UK SLIP RESISTANCE GROUP

The UK's independent authority on slip resistance

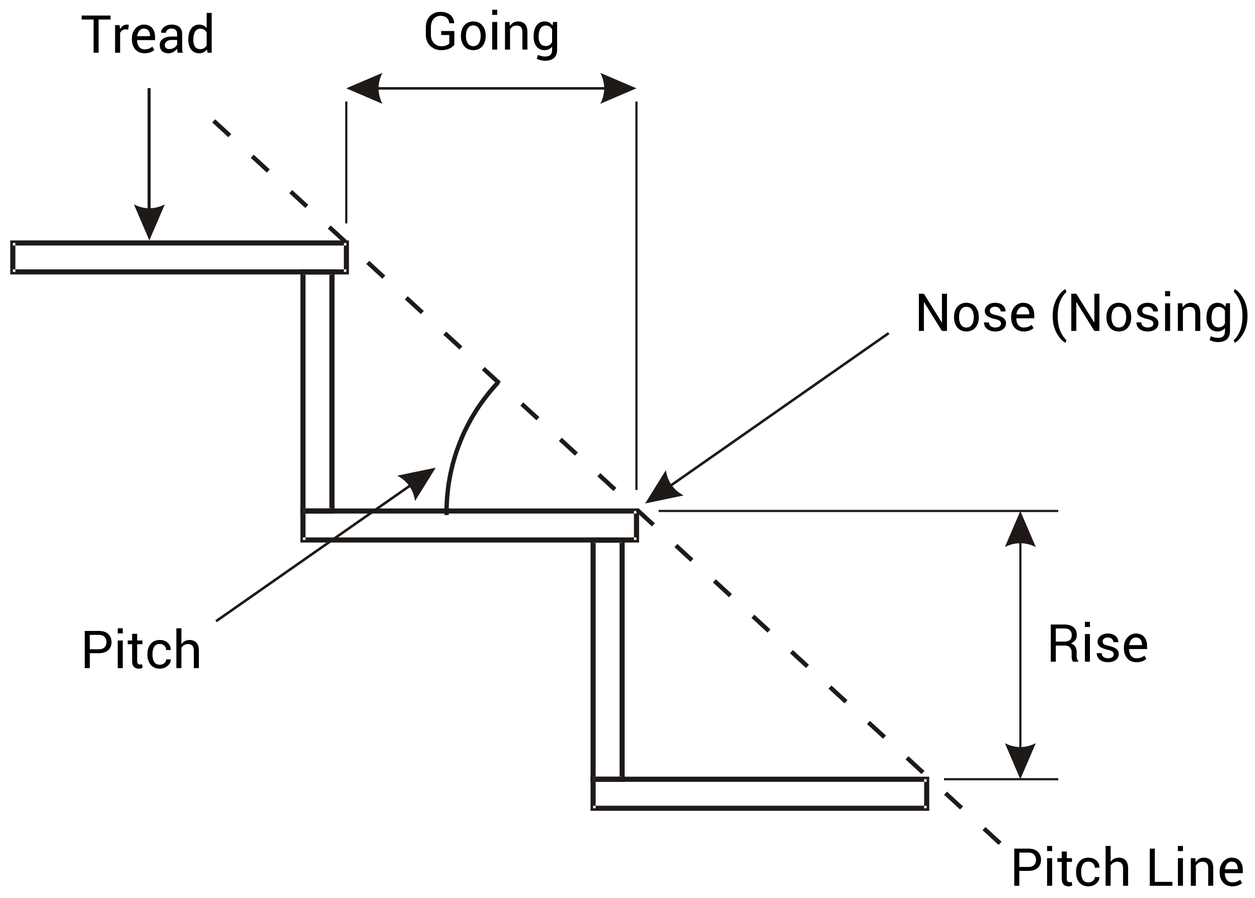
What Makes Stairs Safer?

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

MAY 2018

www.ukslipresistance.org.uk

Stairs: The terminology



Why is stair safety important?

Click here for further reading

UK STATISTICS ILLUSTRATE THE PROBLEM

20%

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

300,000

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

550

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.

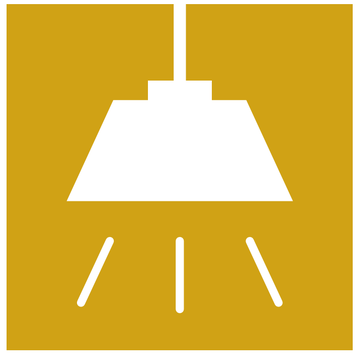
What are the contributing factors to risks on stairs?

WHAT IS IMPORTANT?

Size and Consistency of Step Dimensions

Handrails

Proprietary Stair Nosings



Lighting

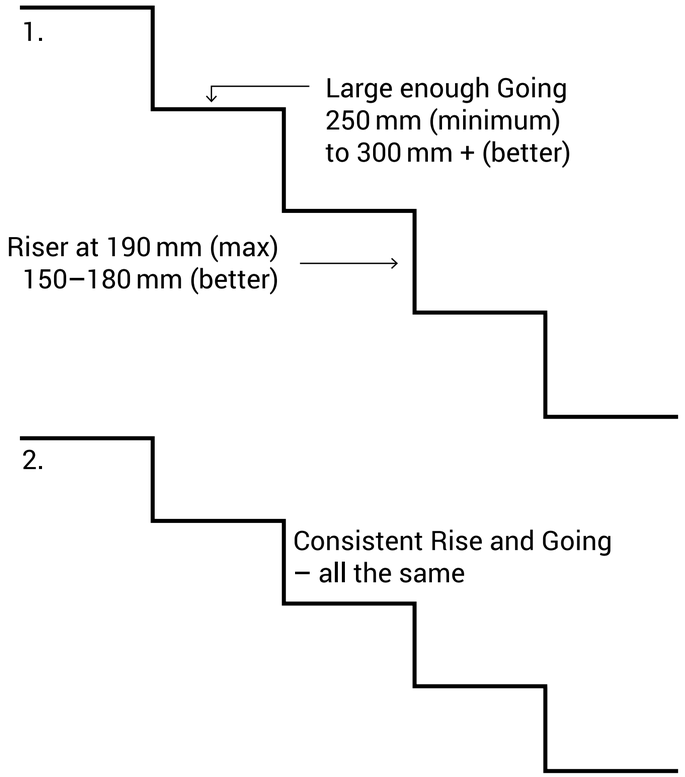
Cleaning and Maintenance

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.

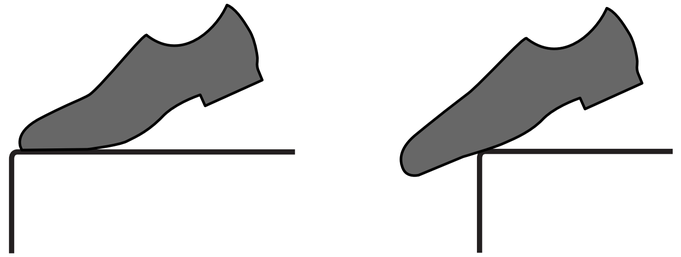


Step Dimensions: The Risk

Click here for further reading

CONSISTENT GOINGS BETWEEN STEPS – 14 STEP FLIGHT

Going (mm)	Average time between occurrences of a large overstep *			
	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



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

* Note: An overstep is a misstep where a large proportion (50%) of the foot is hanging over the edge of the nosing in descent. Undetected variations in step dimensions can also cause stumbles in ascent.

IP 15/03

Step Dimensions: Consistency

Click here for further reading

A SINGLE GOING REDUCED BY 15 mm – 14 STEP FLIGHT

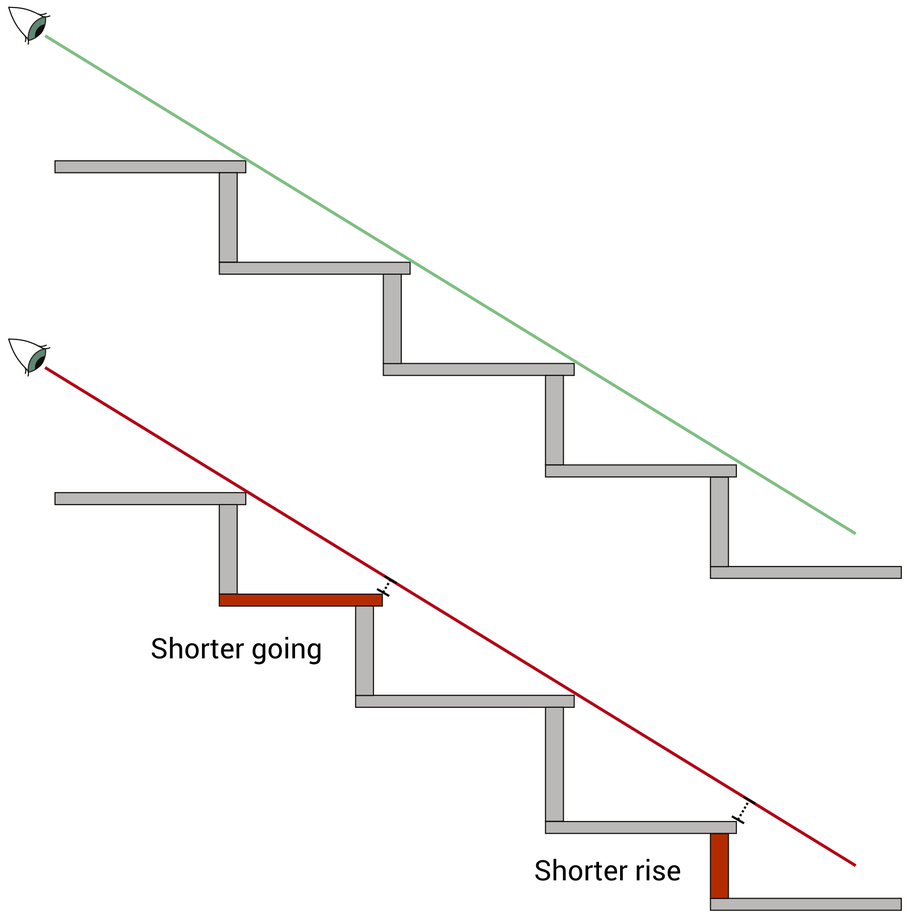
Going (mm)	Average time between occurrences of a large overstep			
	25 uses a day	100 uses a day	2,000 uses a day	10,000 uses a day
250	131 days	33 days	2 days	0.4 days
275	3 years	282 days	14 days	3 days
300	267 years	67 years	3 years	8 months
325	>1,000 years	381 years	19 years	4 years

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

Crouch and Sight Test

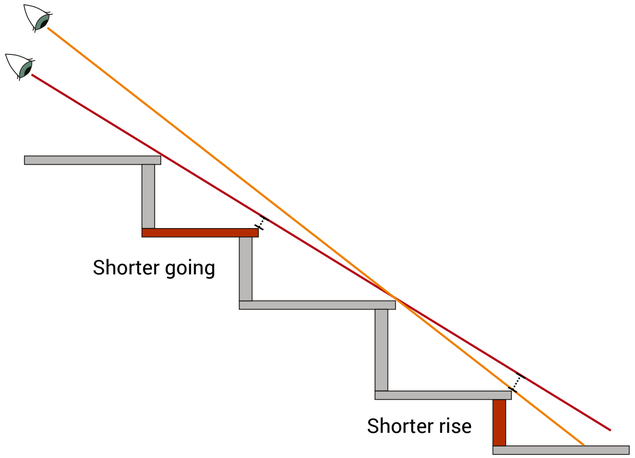


Quick simple test – good indication.

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

Variation in Step Dimensions

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

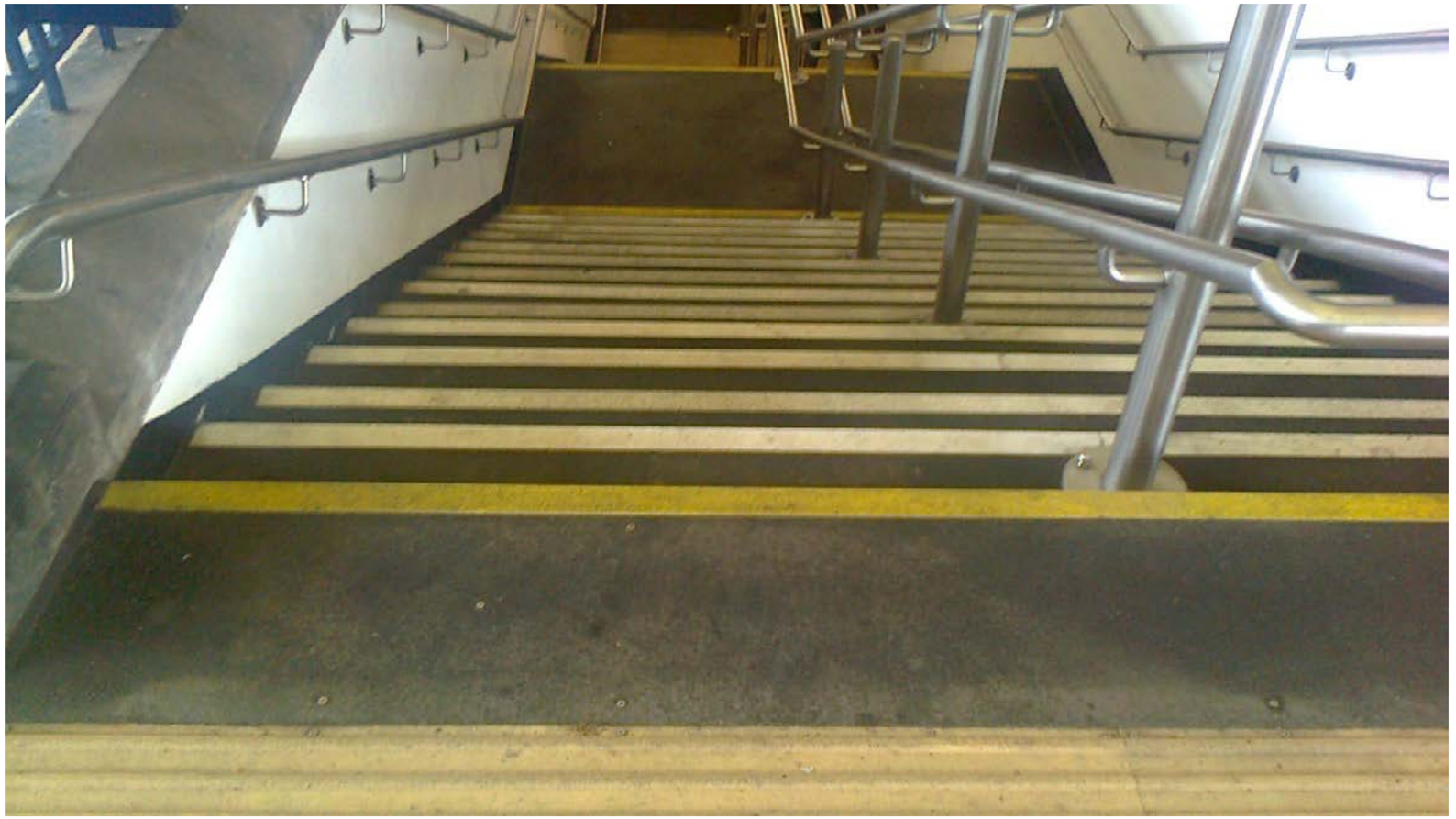


By moving eye position up and down variations will become evident.

Variation in Step Dimensions

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

For example!

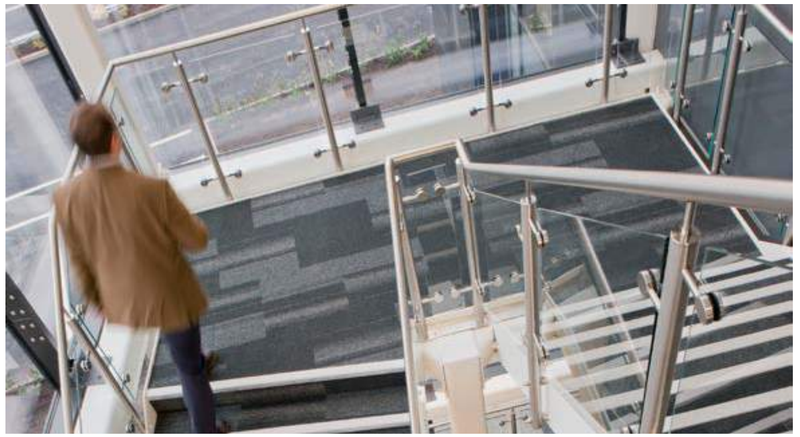


Here the problem might be variations in rise or going dimensions – or both!

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

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.

Good handrail selection = safer stair

Handrails

Click here for further reading

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’.

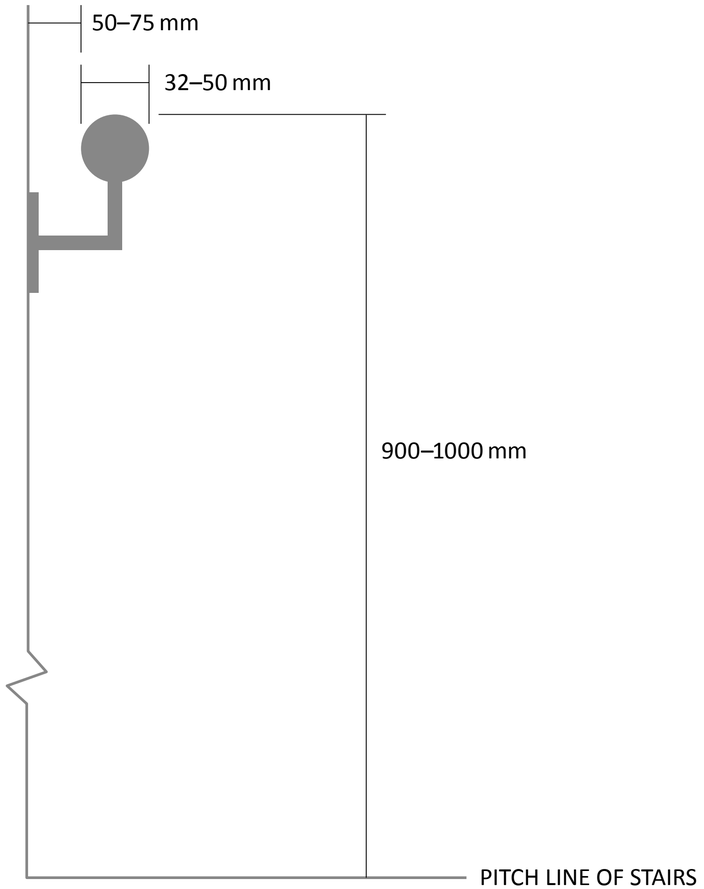
Handrails

Click here for further reading

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.



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.

Good stair nosing selection = safer stair

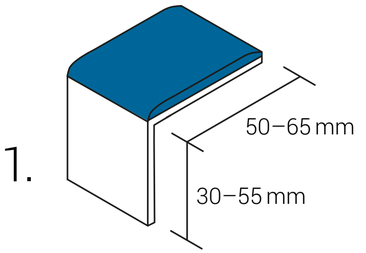
Stair Nosings: Dimensions

Click here for further reading

GUIDELINE DIMENSIONS

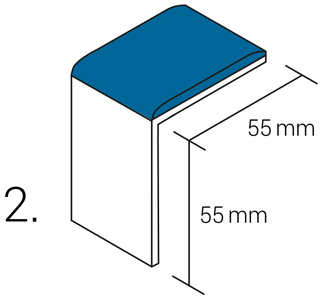
BR Approved Document K (2013), BS8300:2009+A1:2010, BS9266:2013 & BS5395-1:2010

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 (2004+2010 & 2013)

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



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 dimensions of a proprietary stair nosing can achieve this.

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

Stair Nosings: Position

Click here for further reading

POOR POSITION – Does not define step nose

GOOD POSITION – Clearly defines step nose

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.

Flat / Straight /Square

Rake Back

Bullnose

Stair Nosings: Visibility and Contrast

Click here for further reading

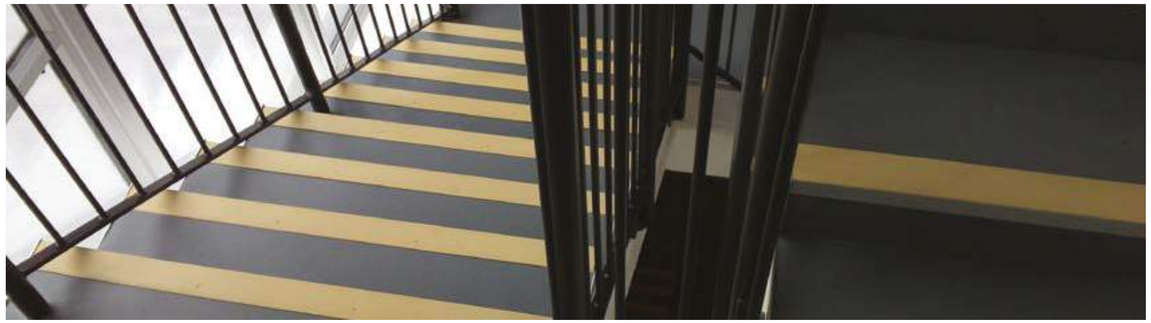
EFFECTIVE

INEFFECTIVE

Stair Nosings: Light Reflectance Values

Click here for further reading

» Current regulations are using Light Reflectance Values (LRVs) as a means of selecting a contrast between the stair floorcovering and the stair nosings.



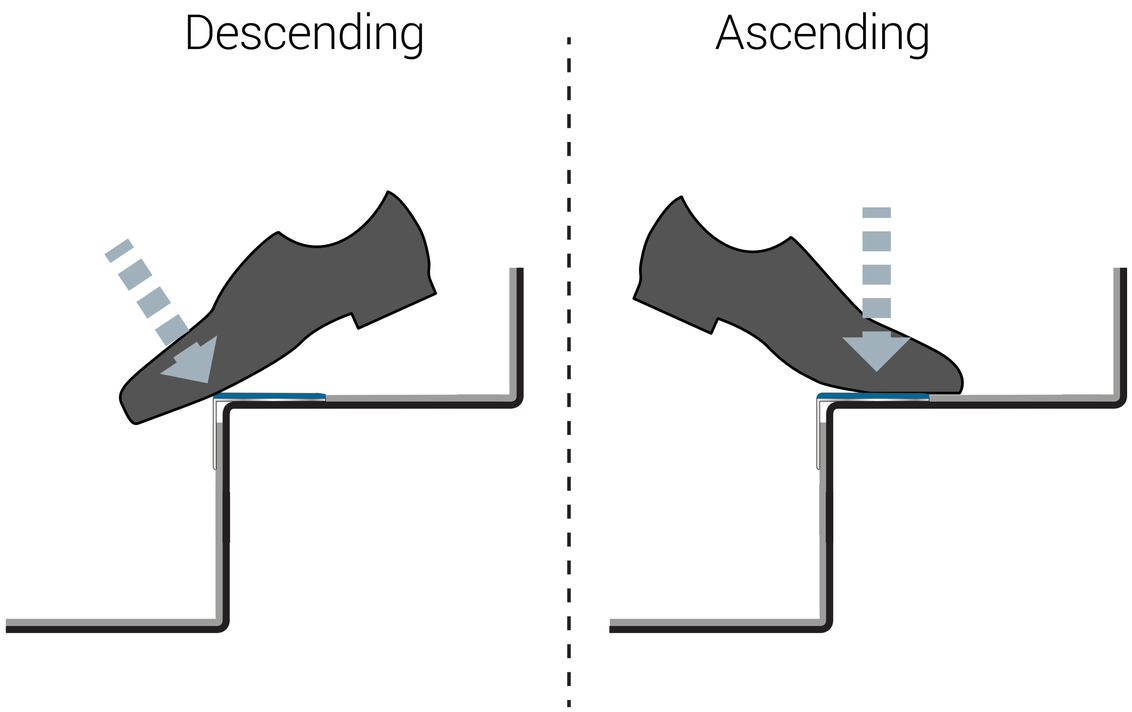
» Light Reflectance Value (LRV) is the total quantity of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source (BS 8300:2009).

» An acceptable visual contrast is achieved when the difference in light reflectance value between the two surfaces is greater than 30 points.

Stair Nosings: Tread Cover

Click here for further reading

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



"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

Stair Nosings: Slip Resistance

Click here for further reading

» Accepted slip resistance criteria (BS8300:2009+A1:2010 & HSE Publication)

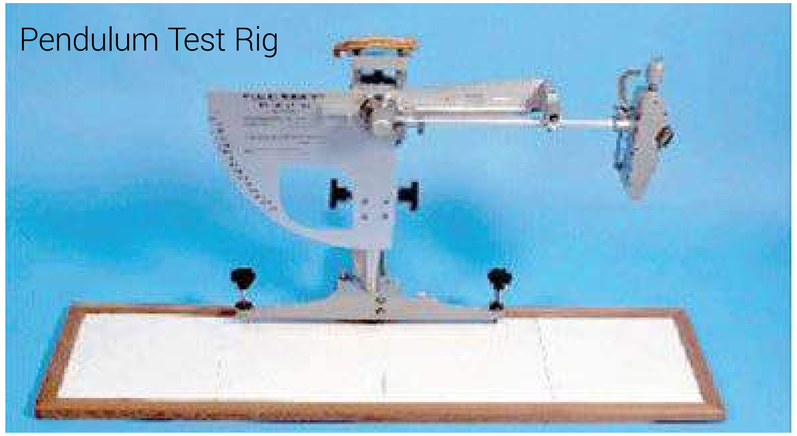
Slip Potential	Pendulum Test* Values
High Slip Potential	0–24
Moderate Slip Potential	25–35
Low Slip Potential	36 + (minimum requirement)

* 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.

Pendulum Test Rig



Microroughness Meter

Lighting

Clearly identifies steps on stairs

MAIN REASONS TO CONSIDER LIGHTING:

» Good lighting = steps clear to see.

» Bad lighting = shadows and poor visibility.

Good lighting = safer stair

Lighting

Click here for further reading

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.

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.

Clean & maintained = safer stair

Cleaning and Maintenance

Click here for further reading

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.

Cleaning and Maintenance

Click here for further reading

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.

Summary

Click here for further reading

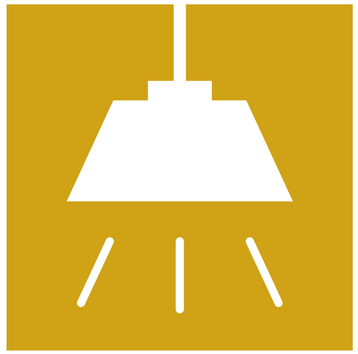
A LOT OF ACCIDENTS OCCUR ON STAIRS

Attention to five key aspects = safer stairs

Step Dimensions: consistency, going, rise

Handrails: height, perimeter, shape, clearance, continuity

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



Lighting: levels, contrast, avoid shadows and glare

Cleaning and Maintenance: inspect, clean, maintain, repair

Further Reading

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	Lighting	Cleaning and Maintenance
1	BS5395.1:2010. *Stairs – part 1: Code of practice for the design of stairs with straight flights and winders.*	✔	✔	✔	✔	
2	BS8300:2009+A1:2010. *Design of Buildings and their approaches to meet the needs of disabled people. Code of Practice.*	✔	✔	✔	✔	
3	BS8493:2008+A1:2010. *Light Reflectance Value – method of test.*		✔	✔		
4	BS9266:2013. *Design of Accessible and Adaptable General Needs Housing.*	✔	✔	✔	✔	
5	Building Regulation Document K. *Protection from Falling,* 2013.	✔	✔	✔		
6	Building Regulation Document M. *Access to and use of Buildings,* 2013.	✔	✔	✔		
7	CIRIA C722. *Safer Stairs in Public Places – Assessment of Existing Stairs,* 2013.	✔	✔	✔	✔	
8	Alderson A. *Stairs, ramps and escalators – RIBA publication in conjunction with Centre for Accessible Environment (CAE),* 2010.	✔	✔	✔	✔	✔

Further Reading

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	Lighting	Cleaning and Maintenance
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.		✔	✔	✔	
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.*			✔		
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			✔		✔

Further Reading

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	Lighting	Cleaning and Maintenance
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.	✔	✔	✔	✔	
20	Quantum Flooring Solutions. *Creating a Safe Stairway through Correct Stair Nosing specification,* 2016.			✔		

Further Reading

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	Lighting	Cleaning and Maintenance
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.	✔		✔		
24	Roys, M. *FB53 Refurbishing stairs in dwellings to reduce the risk of falls and injuries,* 2013.	✔	✔		✔	✔
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.	✔	✔	✔	✔	
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.		✔			

Further Reading

No.	Reference/Link	Step Dimensions	Handrails	Proprietary Stair Nosings	Lighting	Cleaning and Maintenance
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 Conference,* 2012. pp 56-61.	✔	✔	✔	✔	
30	Workplace Health, Safety & Welfare Regulations, 1992 and Approved Code of Practice & Guidance. (www.hse.gov/pubns). HSE Publication – a short guide for managers. 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.

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