

Joseph Maddox (ASM), Daniel Willhelm (ASM)

**Introduction**

Problem Statement

- ◇ To design and build a safe and efficient way to load silica sand into an ADM TrackMobile while not interfering with standard equipment operations

Background

- ◇ Locomotives and Trackmobiles apply silica sand to rail tracks for efficient traction while moving railcars. Currently, the procedure for adding sand to the holding compartments of the machine includes lifting 100 pound bags overhead to pour sand into the hoppers.

Criteria

- ◇ Must be able to fill the sand tanks effectively
- ◇ Be able to work with multiple TrackMobile models
- ◇ Cause less strain on the human body
- ◇ Safer than handling individual bags while climbing
- ◇ Reusable and last for many years
- ◇ Budget of \$500-\$600

**Alternate Solutions**

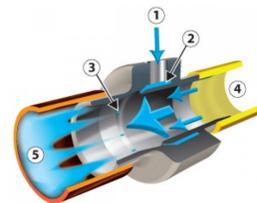
Auger System

- Pros
- ◇ Ability to elevate and move materials with a small power source
  - ◇ Easy to control speed and flow of material
- Cons
- ◇ Inability to be easily mobile when in use
  - ◇ Flexibility
  - ◇ Abrasiveness of sand could potentially cause issues



Pneumatic system

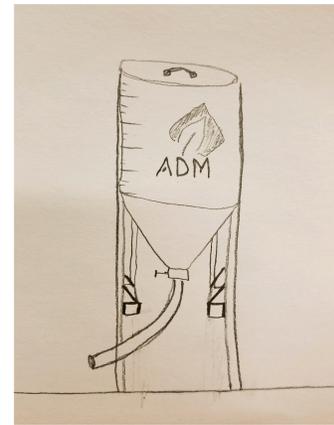
- Pros
- ◇ Easy to use
  - ◇ Mobile
  - ◇ Simple
- Cons
- ◇ Dust
  - ◇ Dust suppression system is expensive.
  - ◇ Quoted at \$20,000-\$30,000



**Final Solution**

Gravity Hopper

- Pros
- ◇ Simple to construct
  - ◇ Simple to use
  - ◇ Least expensive option
  - ◇ Safe when use correctly
- Cons
- ◇ 2 man team
  - ◇ A forklift or skid steer is needed



**Preliminary testing**

- ◇ Built a small scale gravity hopper to determine how long it will take to fill tanks
- ◇ Held fifty pounds of silica sand
- ◇ Had a two inch diameter opening and similar angle to the hopper
- ◇ Went into a two inch PVC 45° bend and a two foot long PVC pipe
- ◇ Took approximately 20 seconds to empty
- ◇ So one tank (one hundred pounds) would take about 40-60 seconds to fill completely



**Specs for a Hopper**

- ◇ Tank must hold at around 400 pounds to fill all tanks to capacity. Sand has a density of 12.8 pounds per gallon so a 30 gal tank will hold 383 pounds.



**Economic Analysis**

Material	Budgeted cost	Actual cost
Hopper + Stand	\$170	\$170
Slide Gate	\$45	\$45
Metal for Stand Modification	\$150	\$0*
Tubing	\$40	\$0*
Misc.	\$20	\$20
<b>Total</b>	<b>\$425</b>	<b>\$235</b>

\*ADM location had extra materials available

◇ Building takes about 5-10 hours

**Recommendations**

- ◇ After testing the design the team came up with a few recommendations if a second hopper was ever made:
  - Use a different style of slide gate. Sand causes the current gate to stick occasionally.
  - Use a bigger diameter hose to allow material to flow easier.

Sponsor:



Technical Advisor:  
Dr. Ess

Instructors:  
Dr. Lumkes

Acknowledgements:  
A special thank you to Rebecca Crowl and all those at the ADM Attica location for their support throughout the project!

