

UK formally recognised British Standard methods for measuring floor slip resistance

The most widely recognised scientific approach for the assessment of whether a floor offers an acceptable level of slip resistance is measurement of the dynamic co-efficient of friction. This assessment can be completed using a swinging 'pendulum'. This method is one of two described in British Standards in BS 7976.

SlipAlert was designed and appears in British Standards BS 8204 Series (In-situ floorings) to reproduce the characteristics of the lubricating film which is uniquely generated by the TRL Pendulum, SlipAlert and a slipping pedestrian. As a result it correlates well with Pendulum test results. The construction and use of the Pendulum is specified in BS 7976 and SlipAlert in BS 8204.

SlipAlert is increasingly being used by flooring contractors and many specifiers to measure slip resistance in both wet and dry conditions. SlipAlert is used widely both in the UK and overseas because it is portable and can be used to determine the slip resistance of even small areas in-situ. It is also the method that is accepted within the HSA and Members of the Association of Consulting Forensic Engineers in respect to litigation issues.

However, whilst the TRL Pendulum which was designed in 1930 is portable, it weighs almost 30 kg, it is very large and relatively difficult and time-consuming to use (and requires specialist training). This resulted in the development of SlipAlert which is quick and easy to use.

There are other test methods not formally recognised within the UK and which do not appear within British Standards. The most commonly referred to standard that is not formally recognised is the 'R' range of results from the German ramp method, DIN 51130 and DIN 51097. This is often quoted on specification sheets from tile and vinyl sheet manufacturers, so is often mentioned by architects and specifiers when looking for alternative finishes.

The ramp test is strictly a laboratory method and cannot be related to site measurements. It consists of an operator walking in short half steps down an incline on which a sample of the flooring is mounted. The angle of the ramp is increased in increments until the operator slips. The lubricant used is oil and his shoes/boots are heavily profiled. The angle at which slipping occurs is translated into an 'R' number varying from 9 - 13. There is very little correlation between the ramp 'R' numbers and the slip resistance value generated by either the Pendulum or SlipAlert, both of which use water as the normal lubricant/contaminant.

One other commonly referred to method is that of surface roughness. This simple test uses a small electronic device to assess the peak to valley depth range of any given surface and produces an average figure based on a number of readings. However, extensive testing in both the UK and Australia has shown little direct correlation between Rz (the surface roughness parameter measured) and slip resistance as measured by the Pendulum or SlipAlert.

As none of these tests is detailed within any current British Standards, they are not formally recognised and generally not accepted.

Acceptable levels of slip resistance

The BS 8204 series of standards for in-situ floorings (including BS 8204-6: Synthetic Resin Floorings), specify that any flooring should give a Pendulum Test Value (PTV) of not less than 40 when tested wet or dry as appropriate for the anticipated service conditions, including any likely surface contamination. There is a rider that *'in particularly wet areas the client should be advised of the benefits of the use of special footwear with slip resistant soles, which can allow a smoother floor finish to be adopted. In such situations a PTV of not less than 33 may be acceptable'*.

Other parameters and figures quoted, including PTV bands published by UKSRG are for guidance only as they are not formalised.

Minimum requirements suggested by the UKSRG and the HSE are as follows.

THE PTV VALUE POTENTIAL FOR SLIP IS AS FOLLOWS:

0 – 24 **HIGH RISK**

25 – 35 **MODERATE**

36 + **LOW RISK**

The above figures are bases on walking in a straight line.

SlipAlert recommends the following criteria in terms of PTV (Pendulum Test Value)

0 – 19 **HIGH RISK**

20 – 39 **MODERATE**

40 + **LOW RISK**

At 40 PTV 1 in 1 million people are at risk of slipping over, at 20 PTV 1 in 2 people are at risk.

These are based on work done by the UK Building Research Station; they were adopted by the old Greater London Council and have been used for many years. They represent all normal pedestrian activity (**as opposed to just walking in a straight line**).

The SlipAlert (trolley), as described in BS 8204, and the Pendulum, as described in BS 7976, are the only two units that conform to BS Standards for carrying out field slip resistance in both wet and dry conditions.

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Sled-type tests

The instruments that have been dubbed 'sled tests' involve a self-powered trolley that drags itself across the floor surface, measuring the CoF as it moves. Laboratory and site-based assessments have strongly suggested that tests currently available produce misleading data in wet conditions. Information from such tests shows that some smooth flooring appears to be less slippery in wet conditions than when dry: this is clearly at odds with everyday experience. Such tests may give credible results in dry conditions, though it should be stressed that the vast majority of slipping accidents occur in wet, contaminated conditions.

Drag testers: which are widely used are designed to measure the static (not dynamic) coefficient of friction (SCOF) and are therefore excluded by ASTM B2047-4; therefore they are not appropriate instruments for pedestrian slip resistance measurements.

Interpretation of manufacturers' data

Most slip resistance information provided by flooring manufacturers is produced from 'as supplied' products (i.e. ex-factory). The slipperiness of flooring materials can change significantly due to the installation process (due to grouting, burnishing, polishing), and after short periods of use due to inappropriate maintenance or longer term wear. Furthermore, data quoted simply as CoF should be viewed with uncertainty, as the type of CoF test used can have a critical effect on the validity of the data.

The test data needed to characterise a floor should relate to the floor as finished for the intended use and with any contamination present in normal use.

Measuring the level of slip resistance

As with any basic measure of performance, regardless of industry, most countries will have their own opinions and approved standards/methods by which performance should be assessed. Across Europe there are a number of test methods that architects and specifiers refer to but there are only two that are formally recognised in the UK within official Standards that relate to flooring. **The HSE and the UKSRG suggest that 36 PTV minimum is recommended for low risk; however it should be clearly understood that this figure relates to a person walking in a straight line and does not cover turning or similar normal pedestrian activities.**

Requirement for measuring floor slip resistance in wet and dry conditions

Test results should be completed using one of the only two methods of measuring wet and dry slip resistance values that are formally recognised in the UK within official British Standards that relate to flooring; one is BS 7976 and the other is BS 8204.

All tests should be completed in wet and dry conditions in accordance with the procedures as outlined within British Standards and according to manufacturers' recommendations.

In litigation situations the only tests regarded as reliable are the Pendulum and SlipAlert.



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