SHIPPING CRATE REDESIGN

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ABSTRACT

Ashley Industrial Molding, or AIM, works as a sizable plastic part manufacturer for several industries. This company came to Trine University asking for avail from a senior design team. The issue at hand was the inter-company conveyance crates for the plastic components. The current crates were taking up space and were not as durable as what AIM needed, Figures 1 and 2.

Figure 1: Current Wooden Crate

Figure 2: Current Rack at AIM

When the team was assigned this project, needs and specifications were set by both the team and the sponsor. Brainstorming sessions created a handful of concepts that were presented to the sponsor representative, Mr. Mike Good. Once a concept was picked, the team used SolidWorks to iterate concept designs. When a design had been created that the team found worked the best, an archetype was made from wood to work out and test fitment of the fenders in the crate. The team then built a final product out of steel to present to the sponsor. Conclusively, the team had to work on iterations of a report to give to AIM that outlines the process of the project and what the team went through to build this product.

CUSTOMER NEEDS/SPECS

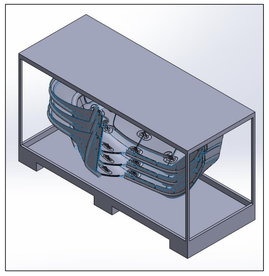
When the sponsor brought the project to the school, customer needs and specifications were needed to be determined. Table 1 shows some of the specifications that were put into place early in the project and if those specifications were met or not.

Table 1: Customer Needs/Specifications

Storage of 4 or More Fenders	**Met**
Durability and Life Span of 3 Years	**Met**
Stackable	**Met**
Cost Justification: Pay Back in 2 Years	**Met**
Compact When Not in Use	**Not Met**

DESIGN CONCEPTS

The team chose four concepts that were presented to the sponsor. Concept 4 was selected, but here is a breakdown of the presented concepts.



Concept 2
- 4 Fender Capacity
- Short, Compact Design
- Easily Stackable
- Large Slots for Forklift

Figure 3: Concept 2

Concept 4
- 8 Fender Capacity
- Large and Open
- Hangers and Teeth to Hold Fenders Vertically
- Small Slots for Forklift

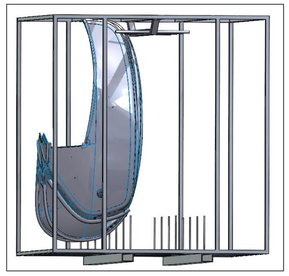
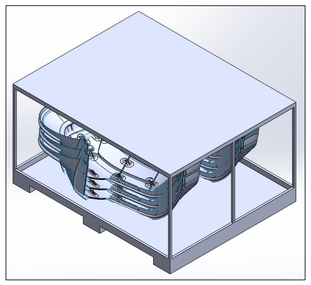


Figure 4: Concept 4



Concept 6
- 8 Fender Capacity
- Short Design
- Easily Stackable
- Wide Slots for Forklift

Figure 5: Concept 6

Concept 8
- 8 Fender Capacity
- Double Layers
- Open Concept
- Small Slots for Forklift

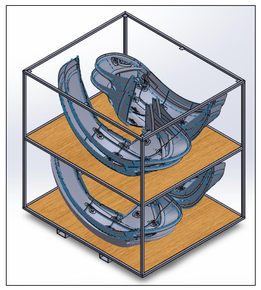
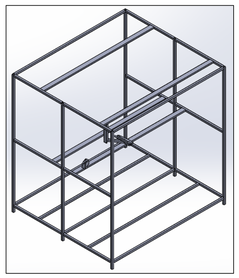


Figure 6: Concept 8



Pre-Prototype Concept
- Hangers and Midway Clamps for Fender Stability
- Open Design
- Vertical Storage for Fenders
- 8 Fender Capacity

Figure 7: Pre-Prototype Concept

TESTING AND RESULTS

Figure 8: Shipping Crate Prototype

Prototype – The team found that creating a partial version of the product out of wood would prove cheaper given the allowed budget. The team also found several design flaws that were fixed. These design flaws include the hanger design (updated in Figure 8) and the placement of the midway beams at both the middle and the top. The team then moved into final assembly once the CAD drawings were updated.

Final Assembly – Once the CAD files were updated and the materials were ordered, the team was able to build the steel version of the crate. This allowed the team to have a finished product to hand over to the sponsor. One of the team members stood on the hangers post-welding to test the integrity of the welds. This is shown in Figure 9.

Figure 9: Shipping Crate Final Assembly Test

FINAL DESIGN

Once the team got through the prototyping and testing phase, the CAD files were updated to show the final design of what the team would end up building out of steel tubing and 3D printed parts. Figure 10 shows that CAD assembly. The team printed out individual part drawings to take to the shop where three of the team members helped weld the crate together.

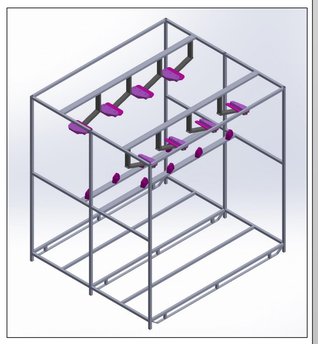


Figure 10: Shipping Crate Final Assembly CAD File

CONCLUSION

All in all, the team found this project was a bit more complicated than expected. However, all the students were able to persevere and have a product to hand over to the client, Ashley Industrial Molding. The team was able to use various skills to complete this project such as CAD work, welding and tool training, leadership, different communication techniques, and writing skills to bring this project to life. The team hopes that AIM will be able to use this design, or one similar, to have a more efficient process of transportation.

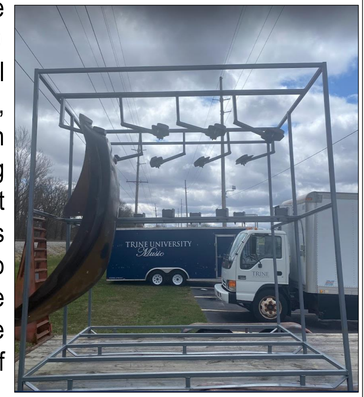


Figure 11: Final Product

LESSONS LEARNED

- During the build process, add in extra days as sometimes the expectation of what needs to get finished versus what is completed are two very different things.
- Make sure the team has the updated part drawings of each component needed when building the final design for a more efficient building/production flow.
- Having clear and concise communication from the beginning of the project to the very end of the project is very beneficial.
- There will always be a road bump and the plan may take more time because of this. Be prepared for this to happen and learn how to get the work done.

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