ASSESSING THE SLIP RESISTANCE OF RESIN FLOORS

FeRFA Guidance Note: No 1

INTRODUCTION

Well-formulated and correctly applied synthetic resin flooring has proved an effective method of protecting concrete and providing an excellent slip resistant finish in dry or wet conditions, specifically in food processing and bottling facilities.

Pre-planning at design stage to evaluate the environment and the use of the floor is critical. The following criteria should be examined before proceeding with the design of the floor, to ensure the causes of slips are minimised.

- Type and concentration of likely spillage
- Free draining or flat floor design
- Drainage and sumps to be provided
- Regular cleaning procedures
- Safety footwear

While avoidance of wet contamination is the first approach, there may be occasions when wet or greasy floors cannot be avoided and reliance on adequate slip resistance becomes more important.

The floor's slip resistance in such conditions may now be assessed by an established suite of measurements.

MEASURING COEFFICIENT OF FRICTION

Measurement of slip resistance has been documented in the guidelines produced by the United Kingdom Slip Resistance Group (UKSRG). The direct measurement of slip resistance, the dynamic coefficient of friction, is best carried out using the swinging 'pendulum' equipment. Of U.S. origin, it was further developed by the Transport & Road Research Laboratory (TRRL) for assessing both the skid resistance of road surfaces and the slip resistance of pedestrian areas. This method has since been adopted by BSI for the British Standards in the BS 8204 series dealing with in-situ floorings.

The construction of the Pendulum Tester is specified in BS 7976:Part 1 and its method of operation in Part 2. This equipment 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 the standard reference method adopted by the Health & Safety Executive (HSE) Laboratories, Sheffield.

A modified procedure for using the Pendulum test to determine the skid resistance of roads or runways is specified in European Standard EN 13036-4.

The SlipAlert tester is increasingly being used by flooring contractors and many specifiers to measure slip resistance. It is quick and easy to use and ideal for a contractor to use to demonstrate that the desired level of slip resistance has been obtained.

SlipAlert was designed to reproduce the characteristics of the lubricating film which is uniquely generated by both the TRL Pendulum and a slipping pedestrian under their heel. As a result it correlates well with the Pendulum. However it was never intended that SlipAlert should usurp the role of the Pendulum, which should always be used in legal situations, but it has opened up the testing of floors to those who would previously never have considered such a test due to the complexities of using the Pendulum Tester. More recently the UKSRG Ramp test has been developed and can be a useful tool for assessing the influence of various shoe sole materials and different types of liquid contamination on slipping behaviour. The test rig is derived from a German Standard (DIN) procedure and work is in hand to make it the subject of a European technical specification. An operator records at what angle on a large ramp, to which a test surface has been applied, a feeling of slip insecurity is experienced as the inclination of the ramp is steadily increased. . Because of its size and method of operation, the Ramp Test cannot be used for in situ investigations of surfaces where slip problems have been reported.

All information from instruments, conditions of use and environments should be taken into account before a categorisation or a type of floor is specified to be installed.

ACCEPTABLE LEVELS OF SLIP RESISTANCE

The BS 8204 series of standards for in situ floorings, including BS 8204-6: Synthetic Resin Floorings, specify that the 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'.

Another standard relevant for Synthetic Resin flooring is BS EN1504-2: Surface protection systems for concrete. This covers coating or flooring systems that are designed to protect concrete from water ingress or chemical attack, such as in food processing areas or car park decking. This standard specifies three classes of slip/skid resistance, when tested to EN 13036-4:

Class I	>40 units wet tested for interior wet surfaces
Class II	>40 units dry tested for interior dry surfaces
Class III	>55 units wet tested for exterior surfaces

Class III represents a high level of skid resistance and is probably only appropriate where vehicle skidding is a real possibility, such as on car park ramps.

The UKSRG provides general guidance on the significance of slip resistance values in relation to users' perception of slipperiness of the floor.

Table 1: Slip resistance values and the risk of slipping

TRRL Pendulum Value	Potential For Slip
0 – 24	High
25 – 35	Moderate
36+	Low

IMPORTANCE OF CONTAMINANT VISCOSITY

HSE Technical Information Sheet (Assessing the slip resistance of flooring) prioritises contaminants and recommends the roughness or depth of the floor profile needed to prevent squeeze-film formation.

Table 2: Minimum Levels of Profile/Roughness Recommended to Allow Satisfactory Coefficient Values

Contaminant Viscosity cps	Typical Contaminant	Minimum Floor Roughness Profile
< 1	Clean Water, coffee, soft drinks	20 µm
1 - 5	Soap solutions, milk	45 µm
5 - 30	Cooking stock	60 µm
30 - 50	Motor oil, olive Oil	70 µm
> 50	Gear oil, margarine	> 70 µm

In areas where the level of contamination cannot be controlled, the surface roughness of the flooring material must be sufficient to penetrate any squeeze-films formed and so provide direct contact between footwear and flooring. The level of roughness required to do this is governed largely by the viscosity of the liquid contaminant present. Greater levels of roughness may be necessary in some situations to assure sufficient slip resistance. **However, extensive studies have shown that there is no direct correlation between surface roughness and slip resistance**. Therefore only testing using the relevant contaminant with the Pendulum Tester or the SlipAlert Tester can indicate the level of slipping risk

SURFACE REGULARITY

Due to their method of application, synthetic resin floorings will inevitably follow the profile of the underlying substrate. The degree of flatness to reduce ponding of liquids should therefore be defined in advance both on new-build or refurbishment projects.

The straight edge method given in BS8204-1 is generally satisfactory for the majority of floor uses and the design should specify an appropriate class of local surface regularity.

Table 3: Classification of Surface Regularity for Wearing Surfaces

Class	Maximum Permissible Departure from a 2m Straight Edge - mm	Application
SR1	3mm	High Standard: Special floors
SR2	5mm	Normal Standard: Normal use in commercial and industrial buildings
SR3	10mm	Utility Standard: Other floors where surface regularity is less critical

Where free draining floors are required in wet environments, a minimum slope of 1 in 80 should be specified. However, a textured surface may require a higher slope to shed water.

REGULAR CLEANING PROCEDURES

If the incorrect cleaning regime is used on contaminated floors, a build up of oils and greases may quickly form, thereby reducing the slip resistance of the floor to an unacceptable level.

The use of mechanical floor cleaning machines with advice from cleaning chemical suppliers should be sought to establish the recommended frequency of cleaning and the most suitable cleaning agents to disperse oils, greases and contaminants and provide the necessary level of hygiene.

Failure to clean floors correctly will affect the slip resistance. It is therefore important to implement an effective cleaning regime in conjunction with the client and this should preferably include regular testing of the slip resistance to ensure that the required performance is being maintained

CONCLUSION

FeRFA manufacturers and contractors should be consulted in the early part of planning and designing a floor that requires slip resistance.

FeRFA members can produce synthetic resin floorings that meet the HSE and BSI criteria for effective slip resistance under a variety of conditions.

REFERENCES AND FURTHER READING

1) *The Assessment of Floor Slip Resistance*
The UK Slip Resistance Group Guidelines Issue 3: 2005
see www.ukslipresistance.org.uk for availability

2) *HSE Information Sheet – Assessing the slip resistance of flooring*

3) *HSE: Slips and trips, Guidance for the food processing industry*
HSG156 HSE Books 1996 ISBN 0 7176 0832 8

3) *FeRFA Guide to the Specification and Application of Synthetic Resin Flooring*
FeRFA, The Resin Flooring Association, 16 Edward Road, Farnham, Surrey GU9 8NP

4) *BS 8204-6: Synthetic resin floorings – Code of practice*
BSI, 389 Chiswick High Road, London W4 4AL