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Item No.5

SLIP RESISTANCE OF  
FLOORS, STAIRS & PAVINGS

Purpose of this item

When selecting finishes for floors, stair treads and external pavings, the architect has to consider a number of factors applicable to each particular situation including:- resistance to the anticipated wear, appearance and durability of that appearance, noise production, initial cost, ease of maintenance and safety. The object of this item is to look at various aspects of the last of these - safety, or resistance to slip, in respect of pedestrian use.

Slip, its cause and consequences

When walking normally, the individual exerts various horizontal forces, backwards, forwards and sideways, on the surface traversed. These forces, which will vary in accordance with weight, speed, agility and changes of direction or momentum, are usually resisted by resolved reaction forces, made possible by minute deformations of the contacting surfaces, and by friction. When the resistance, or grip, is insufficient to contain the horizontal force, slip commences. Once commenced, slip usually results in a very rapid loss of equilibrium, a resulting increase in the horizontal force and a fall, the consequences of which may vary from an amusing incident to a fatal injury. The agile person can sometimes take instinctive action to arrest initial slip and most people can adjust their walk to cross ice in safety.

Measurement of slip resistance

The method employed by the Council's Scientific Adviser, is the use of the Road Research Laboratory skid resistance tester, shod with rubber. Results of this test are quoted in figures, high values indicating good slip resistance and low values poor resistance. Tests are made under wet and dry conditions and both values are normally quoted.

Assessment of slip resistance values

The Council's Scientific Adviser's definitions, which are in line with other opinions, are as follows:-

- (a) 'Dangerous' - 19 or below. This condition is quite unsafe and, where it exists immediate action should be taken to replace or treat the surface to an acceptable standard.

(b) 'Marginal' - 20 to 39. The surface is below the recommended safe level and methods of improving the condition should be considered and carried out as soon as reasonably possible. Some remedial treatments have only temporary effect and will need to be repeated at regular intervals; in the long term, the substitution of an alternative finish may be more economic. In the mean time, warnings should be given to all using the building that care must be observed.

(c) 'Satisfactory' - 40 to 74.

(d) 'Excellent' - 75 and above. This condition, though desirable in many situations, is required in certain special cases, such as railway platform edges and crowded public stairs.

As the consequences of a fall by the elderly age generally serious and frequently fatal, the slip resistance of floors, stairs and pavings, designed for their use, should be well within the 'Satisfactory' range.

#### Factors effecting the slip resistance of a material

##### (a) Surface texture

With some exceptions, the rougher the texture, the better the slip resistance, and the smoother, the worse. However, some of the remaining factors can upset this general rule and rough surfaces can be difficult to clean and may be unacceptable in certain situations on hygienic grounds.

##### (b) Composition and method of manufacture

The materials employed and methods of use and manufacture can frequently have a considerable bearing on slip resistance. For example, the tile described in item 5 of bulletin No.40 (2nd Series), dated December 1970, has very good resistance in both dry and wet situations, yet is sufficiently smooth as to present no serious cleaning problems. The addition of 'non slip' agents, such as silicon carbide or aluminium oxide, incorporated into the surface during making or laying of finishes can produce an initial improvement of resistance, but this seldom lasts under moderate use.

##### (c) Wet and dry conditions

Nearly all surfaces have a considerably poorer resistance when wet and materials which may be quite safe in a dry situation, may be downright dangerous when wet. While it is obvious that materials with adequate wet slip resistance must be used in public entrance halls and lavatories and similar 'wet' situations, the architect must also consider to what extent this wetness may be foot carried onto adjacent 'dry' areas and their resistance under temporary wet conditions. One obvious precaution is the provision of an adequate matted area in entrance halls.

Surfaces which are subject to spillages other than water, such as oils and fats, need special consideration, exceptional wet slip resistance and frequent effective cleaning. Council staff dealing with such a problem should consult Materials Information Group.

##### (d) Surface treatments

It should be appreciated that later treatments over which the architect may have no control, may worsen the resistance of an otherwise satisfactory surface, to a quite unacceptable level. Such treatments may be roughly divided into sealers and polishes:-

(i) Sealers The most common types are oleo-resinous and polyurethane materials and the slip resistance characteristics will vary from brand to

brand, but it is good practice to use as thin a film as practicable and to remove surplus built up material before coating. Council staff should consult Materials Information Group as to slip resistance before selecting any particular brand of sealer. A number of such sealers have been reported in earlier issues of the bulletin.

(ii) Polishes These may be of the solvent based or emulsion type. The disadvantage of the former is that there is a greater risk that wax may be traffic transferred to adjacent surfaces, with highly dangerous results. The slip resistance of any brand of polish on any particular surface should always be investigated before general use. Again the obtaining of the minimum film thickness compatible with appearance and protection is of importance. The selection of a water plastics emulsion type polish is to be preferred.

(e) Wear

Some surfaces with good slip resistance can become dangerous after heavy wear over a long time and periodical inspection of finishes subject to such wear is desirable.

(f) Cleaning

The use of soaps for washing down surfaces should be discouraged, as a residual film can give rise to a condition akin to the traditional schoolboy slide.

Typical slip resistance values for various flooring and paving materials

As the Council's experience from testing, although growing, is at present somewhat limited, the following list is far from comprehensive.

The values quoted must be treated as a guide only, since many factors, including workmanship and differences between one part of a floor and another, one makers product and another, one species of timber and another and between ambient conditions in various buildings, will all tend to diversify such values.

<u>Material</u>	<u>Dry resistance</u>	<u>Wet resistance</u>
Sheet PVC and embossed felt backed PVC	80 to 90	20 to 30
Altro 'Safety' (carborundum in PVC)	110 to 120	20 to 25
Oleo-resinous sealed wood blocks	85 to 95	30 to 40
Terrazzo	50 to 70	20 to 30
*Vitrified tiles, when new	100 to 110	40 to 50
*Quarry tiles, when new	80 to 90	20 to 30
**'Torginol' (polyurethane bound vitrified fine aggregate)	104	70
Linoleum, with water plastics emulsion polish	60 to 70	20 to 30
Thermoplastic tiles, with water plastics emulsion polish	60 to 80	30 to 40

\*The resistance will reduce considerably with wear.

\*\*A very effective remedial treatment for 'dangerous' stable substrates.