Coefficient of Friction

Coefficient of Friction is the rating given for the slip resistance of ceramic tile and other like surfaces. It is a term used to describe the amount of force required to cause an object (shoe sole material) to start moving across a surface (flooring material).

A higher coefficient of friction indicates increased resistance of shoe sole material to start moving across a flooring material. Many factors can affect slip resistance, such as the degree of wear on the shoe and flooring material; presence of foreign material, such as water, oil and dirt; the length of the human stride at the time of the slip; and the physical and mental condition of humans. It may also vary within and between production runs because of inherent characteristics of ceramic tile.

Although ANSI has not established a standard value for Coefficient of Friction, OSHA (Occupational Safety and Health Administration) has established a recognized industry standard of 0.50 (wet and dry) for slip resistant surfaces. The ADA (Americans with Disabilities Act) recommends but does not require a Coefficient of Friction of 0.60 for accessible routes and 0.80 for ramps. ADA does not specifically state that 0.60 is both a dry and a wet requirement.

It is important to provide this information to customers due to legal exposure a building owner has if tile with inadequate slip resistance is installed, particularly in a commercial environment.

Co-Efficient of Friction

ASTM-C1028

- Recommendation for slip resistance by ADA and OSHA. This is just a recommendation, not a standard.

- **ADA = Wet/Dry 0.6 or greater**
- **ADA Ramps = 0.8 or greater**

- **OSHA = Wet/Dry 0.5 or greater**
- **OSHA Ramps = No Test Rating**

Issues with the ASTM C1028 Static Coefficient of Friction (SCOF) test method

- Variables that can affect results (testing requires experienced skilled technician)
  - Pulling motion
  - Sanding pressure
- Availability of Neolite rubber material
- Stiction
  - Affects measurement of polished and highly smooth surfaces
- No standardized reference value

North America is switching from Static COF with ASTM C1028 method to Dynamic COF with BOT 3000

Why the BOT 3000?

- Measures wet and dry, static and dynamic coefficient of friction
- Easy to use with little possibility of human error

- Self-propelled device
- Uses various sensor materials

A little background…

- ANSI A137.1 has always specified ASTM C1028 for coefficient of friction test results
- There has never been a requirement in ANSI or any other governing body (i.e. OSHA, ADA, etc.)
- ADA used to have a 0.6 COF recommendation in an old Access Board document that was removed because it did not specify a test method or condition (wet or dry)
- However, many projects have long required 0.6 SCOF measured by ASTM C1028.

Stiction

- May occur when measuring wet static COF of polished or very smooth surfaces
- Like two wet pieces of glass sticking together
- Possible to generate higher COF results which may give a false expectation of slip resistance

Definitions of SCOF and DCOF

Dynamic Coefficient of Friction (DCOF): Sometimes called kinetic coefficient of friction. This is the ratio of the force necessary to keep a surface already in motion sliding over another divided by the weight (or normal force) of an object. This force is a materials property of the two surfaces. DCOF is usually less than SCOF for the same materials. Contaminants such as dirt, water, soap, oil, or grease can change this value.

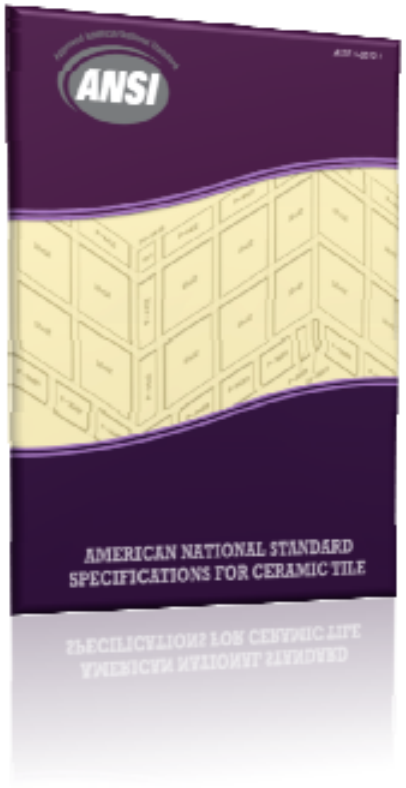
Static Coefficient of Friction (SCOF): This is the ratio of the force necessary for a surface to begin sliding over another divided by the weight (or normal force) of an object This force is a materials property of the two surfaces. SCOF is usually higher than DCOF for the same materials. Contaminants such as dirt, water, soap, oil, or grease can change this value.

Why the switch to Dynamic COF?

- Dynamic testing is done in many other countries
- Generally more repeatable predictor of slip resistance
- DCOF is a more suitable test of polished and highly smooth surfaces
- DCOF measures COF when sensor is already in motion, which better simulates human ambulation at the time of a slip.

What is the new requirement?

For tiles expected to be walked on when wet, …ANSI A137.1 now specifies 0.42 DCOF measured with the BOT 3000 per the procedure in the A137.1 standard



Where did 0.42 DCOF come from?

- The German researchers conducted a validation study with additional human subjects and based on their perception of slipperiness and to incorporate additional safety criteria, the value was set at **0.42.**
  - TCNA Comparison of over 300 tile surfaces: 0.6 SCOF correlated with 0.38 DCOF (w/SLS).