Brandt Heavy Haul Trailer - Wheeler Suspension Design

Faculty of Engineering & Applied Science | Industrial Systems Engineering | Project Day 2021 | Group 6

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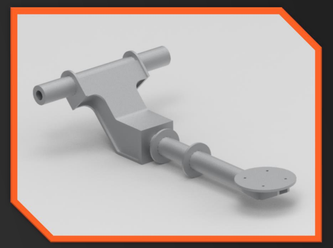
1 Project Goals

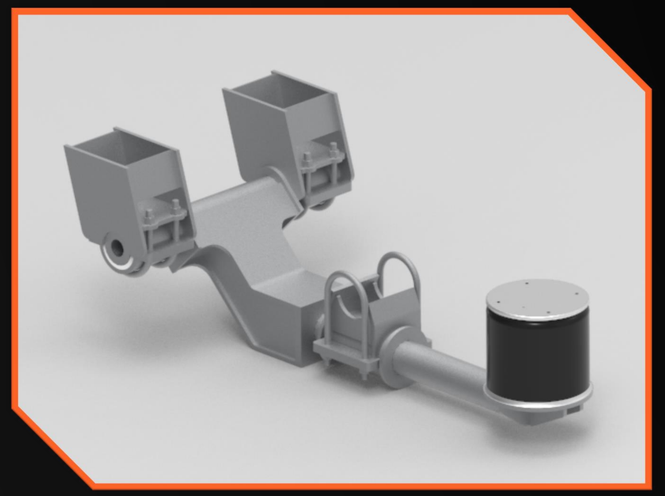
- Design a custom dual axle suspension for Brandt's Heavy Haul Trailer
- Select & design suspension components
- Provide engineering analysis of suspension system

2 Suspension Components

Trailing Beam



- Hollow member design to reduce cost and weight
- Optimized length to reduce component stress
- Flange stops to prevent collar movement



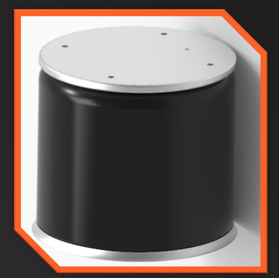
Hanger

- Split hanger design to create room for air spring
- Angled hanger to help reduce material build up
- U-bolt connection to trailing beam for easy maintenance

Collar

- Pivot point from axle to trailing beam to remove torque on beam
- U-bolt provides connection between:
  - Axle and collar
  - Collar and trailing beam
- Angled side plates for neutral axis welding to axle

Air Spring



- Rolling lobe air spring for compact assembly
- Maximum pressure of 100 psi at 14.8" outer diameter for 11000 lbs
- Calculated load of 8100 lbs at 80 psig
- Desired ride height of 10.5"

3 Finite Element Analysis

- Performed 3D static structural analysis using standard load condition on suspension system
- Model constraints:
  - Fixed connection from hanger to trailer
  - 15000 lb trailer load onto axle
  - 1400 lb/in^3 elastic support onto air spring plate
- Utilized mesh convergence study with maximum allowable change of 5% to ensure proper mesh sizing
- Analyzed using equivalent stress and equivalent elastic strain
- Maximum stress of 28000 lbs

4 Manufacturing

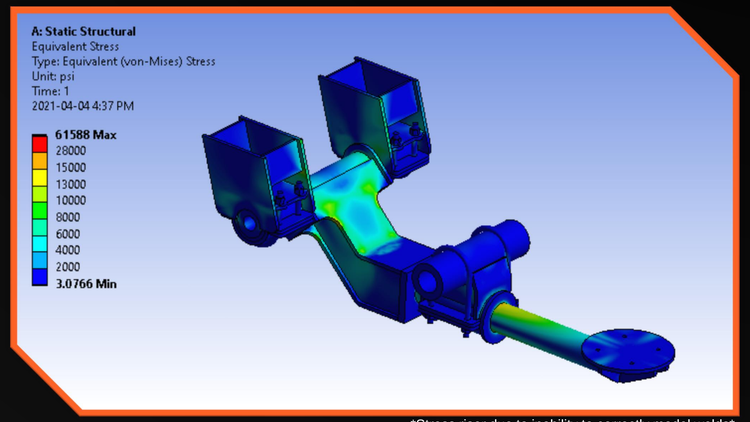
- A514 Grade B plate steel (100 ksi)
- A519 1020 CDSM tubing (75 ksi)
- Laser cut plate components
- MIG weld using E70S-6 wire
  - 5/16" fillet welds
- Formed plates

5 Cost Reduction

- Design for manufacturing
- Design for Assembly
- Commonality in fasteners
- Lower part count

6 Results

- Cost estimates done for a single suspension assembly
  - Six total assemblies per trailer
- Maximum stress from applied loading verifies sufficient material strength



Stress riser due to inability to correctly model welds

Component	Applied Load (lbs)	Max Stress (ksi)	Weight (lbs)	Material Cost ($)	Manufacturing Cost ($)
Trailing Beam	15000	30	331	813.28	240.80
Hangers	3500	8.5	143	351.36	104.00
Collar	15000	1.1	47	115.48	34.18
Air Spring	8100	-	23	200.00	-
Hardware	-	-	6	160.00	-
Total	**-**		**550**	**1640.12**	**378.98**

Acknowledgments – Brandt Industries Canada Ltd | Raymond Strelic & Brett Burke – Industry Advisors | Dr. Stilling – Supervisor