PSU MNE 6 – Improving the Design of a Handheld Tribometer to Measure Slip Resistance of Flooring

Overview
The current handheld tribometer, from a 2001 M.S. thesis, has several design flaws and follows outdated ASTM Standards. The material used for the base and shoe attachment is corroded, the shoe utilizes a tab that makes it difficult to attach and remove from the base, and the handle and chassis make up one boxy, uncomfortable design. Because of these flaws, a more ergonomic and commercial design is needed for mass production of the tribometer.

Objectives
- Design a new shoe-base system to make it easier to remove and attach the shoe
- Use stainless steel for the shoe-base system to prevent corrosion
- Design a more ergonomic chassis to house the electrical components
- Utilize an AR15 grip for the handle to make testing more comfortable
- Minimize the amount of strain gauges and deflection beams used for acquiring measurements

Approach
- Met with sponsor, identified customer needs, and created target specifications
- Performed extensive patent search and benchmarked existing tribometers
- Generated design concepts for the shoe, base, chassis, and connecting parts
- Created CAD models and generated various prototypes using 3D printing and stainless steel
- Purchased the necessary stainless steel materials, electrical components, and AR15 grip
- Made alterations of the CAD models and finalized an end design
- Machined the stainless steel parts for the shoe, base, and connecting parts
- 3D printed the final chassis CAD design
- Assembled the machined parts, connecting the grip, chassis, and shoe-base system
- Attached strain gauges and electrical components to perform testing

Outcomes
- The end product (picture to the right) resulted in a much more ergonomic and commercial tribometer design
- The shoe can attach to the base with ease, via a threaded, stainless steel mason-jar design
- The chassis is a more compact and rounded design that houses the electrical components and an LCD screen to visually see results
- One deflection beam and two full-bridge strain gauges are used to acquire measurements
- Due to the AR15 grip, using the tribometer is a comfortable experience that allows the user to slide the device along various surfaces with ease