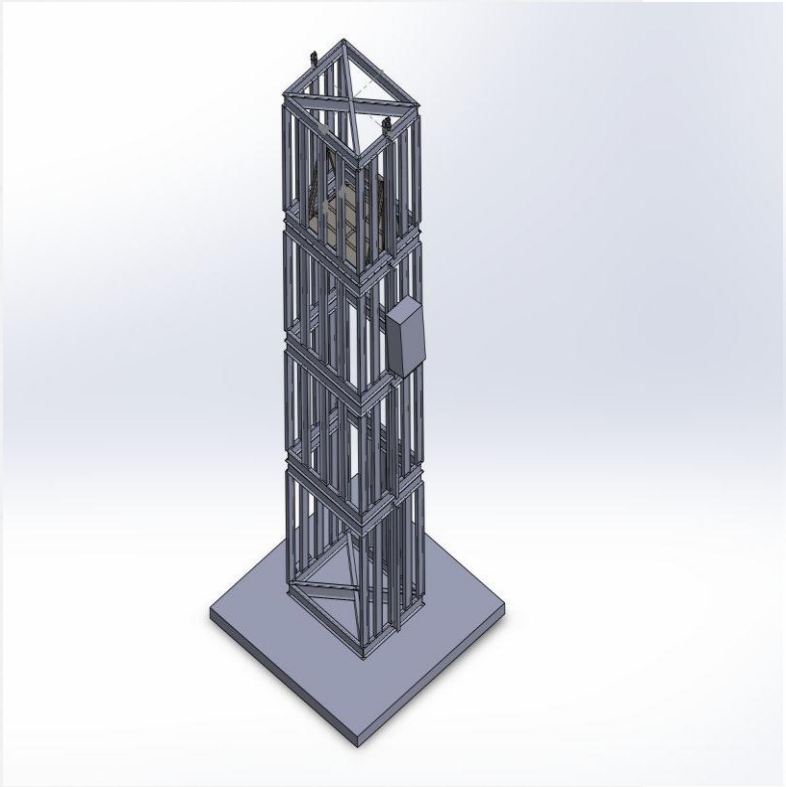
James Eckstein

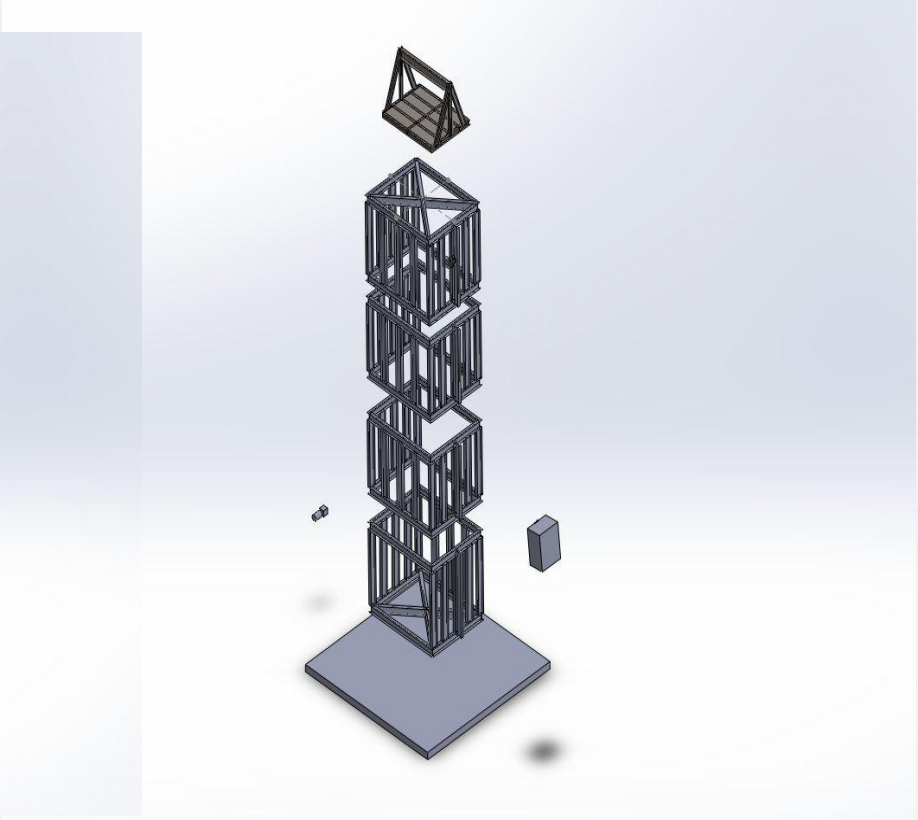
Construction Elevator Design Project
Final Project

Outlining Specifications

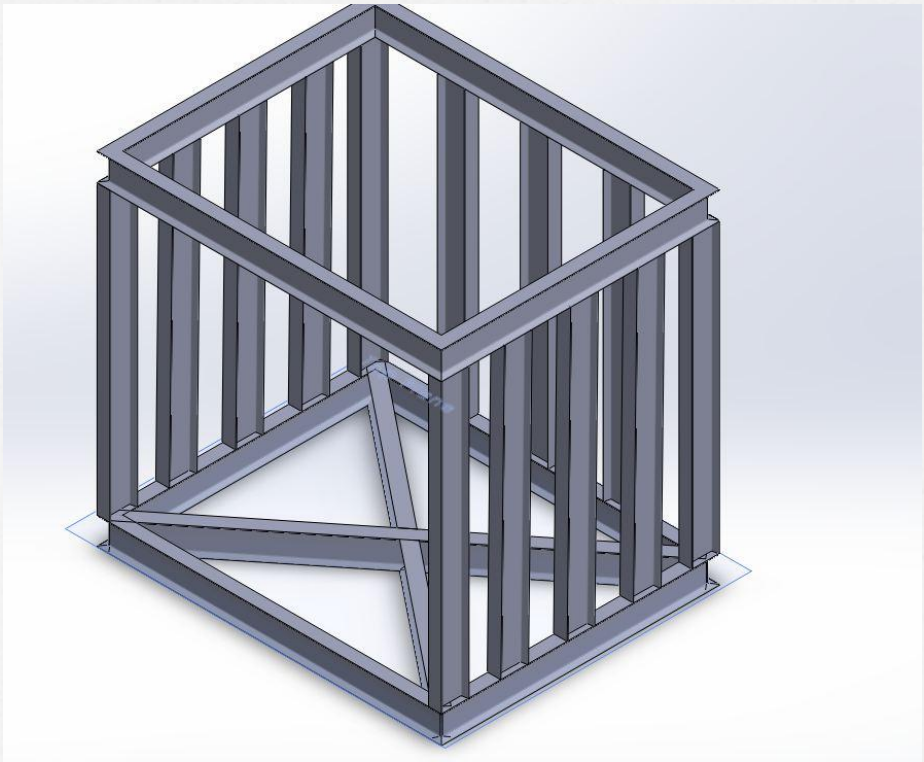
- **Capacity:** 4,500 pounds net weight
- **Non-personnel**
- **Electric Driven:** (480/240V, 3ph) **Non-hydraulic**
- **Velocity:** 1.5 feet per second
- **Maximum Structural Height:** 40 feet
- **Minimum Service Height:** 32 feet
- **Car Size:** Floor Area 48 ft^2
- **Overall Safety Factor:** 3

Assembled Elevator



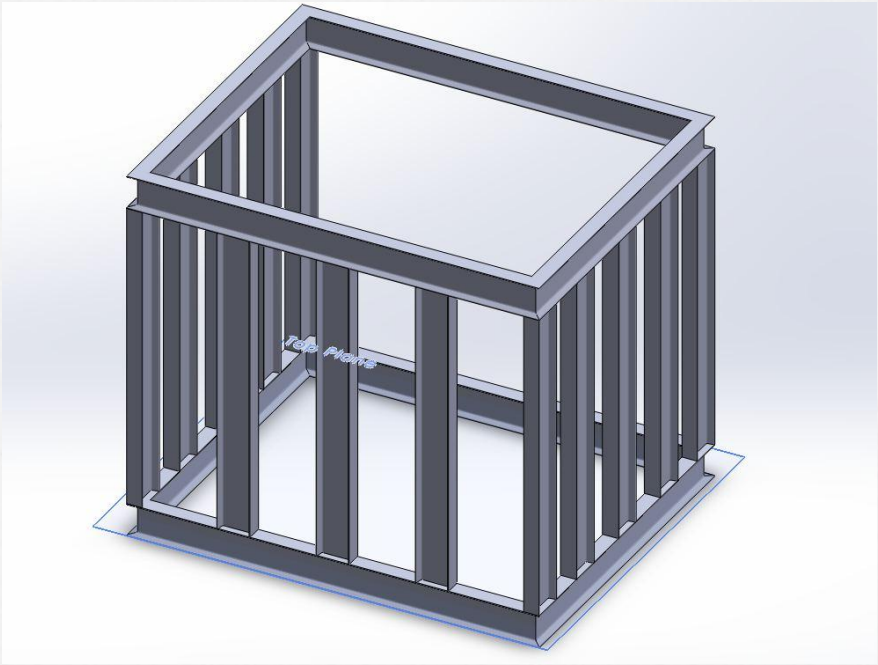


Start From the Bottom



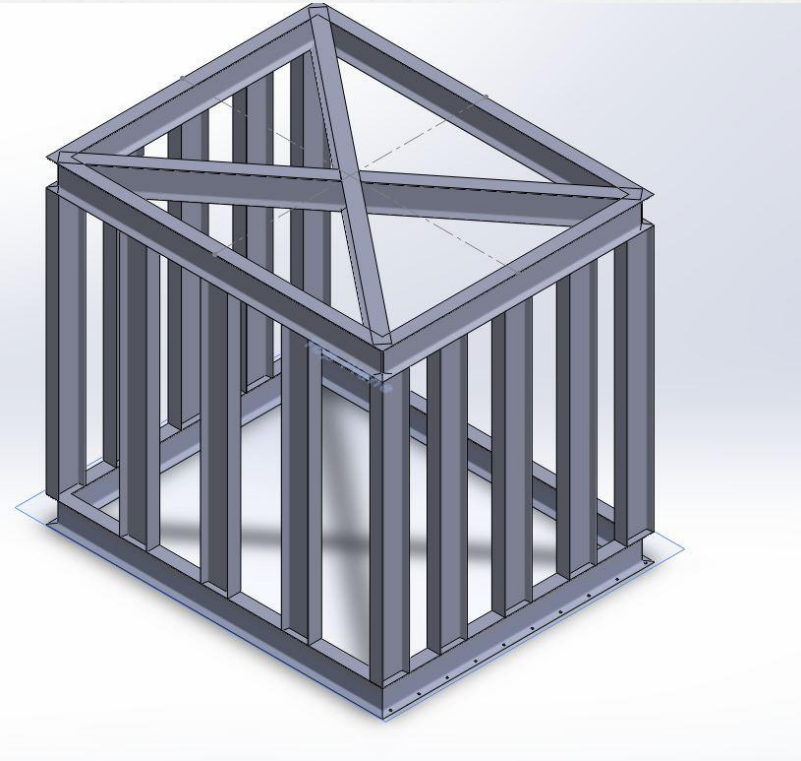
- Made from AISI 4140 Steel
- Sits on a 10” Concrete slab foundation
- Made of S10x25.4 and S10x12 I Beams.

Middle

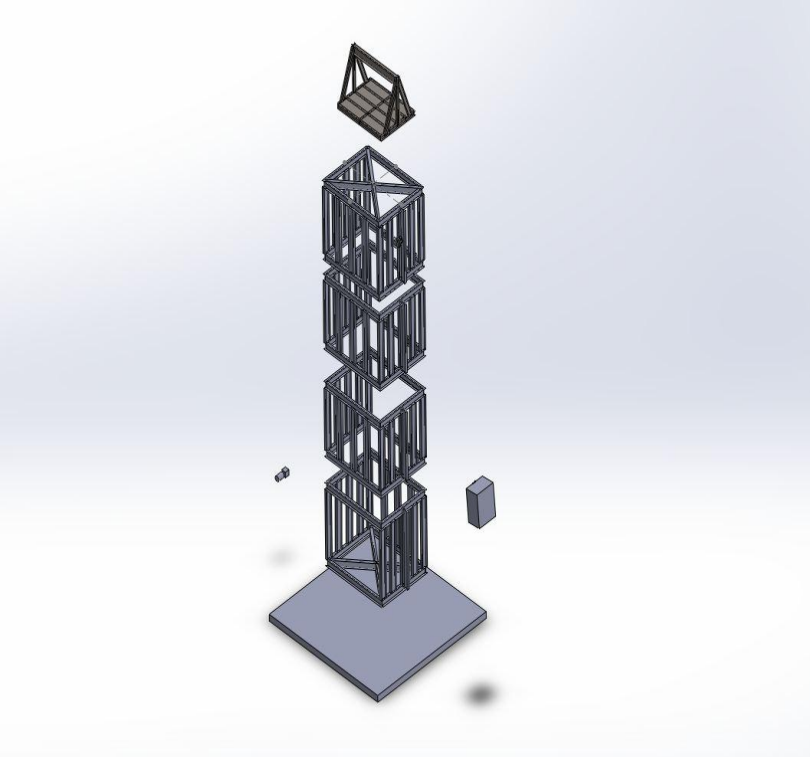


- Opposite facing doorways
- Vertical pieces give support to the horizontal top beams
- Like the bottom it is made of S10x25.4 and S10x12 I beams

Top of the tower



•Like the bottom part of the structure, this also has the cross pieces at the bottom
• The top has to support the most weight due to the pulleys.



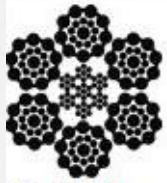
Since we had to make it truck transportable, the idea came to me to have each piece of the structure is pre-fabricated offsite. It will then be crane assembled with ¾” bolts on the bottom of each piece 10.5” apart. Also add a 4” temporary weld on each corner.

Pulleys

Sheave Diameter (in.)	601 Series Stock No.		Resultant Working Load Limit (Tons)	Wire Rope Size (in.)	Weight Each (lbs.)	Dimensions (in.)			
	601-S Painted	601-S Galv.				C	D	E	F
6	772195	772202	2	3/8	10.00	3.50	6.00	5.50	7.00
8	772211	772220	2-1/2	1/2	24.50	4.88	8.00	6.75	9.75
10	772239	772248	3	5/8	31.50	6.38	10.00	7.75	11.75

- 3 10” pulleys
- Made of 601-S Galvanized Steel
- Recommended size wire cable is 5/8”

Wire Cable



6 × 19 Class IWRC

The 6 × 19 class construction is more abrasion resistant yet less flexible than the 6 × 37 class construction of the same diameter.

IWRC Rope—A wire rope core makes this rope stronger and more crush resistant than fiber core rope. Meets Fed. Spec. RR-W-410, unless noted.

Heavy Duty IWRC Rope—Made of premium steel for high strength.

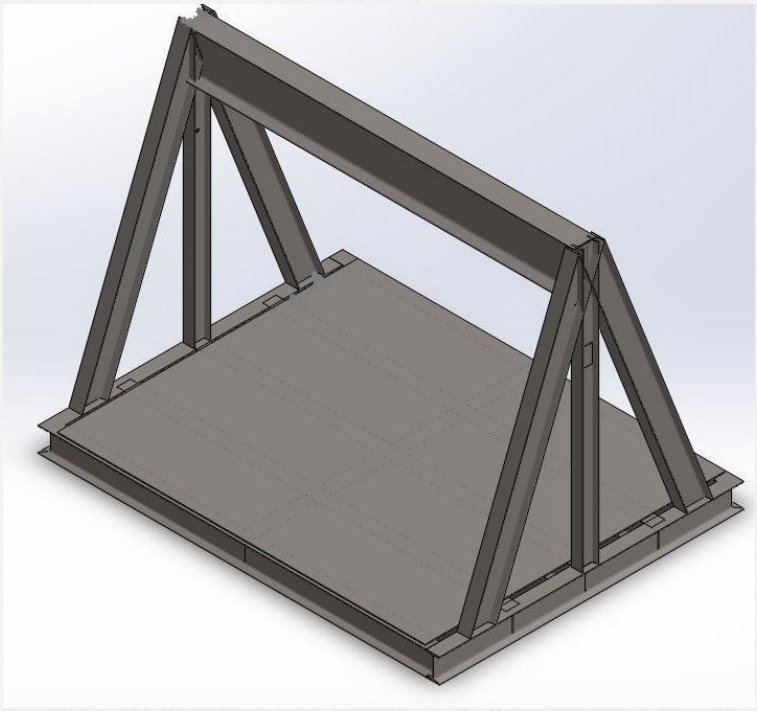
Note: Continuous lengths greater than the longest length listed are also available.

Dia.	Breaking Strength, lbs.	Available Lengths, ft.		Per Ft.
6 × 19 Class IWRC Rope				
3/16"	3,840	10, 25, 50, 100, 300	3440T55*	$1.14
1/4"	6,800	10, 25, 50, 100	3440T56	1.24
5/16"	10,540	5, 10, 25, 50, 100	3440T57	1.69
3/8"	15,100	5, 10, 25, 50, 100	3440T58	1.83
7/16"	20,400	5, 10, 25, 50, 100	3440T59	2.46
1/2"	26,600	5, 10, 25, 50, 100	3440T61	2.68
9/16"	33,600	2, 5, 10, 25, 50, 100	3440T62	3.25
5/8"	41,200	2, 5, 10, 25, 50, 100	3440T63	3.75

I decided to go with 5/8” 6x19 IWRC Class wire rope.

- Stronger than most cable, but makes up in affordability

Car



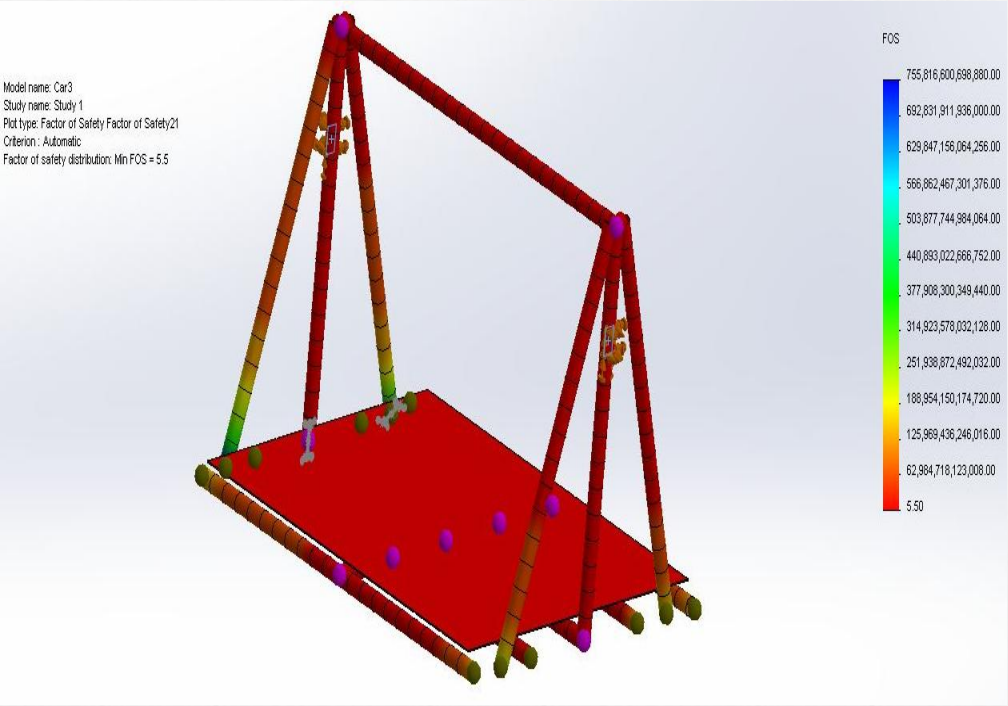
- Simple design
- One central axis of lift.
- Sturdy
- Made of 7075 Aluminum(Aircraft Grade)
- Lift from one point, than four corners. (ex Shopping basket or shoulder cooler)

7075 Aluminum

- Stronger than most metals.
- Has a high yield strength of 73,000psi
- Costly, but is very sturdy

7075-T6 Aluminum		
Physical and Mechanical Properties	Ultimate Tensile Strength, psi	83,000
	Yield Strength, psi	73,000
	Brinell Hardness	150
	Rockwell Hardness	B87
Chemistry	Aluminum (Al)	87.1 - 91.4%
	Zinc (Zn)	5.1 - 6.1% max
	Copper (Cu)	1.2 - 2.0%
	Chromium (Cr)	0.18 - 0.28%
	Iron (Fe)	0.5 max
	Magnesium (Mg)	2.1 - 2.9%
	Manganese (Mn)	0.3% max

Safety Factor



Safety Factor of 5.5.
Up to 15,000lbs
3.3x more than I was given of 4500.

Engine Choice

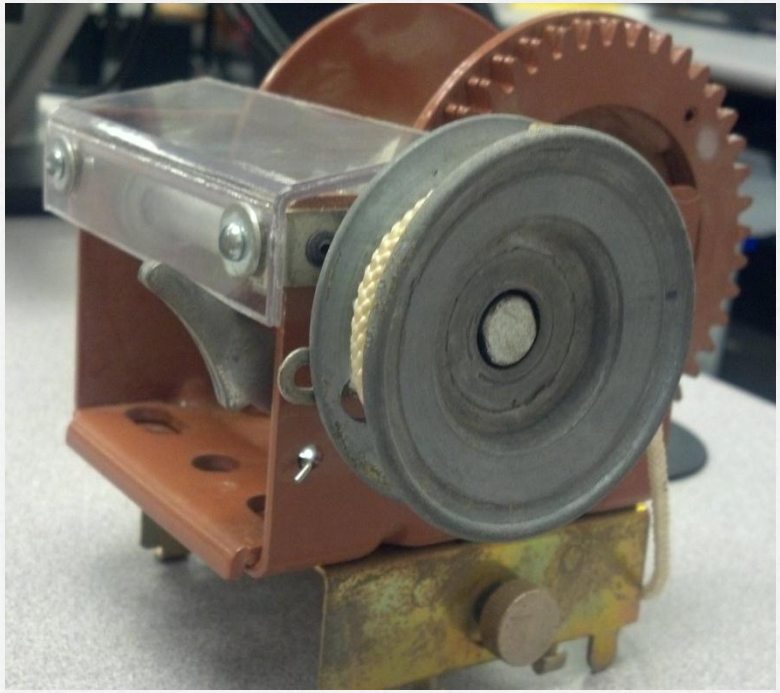
I decided to go with a Dayton 20 HP Motor. Capable of 3525 revolutions per minute.

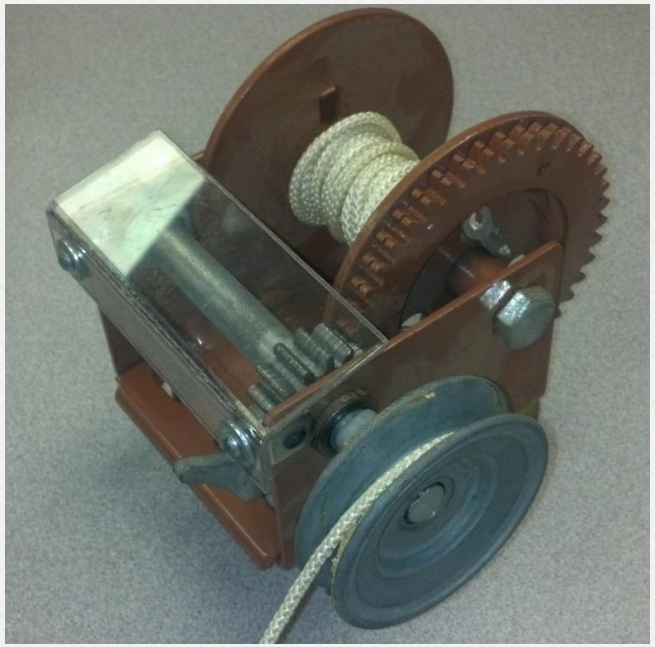
I only needed a 16HP motor, with 85 rpm, so I had to reduce the rpm with a 40:1 Reducer, which takes it down to around 88rpm, with a speed of 1.06 feet per second.

No power? No Problem

What if the power goes out while the car is in the shaft?!?

No Problem!!





Any Questions?