



The UK's independent authority on slip resistance

## What Makes **Stairs Safer?**

An overview of key aspects for safe non-domestic internal stairs

MARCH 2020

www.ukslipresistance.org.uk



## **Stairs: The terminology**





The UK's independent authority on slip resistance



## Why is stair safety important?

### UK STATISTICS ILLUSTRATE THE PROBLEM

# 20% 300,000 550

of occupational 'Slip Trip and Fall' (STF) accidents occur on stairs at the rate of one every 25 minutes

of hospital patients per year are a result of STFs on stairs



The UK's independent authority on slip resistance

deaths per year, or 10 EVERY WEEK, on domestic stairs

No stair is ever 'safe' but attention to elements in this document can help reduce the risk of a fall.

#### CAN ANYTHING BE DONE?

Recent work has identified a number of important factors that affect why people fall on stairs.

See further reading for more details.



## What are the contributing factors to risks on stairs?

#### WHAT IS IMPORTANT?







Size and Consistency of Step Dimensions

Handrails

Proprietary Stair Nosings



The UK's independent authority on slip resistance





Lighting

Cleaning and Maintenance











**Step Dimensions** 

## Adequate and consistent step dimensions reduce risk

### TWO KEY ELEMENTS TO CONSIDER

- Size of step dimensions larger goings and easier to use rises. **>>**
- Consistency of dimensions (rise and going) on every step. **>>**



The UK's independent authority on slip resistance







### CONSISTENT GOINGS BETWEEN STEPS – 14 STEP FLIGHT

Going	Average time between occurrences of a large overstep *					
(mm)	25 uses a day	100 uses a day	2,000 uses a day	10,000 uses a day		
250	2 years	198 days	10 days	2 days		
275	29 years	7 years	133 days	27 days		
300	>1,000 years	>1,000 years	73 years	14 years		
325	>1,000 years	>1,000 years	568 years	114 years		
* Note: An o	verstep is a misstep whe	ere a large proportion (50	)%) of the foot is			

nunging over the eage of the hosing in descent. Undetected variations in step dimensions can also cause stumbles in ascent.









350 mm going

250 mm going

Position of 300 mm (size 9) shoe on stairs with 350 mm and 250 mm goings

### Larger going = safer stair

www.ukslipresistance.org.uk

What Makes Stairs Safer? - March 2020

page 6 of 34





### A SINGLE GOING REDUCED BY 15 mm – 14 STEP FLIGHT

Going	Average time between occurrences of a large overstep					
(mm)	25 uses a day	100 uses a day	2,000 uses a day	10,000 uses a day		
250	131 days	33 days	2 days	0.4 days		
275	3 years	282 days	14 days	3 days		
300	267 years	67 years	3 years	8 months		
325	>1,000 years	381 years	19 years	4 years		



The UK's independent authority on slip resistance

#### IP 15/03

On a 300 mm going stair with 10,000 uses per day the average time between occurrences of a large overstep is 8 months.

## Consistent going = safer stair

www.ukslipresistance.org.uk

What Makes Stairs Safer? - March 2020

page 7 of 34













The UK's independent authority on slip resistance

Quick simple test – good indication.

Measurement of step dimensions (rise and going) is needed to be certain.





## Variation in Step Dimensions





The UK's independent authority on slip resistance

#### A variation in step dimensions can be seen from the landing.



#### By moving eye position up and down variations will become evident.







The UK's independent authority on slip resistance

In addition to crouch and sight, a variation in step dimensions can sometimes be seen from the bottom of the stairs.







![](_page_10_Picture_2.jpeg)

The UK's independent authority on slip resistance

Here the problem might be variations in rise or going dimensions – or both!

The crouch and sight test can indicate a problem. To be certain measurements need to be taken.

www.ukslipresistance.org.uk

![](_page_10_Figure_10.jpeg)

![](_page_11_Picture_0.jpeg)

## Handrails

## Assistance and stability when negotiating stairs

### MAIN FUNCTIONS OF A HANDRAIL

- » A guide for the whole stair from start to finish.
- » An aid to movement up and down a stair.
- » A grab point in the event of a misstep.

![](_page_11_Picture_7.jpeg)

![](_page_11_Picture_10.jpeg)

## Good handrail selection = safer stair

www.ukslipresistance.org.uk

![](_page_11_Picture_15.jpeg)

![](_page_11_Picture_16.jpeg)

![](_page_12_Picture_0.jpeg)

## Handrails

### FEATURES TO CONSIDER

- Height 900–1000 mm. **>>**
- Ideally on both sides. **>>**
- Don't create a ladder that children can climb. **>>**
- Continuous throughout the whole flight without obstructions. **>>**
- Be of the right size to be 'graspable'. **>>**

![](_page_12_Picture_8.jpeg)

![](_page_12_Picture_11.jpeg)

![](_page_12_Picture_13.jpeg)

www.ukslipresistance.org.uk

![](_page_12_Picture_17.jpeg)

![](_page_13_Picture_0.jpeg)

## Handrails

### DETAILS TO CONSIDER

- Ideal shape is round. **>>**
- Perimeter 100–160 mm. **>>**
- Diameter 32–50 mm. **>>**
- Clearance 50–75 mm. **>>**

A correctly installed handrail can not only prevent a fall, but can save someone from one that has already started.

![](_page_13_Picture_8.jpeg)

![](_page_13_Picture_9.jpeg)

![](_page_13_Picture_12.jpeg)

#### 900–1000 mm

![](_page_13_Picture_14.jpeg)

PITCH LINE OF STAIRS

www.ukslipresistance.org.uk

![](_page_13_Picture_19.jpeg)

![](_page_14_Picture_0.jpeg)

## **Proprietary Stair Nosings**

## Define and protect the nose of steps

### FEATURES TO CONSIDER

- Dimensions. **>>**
- Position and Shape. **>>**
- Visibility and Contrast. **>>**
- Tread Cover and Slip Resistance. **>>**

![](_page_14_Picture_8.jpeg)

![](_page_14_Picture_11.jpeg)

![](_page_14_Picture_12.jpeg)

## Good stair nosing selection = safer stair

www.ukslipresistance.org.uk

What Makes Stairs Safer? - March 2020

page 15 of 34

![](_page_14_Picture_18.jpeg)

![](_page_14_Picture_19.jpeg)

![](_page_15_Picture_0.jpeg)

### **GUIDELINE DIMENSIONS**

BR Approved Document K (2013), BS8300:2:2018, BS9266:2013 & BS5395-1:2010

1. Stair nosing dimensions should be between 50–65 mm across the tread, and between 30–55 mm on the riser.

BR Approved Document K (2013) & BR Approved Document M (2016)

2. Refer to both tread and risers as being 55 mm.

dimensions of a proprietary stair nosing can achieve this.

Step dimensions and foot traffic conditions may also determine suitable stair edging selection.

![](_page_15_Picture_9.jpeg)

![](_page_15_Figure_15.jpeg)

- This apparent difference can be reconciled by specifiers and contractors since both sets of guidance are correct. The principle requirement is that the nose of a step is clearly defined and either of these guideline

![](_page_15_Picture_20.jpeg)

![](_page_16_Picture_0.jpeg)

## **Stair Nosings: Position**

![](_page_16_Picture_2.jpeg)

#### POOR POSITION – Does not define step nose

![](_page_16_Picture_4.jpeg)

The UK's independent authority on slip resistance

![](_page_16_Picture_7.jpeg)

#### GOOD POSITION – Clearly defines step nose

www.ukslipresistance.org.uk

![](_page_16_Picture_12.jpeg)

![](_page_16_Picture_13.jpeg)

![](_page_17_Picture_0.jpeg)

## **Stair Nosings: Shapes**

### THERE ARE THREE TRADITIONAL SHAPES THAT FIT MOST STEP NOSE PROFILES

Fitting the correct stair nosing profile can reduce the risk of a fall. It is important that the stair nosing profile should match the profile of the step nose.

![](_page_17_Picture_4.jpeg)

![](_page_17_Picture_5.jpeg)

#### Flat / Straight /Square

![](_page_17_Picture_7.jpeg)

The UK's independent authority on slip resistance

![](_page_17_Picture_10.jpeg)

Rake Back

Bullnose

www.ukslipresistance.org.uk

![](_page_17_Picture_16.jpeg)

![](_page_18_Picture_0.jpeg)

## Stair Nosings: Visibility and Contrast

![](_page_18_Picture_2.jpeg)

#### EFFECTIVE

![](_page_18_Picture_4.jpeg)

The UK's independent authority on slip resistance

www.ukslipresistance.org.uk

#### INEFFECTIVE

![](_page_18_Picture_10.jpeg)

![](_page_18_Picture_11.jpeg)

![](_page_19_Picture_0.jpeg)

- Current regulations are using Light Reflectance **>>** Values (LRVs) as a means of selecting a contrast between the stair floorcovering and the stair nosings.
- Light Reflectance Value (LRV) is the total quantity **>>** of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source (BS8300:2:2018).
- An acceptable visual contrast is achieved when **>>** the difference in light reflectance value between the two surfaces is greater than 30 points.

![](_page_19_Picture_5.jpeg)

![](_page_19_Figure_9.jpeg)

![](_page_19_Picture_12.jpeg)

![](_page_20_Picture_0.jpeg)

![](_page_20_Picture_1.jpeg)

The quote to the right indicates that Stair Nosing tread material should continue to the very (front) edge of the tread.

![](_page_20_Figure_3.jpeg)

![](_page_20_Picture_4.jpeg)

The UK's independent authority on slip resistance

"The risk of slipping can be reduced if the proprietary stair nosing incorporates a material that has slip resistant properties at the point where (foot) contact is likely to be made."

- BRE IP15/03

![](_page_20_Picture_13.jpeg)

![](_page_20_Picture_14.jpeg)

![](_page_21_Picture_0.jpeg)

## **Stair Nosings: Slip Resistance**

Accepted slip resistance criteria (BS8300:2:2018 & HSE Publication) **>>** 

Slip Potential F	Pendulum Tes
High Slip Potential	0–24
Moderate Slip Potential	25–35
Low Slip Potential	36 + (minimun

\* The pendulum test can only be used on stair nosing tread material in laboratory conditions. On in situ steps a micro roughness meter can give an indication of slip resistance – a reading of >20 mu is 'Low Slip' potential.

- When tested in factory or laboratory conditions the tread material **>>** should have a PTV >36
- These are guidelines the priority being that there should be **>>** adequate slip resistance for the foreseeable conditions.

![](_page_21_Picture_7.jpeg)

#### st\* Values

#### n requirement)

![](_page_21_Picture_15.jpeg)

Microroughness Meter

![](_page_21_Picture_17.jpeg)

![](_page_21_Picture_21.jpeg)

![](_page_21_Picture_22.jpeg)

![](_page_22_Picture_0.jpeg)

## Clearly identifies steps on stairs

### MAIN REASONS TO CONSIDER LIGHTING:

- Good lighting = steps clear to see. **>>**
- Bad lighting = shadows and poor visibility. **>>**

![](_page_22_Picture_5.jpeg)

The UK's independent authority on slip resistance

![](_page_22_Picture_8.jpeg)

## Good lighting = safer stair

www.ukslipresistance.org.uk

![](_page_22_Picture_13.jpeg)

![](_page_22_Picture_14.jpeg)

![](_page_23_Picture_0.jpeg)

### FEATURES TO CONSIDER

- Well lit in daylight and/or artificial light (minimum 100 lx is **>>** recommended – a 'clearly visible' stair is one which has lower risk).
- Avoid shadows reflection and glare. **>>**
- Light controls (switches etc) should be located at the top and **>>** bottom of stairs.
- Well positioned light and movement sensors are better than timers **>>** and switches.
- Additional options: **>>**

LED's: Lights incorporated into the stair nosings to illuminate steps. Photoluminescent: Light sensitive pigment in the tread material providing 'after glow' if light source removed.

![](_page_23_Picture_8.jpeg)

![](_page_23_Picture_12.jpeg)

![](_page_23_Picture_13.jpeg)

![](_page_23_Picture_16.jpeg)

![](_page_24_Picture_0.jpeg)

## **Cleaning and Maintenance**

## Reduces risk of accidents

#### INSPECTION

- Should be undertaken frequently in line **>>** with degree of foot traffic.
- Look for signs of wear and tear, loose carpet or fittings, **>>** obstacles, broken lighting and build up of contaminants.

![](_page_24_Picture_6.jpeg)

![](_page_24_Picture_9.jpeg)

![](_page_24_Picture_10.jpeg)

## Clean & maintained = safer stair

www.ukslipresistance.org.uk

![](_page_24_Picture_16.jpeg)

![](_page_24_Picture_17.jpeg)

![](_page_25_Picture_0.jpeg)

## **Cleaning and Maintenance**

### **USE CORRECT CLEANING MATERIALS & ROUTINES**

- » As per manufacturers recommendations.
- Prevents build up of dirt and grease which will increase the likelihood of slips.
- Leave the stairs dry after the cleaning process. **>>**
- Time the cleaning for a period with the least **>>** possible public foot traffic.

### DO NOT USE

Polishes, coatings, steam cleaners or power washers. **>>** 

![](_page_25_Picture_9.jpeg)

![](_page_25_Picture_13.jpeg)

www.ukslipresistance.org.uk

What Makes Stairs Safer? - March 2020

page 26 of 34

![](_page_25_Picture_18.jpeg)

![](_page_25_Picture_19.jpeg)

![](_page_26_Picture_0.jpeg)

## **Cleaning and Maintenance**

### REPAIR OR REPLACE

- Carpets, handrails and stair nosings if damaged or loose. **>>**
- » Non-functioning light bulbs, tubes or LEDs.

#### **KEEP STAIRWAY CLEAR**

» No obstacles to trip over.

#### ENTRANCE MATTING SYSTEMS

At entrances to stair hallways entrance mats reduce the risk of **>>** water and debris transfer from footwear and wheel chairs.

![](_page_26_Picture_9.jpeg)

![](_page_26_Picture_14.jpeg)

![](_page_26_Picture_17.jpeg)

![](_page_27_Picture_0.jpeg)

### A LOT OF ACCIDENTS OCCUR ON STAIRS

#### Attention to five key aspects = safer stairs

![](_page_27_Picture_3.jpeg)

![](_page_27_Picture_4.jpeg)

![](_page_27_Picture_5.jpeg)

Step Dimensions: consistency, going, rise

Handrails: height, perimeter, shape, clearance, continuity

Proprietary Stair Nosings: shape, position, contrast, slip resistance

![](_page_27_Picture_9.jpeg)

The UK's independent authority on slip resistance

![](_page_27_Figure_12.jpeg)

Lighting: levels, contrast, avoid shadows and glare

![](_page_27_Picture_14.jpeg)

Cleaning and Maintenance: inspect, clean, maintain, repair

![](_page_27_Figure_19.jpeg)

![](_page_27_Picture_20.jpeg)

		Step		Proprietary		Cleaning
No.	Reference/Link	Dimensions	Handrails	Stair Nosings	Lighting	Maintena
1	BS5395.1:2010. Stairs – part 1: Code of practice for the design of stairs with straight flights and winders.	✓		✓		
2	BS8300:2:2018. Design of an accessible and inclusive built environment. Buildings - code of practice	✓		~		
3	BS8493:2008+A1:2010. Light Reflectance Value – method of test.		$\checkmark$	<ul> <li>Image: A start of the start of</li></ul>		
4	BS9266:2013. Design of Accessible and Adaptable General Needs Housing.	<ul> <li>Image: A start of the start of</li></ul>	<ul> <li>Image: A start of the start of</li></ul>	✓	<ul> <li>Image: A second s</li></ul>	
5	Building Regulation Document K. Protection from Falling, 2013.	<ul> <li>Image: A start of the start of</li></ul>	$\checkmark$	<ul> <li>Image: A start of the start of</li></ul>		
6	Building Regulation Document M. Access to and use of Buildings, 2016.	<ul> <li>Image: A start of the start of</li></ul>	$\checkmark$	<ul> <li>Image: A start of the start of</li></ul>		
7	CIRIA C722. Safer Stairs in Public Places – Assessment of Existing Stairs, 2013.	<ul> <li>Image: A start of the start of</li></ul>	$\checkmark$	<ul> <li></li> </ul>	$\checkmark$	
8	Alderson A. Stairs, ramps and escalators – RIBA publication in conjunction with Centre for Accessible Environment (CAE), 2010.	✓	$\checkmark$	~		✓

![](_page_28_Picture_2.jpeg)

The UK's independent authority on slip resistance

![](_page_28_Picture_8.jpeg)

![](_page_28_Picture_9.jpeg)

![](_page_28_Picture_10.jpeg)

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	/ I \ Lighting	Cleaning of Maintena
9	Cohen, J et al. Stairway Falls: An Ergonomic Analysis of 80 cases. Professional Safety, 2009. vol.54 no.1 pp 27-41.	✓				
10	Cook, G et al. The Colour Light and Contrast Manual – designing and managing inclusive building environments, 2010.			<ul> <li>✓</li> </ul>		
11	Edwards, Dr. N et al. Steps to Safer Stairs. Community of Health Research Unit University of Ottawa. Access online.	✓		~		
12	Feeney, R J et al. BR260 Safety Aspects of Handrail Design: a review. BRE Publications, 1994.					
13	Gradus Ltd. Flooring Accessories in Public Buildings and www.createsafestairs.uk.			$\checkmark$		
14	Health and Safety Executive (HSE). Assessing the slip resistance of flooring - a technical information sheet. Includes details of HSE/HSL PC based software Slips Assessment Tool (SAT), 2012. http://www.hse.gov.uk/pubns/geis2.pdf			$\checkmark$		

![](_page_29_Picture_2.jpeg)

www.ukslipresistance.org.uk

![](_page_29_Picture_8.jpeg)

![](_page_29_Picture_9.jpeg)

![](_page_29_Picture_10.jpeg)

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	/ I \ Lighting	Cleaning of Maintena
15	Johnson, D A et al. Systemic Stair Step Geometry Defects, Increased Injuries Public Health Regulatory Responses, 2010. Contemporary Ergonomics and Human Factors pp 453-461.	✓				
16	Maki, B E et al. Getting a grip on stairs; research to optimise effectiveness of handrails, 2006. Proceedings of the IEA 2006 Congress: Meeting Diversity in Ergonomics pp 4669- 4674.					
17	Muhaidat, J et al. Measuring Foot placement and clearance during stair descent, 2011. Gait and Posture vol.33 no.3 pp 504-506.					
18	Nagata, H. Evaluation of Safety Dimensions of Stairway, 2006. International Ergonomics Association Paper 0763.	✓				
19	Pauls, J. Introduction to Stairway Safety, 2012-15. www.bldguse.com.	✓		<ul> <li>Image: A start of the start of</li></ul>	<ul> <li>Image: A start of the start of</li></ul>	
20	Quantum Flooring Solutions. Creating a Safe Stairway through Correct Stair Nosing specification, 2016.					

![](_page_30_Picture_2.jpeg)

www.ukslipresistance.org.uk

![](_page_30_Picture_8.jpeg)

![](_page_30_Picture_9.jpeg)

![](_page_30_Picture_10.jpeg)

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	/ I N Lighting	Cleaning of Maintenau
21	Roys, M et al. Minor variations in gait and their effect on stair safety: Proceedings of Contemporary Ergonomics, 2005. pp 427-431.	✓				
22	Roys, M. Better Handrails for Safer Stairs: Proceedings International Conference on Slips Trips and Falls 2001. Health and Safety Laboratory Buxton UK, 2011.					
23	Roys, M. Building Research Establishment (BRE) Information Paper IP 15/03. Proprietary Nosings for non-domestic stairs, 2003.	✓		<b>~</b>		
24	Roys, M. FB53 Refurbishing stairs in dwellings to reduce the risk of falls and injuries, 2013.	✓	<ul> <li>Image: A start of the start of</li></ul>			✓
25	Roys, M et al. Minor effect of changing stair dimensions on safety. Proceedings of Contemporary Ergonomics, 2005. pp 469-474.					
26	Scott, A. Falls on Stairways – Literature Review. Health and Safety Laboratory (HSL) Buxton Derbyshire HSL document 2005/10, 2005.	✓		<ul> <li></li> </ul>		
27	Sinisammal, J. Preferred Handrail Height for Spiral Stairs a fitting trial study. International Journal of Occupational Safety and Ergonomics, 2010. vol. 16 no.3 pp 329.–335.		<ul> <li></li> </ul>			

![](_page_31_Picture_2.jpeg)

![](_page_31_Picture_7.jpeg)

![](_page_31_Picture_9.jpeg)

No.	Reference/Link
28	SSL:2006 Society of Light and Lighting – Code for Lighting. www.cibse.org/society-of-light-and-lighting.
29	Thorpe, S et al. Investigating Stair Accidents: Proceedings of ISOES Co 2012. pp 56-61.
30	Workplace Health, Safety & Welfare Regulations, 1992 and Approved Code & Guidance. (www.hse.gov/pubns). HSE Publication – a short guide for Regulation 8 – Lighting Regulation 9 – Cleanliness and waste materials. Regulation 12 – Condition of floors and traffic routes. Regulation 17 – Organisation of traffic routes

The above references for further reading are guides that can assist the reader with information that can help make a stair safer. In the main they advise on aspects of stairs that are applicable in the UK although there can be minor variations in the Building Regulations applicable in Wales Scotland and Northern Ireland. All countries will have their own specific guidelines that should be consulted, but the overall information provided in this UKSRG document is based on suggested good practice after formal research by the further reading contributors.

![](_page_32_Picture_3.jpeg)

The UK's independent authority on slip resistance

![](_page_32_Figure_6.jpeg)

![](_page_32_Picture_9.jpeg)

![](_page_32_Picture_10.jpeg)

![](_page_32_Picture_11.jpeg)

![](_page_32_Picture_12.jpeg)

![](_page_32_Picture_13.jpeg)

![](_page_33_Picture_1.jpeg)

The UK's independent authority on slip resistance

#### www.ukslipresistance.org.uk enquiries@ukslipresistance.org.uk

Disclaimers

The UKSRG provides information in good faith but makes no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to any information provided and any reliance placed on such information is therefore strictly at your own risk. In no event will we be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from the use of any information provided.

All images used are for illustrative purposes only. Every effort has been made to ensure all visual content used is done so with the proper permissions. However, if you are the owner of the images and you believe that their use in this document is in violation of any copyright law, then please contact us on enquiries@ukslipresistance.org.uk. We will endeavour to modify the document or remove the images at the owners' request to resolve the issue.