



# Dexter Electromagnetic Brake Test

Mechanical and Aerospace Engineering

Caleb Brown, Tucker Hasselman, Blake Lude, Gabriel Luke, Dillon Sims, Dr. Gurudutt Chandrashekar

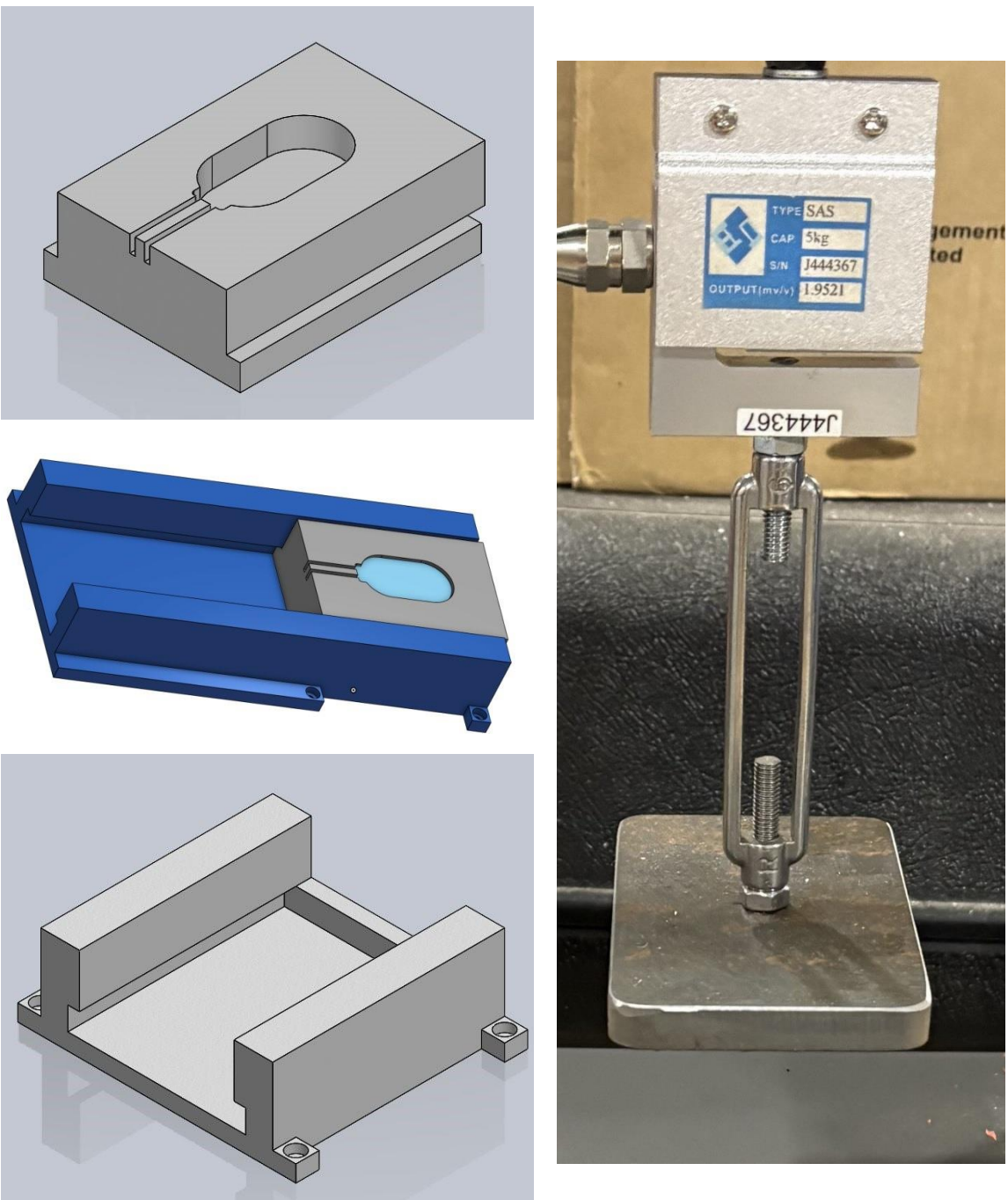
## Abstract

The Dexter Senior Design Team has designed and manufactured a “gap test” system to determine whether Dexter Axle’s electromagnetic brake components produce the required force to be considered a quality part.

## Customer Needs and Requirements

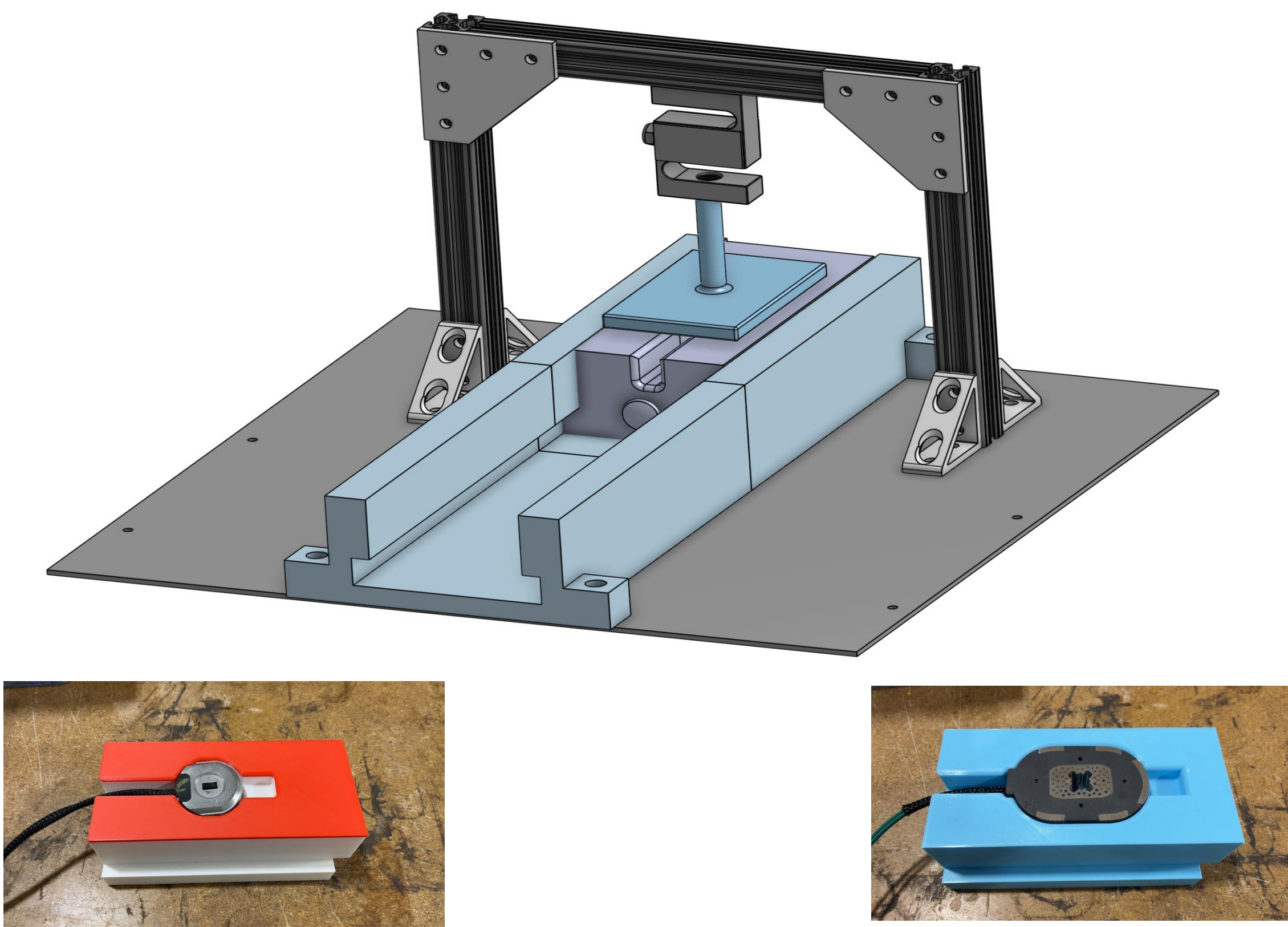
- Customer Needs
1. Able to be integrated into current testing system.
  2. Will provide consistent readings.
  3. System is compatible with all brake components currently in production.
  4. Cost effective design.
  5. Quick cycle time.
- Customer Requirements
1. Must fit on a 4’ by 2’ tabletop.
  2. Generates a range of values to determine a good part vs a bad part with 95% accuracy.
  3. Must be able to operate with all six brake components currently in production.
  4. Stays within \$1,500 max budget.
  5. Has a 45 second total cycle time including a 5 second measurement time.

## Concept Selection



The Dexter Team selected a Wheatstone bridge configured strain gauge to measure the pull force generated by the electromagnetic field of the brake components. The strain gauge was fixed in place by its mount and the brake components were designed to fit into a part insert that translates under the strain gauge set up via the part insert slider.

## Design Solution



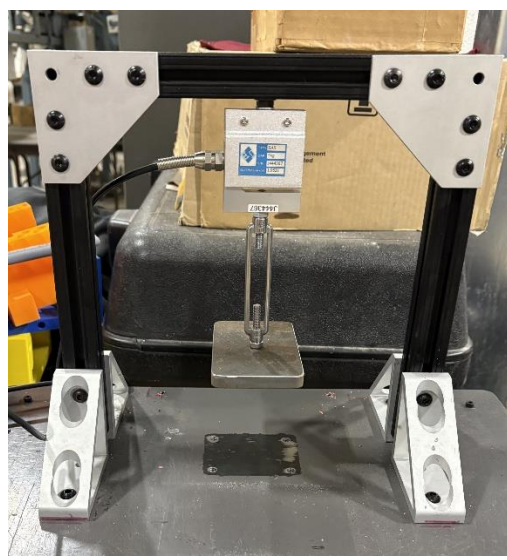
## Manufacturing

### Part Inserts



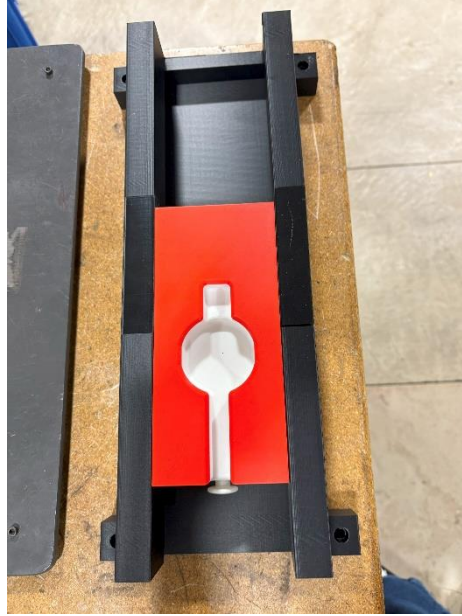
- Designed and 3D printed
- Accommodates multiple part geometries
- Holds parts steady from magnetic pull force yet easy to remove
- Iterations were performed to tune in tolerances

### Strain Gauge Mount



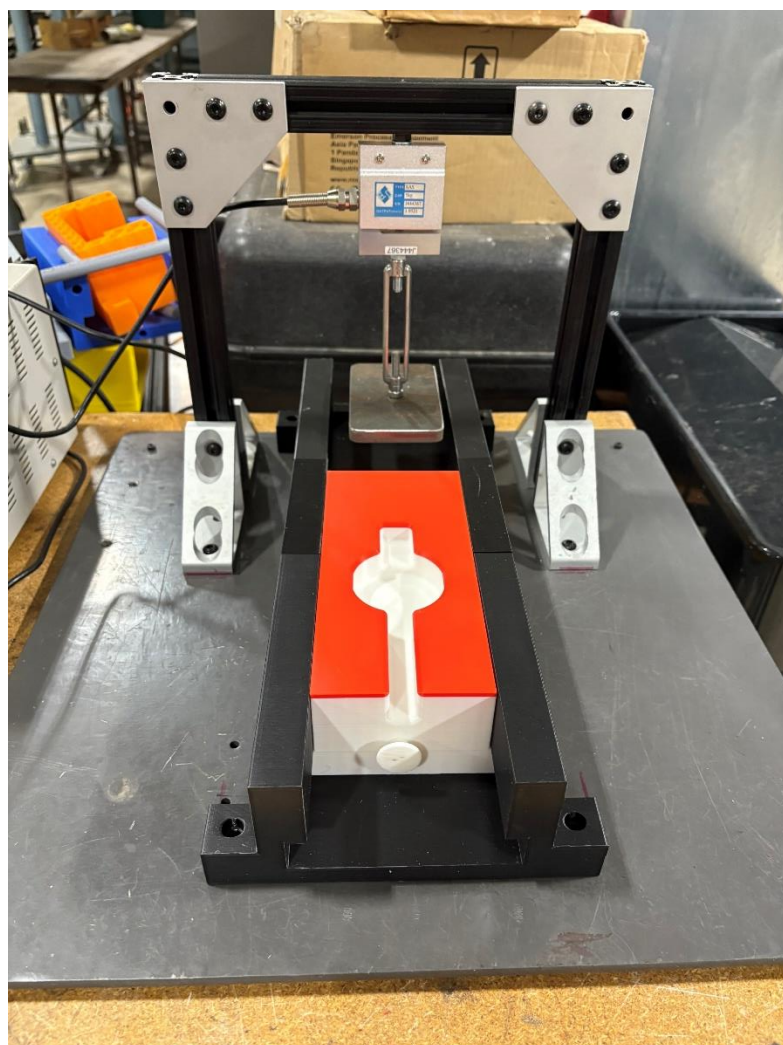
- 80/20 T-slot quick framing and bracket components assembled to make frame
- Strain gauge mounted into 80/20 frame
- Fastened to base plate

### Slider



- Designed to compliment part insert geometry
- Slider was 3D printed in 3 sections
- Assembled sections using mating pins
- Fastened to plate under the strain gauge

### Final Assembly

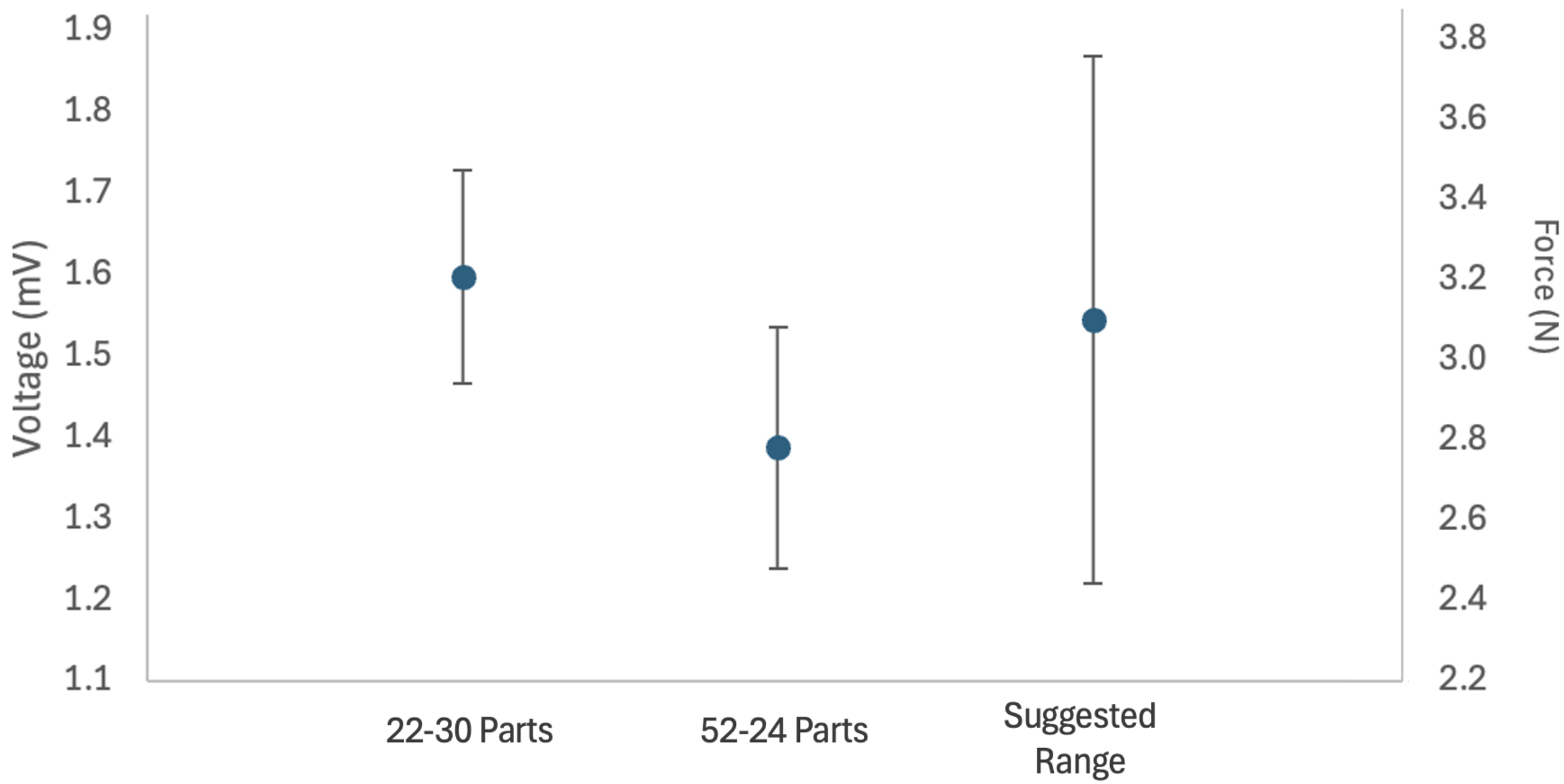


- Subsystems fastened to base plate
- Allows quick test cycles
- Effective part positioning

## Testing and Validation

The brake components were tested to find a range of force values that Dexter Axle would consider a "good part". The components were tested at Dexter, then tested at Trine to determine a good and bad range for each different part.

Variation in Measurements



Good Part Range: 2.459 - 3.787 N

Good Part Range: 1.201 - 1.85 mV

## Acknowledgments

- Dexter Axle Co.
- The Mill at Trine University
- Joe Thompson