



White Paper

STAND YOUR GROUND

A guide to slip resistance in industrial safety footwear

A guide to slip resistance in industrial safety footwear

When it comes to footwear, the topic of slip resistance is almost as treacherous as the slick floors, wet surfaces and uneven terrain employees encounter every day. Confusion exists on the current testing standard for slip resistance of safety footwear as well as how to evaluate slip resistant footwear. This puts employers in a difficult position because slips, trips and falls are among the most reported—and most costly—injuries in many industries.

Navigating the standards

Slip resistance requirements for safety footwear don't exist in the same way they do for other personal protective equipment (PPE). There are a variety of methods for testing the slip resistance of footwear, and there are guidelines that manufacturers can choose to follow (or not) during the testing phase of product development. The current testing method for slip resistance in safety footwear is relatively unknown compared with its withdrawn predecessor. In addition, there is no standard which defines "slip resistant" backed by a regulatory body with enforcement power, such as OSHA or HSE.

The relevant testing standard set forth by the American Society of Testing Materials (ASTM) is ASTM F2913, "Standard Test Method for Measuring the Coefficient of Friction for Evaluation of Slip Performance of Footwear and Test Surfaces / Flooring Using a Whole Shoe Tester" ("Whole Shoe test").

The Whole Shoe test addresses the entire shoe and tests a variety of combinations of footwear materials and surfaces, including those that are regularly contaminated with slippery substances. As such, it offers the most comprehensive picture of slip resistance. The following text lays out the scope of the standard:

This test method determines the dynamic coefficient of friction between footwear and floorings under reproducible laboratory conditions for evaluating relative slip performance. The method is applicable to all types of footwear, outsole units, heel top-pieces (top-lifts) and sheet soling materials.

In the Whole Shoe test, the footwear sole and underfoot surface are brought into contact, subjected to a specified vertical force for a short period of static contact and then moved horizontally relative to one another at a constant speed. The horizontal frictional force is measured after movement starts and the dynamic coefficient of friction is calculated.

Again, the Whole Shoe test is notable because it allows for reproducible testing of footwear and footwear-related soling materials with respect to slip resistance. Other ASTM test methods in this arena typically address flooring materials.

Another slip resistance method employers may be familiar with is ASTM F1677, known as the "Mark II test" (and also known as the "Brungraber test") because it was performed with a portable inclined articulated strut slip tester (PIAST) developed by Dr. Robert Brungraber of Bucknell University. For many years, the Mark II test was an accepted standard for measuring slip resistance.

It is critical to note that the Mark II test was withdrawn by ASTM in 2006 and replaced with the Whole Shoe test in 2011, meaning the Mark II test is no longer supported by ASTM. The Whole Shoe test is not only more versatile, but also employs test equipment capable of precise calibration. It measures the coefficient of friction of the sole of the shoe mimicking more real world conditions than the Mark II test which was created to test flooring, not footwear. Employers accustomed to requesting Mark II test data from safety footwear providers will need to switch over to asking for Whole Shoe test data.

ASTM F2913, the Whole Shoe test, replaced ASTM F1677, the Mark II test, in 2011. Employers should request Whole Shoe test data when evaluating slip resistance.

Exploring a slippery issue

While slip resistance seems like a straightforward concept, measuring it for safety footwear is actually quite challenging. Additional language in the Whole Shoe test documentation illustrates some of the reasons why this is the case.

1. **Surface contaminants include, but are not limited to, water, ice, oil, grease and other chemicals.** These contaminants are among the most prevalent but employers have no real way of knowing how slip resistance changes if the contaminant is food, gravel, cleanser, mud, or construction material.
2. **The test does not account for the risk of tripping due to footwear/ground interlock.** This language refers to special-purpose footwear with spikes or metal studs. The key point is that when footwear is too slip resistant for the task, it can raise additional risk of injury.
3. **The standard does not address all safety concerns.** A variety of other factors may potentially affect the risk of slipping beyond footwear and flooring, including ambient temperature, lighting, surface irregularities, stairs and handrails, floor mats and runners, and human factors such as overall health, inattentive behavior, taking shortcuts or carrying objects that obstruct your view.

OSHA guidelines do not address slip resistance standards for safety footwear. Its safety footwear standards focus on impact and puncture resistance, emphasizing toe and metatarsal guards. There is only

a small note that foot protection may be required when working on slippery surfaces, but slipperiness is not quantified.

In general, OSHA requires slip-resistant surfaces (not footwear) in certain work environments, but its standards do not clearly define slip resistance. One proposed standard specified a 0.5 coefficient of friction (CoF), but the requirement was never adopted.

The takeaway here is that, while friction can be measured between any two surfaces, the risk of an employee slipping involves many variables that are specific to the job and the quality of the footwear. For example, one type of safety footwear may provide adequate slip resistance under optimal conditions but fail if the surface is cold or wet. Another type might initially offer substantial slip resistance but quickly wear down due to poor manufacturing quality.

Evaluating slip resistance

Even if there is no way to “check the box” on a well-known slip resistance rating because it doesn’t exist, employers understand that slip resistance delivers a long list of benefits for the company and its workforce. Preventing slips and falls reduces the risk of accidents and injuries, which has a carryover effect on overhead, insurance premiums, worker’s compensation and profitability, not to mention morale.

So how can employers make a solid assessment of slip resistance? It helps to start with an understanding of the tradeoffs involved.

1. **Safety vs. cost.** Bottom line, it’s unlikely that the least expensive safety footwear will meet the slip resistance requirements of the job. The slip resistance of any shoe or boot comes down to the integration of several anti-slip features, all of which may affect purchase price. Shortcuts, sloppy manufacturing techniques or low-quality materials could compromise any of these

features, as well as create durability issues.

2. **Safety vs. comfort.** Safety features have to exist in proper balance with comfort considerations. If safety footwear does not fit properly or is uncomfortable, employees may not wear them consistently, find ways to avoid wearing them, or wear a less-safe boot or shoe instead.
3. **Safety vs. overdesign.** Not every job requires maximum slip resistance. In fact, it is often the case that safety footwear can be too slip resistant for a specific environment. If the shoe or boot sticks to the work surface too much, employees run the risk of injuries similar to those experienced by athletes who hurt their knees when their cleats become stuck in the turf.

It is ideal to work with a safety footwear provider who understands these tradeoffs and can help advise your organization on the right product for the work environment. This can help individuals avoid choosing footwear that is slip resistant but unsuited to a specific job, such as a boot that works well in wet conditions but fails when coming into contact with material spills that clog the tread.

To help you ask the right questions, here are some general guidelines to consider when selecting the right slip resistance features in safety footwear:

Outsole

The outsole compound is critical for slip resistance. In general, soft rubber compounds offer the greatest slip resistance for environments contaminated with oil and grease. However, it is important to keep in mind that small changes in the compound can result in large variations in overall slip resistance.

Tread

Look for outsoles that channel oil and grease away so the outsole can reach the work surface more fully, as well as outsoles with split and solid lugs specifically designed to shed debris. Treads should allow a maximum amount of material to grip the floor. Softer soles and more tightly spaced treads

are better suited to fluid contaminants and indoor environments. More widely spaced treads are generally better for handling solid contaminants in outdoor areas. It is vital to avoid clogging the tread. A wider or deeper tread pattern may be necessary if footwear needs to be cleaned too often. Over time, watch for worn or flattened soles.

Insoles

Insoles do not play a direct role in slip resistance, but they should offer additional cushioning and impact padding for employees who are on their feet for extended periods or work predominantly on hard surfaces.

Uppers

Uppers can be made of a long list of materials, including various leathers, suede, mesh and combinations of these. Like the insole, the upper does not directly determine slip resistance but plays a key role in fit and comfort. A shafted boot (e.g., a 6" or 8" tall boot) offers more ankle stability than a shorter boot (e.g., an oxford).

Midsole

The midsole should provide ample support and stability. Again, midsole technologies do not have a direct bearing on slip resistance but are important for the overall structural integrity of footwear and the amount of comfort employees can expect throughout the day.

Durability

Slip resistance performance may change over time as footwear is subjected to normal wear and tear. Employers should prioritize highly durable footwear that provides the most slip resistance for the longest period of time so the workforce can operate with confidence.

Setting the standard

Any safety footwear provider can claim its products are slip resistant, precisely because there is no uniform global standard or rating for slip resistance. For this reason, Red Wing Safety Footwear recommends three simple principles for evaluating slip resistance:

1. **Follow the ASTM standard.** ASTM F2913, or the Whole Shoe test, provides the best and most complete approach to evaluating how different footwear materials will interact with various work surfaces. All slip resistant footwear should be tested to this standard to establish a common basis for comparison. Again, the Mark II test has been withdrawn by ASTM and should not be used to evaluate safety footwear.
2. **Understand the details.** Whether or not a specific shoe or boot will provide adequate, long-term slip resistance depends on much more than one test standard. It requires a deep understanding of what the job actually involves: the surfaces,

contaminants and physical requirements of the role. Look for a provider with experience developing purpose-built safety footwear worn in a variety of industries.

3. **Share knowledge.** Every work environment is unique. Ensuring slip resistance depends on a strong, open and transparent collaboration between employer and safety footwear provider. The footwear manufacturer should not only provide as much detail as possible about its products, but should also seek to understand every nuance of the work environment before making a recommendation.

Convenient for workers

With more than 1,200 U.S. retail locations, 170 Mobile Shoe Stores and over 250 purpose-built designs, your workers won't have to travel far to find the Red Wing footwear they need to do their jobs safely and productively.

Simple for you

Red Wing for Business makes it easy to honor your commitment to your workers' well-being. From initial setup through ongoing support, our team of experts will be there to ensure a smooth experience and successful program for you.



RED WING FOR BUSINESS

To learn more about all the ways Red Wing for Business can benefit your workers and your business, please visit redwingsafety.com.

Based in Red Wing, Minnesota, Red Wing Shoe Company has a long tradition of offering premium-quality safety footwear that incorporates the best features available to protect people on the job. Right now, our boots are hard at work in thousands of applications in more than 110 countries.

