The Wine History Project of San Luis Obispo (the “WHP”) has been collecting and presenting viniculture artifacts from the last two centuries. With the need to display and maintain important artifacts comes the need for a structure that can fulfill such criteria. The purpose of this project was to design a pavilion that could entertain individuals while also displaying artifacts for the WHP. Additionally, the project’s design followed the recently trending method of integrated project delivery, which included the Architecture and Architectural Engineering departments. From the beginning, the design was influenced by its value propositions while still working within the constraints of the project. For instance, the structure was designed to be easily deconstructed and transported while maintaining longevity of the materials. The result of the design showcased both the simplicity and durability of aluminum framing and polycarbonate sheathing. Prior to final presentation of the design, a tangible mockup of the structure had to be fabricated in the CAED Support Shop. This mockup required a cost sensitive budget while procuring local materials. Among many design teams in the running, one was to be chosen as first place, with the winning design proceeding to the construction phase. This project design was chosen as second place.

Key Words: Integrated Design, Pavilion, Wine History

Background

The narrative of the WHP is a broad narrative of the viticulture environment: agriculture, land use, crop selection, the economic vitality of the county, and the relationships among the people who form the history of San Luis Obispo County. The purpose of the ISP 2019 project is to design a pavilion that will enable the public to experience a connection to that narrative. This studio will be an immersion in tectonic architecture. Tectonic architecture is defined as “the science or art of construction, both in relation to use and artistic design.”

Process

The Interdisciplinary Studio Pavilion 2019 was structured as a competition between interdisciplinary teams of students to design a suitable pavilion for the Wine History Project of San Luis Obispo (the “WHP”). Its curricula emphasized aesthetics; fabrication methods and techniques; ease of assembly, reassembly and transportability; and function.
Students were organized into eight interdisciplinary teams of architecture, architectural engineering, and construction management students. Teams were tasked to produce conceptual designs, schematic designs, digital models, physical mock-ups, detailed drawings, structural calculations, detailed cost estimates and materials lists, description of fabrication techniques and methodologies, fabrication labor estimates, interconnection details, and assembly and disassembly manuals. At completion of the course, students presented their work, including scaled mockup models. WHP representatives selected the design (or designs) of one or more teams. This design (or designs) will survive to the build phase of the project. The build phase is outside of the scope of this senior project.

The ISP goals and objectives are listed in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Goal</th>
<th>Description of Goal</th>
<th>Description of Objectives</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Incorporate WHP values into the design, demonstrated by achieving the listed objectives.</td>
<td>a) establish a set of 3 to 5 value propositions through interviews with the WHP; b) gain WHP approval of these proposed value propositions; and c) demonstrate how the design addresses each value proposition.</td>
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<td>2</td>
<td>Achieve an integrated design through interdisciplinary teaming, demonstrated by achieving the listed objectives.</td>
<td>a) establish team protocols for interdisciplinary participation; b) measure the team’s adherence to those protocols; c) establish a list of design elements that required interdisciplinary participation in their design; and d) explain the interdisciplinary characteristics of each of those design elements.</td>
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<td>3</td>
<td>Connect the user to the design and the design to the site, demonstrated by achieving the listed objectives.</td>
<td>a) establish a suitable scale that enables users to connect with the pavilion through the exhibits mounted therein; b) express the defining narrative that connects the pavilion to the site; and c) explain the specific features of the pavilion that advance that narrative</td>
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<tr>
<td>4</td>
<td>Facilitate the user experience, demonstrated by achieving the listed objectives.</td>
<td>a) identify one or more elements of the user experience, and b) demonstrate how the pavilion facilitates those experiences.</td>
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<tr>
<td>5</td>
<td>Incorporate tectonic portability into the design, demonstrated by achieving the listed objectives:</td>
<td>a) establish joinery of elements that enable easy knockdown and reassembly of the pavilion; b) specify durable connections that withstand numerous knockdown/reassembly cycles; c) assure that all hardware is weather-resistant, (the use of non-corrosive metals and/or compatible metals is encouraged); and d) amalgamate all connections into the architectural aesthetic.</td>
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Deliverables

Funding and Mentorship

Since this project followed an interdisciplinary design approach, it would only be appropriate to mention that LPA design studios from Irvine California was responsible not only for funding the fabrication portion of this project but for supplying mentors to us as well. LPA is an Architecture and Engineering firm which follows the interdisciplinary studio design approach in the real world. Thus, it was helpful to take advice from them throughout this process and apply it to our own design approach.

The LPA Foundation is a sector of the company focused on charitable giving and volunteer efforts. In this case, two of LPA’s design professionals, an architect, and a structural engineer were allocated to each team to provide one-on-one mentorship. We met with our mentors by video call three times during the entirety of the project. Getting feedback from real life professionals helped our structure become more functional and less of an artistic idea.

Defining the Value Propositions

Before any design could be started it was important for us to understand what artifacts would be displayed in this pavilion and where the pavilion would be located. Therefore, we were sent to a storage facility to view artifacts belonging to the WHP. The artifacts did attribute to various sizes and complexities. For instance, some artifacts were small and simple, like the old woven wine bottles seen in Figure 1, while others were large machines for bottling, as seen in Figure 2.

Aside from seeing the artifacts that would be displayed in the pavilion, we needed to see our site location as well. For this reason, we met with representatives of the WHP at the designated site location - Saucelito Canyon Winery located just east of San Luis Obispo. Figure 3 shows the final site layout of the winery and where the structure
would be placed. Even though Saucelito Canyon would be the first home of the structure, it is vital to mention at this time that this structure was meant to be broken down at some later date and then transported to a different winery within the county.

![Figure 3: Site Plan](image)

Considering the site walk-and-talk on the Saucelito Canyon grounds, the viewing of the artifacts, and all other factors which we felt influenced this pavilion, we found it necessary to create a set of value propositions to guide us in our design. The value proposition which we chose are seen below:

- Portability
- Ease of Construction and Reconstruction
- Multifunctional Design for Artifacts
- A Design Which Invites Onlooker Participation
- Weather Resistant Materials
- Low Maintenance
Designing a Realistic Structure

Since the interdisciplinary studio process gives all team members design control from the very beginning, it can be difficult for a construction manager to find purpose in the early phases. For instance, exercises like making paper models, seen in Figure 4, can appear ethereal to someone like myself who is used to looking at finished construction plans. However, as the ideas for our structure became more tangible and functional, I began to feel more comfortable in my design decisions. On the other hand, while the design progressed and I became more settled in my roles, the architects began to slip into a state of indecisiveness regarding how a structure is built. This created a back and forth power struggle within the group that was difficult to navigate through.

Details

Due to the lack of construction experience possessed by our architects, construction details were drawn and conceptualized by me using AutoCAD. This included all framing plans, joint connections, and section cuts. All artistic renderings were left in the hands of the architects, while the more complex structural details came to fruition by consultation with our structural engineer. Although getting more acquainted with the AutoCAD software seemed frustrating at first, having detailed drawings of our structure did benefit us not only with the mockup, but also in the compilation of a complete fabrication manual and owner’s installation manual.

Owners Meetings

Apart from our meetings with LPA, it was intended that we meet with the WHP two times in order to not stray off track. In these meetings, the WHP expressed concerns for how we would transport the finished structure and how the installation would go. In order to ease their worries, we adjusted the design of our structure to be broken down into smaller pieces to facilitate the ease of transportation and installation. For example, Figure 5 shows the broken-down parts of the structure fitting into a standard box truck.
The feedback in these meetings with the WHP prepared us for a final and more formal review, which took place at the San Luis Obispo Botanical Gardens. The purpose of the final review was to choose a winning design from several other teams in the running. The winning design would go on to the construction phase and be erected in the coming spring.

Fabricating the Mock-Up

In order to present at the final review, it became necessary to fabricate a full-scale mockup of our structure. Using the existing detail drawing which we had at the time, we decided to build a specific piece of our main panel system. Figure 6 shows the detail of that specific piece, while Figure 7 shows that same piece in real life. This mockup provided an opportunity to demonstrate the truss and framing system made from aluminum 2x2 tubing, while also showing the outer skin of the structure made from polycarbonate sheathing.

Problems Arise

In every construction project, there lies a problem to be solved. In this instance there were a variety of problems during the mockup fabrication phase. Some of those problem that needed to be solved are included below.

Estimating the mockup seemed easy in theory, however, things did not go as planned. My first estimation was upwards of $1,200. In fact, after speaking to several other teams, I realized that I was not the only one who came to a number this high. As soon as I finished my first estimate, we were told that the budget for the mockup could not exceed $400. This made things very difficult as I now had to redo my estimate while eliminating almost $800. I then had to value engineer the mockup, meaning I had to find similar materials that would fulfill the design specifications for a cheaper price. The second estimate took me about five days. I found that by decreasing the thickness of polycarbonate the cost was reduced by at least a third. I also had to make the model smaller than I had originally intended, going from two panels and one truss down to one panel and a smaller truss.
The mockup took place in the CAED Support Shop. Unfortunately, we were only given five days in the shop to complete the entire mockup. With a rigorous school schedule, I could only allocate three of those days to complete the miter cuts, welding and securing the polycarbonate to the frame.

On the first day of our allotted time to fabricate, another team’s architects commandeered our aluminum tubing and proceeded to cut it into pieces to fit their mockup. When this was discovered, I informed them that they had made a mistake, and when they surrendered my materials, I was left with various pieces of aluminum tubing in sizes that did not correspond to my needs. Even though I did not have all the materials intended for the mockup, I was lucky to have enough full-length pieces to construct an entire panel. Regarding what was left over and the mistakenly cut pieces, I was resourceful in using this spare aluminum to fabricate a small truss which I attached to my panel frame as seen in Figures 8 and 9.

Many of the other teams’ designs involved aluminum framing however, in their mockup, steel was sourced in its place to ease the fabrication process. It is well known that aluminum is much more difficult to weld than stainless steel. This posed a problem for me since I am not even a good welder of steel. Luckily, through the grace of another peer, I was given help welding my members together which kept my finish time on schedule.

Estimating

The value gained while redoing the estimate of the mockup bled over into the entire project. For example, once I realized we could use a thinner polycarbonate sheathing and achieve the same desired effect, that caused a previous $30,000 cost to lower significantly. We did our best to keep the design simple and use repeatable materials, which consisted of aluminum tubing, self-tapping screws, 5/16” fasteners and polycarbonate sheathing. In the end, the rough estimate price of our structure came to $19,076.66.

Procurement

Additionally, the mockup proved to be beneficial in choosing vendors for our materials. For example, it can be very tempting to order offline when it seems as though any design idea and its associated materials are at your fingertips. However, after driving throughout the county to different suppliers and making many phone calls, a decision was made to stay local. Keeping the materials close gave us more control over unforeseen lead times and availability, something that all construction companies deal with. Therefore, aluminum tubing was sourced from B&B Steel out of Santa Maria, while the polycarbonate shell and other fasteners were obtained through the Home Depot. These suppliers which were used in the mockup were also intended for the final product as well.
Lessons Learned

This project overall was more than just an act of co-designing, but more about coordinating and influencing people while maintaining good working relationships. In certain instances, one member of the team may want to steer the design off track away from the value propositions. In these cases, someone must be brave in saying no. This ability to pull back the reins helped mitigate complex construction problems down the line. If it be that problems still arise, you must be resourceful in your solutions. While these problems took time and patience to figure out, I was glad to have learned some valuable lessons that will help me in the workplace.

It is also important to keep the client’s needs in mind while developing design details that match those needs. Having a real-life client helped us to work towards a tangible goal, and not just another student project that would go unnoticed. Working with clients is necessary to push the boundaries of everything from structure design and functionality to transportation and installation. A real site location and a real purpose gave us the inspiration to create something together that would accomplish a task and teach us along the way.

In the end, this project design was chosen as second place and will not be moving on towards the construction phase. The design had potential to win first place, however small details were not complete ideas, like water run-off and the foundation assembly. I feel that the reason these details were never fleshed out is due to me not guiding the architects to see the importance in something that was not form, but function.

Figure 10: Architectural Rendering