Oasis Church: Designing and Building a Pergola for the Discipleship Home

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The senior project idea for building a pergola, fire-pit, and paver hardscape was designed and executed by Andreas Rasmussen and Logan Smith. With the necessary background knowledge in landscape construction and the required funding, the Discipleship Home in Oceano, California, gave these two construction management students the opportunity to build an outdoor aesthetic area for residents of the Discipleship Home. This document provides information regarding the design, acquired funding, construction process, lessons learned and conclusion after the project was finished. The purpose of the project is to provide a peaceful place in which the residents of the Discipleship Home can study and worship in an area large enough for social distancing outdoors under a peaceful and pleasant covering.

Key Words: Pergola, Fire-Pit, Hardscape, Landscape Architecture, Lumber

Introduction

The senior project of building a pergola designed by myself, and built by Andreas and I, was a great accomplishment and learning experience for both of us. After many meetings and consultations with the Discipleship Home director, we were able to complete all of our tasks and responsibilities. These tasks throughout the project were to complete a design, estimate, and construction of the pergola. Part of the construction process was obtaining the proper equipment and tools, buying the correct and necessary amount of materials, and working in a safe and clean manner while working during the time of a global pandemic. The result of the project consisted of a peaceful and quiet place to relax outdoors where social distancing could be maintained, as well as priceless knowledge and experience obtained through the full construction process of taking on every aspect that goes into the planning and executing of a project.

Background

The Discipleship Home, which is a recovery home run by the non-profit organization Oasis Church, takes in people who are recovering from drug and/or alcohol abuse and people who are on probation from serving sentences in prison, with goals of getting these people back on their feet and on the right path in life through worship. The house is managed by LeAire Griffin, who coincidentally is a landscape contractor in Oceano, California. His responsibilities include making sure the people residing at the Discipleship Home are attending bible studies/prayer time slots, getting to work on time (if they are able to and cleared to work), contacting parole officers, and determining when the residents of the Discipleship Home are ready to move out and start their life journey again.

The reasoning behind building a pergola, fire-pit and paver hardscape was due to the fact that the Discipleship Home didn’t have an outdoor, open area to conduct worship or bible study. The addition of a pergola, fire-pit and hardscape would serve as a nice aesthetic to the existing backyard as well as
provide an area large enough to fit as many as 8-12 people with sitting and standing room. Also, due to Covid-19 becoming a new factor in our lives, this area helps incorporate social distancing into the gatherings that happen at the Discipleship Home, and add an area where people can remain distanced, but also gather together in an inviting area where they can feel comfortable under some shade during the day, or near a warm fire during the cooler evening hours.

The background knowledge required for an accurate lumber estimate was acquired through taking ‘Residential Construction Management’, CM 214 at Cal Poly, SLO, with instructor Joe Cleary and ‘Construction Materials’ CM 113/114, with instructor Barry Jones. Although I had previous knowledge through experience with how to build landscape architectural features, the estimating process for framing lumber would’ve been much more extensive if I hadn’t taken the necessary courses at Cal Poly. Performing concrete and lumber take-offs and developing safety/logistics plans through these courses with the help of the professors, made it possible for me to develop an accurate estimate and design, as well as a safe work environment for the senior project Andreas and I had the opportunity to complete.

Building the pergola, fire-pit and walkway would’ve been an overbearing task for just one builder, so Andreas and I separated the pergola from the fire-pit and walkway to make two senior projects. Andreas would be handling the deliverables required for the fire-pit and paver hardscape, and myself handling the deliverables for the pergola.

The Process

Design

The idea for building a pergola, fire-pit and hardscape for the landscape in the backyard of the Discipleship Home first came to my attention when Andreas told me about an opportunity for a senior project for a local non-profit organization: Oasis Church. As someone who grew up in a religious household, I knew and understood the benefits of having a place of peace and worship, so I thought doing something for an organization which encouraged personal growth and self-acceptance through religion would be a relatable and beneficial project for myself and for the Discipleship Home.

Before meeting with LeAire to discuss plans to build a pergola, fire-pit and hardscape, we needed to figure out where we would get the necessary tools required to complete our project. Andreas and I own smaller tools such as power drills/screw guns, clamps, hammers, levels, shovels and tape measures, but not the bigger stuff for cutting large pieces of lumber and mixing concrete. Andreas had the idea to rent from Grover Tool Rental in Grover Beach, to rent a miter saw (or chop saw), concrete mixer and a couple of 10’ ladders. We told Grover Tool Rental about the project and they were happy to hear we were building the project for the Discipleship Home, as they rent tools to LeAire frequently because of his landscaping work, and they decided to donate the use of the miter saw, skill saw, concrete mixer and ladders until the completion of our project.

Funding

After having multiple meetings with LeAire to get the most aesthetically pleasing look and the most logical and fitting location for the pergola, we were able to expand upon our rough sketches and designs. The dimensions for the pergola were to be 12’x12’, with a height of 10’. The original
estimate called for (4) 12’x6”x6” Douglas fir posts encased in concrete in the ground, with (4) 14’x2”x8” double-header boards, (11) 14’x2”x6” joists running on top of the header boards, and (11) 14’x2”x4” slats running on top of the joists at the top of the pergola. The original estimate also took into account extra costs for the necessary screws and carriage bolts for holding down every piece being hung on the posts, as well as a 10% waste factor to prepare for damaged materials or human error. The final estimate came out to $1,200.00 for the pergola alone. Andreas and I knew we would need funding for this project because we figured that the fire-pit and paver hardscape could easily double our pergola estimate. I decided to contact Scott Kelting after receiving an email from the school that CMAC (Construction Management Advisory Council) would be giving selected students grants to fund senior projects. Scott is a professor at Cal Poly as well as a member of the CMAC executive committee, and he pointed me in the right direction as to how to apply for a $1,200 grant through the CMAC organization. After waiting anxiously to hear back, we were awarded the $1,200 on November 4th, 2020 and we couldn’t have been more grateful. This also gave Andreas and I exactly a month to get rolling on the construction of project we had been preparing for in the couple months prior to receiving the grant.

Construction

Figure 1: Initial landscape of the backyard (Pictured: Andreas)

Our first step in the process of building the pergola was laying out the corners for the posts in which we would be digging. The foundation for the pergola is the most important part, so I allowed a couple days in our schedule for layout to ensure that the pergola was square. The process for finding our right angles on each corner was by using the three, four, five triangle method, in which we used tape measures to find our adjacent distances (three and four feet extending adjacent from our proposed corner, and finding the five foot hypotenuse) and stakes to keep our corner locations marked. Once these locations were correct, Andreas and I built a square border out of 14’x2”x4” which ran outside of the corners, and allowed us to punch nails into this border and run string line two feet inside the
outer perimeter of our border. Running the string line gave us the exact locations for the 12’ dimensions of our square and made it easy to line up where the corners of our 6”x6” posts would be.

![Figure 2: Square border to establish corners of the Pergola](image)

We dug out holes under our string corners roughly two feet in diameter and two feet deep in order to encase the posts in a sufficient amount of concrete to provide lasting stability for the pergola. Luckily, the backyard consisted of mainly “Nipomo Sand”, which is a soft, sandy sediment that makes digging quite easy, and were able to get the four post holes dug fairly quickly. Once the holes were dug, we stood up the posts one by one and encased them in concrete. This was a lengthy process because the 12’ posts are over 100 pounds each, which required one of us to hold the post level while the other would mix the concrete in the mixer and shovel it down into the hole. After the posts were encased enough to stand on their own in the fresh concrete, we braced the posts using six foot 2”x4”s and stakes to make sure the posts stayed in place as the concrete cured.

![Figure 3: Posts encased in concrete in the ground, with bracing for stabilization while curing](image)
The next part of the process was tricky because we had a sloped backyard for drainage, but we needed to keep the pergola at the same height at each corner. The posts were 12’ tall, with two feet already in the ground encased in concrete, and with the natural slope of the backyard, we needed to move the height down far enough to where we could make each post the same height, but also have enough room to get our header boards flush with the top of each post. So, after consulting with LeAire about shifting the height down to account for leveling the pergola, he gave us the ‘OK’ to make the height change from 10’ to 9’6”. The existing slope of the backyard was declining roughly ¼ inch per foot, making the highest elevated post at least three inches taller than the shorter post after they were put in the ground, so Andreas and I decided that cutting the highest post down six inches would be a nice even number. After we made the cut for the first post, we used one of our 14’x2”x8” to span from height of our tallest post cut, to the other posts, marked them, and then cut the remaining posts one by one. Using the 2”x8” for the 12’ span was our thickest board and would have the least amount of sag or bending, and each post landed right on 9’6” in height. After the heights were established, we used C clamps to help hold the 14’x2”x8” header boards in place while we piloted a ½ inch hole for our 10”x ½ inch carriage bolts, two on each post, to hold up a header board on each side of the posts.

At this point in the project we were looking right on schedule. In my original schedule, we would complete the by Wednesday, November 18th, the day before Andreas and I would be traveling out of town for Thanksgiving break. And we completed hanging the header boards on November 14th, giving us over a week to complete the hanging of the joists and slats on top of the pergola.

The joists and slats took us four days to complete, which was a day longer than I had anticipated. Andreas and I were still taking other classes during our senior project, so some days we only worked for a few hours, but we made a conscious effort to make each hour we put into the project count. The reasoning behind choosing 11 total 14’x2”x6” joists, was so that we could get an even 15” on center spacing between each joist at the top, giving the pergola two extra 14’x2”x6”s mimicking the double header boards on each side, and seven spanning across the middle. We chose to use 14’ sticks for the 2”x6”s and 2”x8”s so that we could get a one foot overhang on each side of the pergola, which gave it a really nice look with the finish cut we chose to go with. Andreas and I had a couple different options to choose from when placing our joists, we could either rest the 2”x6”s on top of the header boards and toe-screw them in, or notch the 2”x6”s so they rested snug on the header boards, while also providing stability with a toe screw. Our choice was to go with the notching even though it was extra work for us, we decided that the integrity of the joists were more important than getting the job done quicker.
Due to the lumber being imperfect and having some bowing and flexing, we were only able to measure two joists at a time for the notching of the boards. If we were to measure one board at one end and use that board as a template, there was a possibility that the other boards might run into some bowing or flexing, which would cause our notch cuts to be slightly off and cause the joists not to fit snug on top of the header boards. For cutting the notches, we primarily used a multitool, which was generously donated to us for the notching by LeAire. Once the joists were all spaced correctly and toe-screwed in for extra stability, Andreas and I were able to start on the slats to top off the pergola.

The slats for the pergola only took us a couple of hours to complete, which pushed us ahead of my original schedule for the pergola and it let us start staining the pergola a day earlier than anticipated. The slats had a slightly different spacing in comparison to our joists because we were going with an even spacing all the way across as opposed to the ‘double header’ method. This meant that to leave a one-foot overhang on each side, we measured the spacing at just under one foot on center for the 14’x2”x4” slats. After we had the slats in place, we were able to screw down each one, but it wasn’t as easy as one might think. The ladders that Grover Tool Rental donated to us were 10’ A-frames, which were perfect for the outside edges of the pergola. But when we had to maneuver the ladders around the inside of the pergola in order to reach through and screw down each slat, it became quite time consuming because the joists hung lower than the top of the ladders. Regardless of that obstacle, Andreas and I were able to complete the slats in less than half a day which put some ease on the pressure of getting the pergola done before Thanksgiving break.

Before we could start staining, we needed to add a couple diagonal pieces to the posts for added stability to the pergola and to provide a look that seemed to flow better when examining the pergola as a whole. This part is where the miter saw came in handy. Andreas and I needed to make angle cuts on 6”x6” posts so they would be flush with the posts and extend up into the gap of the double header boards. Calculating how much length of 6”x6” was complex because the distances to the double header of the 2”x8” and 2”x6” were different. We came to the conclusion that the distance needed to extend from the post to the 2”x8” were three foot, and the distance from the post to the 2”x6” were
just under four foot, which meant we needed to buy one 12’ to account for the two, three foot pieces on each side for the 2”x8”, and two eight foot 6”x6” posts for the two, four foot pieces extending to the 2”x6”s. After picked up the lumber, we set the miter saw to 45 degrees, and made the cuts to set our diagonals between the posts and double header boards.

The staining of the pergola began a couple of days after the slats and diagonals were installed, and it took us a full day to stain the entire pergola. The stain was required to seal the lumber from weathering because the lumber was not pressure treated, as well as give it a nice color to bring out some of the unnoticed patterns in the lumber. To stain the entire surface area of the pergola it took about one and a half gallons of ‘Transparent Oak’ stain. Andreas and I used rollers on the longer spans and brushes to get the tight corners and hard to reach places. Andreas and I completed the staining three days before my original schedule calculated, which gave us some extra time to start working on the fire-pit and paver walkway.

Figure 5: The finished Pergola after staining (underneath the pergola is the gas line running to the center of the fire pit, undergoing a pressure test pictured here)

Purchasing

All materials purchased for this project were bought from local businesses in Arroyo Grande, Oceano, and Grover Beach. We made a conscious effort to shop locally and support local business in these
difficult times with the presence of Covid-19. We knew it was tough for local business with the lockdowns in place, so Andreas and I wanted to do what we could to not shop from the bigger corporations like Home Depot which have the capital to survive a global pandemic.

The lumber primarily came from Burk and Pace Lumber Sales. Some lumber we bought from Brisco’s, but unfortunately they didn’t have the 14’ sticks or the 6”x6” posts. We did however buy the self-tapping screws as well as the carriage bolts from Brisco’s True Value and Lumber Mill.

**Lessons Learned**

During the construction process, there were many things that Andreas and I learned. Some of the major take-aways for me although, begin with working with a sloped grade when going for a level pergola. We originally planned to have the pergola sit at 10’ high, but it wasn’t until we bought the 12’ posts that we realized they wouldn’t all be able to sit at 10’ and still be level with two feet of the post going the ground to be encased in concrete. But figuring the solution to use a 2”x8” board to find the level going off the post that was sitting the highest was very beneficial and helped us in the long run.

Working during a global pandemic was also a big obstacle for building this project. The Discipleship Home houses up to 10 people at a time, and sometime multiple residents would want to come talk to us while we were working and ask questions about what we were doing. This meant we had to be conscious of social distancing protocols advised by the state of California, as well as keeping masks on our person at all times, and wearing them whenever working or talking within six feet of someone else.

Something that was out of our control was the natural warping of the lumber we bought. Using Douglas fir framing lumber doesn’t make for the highest quality lumber in terms of shape and appearance, but it saved us at least double in terms of cost. Plus with the stain, the pergola turned out to have a really nice color and will be sealed for weathering for years to come. With the lumber being imperfect, our notching took longer than anticipated. Being more accurate and measuring the 2”x6”s for each notch made us feel better about each notch fitting more snug than it would if we measured off the first notched board, and potentially running into bowing along the double header boards.

**Results**

Illustrated in the picture below is the final product. The hand constructed pergola, with a gas-powered fire-pit and paver hardscape. The project in total took exactly one month to complete which was right on schedule, and the price of the entire project came in under budget in comparison to the original estimate. The original estimate for the pergola being $1,200, Andreas and I spent only $980 to build the pergola, and the remainder of the $1,200 grant went toward the construction of the fire-pit and paver hardscape.
Conclusion

Overall, this project turned out to be a great experience and a very nice yard piece for a home that does good in the community. LeAire was very satisfied with how it turned out and can’t wait to start conducting bible studies and worship out in the shade under the Discipleship Home’s new pergola. Through the initial stages of designing and estimating meetings with the Discipleship Home Director, all the way to the final product after construction were completed were made possible through past experiences in construction, as well as assistance from professors and necessary courses taken at Cal Poly. The construction of the project had zero injuries, and zero cases of Covid-19 due to our extensive safety planning and social distancing protocol.

There were many learning curves along the way, but this project helped me learn some new tricks that I will be able to utilize for future projects of my own. Building something for fun is a great feeling when you know you’ve learned something, but building something for a greater purpose that serves the community and helps bring people together is priceless.