Timberland Pro Dynamic Outsole

Team Members: Kyle Preble, Matt Batal, Russ Somphonlug, Lexi Yerardi, Andrew Trasatti
Dept. of Mechanical Engineering, University of New Hampshire, Durham, NH 03824

Project Overview

Mission Goal
Create an innovative outsole design for construction workers to wear that increases safety in icy winter conditions.

Design Criteria
The developed design was required to meet the following criteria:

- Durable
- Quick and Easy On/Off (<10 Seconds)
- As light or lighter than competitors
- Affordable
- Incorporate Ladder Lock Feature

Methodology

Steps in Design Process

- Market Research
- Rough Sketches and Design Drawings
- 3D Modeling Prototypes from Drawings in SolidWorks
- 3D Prints of Solidworks Models
- Testing of Competitors Models (On/off Time, Friction Testing)
- Initial Testing of 3D Prints

What was Evaluated

- Timed how long it took to add and remove each model from a boot
- Friction traction test with weights in the boot to determine the coefficient of friction

Setup of Friction testing (left): Crane scale used to measure force required for boot slippage

Competitor's Models

STABILicers

Microspikes

FANBX

Acknowledgements

Special thanks to Joshua Thorson, Matt Piotrowski, the Timberland PRO Team, and our advisor Todd Gross for their guidance throughout the project. Thanks as well to Dover Ice Arena for allowing us to complete traction testing at their rink.

Prototype Design

Sandal

Seatbelt

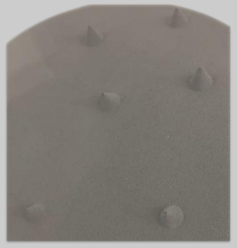
Twin Clip

Attachment Design

Buckles

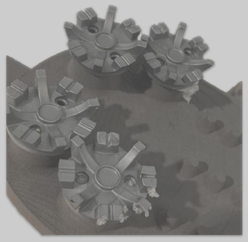
Velcro

Spike Design



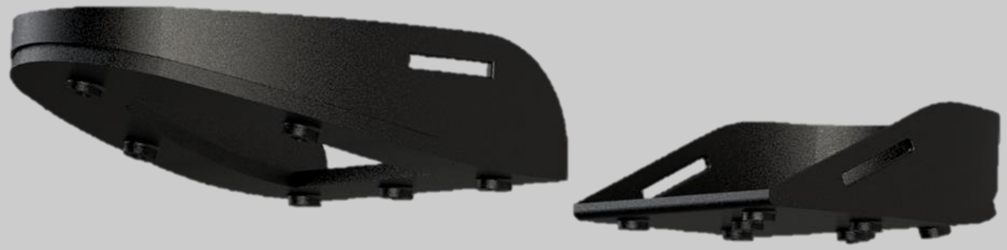
3D Printed Polymer Spikes

Metal Spikes



TPU Golf Spikes

Final Design



Seatbelt with clips and metal spikes

Results

General Overview

- From wear testing, the "Seatbelt" prototype fit the shape of the boot best, tightened and gripped the boot while wearing and walking.
- From wear testing and friction testing, the metal cone spikes outperformed the others as they gripped the ice best and had the highest coefficient of friction (C.O.F).

Testing category specifics

- From C.O.F. testing, the highest competition was the Microspikes traction device with a C.O.F of **0.2**.
- The best team prototype was the "Metal Spikes" design with a C.O.F of **0.35**.
- From testing the on/off time, the best average time of competitor models was FANBX. It had an on time of **6.8** seconds and an off time of **1.78** seconds.
- The shortest average time of team prototypes was the Sandal model. It had an on time of **4.71** seconds and an off time of **0.97** seconds. The downside of this design was it not being tight enough around the boot which contributed to a short on/off time.
- Once our prototype is in full, ready-for-market quality, we believe it will outperform the competition even more so than it currently does.

On/Off Time Comparison

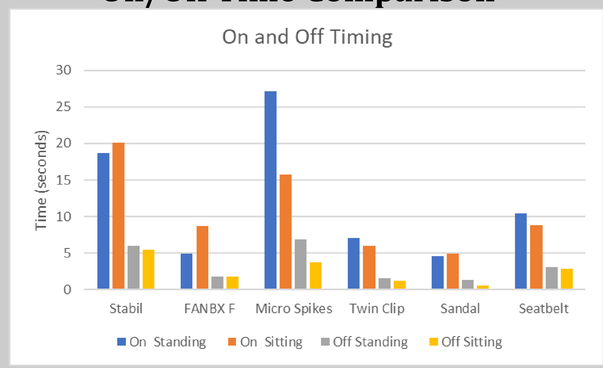


Figure 1: On/off time comparison of prototypes and competitor models.

Coefficient of Friction Results

Device Used	Normal Force applied with weight (N)	Average Force required to slip from 3 Trials (N)	Average Coefficient of Friction
STABILicers	732 N	120 N	0.16
FANBX	732 N	100 N	0.13
Microspikes	732 N	150 N	0.20
Metal Spikes	732 N	260 N	**0.35**
3D Printed Spikes	732 N	150 N	0.20
TPU Golf Spikes	732 N	40 N	0.05

Table 1: C.O.F. Testing between prototypes and competitor models. Competitors in grey color. Team prototypes in orange. *NOTE*: 732 N is equivalent to 165 lbs.