Seesaw Safety Device

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Goal Statement

Design a device that attaches to a seesaw and activates when one user jumps off. Activation will cause braking force to be applied to the seesaw board, which will slow down or stop the seesaw board before the seesaw or user makes contact with the ground, resulting in safe impact forces.

Key Functional Requirements

1. **User Age:** Based upon statistical data and safety standards, the device should be designed for children of ages 5-12.

2. **Non-Interference:** Must not interfere with normal seesaw operation.

3. **Activation:** Must activate when one user leaves the seesaw.

4. **Performance:** Must slow the user sufficiently to achieve safe impact forces.

Target Deceleration

The Head Injury Criterion (HIC) is a common method of determining injury likelihood upon impact, as given by the equation below. The threshold for 0% injury probability is an HIC of 150.

$$HIC = \left\{ (t_2 - t_1) \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a(t)dt \right]^{2.5} \right\}$$

Device Overview

The seesaw safety device consists of two mechanisms: the activation mechanism and the braking mechanism:
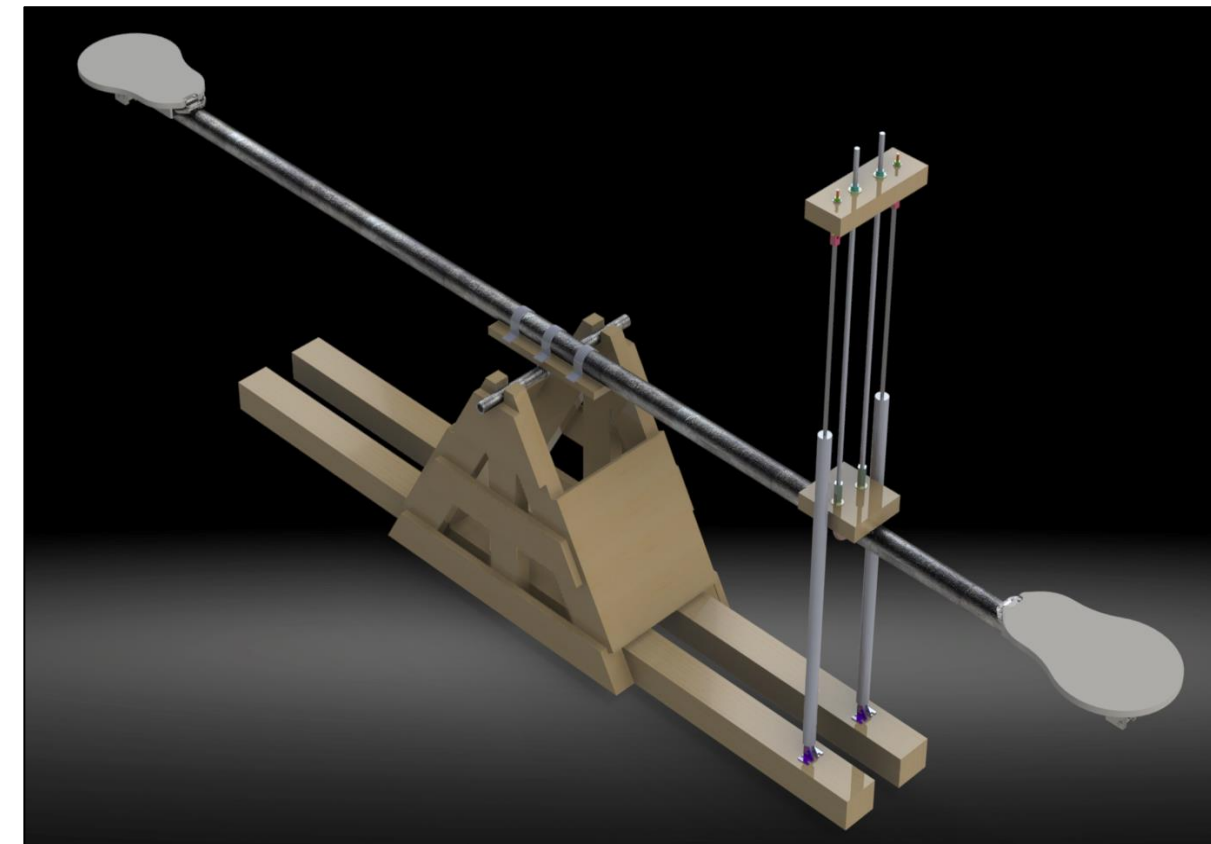
Testing

- The device was tested by attaching various weights to the seesaw arm.
- Counterweight was added to other side of seesaw to balance the mechanism.
- Acceleration data was gathered using an accelerometer to determine g-force.
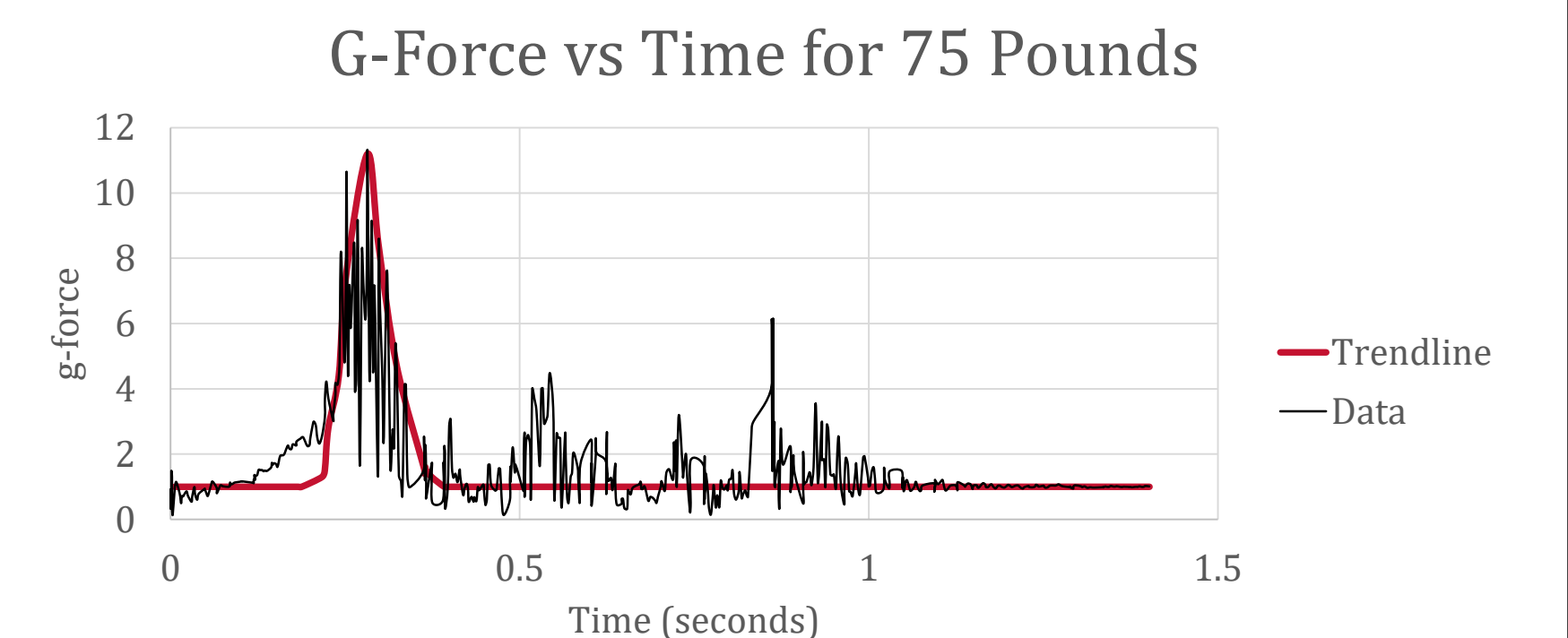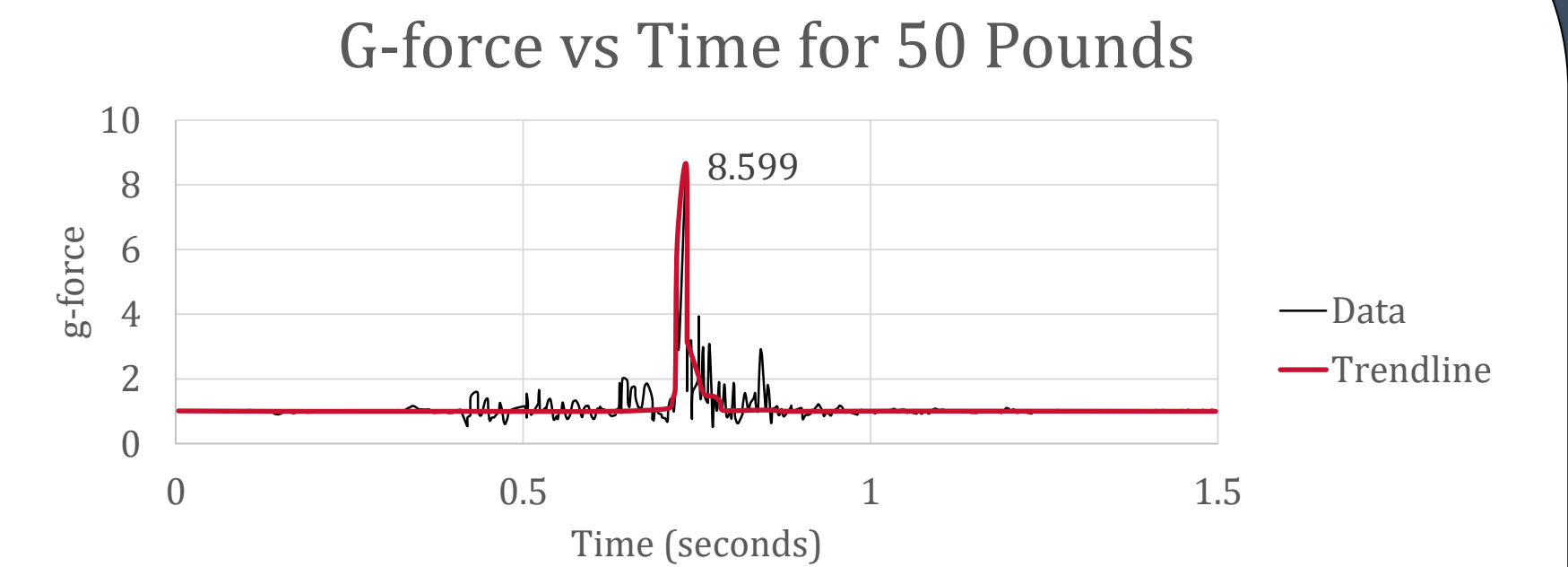- The device was also tested to ensure that it does not interfere with normal seesaw operation.

Conclusion

- Mechanism performed as expected for lower weights, but did not withstand higher loads.
  - Successful in slowing the seesaw to tolerable limits.
- Parts selected did not withstand force applied during testing.
  - Braking mechanism would be more rigid and durable.
- In the future, we recommend larger air cylinders.

Analysis

Piston Force as a Function of Seesaw Angle

Results

G-force vs Time for 50 Pounds
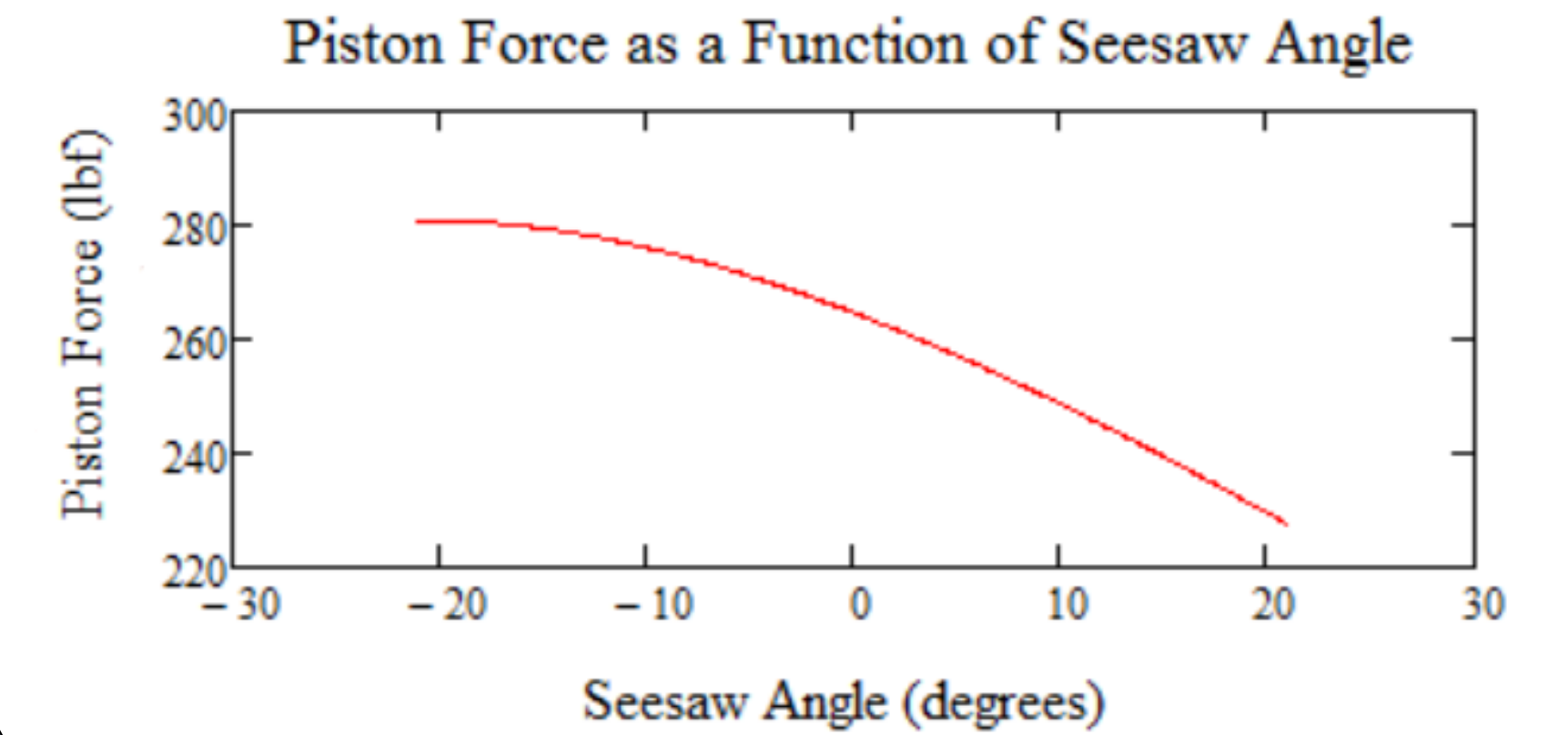
G-Force vs Time for 75 Pounds

	Average G-force	**Acceleration (g's)**	**HIC**
50 lbs	3.203	21.618	24.29
75 lbs	6.715	56.003	262.41