Team 20: Rod Storage

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Background

The sponsor's original prototype had a base frame with an L-shaped platform to hold the bins of rods, shown in the figure below. While simple in design, there was no safety mechanism to keep the platform from falling back down if the operator lifts it. A lifting mechanism was also not prepared.

Project Summary

The goal of this project is to design and manufacture a device capable of presenting steel rods upright to an operator for ease of access and the minimization of handling.

Key Specification

- Max Weight of device < 2500 lbs
- Total Cost of project < $10000
- Needs to support 3100 lbs (per bin)
- Must not tip if struck from side

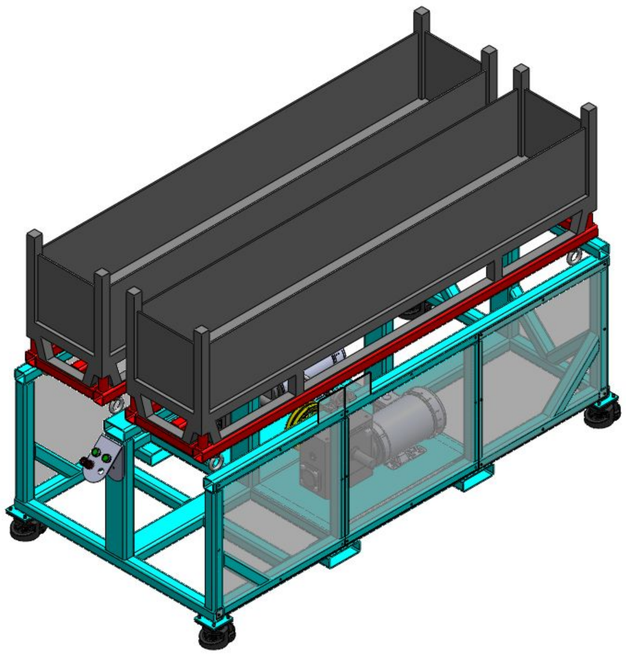
Engineering Responsibilities

The primary engineering responsibility for this device is ensuring public safety. This includes both ergonomic concerns as well as device safety (see Business Case and Safety sections). Other engineering responsibilities include economic impact and environmental impact, although these are less significant.

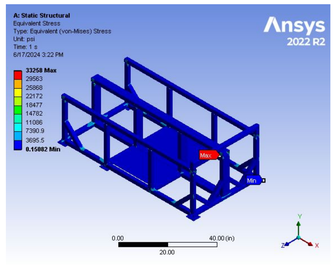
Safety

The following safety measures were implemented to ensure a safe work environment:

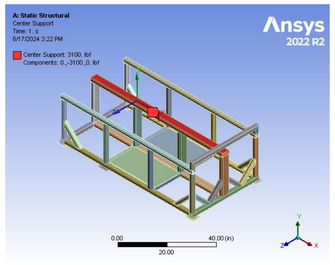
- E-stop
- Time based fault detection
- End of travel limit detection
- Locking Mechanisms
- Hard stops
- Increased footprint to reduce risk of tip over
- LOTO disconnect during maintenance



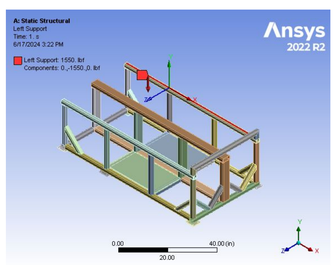
Simulation Results (FEA)



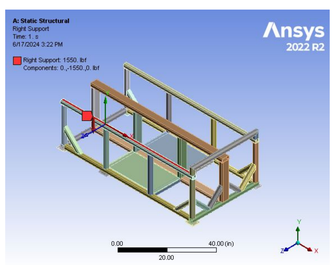
Equivalent Stress



Center Support



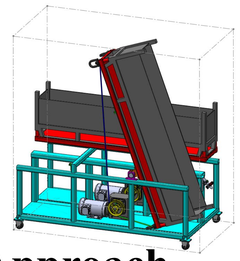
Left Support

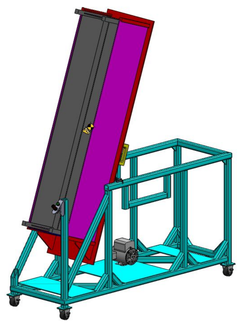


Right Support

Prototyping Phase

Several concepts were considered, all with different ways of which to move the bins. After careful consideration, it was decided to use a cable system to move the bins. While the single bin system (below and right) was simplest, a double bin system (below and left) was utilized in order to minimize floor space requirements without increasing danger of tipping..





Design Approach

- Framing Material: Steel Tubing
- Moveable: Casters and HiLo Pockets
- Rotation Mechanism: Winch & Cable
- Pivot Point: 25 in from front (user side) of cradle
- Bearings
- Control Device: PLC

Notable Changes

- Final Design has HiLo pockets
- Angled Support beams in the back to prevent buckling
- Pivot remains to be 25 from the center
- Two buttons for both bins and an E-stop

Business Case

- Ergonomics - by reducing the amount operators need to bend over to pick up rods, strain on the body (especially the lower back) can be reduced, improving safety for operators.
- The life span of the device will be a minimum of 260 cycles (Estimated to exceed 10 years of service).

Acknowledgements

The team would like to thank Jared Bergeron, Roy Visser, and the entire Engineering front office.

And a special thanks to Jill Ely for keeping us all fed and happy during the project duration.