Dock Dolly

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ABSTRACT

Numerous waterfront property owners throughout the nation own docks to help further enjoy activities near the shoreline or with various watercraft. Twice a year, these non-permanent docks, like that in Figure 1, need to be manually removed or installed by either the property owner or a hired company.

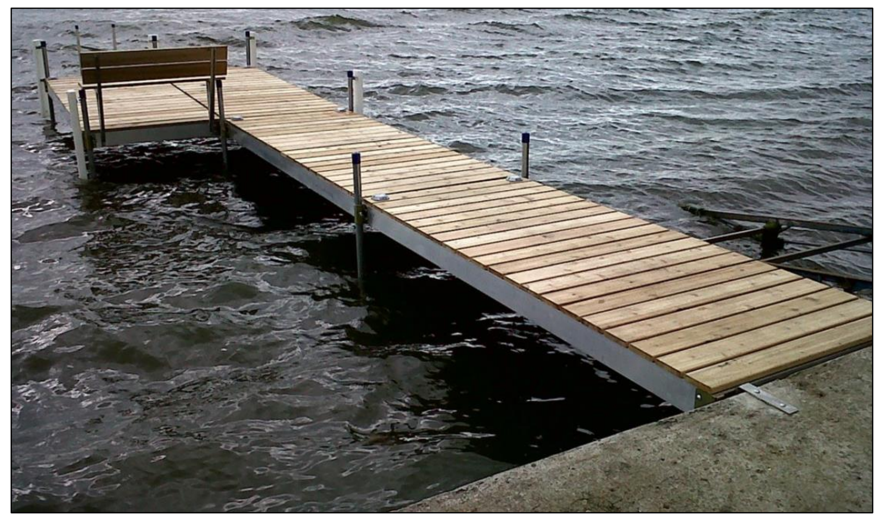

Figure 1: Non-Permanent Dock

This method can be costly, time consuming, and unsafe due to the nature of dock sections. The design team was tasked with creating a device capable of helping remove dock sections to help reduce the required workforce to two people and required time to under two hours. Through a series of process steps such as conversations with the sponsor, concept generation, testing, and refinement, the design team created a lightweight dock dolly that easily lifts up forward dock sections, reels sections in, and aids in transportation to stacking or storage locations. The team came up with a dock dolly that keeps product production cost and function in mind to allow for the concept to be reproduced for commercial use. The dock dolly was designed within the established budget and was completed for the sponsor, Mr. Hauguel, to begin using during the next upcoming dock removal session.

CUSTOMER NEEDS/SPECS

EO Snell, LLC'S needs for the "Dock Dolly" are stated in Table 1. Based on the needs in Table 1, the design team produced the following specifications in Table 2.

Table 1: Customer Needs	Table 2: Specifications
Carry one or more dock sections	Carry up to 300 lbs.
Operable by two or fewer people	Weighs less than 200 lbs.
Traverse multiple types of terrains	Wheel width of 3-5 in.
Stowable	Function with 6-7 dock types
Easy maintenance	5' to 7' max length when stowed
Use for stacking	Grade 5 Components
Portable	Aluminum Frame
Corrosion resistance	Airless rubber tires & Weigh less than 200 lbs.

DESIGN CONCEPTS

The team developed a total of 7 design concepts as possible solutions to the problem. Using a decision matrix shown in Table 3, the design team narrowed the concepts down to three:

Table 3: Decision Matrix

	Operability	Portability	Traverse Terrain	Carry Multiple Sections	Compatibilty	Stowable	Easy Maintenance	Corrosion Resistance	Use for Stacking	**Total**
Convertible Dolly	+	+	+	-	+	+	+	+	0	6
Jib Crane	+	+	0	+	+	-	0	+	+	5
Slanted Roller Dolly	+	0	+	0	+	-	0	+	-	2
Angled Platform Dolly	+	+	-	+	0	-	+	+	+	4
Pallet Style	+	0	0	-	+	-	+	+	+	3
Short Jib Crane	0	0	+	-	0	0	0	+	-	0
Manual Short Dolly	0	0	-	-	0	0	+	+	-	-1

The Convertible Dolly, The Angled Platform Dolly, and the Jib Crane Dolly (Figures 2-4).

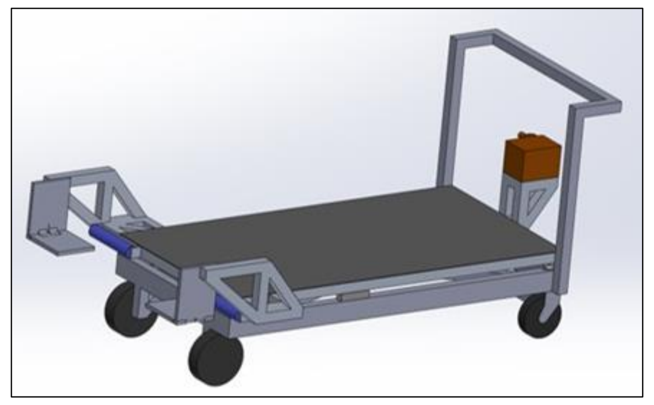

Figure 2: Convertible Dolly

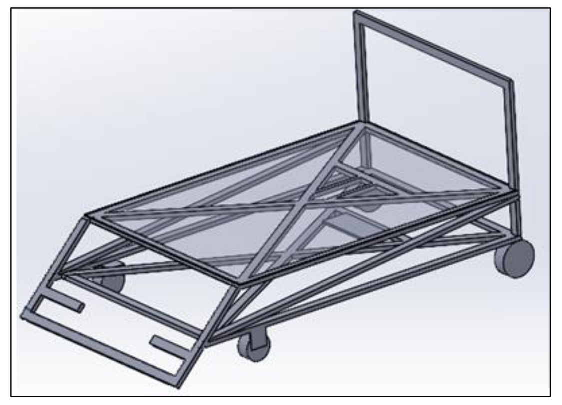

Figure 3: Angled Platform Dolly

Figure 4: Jib Crane

After presenting these concepts to the sponsor for selection, the team moved forward with the convertible dolly concept for the final design.

TEST RESULTS

The convertible dolly design went through finite element analysis via Solidworks CAD program. The yield strength of the aluminum used to make the frame is 8,000 psi. This test was run to emulate a possible worst case scenario for the frame. The results can be seen in Figures 5 and 6. These tests were run to ensure safety under any foreseeable use as well as some possible unforeseeable circumstances as well.

TEST RESULTS cont.

The FEA test results are shown in Figures 5 and 6. Each individual frame section is designed to a factor of safety of 1.5. This means that it can experience 1.5 times the load it is expected to encounter, ensuring safety if used as intended.

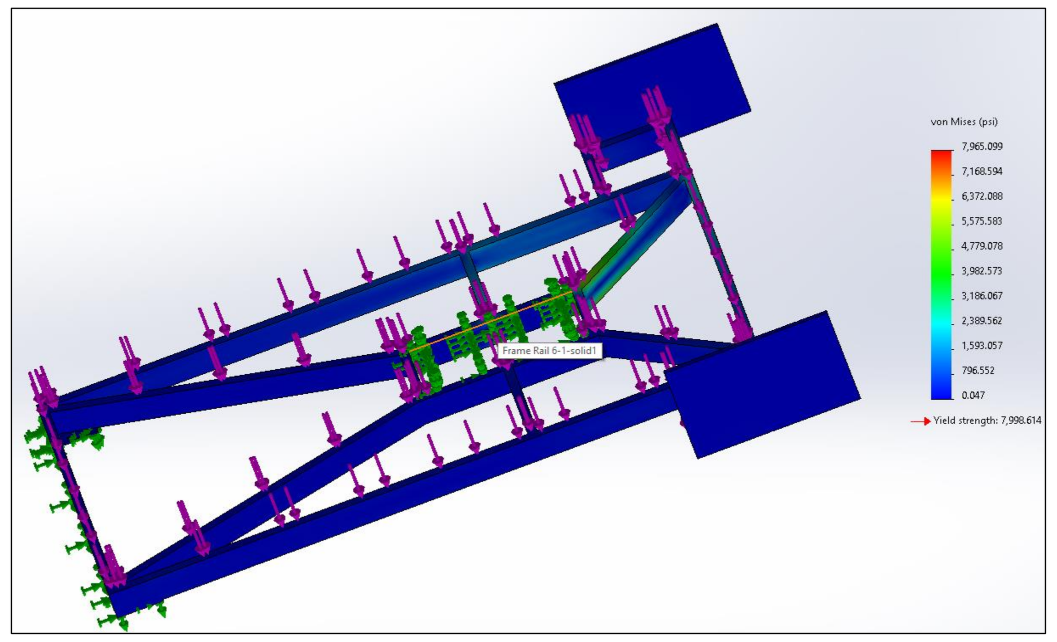

Figure 5: Upper Frame Worst Case Scenario Test

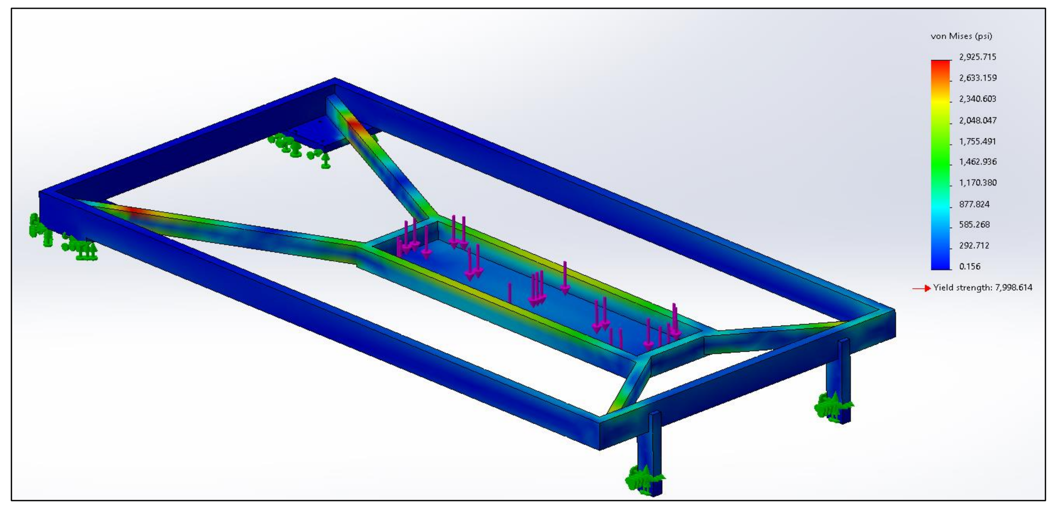

Figure 6: Lower Frame Worst Case Scenario Test

The testing also shows that the design will not fail under an unlikely load bearing situation. This testing validates the design and ensures that it will not fail under expected use.

FABRICATION

Aside from welding and milling, all other fabrication was done by the design team. The team attached the two frames, put all accessories on, and built the initial trolly system for the dolly. Fabrication images can be seen in Figures 7 and 8.

Figure 7: Initial Built Concept

Figure 8: Initial Functioning Concept

FINAL DESIGN

The last iteration of convertible dolly was the final Dock Dolly design presented to the sponsor and shown in Figure 9. This design was chosen for its dock type compatibility, ability to stack sections, portability, and corrosion resistance. Figure 10 shows the current built concept with some changes made to the lifting mechanism after real world testing. It was determined the rolling linkage was not stable and the jack was simply affixed directly to the upper frame.

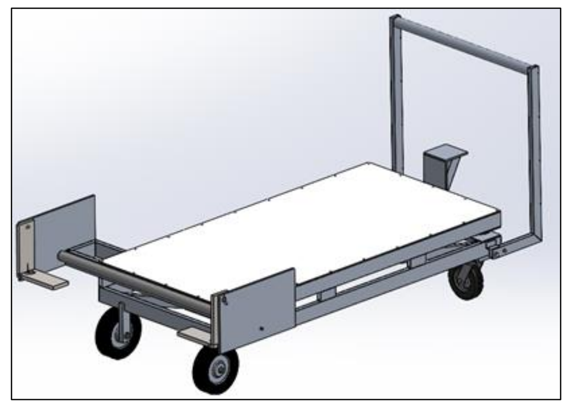

Figure 9: Final Concept Design

Figure 10: Final Built Concept

CONCLUSION

The team has assembled a partially functional Dock Dolly for E.O. Snell, LLC. The team used a six phase system to fully develop the concept from scratch. The dock dolly aids in installing, removing, transporting, and stacking dock sections. Figure 9 shows the final built concept the team was able to produce. Although this prototype functions, the team believes the best results would be achieved through implementing the designed hydraulic system devised after real- world testing. The team believes that this is a product that meets a majority of E.O. Snell, LLC's needs, but can be further improved through the provided design changes.

LESSONS LEARNED

Throughout this project, the team learned:

- Communication is key to the completion and success of a team base project.
- Computer aided calculations do not calculate for the imperfections of the manufacturing process.
- The importance of being able to adapt after testing.
- How to properly document everything throughout the design process.

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