

# Safer surfaces to walk on

*reducing the risk of slipping*

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**CIRIA** *sharing knowledge ■ building best practice*

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**Safer surfaces to walk on – reducing the risk of slipping.**

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# Foreword

Slipping accidents cause many thousands of occupational major injuries each year, more than 90 per cent of which involve broken bones, and much pain, suffering and financial loss for society. Yet the perception by the public, the workforce and those who design or manage floors in buildings is that these accidents are inevitable. The reality is that sensible precautions could eliminate the majority of these accidents. As with many problems, we believe that if the problem is explained, and sensible solutions are suggested, then people will start to manage the risks more effectively.

This CIRIA good practice guide has been produced as part of the Health and Safety Commission's programme to reduce the number of slips and trips accidents in the UK. It is an attempt to give practical guidance to those who design, procure and manage flooring in buildings and is based upon many research projects undertaken, primarily by the Health and Safety Laboratory.

These research projects looked at the science and mechanics of why people slip. The Health and Safety Executive, armed with the information from this research, have looked at the other contributing factors that may initiate a slip – flooring material, contaminant, shoe soles, cleaning regimes and environment issues – and have developed the Slip Potential Model that allow owners of floors to predict through risk assessment where slips may happen.

The CIRIA guide is based upon this research and in particular the Slip Potential Model. It is designed to provide designers, procurers and managers of floors with good practice guidance that, if followed, should significantly reduce the number of accidents on existing and new floors.

Research is continuing. Work has started looking at human behaviour factors and also why people trip. This research will be used to update and extend the book, so that it becomes the authoritative guide to slips and trips.



Joyce Edmond-Smith  
HSE Commissioner, with responsibility for slips, trips and falls

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<b>Health and Safety Laboratory</b>	<p>HSL has had a considerable input into this guide, primarily in terms of supplying and interpreting research material and making photographic material available. The contribution of those named below is acknowledged.</p> <p>Dr <b>Marianne Loo-Morrey</b> is a higher scientist (materials scientist) in HSL's Pedestrian Safety Section. She is the principal investigator and project leader of research projects into aspects of the pedestrian tripping problem and of projects designed to gain a better understanding of the slip characteristics of a wider range of flooring materials.</p> <p>Dr <b>Paul Lemon</b> is a senior scientist (physicist) within the Pedestrian Safety Section. He co-ordinates HSL's research efforts into the area of pedestrian safety and serves as the Laboratory's expert witness at legal proceedings. He previously led HSL's specialist slips and trips forensic investigation team.</p> <p>Dr <b>Steve Thorpe</b> is a principal scientist and head of the Pedestrian Safety Section in HSL's Human Factors Group. He takes an active role in all the practical and management aspects of the diverse range of the team's work.</p>
<b>Note</b>	<p>Separate systems of building regulation apply in England and Wales, Scotland, and Northern Ireland. Similar intent exists under all three systems, though there are variations in both scope and method of application. For simplicity, this guide cites references to the system within England and Wales. Further information on building regulations in Scotland and Northern Ireland can be found online at, respectively:</p> <p>&lt;<a href="http://www.sbsa.gov.uk">www.sbsa.gov.uk</a>&gt;  &lt;<a href="http://www.dfpni.gov.uk/buildingregulations/technical.htm">www.dfpni.gov.uk/buildingregulations/technical.htm</a>&gt;</p>
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**Slips and trips training CD**

Attached to the inside back cover of this book you will find a CD-ROM containing a Powerpoint presentation and training material on managing slips and trips.

# Contents

Foreword.....	3
Acknowledgements.....	4
List of figures.....	9
List of tables.....	12
Executive summary.....	13
Key issues.....	15
Glossary.....	19
Abbreviations.....	20
<b>1 Introduction.....</b>	<b>21</b>
1.1 General.....	21
1.2 Background statistics.....	22
1.3 Specifying a walking surface: a holistic approach.....	23
1.4 Drivers.....	25
1.5 Walking surfaces considered in this guidance.....	27
1.6 Background data.....	27
1.7 Purpose and scope of guidance.....	28
<b>2 Setting the scene.....</b>	<b>29</b>
2.1 The physiology of walking.....	29
2.2 Slip Potential Model.....	30
2.3 Slips Assessment Tool.....	31
2.4 Manufacturers' data.....	32
<b>3 Testing of walking surfaces.....</b>	<b>33</b>
3.1 Assessment instruments and techniques: walking surface properties.....	33
3.2 Pendulum test.....	34
3.3 Surface roughness measurement.....	37
3.4 HSL ramp test.....	39
3.5 Application of preferred tests.....	40
3.6 Other techniques.....	41
<b>4 Selection and management of walking surfaces.....</b>	<b>43</b>
4.1 Introduction.....	43
4.2 The selection process.....	44
4.3 Management of walking surfaces.....	53
4.4 Design and management summary.....	54
4.5 Using the Slips Assessment Tool.....	55
4.6 Specification of requirements.....	55
<b>5 Contamination.....</b>	<b>57</b>
5.1 Introduction.....	57
5.2 Statutory aspects of contamination.....	58
5.3 Research.....	59
5.4 Hydrodynamic squeeze film theory.....	59
5.5 Real workplace contamination.....	60
5.6 Dry contaminants.....	62
5.7 Contamination on stairs.....	63
5.8 Profiled floors.....	64
5.9 Macro-rough floor surfaces.....	65

5.10	Drainage.....	65
5.11	Cleaning.....	65
5.12	Management of contamination .....	65
5.13	Summary.....	66
<b>6</b>	<b>Cleaning .....</b>	<b>67</b>
6.1	Introduction.....	67
6.2	Cleaning methods.....	70
6.3	Cleaning different floor materials.....	75
6.4	Effectiveness.....	79
6.5	Cleaning and drying.....	80
6.6	A cleaning environment .....	82
6.7	How clean is “clean” .....	84
6.8	Use of the Slips Assessment Tool .....	87
<b>7</b>	<b>Footwear .....</b>	<b>89</b>
7.1	General.....	90
7.2	Slips Assessment Tool .....	90
7.3	Guidance for employers .....	90
7.4	Contact area of shoe with floor .....	91
7.5	Overshoes.....	92
7.6	Sole pattern.....	92
7.7	Sole material .....	93
7.8	Wear and fit of shoes .....	95
7.9	Slip testing of occupational footwear .....	96
<b>8</b>	<b>Environment .....</b>	<b>97</b>
8.1	Introduction.....	97
8.2	Lighting.....	97
8.3	Noise .....	99
8.4	Visual and other distractions .....	100
8.5	Condensation.....	101
<b>9</b>	<b>Human factors .....</b>	<b>103</b>
9.1	Introduction.....	103
9.2	Elderly.....	106
9.3	Pushing, pulling, carrying.....	107
9.4	Pedestrian gait .....	108
9.5	Cognitive senses.....	110
9.6	Perception .....	111
9.7	Additional behavioural research .....	112
9.8	Others .....	112
9.9	Organisational.....	113
<b>10</b>	<b>Generic flooring .....</b>	<b>121</b>
10.1	Introduction.....	122
10.2	Floor substrate .....	122
10.3	Change in slip resistance with time .....	123
10.4	Profiled surfaces .....	125
10.5	Generic floor types .....	126
10.6	Flexible floor coverings .....	133
10.7	Rigid flooring.....	139
10.8	Accessories.....	151
10.9	Surface alteration techniques .....	154
10.10	Data on walking surface materials slip resistance.....	157

<b>11 Building elements</b>	<b>165</b>
11.1 Introduction	165
11.2 Entrances	166
11.3 Thresholds and doors	166
11.4 Entrance matting	167
11.5 General circulation space	169
11.6 Stairs	171
11.7 Vertical access ladders	177
11.8 Ramps and slopes	178
11.9 External pedestrian area	180
11.10 Footbridges	182
11.11 Railways	182
11.12 Gratings	185
<b>12 Case studies</b>	<b>187</b>
12.1 General	187
12.2 HSE case studies	188
12.3 HSL investigations	205
<b>Appendices</b>	<b>211</b>
<b>A1 Standards on testing</b>	<b>213</b>
<b>A2 Legislation</b>	<b>215</b>
<b>A3 Statistics</b>	<b>221</b>
<b>A4 Trips</b>	<b>229</b>
<b>A5 Other techniques of surface measurement</b>	<b>235</b>
<b>A6 References</b>	<b>239</b>

## FIGURES

1.1 Swiss cheese model of accident causation	24
1.2 Surfaces considered in this guide	27
2.1 Slip influences	31
3.1 Pendulum test instrument	35
3.2 Schematic of test area on a test site of approximately 500 mm × 500 mm	37
3.3 Idealised surface micro-profile: roughness terminology	38
3.4 Typical roughness meters	38
3.5 HSL ramp test	40
4.1 New walking surfaces: using the Slip Potential Model	47
4.2 Existing walking surfaces: using the Slip Potential Model	49
4.3 Poor management – “Wet Floor” sign chained to a handrail for long periods	53
5.1 Diagram of a squeeze film	59
5.2 Dry contamination from machine waste on a very smooth power-floated concrete surface	63
5.3 Typical profiled floor surface	64
6.1 Mop and rinse	71

6.2	Mop and dry. . . . .	71
6.3	Scrubber-driers. . . . .	71
6.4	Vacuum. . . . .	73
6.5	Newly installed terrazzo – highly reflective. . . . .	77
6.6	High-slip-resistant ceramic tiles and rounded nosing . . . . .	79
6.7	Warning signs displayed. . . . .	80
7.1	Excerpt from SATRA design guidelines for good slip resistance. . . . .	93
7.2	Examples of deep tread profiles . . . . .	93
7.3	An example of badly worn (and badly fitting) borrowed footwear . . . . .	95
8.1	Polished sheet vinyl in a supermarket coffee shop area: sunshine through external windows producing glare and reflection on floor surface . . . . .	98
8.2	Poor lighting in staircase combined with dirty stairs and additional non-standard nosing . . . . .	98
8.3	Visual indication of a change in level . . . . .	100
9.1	A busy station platform . . . . .	105
9.2	Hospital entrance – signs at different levels . . . . .	105
9.3	Railway stations present a variety of slip hazards. . . . .	106
9.4	Pedestrians with a variety of encumbrances . . . . .	107
9.5	Warning sign outside Beaumaris Castle . . . . .	111
9.6	Warning of spillage: sign in place and cleaner approaching . . . . .	118
9.7	The sign very rarely moves away. . . . .	118
10.1	Uneven wear on timber and metal stair treads and landings changes their slip resistance characteristics over time . . . . .	124
10.2	Outdoor stairs – coated with epoxy/grit only in the centre and mostly worn off. . . . .	124
10.3	A typical raised profile flooring for contaminated areas. . . . .	126
10.4	Polymer-modified concrete flooring . . . . .	128
10.5	Terrazzo flooring . . . . .	129
10.6	Mastic asphalt flooring . . . . .	130
10.7	Painted concrete floor . . . . .	131
10.8	Pumpable self-levelling wearing screed. . . . .	133
10.9	Worn carpet with potential trip hazards . . . . .	134
10.10	Linoleum flooring: Marmoleum Dual. . . . .	135
10.11	Vinyl flooring: SureSTEP. . . . .	137
10.12	Profiled rubber flooring on steps, with contrasting stair nosings. . . . .	137
10.13	Cork flooring: HARO Corkett. . . . .	138
10.14	Parquet flooring in a sports hall . . . . .	139
10.15	A deck of hardwood planks in Paris immediately after heavy rain . . . . .	140
10.16	Grooved timber decking . . . . .	141
10.17	Timber decking with chicken wire overlay on footbridge . . . . .	141
10.18	Sand-epoxy strips set into a dovetail groove. . . . .	141
10.19	Fully vitrified ceramic granite tactile tiles containing corundum anti-slip additives, with layout to BS 7997. . . . .	143
10.20	Quarry tile flooring in catering area . . . . .	144
10.21	Clay brick paving near the Trafford Centre, Manchester. . . . .	145
10.22	External stone paving. . . . .	146

10.23	Wath Blue limestone at Fetter Lane, London EC4. . . . .	146
10.24	Concrete paving units . . . . .	148
10.25	Incorrectly installed corduroy warning strip . . . . .	149
10.26	Glass floor with fritted surface . . . . .	150
10.27	Steel “Durbar” patterned metal flooring . . . . .	150
10.28	Metal grating . . . . .	151
10.29	Profiled metal surface at head of escalator . . . . .	152
10.30	Wear immediately adjacent to escalator steps . . . . .	152
10.31	Polished brass air intake duct cover to carpeted raised floor . . . . .	153
10.32	Metal gulley cover at threshold . . . . .	153
10.33	New and in-service Luxcrete pavement lights . . . . .	154
10.34	Incorrectly located anti-slip strip applied to stair goings . . . . .	156
11.1	Entrance with large canopy to reduce ingress of rain . . . . .	166
11.2	Entrance canopy serving no useful purpose in protecting the entrance . . . . .	167
11.3	Building façade and canopy protecting entrance to building . . . . .	167
11.4	Thresholds with low-SRV materials: (a) terrazzo tile; (b) stainless steel . . . . .	168
11.5	Heavier doors installed to reduce occurrences of wind-driven rain or dust being blown into the building . . . . .	168
11.6	Entrance matting that may not coincide with the direction in which pedestrians are likely to walk . . . . .	170
11.7	Example of general circulation space: University of Limerick Foundation Building . . . . .	170
11.8	Steps with contrasting nosings to tread material, corduroy warning strip and three-level handrails . . . . .	171
11.9	Stair terminology . . . . .	172
11.10	Example of steps with uneven riser heights outside the tolerances allowed by the Building Regulations. . . . .	174
11.11	Stair with different riser heights and materials. . . . .	174
11.12	Terrazzo stairs with slip-resistant nosing correctly placed at the front of each stair tread . . . . .	176
11.13	Access ladder complying with BS 4211 . . . . .	177
11.14	Example of a ramp that is not marked in a contrasting colour . . . . .	178
11.15	Worked example of additional SRV required for a 1:20 gradient slope surface. . . . .	179
11.16	Example of an access ramp with contrasting sloped surface at the rear entrance to a church in the City of London . . . . .	180
11.17	Example of unacceptable uneven paving . . . . .	181
11.18	Pedestrian circulation space outside railway station . . . . .	181
11.19	Timber footbridge with slip-resistant strips, Corporation Street, Manchester . . . . .	182
11.20	Slips, trips, falls and related accidents at stations . . . . .	183
11.21	Problems with pigeons: (a) nesting on horizontal structure; (b) the resulting slip hazard below; (c) mesh installed to exclude pigeons from roosts . . . . .	184
11.22	Example of a tactile warning surface near the platform edge . . . . .	184
11.23	Grating over gulley in an industrial floor . . . . .	185
12.1	Warning cone permanently located at railway station . . . . .	195
A4.1	Pallet: trip hazard . . . . .	229
A4.2	Trailing cables . . . . .	230
A4.3	Uneven paving . . . . .	231

## TABLES

2.1	Factors included within Slip Potential Model . . . . .	30
3.1	Pendulum results (SRV) in relation to slip potential: Four-S rubber . . . . .	36
3.2	Pendulum results (SRV) in relation to slip potential: TRRL rubber . . . . .	36
3.3	Surface roughness related to slip potential . . . . .	39
4.1	Minimum values of slip resistance parameters . . . . .	45
4.2	SRV required for various risks of slipping . . . . .	45
4.3	Examples of Slip Potential Model component issues . . . . .	51
4.4	Walking surface attributes . . . . .	51
4.5	Control checklist for contamination-related slip risks . . . . .	52
4.6	Management regimes: potential shortcomings . . . . .	53
4.7	Hierarchy of hazard and risk management . . . . .	54
5.1	Types of contamination . . . . .	58
5.2	Roughness details . . . . .	60
5.3	Flooring/contaminant performance matrix . . . . .	61
5.4	Categories of slip resistance . . . . .	62
5.5	Examples of dry contaminant . . . . .	62
6.1	Fill materials for scrubbing brushes . . . . .	72
6.2	Successful cleaning techniques – easy reference matrix . . . . .	75
6.3	Indicative cleaning routines for hard finishes . . . . .	76
6.4	Indicative cleaning routines for soft finishes . . . . .	76
6.5	The effects of different polishes and applications on the slip resistance of flooring . . . . .	79
7.1	Relative slip resistance of combinations of shoes and floors in water-wet conditions . . . . .	94
8.1	Selected standards and guidance . . . . .	99
8.2	Design issues . . . . .	99
8.3	Control of visual distractions . . . . .	101
10.1	Typical data on walking surface materials slip resistance based on HSL experience . . . . .	158
11.1	Maximum and minimum rise and going sizes . . . . .	173
11.2	Recommended maximum gradients for ramps and additional coefficient of friction and SRV requirements on ramps . . . . .	178
12.1	HSL floor slipperiness assessment: elderly ward of a hospital . . . . .	205
12.2	HSL floor slipperiness assessment: supermarket . . . . .	207
12.3	HSL floor slipperiness assessment: fast-food restaurant kitchen . . . . .	208
12.4	HSL floor slipperiness assessment: leisure centre . . . . .	209
A3.1	Slip and trip incidents in education for 1999/2000 . . . . .	225
A3.2	Passenger accidental fatalities: accidents at stations . . . . .	226
A3.3	Passenger accidental major injuries: accidents boarding and alighting trains and accidents on railway premises unconnected with movement of trains . . . . .	226
A4.1	Trip risk control . . . . .	231

# Executive summary

*Safer surfaces to walk on – reducing the risk of slipping* provides comprehensive information and guidance on ways to reduce the number of slip incidents that occur on all types of interior and exterior walking surfaces. Slip incidents are responsible for 50 per cent of all reported accidents to members of the public. They result in a loss to employers and a burden on the health service amounting to hundreds of millions of pounds annually, and there is an enormous additional cost in terms of human suffering.

Production of the guide has been substantially funded by the Health and Safety Executive, aided by contributions from bodies responsible for the design, maintenance and operation of transport systems, shopping centres and hospitals – all organisations where the costs of slip incidents are high. It draws together research, much of it from the UK's Health and Safety Laboratory, to explain clearly how slips occur and the measures that should be adopted to prevent them. It is only quite recently that the detailed mechanisms of slipping have been understood, so this is the first time that such extensive guidance has been available.

The guide sets out the statutory obligations of those who specify and manage walking surfaces – requirements that may not be fully understood by those concerned. It is hoped that the guide will help these individuals and organisations meet their obligations.

The two preferred methods for measuring the properties of walking surfaces are described in some detail. Guidance is given on the range of values required for the different parameters to ensure that the walking surface has an adequate slip resistance under particular conditions. Case studies used throughout the guide illustrate practical applications of these measurements and of the management issues associated with floor maintenance. They also describe some forensic investigations where serious slip incidents have occurred.

A holistic approach to the selection of walking surfaces is required. The guide describes the Slip Potential Model, the so-called “gold standard” for selection, and also the Slips Assessment Tool developed by the HSE and promoted for initial design and comparative assessment. Flow charts are provided for the design processes involved in specifying new and refurbished walking surfaces. Examples of the application of these processes are also provided. The distinction is made between areas where control over factors such as use and footwear can be exercised, for example in factories and commercial food preparation premises, and those used extensively by the public. Areas that are used by both employees and the public are also considered; these include retail outlets and, importantly, healthcare facilities.

The guide illustrates that simple, cost-effective measures can reduce the incidence of slips. Failure to provide an appropriate surface can have serious financial implications. There is a need to bring together designers and facilities managers at an early stage of the design process. Consultation with the cleaning manager should also be undertaken. In specifying a walking surface the process of risk management should be followed.

Data is included on the slip resistance of a wide variety of flooring **materials** in both wet and dry conditions. Requirements for minimising the risk of slipping on specific building **elements** deal in some detail with stairs.

The impact of a wide variety of **contaminants**, both wet and dry, on the slip resistance of various walking surfaces is examined, including that of water. Although water might not commonly be regarded as a contaminant, it is probably the one most often encountered. Even a very small amount of water can dramatically reduce the slip resistance of a surface. Appreciation of the need to remove even small spills is emphasised, together with the need for the appropriate management strategy to ensure that this is implemented.

Some industries are known to have a particularly high incidence of slipping. The guidance draws on material on the HSE website addressed specifically towards the food processing industry, the food and drink industry and kitchens and food service. Guidance is also given for the education sector and the health services.

Managerial commitment to safety is identified as a pivotal influence on safety culture. Stemming from this, there is also discussion of the need for training to overcome lack of awareness on the causes of slips (and trips) and on the need to follow protocols on reporting incidents, cleaning spillages and using safety equipment. The guide recommends that **cleaning** should become an integral part of the work environment.

Much of the material used in the production of this guidance covers **slips and trips**, and also, in many cases, falls. Trips, primarily their causes and avoidance, are covered briefly in an appendix. It is intended that more detailed guidance will be produced on this topic before long.

# Key issues

## 1 The scope of the guide

Slips cause untold pain and suffering every year, and are responsible for an unknown number of deaths arising from the complications that may follow. This guide is designed to provide comprehensive information and advice which, if followed, should greatly reduce the number of such accidents.

## 2 Target readership of the guide

The guide is intended for use by all those responsible for or involved in:

- specifying new floor materials for new and refurbished premises
- assessing the suitability of existing floor materials for changes in use
- managing the use, environment or maintenance (including the cleaning regime) of flooring surfaces
- investigating slip incidents on flooring surfaces.

## 3 Statistics (see also Appendix 3)

Slips and trips are the most common cause of injuries at work:

- 95 per cent of major slips result in broken bones
- they are estimated to cost the UK economy more than £1 billion a year in terms of staff replacements, claims and lost business; the human cost is incalculable
- *one slip or trip accident is estimated to happen every three minutes.*

## 4 Legal requirements (see also Appendix 2)

The law requires that walking surfaces be safe, that effective means of drainage be provided where necessary, and that contamination be avoided as far as reasonably practicable. The main legal requirements are set out in the Workplace (Health, Safety and Welfare) Regulations 1992; other legal requirements, such as the Building Regulations and health and safety legislation, will apply.

## 5 A framework for the specifier (see also Chapter 2)

The Slip Potential Model provides a framework for the specifier to give due consideration to all the factors that may influence the selection or refurbishment of a safe walking surface. Specifiers have to assess the risk of slipping, taking careful account of:

- possible *contamination* conditions or events
- the *cleaning* regime to be put in place
- the *floor surface material*
- *environmental factors* such as glare, colour, changes in surface condition or slope
- *human factors* including distraction, crowding, disability and encumbrance
- types of *footwear* that may be worn (in some areas the type of footwear may be within the control of some or all of the users; elsewhere, people may have no choice in the footwear they can use).

## **6 Risk management (see also Chapter 4)**

The specifier has to follow the hierarchy of risk management when considering the factors influencing selection of a walking surface

## **7 The Slips Assessment Tool (see also Chapter 2)**

The HSE Slips Assessment Tool may be used to for making approximate comparisons between different solutions in the preliminary stages of selection. It may also be used both to determine in general terms the slip potential of an existing floor and to monitor the wear of a surface in use.

## **8 Testing flooring materials (see also Chapter 3)**

Testing a flooring material as it leaves the production line does not necessarily provide the necessary information for performance in us, because:

- the slip resistance value of the installed floor may differ from that of the ex-factory product
- surface roughness measurements of products in the factory may differ from those taken *in situ*, even immediately after laying
- some flooring materials will require surface treatment to provide good performance
- floors will wear with use, often becoming smoother over time
- contamination of surfaces – perhaps with even small amounts of water – *significantly* reduces the slip performance characteristics of most floors and increases the risk of slipping.

## **9 Alternative test methods (see also Chapter 3 and Appendix 5)**

- There are many methods for testing the performance characteristics of flooring materials, some of which are more reliable than others, depending on the circumstances
- each material has different characteristics under different conditions, and the testing of floors may be considered a science in itself
- the interpretation of the test results may not be readily apparent: similar numbers from different tests will not have the same interpretation.

This guide explains the various tests that may be used and their relative merits but suggests the pendulum test and the surface roughness meter as the preferred methods.

## **10 Facilities maintenance (see also Chapters 5 and 6)**

Those responsible for the use and maintenance of floors need to take account of the factors affecting slip resistance, and in particular to recognise that:

- cleaning should be integral to the work environment
- manufacturers' instructions for cleaning specific flooring products should be followed, together with any requirements contained within the maintenance plan
- surfaces should be thoroughly dried after cleaning and before subsequent use
- contamination should be removed promptly and thoroughly to leave a clean, dry surface
- testing for change of roughness over time should be carried out, with further pendulum testing considered when significant changes have been noted. Areas that have become too smooth will be need to be renewed or replaced.

## **11 Strategic risk management policy**

Managerial commitment to safety is a pivotal influence on safety culture:

- a risk management strategy policy should be implemented by those responsible for the premises
- appropriate (and adequate) training is required
- near-miss reporting should be incorporated in the policy
- slip investigations should aim to identify the root causes.

## **12 Human factors (see also Chapter 9)**

The contribution of human factors to the occurrence and prevention of slips needs to be recognised:

- slip incidence can be reduced by modification of behaviour, which may be achieved with appropriate training and/or warning of potential hazards
- distractions cause people to overlook obvious hazards
- impaired mobility when pushing, pulling or carrying contributes to a large number of slips, trips and falls
- age is a significant factor in many slip accidents
- physical frailty is a factor. Vulnerable groups include the disabled, children, and young people in their first employment.

## **13 Flooring surface properties (see also Chapter 10)**

Profiled surfaces, including ceramic tiles, pressed metal sheet or rubber sheet, are perceived as being slip-resistant, but this is not necessarily the case. Unless there is interlock between the shoe and the profiled surface, it is the surface micro-roughness of the highest surface of the profile that determines the slip resistance (see also Chapter 5). Pendulum testing of profiled surfaces is possible, but the data generated may need careful interpretation: expert advice should be taken. The HSL ramp method is an alternative test method for profiled surfaces.

## **14 Surface compatibility (see also Chapter 11)**

Elements inserted within a floor can constitute slip hazards, where adjacent surfaces have very different slip resistance. Examples include a metal cover for a drainage channel set in paving, or a smooth metal or plastic ventilation cover in a carpeted floor.

## **15 Building entrances (see also Chapter 11)**

Building entrances require special attention to reduce the likelihood of slip incidents:

- the location and design of the entrance should aim to reduce the extent to which water and dirt are carried into the building, whether blown by wind or transported by users. Canopies and lobbies that provide shelter from prevailing weather and act as an intermediate zone between outdoors and indoors can be effective
- the provision of appropriately located, sized and maintained matting is also of great importance.

## 16 Stairs (see also Chapter 11)

Serious slips and falls often occur on stairs:

- factors in stair design that are particularly relevant to slips and trips are the size of the tread, the shape of the nosings, the inclusion of proprietary nosings and the slip resistance of the tread or nosing material where first contact with the foot is expected in descent
- a small tread size greatly *increases* the risk of slipping caused by overstep in descent. Conversely, larger treads significantly *reduce* the likelihood of slipping in descent
- the risk of slipping also increases if the tread and nosing are finished in a smooth material, if the steps are wet, or if the edge of the step is rounded (reducing the effective tread size)
- poor lighting and a lack of usable handrails may also increase this risk.

## 17 Footwear (see also Chapter 7)

Footwear, and the extent to which this can be controlled, is the component of the Slip Potential Model to be considered in determining the required slip resistance of the floor surface: the properties of the shoe sole are highly relevant to reducing pedestrian slipping:

- the wear rate and to a degree, cleanability of the sole influences the surface roughness levels throughout the life of a shoe sole and is vital in maintaining satisfactory slip resistance in contaminated conditions.

It is important that footwear fits correctly, as slipping is more likely if the wearer's foot moves within the shoe.

**KEY POINTS**

- ◆ *Slips are an important and dominant element in the overall pattern of accident statistics.*
- ◆ *A holistic approach should be adopted to understanding and analysing slips.*
- ◆ *There are key drivers encouraging the improvement of the slip resistance of walking surfaces.*
- ◆ *The guide contains wide-ranging background data to assist specifiers and others.*
- ◆ *The readership of this guide should include all those with an interest in and responsibility for walking surfaces.*



Courtesy HSL

**1.1****GENERAL**

This guide emanates from a recognition that injuries to pedestrians as a consequence of slipping on walking surfaces is a major cause of personal suffering, disruption, and cost to individuals, organisations and ultimately to the national economy. It is the most common cause of injury in the workplace. For employers, and owners and managers of walking surfaces, the likelihood of slip accidents should be a major concern for the reasons set out in this guide.

The consideration of slips is usually as part of the grouping “slips, trips and falls”. This guide however concentrates on “slips” with the aim of collating the key research into this area, highlighting current thinking as to causality, and providing advice to clients, owners, designers, managers and others with a responsibility for the provision, specification and maintenance of safe flooring surfaces.

Slips would probably not be recognised as one of the major safety concerns in many businesses and organisations, and many people would perhaps consider them rather mundane. However anecdotal evidence suggests that, in 2003, there were almost 900 000 NHS bed-nights arising from slips, compared with 82 000 from car accidents. Statistically, it is one of the most common risks confronting us all (Beaumont *et al*, 2004). The simple message is:

- slips can have serious consequences
- simple, cost-effective measures can reduce these accidents.

This serious message is not assisted by a supposedly comic side to slipping; it is after all the backbone of many comedy sketches, particularly those directed at children. It is these children who are the managers of tomorrow.

People with an impairment, through age, disability or perhaps by virtue of what they are carrying or manoeuvring, are particularly prone to this form of accident. As the demographic shift continues over the next few decades, age-related impairment is likely to generate a significant increase in slip-related injury.

The elderly are particularly susceptible to slips as they are far more sensitive to the various contributory factors, illustrated in Figure 2.1. They are also more likely to suffer injury than a younger person; either a direct injury, such as a broken hip, or a consequential medical complication, which in some cases may ultimately result in death. Visual acuity decreases with age (Newton, 1997). Stairways, steps and uneven surfaces can therefore be a problem for people with decreased depth perception, ie a diminished ability to judge distances (Beaumont *et al*, 2004).

This guide aims to dispel some of the biggest barriers in respect of slip accidents, ie:

- not taking the risks seriously
- not understanding the causes of slipping
- thinking that slips are inevitable
- poor application of risk assessment and management controls.

## 1.2

### BACKGROUND STATISTICS\*

Slips and trips are the most common cause of major injuries<sup>†</sup> at work. They occur in almost all workplaces; 95 per cent of major slips result in broken bones and they can also be the initial causes for a range of consequential accident types such as falls from height<sup>‡</sup> or subsequent ill health in the elderly.

It is a sobering thought that, on average, workplace slips and trips account for:

- 33 per cent of all reported major injuries
- 20 per cent of over-three-day injuries to employees
- two known fatalities per year (as a consequence of consequential effects, eg falling from height)
- 50 per cent of all reported accidents to members of the public
- incalculable human cost (HSE website, <[www.hse.gov.uk/slips](http://www.hse.gov.uk/slips)>).

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\* Where separate statistics are not available, they are quoted for both slips and trips.

† Defined in Schedule 1 of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995.

‡ HSE estimates that 30 per cent of falls from height are initiated by a slip or trip.

Although only two fatalities per year are reported in the data above, it is suspected that slips are often the root cause of fatalities arising from the consequences of a slip, particularly in the elderly. Hence the true fatality rate is almost certainly higher. In addition these figures do not include non-workplace injuries and fatalities (particularly in the home), which account for a substantial number of slip accidents.

The breakdown of statistics does not allow a detailed analysis of slips alone. However since additional data became available in 2002/03 it is estimated that 19 per cent of all slips, trips and falls were attributable to slips on surfaces that were “wet or covered in substance” (HSC, 2004). Because of factors such as the under-reporting of accidents in many industry sectors, and the tendency of the sufferer’s clothing to absorb contamination after slips (thus hiding or disturbing the evidence), it is believed that the real figure could be higher. A study carried out to identify human factors associated with slip and trip accidents (Peebles *et al*, 2004) indicated that slips accounted for 46 per cent of all the reported incidents.

Some sectors have a particularly poor record in this area, specifically the food, drink and tobacco industries (HSE, 1996a). The hospitality sector is also poor and suffers from a very low formal accident reporting level. Recent research (HSL, 2004) in respect of trips has concluded that “the service industry should be the focus of attention in efforts to reduce the number of trip accidents”.\* The same could be said of slips.

The concern is not just a human one, important though that is. The costs associated with slips and trips are significant and amount to:

- £512 million per year for employers
- £133 million per year for the National Health Service.

A reduction in the incidence of slips therefore has the direct benefit of improving efficiency, profits and the nation’s wealth.

Statistics are covered in more detail in Appendix 3.

## 1.3

### SPECIFYING A WALKING SURFACE: A HOLISTIC APPROACH

Historically, the need for walking surfaces to provide adequate resistance to slipping has not always received sufficient attention, with specifiers often prioritising cost and appearance. Those specifiers who have given the issue some thought, have in some instances made conditions worse because they have had an incorrect appreciation of the mechanism of slipping. To be fair, a realistic understanding of the many strands of contributory factors necessary to avoid or minimise the occurrence of slipping has only recently been developed, and is still in its formative stages of verification, although results are very encouraging. A further complication has been the lack of coherence and reliability in the manner in which manufacturers’ data has been presented.

Some commentators (Thorpe and Lemon, 2000; Rossmore Group, 2003) suggest that taking a holistic approach in tackling these issues enables the causes of slips to be determined. This will allow mitigation plans to be developed that tackle root causes rather than assuming that slips are inevitable. These various factors interact, so it is not possible to give a general rule – each case needs to be considered on its own merits. This is the “goal setting” approach required by health and safety legislation.

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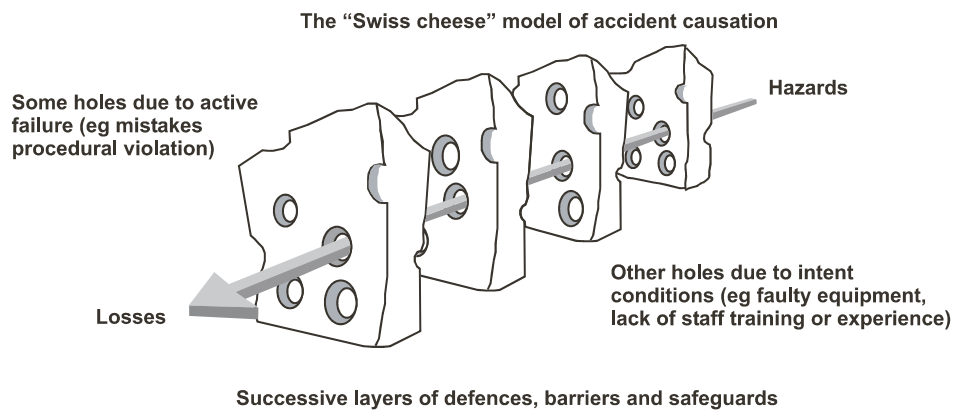
\* The *Review of RIDDOR trip accident statistics 1991–2001* (HSL, 2004) is concerned with trips. There is no equivalent study for slips, but the sentiments are likely to be the same.



The holistic approach considers the causes as being made up of the dynamic relationships between the environment, the processes or tasks that are carried out within that environment, the technologies present and in use, and finally the users or people that use them (Rossmore Group, 2003). The last element is a complex part of the system since they must be considered as both physical and psychological elements of the whole. This process is discussed in Chapters 2 and 4 in particular.

The guide has been generated from a large quantity of research data derived by HSL, and expert advice from HSL, HSE, the steering group and others. This data has been open to expert scrutiny and has been presented at industry workshops. Nonetheless, it is intended that the guide will be kept under review, so feedback is welcomed.

The “Swiss cheese” model (Reason, 1997) is a good illustration of how accidents can occur, and indeed can be prevented. The theory postulates that each “slice” is a defence against an accident; the holes represent local shortcomings in these defences. When a number of holes manage to align however, it indicates a situation where all the defences have been breached and an accident may occur. These “slices” are represented by the many factors which work to prevent slips. These are explained in Chapter 2.



**Figure 1.1** *Swiss cheese model of accident causation (Reason, 1997)*

It has not been appreciated by many specifiers or managers that there is an obligation on them to ensure that floor surfaces are suitable for their purpose – ie they must not be slippery.\* This has to be achieved in part through the hierarchy of risk management.† This has two implications:

- there is a sequence that must be followed in order to satisfy these regulations
- as new technology or practice becomes available, and societal expectations rise, these must be taken into account in deriving a solution.

The second bullet point means that what might have been an acceptable solution in the past, may not be acceptable in the future on account of developments in materials, cleaning technology, or some other advance. All those involved therefore need to keep abreast of contemporary thinking.

The key to success is to get it right first time.

\* The Workplace (Health, Safety and Welfare) Regulations 1992 infer that this is an absolute obligation; case law has identified some latitude, however (see Section 9.9.1).

† As set out in the Management of Health and Safety at Work Regulations 1999.

Some of the drivers that have created a need for improved understanding are listed below.

### Health and safety-related legislation

Health and safety legislation makes it clear that those specifying walking surfaces, and those who subsequently manage them, have a statutory obligation to ensure that they are safe. Quite what constitutes “safe” has been a matter of debate, but this guide is intended to assist in this respect. Appendix 2 outlines the relevant acts and regulations that apply to the safety of walking surfaces.

### The Disability Discrimination Act 1995 (DDA)

This ground-breaking Act requires those responsible for premises accessible to the public to make reasonable adjustments to prevent discrimination against those with disabilities. The two key impairments relevant to the safe use of walking surfaces are sight and walking gait. This Act indirectly affects both specifiers and manufacturers of new flooring and directly affects those who manage existing surfaces. The DDA exempts by regulation any feature of a building that complied with the relevant objectives, design considerations and provisions of the edition of Building Regulations Approved Document M that applied at the time of construction and continues substantially to do so, provided no more than 10 years have elapsed since the construction of that feature.

### Civil action

Although the assertion that we live within a “compensation culture” is not universally accepted\*, many organisations with responsibilities for walking surfaces pay out thousands of pounds each year following claims arising from injury sustained from poor surfacing (albeit not all of them arising from slips). There are various reasons why a responsible duty-holder should be concerned, and one of them is surely the cost of these actions. Adopting a whole-life approach often demonstrates the sense of choosing the correct surface at the start.

### Costs

Apart from the potential costs arising from a civil action, incorrect choice or maintenance of a walking surface can have significant cost implications for owners and operators. These arise both as direct costs, such as the expense of replacing or re-treating the surface, and also as indirect costs arising from disruption, damage to the organisation’s image, loss of trade and inefficiencies in working etc. The latter group can often be significant.

\* Keynote speech by Lord Falconer at HSC seminar on risk and compensation, 22 March 2005.

## **Higher standards and best practice**

Many of our common public areas are no longer considered to be low-priority streetscapes: shopping malls, station concourses, airport terminals and hard landscape areas have high-quality walking surfaces. Architects and others are constantly striving for improvements both in quality and cost. These materials often feature polished surfaces. While this general advance is to be welcomed, it is necessary for all those concerned (manufacturers, specifiers and maintainers) to realise that they must also be safe. This guide emphasises that this is achieved through the management of a wide range of influencing factors, which demands the holistic approach mentioned above.

This improvement is matched by a corresponding increase in industry standards and guidance, particularly from clients and owners with large interests such as Network Rail.

## **HSE initiatives and accident statistics**

HSE is very much aware of the importance of slips (and trips and falls) as components of ill-health and accidents generally and it has a priority programme directed at the topic. The statistics given in Section 1.2 and Appendix 3 support this. HSE's website, <[www.hse.gov.uk](http://www.hse.gov.uk)>, contains data and background information on the subject, and leaflets and guidance documents are available from HSE Books. HSE has developed the Slips Assessment Tool (SAT), which is described in Chapter 2.

HSE set overall targets for accident reduction in 2000 (HSC, 2000), which included reducing the rate of fatal and major injuries to workers by 5 per cent by 2005, and by 10 per cent by 2009/10. This target does not include those not at work such as the elderly. Although an accurate analysis of accidents over the period since 2000 is not possible owing to changes in the way accidents are reported and analysed, it appears that the accident rates are being maintained or are increasing slightly (HSE, 1996a). Given the prevalence of slips (trips and falls) within the overall accident rate, HSE has a continuing concern over the level of slip accidents.

## **Industry initiatives**

The UK Slip Resistance Group (UKSRG) is made up of representatives from the flooring and associated industries, including floor manufacturers, representatives of the HSE, test houses, end-users, instrument manufacturers and forensic engineers. In October 2005 UKSRG issued the third edition of its guidelines for the testing and investigation of walking surfaces (UKSRG, 2005).

## WALKING SURFACES CONSIDERED IN THIS GUIDANCE

This guide considers a wide range of walking surface situations, as illustrated in Figure 1.2, which also indicate some exclusions that should be noted.

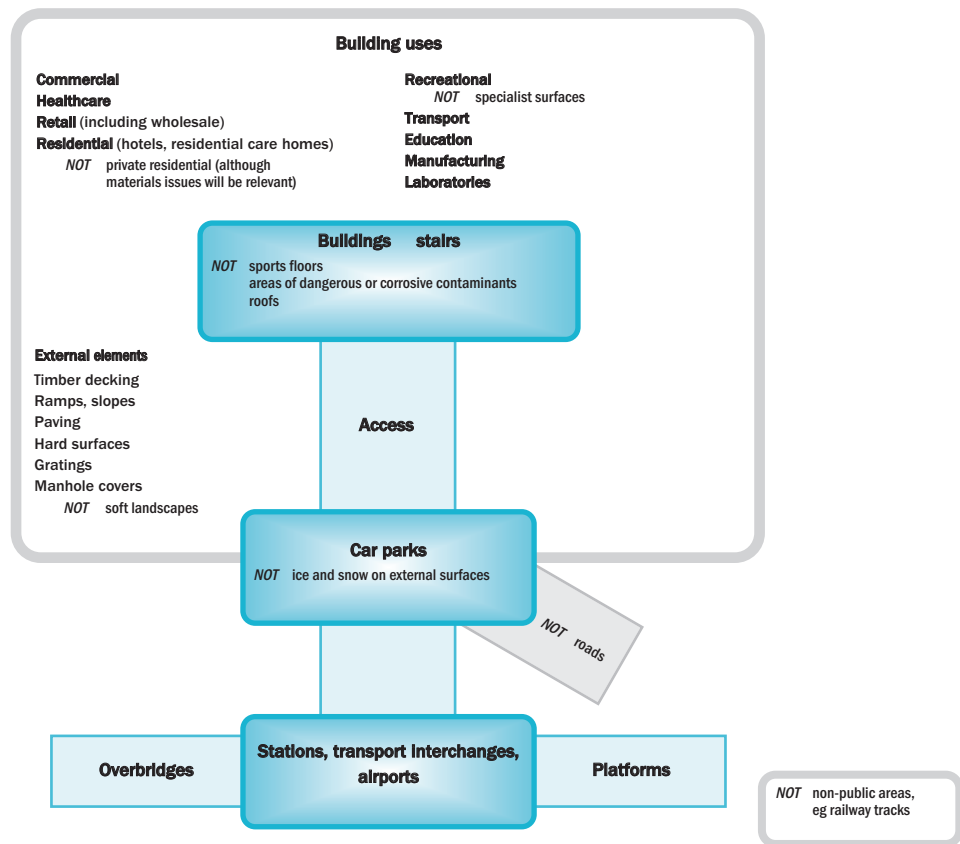


Figure 1.2 Surfaces considered in this guide

## BACKGROUND DATA

Although the research team has considered a wide range of UK and overseas research material, the primary source and emphasis for this guide has been the research carried out by the Health and Safety Laboratory and the Health and Safety Executive.

The period of research in this area of investigation is relatively recent and it is only over the latter part of this time-span that an understanding of the mechanisms of slip accidents has started to become sufficiently clear to allow theories to be postulated with confidence. The Slip Potential Model and the Slips Assessment Tool (both described in Chapter 2) utilise this understanding, but with an awareness that more research is required in many respects. As this knowledge becomes available the Slip Potential Model and the Slips Assessment Tool will need to be adapted accordingly.

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- 2
- 3
- 4
- 5
- 6
- 7
- 8
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This guide is designed to give an authoritative background to slips and to help those who:

- specify new floor materials for new and refurbished premises
- assess the suitability of existing floor materials for changes in use
- manage the use, environment or maintenance (including cleaning) of flooring surfaces
- investigate slip incidents on flooring surfaces
- need to identify the ways in which various factors interact and thereby potentially affect the safety of the surface.

The guidance will be of interest therefore to:

<i>Clients/owners</i>	Promoters of projects, owners of facilities, those responsible for facilities
<i>Designers/specifiers</i>	Design consultants, specialist contractors, manufacturers
<i>Planning supervisors*</i>	To provide a base from which actions of others may be judged and questioned
<i>Maintenance contractors</i>	Facility managers, cleaning companies
<i>Forensic architects and engineers</i>	Those who need to review existing floors to assess suitability or investigate accidents
<i>Others</i>	Tenants, landlords

**Chapter 2** provides an outline of the physiology of walking and describing the two main techniques used to derive a safe surface. The importance of manufacturers' data is also discussed. **Chapter 3** describes the testing methodologies favoured by HSE/HSL and their application to various generic surfaces with wet or dry contamination.

**Chapter 4** outlines the obligations of those with an involvement in the specification or management of walking surfaces. It explains how the techniques described in Chapter 2 may be used to practical effect, drawing on data covered in the other chapters.

**Chapters 5–10** review the various influences illustrated in Figure 2.1 and that contribute to the Slip Potential Model, namely contamination (5), cleaning (6), footwear (7), environment (8), human factors (9) and surface characteristics (10).

**Chapter 11** describes building elements relating to walking surfaces. The guide concludes with **Chapter 12**, which provides a number of case studies. Supporting data is contained in **Appendices 1–6** including a brief commentary on trips in **Appendix 4** and a review of other surface test methods in **Appendix 5**.

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\* Due to be replaced by the “co-ordinator” in the 2006 draft revision of the CDM Regulations.