Department of Engineering

Messiah College

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Disability Resources

Electric Mobility Tricycle – Brake Redesign

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Project Background

Partnership with The Center for the Advancement of the Handicapped in Mahadaga, Burkina Faso.

Goal is to redesign and improve a tricycle for disabled individuals.

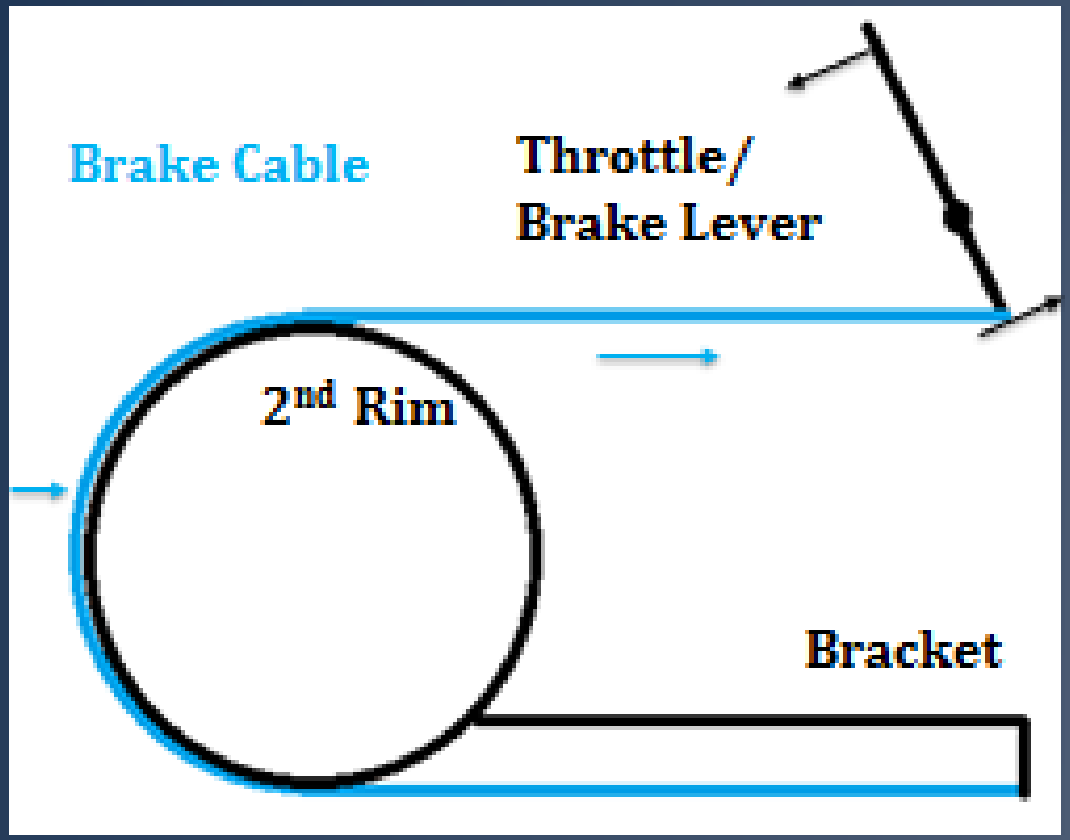
Double Rim Design

- Field data indicated buckling in the wheels.

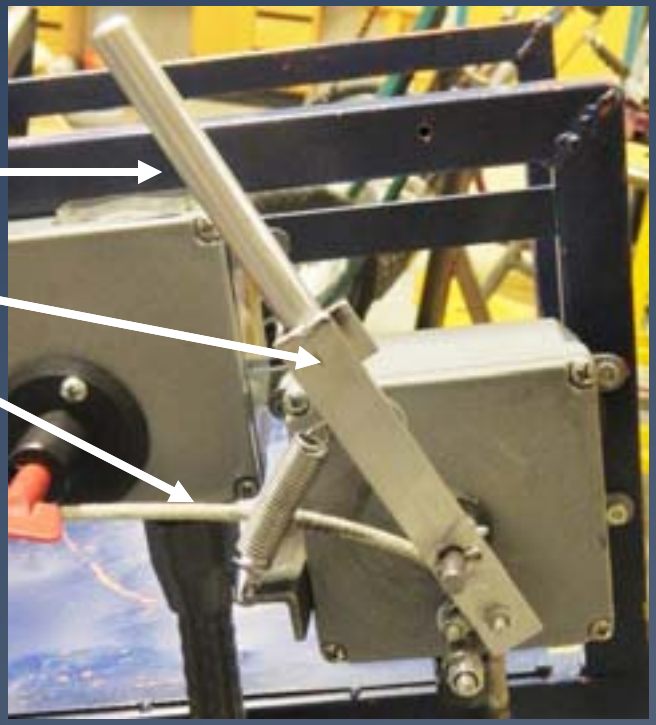
- Double rim design increased strength and rigidity which solved the buckling problem.

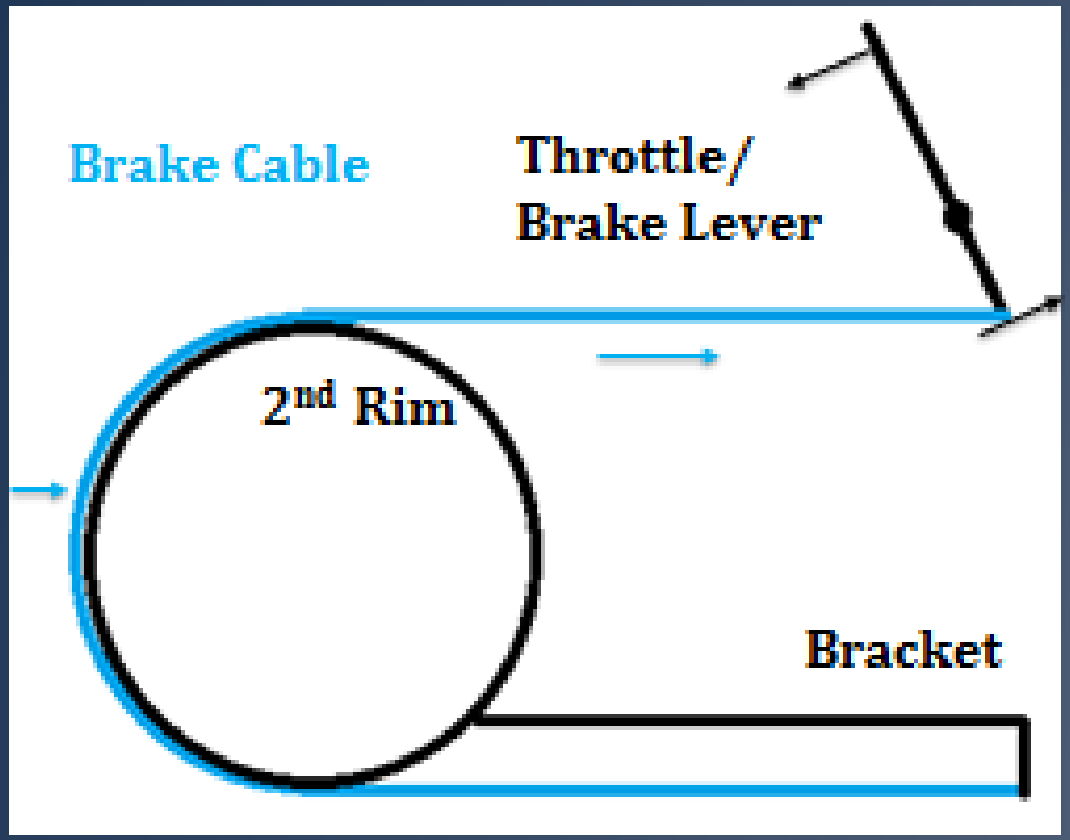
- However, double rim design mad
brake problems worse

Band Brake Prototype

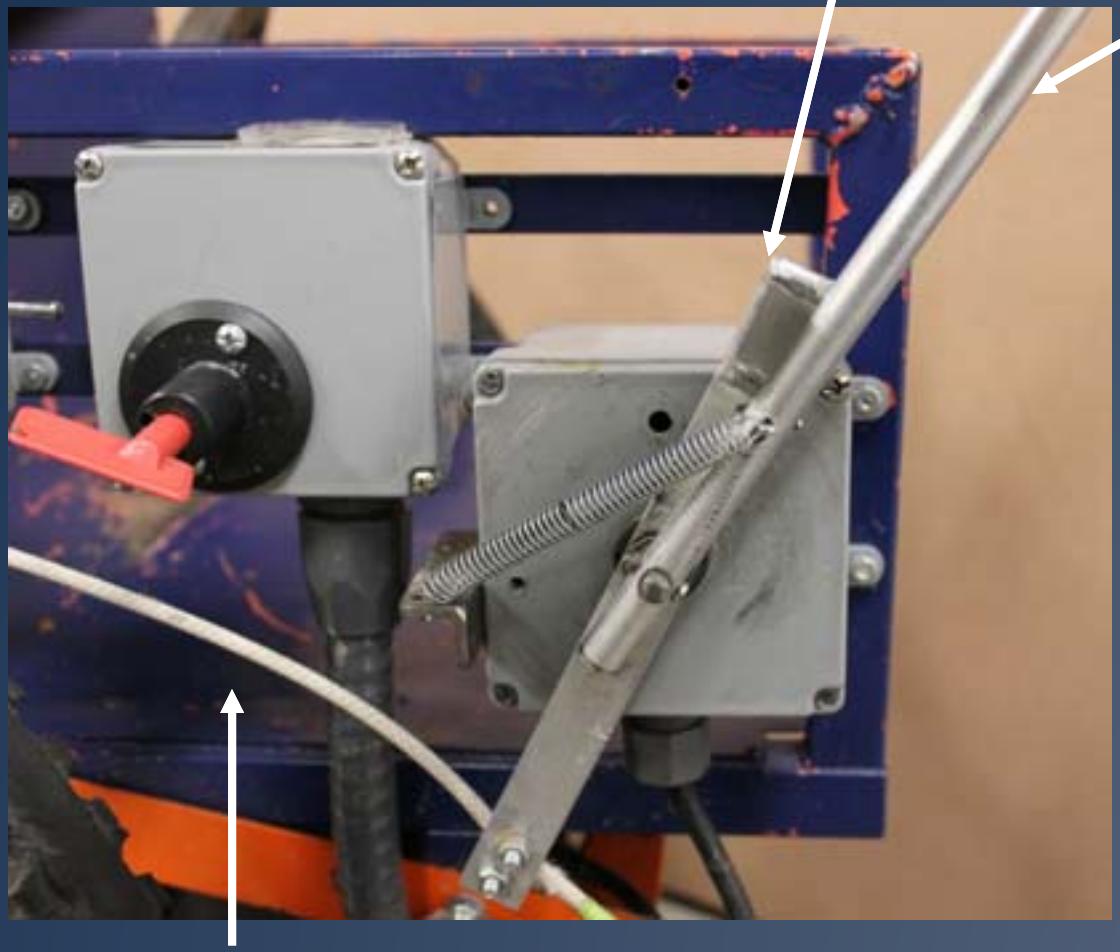


Band Brake Prototype



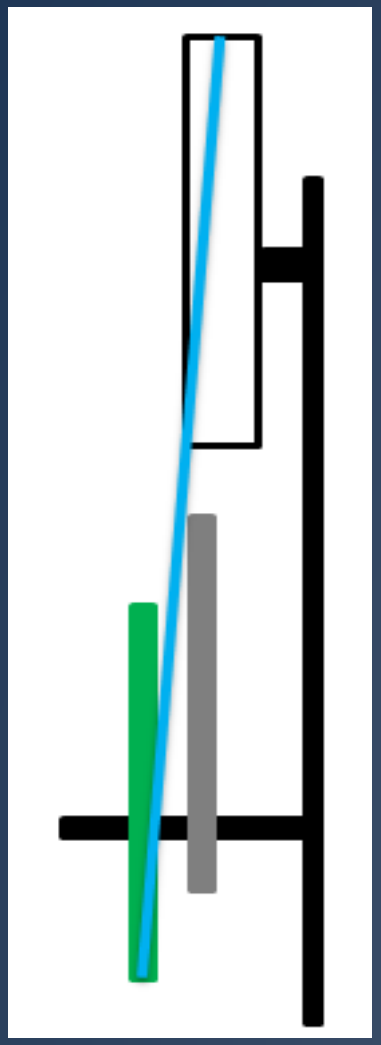


Problems

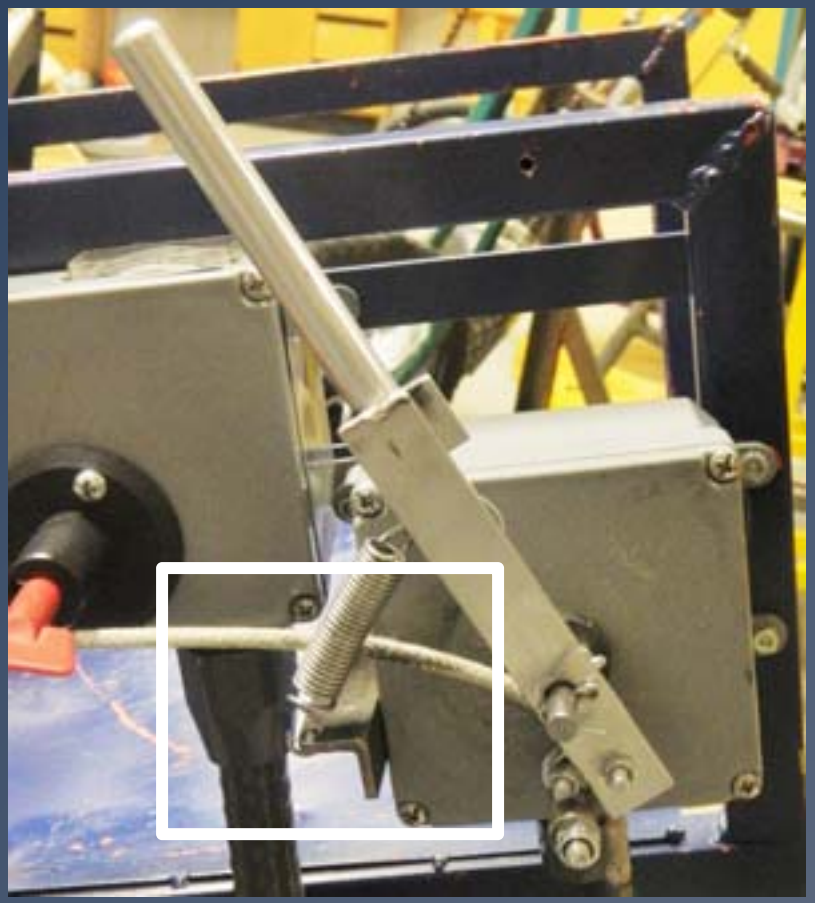


- The brake lever rotates forward when the throttle is pushed forward.

Problems



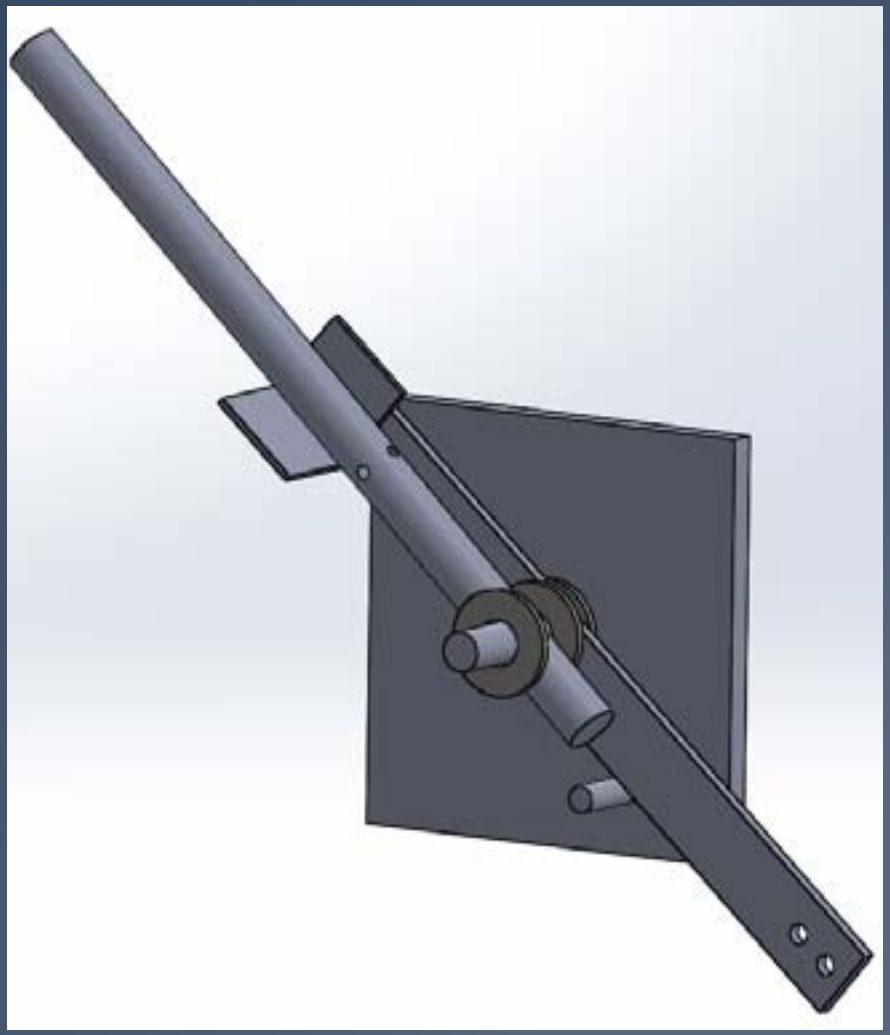
The brake cable is not lined up well with the 2nd rim.



The spring bracket interferes with the brake cable.

Solutions

- Added pin behind brake lever.
- Extend brake lever.
- Move the brake lever inside of the throttle.

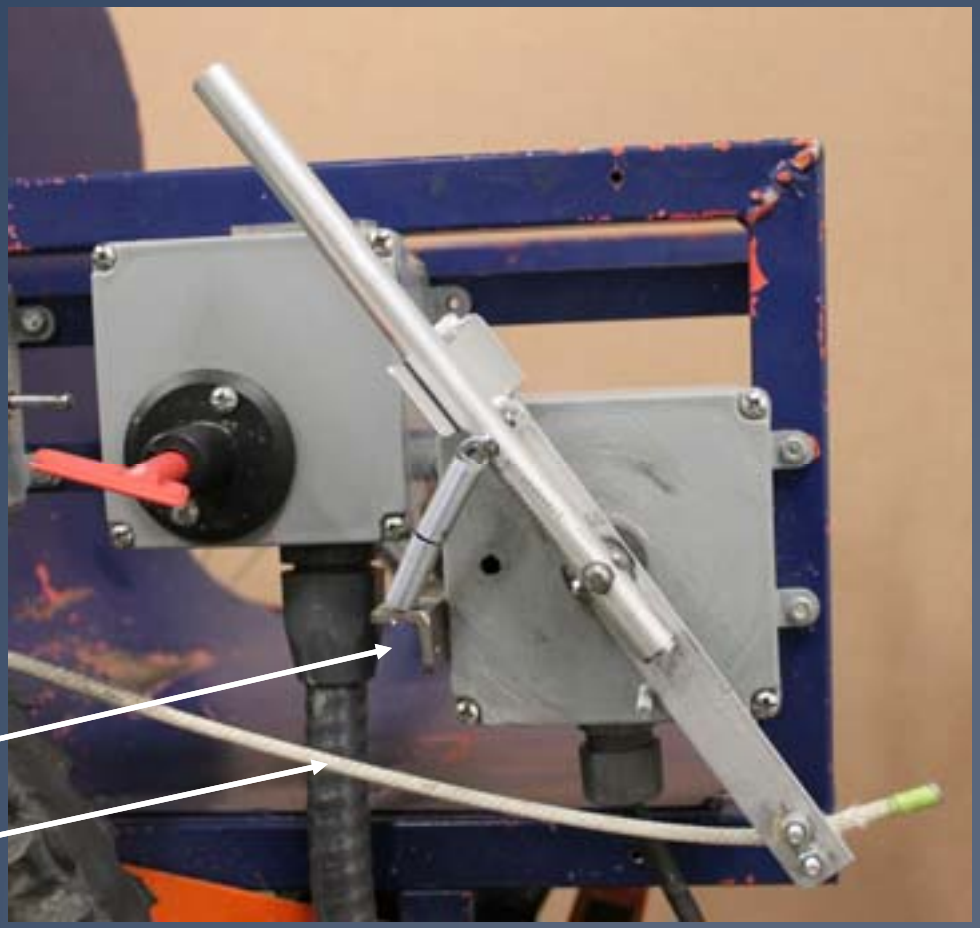


Solutions

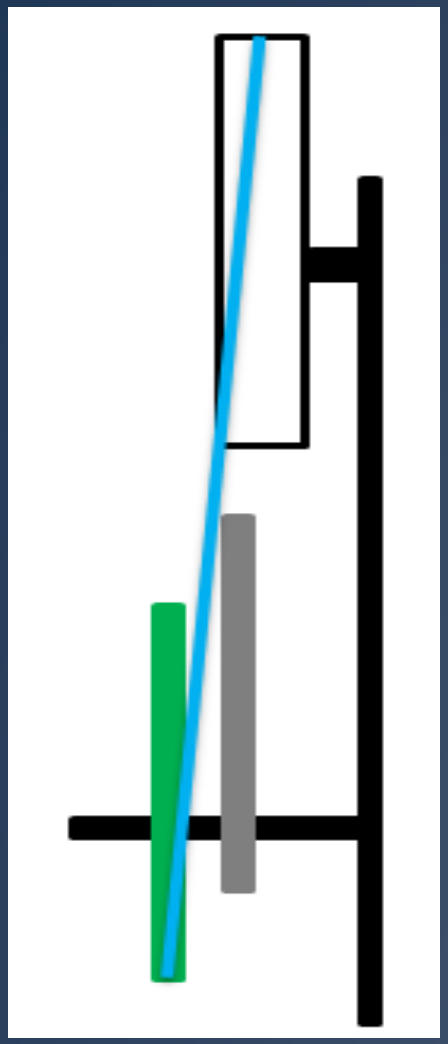
- The brake lever does not rotate forward.

Solutions

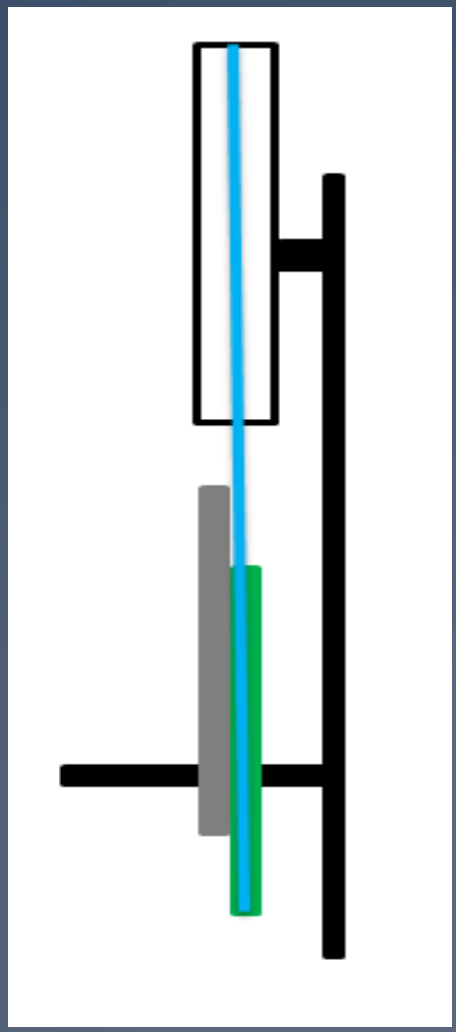
- Spring bracket is avoided.



Solutions



Makes the brake cable line up well with the 2nd rim.



Finding Brake Cable

- Ideal Brake Cable:
  - Effective – consistent stopping distance of less than 15 ft.
  - Durable – can be used for at least 500 miles
  - Inexpensive – costs less than $5
  - Locally Available

Potential Brake Cable Materials

- Polyester
  - $ 1.07/brake

- Nylon Strap
  - $ 0.76/brake

- Metal-Reinforced Nylon
  - $ 2.09/brake

Performance Testing

- Designed to look at braking capabilities of each material.
- Measured stopping distance when traveling at 10 mph.

Material	Polyester	Nylon Strap	Reinforced Nylon
Average Stopping Distance (ft)	14.4	26	9.1

Durability Testing

- Looked at durability under accelerated wearing conditions.
- Attached cable with 10 lbs of tension.
- Ran for 30-minute intervals at 10 mph (5 miles).
- Test ended once we reached 50 miles or cable broke
- Tested clean and dirty cables.
    - Dirty samples replicate conditions in Burkina Faso.

Apparatus

Results

- Polyester – Both samples completed test.
- Nylon Strap
  - Failed after 33 miles.

- Reinforced Nylon – Both samples completed test.

Results

Clean

Polyeste
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Results

Clean

Polyester

Reinforced Nylon

Dirty

Polyester

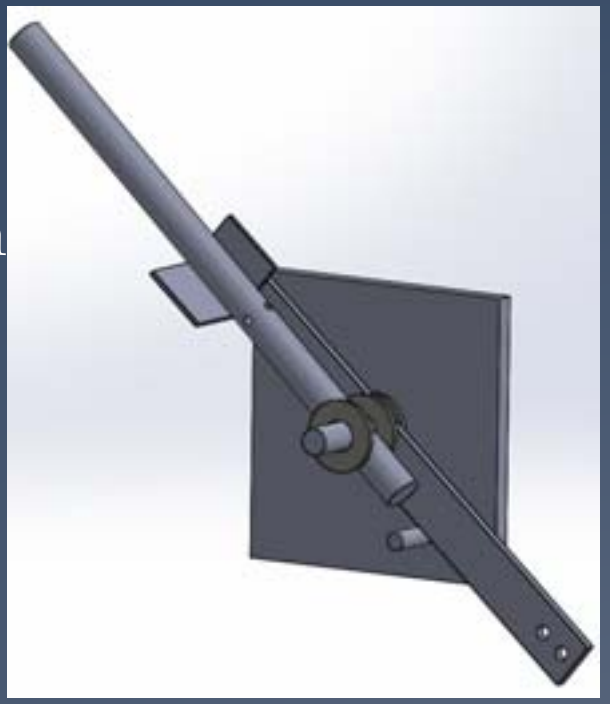
Reinforced Nylon

Comparison

	Polyester	Nylon Strap	Metal-Reinforced Nylon
Stopping Distance	14.4 ft.	26 ft.	9.1 ft.
Durability	Good	Poor	Good
Cost	$1.07	$0.76	$2.08
Locally Available?	Yes	Yes	No

Summary

- Improved design of brake system
  - Lengthened brake lever
  - Changed brake lever position
  - Added pin



- Completed brake cable testing
  - Recommended polyester rope as a suitable brake cable material

Future Work

- Monitor the brake cables and hardware for any issues
- Implement the band brake in Burkina Faso
  - Use rider feedback to make improvements

Acknowledgements

- Advisors:
  - Dr. Timothy Van Dyke
  - Mr. John Meyer
- Former Team Member:
  - Nate Richards
- Client:
  - Andrew Betteridge

Questions?