How to Buy Flooring Having *Sustainable* Wet Slip Resistance

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This article specifies a particular testing method and selection criteria for use in choosing and sourcing slip-resistant flooring that maintains good wet slip resistance over its life cycle. The test method assesses Sustainable Slip Resistance (SSR). Together with situation-specific safety criteria, it is becoming an established specification method in some international venues.

In safety engineering, it is widely accepted that "safety by design" is the most reliable method of preventing accidents; people should not be expected reliably to use safety equipment (e.g., slip-resistant footwear) or exercise special caution ("Slippery [or wet] floor" warnings). If flooring is in an area where it can get wet or otherwise lubricated (airborne deep-fryer fat, tracked-in grease, etc.), it needs to be slip resistant under such conditions.

Although some people assume flooring slip resistance never changes with time, the experience of many building and cruise ship owners shows this is not true. Wear from shoes plus abrasive soil on a busy floor, or certain inappropriate maintenance practices, can in some cases destroy the wet slip resistance in a matter of weeks — or even an hour.

Post-construction cleanup using an abrasive pad has in a number of instances destroyed the slip resistance before the building or outdoor swimming pool has even opened. One well-publicized example was at the Watershed Centre in Kilkenny near Waterford, Ireland. The tile installed had good wet barefoot slip resistance, but this was destroyed by post-construction cleanup with an abrasive pad before the pool opened. In the four months after the new pool opened in December 2008, there were 28 reported slips and falls while various remediation methods were tried. The pool subsequently was closed until April 27, 2009, after being remediated successfully by chemical treatment. Numerous lawsuits are in progress.

The Americans with Disabilities Act (ADA) requires that flooring accessible to disabled persons be slip-resistant — not just when the building is constructed, but throughout its lifetime. Typical building codes in the USA require that "Every existing building, structure, premises or portion thereof shall be maintained in conformity with the code regulations and Department approvals in effect at the time of such construction and occupancy. . . . Every existing building, structure, or portion thereof shall be maintained in a safe condition and good repair . . . all physical elements of every existing building, structure or portion thereof shall be maintained . . . by restorative means, in a condition as close as reasonably feasible to their originally required and approved state."

If a building owner can be confident that new flooring will sustain its slip resistance for a period of years, this can protect a considerable investment in the flooring, prevent business interruptions, and protect the safety of the pedestrian. The stakes are even higher for hotels and cruise ships, which are occupied virtually nonstop with guests who will not tolerate the noise involved in changing out hard flooring.

Sustainable Slip Resistance (SSR) testing was developed by Carl Strautins in Australia for McDonald's Restaurants to identify flooring that is not highly susceptible to loss of its slip resistance from wear or some types of inappropriate maintenance. This test and appropriate selection criteria can help to avoid investment in inappropriate flooring, as well as prevent costly, life-altering accidents and increased health

care costs. Below I'll explain the method and how it can be used to improve flooring safety in the USA.

Test Methods and Safety Criteria

Germany and Australia have for more than 10 years had detailed flooring slip resistance standards based on some 150 specific situations — e.g., external walkways, swimming pool decks, swimming pool stairs into the water, commercial kitchens, hospital operating rooms, etc. Many architects elsewhere in Europe have informally adopted them. The slip resistance ratings are based on humans walking an oily or wet flooring sample in standard footwear and/or bare feet on a laboratory variable-angle ramp, the repeatability of which was extensively documented. However, the test results generally apply only to flooring before it's installed. In some cases, initially good wet slip resistance is gone after the building has been open for only a few weeks. The ramp test can't conveniently be used to assess safety of the flooring on site under the ambient conditions.

The United Kingdom since 1971 has had well-established slip resistance standards based on a portable test method, the "British" pendulum. This test was developed for pedestrian traction by the U.S. National Bureau of Standards in the 1940s and further refined in the UK. It was validated for pedestrian traction in 1971, together with its safety standards, by the Greater London Council and tested in the UK during a period of 25 years by 3,500 real-world public walking area tests and site accident records. The test is an ASTM standard (E 303), slightly modified for pedestrian traction.

The pendulum is now a standard test method for pedestrian slip resistance in 49 nations (European Committee for Standardization EN 13036-4, 2003 names many of them) on four continents and has been endorsed by the Ceramic Tile Institute of America since 2001.

In the United States, architects and designers generally look for a wet static coefficient of friction of 0.60 or higher by ASTM method C 1028 to assess potential safety for wet areas of level floors. This often gives deceptive results, applying "safe" ratings to some flooring samples that are in fact very slippery when wet. The method is now acknowledged by ASTM, Ceramic Tile Institute of America, and Tile Council of North America and many forensic experts to be inadequate for assessing safety.

The ASTM C 1028 method does not represent the most current state of knowledge about testing methods, but this is not widely known by American architects, designers, and property owners. We can correct this situation and suggest a more useful test and safety standards (safety assessment) for due diligence based on the pendulum.

The SSR test procedure consists of an initial wet pendulum test; abrasion, wet, for up to several thousand cycles with a standard (3 inch by 3 inch 3M green Scotch-brite) abrasive pad under a standard load of 1 kg at 50 cycles per minute; and another wet pendulum test after abrasion. Both hard and soft rubber pendulum sliders (or "test feet") might be used if the area is walked on in both hard-bottom footwear and bare feet or soft-soled footwear. The abrasion is conducted either manually or mechanically using a Gardco 12VFI linear washability and wear tester.

Typically, about 85 percent of the loss in slip resistance after 5,000 cycles has already occurred after 500 cycles. Depending on the flooring buyer's situation, the flooring might be considered to have Sustainable Slip Resistance for a level floor if (for example) the wet Pendulum Test Value (PTV) is 35 or higher after abrasion for 500 cycles. The 500-cycle result in the laboratory has been found by in situ pendulum tests to be roughly equivalent to 12-24 months of wear in customer areas at a busy McDonald's restaurant. McDonald's in Australia adopted the 500-cycle specification, minimum PTV of 35 in October 2006. Other major property owners, such as Aldi, Toyota, Westfield, and a major cruise ship company, have adopted similar specifications.

In the United States, flooring with SSR is available in ceramic tile, natural stone, and resilient products. There are at least a half dozen manufacturers offering such flooring. Abrasive-containing coatings, some transparent, also are available that have SSR.

In some cases, analogous to the variable-angle ramp test-related standards mentioned above, the SSR safety standards are situation-specific rather than "one size fits all." Thus, a minimum pre-abrasion wet PTV of 35 (hard or soft slider) might be required for hotel or hospital bathroom floors; a minimum of 45 (hard rubber slider) for stair nosings that get wet in use; and 54 (hard slider) for commercial kitchens and steep outdoor ramps. If the flooring is to be sealed after installation, the laboratory tests must be conducted with the correct sealer properly applied. Cleanability tests with expected contaminants (local mud, coffee, red wine, ketchup, etc.) by owners and/or other duty holders are also advisable before final selection of flooring. The methods of cleaning should be planned. (A dirty mop with dirty water might not be adequate for cleaning non-slip flooring, but abrasive pads can destroy wet slip resistance quickly. An autoscrubber with a soft white brush is ideal.)

Experience has shown that what is specified and ordered is not always what is delivered, and it is prudent for property owners to verify that flooring meets their slip resistance specification both before installation and at turnover of the property for occupancy. For a busy floor, monitoring of dry and wet slip resistance every 3-12 months after that can further protect pedestrian, owner, and other duty holders.

Conclusion

Sustainable Slip Resistance as a test method and formal or informal standard provides advantages over older methods, in that it addresses a most important component of product utility: the ability to assess potential flooring wet slip resistance over its life cycle. The informal adoption of this standard as part of due diligence potentially establishes conformance with the state of the art in surface slip resistance specification. OHS

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