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Objective:

To design and create a prototype of a ground pile that Consolidated Grain and Barge can transport to multiple facilities to demonstrate a tarping system that can safely cover an outside grain pile with only three employees. This system will allow for a small number of employees to tarp a grain pile allowing others to conduct their normal business.



Example Capstan to be used

Budget for Tarping Prototype

Material	Quantity	Budgeted	Actual
Wood	N/A	\$ 69.00	\$ 53.65
Motors	6	\$ 240.00	\$ 83.94
Motor Stands	6	\$ 10.00	\$ 14.91
Power Converter	1	\$ 100.00	\$ 84.99
Tarp	1	\$ 30.00	\$ 29.31
Hardware	N/A	\$ 12.50	\$ 10.68
Side Walls	N/A	\$ 132.00	\$116.58
Wiring & Supplies	N/A	\$ 100.00	\$ 45.62
Paint	N/A	\$ 94.00	\$ 86.40
Handles & Hinges	N/A	\$ 18.00	\$ 21.42
Miscellaneous	N/A	\$ 190.00	\$ 36.70
Total		\$ 995.50	\$584.20



Consolidated Grain and Barge Grain Pile

Background Information:

Outside grain piling is an inexpensive way of storing grain when there is not a sufficient amount of grain storage in bins. Grain piles can be multiple sizes, but a large pile at Consolidated Grain and Barge (CGB) can be about 200 ft x 400 ft that is covered by one large tarp. These tarps can be spanned across the center of the grain by only a few employees, but it takes almost all the employees at the facility to pull the tarp down by hand. Tarp pulling not only takes everyone away from their respective job, but it also is not very safe to have that many employees on top of the grain. This project, if implemented by CGB, would allow for only three employees to effectively and safely spread the tarp over the grain. Also the capstan design would work for any pile because even when piles are close to other structures, the capstans will be able to fit into that area.

Alternative Solutions:

- One possible solution considered was a 4-post overhead tarp design. This design would suspend the tarp above the pile until it is needed to be placed on the grain. A problem with this is wind would be a huge factor in keeping the tarp together along with high cost.
- Another possible solution was a 8-post track system design. This would allow the tarp to be pulled across a track and could be easily rolled and unrolled. This solution would not work because of high expense and stationary large structures at every facility.
- The last solution considered was a dump truck style tarping system. This would use two hydraulic arms to cover the pile in a semi-circle formation. Problems with this are a costly hydraulic system along with high investment expense and not being feasible with large grain piles.



Capstan Prototype

Prototype Components:

- 4 ft x 8 ft model for easy transportation from one facility to another
- 6 – 30 rpm motors to simulate capstans ran at one continuous speed
- Wheat instead of corn for more accurate simulation at scale level
- Drain hole in center of board for easy cleaning of the wheat

Final Recommendations:

- Placement of a capstan in an area so that the tarp is not pulled into the grain is crucial. Capstans can be either right above the side walls or far enough away to keep the tarp and cable above the grain.
- Evenly place capstans along the side of the pile to allow uniform pulling of the tarp.
- Use Amsteel Blue winch line to pull the tarp because it is very flexible with high tensile strength.