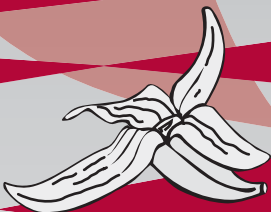


Reducing Slips, Trips and Falls in the Workplace

a guide for architects and designers



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REDUCING SLIPS, TRIPS AND FALLS IN THE WORKPLACE

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This document has been prepared by Slough Borough Council's Commercial Services Team and provides information on the methods of reducing slips, trips and falls in the workplace. Produced primarily for the benefit of architects and designers, it aims to:

- advise on safe floor and building design
- inform on measures to minimise the risk of slip, trip and fall incidents
- encourage partnership working to reduce risk of injury

1. STATISTICS

Between 1996 and 2000, the causes of major injuries reported in the workplace were as follows:

- 37% Falls from heights
- 20% Slips and Trips
- 12% Transport
- 31% Other

Falls from Height

Falls from height can happen for a variety of reasons. The following indicate the average number of injuries each year caused by falls from each of the following objects:

- | | |
|------------------|-----|
| ● Ladders | 515 |
| ● Scaffolding | 150 |
| ● Work Platforms | 120 |
| ● Vehicles | 85 |
| ● Roof Edges | 65 |
| ● Stairs | 53 |
| ● Fragile Roofs | 52 |

It is evident from the figures above that the main cause of all falls from height injuries is people falling from ladders. This accounts for 24% of all fatal and major injuries.

It is particularly important to prevent falls from height as, **approximately 56% of all those who fall from a height, die.**

Slips and Trips

Workplace slips, trips and falls on level ground cause 33% of major injuries, and over 20% of over-3-day injuries throughout Great Britain.

Same level slips, trips and falls account for at least 35,000 injuries per year, which equates to **1 serious slip accident every 3 minutes.**

2. LEGISLATION

The Health and Safety at Work etc Act 1974, Section 2 (2)(d)

The law requires that every employer shall, so far as is reasonably practicable, maintain every workplace, including access to and egress from it, so that it is safe and without risk to health.

The Workplace (Health, Safety and Welfare) Regulations 1992

Regulation 12(2)(a)

The law requires that floors in a workplace must not be slippery, holed, sloped, or uneven, so as to expose any person to a risk to their safety.

Regulation 13(3)(a)

Suitable and effective measures shall be taken to prevent any person falling a distance likely to cause personal injury.

Regulation 13(3)(b)

Suitable and effective measures shall be taken to prevent any person being struck by a falling object likely to cause personal injury.

Regulation 16(1)

All windows and skylights in a workplace shall be of a design, or be so constructed, that they may be cleaned safely.

Regulations 17(1) and 17(4)

Every workplace shall be organised in such a way that pedestrians and vehicles can circulate in a safe manner. All traffic routes shall be suitably indicated where necessary for reasons of health or safety.

Guidance on how to comply with legislation is contained in Approved Code of Practice Workplace (Health, Safety and Welfare) Regulations 1992 and the Construction (Design and Management) Regulations 1994, Regulations 9 and 13.

Architects and Designers have a statutory duty to make provision for health and safety and ensure that any design prepared for construction will have regard to avoiding foreseeable health and safety risks.

3. RESEARCH

Research by the Health and Safety Laboratory (HSL) has shown that a combination of factors contribute to slip accidents in workplace and public areas, these include:

- floor type
- contamination sources
- footwear
- pedestrian factors
- cleaning
- environment

4. SLIP RESISTANCE MEASUREMENTS

The Health and Safety Executive (HSE), together with the Health and Safety Laboratory (HSL), have developed a reliable and robust test method using instruments for the assessment of floor surface slipperiness.

The method has been used as an enforcement tool by HSE and Local Authorities (LAs). The methodology developed is based on the use of two instruments:

- (i) 'Pendulum' coefficient of friction (CoF) test (see Figure 1),
and
- (ii) Surface Micro-Roughness Meter 'Kenny' (see Figure 2).

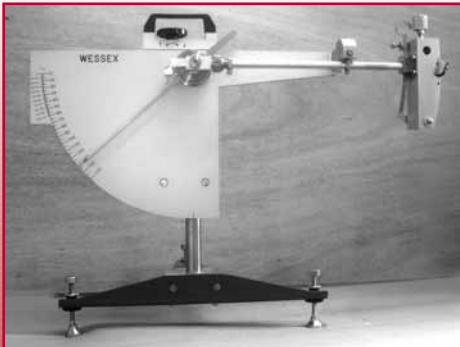


Figure 1
Coefficient of Friction Test 'Pendulum'



Figure 2
Surface
Micro-
roughness
Meter

5. THE PENDULUM COEFFICIENT OF FRICTION (CoF) TEST

The pendulum (CoF) test (also known as the 'portable skid resistance tester', the 'British pendulum', and the 'TRRL pendulum') is now the subject of a British Standard: BS 7976. The pendulum has a rubber pad which swings across the floor surface, simulating the action of a foot slipping on a floor surface. It measures the coefficient of dynamic friction. It is HSE/HSL's preferred test method for the assessment of a floor surface's CoF as it can be used in both dry and contaminated conditions.

The slipperiness of the flooring has a direct and measurable effect on the pendulum value given (known as the 'slip resistance value'). Using this technique on a dry or wet surface, values of 36 or more (equivalent to a CoF of 0.36) are currently accepted to indicate satisfactory slip resistance. Further tests are usually carried out after contamination of the test surface with any 'expected' contaminant; which allows an insight into the actual CoF experienced in everyday working situations.

The instrument requires a 'competent operative' both to use it and interpret the results.

6. SLIP RESISTANCE MEASUREMENTS 'RZ'

An indication of 'slipperiness' may be obtained simply by measuring the 'surface roughness' of flooring materials.

Many types of roughness tests exist, but research has shown that measurement of the 'Rz' parameter (formerly known as 'RzDIN' and 'Rtm') allows slipperiness to be predicted for a range of common materials.

Rz is a measure of total surface roughness, calculated as the mean of several peak-to-valley measurements. This measurement is simple, quick and a good indicator of floor slip resistance. See Table 1 below.

Rz surface roughness (microns)	Potential for slip
Below 10	High
10 - 19	Moderate
20 or above	Low

Table 1 Potential for Slip Classification
(Applicable for Water-Wet, Low Activity Pedestrian Areas)

A surface micro-roughness meter 'Kenny' is used by Slough Borough Council's health and safety enforcement officers, to assess slipperiness of floors in the Borough.

However, it is unsuitable for use on some common flooring types, such as carpet or unusually rough/undulating floors. As such, roughness measurements should only be used as a guide, and should not be used as the sole indicator of the slip potential of flooring materials.

Roughness measurements may be used to monitor changes in floor surface characteristics, for example, due to wear and tear.

The figures quoted in Table 1 above relate to floor surface slipperiness in water-wet conditions.

If other contaminants are present, differing levels of roughness will be required to lower slip potential. As a general rule, the level of floor surface roughness required is related to the viscosity (or thickness) of the contaminant, as shown in Table 2 overleaf.

Minimum roughness	Contaminant
20 µm	Clean water, coffee, soft drinks
45 µm	Soap solution, milk
60 µm	Cooking stock
70 µm	Motor oil, olive oil
Above 70 µm	Gear oil, margarine

Table 2 - Minimum Floor Roughness Levels Required for Typical Workplace Contaminants

This slip potential model approach has been shown to be a very powerful tool for the accurate assessment of slipperiness and can be used as a starting point for a risk assessment-based approach to prevent accidents and incidents.

7. SLIPS ASSESSMENT TOOL (SAT)

HSE and HSL have recently developed a PC based package that allows 'non-experts' to assess the slip risk potential presented by level pedestrian walkway surfaces.

This Slips Assessment Tool (SAT) prompts the user to collect surface micro-roughness data from the test area using a hand-held meter. Further information is then fed into the system, such as the floor surface type, the cleaning regime used, the condition of the floor (both in terms of its cleanliness and history), type of footwear worn and human factors relating to pedestrian use.

On completion, a 'slip-risk classification' is supplied to the user, this gives an indication of the potential for a slip.

SAT is designed to assist in the decision making process when considering the risk of slipping in a defined area.

However, it should not be relied upon when considering the performance of just the flooring. In this instance the pendulum should be used.

In addition, the SAT is also a valuable source of training information, which aims to increase the awareness of the scale of the slips problem, and to familiarise the user with common slip-resistance test methods.

In autumn 2004 HSE/HSL made SAT widely available through the Internet, <http://www.hsesat.info/> following the completion of an extensive field-testing programme by HSE and local authority inspectors.

8. SAFE FLOOR AND BUILDING DESIGN

Architects and Designers need to interpret flooring manufacturers' data. It should be noted that most slip resistance information provided by flooring manufacturers is produced from "as-supplied" products (i.e. 'ex-factory').

The slipperiness of most flooring materials will normally change significantly on installation and after short periods of use, maintenance and wear. Furthermore, data quoted simply as 'CoF' should be viewed with uncertainty as, as described previously, the type of CoF test used can have a critical affect on the validity of the data.

Designers and architects should also consider other relevant information relating to the slipperiness of the floor to give a more complete picture of pedestrian slip potential. Such information should include:

- Causes and means of preventing floor surface contamination
- Regimes used to clean the floor surface (both in terms of their effectiveness and frequency)
- Footwear types worn in the area (specifically, sole material, tread pattern and condition)
- Environmental factors, for example, location of potentially dangerous equipment
- Human factors.

If a workplace that you are designing is situated within the Borough of Slough, tests on the flooring may be requested by calling at the Slips and Trips Hotline (01753) 477912 or by emailing foodandsafety@slough.gov.uk.

9. SAFE ACCESS TO HEIGHT AND BUILDING DESIGN

Architects and designers need to consider and provide means of safe access to and from height in buildings prior to construction.

Risk of injury arises where employees, maintenance and other contractors need to access high level areas, for example: roofs, lofts, atria, skylights, parapets, ceilings, racking, antennae, communications equipment, mezzanine floors, teagles, lights and other high level fixtures.

The level of risk from people falling and/or being struck by falling objects should be minimised so far as is reasonably practicable.

The provision of fixed and portable high level access equipment, fixtures, restraints, fencing should be considered and evaluated as part of a specific risk assessment. Reliance on personal protective equipment (PPE) should be the last resort.

Consideration should be given also to rope access techniques, rope restraint and fall arrest systems for work at extreme height.

Contingency provision for emergency situations needs to be planned in detail and agreed with the Emergency Services.

10.SLIP ACCIDENT CASE STUDY

The failure to install plant /equipment in a safe manner, prevent contamination, and provide effective training and supervision has been shown to contribute to slips, trips and other major injuries as detailed in the following case study:

Details of other case studies involving real life incidents are to be found on the HSE's Slips website at www.hse.gov.uk/slips/experience.htm



Scalding injury arising from slip on greasy floor resulting in immersion of hand into deep fat fryer.

On the 11th February 2003, Watford Borough Council received a call from the mother of a 17 year old boy reporting that her son had tripped, slipped and consequently immersed his left hand into a fryer unit full of hot oil whilst working in a restaurant kitchen. The accident caused severe burns to his arm, parts of the chest and neck.

Health and Safety Inspectors visited the premises to investigate; examined the area where the accident occurred and noted that the fryer unit was unguarded and located at the end of the cooking line.

The tiled floor by the cooking areas was extremely greasy even though the restaurant was not busy at the time of the accident.

The restaurant's deep fat fryers had been moved to the end of the cooking line because the location of the

extraction system had changed. The restaurant management did not consult company risk assessments or their Health and Safety adviser in relation to the new layout.

The risk assessment kept at the premises showed that it was not company policy to place fryer units at the end of the cooking line.

It also became clear that no additional local site assessments were undertaken to cover hazards and risks not referred to in the company's generic model risk assessment.

It was common for the floor in the kitchen to become contaminated with grease and staff were accustomed to walking on the greasy floor. Whilst the restaurant was quiet, it was an ideal time to clean the floor to make it safe to walk on.

Rather than staff being vigilant in mopping and drying the floor, it was common practice for staff to throw salt to create friction on the floor and/or place cardboard sheets on the floor to absorb grease and provide a non-slip walking surface.

It was not necessary to assess the coefficient of friction (COF) of the tiled floor, as it was evident that the tiled floor was safe to walk on when the floor was adequately mopped and dried.

Although he had received training for dealing with contaminated floors, the injured employee had not received any safety training in connection with his new job description as a chef.

On the day of the accident the injured employee described the floor to be dangerously greasy, in particular, by the cooking areas and sheets of cardboard were placed on various part of the floor.

None of the staff, in particular the kitchen porter, took time to mop and dry the floor.

Following the accident the restaurant modified the design of the fryer, fitting guards at the end and re-trained all staff in line with procedures on slip prevention.

The company pleaded guilty to the following offences under The Management of Health and Safety at Work Regulations 1999:

- Regulation (3)(3)(b) for failing to revise its risk assessment due to the relocation of the fryer unit and re-fitting of the kitchen was carried out without consultation with head office on safety matters. A fine of £ 4000 was imposed
- Regulation (13)(2)(b) for failing to provide adequate health and safety training. A fine of £2000 was imposed.

11. USEFUL WEBSITES

1. Pedestrian Safety: www.hsl.gov.uk/capabilities/pedestrian.htm

Health and Safety Laboratory's Pedestrian Safety Team offers an independent and impartial pedestrian slipping assessment service, including on-site measurements of slipperiness complemented by a well established range of laboratory-based tests. Forensic investigations can also be undertaken following significant pedestrian safety accidents; this facility is routinely used by HSE's inspectors.

2. Risk Assessment Training Online: www.leeds.gov.uk/risk/

This training package combines simple and practical advice with interactive learning exercises, to take you through a comprehensive step by step guide to health and safety risk assessment. The tutorial covers the basic principles behind risk assessment, explains the requirements of the Law - along with how to achieve compliance, and gives a simple demonstration case study to show how the different elements of risk assessment can be brought together to achieve real health and safety improvements.

The final stage in the training package is a mock risk assessment exercise for you to practice the techniques you have learned.

3. Signup: www.signupweb.net/

The Healthy Workplace Initiative (HWI) is jointly sponsored by the Department of Health and the Health and Safety Executive and encapsulates a new approach to the problems of health at work. Includes, for example, information and advice on helping employees with long-term health conditions get back to work.

4. Small Business Health & Safety: www.hse.gov.uk/smallbusinesses/gettingstarted.htm

This website from the Health and Safety Executive is aimed at small businesses to help them to understand what they need to do to comply with general health and safety legislation.

5. Falls From Height: www.hse.gov.uk/falls/

This website explains what the HSE know about falls from height; outlines their evolving proposals to tackle its incidence in the workplace; and provides links to guidance, research and other useful resources.

6. Construction and Design: www.hse.gov.uk/construction

Construction is Britain's biggest industry and one of its most dangerous. HSE deals with all aspects of construction work. These pages explain what they are doing to tackle key issues and provide access to a range of information about safety in the industry - for workers, employers and contractors - in fact, anyone with an interest in construction health and safety.

7. Slips and Trips: www.hse.gov.uk/slips/

The HSE's slips and trips website offers a wealth of information on the subject including, information, slip assessment tool, work programme and case studies.

13. REFERENCE MATERIALS AND FURTHER READING

1. Workplace (Health, Safety and Welfare) Regulations 1992 SI 1992/3004. The Stationery Office, ISBN 0 11 025804 5
2. HSC, Workplace, (Health, Safety and Welfare) Regulations 1992: Approved Code of Practice and Guidance, L24, HSE Books, ISBN 0 7176 0413 6
3. BS 7976-1: 2002, Pendulum Testers: Specification British Standards Institution 2002 ISBN 0 580 40144 8
4. BS 7976-2: 2002, Pendulum Testers: Method of operation British Standards Institution 2002, ISBN 0 580 40145 6
5. BS 7976-3: 2002, Pendulum Testers: Method of calibration British Standards Institution 2002, ISBN 0 580 40146 4
6. The measurement of floor surface slip resistance: Guidelines recommended by the UK Slip Resistance Group United Kingdom Slip Resistance Group 2000. ISBN 1 85957 2278
7. DIN 51097: 1992 Testing of floor coverings; determination of the anti-slip properties; wet-loaded barefoot areas; walking method; ramp test, German National Standard 1992
8. DIN 51130: 2004 Testing of floor coverings; determination of the anti-slip properties; workrooms and fields of activities with slip danger; walking method ramp test, German National Standard 2004
9. Preventing slips in the food and drink industries: Technical update on floor specifications Food Information Sheet FIS22, HSE Books 1999
10. Slips and trips: Guidance for the food processing industry, HSG156, HSE Books 1996, ISBN 0 7176 0832 8
11. HSC, Slips and Trips: Summary of guidance for the food industry, Food Information Sheet No. 6 (FIS06), HSE Books (single free copy)
12. HSC, "Stop Slips: Managing slips to reduce injuries and costs" Video, HSE Books, ISBN 0 7176 1819 6
13. The Construction (Design and Management Regulations) 1994. SI 1994/ No. 3140, The Stationery Office

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