



SPECIFYING FLOORING TO CREATE SAFER SPACES

A guide to minimise slip risks

Reviewed by Health and Safety Executive (HSE)*



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Common sense design – make a floor safe to walk on

Floors in public building and commercial premises have to be safe to walk on.

Preventing slips needs to be done in a holistic, common sense way. This starts with addressing issues at source rather than assuming that slips are inevitable. Designers need to consider layouts, pedestrian flows, grab rails, sources of lighting, glare in the context of human activity, risk of contamination, footwear and effective use of on-site professional cleaning resources.

When it comes to floors, a 36+ PTV / Pendulum Test Value is categorised as offering low slip risk for pedestrian traffic. This applies to dry areas as much as it does to wet areas. The Health and Safety Executive (HSE) presentation “Watch your Step. Controlling Slip and Trips Risks at work” emphasises:

“Floors with a coefficient of friction of 0.36 and above are regarded as safe to walk on for the vast majority of the working population.

Clean, dry floors generally have a CoF greater than 0.36. Employers should have a safety management system with controls in place to ensure that floors remain clean and dry as far as reasonably practicable.”¹

nora smooth resilient floors can be easier to clean and maintain than floor surfaces with a rougher surface texture and exceed the required slip resistance standard when uncontaminated. These characteristics make them a good choice for many clean and dry commercial settings. They can be used without limitation as long as occasional spillages are dealt with appropriately and promptly.

This guide provides a sensible approach to designing and maintaining safe resilient flooring in commercial and public buildings with recommended best practice.

A floor with a Pendulum Test Value of 36+ (PTV) is categorised as low slip risk for pedestrian traffic. This applies to dry areas as much as it does to wet areas.

Smooth resilient floors meet or exceed the required slip resistance standard, making them a suitable choice for dry, commercial and public settings.

Getting the specification right

The majority of floors in every day conditions are dry most of the time.

High quality smooth or moderately textured floors which offer low slip risk are a good choice for these areas.

Floors with increased surface roughness affect cleaning by:

- Taking extra time and/or effort to remove dirt from the floor
- Holding more cleaning solution even after the excess has been removed, which means residual dirt deposits can remain even after the water evaporates. This can only be prevented by additional cleaning to remove the solution completely and leave the floor dry.

A build-up of dirt or cleaning solution over time increases the

- > Risk of slipping
- > Cleaning costs which mount up over the lifetime of the floor

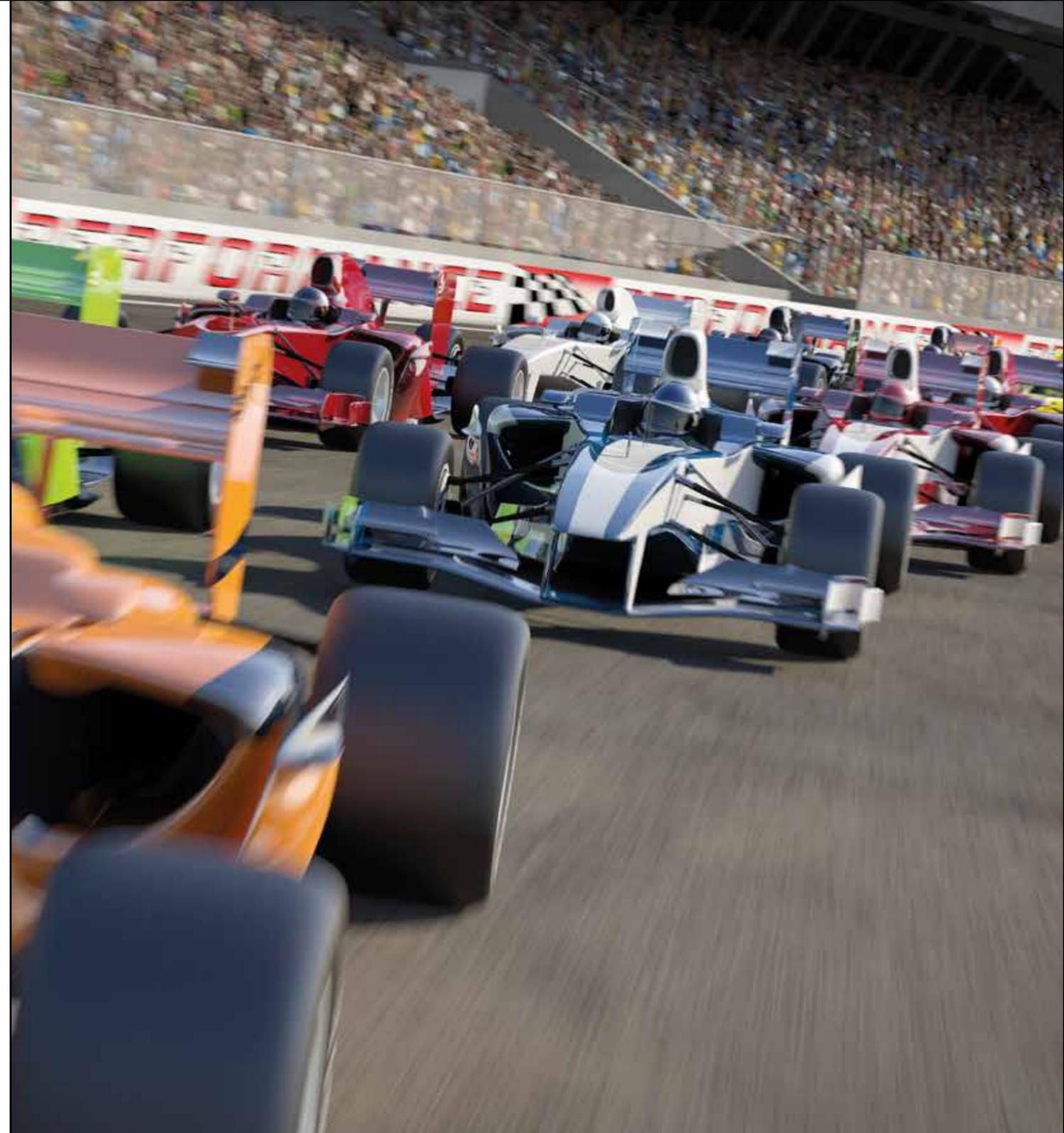
When specifying flooring, it is therefore sensible to choose the most practical and easy to maintain surface finish where housekeeping and cleaning regimes deal adequately with occasional spills.

When you consider that the lifecycle cost of any floor sees 10% of the total cost go to investment in the flooring with the remaining 90% attributed to cleaning and maintenance, choosing an inappropriate material can significantly increase overall costs^{2,3}.

With this in mind, selecting material that does not require stripping and re-coating, or flooring that does not need detergent for routine cleaning, can prove extremely cost effective in the long term.

When specifying flooring, be careful not to over specify where housekeeping and cleaning regimes deal adequately with occasional spills.

Specifying rough surfaces in areas that are predominantly clean and dry can add significant costs in terms of time, money and effort.



A smooth rubber floor finish will prevent slip issues occurring within clean, dry environments, just like a racing car's slick rubber tyres provide extra grip and traction on dry tracks. Racing tyres are made from a blend of rubber compounds. They are designed for high Coefficient of Friction (CoF) to offer the best possible grip and optimum hold when braking whilst withstanding wear and tear.

Good design, robust maintenance and common sense

To minimise slips risk, good design, robust maintenance and housekeeping is not only needed at entrances, but throughout the entire building.

The HSE information sheet on cleaning states that
“people rarely slip on a clean dry floor”.⁴

So, when designing or selecting flooring for a public or commercial building, contamination levels have to be considered. Where floors are going to be foreseeably contaminated due to the nature of the activity and it is not reasonably practicable to keep them dry, a floor should be provided which offers slip resistance of 36+ (PTV) or more in the contaminated state.

However, for general, every day areas that are dry and where occasional spillages are dealt with appropriately and effectively, nora smooth resilient flooring with slip resistance of 36+ (PTV) and over provides the same level of protection when dry.

Every day areas that are dry and where occasional spillages are dealt with appropriately and effectively, smooth resilient flooring with slip resistance of 36+(PTV) and over provides slip protection, just as a rough surface does in a wet area.



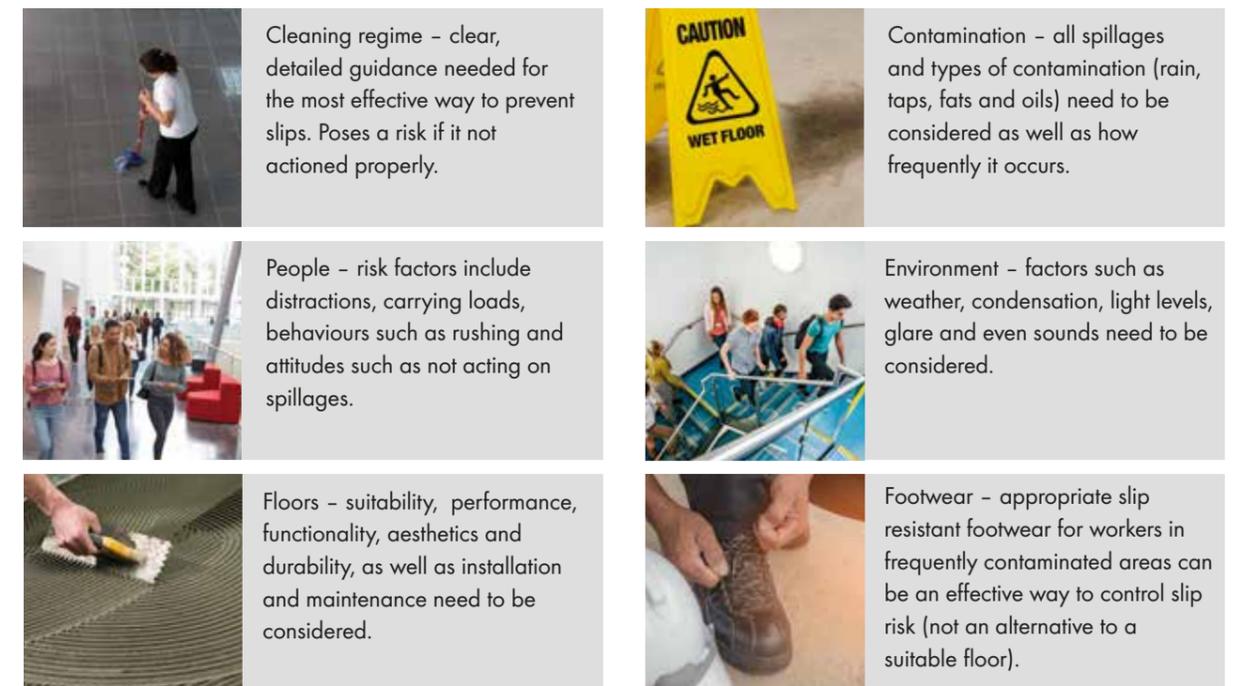
Photography: Klemens Ortmeier

To minimise slips and create safe places, design and good practice are needed in equal measure.

- Designers have choices to make such as layout, entrance design, grab rails, lighting (especially for stairs), light sources and glare and the right flooring suitable for the conditions of use. They need to establish whether an area is generally dry and uncontaminated or whether it is foreseeably contaminated and not reasonably practical to keep dry, which may be the case in kitchens, toilets and bathrooms.
- Building occupiers need to deal with in-use factors such as human behaviour, appropriate footwear, a culture of responsibility and to address risk factors as they arise. They have a duty to ensure an effective maintenance and housekeeping regime.

The HSE offers a sensible model to control the interacting risk factors as shown in figure 1.

Figure 1. HSE Slip Model.⁵



Safety, sustainability, budget and aesthetics are deciding factors for flooring.

Experts agree that flooring should not be specified on the basis of slip resistance alone. Wider consideration has to be given to other requirements including hygiene, aesthetics, cleanability and how cost-effective the floor is over its lifetime.

Understanding slip risk in contaminated areas

Contamination of flooring is the cause of most slips. Where a floor is likely to be subject to frequent contamination, people should still be able to walk on it without the risk of slipping.

The slip resistance must be tested under the conditions of use. HSE therefore recommends the use of a portable test instrument called a Pendulum Test which can be used on site (BS 7976-2 +A1:2013)⁶.

The test is based on swinging a slider over flooring to imitate a heel strike, the critical point for a slip accident. To accurately replicate the conditions on site, the test must be carried out in a controlled manner and adjusted as necessary. For example:

- The slider(s) used to simulate the heel strike needs to be selected to reflect if the area is used by barefoot or shoe-wearing pedestrians or both.
- The contamination agent used in the test needs to reflect the prevailing type of contamination (e.g. water, soapy water, oil, dust or none for dry areas).

The resulting pendulum test values are categorised by slip potential outlined in figure 2.

Figure 2. HSE Slip Potential / PTV results⁷

Slip Potential	Pendulum Test Value (PTV)
High	0 - 24
Moderate	25 - 35
Low	36+

Applying the test standard as intended, you may be surprised that smooth resilient floor with an R9 ramp test rating can produce PTV values that fall well within the low slip potential category. nora's smooth R9 and moderately textured R10 flooring produce a PTV of 63 to 75 in the dry. Given that the majority of floors in every day conditions are dry most of the time, the safest option could just be a smooth resilient floor.

Putting flooring to the test

Manufacturers often refer to different measurements because flooring is produced in different global regions, each with their own preferred measurement methods and standards.

The Health and Safety Laboratory (HSL), the UK Slip Resistance Group (UKSRG) and the British Standards Institution (BSI) compared different tests available to measure the slip resistance of flooring.

The Pendulum Test and a range of other prevalent slip resistance test methods and standards that are generally available in the UK are compared in Figure 3.

Choosing the right floor to prevent slip accidents means ensuring that the test result is relevant to the prevailing conditions of use.

Always check that 36+ (PTV) is achieved in the appropriate test conditions that reflect the area you are specifying for. Forget any preconceptions: the highest slip resistance in a dry area can be a smooth resilient floor offering the required slip resistance of 36+ (PTV), just as rough surfaces do in wet areas.



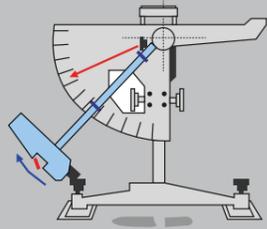
Measuring slip resistance

SLIP RESISTANCE TESTS

Figure 3: Slip resistance test: A comparison⁸

BRITISH / TRRL / PENDULUM TEST*

- Measures Coefficient of Friction (CoF)
- Subject to BS7976 part 1-2 2002



Imitation heel sweeps over an area (shod and barefoot, heel strike simulations)

Slip Potential	Pendulum Test Value (PTV)
High	0 - 24
Moderate	25 - 35
Low	36+

POSITIVE

- Can be used on site to test installed floors
- HSE considers it reliable for dry conditions and for wet and dry contaminants

NEGATIVE

- Must be operated and interpreted by a trained person
- Large heavy instrument

SURFACE MICROROUGHNESS METER

- Measures surface roughness for slipperiness in water contaminated areas
- Recommended for use in conjunction with pendulum test



Unit is put on the floor to measure the surface, whilst the accompanying handheld device displays the results

Slip potential in wet (water)	Rz Surface Roughness
High	<10μ
Moderate	10 - 20μ
Low	>20μ

POSITIVE

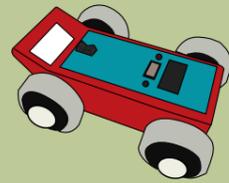
- Can be used on site to test installed floors
- Simple and quick
- Indicates slip resistance when a floor is contaminated (e.g. water)
- Monitor changes e.g. wear

NEGATIVE

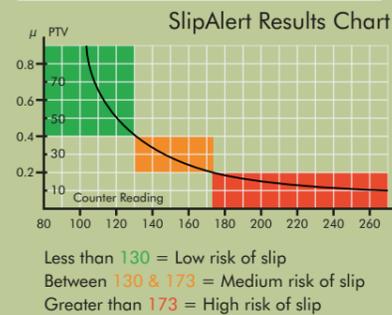
- Limitations mean that surface roughness measures should not be used alone for specification

ROLLER COASTER TEST

- Measures Coefficient of Friction (CoF)
- May be used in conjunction with pendulum test



A slider is mounted under a trolley. The trolley is released from a ramp to ride along the floor. The distance travelled is converted into a coefficient of friction (CoF).



POSITIVE

- SlipAlert is useful for simple CoF measurements (these closely match pendulum test predictions)
- Easy to operate
- Visual easy to understand readings

NEGATIVE

- Test does not reflect pedestrian traffic
- Cannot detect patchy performance / variations in slip resistance
- Measures should not be used alone for specification

RAMP TEST (HSL)

- Measures Coefficient of Friction (CoF)

Walk on ramp with increasing gradient to measure mean critical point of slip (water / standard sole or barefoot)

Table from BS 4592

CoF	Slip Resistance
<0.4	Unsuitable for foreseeable wet conditions
=>0.4	Suitable for use in wet conditions
=>0.6	Enhanced slip resistance - for use in areas where there is a higher friction demand

POSITIVE

- Simulate working conditions, person walking
- Good for working conditions with water contamination
- Can be done with different contaminants and footwear/barefoot

NEGATIVE

- Not portable, cannot be done on site

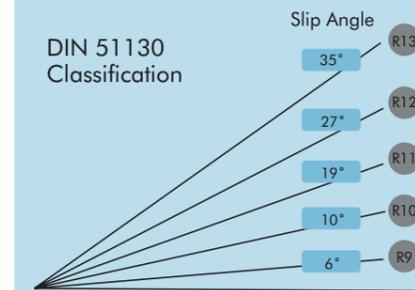
RAMP TEST (DIN 51130)

- Measures Coefficient of Friction (CoF)

Walk on ramp with increasing inclination to measure mean critical point of slip (cleated shoe, oil)

CoF	R9	R10	R11
CoF	0.11-0.18	0.18-0.34	0.34-0.51

CoF	R12	R13
CoF	0.51-0.70	>0.70



Example: R13 - industrial kitchens
R 9 - general, offices, classrooms

POSITIVE

- Simulate working conditions, person walking
- Widely used for specification
- Internationally accepted
- Good indicator for working conditions with oily, viscose contamination

NEGATIVE

- Not portable, cannot be done on site
- R ratings can be misinterpreted as they start at R9 » a smooth floor
- Requires guide with R ratings against specification areas in different industries

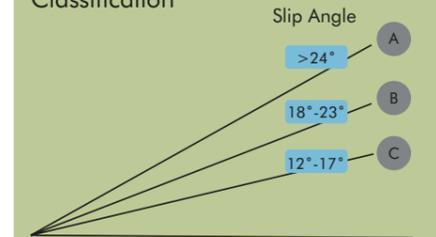
RAMP TEST (DIN 51097)

- Measures Coefficient of Friction (CoF) / barefoot

Walk on ramp with increasing inclination to measure mean critical point of slip: barefoot with soap contaminant

CoF	A	B	C
CoF	0.21-0.31	0.32-0.42	>0.45

DIN 51097 Classification



A - Mainly dry
B - Pool surrounds
B - Showers and bathrooms

POSITIVE

- Simulate person walking
- Good for wet room, showers, bathrooms

NEGATIVE

- Not portable, cannot be done on site

*The imitation heel consists of a slider. There are specific sliders for shod and barefoot areas (#96 for shod/#55 for barefoot). Care must be taken to read the correct Pendulum Test Value (PTV) for the area specified.

Keep it safe

Because contamination is the cause of most slip accidents, HSE emphasises in its "Slips & Trips - The importance of floor cleaning" information sheet:

"Where cleaning is carried out effectively, it can make the difference between a floor being an unacceptably high slip risk or one that has an acceptably low slip risk."⁹

All proprietors or occupiers of public buildings are duty-bound to have a safety management system with controls in place to ensure that floors remain clean and dry as far as reasonably practicable.

Prevention is better than cure to prevent slips. The model in Figure 4 provides a 3-step approach as recommended by HSE to prevent slip accidents¹⁰.

Figure 4: How to prevent contamination of flooring



HSE provide a free, online Slips Assessment Tool (HSE SAT tool) to assess the slip potential of surfaces and potential remedies.



Take control

Personal injury legal case studies show the harm caused by slips, trips and falls to individuals. Industry and the public sector is also affected by a loss of working days and claims against liable parties, be it the building owner or occupier.

Whilst designers have a duty to specify suitable flooring for the conditions of use, they are not responsible for inappropriate use by individuals or inadequate duty of care towards employees, guests, visitors, patients as result of inadequate risk management, maintenance and housekeeping.

Design liability means making sure that specifications are fit for purpose and that information is shared down the supply chain with regards to installation, cleaning and maintenance so that other parties involved in a building project can meet their compliance obligations.

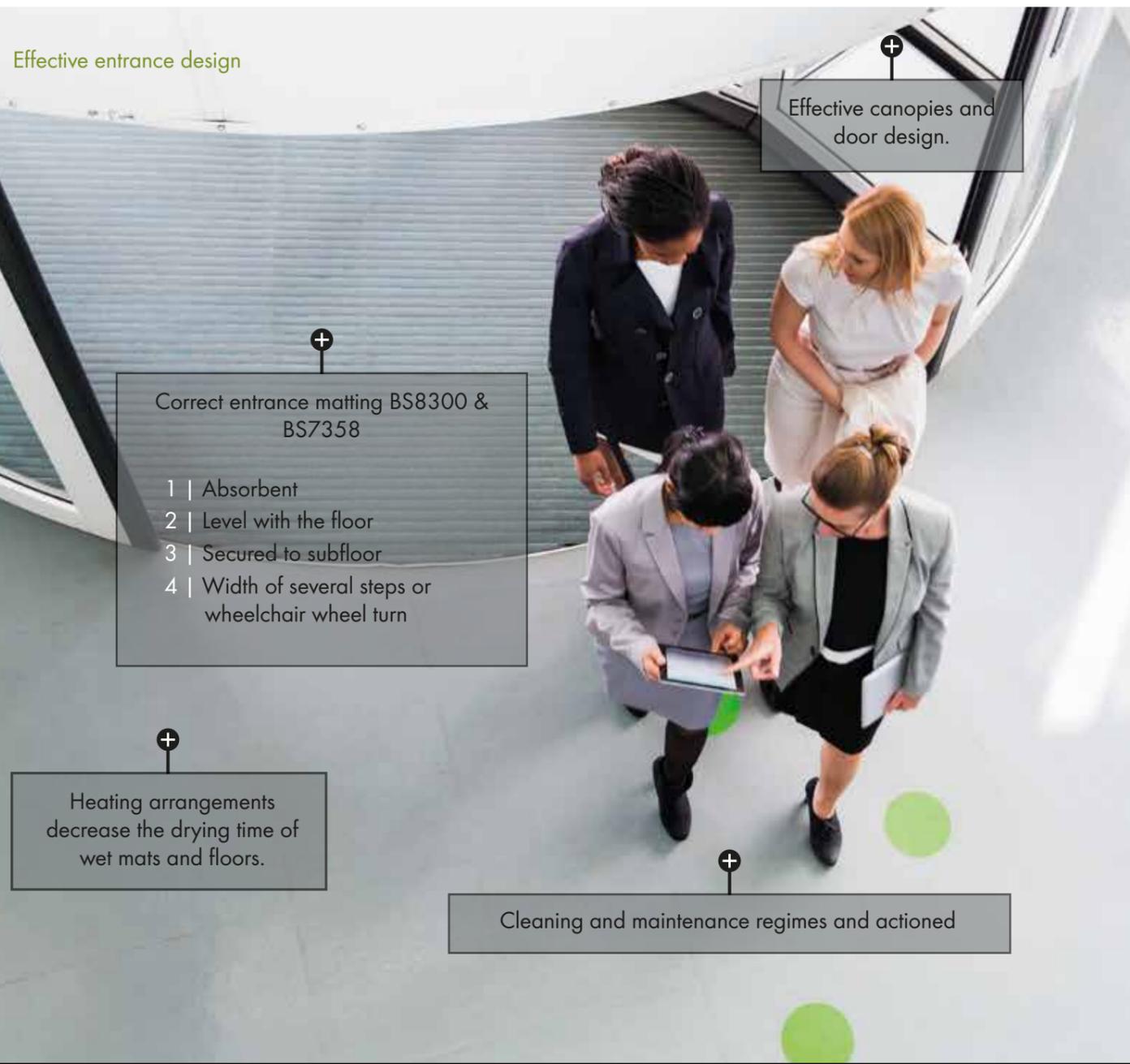
Whilst designers have a duty to specify suitable flooring for the conditions of use, it is usually the building owner/manager and/or the end user's responsibility to ensure effective risk management, maintenance and housekeeping are in place.

Make a clean entrance

Preventing contamination in a building starts at the entrance. A high footfall increases the chance of moisture and dirt being tracked into a building. Effective entrance design stops ingress of water and dirt at source. The position of the entrance, canopy and door design can reduce the amount of dirt and moisture that is tracked into a building by up to 90%¹¹.

British Standards (BS 7953; 1999 2 Entrance flooring systems)¹² mandates a clean off zone to reduce ingress of soil and transfer to other parts of the building. This zone must be a minimum of 2.1m in length in order to cater for several steps and repeated turns of wheelchair wheels. Where footfall is high and there is space, this zone can be increased up to 6m.

Effective entrance design



Effective canopies and door design.

Correct entrance matting BS8300 & BS7358

- 1 | Absorbent
- 2 | Level with the floor
- 3 | Secured to subfloor
- 4 | Width of several steps or wheelchair wheel turn

Heating arrangements decrease the drying time of wet mats and floors.

Cleaning and maintenance regimes and actioned

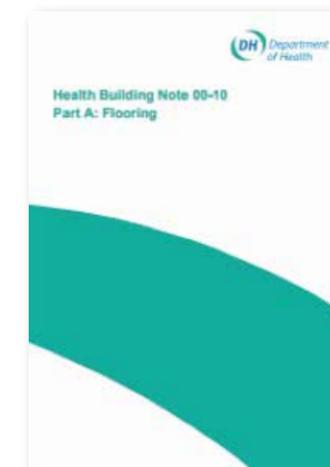
There is more to safety

There are other critical considerations when designing and choosing flooring, such as hygiene and infection control.

The hygiene and cleanability of any flooring is crucial, especially when installing floor coverings in a healthcare environment.

Consideration must be given to the environment and use of the flooring to ensure that it is appropriate and can be cleaned efficiently and effectively. Health Building Note 00-10 (HBN 10) recommends that smooth, non-porous and water-resistant flooring should be chosen where contamination with blood or bodily fluids is possible. Microbial growth and fungicidal activity should be inhibited on an uncontaminated floor.

The Department of Health advocates that selecting the right flooring requires balancing multiple factors from aesthetics to functional needs as laid out in Health Building Note 00:10 Part A: Flooring¹³. This also provides a matrix with recommendations for flooring for each category of room space.



Conclusion

Forget any preconceptions: the highest slip resistance in a dry area can be a smooth resilient floor offering the required slip resistance of 36+ (PTV), just as rough surfaces do in wet areas.

To reduce slip risk, address all risk factors, including layouts, pedestrian flows, grab rails, sources of lighting and glare, human activity, risk of contamination, footwear, and the effective use of on-site professional cleaning resources.

When deciding on the appropriate flooring material, a safe environment means more than slip resistance alone. Other performance requirements for hygiene and infection control, acoustics, ergonomics, fire resistance, indoor air quality and sustainability also need to be satisfied.

Be mindful of the potential increase in lifecycle costs from installing rough, hard-to-clean floors in areas where they are not needed. A cost-effective life of a floor goes beyond the initial investment to include wear and tear, maintenance and cleaning costs which account for 90% of the life-cycle cost.

A sensible and diligent decision can greatly reduce the risks of slips, trips and falls across the UK, whilst ensuring that beautifully designed, functional and safe flooring is used in all public spaces.

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Contact Us

At nora, our approach is "Creating Safer Spaces". Contact us today to speak to our experienced representatives or technical support to discuss your requirements or visit our website at nora.com/united-kingdom.

Tel: (+44) 1788 / 513 160



*This guide to specifying flooring was reviewed the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed or recommendations made, do not necessarily reflect policy or views of the Health and Safety Executive.

nora flooring systems UK Ltd.

4-5 Allerton Road

Rugby CV23 0PA, Great Britain

Phone: (01788) 513 160 - 513 169

Fax: (01788) 55 28 12

Email: info-uk@nora.com

www.nora.com

nora systems GmbH

Höhnerweg 2-4

69469 Weinheim, Germany

Phone: +49 (0) 6201 - 80 66 33

Email: info@nora.com

www.nora.com



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