



SLIP RESISTANCE OF BELGARD® PAVERS AND SLABS

Belgard concrete pavers and slabs are an excellent choice for providing slip-resistant floors and walkways. Identifying the appropriate reference criteria can be challenging. This Technical Note provides an update on the latest developments related to pavers and slip resistance testing.

Background

The Americans with Disability Act (ADA) ensures access to the built environment for people with disabilities. ADA Standards establish design requirements for the construction and alteration of facilities subject to the law. These enforceable standards apply to places of public accommodation, commercial facilities, and state and local government facilities. The Access Board is responsible for developing and updating design guidelines known as the ADA Accessibility Guidelines. For pavers, a useful reference is Chapter 3, [Floor and Ground Surfaces of the ADA Standards](#). Section 302 states "Floor and ground surfaces shall be stable, firm and slip resistant." [The ADA provides no specific method of assessment or numerical values that must be achieved](#). An associated advisory statement states: "A slip resistant surface provides sufficient frictional counterforce to the forces exerted in walking to permit safe ambulation." Pavers and slabs installed on a constructed base and aggregate bedding layer or other assemblies such as pedestal set, overlays including, bitumen or mortar set, are inherently stable. Pavers are manufactured to high strength standards and are considered a firm, casted building material. And paver textures in general have high slip resistance as measured by various test methods.

Coefficient of Friction

One of the more common means of measuring slip resistance is to evaluate the material's Coefficient of Friction. COF describes the ratio of the force of friction between two bodies, ranging from zero to greater than one. COF depends on two materials being compared; for example, ice on steel has a low COF, while rubber tires or soled shoes on concrete pavement has a high COF.

Static coefficient of friction (SCOF) is a measure of the friction between two items that are motionless, for example a person standing on a pavement. Dynamic coefficient of friction (DCOF), also known as kinetic or sliding coefficient of friction, is a measure of the friction between an item and the surface it is moving across, for example a person walking across a floor. To add another variable, both coefficients can be run dry or with a lubricated wet surface.

At one time, ADA referenced a minimum recommended 0.6 SCOF guideline for pedestrian slip resistance as tested by ASTM C1028 test method (1991 Accessibility Guidelines, Appendix Section A4.5). This outdated appendix document never set a specific requirement and didn't specify the test method for measuring SCOF. With multiple testing devices claiming to measure COF and providing different values that were difficult to interpret, the recommendation was subsequently withdrawn in 2004. There are no industry standards that reference 0.60 SCOF when testing per ASTM C1028, although this value is sometimes specified for commercial projects.

Slip resistance testing using ASTM C1028, *Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method*, is now rarely used due to poor correlation with actual slip conditions and inherent flaws in the testing process (sticktion eg.al.). ASTM officially withdrew method C1028 in 2014.

Fortunately, the SCOF criteria and test method has been superseded by a new method and a new threshold value, the American National Standards Institute (ANSI) A137.1, the American National Standard Specifications for Ceramic Tile. The new method (often referred to as an AcuTestSM) determines DCOF with a tribometer called the BOT-3000, designed specifically for flooring applications. The DCOF AcuTest method, is referenced in ANSI A137.1 and determines DCOF under wet conditions using a soapy water solution. ANSI A137.1 states that "... level interior spaces expected to be walked upon when wet shall have a wet DCOF of 0.42 or greater...". The 0.42 threshold is from German research that is considered reliable and practical for pedestrian applications.

Results from the old SCOF method cannot be directly compared to the new DCOF method. Frictional resistance between two objects at rest is different and higher than that measured when in motion. The forces applied in the test are different, and the new method uses a completely different lubricating solution.

ASTM International Update

In 2014, ASTM's F13 committee agreed there were no existing ASTM standards that provided a sufficient level of guidance for making decisions regarding selection of flooring and walkway surfaces under varying conditions of use. In response, ASTM F3132 ***Standard Practice for Selection of Walkway Surfaces When Considering***

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Pedestrian Safety was published in 2020 to enable architects, engineers, and property managers to reduce pedestrian walkway fall and slip risk with important design considerations related to selection of surface materials. Benefits and considerations for precast unit concrete pavers and slabs as a slip resistant surface are identified in the standard.

Recommendation for Specifiers

There are many factors that affect slip potential on a floor or path surface including the type of shoe sole, the presence and type of surface contaminants; the surface slope, the surface condition and maintenance level, drainage conditions, and the pedestrian’s speed or type of stride. Because of the number of variables, the DCOF should not be the only factor in selecting a paving material. However, once a pavement material is selected Oldcastle Architectural recommends specifying pavement materials with a minimum wet DCOF of 0.42 in accordance with ANSI A326.3.

The Tile Council of North America (TCNA), an active leader in defining slip resistance regarding indoor and outdoor porcelain tile flooring, also promotes ANSI A137.1 for measuring slip resistance for ceramic floor tiles. The standard specification is suitable for determining pedestrian slip resistance of porcelain tiles and slabs, as well as concrete pavers and slabs. A 2018 standard, ANSI A326.3 *American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Materials*, was issued to cover all hard flooring surfaces, interior and exterior. Like ANSI 137.1, the test method uses the BOT 3000E device. Developed by a wide range of industry and user stakeholders, the test method includes the DCOF acceptance criteria of 0.42. Belgard pavers and slabs are an excellent choice when selecting slip resistant pavement material and can exceed a wet DCOF of 0.42. Consult a Belgard Sales Representative for more information or test reports.



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