



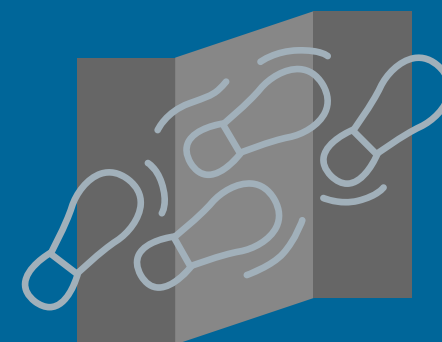
What Makes Stairs Safer?

An overview of key aspects
for safe internal stairs

APRIL 2016

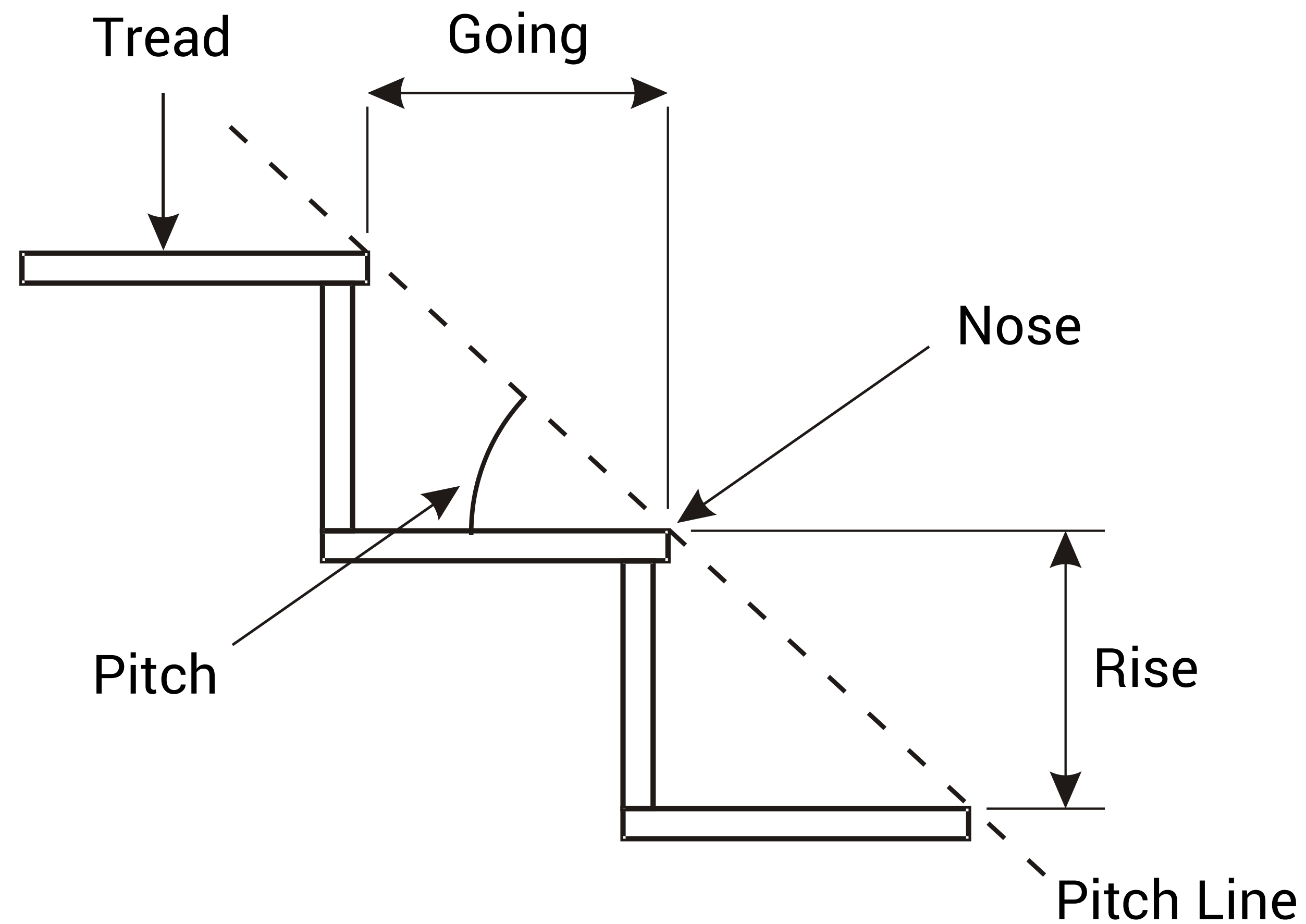
UK SLIP RESISTANCE GROUP

The UK's independent authority on slip resistance



www.ukslipresistance.org.uk

Stairs: The terminology



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

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

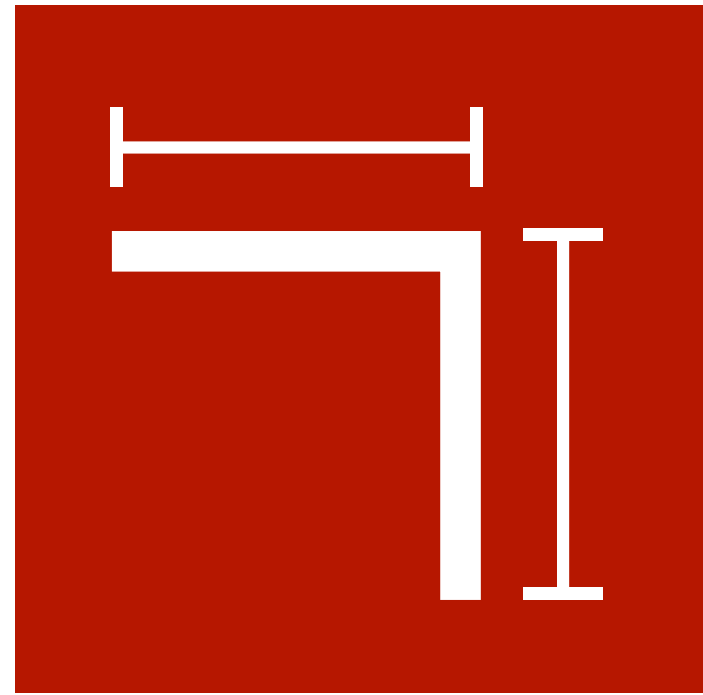
CAN ANYTHING BE DONE?

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

See further reading for more details.

Why do people slip on stairs?

WHAT IS IMPORTANT?



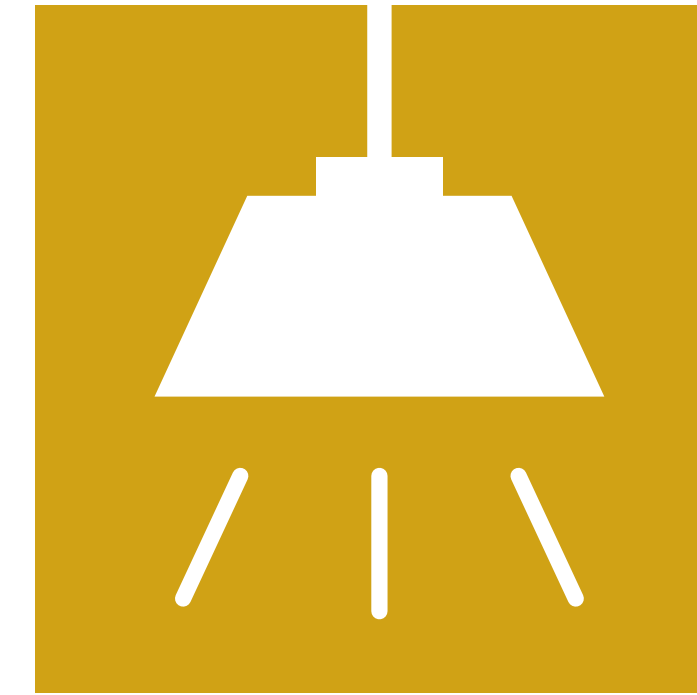
Size and
Consistency of
Step Dimensions



Proprietary
Stair Nosings



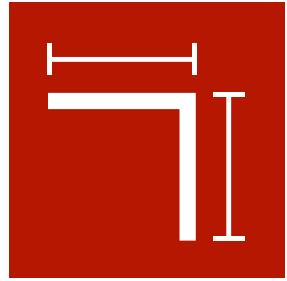
Handrails



Lighting



Cleaning and
Maintenance

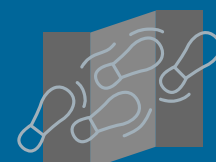
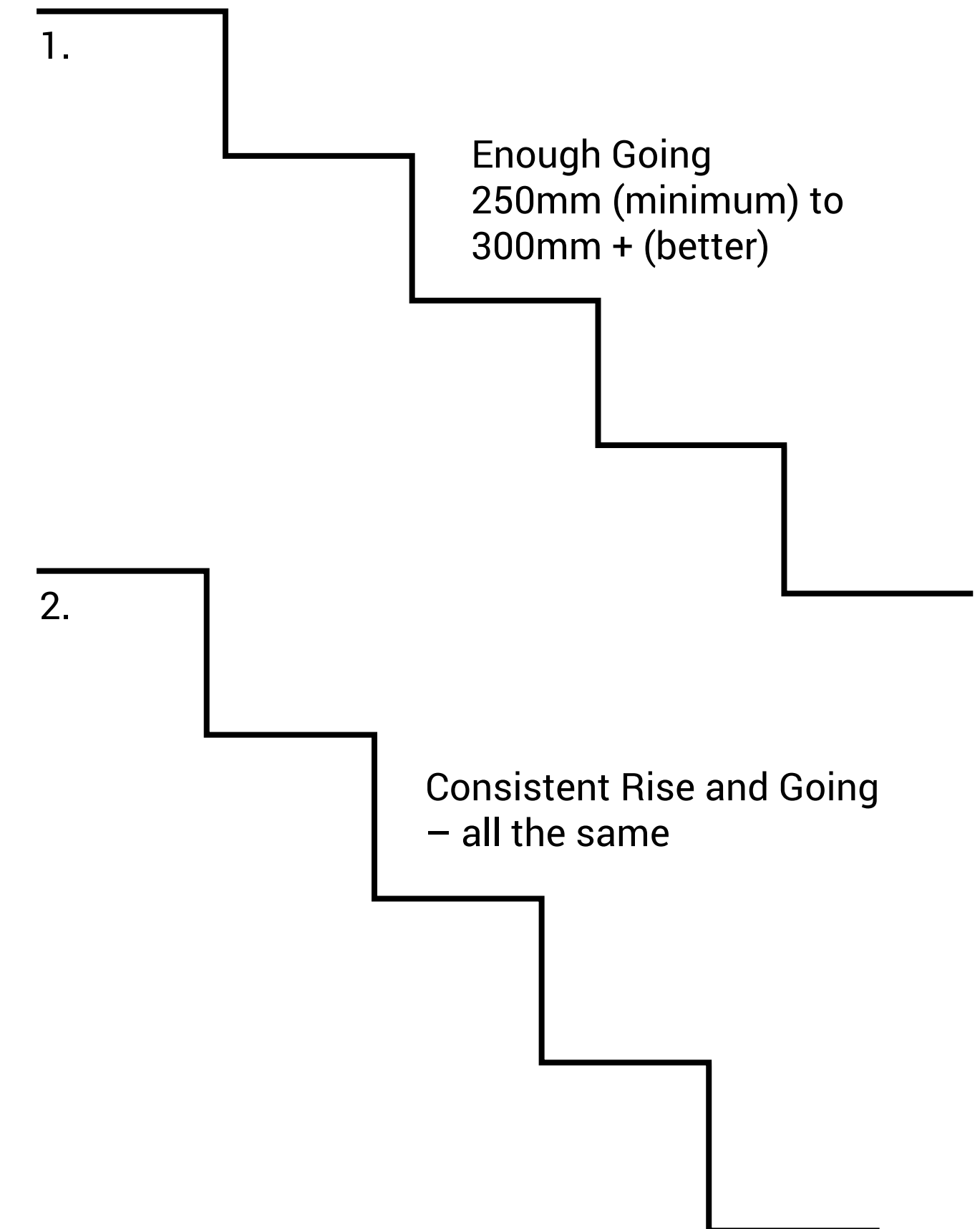


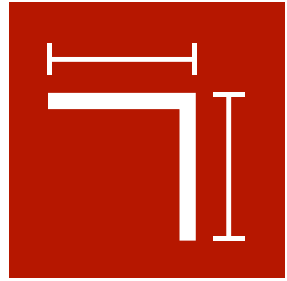
Step Dimensions

**Adequate and consistent step dimensions
reduce risk**

TWO KEY ELEMENTS TO CONSIDER

- » Size of dimensions - larger goings and easier rises.
- » Consistency of dimensions (rise and going) – on every step.



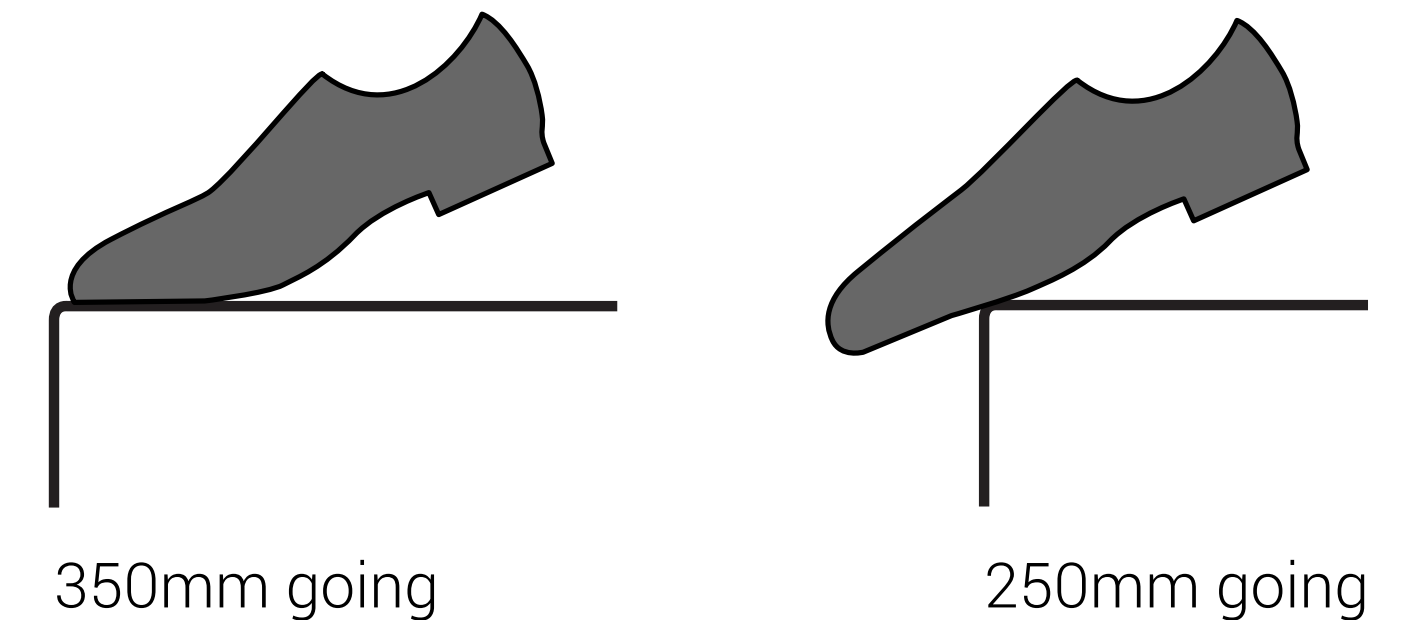


Step Dimensions: The Risk

CONSISTENT GOINGS BETWEEN STEPS - 14 STEP FLIGHT

Going (mm)	Average time between occurrences of a large overstep *			
	5 uses a day	25 uses a day	100 uses a day	2,000 uses a day
225	4 years	298 days	75 days	4 days
250	11 years	2 years	198 days	10 days
275	145 years	29 years	7 years	133 days
300	>1,000 years	>1,000 years	>1,000 years	73 years
325	>100,000 years	>1,000 years	>1,000 years	568 years

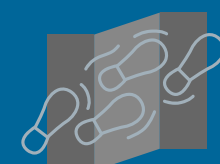
* Note: An overstep is a misstep where a large proportion (50%) of the foot is hanging over the edge of the nosing in descent. Undetected variations in step dimensions can also cause stumbles in ascent.

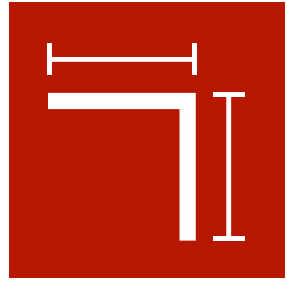


Position of 300 mm (size 9) shoe on stairs with 350 mm and 250 mm goings

**Larger going
= safer stair**

IP 15/03





Step Dimensions: Consistency

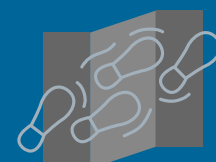
A SINGLE GOING REDUCED BY 15mm - 14 STEP FLIGHT

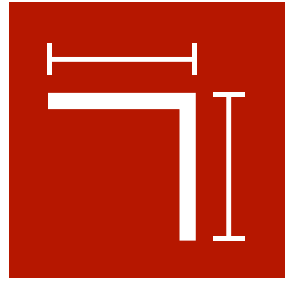
Going (mm)	Average time between occurrences of a large overstep			
	5 uses a day	25 uses a day	100 uses a day	2,000 uses a day
225	292 days	58 days	15 days	1 day
250	2 years	131 days	33 days	2 days
275	15 years	3 years	282 days	14 days
300	>1,000 years	267 years	67 years	3 years
325	>1,000 years	>1,000 years	381 years	19 years

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

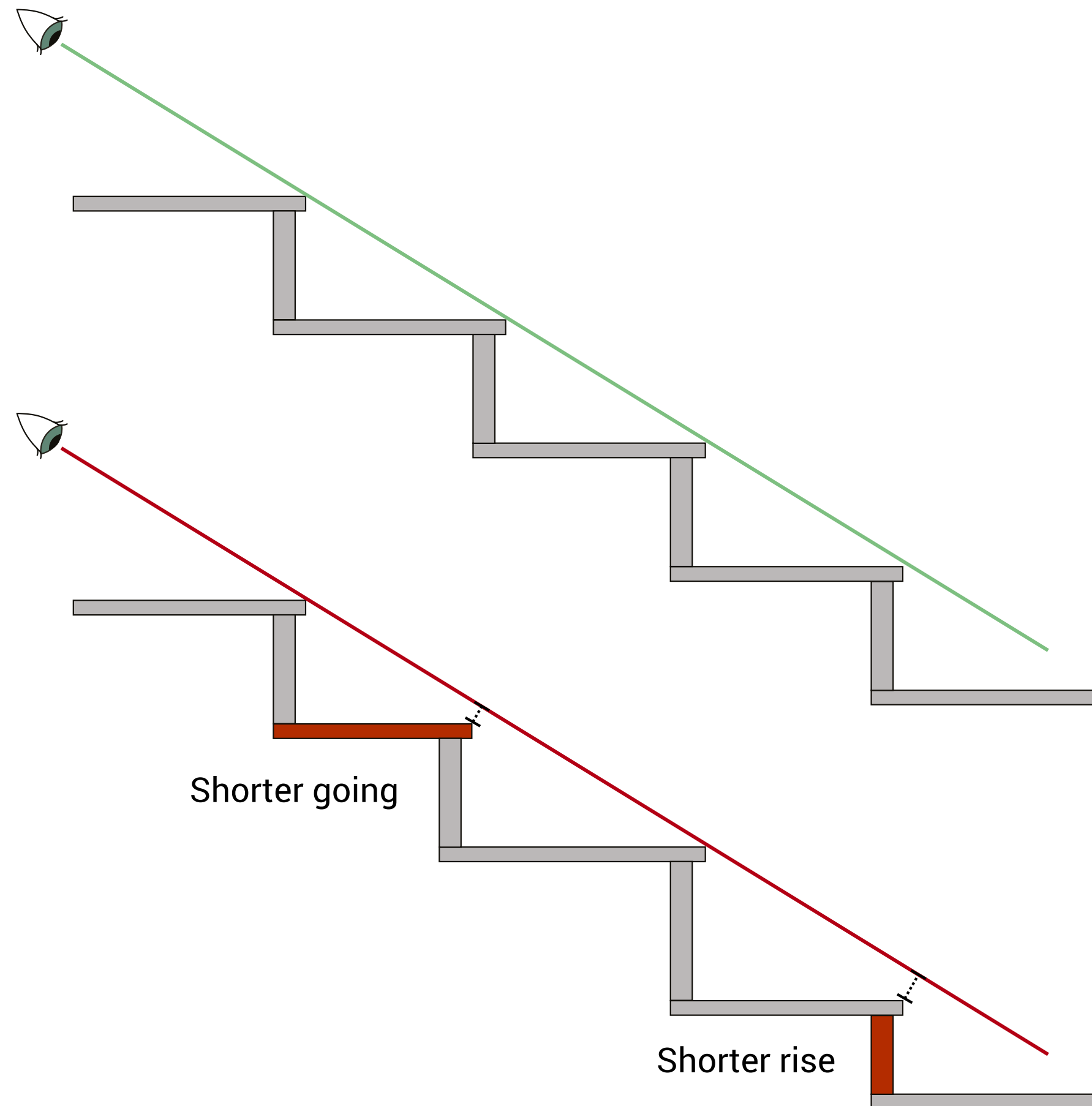
**Consistent going
= safer stair**

IP 15/03



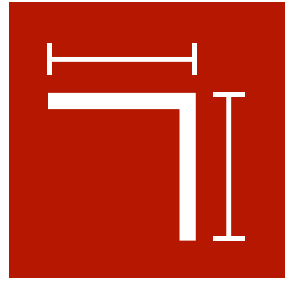


Crouch and Sight Test



Quick simple test – good indication.

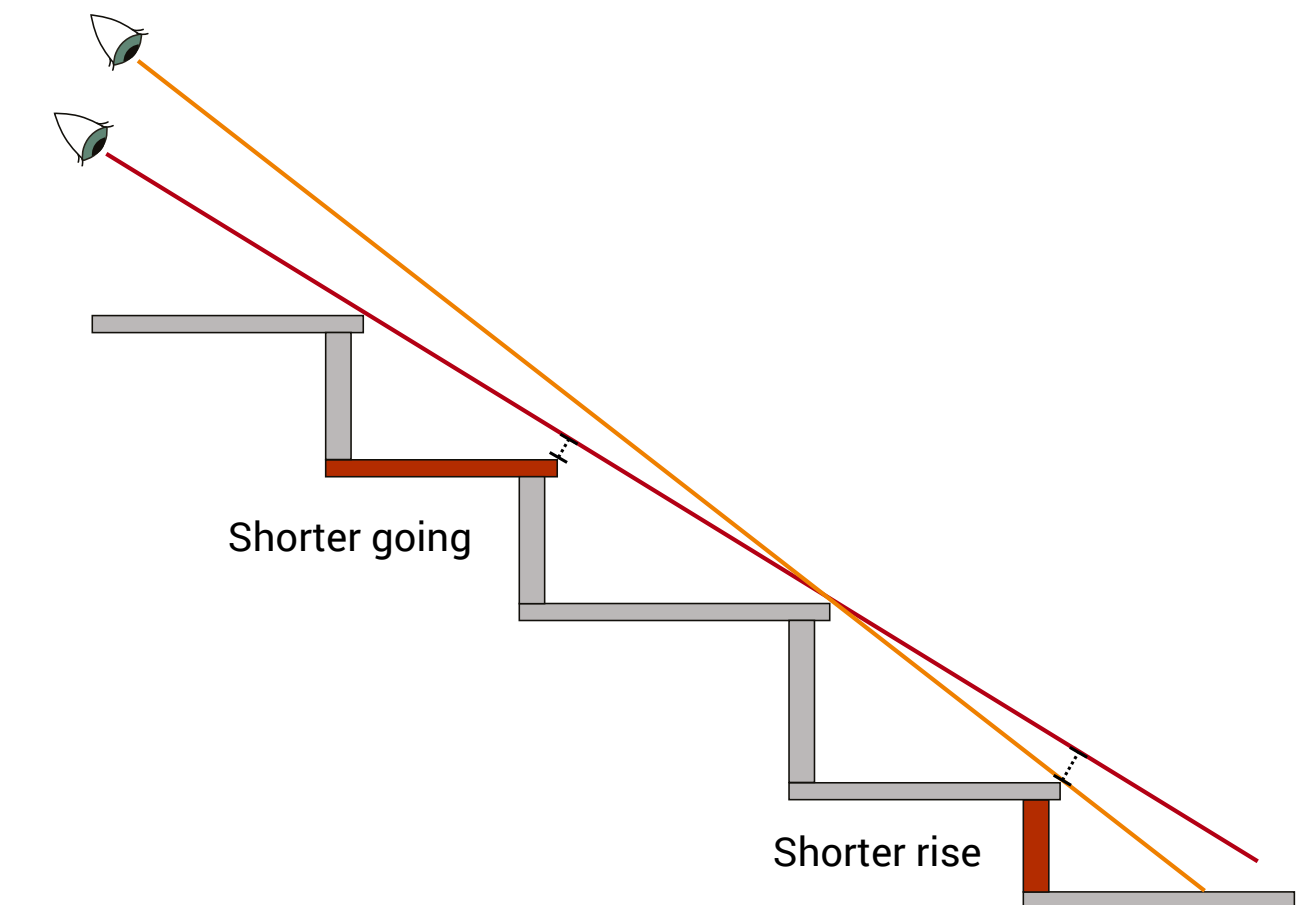
Measurement of step dimensions (rise and going) is needed to be certain.



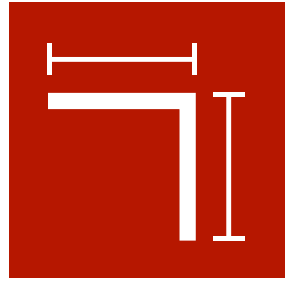
Variation in Going



A variation in going can be seen from the landing.



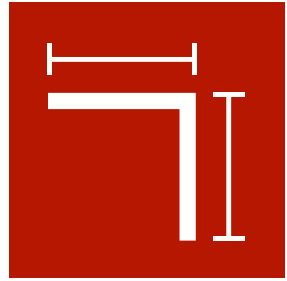
By moving eye position up and down variations will become evident.



Variation in Rise



A variation in the rise heights can be seen from the bottom of the stairs.

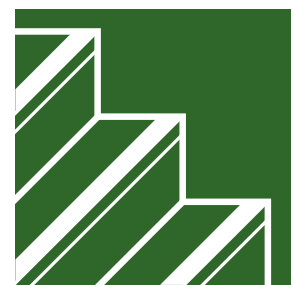


Variation?



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.



Proprietary Stair Nosings

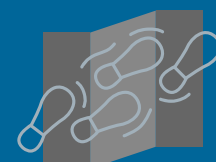
Define and protect the nose of steps

FEATURES TO CONSIDER

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



**Good stair nosing
selection = safer stair**





Stair Nosings: Dimensions

GUIDELINE DIMENSIONS

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

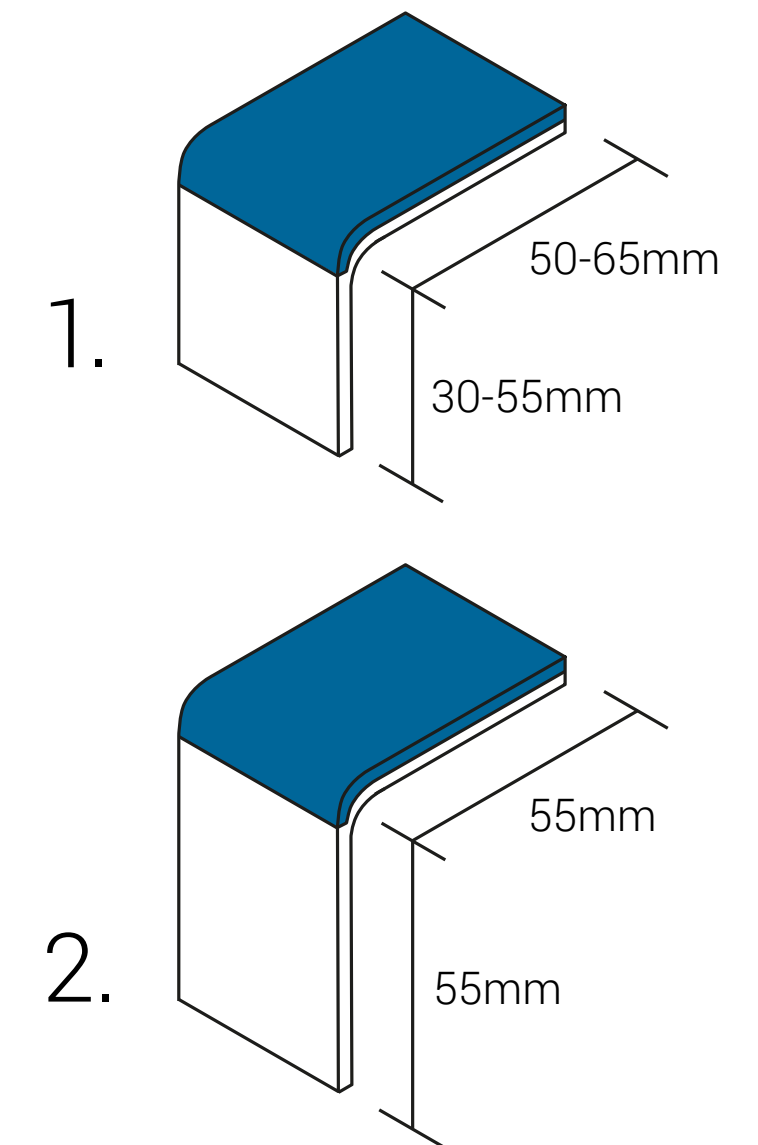
1. Stair nosing dimensions should be between 50-65mm across the tread, and between 30-55mm on the riser.

BR Approved Document K (2013) & BR Approved Document M (2004+2010 & 2013)

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

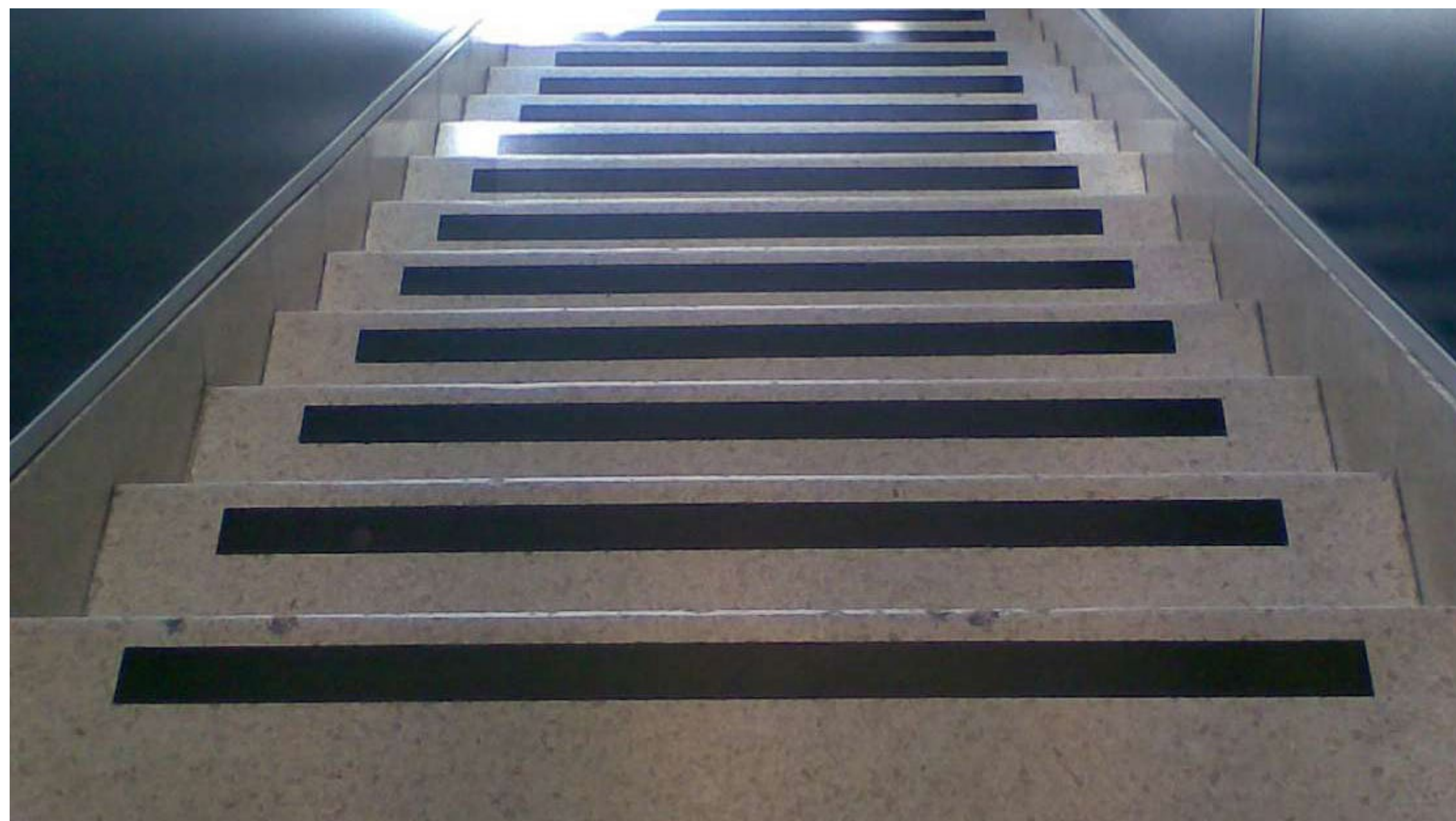
This apparent difference can be reconciled by specifiers and contractors since both sets of guidance are correct. The principle requirement is that the nose of a step is clearly defined, and a proprietary stair nosing with any of these dimensions can achieve this.

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





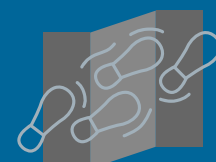
Stair Nosings: Position

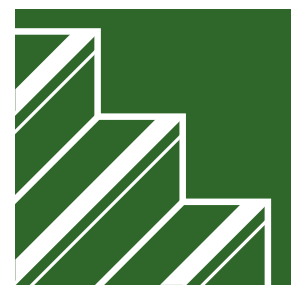


POOR POSITION - Does not define step nose



GOOD POSITION - Clearly defines step nose





Stair Nosings: Shapes

THERE ARE THREE TRADITIONAL SHAPES THAT FIT MOST STEP NOSE PROFILES



Flat / Straight /Square



Rake Back



Bullnose



Stair Nosings: Visibility and Contrast



EFFECTIVE



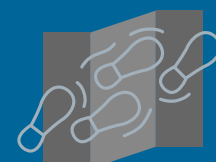
INEFFECTIVE



Stair Nosings: Steps not identified without them!



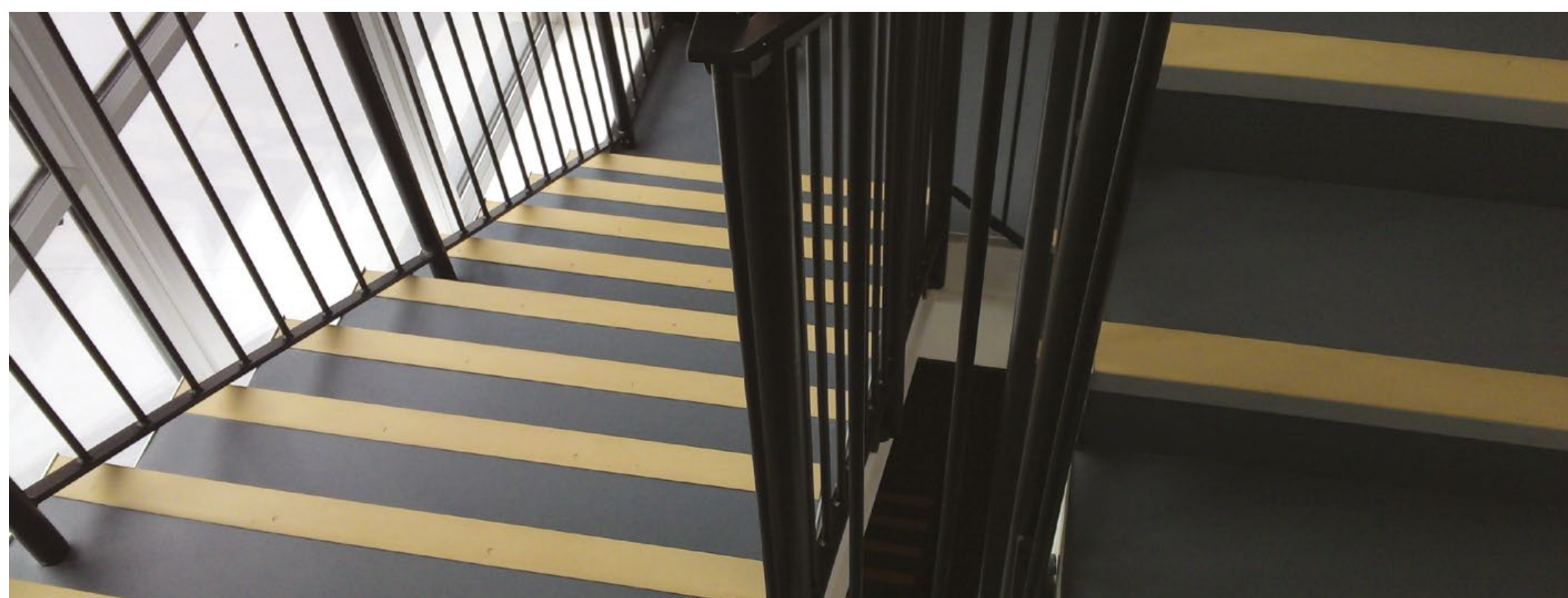
AIM IS TO CONSISTENTLY IDENTIFY THE NOSE OF THE STEPS



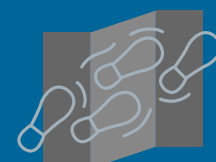


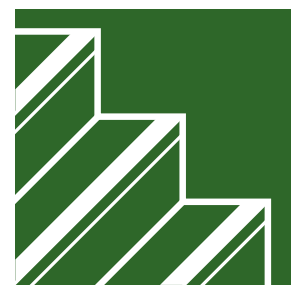
Stair Nosings: Light Reflectance Values

- » The proprietary stair nosing tread and riser colour should be selected to differ in LRV when compared to the stair floorcovering material.
- » Avoid floorcoverings with heavy bold patterns or stripes.



BS 8300 states that the nosing on steps *“should contrast in colour and luminance with the remainder of the respective tread.”*



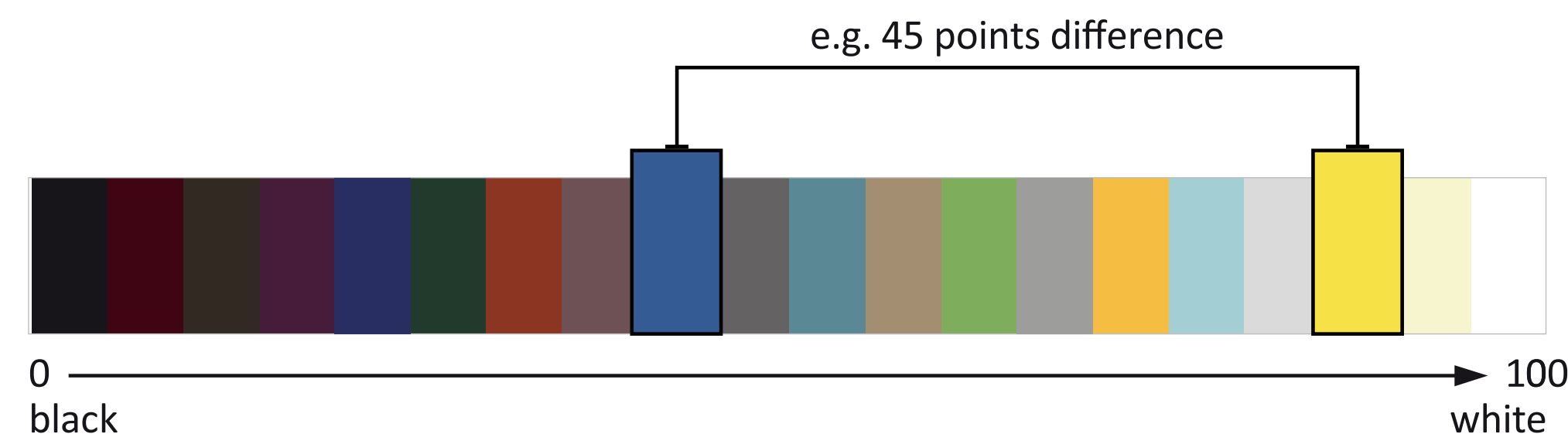


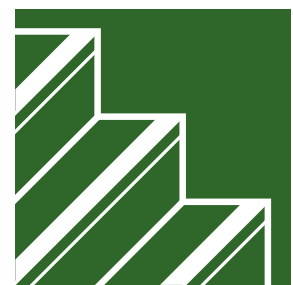
Stair Nosings: Light Reflectance Values

- » 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).
- » Black is 0 – White 100.



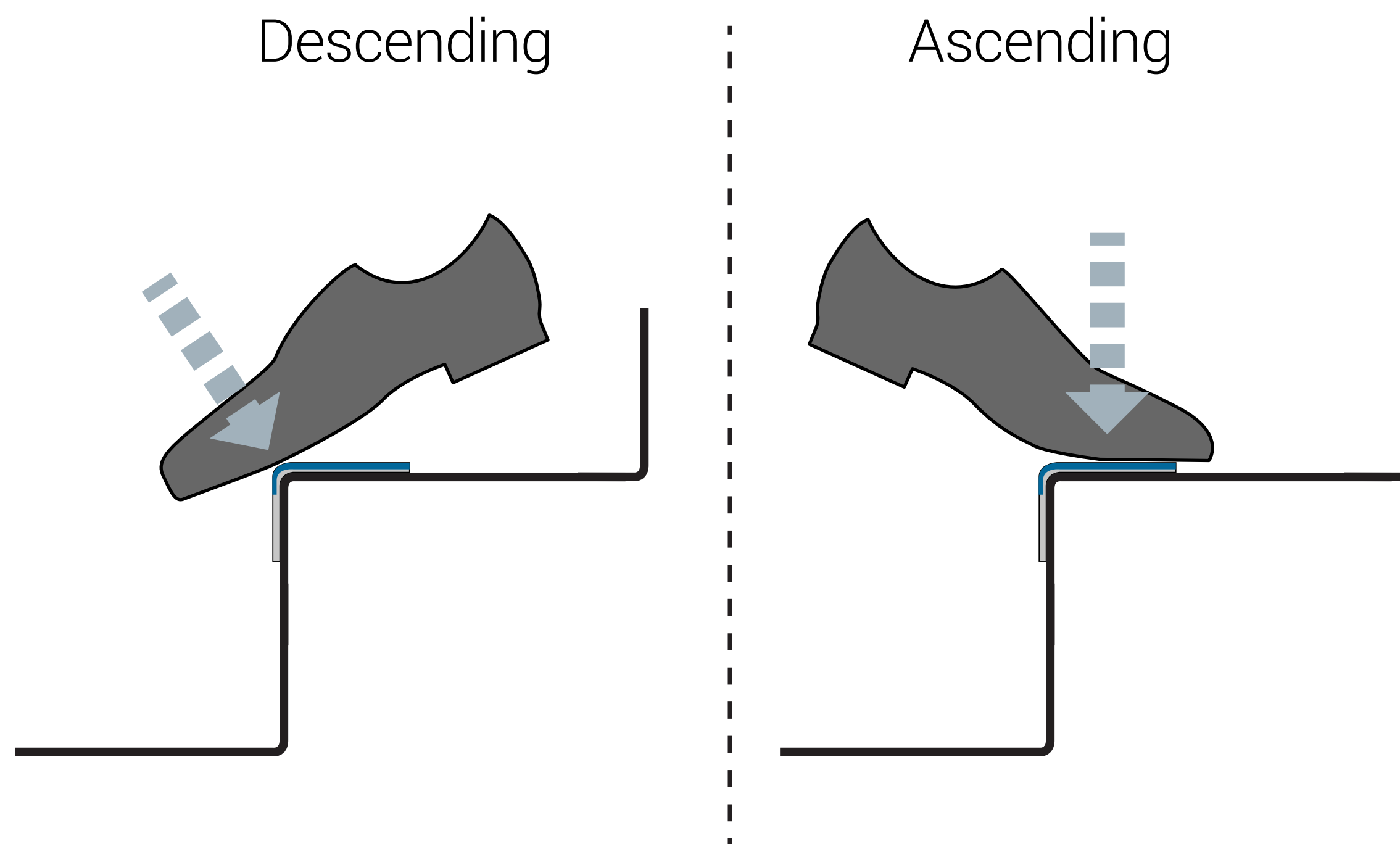
- » An acceptable visual contrast is achieved when the difference in light reflectance value between the two surfaces is greater than 30 points.





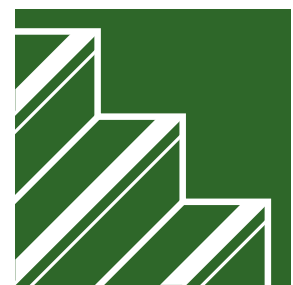
Stair Nosings: Tread Cover & Slip Resistance

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



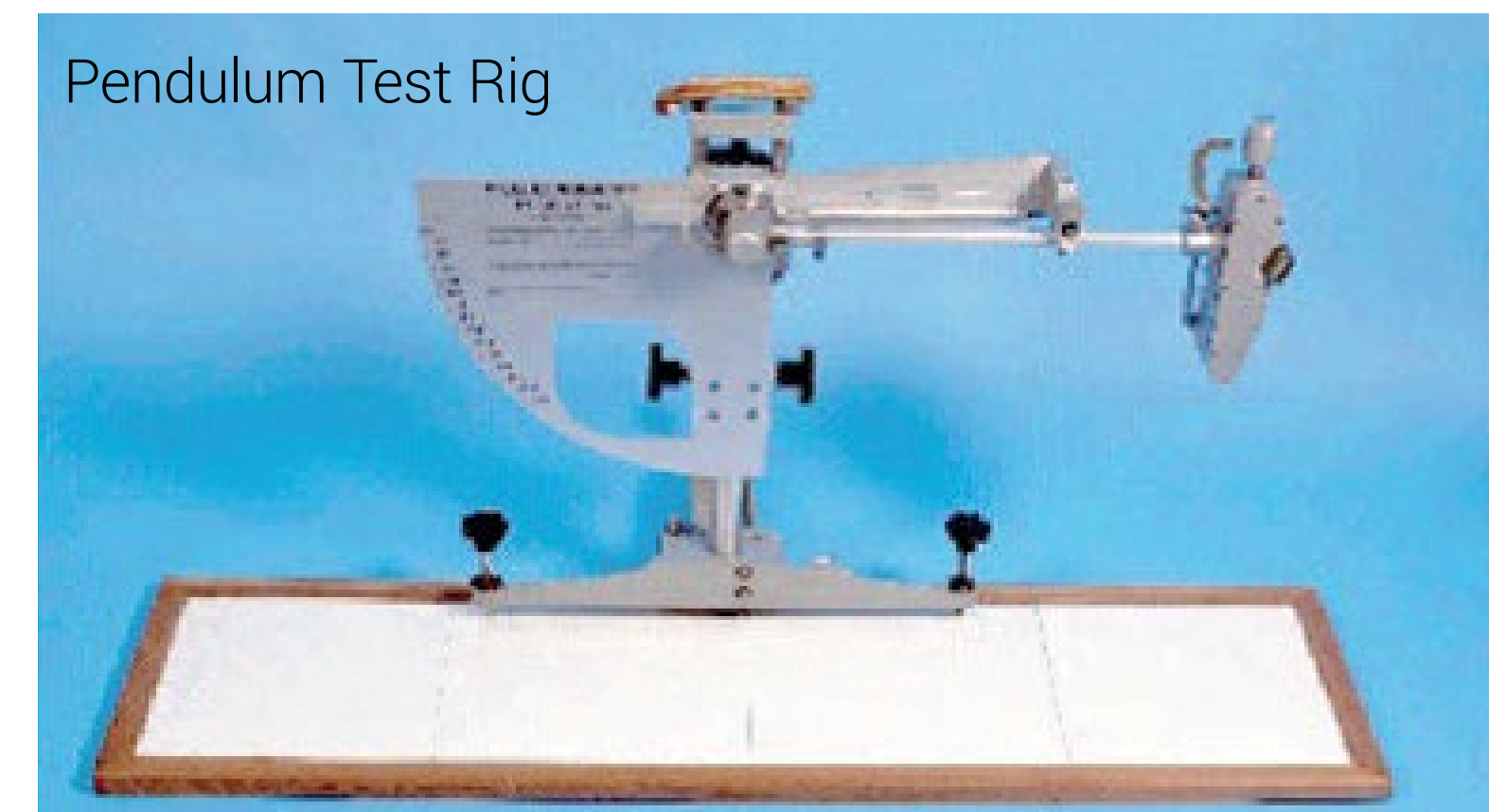
Stair Nosings: Tread Cover & Slip Resistance

- » 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 μ is 'Low Slip' potential. A variation in roughness between the nosings on the walking line and at the edge of the steps, could indicate a change in the risk of slip resistance compared to laboratory conditions.

- » These are guidelines - the priority being that there should be adequate slip resistance for the foreseeable conditions.
- » Where conditions are wet or contaminants (e.g. grease/ oil) are present, tread material that is suitable for the conditions with a minimum PTV value of 36 should be selected. Regular cleaning will ensure slip resistance properties are maintained.



Pendulum Test Rig





Handrails

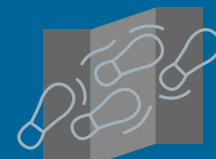
Assistance and stability when negotiating stairs

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 handrails
= safer stair**

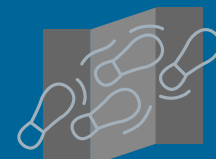
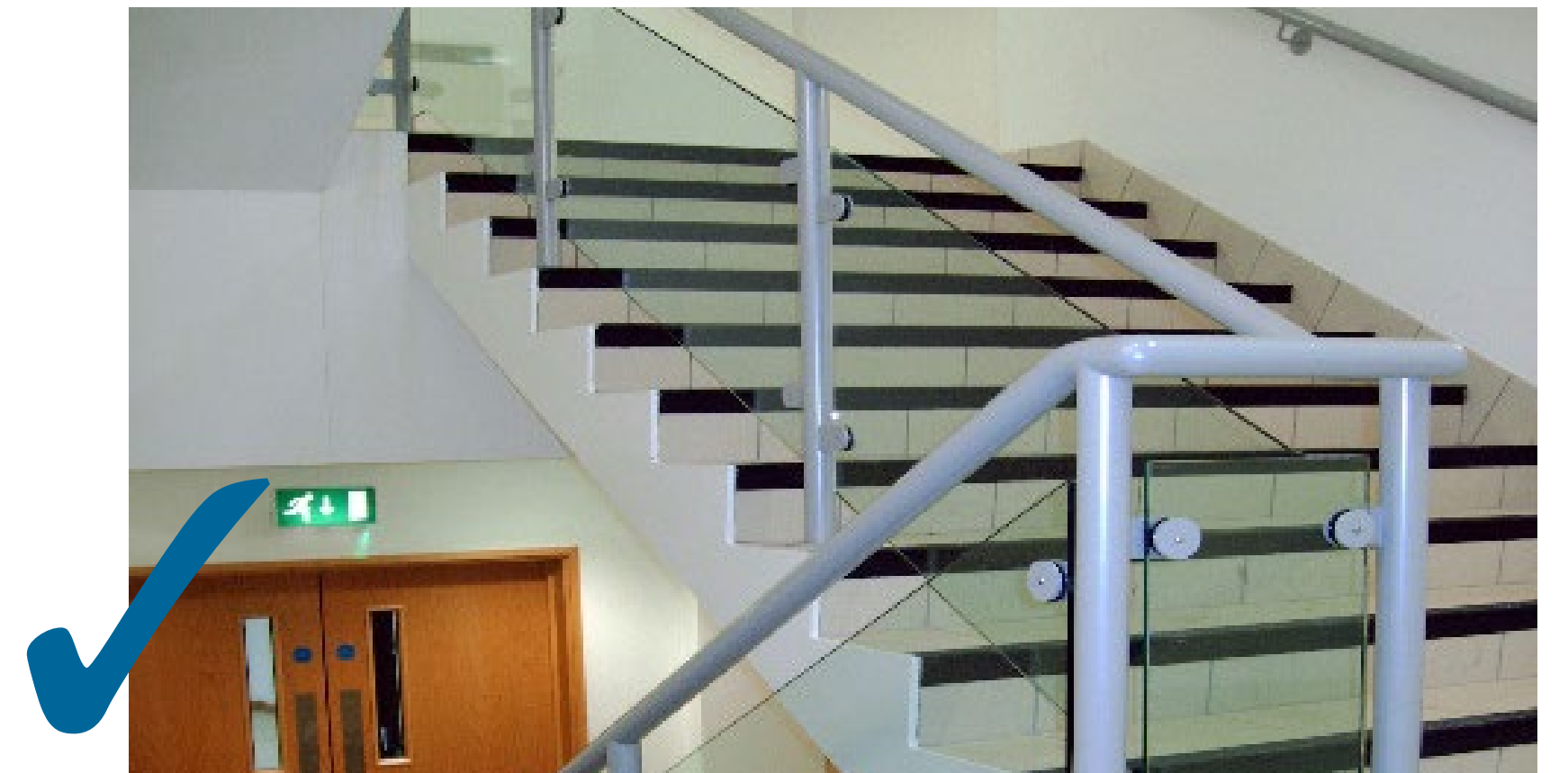




Handrails

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.
- » Be of the right size to be 'graspable'.





Handrails

DETAILS TO CONSIDER

- » Ideal shape is round.
- » Perimeter 100 - 160 mm.
- » Diameter 32 - 50 mm.

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

Allows a powergrip



No power grip

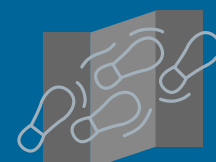
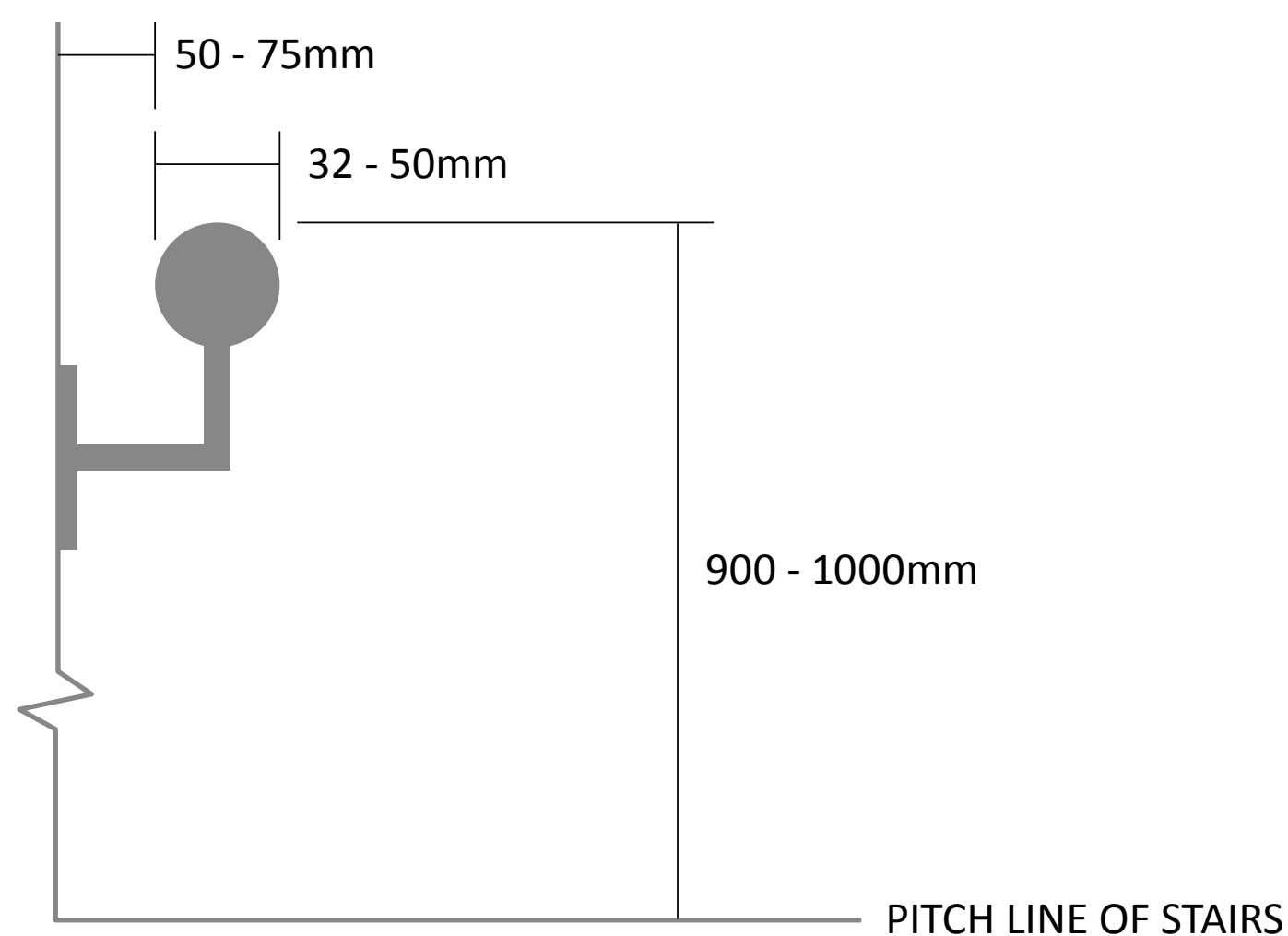


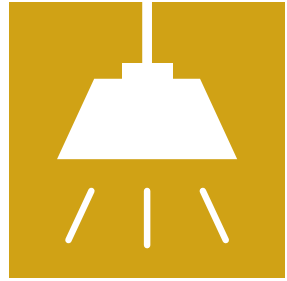


Handrails

DETAILS TO CONSIDER

- » Continuous.
- » Clearance 50 - 75 mm.





Lighting

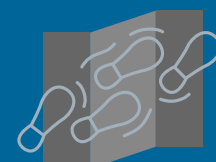
Clearly identifies steps on stairs

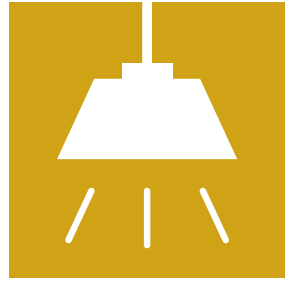
MAIN REASONS TO CONSIDER LIGHTING:

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



**Good lighting
= safer stair**





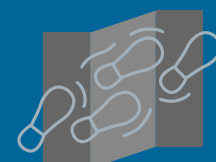
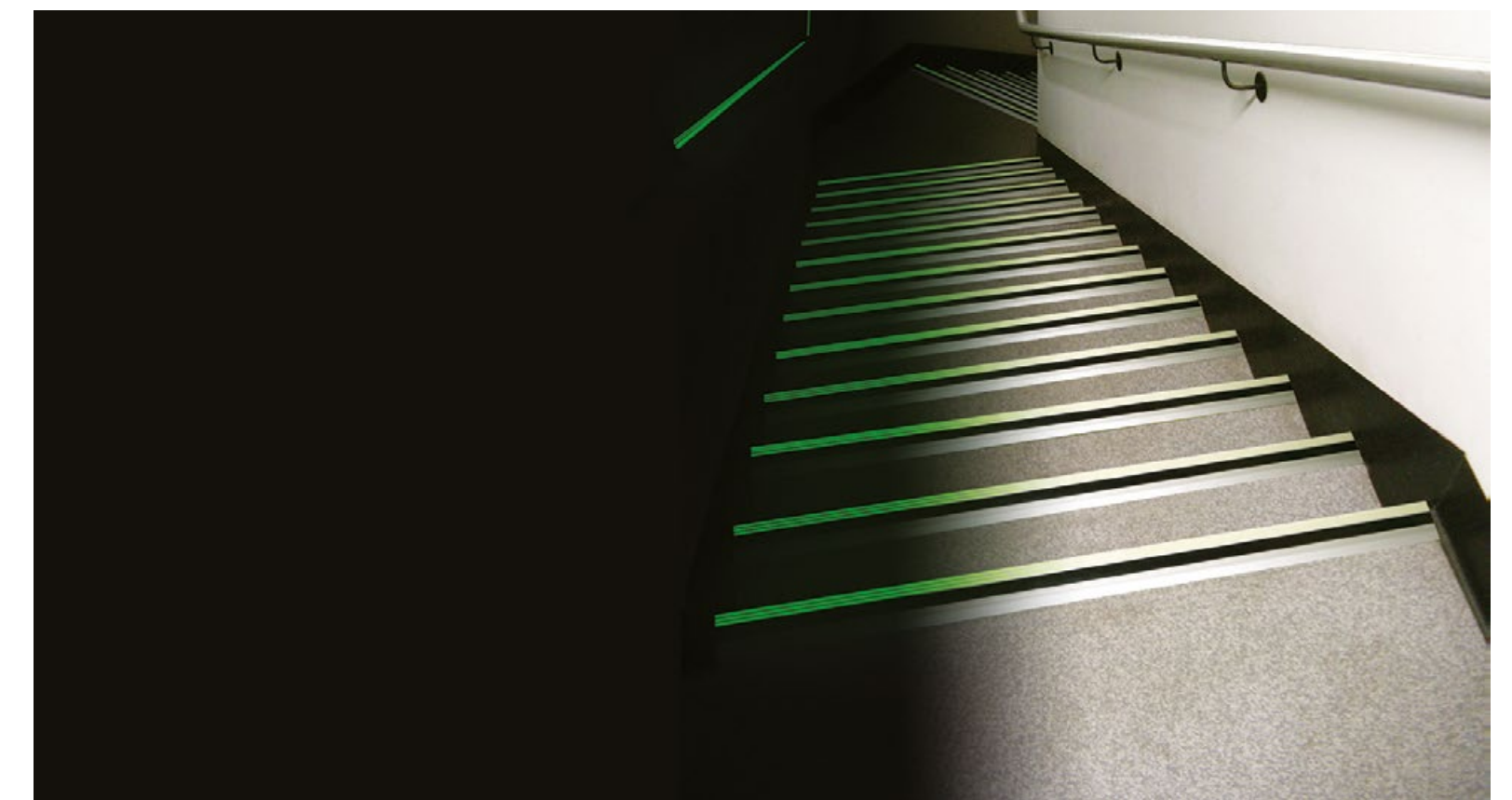
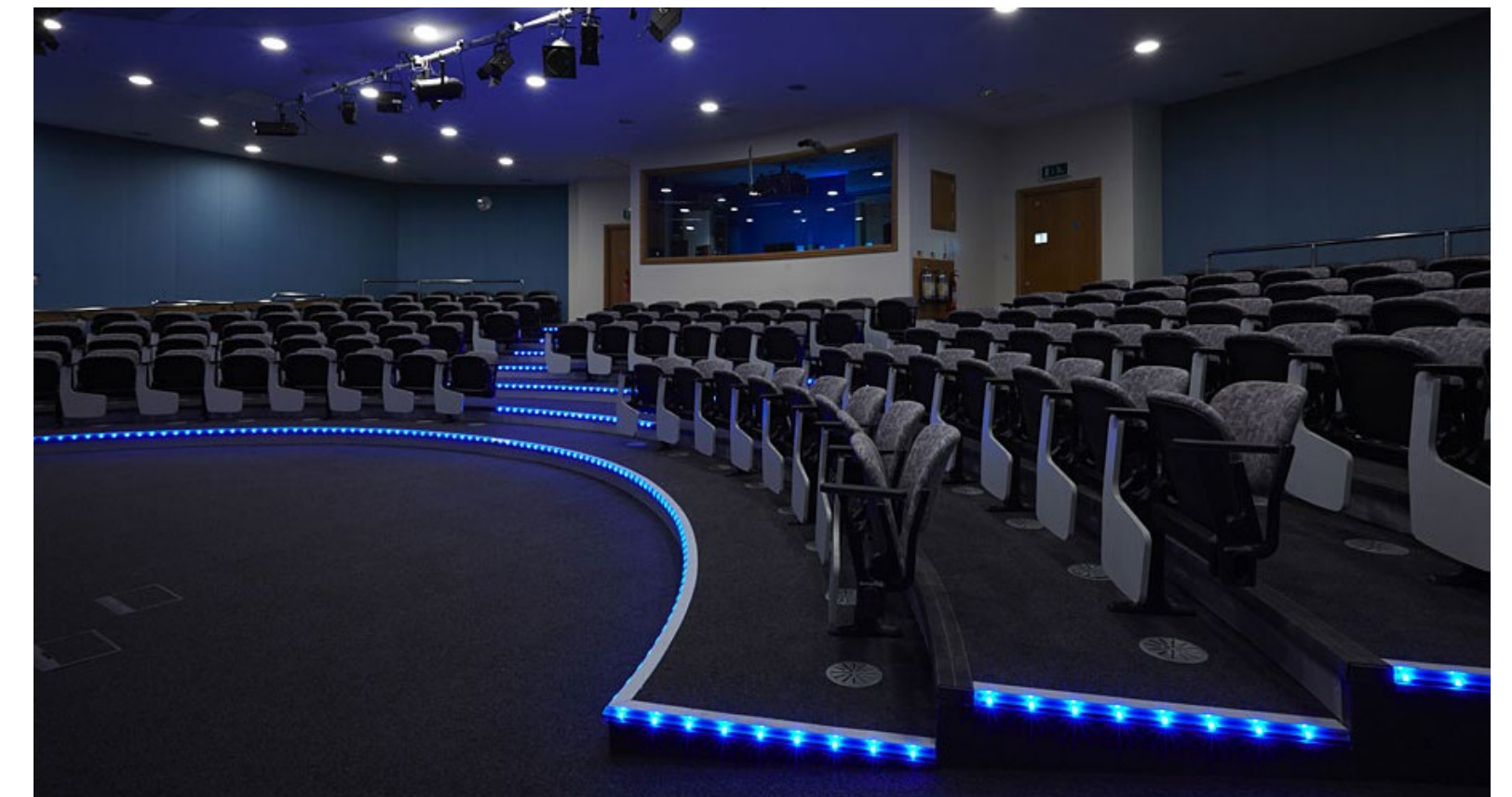
Lighting

FEATURES TO CONSIDER

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

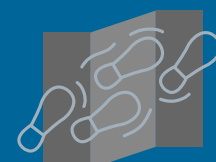
Reduces risk of accidents

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**





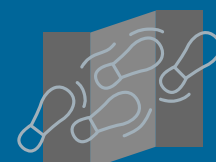
Cleaning and Maintenance

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

- » Polishings/ coatings/ steam cleaners/ power washers.





Cleaning and Maintenance

REPAIR OR REPLACE

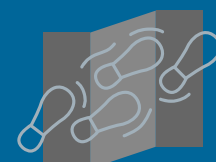
- » Carpets, handrails and stair nosings if damaged or loose.
- » Non-functioning light bulbs / tubes / LEDs.

KEEP STAIRWAY CLEAR

- » No obstacles to trip over.

ENTRANCE MATTING SYSTEMS

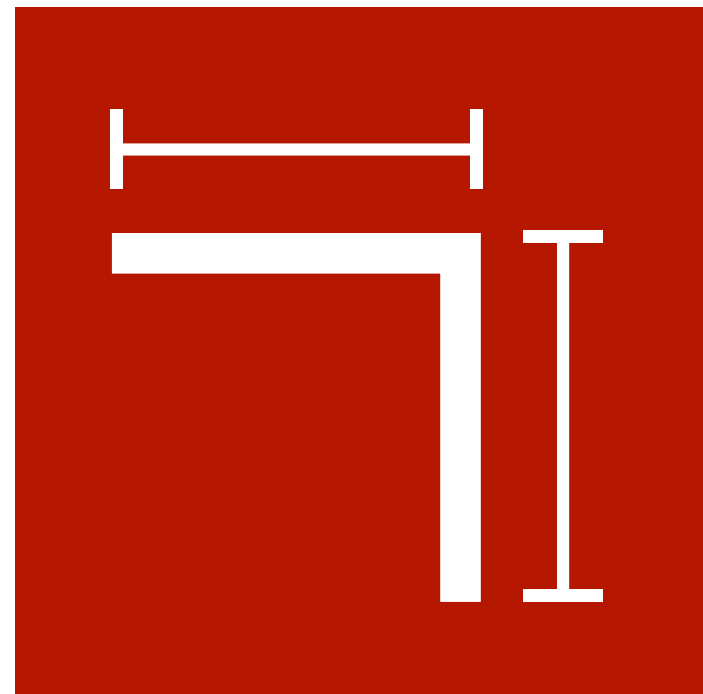
- » At entrances to stair hallways entrance mats reduce the risk of water and debris transfer from footwear and wheel chairs.



Summary

A LOT OF ACCIDENTS OCCUR ON STAIRS

Attention to five key aspects = safer stairs



Step Dimensions:
consistency,
going, rise



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



Handrails:
height, perimeter,
shape, clearance,
continuity



Lighting:
levels, contrast,
avoid shadows
and glare



**Cleaning and
Maintenance:**
inspect, clean,
maintain, repair

Further Reading

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

Further Reading

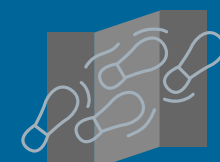
No.	Reference/Link	 Step Dimensions	 Proprietary Stair Nosings	 Handrails	 Lighting	 Cleaning and Maintenance
9	Cohen, J et al. <i>Stairway Falls: An Ergonomic Analysis of 80 cases</i> . Professional Safety, 2009. vol.54 no.1 pp 27-41.	✓				
10	Cook, G et al. <i>The Colour Light and Contrast Manual - designing and managing inclusive building environments</i> , 2010.		✓	✓	✓	
11	Edwards, Dr. N et al. <i>Steps to Safer Stairs</i> . Community of Health Research Unit University of Ottawa. Access online.	✓	✓	✓	✓	
12	Feeney, R J et al. <i>BR260 Safety Aspects of Handrail Design: a review</i> . BRE Publications, 1994.			✓		
13	Gradus Ltd. <i>Flooring Accessories in Public Buildings and</i> www.createsafestairs.uk .		✓			
14	Health and Safety Executive (HSE). <i>Assessing the slip resistance of flooring - a technical information sheet</i> . 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	 Proprietary Stair Nosings	 Handrails	 Lighting	 Cleaning and Maintenance
15	Johnson, D A et al. <i>Systemic Stair Step Geometry Defects, Increased Injuries Public Health Regulatory Responses</i> , 2010. Contemporary Ergonomics and Human Factors pp 453-461.	✓				
16	Maki, B E et al. <i>Getting a grip on stairs; research to optimise effectiveness of handrails</i> , 2006. Proceedings of the IEA 2006 Congress: Meeting Diversity in Ergonomics pp 4669- 4674.			✓		
17	Muhaidat, J et al. <i>Measuring Foot placement and clearance during stair descent</i> , 2011. Gait and Posture vol.33 no.3 pp 504-506.	✓				
18	Nagata, H. <i>Evaluation of Safety Dimensions of Stairway</i> , 2006. International Ergonomics Association Paper 0763.	✓				
19	Pauls, J. <i>Introduction to Stairway Safety</i> , 2012-15. www.bldguse.com.	✓	✓	✓	✓	
20	Quantum Flooring Solutions. <i>Creating a Safe Stairway through Correct Stair Nosing specification</i> , 2016.		✓			

Further Reading

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



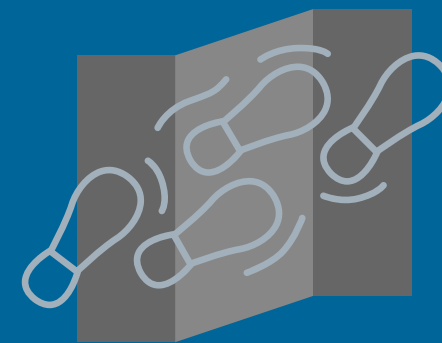
Further Reading

No.	Reference/Link	 Step Dimensions	 Proprietary Stair Nosings	 Handrails	 Lighting	 Cleaning and Maintenance
28	SSL:2006 <i>Society of Light and Lighting - Code for Lighting</i> . www.cibse.org/society-of-light-and-lighting .				✓	
29	Thorpe, S et al. <i>Investigating Stair Accidents: Proceedings of ISOES Conference</i> , 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 - Clealiness 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 Buildding 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.

UK SLIP RESISTANCE GROUP

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