

City Farm SLO Educational Pizza Oven

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Abstract

City Farm SLO is a nonprofit that educates the public about growing food, and they donate the produce to food banks and communities in need. Their mission is to promote healthy living through sustainable agriculture and farm-based education. This senior project is to build them an educational pizza oven for them to use in their classes. With it they will give lessons where they cook pizzas using ingredients that they grow on site. To do this, the builder had to make it lightweight and able to move around the property to different meeting places and outdoor classrooms. It is also a woodfired oven with areas to store wood, cooking tools and provide a butcher block workstation to make the pizzas on. Funding came solely from donors that the author reached out to because City Farm SLO didn't have money budgeted to front the project. This project was a solo project, meaning that one person designed it, procured materials, planned, and constructed it on their own. The Areas of this project that proved to be most difficult were the acquisition of funds, and the construction of the oven dome, being that it was a new building method for him.

Key Words: Pizza oven, Perlite, Cart, Carpentry

Introduction

The author was introduced to this project by an email that was forwarded to our senior project class from City Farm SLO. On this email was a list of senior projects that they wanted done at their farm, of which included a mobile pizza oven. The author was initially drawn to this project because he had previously constructed a wood fired pizza oven at his parent's property and really enjoyed building it. He immediately reached out and secured the project after meeting up with the client and discussing their expectations for it. City Farm SLO is a non-profit organization that has a mission to promote health, success, and environmental stewardship through farm-based education, especially for at-risk and underserved youth. In addition to this they want to model regenerative and sustainable agricultural practices, seeking to improve the long-term health and productivity of farmland. The Educational Pizza Oven will aid in their mission by providing a way for the students to cook and eat produce that they've grown in a way that is fun and interactive for the kids. A local high school has an elective class which comes to the farm twice a week to learn about sustainable agriculture. This class will use the oven to make pizzas that will be topped with fresh produce that the students cultivate and harvest. This is done in the effort to create a link between fresh produce, and food that students love and are familiar with.

Pre-Construction

Design

The rough design for this project took very little time to establish. The recipient and the author had a very similar vision for what we wanted it to look like and the dimensions that it should be. He met with the recipient then drafted the final drawings within three hours of meeting with him. His requirements included that it was mobile and was designed like a cart or wheelbarrow. He also wanted the dome to look hand sculpted like a cob oven and in the shape of a dome. Also, that it would be light, and have handles low enough so that any one person can move it. He found the optimal handle height to be 2' 6" and the dimensions of the cart to be 2'6"x3'x5' as shown in Figure 1 and Figure 2.

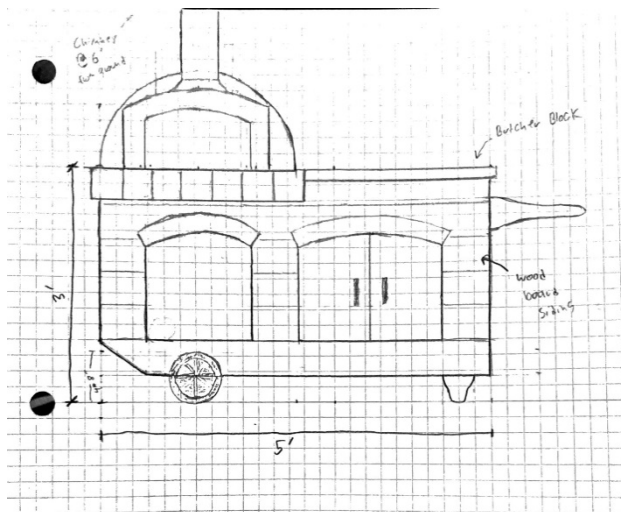


Figure 1: Front Elevation

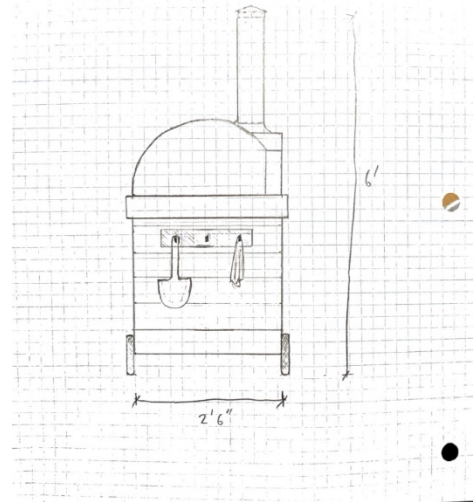


Figure 2: Side Elevation

Estimating

The author estimated this project by wandering Home Depot and taking pictures of the prices of materials that would possibly work. The author then made an Excel spreadsheet and calculated the quantities and total price of each material. He also added any foreseen costs to my estimate such as trailer rental or extra tools and materials. The estimated budget for this project was just under \$1,500 as shown in Figure 3.

Funding

City Farm SLO was not able to financially support this pizza oven, so the author needed to find donors to supply the funds for this project. Requests were sent via email to a variety of local businesses and only heard back from Specialty Construction Inc., who donated \$1,000 to the project. Later, when the project was already started, another donation was received from Higuera Ranch for \$100, and the author's parents donated some materials such as the butcher block and some lumber. The donations were still About \$100 short, so the author had to find cheaper tile and planned around having to rent a trailer to transport the project. It ended up working out perfectly and he spent almost exactly the amount that was donated. He even went a little over budget and gifted them a pizza peel and a couple other necessary pizza making tools.

Pizza Oven Materials (City Farm SLO)			
Material	Quantity	\$	source
metal	9(72x1 1/2x1/8)+1(48x1 1/2x1/8)		372.16 home depot
lumber	1(2x6x8') 8(2x2x8')2(1x4x8)		38.25 home depot
perlite	15bagsx8 litres		75 lowes
cement	94lb bag		15 homedepot
lime	50lb bag type s		17 homedepot
chimney	flue + chimney		41 home depot
pizza stone	4 (15x15)		120 https://www.etsy.com/
butcher block		1	260 home depot
wheels	2 (10in)		44 home depot
axil	1 (5/8x36")		18 home depot
board siding	10(1x6x8')		97.4 home depot
screws lags	1box + 4 bolts		25 home depot
mortar	AcrylPro 1 Gal. Ceramic Tile Adhesive		21 home depot
tile	24(4x4)		48 etsy
grout	1 bag white		17 home depot
cabinet hinges		4	20 home depot
cabinet handles		2	10 home depot
metal cutting wheel		10	25 home depot
drill bit		1	10 home depot
plaque		1	45
trailer rental	1day		50 home depot
construction adhesive		1	7 home depot
	total:		1375.81
	sales tax		120.3834
	Total after tax		1496.193

Figure 3: Estimate Spreadsheet

Construction

Frame

Once the builder procured the metal for the frame, he took the metal to his home to cut and weld all the pieces together, as shown in Figure 4. He used a flux core MIG welder to weld the 1 ½” angle iron and used off-cuts to add diagonal reinforcements. The metal frame was designed to have offset end walls so that he could put wood 2x2s on the ends and make it easier to attach the cedar board siding later in the project. This is shown in figure 5. The builder chose to make the frame out of metal because it has a better weight to strength ratio than wood alone. Although it was more expensive it added a lot more stability while allowing it to be moved by anyone regardless of strength. Steel will also last a lot longer than wood and won't require the tightening of bolts whenever the wood shrinks and expands. The wheels were also moved back so that they lie right beneath the weight of the oven. By lifting it up by the handles it shifts the weight to the far side of the wheel, almost balancing it out and making it extremely easy to move around.



Figure 4: Welded Frame



Figure 5: Finished Framing/ Ready for Casting

Oven

The oven consists of a casting of a perlite and cement mix that makes up the base and inner layer of the oven as shown in Figure 7. A perlite to cement ratio of 1-6 was used and was mixed relatively dry to keep it from slumping. The use of perlite allows it to be very lightweight as well as introduce heat resistant, and insulating properties. However, it is very fragile, so he included a chicken wire wrap as reinforcement, covered by a half inch layer stucco mix of cement, lime and sand as shown in Figure 8 and Figure 9. This mix had a ratio of 6 parts sand, 1 part cement, and 1 part lime. The purpose of the lime in the mix is to provide a self-healing property to the outer layer. Because of the heating and cooling of the oven there will be plenty of micro cracks introduced over time. The lime in the mix will react to the water and air and create limestone deposits, which will fill in the cracks and bind it together. Finally, he added a 1/8 inch layer of white grout to reduce wear of the stucco layer, as well as add waterproofing properties to the outside, and overall make it look nice and clean. This can be seen in Figure 11.

To cast the oven, The builder made a negative of the inside of the oven out of Styrofoam and wrapped it in cellophane as shown in Figure 6. He also made sure the face of the oven was square by placing scrap boards, with the outline of the depths and curve on them, to make it consistent from the head-on view. The temporary supports for the chimney were attached to this. He placed the forms on top of the pizza stone and perlite-cement base and drilled holes around the perimeter of the oven to place screws through. These screws serve to connect the base to the dome and provide shear strength, as well as provide something to attach the chicken wire to. From there the perlite-cement layer of the dome was placed by compressing 2 1/2" thick bricks in the builders hand and pushing them into the mold to form the dome. He then shaped the rest by hand using a set of trowels. The results of this are shown in Figure 7.

The builder chose to cast the oven during this phase of construction because the frame is functional to be moved around and supports the weight of the oven. Also, he wanted to cast the dome before he added any of the finishes. This is to ensure none of the finishes get ruined by cement stains, being that the casting is a messy process. Any surfaces that would be exposed in the final product were taped off to ensure cleanliness.



Figure 6: Ready for Dome Cast



Figure 7: Perlite Cement Cast



Figure 8: Chicken Wire Wrap



Figure 9: Stucco Layer Finished

Finishes

For the siding he used ¼” cedar T&G boards because they are lightweight and have natural weather resistant properties. The installation can be seen in Figure 10. The builder screwed them into the wood 2x2s, and when attaching to steel angle iron, he drilled holes through the metal and had a wood backing strip behind it for the screw to grab on to. He cut the cedar arches above the openings out of a ¾” board, with a jigsaw, then sanded them and added mineral oil to add a color contrast, as seen in Figure 11. The cabinet drawers were made by attaching the siding across the face of the opening, then once the arch was installed, he used a vibrating flush cut saw to cut the shape of the opening and was able to use the off cuts for the doors. They ended up being the perfect size and shape with the desired 1/16th gap around the perimeter, brought upon by the kerf of the blade used. Around the base of the oven, he added white tile which was attached to strips of backer board and bound them with thin set mortar and then finished it with the same color grout as the dome, as seen in Figure 11. The maple butcher block as seen in Figure 13, came in a dimension that was too short for the design, so he glued and clamped some extensions to make it the desired dimension at my shop back home. When installing it, he added shims to the frame to make the surface the same elevation as the pizza-stone oven floor. This can be seen in Figure 11 and 12.



Figure 10: Installation of Cedar Siding



Figure 11: Arches Finished/ Tile Installed and Grouted/ Grout Layer Applied to Dome



Figure 12: Butcher Block Fit-up/ Door Construction



Figure 13: Finished Product

Lesson Learned

Throughout the construction of the educational pizza oven for City Farm SLO, the author encountered several challenges that taught me valuable lessons. Firstly, the acquisition of funds proved to be a difficult task. It taught the importance of persistence and reaching out to a wide range of potential donors. Despite facing rejections, the author remained determined and ultimately secured the necessary funding through generous contributions from Specialty Construction Inc., Higuera Ranch, and the author's parents. Secondly, the construction of the oven dome posed a new building method for the author. It highlighted the importance of research and preparation before undertaking unfamiliar techniques. He learned the significance of thorough planning, seeking expert advice, and being adaptable during the construction process. Overall, this project taught lessons of resilience, resourcefulness, and the ability to overcome unforeseen challenges.

Conclusion

Building the educational pizza oven for City Farm SLO has been a fulfilling experience. From the initial design phase to the final touches, the author has poured his dedication and passion into creating a mobile, functional, and aesthetically pleasing oven. The support from donors and the recipient's shared vision played a pivotal role in bringing this project to fruition. By incorporating sustainable materials such as perlite and cedar, he ensured the oven aligned with City Farm SLO's mission of promoting healthy living through sustainable agriculture. This project has not only provided a valuable learning opportunity for the author but will also serve as a practical and engaging tool for educating the community about growing food. He is grateful for the experiences and lessons learned throughout this project and look forward to witnessing the positive impact it will have on City Farm SLO and its mission.