Standard Category 1

S1135 A6 Built Environment - finishes

Contents

1 Purpose

1.1 The purpose of this standard is to define the requirements for determining performance for finishes in public and non-public areas as a part of all London Underground (LU) premises. These may include, but are not restricted to finishes to roofs, walls, floors (including entrance matting and access covers), ceilings, screens, signs, housings to equipment & services etc.

2 Scope

2.1 This standard applies to all new and altered finishes as a part of all LU premises.

2.2 The scope of this standard excludes the primary structure to which the finishes may be fixed but includes the fixing elements.

2.3 Finishes shall be designed and specified for the location in which they are to be installed. The requirements of this standard primarily apply to public facing assets. For finishes within staff and maintenance areas, the design and specification shall be demonstrably fit for purpose, in accordance with the appropriate standards.

2.4 This standard applies to designers, contractors, suppliers and maintainers undertaking work within LU owned, managed or occupied operational premises.

Note: This standard is supported by G0135 'Guidance on premises finishes'.

Note: For the appearance of finishes, including heritage considerations, refer to S1374 'Customer experience in London Underground stations'. See also clause 3.1.20 below.

Note: For fixings, also refer to S1063 'Civil engineering – cutting, grinding, drilling, fixing to and supporting from existing structures'.

Note: For surface coatings, refer to G0230 'Good practice guide for the application of surface coatings to premises'.

Note: For signage requirements, refer to S1006 'Signage in the TfL environment'.

Note: For finishes' loading requirements refer to S1053 'Civil engineering – building and station structures'.

3 Requirements

3.1 General requirements - design

3.1.1 Finishes shall comply with the Building Regulations and shall apply Security in Design of Stations (SIDOS) Guide, 'Protecting Crowded Places: Design and Technical Issues' and CIRIA C710 'Addressing crime and disorder in public places through planning and design'. Where any conflicts arise between the building regulations, the documents listed in this clause and this standard, compliance with this standard shall take precedence except where a breach in the law would arise.

3.1.2 The selection of materials and installation of finishes shall be in accordance with Building Regulations Part 7 materials and workmanship.

3.1.3 All materials shall comply with S1085 'Fire safety performance of materials – stations and tunnel infrastructure' where required.

3.1.4 The designer shall select prefabricated finishes or assemblies where this is demonstrably efficient for whole life costs and sustainability.

3.1.5 Finishes shall be modular where practicable to facilitate replacement when localised damage occurs or when any item of furniture or equipment is removed.

3.1.6 Any modification to the design of a standard system or assembly shall be subject to change control processes.

3.1.7 The designer shall ensure that sustainability has been considered in the selection, sourcing and specification of materials and finishes, in compliance with TfL's latest Corporate Environment Plan and Building Research Establishment Environmental Assessment Method (BREEAM) targets. Finishes to projects that do not fall within the TfL criteria of applicability for BREEAM assessment must meet the current Building Regulations Part L2 as a minimum.

Note:	This is supported by the GLA Group Responsible Procurement Policy.

3.1.8 Products and materials for finishes shall be selected, assessed and authorised in accordance with S1011 'Product Selection, Assessment and Authorisation for Use'.

3.1.9 The design life for finishes shall be specified where cyclical replacement is necessary, and subsequently captured in the operations and maintenance manuals.

3.1.10 The service life planning of any finishes shall comply with BS ISO 15686-1 & BS ISO 15686-2. The design life for major replaceable components in public areas shall be a minimum of 40 years.

3.1.11 Whole life costs shall be applied in the decision-making when comparisons are being made between alternative materials for finishes. Refer to CIRIA C677 'Whole life infrastructure asset management: good practice guide for civil infrastructure'.

3.1.12 Materials used for finishes shall be specified to optimise the ability to re-use or recycle them.

3.1.13 Movement between materials/components and the relevant supporting structures shall be assessed and accommodated as part of the design process.

3.1.14 All finishes shall sustain predicted air velocities caused by train motion where required, particularly the piston effect in deep tunnel environments. Refer to S1067 'Tunnel and public area cooling and ventilation'.

3.1.15 All finishes shall sustain wind loading where required, in accordance with Building Regulations Part A and BS EN 1991-1-4:2005+a1:2010.

3.1.16 Finishes shall be capable of transmitting the imposed loads to the structure.

3.1.17 Materials and finishes that can absorb moisture and consequently fail, such as gypsum plaster or fibrous ceiling tiles, shall not be used in high risk or below ground locations.

Note:	All materials used in locations where there is a known significant risk of moisture ingress or in below ground locations are deemed to be at an above normal risk of becoming wet.

3.1.18 All finishes in areas where there is a risk of a graffiti attack shall be graffiti resistant, either inherently or using a coating.

Note:	Consideration should be given to the porosity of the finish when selecting finishes (ie some finishes are better at resisting graffiti than others) and any anti-graffiti coatings which may require to be applied.

3.1.19 Where finishes have a cavity/void behind or above them, the design shall prevent or limit the ingress or accumulation of pests and debris.

Note:	Consideration should be given to the presence of pests and debris when voids are accessed.

3.1.20 Visual contrast between finishes shall be in accordance with BS 8300. Refer also to S1374 'Customer experience in London Underground stations' for requirements on materials, colours, surface finishes and heritage considerations.

3.1.21 Upright posts and pillars shall achieve visual contrast with their surroundings. This shall be by marking with a visually contrasting band of 150mm high whose bottom edge is 1500mm above finished floor level in accordance with BS 8300, or by another design which delivers an equivalent degree of contrast.

3.1.22 Acoustic performance of wall and ceiling finishes shall be considered where required, to support audio information delivery requirements. Refer to S1142 Operational information systems.

3.1.23 Finishes shall not have sharp edges, projections, finger traps, open or deep joints or other features that may cause injury to persons, entrapment or damage to clothing.

Note:	Sharp edges can generally be avoided by having a minimum radius of 3mm. Gaps between 6mm and 20mm wide and greater than 25mm deep may constitute a finger trap where the finish is accessible to customers.

3.1.24 Where handrails, posts, furniture, signage or similar items are used in public areas, the interface with the finish shall be cleanly trimmed.

3.1.25 Any material which is used in the construction of an internal wall or ceiling in any public area of a sub-surface station shall be of limited combustibility in accordance with The Fire Precautions (Sub-surface Railway Stations) (England) Regulations 2009. This requirement also applies to external cladding and insulation. Refer also to G0137 'Walls, partitions and ceilings in Sub-Surface Stations'.

3.1.26 Fixings shall be designed, selected, installed and managed in service in accordance with CIRIA C777 'General fixings – guidance on selection and whole-life management' and CIRIA 778 'Management of safety-critical fixings'.

3.1.27 Fixings for or to finishes shall incorporate measures to prevent the risk of bimetallic corrosion.

3.2 General requirements – installation, inspection and maintenance

3.2.1 Supports and fixings to finishes shall be installed in accordance with the assured design. Hidden fixings shall be avoided, except for aesthetic reasons. Where hidden, the integrity, numbers, locations and centres of fixings shall be inspected and verified with photographic evidence prior to being concealed by the finishes.

3.2.2 Installers shall be demonstrably competent to install the given finishes and approved by the finishes' manufacturer where appropriate.

3.2.3 Provision shall be made for the inspection and maintenance of primary structures located behind finishes. Finishes installed to existing assets shall not diminish the inspectability and maintainability of the structure.

3.2.4 The design of the finishes shall allow for the inspection of the finishes' support structure and fixings, commensurate with risk, for the duration of the service life of the finishes.

3.2.5 An individual finishes unit (eg wall cladding panel or ceiling tile) shall be removable without having to strip the row of units.

3.2.6 Ancillary elements and fixtures (eg. lighting, advertising screens etc.) interfacing with finishes shall be independently supported and removable without affecting, disturbing or limiting the maintainability of the finishes.

3.2.7 A maintenance, cleaning and replacement strategy appropriate to the materials used for all finishes is a requirement of the handover documentation.

3.2.8 All cleaning strategy specifications shall identify the cleaning materials to be recommended or to be used.

3.2.9 Maintenance and use of cleaning products shall not reduce the performance or service life of any finish with which they come into contact.

3.2.10 All services beneath, behind or above any finish shall be accessible.

3.3 Roofs

3.3.1 The risk of water ingress to critical rooms and buildings must be assessed. Roof systems shall be designed, installed and maintained to ensure that any water ingress as a consequence of roof finishes failure is prevented.

Note:	Critical rooms and buildings as well as their inspection and maintenance requirements are defined and described in PR0012 'Inspections of buildings'.

3.3.2 The roof design shall incorporate adequate falls to the finishes to allow for rainwater discharge to prevent ponding or water ingress.

3.3.3 The roof design shall incorporate thermal insulation to control heat loss and condensation.

3.3.4 The roof design shall incorporate the discharge of rainwater into existing or new drainage in accordance with S1052 'Civil Engineering – gravity drainage systems'.

Guttering systems shall be designed to overflow safely in the event of extreme rainfall to prevent excess water compromising the roofing system and entering the building.

3.3.5 London Underground supports the use of Sustainable Drainage Systems (SuDS), in line with the London Mayor's London Plan policy. Sustainable drainage systems or approaches shall be adopted where practicable in roof drainage solutions including, but not limited to, the consideration of living roofs. Refer to S1052 'Civil Engineering – gravity drainage systems'.

Note:	A pan-TfL standard S1802 for flood risk management and sustainable drainage systems is in progress at time of publication of S1135 A6.

3.3.6 A safe means of access for inspection & maintenance to roofs shall be provided. Capacity for dealing with emergency situations shall be considered.

3.3.7 Where regular maintenance access across a flat roof is required, a safe walkway shall be defined and roof finishes suitably protected.

3.3.8 Where the roof to a secure suite/room may be accessible to the public, refer to S1372 'Operational Accommodation' for security requirements.

3.4 Walls and wall finishes

3.4.1 The impact and abrasion resistance and cleanability of walls shall be designed as per Attachment 1, Table 1.

3.4.2 Walls required to resist unauthorised access shall be designed to prevent that risk. Security devices shall also be installed commensurate with the level of risk. Refer to S1785 'TfL Security standard for construction works – design and implementation'.

3.4.3 For the security requirements to secure suite or room walls, refer to S1372 'Operational Accommodation'.

3.4.4 Walls shall have an equivalent security rating to any security doors, windows and screens within them and shall be designed to ensure that those doors, windows and screens are retained in the event of attack.

3.4.5 Where a wall in a public or regularly occupied staff area has a finish, service conduits shall not be surface mounted. Refer also to S1374 'Customer experience in London Underground stations' for further requirements in public areas.

3.4.6 Skirtings and the base of cladding shall be sufficiently robust or be protected to withstand impact damage. Skirtings shall be coved where possible.

3.4.7 Where walls are required to form a fire compartment, fire safety standards S1081 'Design and installation of fire protection systems and compartmentation measures', S1083 'Passive fire protection systems' and S1085 'Fire Safety Performance of Materials - Stations and Tunnel Infrastructure' apply.

Note:	G0137 'Walls, partitions and ceilings in sub surface stations' provides further information.

3.4.8 Wall copings, window sills and other horizontal surfaces which are accessible to the public shall be designed to safely shed any significant item placed on the top.

3.4.9 Wall louvres which are required to be intruder resistant shall be provided in accordance with Loss Prevention Standard LPS 1175 security rating 3 or equivalent.

3.4.10 Clip-on external wall cladding is not permitted unless fastened with additional mechanical fixings.

3.4.11 Ceramic tiles shall only be used in public and staff areas between a level above the skirting to just above normal head-height where a logical decorative datum can be achieved, to reduce the risk of tiles falling from height. No tiles shall be affixed to soffits.

3.4.12 Over-tiling is not permitted.

Note:	This is due to an increased risk of failure due to poor bond in the underlying strata.

3.5 Floors

3.5.1 The impact and abrasion resistance and cleanability of floors shall be achieved in the specification of new flooring as per Attachment 1, Table 1.

3.5.2 Flooring shall be free from slip and trip-hazards as per BS 8300, CIRIA C652 'Safer surfaces to walk on – reducing the risk of slipping' and the update to C652.

Note : Slip resistance requirements do not apply to the first 150mm from any wall.
Note: Apertures to gratings in public areas of 8mm or less are considered to be heel safe. 6-8mm apertures are preferred in order to ensure the free passage of water.

3.5.3 New and existing flooring in public and staff areas shall be assessed for risk of slipping using the Risk Model in Attachment 2 and the appropriate Pendulum Test Value (PTV) ascribed. Flooring which achieves a PTV ≥ 36 is fully compliant with slip resistance requirements and no risk assessment is required. This does not apply to sloped floors where the required PTV may be higher.

3.5.4 Tactile paving and entrance matting require to be risk assessed using the risk model in Attachment 2 and the appropriate PTV achieved in the primary direction of customer flow.

3.5.5 When the current condition of flooring in public areas is assessed, the HSE Slip Assessment tool shall be used. Flooring that registers as high risk using the tool shall be subject to further investigation using the test method defined in BS EN 16165 Determination of slip resistance of pedestrian surfaces - Methods of evaluation. Note the Pendulum Test method should be used for all of these assessments unless inappropriate (see note below on metal open grids etc.) Flooring which is non-compliant with the PTV defined in the risk model in Attachment 2 shall be reported by exception within the asset condition system and listed as a Code 2 concern. See S1042 'Managing LU Asset Risk: Recording of Assets and Data for Condition Reporting' for concern definitions.

3.5.6 Where current condition of any profiled flooring is assessed, carry out a slip assessment using the HSE Slip Assessment tool ensure that slip resistance is checked at all relevant angles and the minimum result recorded.

Note:	UK Slip Resistance Group (UKSRG) guidelines apply for slip testing. Cleaning, testing and maintenance are covered in the requirements of the risk-based approach in the risk model in Attachment 2. The slip resistance requirements for stairs and sloped floors are detailed in LU standard S1133 'Premises – stairways and ramps'.
Note:	Metal open grid flooring in depots and back of house areas can be difficult to achieve consistent PTV results (ref HSE report RR534). Ramp tests in accordance with BS 4592-0 are acceptable for these floors instead of PTV tests. It is assumed that all staff and contractors using these floors will be equipped with safety footwear.
Note:	Carpeted areas do not require to be tested for slip resistance, but shall be kept dry and in reasonable condition with no backing exposed.

3.5.7 External suppliers undertaking slip-testing shall be UKAS approved. Any individuals carrying out slip-testing should have formal training to use the HSE Slip Assessment tool.

3.5.8 There shall be no ponding on any floors.

3.5.9 Floor movement joints shall be appropriate to the type of flooring and be installed in accordance with manufacturer's recommendations and correct laying procedure.

3.5.10 Fixing of furniture or equipment to a solid base shall be appropriate to the flooring and the type of fixing.

3.5.11 Any junction between a floor and wall shall be designed to facilitate the cleaning of the floor and ensure minimal damage.

3.5.12 All public areas shall have a visual contrast between floors and walls to aid the visually impaired in accordance with BS 8300.

Note:	Where it is impractical to achieve sufficient contrast between a wall and floor because of existing constraints, consideration should be given to the provision of a skirting contrast to the floor.

3.5.13 Floor finishes in public areas shall not be patterned, in accordance with the restrictions described in BS 8300, except where it is an identified Railway Heritage Feature. Refer to the LU Station Heritage Register: (https://transportforlondon.sharepoint.com/sites/railway-heritage-features)

3.5.14 Edges of access points, hatches and openings shall be appropriately protected by a frame or trim.

3.5.15 Adequate means of opening or lifting access covers without damaging finishes shall be provided. Finishes to access covers shall be detailed to ensure no cracking or lifting of infill finishes.

3.5.16 Design of access covers shall comply with S1050 'Civil engineering – common requirements'.

3.6 Entrance matting

3.6.1 Entrance matting installation shall be provided at all station entrances including at the ends of stairway entrance points, in accordance with manufacturer's instructions, ideally providing three normal footfalls in length ie 2-3m.

3.6.2 Entrance matting shall be at least as wide as the entrance.

3.6.3 Any metal ribs to entrance matting shall be perpendicular to the primary direction customer flow. Bi-directional matting shall be used where appropriate.

3.6.4 Entrance matting shall be cleanable, maintainable and allow water to drain freely through the matting to local surface water drainage outlets.

3.6.5 The design of entrance matting shall accommodate thermal movement and curling.

3.7 Ceilings

3.7.1 Suspended ceiling panels shall not absorb water.

3.7.2 When used in any area where there is a risk of water ingress, suspended ceiling systems, other than water management systems, shall allow the passage of moisture from the ceiling tiles without deformation or deterioration of the tiles.

3.7.3 Ceiling tiles and systems with acoustic properties shall be maintainable and cleanable.

3.7.4 There shall be no suspended ceilings in plant and machinery rooms, switchrooms, stores, workshops or in any other industrial area, other than water management systems.

3.7.5 Consideration shall be given to not specifying and installing suspended ceilings in regularly staffed back of house areas, where the ceiling serves no function other than aesthetic, if an acceptable level of ambience can be achieved.

3.7.6 Where ceilings are required to form a fire compartment, fire safety standards S1081 Design and installation of fire protection systems and compartmentation measures, S1083 Passive fire protection systems and S1085 Fire Safety Performance of Materials - Stations and Tunnel Infrastructure apply.

3.7.7 Loose or drop-in ceiling panels shall not be permitted in public areas.

3.7.8 Flexible hangers shall not be used.

3.7.9 The loss of an individual hanger shall not cause a partial or full collapse of the ceiling.

3.7.10 Ceilings shall provide access for the inspection and maintenance of the ceiling system and of any structure, fixing or building fabric behind the ceiling.

3.7.11 Where ceilings have services within the ceiling void or contain fixtures or fittings, the design of the ceiling shall ensure that regular access is accommodated without

damage to the ceiling. Clip-in ceiling tile systems shall not be used where regular access is required. Instead, hinged systems or hook-on panels shall be installed and these shall be equipped with safety chains or lanyards where risk determines it.

3.7.12 To ensure that the ceiling is not damaged and is made safe following access, reference shall be made to Best Practice Guide – maintenance and access into suspended ceilings published by the finishes and interiors sector. https://www.thefis.org/knowledge-hub/technical/

3.8 Evidence of compliance

3.8.1 Compliance with the requirements of this standard shall be demonstrated to LU by each party contracted to LU. Additionally LU may audit compliance as part of its surveillance regime.

4 Responsibilities

4.1 The TfL Principal Engineering Leader shall be responsible for creating and maintaining this standard thereby ensuring compliance, whilst identifying opportunities for improvement.

5 Supporting information

5.1 Background

5.1.1 This standard is part of the Built Environment suite of Standards and associated guidance documents that form part of the TfL safety management system. Compliance with these standard requirements will result in ALARP risks for finishes.

5.2 Safety considerations

5.2.1 Safety aspects shall be considered throughout the design process and due account taken of the Construction (Design and Management) (CDM) Regulations 2015.

5.3 Environmental considerations

5.3.1 All activities including planning, design, procurement, construction, installation, testing, commissioning, operation, maintenance, decommissioning and disposal must comply with current environmental legislation, approved codes of practice and authoritative guidance literature issued by relevant statutory bodies.

6 Person accountable for this document

Name	Job title
[redacted]	Principal Engineering Leader – Built Environment

7 References

Document no.	Title or URL
S1133	Premises – stairways and ramps
S1372	Operational Accommodation
S1785	TfL Security standard for construction works – design and implementation

S1081	Design and installation of fire protection systems and compartmentation measures
S1083	Passive fire protection systems
S1085	Fire safety performance of materials – stations and tunnel infrastructure
S1050	Civil engineering – common requirements
S1052	Civil engineering – gravity drainage systems
S1053	Civil engineering – building and station structures
S1063	Civil engineering – cutting, grinding, drilling, fixing to and supporting from existing structures
S1067	Tunnel and public area cooling and ventilation
S1142	Operational Information Systems
S1374	Customer experience in London Underground stations
S1042	Managing LU Asset Risk: Recording of Assets and Data for Condition Reporting
G0135	Guidance on premises finishes
G0230	Good practice guide for the application of surface coatings to premises
G0137	Walls, partitions and ceilings in sub-surface stations
PR0012	Inspections of buildings
	LU station design idiom (http://content.tfl.gov.uk/station-design-idiom-2.pdf)
	LU Station Heritage Register: (https://transportforlondon.sharepoint.com/sites/railway-heritage-features)
	Best Practice Guide – maintenance and access into suspended ceilings https://www.thefis.org/knowledge-hub/technical/
CIRIA C777	General fixings – guidance on selection and whole-life management
CIRIA 778	Management of safety-critical fixings
CIRIA C652	Safer surfaces to walk on – reducing the risk of slipping
CIRIA C677	Whole life infrastructure asset management: good practice guide for civil infrastructure
CIRIA C710	Addressing crime and disorder in public places through planning and design
BS EN 1991-1-4:2005+a1:2010	General actions – Wind actions
BS 8300-1 - 2	Design of an accessible and inclusive built environment
BS 4592-0	Flooring, stair treads and handrails for industrial use
BS EN 16165	Determination of slip resistance of pedestrian surfaces - Methods of evaluation
BS 4592-0	Flooring, stair treads and handrails for industrial use. Common design requirements and recommendations for installation

BS ISO 15686-1-2	Buildings and constructed assets. Service life planning.
BS 8000-1 – 16	Workmanship on building sites

8 Document history

Issue no.	Date	Changes	Author
R5	July 2007	Standard 2-1107-007 re formatted and re-numbered to 1-135, no technical changes have been made to the content other than changing references to other Standards where their numbers have changed.	
A1	October 2007	Authorised for use. Previous authorisation is valid	
R6	February 2008	Changes after Director led review	
A2	March 2008	Authorised for use	
R7	May 2009	Updated to address comments from PSC S1-01246 & S1-01204	
R8	May 2009	Revised following joint meeting between LU and TLL	
A3	May 2009	Authorised for use	
A4	December 2013	Standard 1-135 A3 updated, reformatted and re-numbered to S1135 A4 as per DRACCT No. 1956.	[redacted]
A5	September 2017	Standard S1135 A4 updated with all Written Notices incorporated, as per DRACCT No. 05437.	[redacted]
A6	March 2023	Standard S1135 A5 updated with all Written Notices incorporated, as per Change Request No. CR-17426.	[redacted]

9 Attachments

9.1 Attachment 1 - Impact and abrasion resistance and cleanability categories

1 The grades of resistance to impact and abrasion shall be defined as:

Grade A - Surfaces that will resist heaviest impact and frequent abrasion from hard-edged objects without change to integrity of the finish or surface finish appearance;

Grade B - Surfaces that will resist heavy impact and frequent abrasion from hard-edged objects, but some visible damage to the surface appearance is acceptable;

Grade C - Surfaces that will resist light and infrequent impact and abrasion, but in severe conditions will rapidly deteriorate and structural damage may occur.

2 Cleanability categories shall be defined as:

D - Dry methods such as brushing, vacuum cleaning and as applied to carpets and fabrics - dry or steam cleaning in-situ;

W - Wet clean with water and mild detergents only;

HW - Heavy washdown to achieve high standards of hygiene and may involve the use of aggressive solvents for the removal of graffiti.

Facility	Impact & Abrasion Resistance	Cleanability Rating
Ticket Hall (below head-height)	A	HW
Station Concourse (below head-height)	A	HW
Escalator Shafts (public area) (below head-height)	A	HW
Platforms and passages (below head-height)	A	HW
Ticket Hall (above head-height)	B	W
Station Concourse (above head-height)	B	W
Escalator Shafts (public area) (above head-height)	B	W
Platforms and passages (above head-height)	B	W
Public WCs	A	HW
Pressurisation Fan Room (PFR)	B	D
Protected Escape Shaft	B	W
Relay Room	B	D
Interlocking Machine Room	B	D
Communication Room (COR)	B	D
Switch Room (SR)	B	D
Energy Switch Room	B	D
Uninterrupted Power Supply (UPS)/Battery Room	B	D
Fire Main Valve Room	B	W
Meter Cupboard	B	D
Fire Suppression Equipment Room	B	W
Bin Store (BS)	A	HW
Cleaning Machine Store	A	W

Surface Water Pump	B	HW
Sewerage Ejection Room	B	HW
Escalator Machine Room and Maintenance Shaft	B	D
Lift Pump Room	B	D
Lift Shaft and Pit	B	D
Station Tunnel Fan Room	B	D
Mid Tunnel Fan Room	B	D
Ventilation Shaft	B	D
Tunnel Fan Control Room	B	D
Station Fan Room	B	D
Traction Substation	B	D
Station Substation	B	D
Switchroom Substation	B	D
Station Staff Offices/SOR	C	W
Station Computer Room	C	D
Mess/Kitchen	B	W
Locker and Shower Rooms	B	W
Station Staff WCs	B	HW
Secure Suite	B	W
Cleaners' Rooms	B	W

Table 1 – Impact and abrasion resistance and cleanability of wall and floor finishes

9.2 Attachment 2 - Risk model - flooring slip resistance

1 Introduction

The following is a methodology for selecting the Pendulum Test Value (PTV) of a horizontal floor surface using a risk-based approach. It does this by firstly identifying the factors that make slipping more likely and secondly identifying the factors that might make the injury consequences of a slip more severe.

2 Scope

2.1 The scope of this risk assessment method extends to both customers and staff on level, horizontal surfaces in public hard flooring station and staff areas.

2.2 The PTV requirements for stair treads and ramps are set out in S1133 'Premises – stairways and ramps'.

3 Base line factors

3.1 Certain factors must be accepted by floor specifiers and designers to be always present at all locations and at all stations. In the absence of other factors, these equate to the Low Risk Category when calculating PTV.

a) **Passengers or staff**

- I) With disabilities who are capable of walking; for example limited hip, knee or ankle articulation.
- II) Young passengers with limited walking skills; i.e. under four years of age
- III) Passengers with limitations in balance due to disease, the use of medications and abuse of substances.

b) **Encumbrances**

- I) Luggage
- II) Pushchairs – folded or deployed
- III) Shopping bags

c) **'Unsuitable or challenging' footwear**

- I) Platform soles
- II) High heels
- III) Stiletto heels
- IV) Unsecured soles – e.g. flip flops

d) **Occasional spillages**

- I) Coffee and tea in disposable cups
- II) Litter
- III) Bottled water*

e) **Surface overriders**

I) Dog faeces, these are rarely the cause of accidents but in principle could be found at any point in the system.

*Special risk management measures must be instated to handle the increased risk of spillage and litter when bottled water is handed out in high temperature conditions.

3.2 Minimum floor surface characteristics

The minimum floor surface characteristics given here can be used when there are no factors identified in the table which follows to increase this requirement.

The measured minimum Pendulum Test Value for an installed floor surface should not be less than 25 wet or dry throughout its surface area.

3.3 Risk assessment to identify any higher PTV for a horizontal floor

3.3.1 Individual risk table

3.3.1.1 The following Table 2 outlines the factors that increase the risk to an individual of slipping in a specific station area and which can be influenced by floor specification.

3.3.1.2 It will be seen that the existence of factors affecting risk over and above the baseline may vary in different areas of a station or staff facility and therefore the floor surface requirement may differ in different areas of a station or staff facility.

3.3.1.3 It is recommended that initially risk assessment should be done for each distinguishable area according to the risk factors that are present. However, there is good evidence that *changes* in floor surface characteristic, whether by design, due to improper cleaning or due to spillage could lead to slipping. Accordingly, an overriding objective should be to minimise the changes in floor surfaces' PTV's and limit them to those identified in the PTV table.

3.3.1.4 Items listed on each row in the following Table 2 identify the factors that make slipping more likely. Each identified set of factor scores one point.

3.3.1.5 The table also identifies the factors that might make the injury consequences of a slip more severe.

3.3.1.6 Complete the following table for each separate floor area being considered.

Category	Factors increasing risk	Present? (Yes=1, No=0)
Slip initiator	Multi-directional pedestrianflows = 2 2 way pedestrian flow (or where passengers intersect) = 1 1 way pedestrian flow (or where passengers don't intersect) = 0	
Pedestrian behaviour	Running is likely: i.e. on long corridors, close to or on platforms ie. in eye line or within 10m of near departing trains	
	Station located in an area with a higher age profile (residential areas with high level of senior citizens)	

Category	Factors increasing risk	Present? (Yes=1, No=0)
	Large proportion of unfamiliar passengers – coming directly from mainline stations, airports, major tourist attractions	
	Passenger flows: High (annual entry+exit from station greater than 10 million) = 2 Medium (annual entry+exit from station between 4 and 10 million) = 1 Low (annual entry+exit from station less than 4 million) = 0 Source: LU intranet ssd/resources/data/demand/counts	
Slip initiator built environment	Within 35m of the external environment so water can be walked into the area (discount the influence of interceptors or matting),within a public toilet or any staff area where floor contaminants may be present. Yes = 9 No = 0	
	Presence of trees so leaves can be walked onto the adjacent floor surface	
	Proximity of retail unit selling surface contaminants that can be dropped: e.g. fruit, vegetables, flowers, snacks – within 50m of station or up to 35m from retail unit within station	
	Proximity of licensed premises (excess alcohol consumption-leading to the likelihood of vomit / urine being deposited) within 100m of station – applies to all public flooring within station	
Slip initiator natural environment	Direct exposure to weather: rain, snow, ice or surface condensation	
Injury Increasers Station furniture	Likelihood of falling onto raised features, station/staff furniture, e.g. ticket barriers, stanchions, escalators etc	
	Furniture features with apertures that can engage with limbs or digits to cause bone breaks	
	Surfaces with edges having radii less than 30mm to cause fractures or penetration injuries	
	Total risk score	

Note: These apply to both public and staff areas as appropriate.

Table 2: Risk Table

3.3.1.7 The decision table below indicates the floor PTV specification that follows from the risk score obtained above.

PTV decision from assessed risk	
Total risk score	Measured PTV range when wet
High 9 and above	PTV 36 and above
Medium 1-8	PTV between 30 and 35
Low (Baseline) 0	PTV 25 - 30

3.3.2 Requirements of the risk-based approach

3.3.2.1 The floor surface specified must be cleaned to the specifications of the manufacturer of that surface and the cleaning regime will be objectively shown to remove the dirt and other adherents found in practice. This is necessary because slips data shows that incidents have happened because of incorrect cleaning regimes and because floor surface performance is compromised because of surface clogging.

3.3.2.2 The floors will be re-tested at regular intervals in accordance with the Maintenance Regime to ensure that their PTV surface performance is sustained.

3.3.2.3 Spills of liquids, vomit, foodstuffs, faeces etc and litter will be removed as soon as practicable. This requires a regular effective surveillance and patrol. This is necessary because slips data shows many incidents occur because of such contaminants. Some of these make the floor surface characteristics irrelevant to the likelihood of slip occurring.

3.3.2.4 Floor PTV will be re-tested as soon as practicable after a slip incident at the site of the incident with the contaminants of the incident recreated if necessary.