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**Don't get tripped up on Tribometer misinformation- the truth and myths on various Tribometers**

**I. The Mechanics of Walking**

**Human Ambulation**

Under the general topic of Premises Liability is a type of accident collectively referred to as "Slip & Fall." What causes a slip and fall incident? Various factors can contribute to a slip and fall. There are four factors that typically govern pedestrian traction: the floor surface, the shoe of the pedestrian, contaminants, and gait dynamics of the pedestrian. The basic analytical model for analyzing the slip resistance of a walking surface is that a pedestrian will not slip if the friction available between the walking surface and the shoe bottom is greater than the friction required by the ambulation activity. Not everyone has the same traction demand. Everyone walks differently. A slip and fall occurs when there is not enough friction between the walking surface and the pedestrian's shoe bottom to sustain the ambulation activity and the pedestrian cannot control their balance to stay upright. The phase of walking motion will also dictate the probability of a slip and fall.

**Terminologies**

The study of slip and falls has its own terms and verbiage that identify tools, the science involved with friction, walking, and of course slipping. The history of slip and fall testing and identification of slippery walking surfaces date back to the early 1900's. Terminology was developed to address these studies and new terminology continues to be developed as further research and studies provide information. What is a tribometer? It is the technical name for an instrument used to measure walkway friction.

Tribometers were developed to measure walkway friction. Most tribometers were developed and are used to measure in-place walking surfaces versus walking surface materials in a laboratory, although most are capable of testing materials in a laboratory reliably. The idea is to determine if a walking surface is safe for the intended purpose of...walking. Contaminants play a large role in walkway safety and can cause unexpected, localized slippery conditions. Contaminants can be on the floor or on the shoe bottom. Contaminants that are of concern for

slip and fall incidents are those that reduce the friction between the walking surface and the shoe bottom. Contaminants can be anything from simply water, to sand or soil, to grease and oil, to a floor cleaning product, or to a spilled beverage. But was the friction of the walking surface adequate and safe for the intended use of the walking surface and the space.

## **II. Friction demand**

### **Static coefficient of friction**

What is static coefficient of friction? First of all, friction is the force resisting the relative motion of solid surfaces, fluid layers, and material elements sliding against each other. Static friction is the friction that exists between a stationary object and the surface on which it's resting. Coefficient of static friction is the ratio of force required to start sliding the stationary object over a particular surface relative to the normal force, which is the weight of the object. If you try to push a couch across the room, the first push is the hardest part. Maybe some people assume that's nothing more than psychological, but there really is a physics reason for it. The reason is static friction. Several tribometers can measure the static coefficient of friction of a walking surface.

### **Dynamic coefficient of friction**

Dynamic friction also known as kinetic friction or sliding friction, occurs when two objects are moving relative to each other and rub together (like a sled on the ground). Dynamic friction is the friction between two surfaces that are in relative motion with respect to each other. Dynamic coefficient of friction is the ratio of the horizontal component of force applied to a body required to overcome resistance to movement when the body is already in motion divided by the vertical component of the weight of the body or force applied to the surface where movement occurs. Not all tribometers can measure the dynamic coefficient of friction of a walking surface.

## **III. Tribometers**

### **Comparison of tribometers**

An introduction to tribometers. Several tribometers will be physically shown and available during the presentation. Differences between the types of tribometers will be discussed. What is the difference between a variable incidence tribometer, articulated struts, pendulums, and a pull meter or a drag sled? The different tribometers have different mechanisms for the tribometers to measure the friction available for a walking surface. Some of the tribometers use a weight to measure the coefficient of friction. Some tribometers use compressed air cartridges to initiate a slip. And others use battery operated computers to measure the coefficient of friction. Some tribometers have benefits over others. Some tribometers have limitations as to what it can do. Additionally, there are myths or misunderstanding with some tribometers.

## **Industry Standards**

Industry standards organizations provide some guidance, information, research, and studies on the use of tribometers and the information gathered from the testing of walkway surfaces. Organizations such as ASTM International (formerly known as the American Society of Testing and Materials) and ANSI (American National Standard Institute) have committees of professionals that write standards specifically addressing walkway safety. Governmental organizations such as OSHA (Occupational Safety and Health Administration) or government regulations such as ADA (Americans with Disabilities Act) provide some information and requirements that affect walkway safety and to a certain degree discuss slip resistance requirements for pedestrian walkways. Issues such as slopes of walking ramps, levelness of walking surfaces, appropriateness of a walkway surface material for an area of intended use and non-mandatory thresholds for slip resistance, are/were discussed in these standards and regulations including past rulemaking. There are currently no mandatory thresholds for slip resistance in these standards.

## **IV. Case Studies**

### **Slip and fall coefficient of friction test on concrete**

Case study information will be shared showing an investigation where a slip and fall incident occurred and slip resistance measurements were attained using a particular tribometer. The presentation will show photographs of the incident location, testing procedures, provide information on length of time necessary for testing and other equipment and materials needed to complete the testing. Each of the case studies will focus on a different walkway surfaces and a different tribometer. One case study will focus on the use of the Excel Tribometers English XL tribometer used on a concrete walking surface.

### **Slip and fall coefficient of friction test on tile**

One case study will focus on the use of the Reagan Scientific Bot3000e tribometer used on a tile floor finished walking surface.

### **Slip and fall coefficient of friction test on vinyl**

One case study will focus on the use of the Slip Test Mark IIIB tribometer used on a vinyl floor finished walking surface.