



Statement Making Products

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Design Guide: Anti-Slip Bulletin¹

This bulletin will assist you in determining the appropriate specification for any type of flooring product. In real life terms there are several conditions that one must consider.

1. Pedestrian starting from a stop position.
2. Pedestrian traversing over a surface to include change of directions.
3. Pedestrian stopping on a surface.
4. Wet and Dry surfaces.

Here are some rules of thumb.

1. Dynamic Coefficient of Friction (DCOF) tested in both wet and dry conditions are truly the only useful specification and test procedures that should be specified.

DCOF is defined as "If the object is pulled until it starts to slide, the amount of force necessary to continue the slide results in a calculated value called the dynamic coefficient of friction."²

2. Static Coefficient of Friction has very limited usefulness and should not be used solely as a requirement.

SCOF describes "the relationship between the weight of an object and the force necessary to cause the object to [begin to] slide across a surface. Static is defined as 'not moving or stationary.' When an object starts at rest, the calculated value is called the static coefficient of friction."

SCOF dry testing can be valid, but SCOF wet testing is widely known to be a very poor method of assessing pedestrian slip resistance. Any instrument or test method that yields wet SCOF does not offer reliable, research-backed safety data.

¹ Special Acknowledgement to Professor Nicholas Kissoff of the University of Toledo; George and John Sotter Safety Direct America; and Russell Kendzior – NFSI for their technical assistance and insights.

² Definitions provided by Safety Direct America – John and George Sotter

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3. When specifying you must tie the specification to a specific test procedure and equipment. In other words, saying 0.5 or 0.6 DCOF is *meaningless* unless it is tied to a single test procedure, test standard, and/or test equipment (device).
4. As safety criteria, 0.5 or 0.6 DCOF etc. are not magical numbers. Two different types of tests can obtain the same results but in one case the result could be a failure and in the other case the result may be acceptable.
5. All products should be tested by a credible independent agency.
6. ADA has no specific requirements regarding anti-slip other than the vague requirement that disabled-accessible surfaces should be “slip-resistant.”

Standards or test equipment that have limited or no usefulness

1. UL 410, static test only
2. ANSI B101.1, a static test. OK for dry testing only.
3. ANSI/ASSE TR-A1264.3-2007
4. James Machine, described in ASTM D 2047. A dry static test mainly for checking floor finishes or waxes
5. English XL - Variable Incidence Tribometer (VIT). Subject of withdrawn ASTM F 1679
6. ASTM -C-1028 – has been withdrawn
7. ASTM - F-1679 - has been withdrawn
8. Tortus Test equipment is good for dry testing, but can give misleading results in some wet tests, e.g., flat non-porous surfaces like polished stone or some glass
9. UNE ENV 12633³ – status cancelled

Good Practices: Standards and test equipment, provide useful information but flawed

1. ASTM E- 303 – rough and vehicle surfaces
2. ANSI A137.1, specified by reference in 2012 International Building Code, Section 2103.6 Ceramic Tile (p. 435)
3. DIN 51130⁴

³ https://infostore.saiglobal.com/en-us/standards/une-env-12633-2003-23774_SAIG_AENOR_AENOR_52308/³

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4. DIN 51097 Classes A, B and C.⁵

Best Practices: Standards and Test Equipment

1. SA HB 198:2014 (Australian)
 - 1a. Australian Test Method (British Pendulum) – AS 4586 – 2013, Appendix A
AS 4586 – 2013 Slip Resistance classification of new pedestrian surface materials
AS 4663 – 2013 resistance measurement of existing pedestrian surfaces
2. ANSI B101.3, "Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials," using BOT-3000E
3. Ceramic Tile Institute of America, <http://ctioa.org/reports/cof18.html>
4. British Pendulum Test Equipment
5. United Kingdom Slip Resistance Group (UKSRG) Standards – Issue 4/2011 – www.ukslipresistance.org.uk, using British Pendulum test equipment
6. European Standard – EN 13036-4 (Wide spread adoption), using British Pendulum

Here are some numbers⁶.

*** Remember a safety standard must be tied to a specific test and test equipment.

Both the CTIOA and the UK Slip Resistance Group state that slip resistance can be affected by factors such as floor coatings, abrasives, detergents, contamination, chemical treatments, floor angles, and footwear.

The Ceramic Tile Institute of America (CTIOA) makes a more general recommendation and says that a **minimum** pendulum test value (BPN) of **35** for level floors is considered “low slip potential”. According to CTIOA, values of 25-34 BPN are classed as “moderate slip potential”. Values of 0-24 BPN have “high slip potential”.

⁴ Uses oiled flooring and heavily treaded shoes and so is not applicable to a commercial environment

⁵ Maybe difficult to find a testing facility in the US.

⁶ Ref and Technical Assistance – Sotter Engineering Corporation

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CTIOA’s first choice from their literature appears to be the British Pendulum (BP) Test Device over the Tortus for wet testing. They do allow for new test equipment so long it has a strong correlation to BP Test Device.

United Kingdom Slip Resistance Group (UKSRG) Standards makes a more general recommendation and says that a **minimum** pendulum test value (BPN) of **36** for level floors is considered “low slip potential”.

The Australian Standard takes a novel approach. AS HB 198: 2014 paragraph 1.2 factors in a myriad of conditions to include pedestrian surface materials, wear characteristics, maintenance, contamination, presence of water, nature of pedestrian traffic (age, gait, crowding), footwear, slope, environmental factors (lighting and handrails). Based on these situations the handbook specifies BPN (PTV) based on application and location. These recommendations are captured on their Table 3A. Unfortunately, the table is filled with Australian classification codes rather than BPN, PTV, or DCOF numbers. But below are some examples on how the classifications can be converted to British Pendulum Numbers

Building/Walkway Type	Minimum BP-Hard rubber	Minimum BP-soft rubber
Exterior walkway - level	45	40
Hotels, Offices, School wet area	35	35
Shopping Centers – wet areas	35	35
Hospitals – public areas	25	20

It is likely under the Australian standard that different portions of a building would have different anti-slip requirements, depending on the use of the area: foodservice, pool deck, lobby, rest room, etc.

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