consolidation. With the location and dirt primed for the project, the process for creating the deck's footings began. Holes were excavated to the needed depths in preparation for the pouring of the footings. Once finished with the excavation, each deck had three rows of five footing holes created. Above the ground surface, formwork was placed to provide a square profile for the small amount in which the footings were to protrude from above the holes and ground level. Rebar cages were placed inside the footings to provide reinforcement for the footings. Concrete was poured to fill the extent of the holes and reach the top plane of the formwork. Simpson column bases were placed in the center of each footing to provide anchors for the deck posts. Column bases are designed to provide a connection between a primary-load-carrying vertical wood column to the concrete foundation. They provide vertical support and connection to transfer loads to the building foundation, acting as a brace for the structural loads supported by the columns.

The deck posts were constructed from four by four pressure treated Douglas fir. The posts were placed inside and anchored to the column bases using heavy duty bolts and nuts. Prior to finalizing the mechanical fastenings of the posts, they were plumbed for vertical straightness. After finalizing positioning, the posts were securely fastened to the cast-in-place column bases creating a connection to the concrete footing foundations that provided high structural value, capable of rugged performance. After the posts were erected it came time to construct the perimeter beams and center beams from which the floor joists would be connected to.

To begin constructing the beams, some initial layout was required. Strings were lined around the columns to ensure straightness of the first beam placement. With each deck taking the shape of a rectangle, the longest side was set to be placed first. The long side beam was fastened directly to the columns using heavy duty bolts and nuts except in the case of one side of one deck where it was fastened directly to a concrete stem wall from an adjacent animal enclosure. After the beams on the longest sides were set on each deck, the perpendicular perimeter beams were set for each deck. These beams were also directly fastened to perimeter columns via heavy duty bolts and nuts. During the placement process, string lines were used to ensure level and square for the deck's perimeter beams and the connection between short and long side beams. Following the perimeter beams, the interior beams were ready for placement. Again, using string line for level and square, the beams were directly fastened to interior posts via heavy duty bolts and nuts. With the perimeter and interior beams set, it was time to install the joists.

The process for constructing the joists began similarly to the beams, with initial layout largely influencing the success of the joist placements. The joists were set to be sixteen inches on center, so at increments of sixteen inches along the beams, crowfoot markings were made to indicate the location of joists. The joists were set to lay perpendicular to the short side perimeter and interior beams, making them parallel to the long side beams of the rectangular decks.

Following layout, is was time for joist placement. To begin the construction of the first joist, the gap between the short side perimeter beam and the first interior beam was measured along the crowfoot markings relative to each beam. After the measurement was obtained, the joist was cut to length and hung via Simpson joist hangers. These hangers were face-mounting mechanical fastening structures that provided installation versatility and nailing grids that replaced traditional nailing patterns,

allowing for faster installation. After one joist was placed, the next measurement for the next on center placement was obtained, and a new joist was cut. This method was chosen as it was most efficient in accounting for growth that may have occurred in the gap between beams with the newly placed joist between them. The joist construction process was noted to be special as the efficiency of a construction duo was optimized.

The two students developed an efficient and systematic method for placing the deck joists. One student measured the gap for the joist that was ready to be placed while the other cut the joist to length. The joist was then ready to be placed. One student provided the lifting force needed to hold the joist in place, flush to the beam it was being adhered to. The other student wrapped the joist hanger snuggly around the joist and used an impact driver to drive to screws into each side of the hanger, securing the exact needed location of the hanger. The process was repeated for the opposite side joist-to-beam connection. Once the hangers were set, the joists could be screwed to the beams via the hangers. One student worked on finishing off the screws of the hanger for finalized joist-to-beam connection while the other student procured a new piece of lumber to become the next joist. The process repeated itself until both decks were fully completed as far as infrastructure was concerned, with installation of the flooring ready to be the next step in the deck construction process.

Prior to finishing the construction of the deck by laying the flooring, a ramp and stair system needed to be completed to create walkable access to the elevated decks. One deck was elevated twice as high as the other deck. For the taller deck, stairs were installed, and for the shorter deck, an ADA approved ramp was installed to fit the capabilities of those zoo guests unable to walk up a set of stairs. The stairs were obtained from a donor who was able to transport the stairs from their old use at a winery to the site of construction. Essentially the stairs arrived as a premanufactured component to the project. Minor improvements were required to adjust the stairs to meet flush with the deck as well as some older pieces of wood from the stairs were replaced. The construction of the ramp for the shorter deck was started by excavating dirt to provide the need gradual slope that otherwise would have been too steep. The beam structure of the ramp was anchored to the concrete stem wall of the adjacent animal enclosure in addition to being staked into the ground. Once the logistics for accessibility to the top of the decks were configured, it was time to lay the floor decking which was to be placed on the ramp and stairs in addition to the decks themselves.

For the decking, rainforest alliance certified eucalyptus was chosen for its sustainable properties and rugged lifespan. The sticks of eucalyptus came in sizes of eight and nine feet to cover the width of the decks, staggering their placement to create an alternating pattern where pieces meet that was visually aesthetic. The decking ran parallel to the short side perimeter beams, with one row of decking being placed with an eight-foot piece followed up next to it with a nine-foot piece to complete the row. The next row was then completed alternatively with first laying a nine-foot piece and then following it with an eight-foot piece to complete the row. This created the desired flooring pattern in the middle of the decks. To install the initial row for each deck, a string line was used to assure the decking placement was parallel to the short side perimeter beams and perpendicular to the long side beams, respectively. After the first row of decking was placed, string line could be neglected as the next row just need to be flush with the previous row to have proper placement. With the completion of the flooring, the deck was finished and the glamping decks were ready for assembly.

The safari style glamping tents were purchased and arrived onsite, but the skeletal structure was not included. To create the structure, metal conduit was purchased in excess lengths and cut to form the studs, top plates, rafters, and ridge beams. After cutting the conduit to the needed lengths for all the components, they were connected via couplings designated for the conduit. With the skeletal structures erected, the tents were then draped over the roof structure by attaching ropes to one side of

the tent, throwing the ropes up and over the ridge and pulling the ropes until the tents made their way from one side, over the ridge, to the other side. To fasten the tents to the decks, ropes with mechanical tensioners were connected from eyelets in the tents at the top of the tents' side walls, down to bolts screwed into the long side perimeter beams. Prior to fastening the decks, insulation foam boards were placed between the two layers of the roof of the tents to provide added interior conditioning. With the tents completed, the construction process of the senior project was finished and the students had built a new housing facility that will greatly contribute to the future success of Zoo to You.

Photographs

Figure 1. Concrete Footings, Formwork, and Post Bases

Figure 2. Short Deck Primary Beams

Figure 3. Tall Deck Primary Beams

Figure 4. Secondary Member Joists

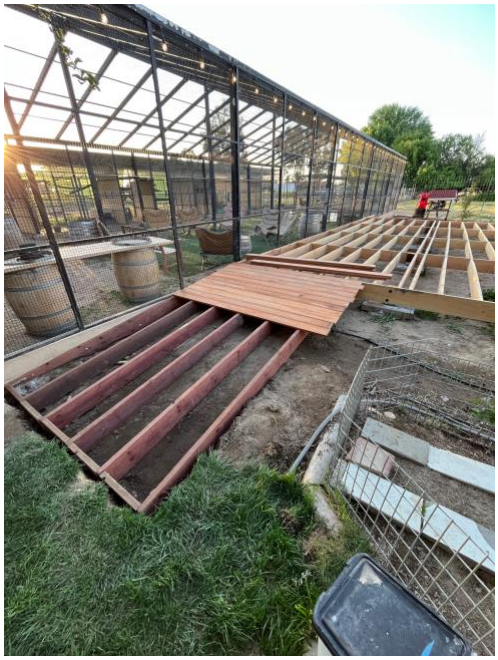

Figure 5. ADA Ramp

Figure 6. Stairs

Figure 7. Eucalyptus Decking

Figure 8. Glamping Tents