TreadX
Testing Traction Anywhere

Portable Shoe Traction Tester for Uneven Surfaces

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Background

The portable traction tester, operable by a two-person team and compact enough to fit within a car trunk, weighs approximately 80 lbs and occupies a footprint of under 7 ft². To simulate a human step, the device employs an electronic actuator coupled with a linear bearing system capable of exerting forces up to 225 lb. Integrated sensors measure relevant parameters, enabling precise calculation of friction coefficients

Flow Chart

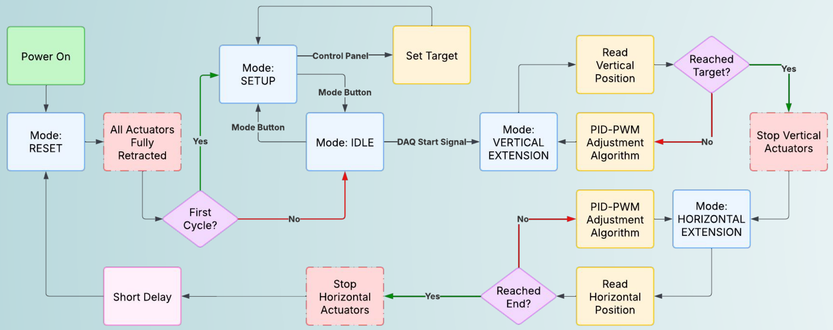


Figure 1: Automation Software Flow Diagram

The tester operates using finite state machine logic to control when and where to run the actuators to. A PID controller uses the actuators' position feedback and pulse-width modulation to streamline movement and loading. This configuration of electronic hardware and control algorithm allows for the operator to run the test procedure with the click of a button.

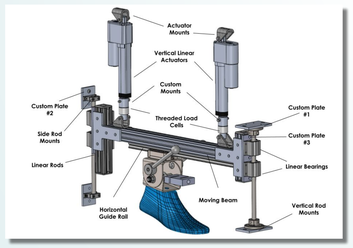
Operational Overview

The test protocol is initiated when dual vertical actuators lower the moving beam until a predetermined normal force is achieved. Horizontal actuation then moves the shoe across the ground, during which load cells record both normal and tangential forces with an uncertainty of 7%, quantifying friction coefficients up to 1.2.

TreadX: Final Design

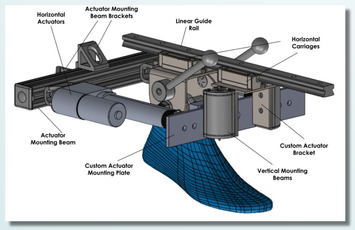
Figure 2: TreadX Portable Traction Tester

Key Mechanical Systems



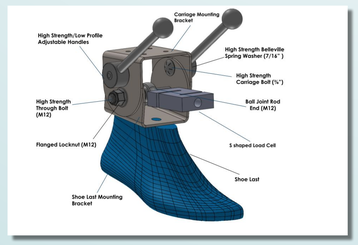
Vertical Loading System

Two actuators slide the moving beam downward along the coupled linear bearings. A guide rail underneath allows for lateral movement.



Horizontal Loading System

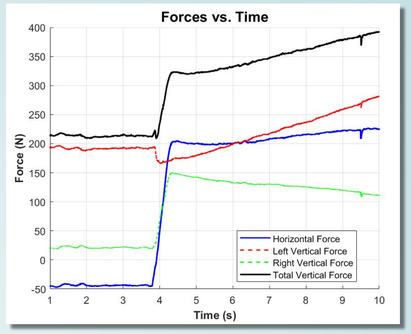
Fastened to the moving beam, dual actuators drive the shoe laterally. A custom designed bracket attaches the load cell to the ends of the actuators.



Adjustable Shoe Last System

Custom mounting brackets utilize slotted cutouts to allow for angle adjustment. A rod end connects the S-shaped load cell to the last itself. Allowing for rotational freedom

Friction Test Results



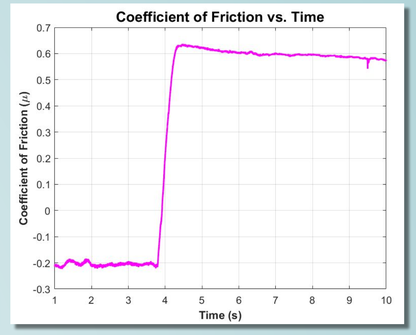


Figure 3: Force and Friction Outputs in LabVIEW

LabVIEW Interface Outputs:

- Live displacement plots for each linear actuator
- Live force outputs; individual sensors and combined
- Live average coefficient of friction over time
- Sample rate and filter frequency adjustability

Test Procedure

Figure 4: Operators Leveling Tester During Procedure

1. Locate and prepare level surface of desired material
2. Level the tester using the adjustable feet
3. Adjust shoe angle before both operators sit down
4. Calibrate actuator displacement on the control panel
5. Run the test in LabVIEW and observe output values

DECKERS BRANDS

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