

Coefficient of Friction and the DCOF AcuTestSM

Coefficient of friction (COF) is the measurement of a tile's frictional resistance, closely related to traction and slipperiness. The method for measuring the COF of ceramic tile floors changed in 2012, after years of research and with the approval of the accredited national consensus body (ASC-A108) responsible for ANSI A137.1, the American National Standard Specifications for Ceramic Tile. Previously, COF was determined per the ASTM C1028 method from a measurement of static friction, which is the frictional resistance one pushes against when starting in motion. The new method, known as the **DCOF AcuTest***, measures dynamic friction, which is the frictional resistance one pushes against when already in motion. For both static coefficient of friction (SCOF) and dynamic coefficient of friction (DCOF), a slip occurs when pushing off with more force than the surface can resist.

In addition to mandating the switch from SCOF to DCOF, the standard now requires a minimum wet **DCOF AcuTest** value of 0.42 for ceramic tiles for level interior spaces expected to be walked upon when wet. According to the standard, tiles with a wet **DCOF AcuTest** value of less than 0.42 are only suitable for floor areas that will be kept dry. Polished tiles generally fall into this category.

Previously, there was no required value in ANSI A137.1 for wet floors (static or dynamic), although a minimum value of 0.6 wet SCOF, measured by ASTM C1028, was commonly specified for ceramic tile in commercial spaces for many years. The new required value stems from extensive research in Europe and at TCNA. Researchers at the University of Wuppertal in Germany studied human subjects walking on force plates to find the relationship between the tangential force and the vertical force needed for reliable traction (this relationship defines the coefficient of friction and has been widely studied in the US and in Europe). They then considered many different slippery conditions, different ways people could move on a surface, and accident statistics over many years to recommend to the German national insurance body a minimum wet DCOF value of 0.42 for flooring.¹

In various studies at TCNA, including a study of over 300 tile surfaces², TCNA researchers found that 0.60 wet SCOF could be correlated on average with 0.38 wet DCOF.

Considering both the TCNA research and the years of research in Europe, the ANSI A108 Accredited Standards Committee decided to include an additional measure of safety over the widely used ASTM C1028 wet SCOF value of 0.60. They revised ANSI A137.1 to include a threshold minimum wet **DCOF AcuTest** value of 0.42 for level interior spaces expected to be walked upon when wet.

Not all tiles, though, with a wet **DCOF AcuTest** value equal to or greater than 0.42 are suitable for all level interior spaces. The specifier shall determine tiles appropriate for specific project conditions, considering by way of example, but not in limitation, type of use, traffic, drainage, how the tiles are profiled or structured, expected contaminants, expected maintenance, expected wear, and manufacturers' guidelines and recommendations.

Refer to Section 6.2.2.1.10 of ANSI A137.1 for further explanation and detail.

***DCOF AcuTest** is the industry designation for the test procedure contained in ANSI A137.1 Section 9.6., which has been extensively researched, allows for in-situ field measurements, and is in use at tile manufacturing facilities. It was so named to distinguish it from other DCOF measurements using different instruments and/or protocols.

¹The German research considered was extensive and can be found in the following publications: (1) Boenig, Stefan. Experimental Investigation to Determine the Standardized Limits of the Coefficient of Friction When Walking (Archive Number D468), University of Wuppertal Department of Safety Technology, 1996. (2) Skiba, Reinald. (1988). Sicherheitsgrenzwerte zur Vermeidung des Ausgleitens auf Fuessboeden, Zeitschrift fuer Arbeitswissenschaft (Journal of Occupational Science), 42, 47-51. (3) BGI/ GUV-I 8687, 2011, "Bewertung der Rutschgefahr unter Betriebsbedingungen", German National Institute for Social Accident Insurance (DGUV). (4) Sebald, Jens. (2009). System oriented concept for testing and assessment of the slip resistance of safety, protective and occupational footwear. Berlin: Pro BUSINESS GmbH.

²While the 300 surfaces chosen were selected to represent a wide spectrum of tile surfaces, no claim is made or offered that this represented the entire spectrum of available tile surfaces nor can any inference be made regarding any individual tile surface. ASTM C1028 SCOF measurements and **DCOF AcuTest** measurements cannot be directly compared or correlated on a per tile basis as different sensors, test conditions, and measurement physics are employed.