Understanding Slip Resistance

Australian timber flooring association

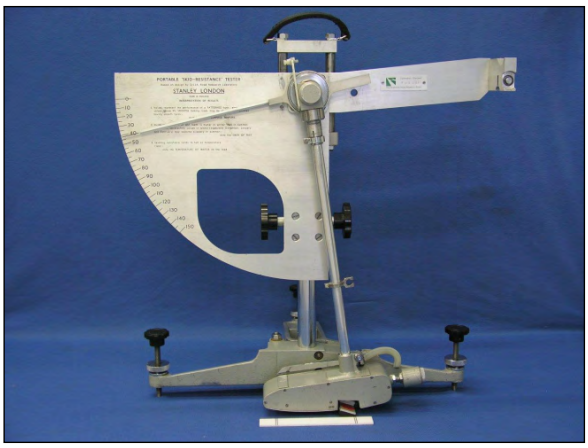
Information Sheet #45 September 2016

E admin@atfa.com.au
W www.atfa.com.au

Introduction

When we refer to slip resistance with timber flooring products we are generally referring to the slip resistance of the coating on the product. In Australia there are a significant number of accidents from slips, trips and falls and therefore occupational health and safety requirements outline duties for safe designs which include the specification and supply of floor surfaces. Under the Building Code of Australia and reference to Australian Standards, it states that paths of travel for most new commercial buildings shall have a slip resistant surface. To assess the slip resistance of new surfaces, we are guided to *AS4586 – Slip resistance classification of new pedestrian surface materials* and the associated hand book *HB 198 – An introductory guide to the slip resistance of pedestrian surface materials*. This handbook is seen as best practice for satisfying slip resistance requirements for new floor surfaces. The intent of this information sheet is to provide an understanding of the different test methods and what the data contained within product information sheets mean.

Classifying Slip Resistance



With reference to AS4586, the slip resistance of new products can be classified through four methods of testing where the tests undertaken are selected to suit the application from which guidance can be gained from the hand book. The tests are briefly described below.

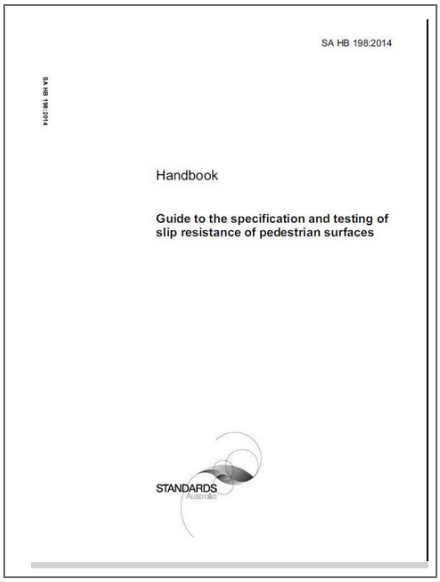
Wet pendulum slip resistance test (Appendix A of AS4586)

The test equipment consists of a swinging pendulum with a spring loaded rubber foot. As the pendulum passes through the vertical position, the rubber foot

makes contact with the wet test surface and slides across it. The resistance is recorded as a Slip Resistance Value (SRV) which is then classified by AS 4586. The rubber material used is often referred to as 'Four S', meaning 'simulated standard shoe sole' as this is generally accepted for assessing the slip resistance for people wearing normal and acceptable footwear, however this rubber is now referred to as Slider 96. At times an alternative rubber material, TRL (or Slider 55), is used. There are five classes that the SRV number can fall into. These being designated 'P1', 'P2', 'P3', 'P4' and 'P5'. Class 'P5', the greatest slip resistance where the SRV is above 54, 'P4' is 45-54, 'P3' is 35-44, 'P2' 25-34, 'P1' 12-24 and 'P0' the least slip resistant where the SRV is below 12.

Dry floor friction slip resistance test (Appendix B of AS4586)

The dry test involves a battery operated machine with a 9mm diameter Four S rubber slider. At a constant speed of 1m per minute, the opposing force on the slider is measured. The machine is sometimes referred to as a 'dry FFT' or the 'Tortus'. The results of two tests are averaged and the test result is expressed as the Coefficient of Friction (CoF) which is the ratio of the horizontal to vertical force. Here we have two classes: 'D1' and 'D0'. With class 'D1', the CoF is ≥ 0.4; in class 'D0', the CoF is ≤ 0.4. Note that the standard handbook does not use this test for product selection purposes; however, a smooth surface is prone to a large decrease in its slip resistance when contaminated, highlighting the importance of routine cleaning and maintenance.


SA HB 198:2014

Handbook

Guide to the specification and testing of slip resistance of pedestrian surfaces

STANDARDS Australia

Wet bare foot inclining platform slip-resistance (Appendix C of AS4586)

In this test method, samples of a suitable size are mounted on to a inclining platform surface for a person to walk on whilst being wetted. Two people soften their feet in water for 10 minutes, then separately use the inclining platform, while in a safety harness. The angle of the inclining platform is raised until the test person feels that walking will result in slipping. From the two test people this then establishes a safe walking limit known as the mean angle of inclination. Comparison of this angle with that of three calibration test boards is used to calibrate each walker. Results are categorised into three classes: 'A' for a shallow angle ≥12°, 'B' ≥18° and 'C' for steeper angles ≥ 24°. Note that some slippery surfaces may not meet any of these classifications.

Oil wet inclining platform slip-resistance (Appendix D of AS4586)

Designed for testing highly profiled industrial surfaces, this test uses the same equipment as described above, however motor oil replaces water as the wetting agent and safety boots are worn on the feet. With this test the results are categorised into five classes from 'R9' to 'R13' where 'R9' represents a shallow angle ≥6° & ≤ 10°; 'R10' ≥10° & ≤ 19°; 'R11' ≥19° & ≤ 27°; 'R12' ≥27° & ≤ 35° and 'R13' the steepest angle ≥35°. Note that some slippery surfaces may not meet any of these classifications.

Aspects to be noted regarding these test methods

The table provides a summary of these four test methods and the applications where such test methods are more applicable. These tests should be seen as being independent of each other. Note that the Wet Pendulum and Dry FFT can be performed on site whereas the other two cannot. Therefore also when considering applications, the wet pendulum test is often the most useful for public areas in that most people wear shoes with worn soles and the floor surfaces in these areas are more likely to be affected by water.

Test	Footware	Surface contaminant	Classification (most to least resistant)	Example Applications
Wet pendulum	Simulated smooth shoe	Water	'P5' to 'P0'	All areas subject to water
Dry FFT	Simulated smooth shoe	None	'D1' and 'D0'	Dry areas in shops
Inclining platform – Wet	Bare feet	Water	'C' to 'A'	Swimming pool areas and changing rooms
Inclining platform – Oil	Contoured safety boot	Oil	'R13' to 'R9'	Commercial kitchens

The Standards Handbook may be used to identify the level of slip resistance for specific buildings and walkway applications. The slip resistance must relate to the specific product being used and note that ongoing slip resistance can be monitored with the wet pendulum method. Also it should be considered that wear and cleaning practices can alter, and reduce the slip resistance with time. Slip resistance will generally be greatest when new and can reduce quite quickly before it plateaus out. Areas of higher traffic are also likely to reduce in slip resistance more quickly than areas of lower traffic. For these reasons the ongoing risk should be assessed with specific attention to where ongoing testing is undertaken. AS4663 defines the test methodology to test and measures the slip resistance properties of existing floor surfaces using the same methodology, but different classification criteria. Other considerations such as the type and amount of traffic is also an important consideration and may also include cleaning practices and methods, as well as other occupational health and safety aspects such as handrails and signage.

TABLE 3B

WET PENDULUM TEST OR OIL-WET INCLINING PLATFORM CLASSIFICATIONS FOR APPLICATIONS WHERE THE NCC DOES NOT REQUIRE SLIP RESISTANCE

Location	Wet Pendulum test	Oil-wet inclining platform test
External Pavements and Ramps		
External ramps including sloping driveways, footpaths etc. Steeper than 1 in 14	P5	R12
External ramps including sloping driveways, foot paths etc., under 1:14, external sales areas (eg. Markets), external carpark areas, external colonnades, walkways, pedestrian crossings, balconies, verandas, carports, driveways, courtyards and roof decks.	P4	R11
Undercover car parks	P3	R10
Hotels, Offices, Public Buildings, Schools and Kindergartens		
Entries and access areas including hotels, offices, public buildings, schools, kindergartens, common areas of public buildings, internal lift lobbies.		
Wet Area	P3	R10
Transitional Area	P2	R9
Dry Area	P1 (see Note 3)	R9
Toilet Facilities in offices, hotels and shopping centres	P3	R10
Hotel apartment bathrooms, en suites and toilets	P2	A
Hotel apartment kitchens and laundries	P2	R9
Supermarkets and Shopping Centres		
Fast food outlets, buffet food servery areas, food courts and fast food dining areas in shopping centres	P3	R10
Shop and supermarket fresh fruit and vegetable areas	P3	R10
Shop entry areas with external entrances	P3	R10
Supermarket aisles (except fresh fruit areas)	P1 (see Note 3)	R9
Other separate shops inside shopping centres - wet	P3	R10
Other separate shops inside shopping centres - dry	P1 (see Note 3)	R9
Loading docks, Commercial Kitchens, Cold Stores, Serving areas		
Loading docks undercover and commercial kitchens	P5	R12
Serving areas behind bars in public hotels and clubs, cold stores and freezers	P4	R11
Swimming pools and Sporting Facilities		
Swimming pool ramps and stairs leading to water	P5	C
Swimming pool surrounds and communal shower rooms	P4	B
Communal changing rooms	P3	A
Undercover concourse areas of sports stadiums	P3	R10
Hospitals and Aged Care Facilities		
Bathrooms and en suites in hospitals and aged care facilities	P3	B
Wards and corridors in hospital and aged care facilities	P2	R9

Timber floor coatings

Timber floor coatings are going to have different properties when it comes to slip resistance and there are three categories that we can consider. Firstly the smoothness of the surface. Smoother surfaces have lower friction when wet and are therefore more slippery. Therefore, reducing the gloss level of a product will increase the slip resistance. The second area relates to what is called the dynamic modulus which in essence means that the more 'rubbery' the coating the better both dry and wet slip resistance. For this the likes of single pack water based polyurethane could be expected to have better slip resistance than a two pack water based polyurethane. So softer coatings have improved slip resistance over more brittle coatings. Some metallic polishes also fall into this category. Finally, the wet surface tension is also a consideration. A surface of low surface tension will resist water forming over it as a film and results in a more wax like surface (consider waxing of surfboards).

Product slip rating

With many products the slip rating is provided and this is especially so with specific non-slip coatings. So with reference to product information it is not uncommon for them to state the likes of the following:

> Tested to AS4586 – 2013 Slip resistance classification of new pedestrian surface materials Appendix A: Wet Pendulum = Class P5
> Appendix D: Oil – Wet Inclining platform = Slip resistance assessment group R12

These being the common test methods from which guidance can be gained from the table of minimum recommendations held in Standards Handbook HB198 and reproduced in the section above.

If we were to consider dry slip resistance of the various product types then we would want to see a CoF greater than 0.4. Although results will differ between individual products the following is provided as an indicative guide to the dry slip resistance of the various coating types.

Two pack moisture cured polyurethane	0.65
Single pack moisture cured polyurethane	0.70
Oil modified urethane	0.55
Water based polyurethane	0.70

Prepared with the assistance of ATTAR

ATTAR
Advanced Technology Testing and Research

Slip resistance testing or advice is available from the following:

ATTAR Head Office (Victoria) www.attar.com.au
Unit 1, 64 Bridge Road, Keysborough. VIC 3173 T (03) 9574 6144 | E info@attar.com.au
Flooring Consultancy WA Pty Ltd (Western Australia) www.flooringconsultancy.com.au
Contact Nils Uhlenbruch T (08) 7444 5066 | M 0455 439 920 | E slipwa@attar.com.au
Test Slip Australia Pty Ltd (New South Wales and ACT) www.testslip.com
Contact Clark Ahearn T (02) 8205 7589 | M 0487 777 287 | E clark@testslip.com