Australian Standards for Slip Resistance

While **Table 2** lists the three principal Australian pedestrian slip resistance standards, architects and should only need to be familiar with Standards Australia Handbook 197, An introductory guide to the slip resistance of pedestrian surface materials. This deals with the selection of products based on the wet slip resistance classifications that are obtained according to the test methods that are published in AS/NZS 4586, Slip resistance classification of new pedestrian surface materials. HB 197 was also written to help with the transition from AS/NZS 3661.1, Slip resistance of pedestrian surfaces - Requirements. The major differences are summarised in **Table 3**. Some important implications of AS/NZS 4663, Slip resistance measurement of existing pedestrian surfaces, have been published in **http://www.infotile.com.au/tiletoday/issues/pdf/34article.pdf.**

Table 2
An overview of the new suite of Australian Slip Resistance Standards

Standard	Coverage	Anticipated Users
AS/NZS 4586	Testing of new products and floors	Manufacturers, Test Houses
AS/NZS 4663	Testing of existing floors	Slip auditors, forensic investigators
HB 197	Selection of products	Architects, Specifiers, Merchants

Table 3
Differences between AS/NZS 3661.1 and AS/NZS 4586

	AS/NZS 3661.1: 1993	AS/NZS 4586: 1999	
Scope	Measured both new pedestrian surface materials and existing surfaces.	Only classifies new pedestrian surface materials	
			Classes
Test Methods	Dry Floor Friction Test	Dry Floor Friction Test	F,G
	Wet Pendulum Test	Wet Pendulum Test	V,W,X,Y,Z
		Wet/Barefoot Ramp Test	A,B,C
		Oil Wet Ramp Test	R9 – R13
Compliance Requirements	Coefficient of Friction, Wet or Dry, >0.4, No value less than 0.35.	None, Pendulum now reported in BPN Units.	

AS/NZS 4586 introduced the ramp tests due to concerns about the suitability of the pendulum for measuring the slip resistance of highly profiled surfaces and resilient materials. The relevance of walking on a ramp to walking on the level has been questioned, recognising that a natural gait pattern becomes different at high slopes. However, the intention is to reliably determine the available traction, rather than to replicate a walking-onthe-level gait. Very short half-steps are used during ramp tests, because the coefficient of friction is a function of the step length. Such testing yields a measure of the available friction of the test surface when it is installed as a horizontal floor. The tangent of the critical ramp angle gives the available coefficient of friction of the tested shoe-bottom/floor-surface combination when used on a level floor.

Dry floor friction test results of new stone tiles are of dubious value, as there is no contamination, unlike the real world. Clean Four S rubber tends to adhere to very smooth flat surfaces such as float glass, due to a very high degree of contact between the surfaces. The measured coefficients of friction on such surfaces are significantly higher than rougher surfaces that provide far greater traction when there is some form of dry soiling. Although pedestrian surface materials are classified according to the dry floor friction test, there is no notional interpretation of each class. While there are very few new pedestrian surfaces that would have a dry mean coefficient of friction of less than 0.4, they would make a high contribution to the risk of slipping. However, it would be inappropriate to assume that all products that have high coefficients of friction would make a very low contribution to the risk of slipping when dry.

Table 4
Dry floor friction tester classification

Classification	Floor Friction Tester, Mean Value
F	>0.4
G	<0.4

Table 5
Notional interpretation of wet pendulum classes

Class	Rubber		Contribution of the floor to risk of slipping when wet.
	Four S	TRRL	
V	>54	>44	Very Low
W	45 – 54	40 - 44	Low
X	35 – 44	-	Moderate
Y	25 – 34	-	High
Z	<25	-	Very High

The most common form of slip resistance testing in Australia is the wet pendulum test. The associated classifications (**Table 5**) are used for classification purposes (**Table 6**). There is an obvious need to fill in the blanks in **Table 5**, since one should be able to classify a product after it has been tested. However, when products are tested with both rubbers, a significant scatter of results occurs. When potential classification boundaries are considered, the correlation is poor. This provides evidence that the type of soling material has an influence on the slip potential.
Transport authorities measured the skid resistance of roads using the pendulum with TRRL rubber before it was widely used for measuring slip resistance. This led to the brick paver and concrete paving industries adopting TRRL rubber. Four S rubber was developed later for measuring the slip resistance of marginal internal floor surfaces. Manufacturers were expected to use one rubber or the other for testing their products, as appropriate for their primary market. The initial withholding of classes X, Y and Z has forced some manufacturers to use Four S rubber. Recent CSIRO research suggests that TRRL rubber provides a better indication of wet barefoot slip resistance than Four S rubber, so some manufacturers might elect to test with both rubbers.

If one presumes that the interpretation for new products includes a factor of safety allowing for some loss of slip resistance (in the more slip resistant products) with time, then there are some potential difficulties in applying the same interpretation to existing surfaces. However, these notional interpretations were intended to be indicative rather than definitive.

Table 6
Recommendations extracted from Table 3 of HB 197

	Pendulum Classification	Ramp Classification
External Walkway	W	R10
External Ramps	V	R11
Hotel Entry Foyer	X	R10
Communal Change Rooms	X	A
Ensuites in Hotels, Hospitals, Aged Care	X	A, R10
Commercial Kitchens	V	R12
Serving areas behind bars in public hotels and clubs	W	R11
Swimming pool surrounds	W	B
Communal shower rooms	W	B
Communal change rooms	X	A

Table 6 includes both pendulum and ramp classifications. If one regards slip resistance results as being indicative, and recognises the probability that some results will underestimate or overestimate the available friction, then it is easy to appreciate the benefit of relying on two methods of classification rather than one. It is quite possible to get a product that has X and R9 or Y and R10 classifications, but a product with X and R10 classifications is likely to perform better than some that are selected just on the basis of an X or an R10 classification. Since slip resistance test methods have inherent limitations, some test methods will be more appropriate for specific circumstances. For instance, since rubber is a poor surrogate for human skin, the wet barefoot ramp test should provide the best indication of slip resistance for areas such as bathrooms.
Table 3 of HB 197 provides basic guidance, which might be considered as recognised best practice. The text indicates that some recommendations may be onerous and others lenient, and draws attention to other design factors that architects should consider. The handbook thus permits variations (probably one class), which should be based on either existing practice/experience or considered reasoning, logically based on an appropriate risk minimisation strategy. Tables 4 and 5 of HB 197 report the more detailed German requirements, and Committee BD/94 cannot modify these.

The HB 197 recommendations do not cover all locations, for instance, balconies. The handbook was not intended to outlaw products that have a track record of successful use in specific locations. Individual manufacturers (or importers or retailers) may make claims about the suitability of specific products for particular applications. It is up to architects to assess individual situations to determine what other design considerations apply (i.e., they should read clause 3 of HB 197). Given knowledge of products that have been traditionally used to fulfil a function, the architect can specify products they consider appropriate. If they choose not to comply with the HB 197 recommendations, it would seem sensible to document the basis for their selection.

There may not be a lot of difference in the slip resistance of a product at the top of the R11 classification and another product at the bottom of the R12 classification, but there is a significant difference in performance between products at the bottom of the R9 and the bottom of the R10 classifications. Unfortunately too few manufacturers publish the actual mean corrected angles. **Tables 7 and 8** give the angles that pertain to each classification.

Table 7
Classification of pedestrian surfaces according to the wet barefoot ramp test

Classification	Angle (degrees)
A	12.0 – 18.0
B	18.1 – 24.0
C	> 24.0

Table 8
Classification of pedestrian surfaces according to the wet oil ramp test

Classification	Angle (degrees)
R9	3.0 – 10.0
R10	10.1 – 19.0
R11	19.1 – 27.0
R12	27.1 – 35.0
R13	> 35.0

The wet barefoot ramp test is technically equivalent to DIN 51097. The actual classification is dependent on the angles attained on the calibration boards, which have nominal angles of 12, 18 and 24 degrees. If the walkers obtain an angle of 26 degrees for the C board, the walkers have to obtain an equal or better result in order for a product to receive a C classification.
The oil wet ramp test is technically equivalent to DIN 51130. Despite this, CSIRO has been unable to obtain some of the ramp classifications that have been accorded to some imported products. Since batch-to-batch variations occur, consumers are advised to test a representative sample, particularly on large projects. The question of whether to recognise foreign results is considered in
http://www.infotile.com.au/tiletoday/issues/pdf/32article.pdf
A few products have been tested that have a corrected mean angle of less than 3 degrees. Such products should be suitable where class Z and R9 products are recommended for dry locations.

Source:
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