DOCK DOLLY REDESIGN

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ABSTRACT

It is common for owners of waterfront property to own dock systems, allowing for both easier access to the water and docking of various watercraft. In Northern states susceptible to freezing artificial structures, especially dock sections, must be removed from the lake prior to freezing to avoid damage. Thus, conventionally property owners must install said dock sections in the Spring and remove said dock sections in the Fall, by either the property owner or a contractor. Installing and removing dock sections can be costly if done by a hired contractor, and if done by the property owner this task can be awkward, time consuming and most importantly unsafe if done improperly. The design team was tasked with improving upon a previous iteration of the Dock Dolly (Figure 1), a device used to aid in the installation and removal of dock sections.

Figure 1: First Design

Through in-depth conversations with the sponsor, concept generation, testing and refinement, the design team created a Dock Dolly that is lighter, more compact, more maneuverable and more functional than the previous iteration. The current iteration of the Dock Dolly is also cheaper and easier to manufacture than the previous iteration.

CUSTOMER NEEDS / SPECS

EO Snell, LLC's needs for the dock dolly are stated in Table 1. Using these needs the design team created the specifications in Table 2.

Table 1: Customer Needs	Table 2: Specification
Assist with Install of Dock Sections	Carry at least 200 lbs.
Operable by two or fewer people	Weigh less than 200 lbs.
Traverse rough terrain	Wheel diameter of 4-8 in.
Stowable	Aluminum Frame
Easy Maintenance	Stainless Steel Hardware
Corrosion Resistance	Airless rubber tires
Adjustable	Dolly is 36 in. wide

DESIGN CONCEPTS

Figure 2, Scissor Lift Concept, aimed to improve upon the existing design through utilizing a scissor-lifting mechanism and a lighter frame. Figure 3, Crane Concept, aimed to provide the most flexibility for all dock sections and shapes.

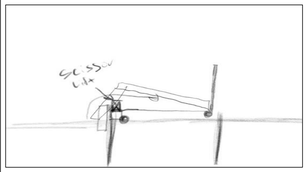

Figure 2: Scissor Lift Concept

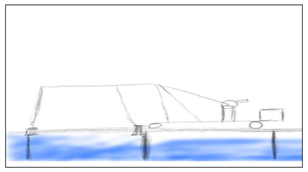

Figure 3: Crane Concept

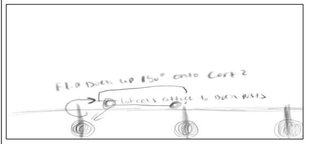

Figure 4: Small Cart Concept

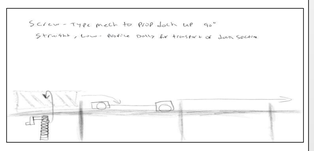

Figure 5: Screw Lift Concept

Figure 4, Small Cart Concept, aimed to solve the problem with a simple cart and screw jack, effectively minimizing cost. Figure 5, Screw Lift Concept, is the screw jack concept detailed from Figure 4.

TEST RESULTS

The winch-powered lift design went through live and finite element analysis (FEA) tests. The live tests are shown in Figures 6 and 7. As seen, the dock sections were longer than expected, however the lifting system worked as designed with few issues. The ballast on the back is needed to ensure a stable lift of each section.

Figures 6 and 7: Live Test Results

FEA analysis was used to simulate an extreme case scenario to ensure product safety and performance. FEA results can be seen in Figures 8 & 9. In *Figure 8* a minimum Factor of Safety of 2.5 is shown, and in *Figure 9* maximum deflection on the Lift Arm Axle is just over 0.030".

TEST RESULTS (CONT.)

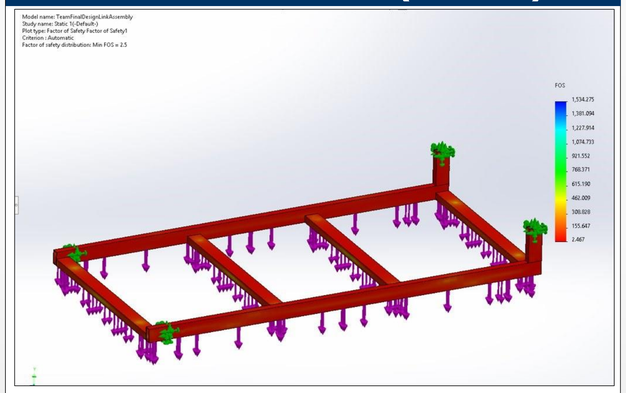

Figure 8: Lift Arm Factor of Safety

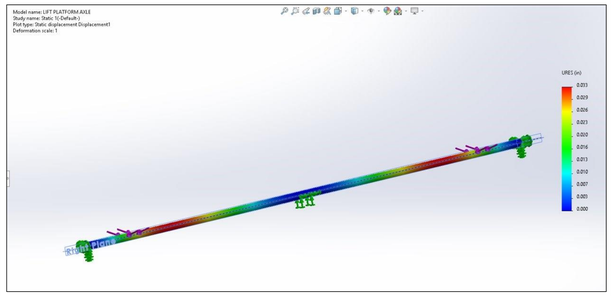

Figure 9: Lift Arm Axle Deflection

FABRICATION

The Dock Dolly was fabricated using welded aluminum forming two pieces, consisting of a lift gate and main frame, connected by an aluminum bar shaft. The Dock Dolly also includes many smaller attachments such as a winch, straps, pulley and tie-downs to hold the dock when lifting. The Dock Dolly also contains two swivel and two locked wheels, and a platform for counterweight, Figures 10 and 11.

Figure 10: Partial Build

Figure 11: Completed Dolly

FINAL DESIGN

The final design that was chosen to be developed into a prototype is shown below in Figure 12. This design was chosen based on its ability to meet the customer needs and specifications.

Figure 12: Final Design Prototype

CONCLUSION

In conclusion, the Dock Dolly team designed, tested and produced a working prototype. The team encountered a few problems during the process, but the team found adequate solutions. The team succeeded in staying under a $1500.00 budget given by the sponsor, Mr. Hauguel. The team meet other design requirement such as a light weight, storability, and ease of maneuvering.

LESSONS LEARNED

Throughout this project, the team learned:

- Communication is key to complete a successful project
- Ensure everything is documented throughout the design project
- Always be ready to adapt and problem solve
- Allow ample amount of time for testing and redesign

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