AS 4586—2013
(Incorporating Amendment No. 1)

AS 4586—2013

Australian STANDARD

Slip resistance classification of new pedestrian surface materials

STANDARDS Australia

This Australian Standard® was prepared by Committee BD-094, Slip Resistance of Flooring Surfaces. It was approved on behalf of the Council of Standards Australia on 16 May 2013. This Standard was published on 28 June 2013.

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- Association of Consultants in Access Australia
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- Australian Institute for Non-Destructive Testing
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- Property Council of Australia
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Australian Standard®

Slip resistance classification of new pedestrian surface materials

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee BD-094, Slip Resistance of Flooring Surfaces, to supersede AS/NZS 4586:2004, *Slip resistance classification of new pedestrian surface materials*.

This Standard incorporates Amendment No. 1 (June 2017). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide users and specifiers of pedestrian surface materials (architects, engineers, ergonomists, facility managers, manufacturers and the like) with means for classifying such surfaces according to their pedestrian slip resistance for use in the selection of surfaces.

This revision incorporates an additional requirement for preparing rubber test sliders when testing smooth surfaces. Consequential changes to the nomenclature used for classifying surfaces have been included.

Appendix D will be subjected to revision in consideration of long-term availability of shoes.

This Standard provides a means of demonstrating compliance for the acceptance and rejection of new surfaces for nominated criteria.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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FOREWORD

The slip resistance classifications have been determined for unused surfaces using specific conditions, for instance special rubbers, barefoot testing, and so on. These classifications are based on an assessment of the relative contribution of a pedestrian surface to the overall risk of slipping; they will assist in the specification of a minimum slip resistance category for a surface material suitable for most pedestrian applications. Factors such as usage, cleaning systems, applied coatings and patterns of wear may affect the characteristics of the surface after classification.

This Standard does not provide for the conditioning of specimens to account for in-service wear.

When specifying a particular slip resistance classification, specifiers should consider the likely in-service wear and its effects on slip resistance, taking into account the material type, pedestrian and other traffic and environmental conditions including cleaning and sealing.

Additional accelerated wear conditioning may help specifiers to better understand how the slip resistance of an individual product may alter with wear, thus helping to differentiate between products that might otherwise have seemingly similar slip resistance characteristics. This Standard provides no guidance on the conduct of such accelerated conditioning procedures.

HB 197, *An introductory guide to the slip resistance of pedestrian surface materials*, provides guidelines for the selection of slip-resistant pedestrian surfaces classified in accordance with this Standard.

Wet pendulum friction testing is carried out using two types of rubber materials, Slider 55 (also known as TRL rubber), which has been traditionally used for testing outdoor surfaces and wet barefoot surfaces, and Slider 96 (also known as Four S rubber), which was specifically developed to replace the TRL rubber for testing smoother indoor surfaces, as it provides greater discrimination between such internal surfaces.

This revision incorporates an additional requirement for preparing rubber test feet when testing smooth surfaces. Research has shown that when a slider 96 (Four S rubber) is only prepared with P400 abrasive paper, the pendulum result on smoother surfaces may be more representative of the rubber roughness than the slip resistance of the pedestrian surface that is being tested. A more representative reading that also enables a greater level of discrimination between smoother surfaces may be obtained by preparing the slider on a 3 µm lapping film as detailed in the Standard. A slider prepared in this way is a closer representation of a worn and polished heel and may best reflect the lower slip resistance attributable to the contact of two smoother surfaces under water-wet conditions.

Adoption of the lapping film preparation enables better differentiation between potentially slippery surfaces than was previously the case. It will result in some products receiving a lower classification than when the product was tested according to AS/NZS 4586:2004. This is recognized in the guidance provided in HB 197.

A new pedestrian surface is considered to become an existing pedestrian surface once it has been installed and made available for pedestrian traffic, other than movements specifically for purposes of formal testing to determine compliance with this Standard. Testing of existing pedestrian surfaces is covered in AS 4663, *Slip resistance measurement of existing pedestrian surfaces*.

STANDARDS AUSTRALIA

Australian Standard

Slip resistance classification of new pedestrian surface materials

1 SCOPE

This Standard provides means of classifying pedestrian surface materials according to their frictional characteristics when determined in accordance with the test methods set out in Appendices A, B, C, D and E. The test methods enable characteristics of surface materials to be determined in either wet or dry conditions.

This Standard does not provide for the conditioning of specimens to account for in-service wear.

NOTE: When specifying a particular slip resistance classification, specifiers should consider the likely in-service wear and its effects on slip resistance, taking into account the material type, pedestrian and other traffic and environmental conditions including cleaning, sealing and carpet wear and stretch.

2 APPLICATION

The test methods in this Standard shall be used for the classification of pedestrian surface materials for use in either the ‘wet’ or the ‘dry’ condition.

This Standard may also be used for evaluating surface applications and treatments including products such as sealers, polishes and etchants which may modify the surface characteristics of pedestrian surfaces.

As a minimum, one of the three methods specified for the measurement of wet slip resistance (Appendix A, C or D) shall be used for all external pedestrian surfaces and those internal pedestrian surfaces that have a reasonably foreseeable risk of the presence of wet substances such as water, grease and oil.

NOTES:

1 The indication of the test apparatus relates to the slip resistance potential of the surface tested in the test environment. It does not contemplate shoe sole materials, characteristics of individual gaits, or other factors that may contribute to slips.

2 The inclining ramp test methods (Appendices C and D) are suitable for measuring the slip resistance of gratings, heavily profiled surfaces, tactile indicators, rock, bush-hammered surfaces and resilient surfaces. Appendix E contains an ancillary test method for determining the displacement volume of heavily profiled surfaces. Such surfaces are primarily intended to provide drainage or entrapment of anticipated contaminating materials. Heavily profiled surfaces should take into consideration any requirements of AS 1428.1, such as tripping hazards.

3 Where heavily profiled surfaces have been specifically manufactured to have a high slip resistance, that relies heavily upon the interlock action between the highly profiled pedestrian surface and the heavily profiled soles of some footwear, the ‘pendulum test’ method in Appendix A may not provide accurate indications of the slip resistance.

4 The ‘dry floor friction’ test method in Appendix B is not suitable for heavily profiled surfaces or carpets.

5 Some examples of highly profiled surfaces are shown Figure 1. Such surfaces generally have a displacement volume greater than or equal to 4 cm^3/dm^2.

6 Dry results, including those determined using the ‘dry floor friction’ test method in Appendix B, that are obtained on dry new surfaces without any contamination may be unreliable in predicting in-service behaviour of surfaces that subsequently become wet or contaminated.

7 In Appendix A, provision has been made for either of two rubbers to be used in the wet pendulum test method. Clay and concrete pavers have traditionally been tested using Slider 55 (TRL rubber), whereas Slider 96 (Four S rubber) is used for other pedestrian surfaces. When testing highly profiled surfaces such as shown in Figure 1, Slider 55 (TRL rubber) generally produces more consistent results than Slider 96 (Four S rubber). The standard Slider 96 (Four S rubber) was prepared so as to have a poor abrasion resistance such that the rubber would be less likely to become contaminated, as fresh surfaces would be produced during testing. It was also formulated to be temperature independent. When assessing products for wet barefoot areas, or unusually rough products, the use of the softer more resilient Slider 55 (TRL rubber) is preferable.

8 Caution should be exercised when comparing friction/slip resistance test results of existing pedestrian surfaces and test results that were obtained on new pedestrian surface materials. The latter may be unexpectedly high on some surfaces because, after installation, the presence of contaminants and surface wear and/or polishing can significantly alter some results.

3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

AS
1428 Design for access and mobility
1428.1 Part 1: General requirements for access—New building work

A1 **'Text deleted'**

3942 Quality control—Variables charts—Guide

4663 Slip resistance measurement of existing pedestrian surfaces

ISO
7619 Rubber, vulcanized or thermoplastic—Determination of indentation hardness
7619-1 Part 1: Durometer method (Shore hardness)

BS
7976 Pendulum testers
7976-3 Part 3: Method of calibration

A1 **'Text deleted'**

CEN/TS
16165 Determination of Slip Resistance of Pedestrian Surfaces—Methods of Evaluation

4 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

4.1 British Pendulum Number (BPN)

Dimensionless unit of slip resistance when measured using the pendulum friction tester.

4.2 Carpet

Heavy fabric floor covering of wool, nylon or similar material, with or without underlay.

4.3 Coefficient of friction (COF)

The ratio of the tangential force required to move a body across a horizontal surface to the vertical load imposed on the surface by the body.

4.4 Displacement space

The open cavity that is accessible below the walking surface of a pedestrian surface, which is designed to allow sub-surface drainage and entrapment of spillages, thereby helping to retain the anti-slip properties of the walking surface.

4.5 Dynamic coefficient of friction

The coefficient of friction required to maintain movement at a constant speed.

4.6 Friction

An intrinsic property of the two interfacing, interacting surfaces resulting from their micro- and macro-roughness, inter- and intra-molecular forces of attraction and repulsion, and their visco-elastic properties.

4.7 Industrial work area

An area from which the public is generally excluded, and in which there may be an increased risk of slipping on the pedestrian surface due to a high incidence of substances such as grease, oil, water, foodstuffs, food residues, dust, flour or vegetable waste.

4.8 Nosing

A device intended to improve the slip resistance of the leading edge of a step.

4.9 Profiled surface

A surface with a designed raised geometrical pattern, which provides volumetric displacement.

NOTE: For example of profiled surfaces, see Figure 1.

4.10 Slip resistance

Frictional force opposing movement of an object across a surface, usually with reference to the sole or heel of a shoe on a pedestrian surface.

4.11 Slip resistance value (SRV)

The mean BPN value for the sample that has been tested and calculated in accordance with Appendix A, regardless of whether the surface was level or on a slope.

4.12 Slip resistive

Property of a pedestrian surface where the available friction is sufficient to enable a person to traverse that surface without an unreasonable risk of slipping.

4.13 Slope correction value (SCV)

The adjusted SRV when the slip resistance of a sloping surface of known maximum gradient is measured, which gives a value equivalent to that of the equivalent SRV for a level surface.

4.14 Slope design value (SDV)

The mean BPN value required on a slope of a known maximum gradient.

4.15 Step tread

The horizontal surface of a step.

4.16 Structured surface

A constructed surface with distinct irregularities within the surface profile.

4.17 Wet-barefoot area

An area in which the pedestrian surfaces are generally wet and walked on by people in bare feet.

NOTE: Wet-barefoot areas include swimming pool surrounds and are typically found in recreational buildings used by the public, communal showers, washrooms and changing rooms. Similar facilities are also found in some industrial and commercial buildings.

5 CLASSIFICATION OF SLIP RESISTANCE

5.1 Slip resistance

Pedestrian surfaces shall be classified using at least one of the combinations given in Table 1 and shall be reported as noted.

When this Standard is used for the testing and classification of the slip resistance of carpets (or carpet-like products) in potentially wet locations, the carpet shall be tested using the wet pendulum test method set out in Appendix A, and shall be reported as such.

When this Standard is used for the testing and classification of the slip resistance of carpets in dry locations, the test shall be carried out in the dry condition using the pendulum test method set out in Appendix A modified in accordance with Paragraph A2, and shall be reported as such.

The ‘dry floor friction’ test method in Appendix B is not suitable for heavily profiled surfaces or carpets.

5.2 Compliance

The surface shall comply with the stated classification for the test method and test rubber that is nominated and declared by the manufacturer or supplier.

The testing and classification of new pedestrian surface materials shall be in accordance with one or more of Tables 2, 3, 4 or 5.

TABLE 1

TEST AND CLASSIFICATION COMBINATIONS

Test conditions	Test method	Classification table to be used
Wet pendulum	Appendix A	Table 2
Wet pendulum and dry floor friction	Appendices A and B	Tables 2 and 3
Dry floor friction	Appendix B	Table 3
Wet-barefoot inclining platform	Appendix C	Table 4
Oil-wet inclining platform	Appendix D	Table 5

TABLE 2

CLASSIFICATION OF PEDESTRIAN SURFACE MATERIALS ACCORDING TO THE AS 4586 WET PENDULUM TEST

Class	Pendulum SRV (see Note 1)	
	Slider 96	Slider 55
P5	>54	>44
P4	45–54	40–44
P3	35–44	35–39
P2	25–34	20–34
P1	12–24	<20
P0	<12	

NOTES:

1 While Slider 96 or Slider 55 rubbers may be used, the test report shall specify the rubber that was used.

2 It is expected that these surfaces will have greater slip resistance when dry.

3 SDV may be calculated by using the tables that are given in Appendix F, and the minimum SRV that is considered appropriate for a level surface (see examples given in Appendix F).

TABLE 3

CLASSIFICATION OF PEDESTRIAN SURFACE MATERIALS ACCORDING TO THE DRY FLOOR FRICTION TEST

Classification	Floor friction tester mean value
D1	≥0.40
D0	<0.40

TABLE 4

CLASSIFICATION OF PEDESTRIAN SURFACE MATERIALS ACCORDING TO THE WET-BAREFOOT INCLINING PLATFORM TEST

Classification	Angle, degrees
No Classification	$<\alpha_{barefoot}$ Verification Surface A
A	$>\alpha_{barefoot}$ Verification Surface A $<\alpha_{barefoot}$ Verification Surface B
B	$\geq\alpha_{barefoot}$ Verification Surface B $<\alpha_{barefoot}$ Verification Surface C
C	$\geq\alpha_{barefoot}$ Verification Surface C

TABLE 5

CLASSIFICATION OF PEDESTRIAN SURFACE MATERIALS ACCORDING TO THE OIL-WET INCLINING PLATFORM TEST

Classification	Angle, degrees
No Classification	<6
R9	≥6<10
R10	≥10<19
R11	≥19<27
R12	≥27<35
R13	≥35

TABLE 6

CLASSIFICATION OF DISPLACEMENT SPACE ACCORDING TO DISPLACEMENT VOLUME TEST METHOD

Surface-related minimum volume of displacement space cm^3/dm^2	Displacement space assessment group
4	V4
6	V6
8	V8
10	V10

5.3 Means of demonstrating compliance

Pedestrian surfaces that are classified in accordance with Table 2 and, where appropriate, Table 3 shall meet the following criteria:

(a) The mean test results shall be as follows:

(i) For the classifications in Table 2, the mean of the test results shall be—

(A) within the relevant criteria set out in the table; and

(B) each individual result shall be equal to or above the lower limit for the classification or, if below the classification, within the mean of the result minus 20%.

If either criteria is not met, the lot shall be considered to be of lower classification.

(ii) For Classification D1 in Table 3—

(A) the mean of the test results shall be equal to or greater than 0.4; and

(B) each individual slope corrected result shall be equal to or greater than 0.35.

If either of these criteria is not met, the lot shall be considered to be Classification D0.

(b) The classification in accordance with Table 2 or 3 shall be determined by—

(i) selecting and testing at least five specimens at random as specified in Appendices A and B; or

(ii) carrying out continuous testing and process control in accordance with AS 3942.

(c) When testing individual lots, if a particular test fails to produce the expected classification it shall be permissible to—

(i) disregard the first sample, resample a minimum of 10 specimens from the whole lot, retest and apply the criteria to the new sample; or

(ii) subdivide the lot into smaller lots of different quality, resample, retest and reclassify each of the smaller lots.

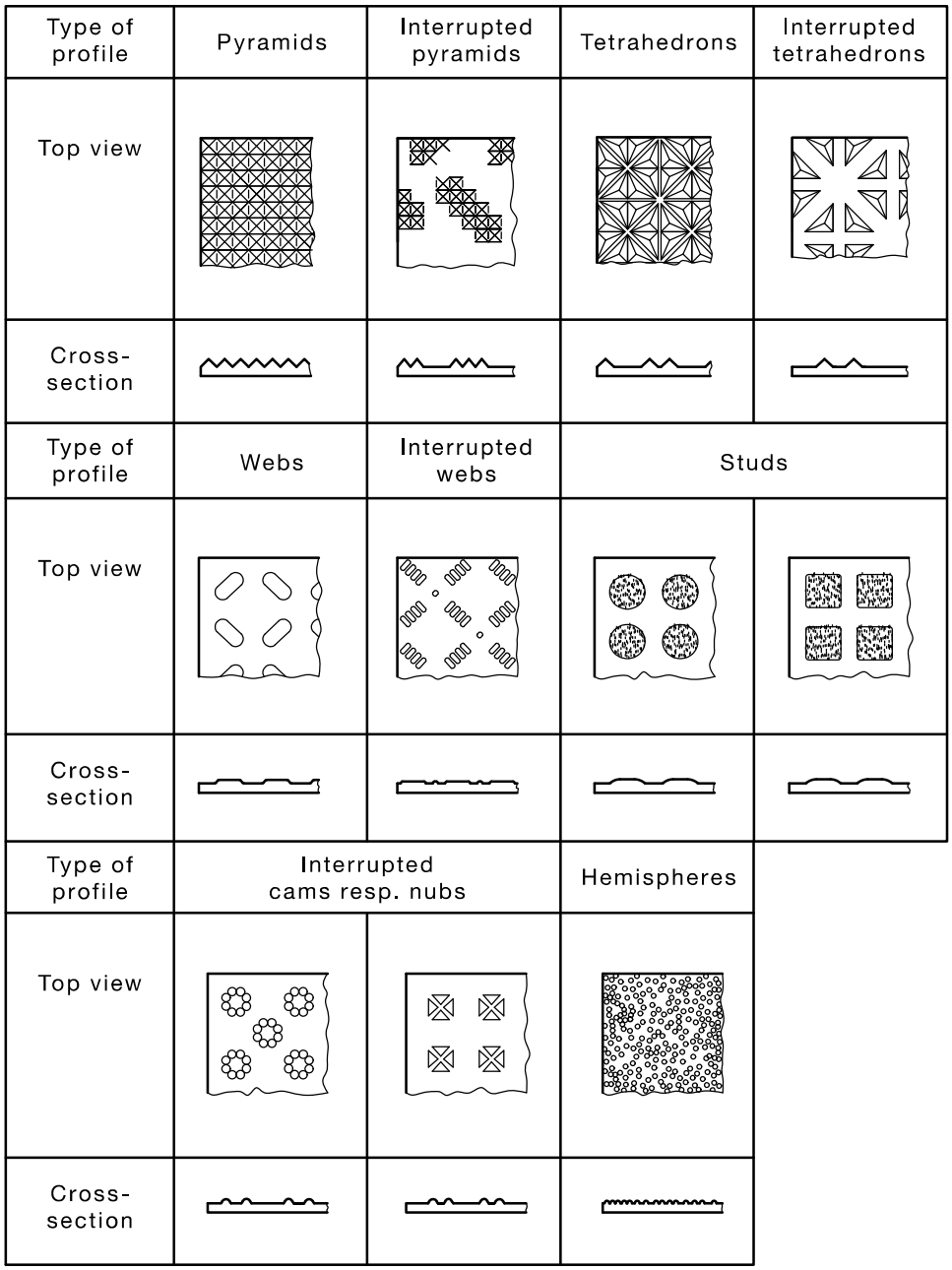


FIGURE 1 EXAMPLES OF HIGHLY PROFILED SURFACES
(Not to scale)

APPENDIX A

WET PENDULUM TEST METHOD

(Normative)

A1 SCOPE

This Appendix sets out the method for the measurement of the frictional characteristics of new pedestrian surface materials under wet conditions using a pendulum friction tester.

A2 CARPETS

When this pendulum test method is used for the measurement of the frictional characteristics of new carpet or 'carpet-like' surface materials, the presence of any underlay and the condition of the surface shall be reported.

When this pendulum test method is used for the measurement of frictional characteristics of new carpet or 'carpet-like' surface material that is intended for use in only dry conditions, the following variations to the test method shall apply:

(a) The test surface shall be tested dry (not saturated with potable water).

(b) The surface contact length for the slider shall be determined with the slider resting on the surface (not held up so that the first and last contact with the rubber slider is at the top of the carpet pile).

(c) Reporting of test values and classifications shall state 'Surface Tested Dry'.

A3 AGEING OR WEAR

If a product Standard or specification contains a requirement for the permanence of slip resistance, this requirement shall be determined after the appropriate accelerated ageing or wear testing procedure.

A4 PRINCIPLE

The frictional characteristics of each specimen shall be assessed by determining the wet dynamic friction between the specimen and the slider of a pendulum swinging in a vertical plane.

A5 APPARATUS

A5.1 Pendulum friction tester

A pendulum friction tester shall be constructed, and shall comply with the following:

NOTE: An example of a friction tester is shown in Figure A1.

(a) All bearings and working parts of the instrument shall be enclosed as much as practicable, and all materials shall be suitably treated to prevent corrosion under wet conditions.

(b) When not in use on site, the apparatus shall be used and stored in a dust-free environment that is not subject to significant temperature variations.

(c) The pendulum friction apparatus shall be calibrated to ensure compliance with BS 7976-3 or CEN/TS 16165. After the apparatus has been calibrated, regular internal checking shall be conducted on a set of control specimens and the results recorded. When results obtained from the control specimens vary from the values established following calibration by more than three units, the apparatus shall be partially or completely recalibrated.

NOTES:

1 Calibration may be arranged through a suitable accredited laboratory proficient in calibration and repair of friction apparatus. Australian laboratory accreditation authorities have traditionally expected that equipment be calibrated at intervals not exceeding two years. However, submissions for the extension of calibration intervals are considered on the basis of factors such as history of stability, frequency of use, required accuracy, ability of staff to perform in-house checks, internal laboratory equipment assurance programs, and successful participation in proficiency testing programs.

2 The control specimens should be stable with time and be of a range of surface roughness that are typical of the materials that the apparatus is used for measuring. New control specimens may benefit from having been subjected to an appropriate accelerated conditioning procedure.

(d) The tester shall incorporate the following:

(i) A spring-loaded rubber slider of the mass, size and shape specified in Paragraph A5.2, mounted on the end of the pendulum arm so that the sliding edge is 514 ±3 mm from the axis of suspension.

(ii) Means for levelling the instrument.

(iii) Means for raising and lowering the axis of suspension of the pendulum so that the slider can—

(A) swing clear of the surface of the specimen; and

(B) be set to slide over a fixed length of surface.

(iv) Means for holding and releasing the pendulum arm so that it falls freely from a horizontal position.

(v) A pointer balanced about the axis of suspension, indicating the position of the pendulum arm throughout its forward swing and moving over the circular scale attached to the instrument. The mass of the pointer, excluding felt friction washers, shall be not more than 85 g and the friction in the pointer mechanism shall be adjustable so that with the pendulum arm swinging freely from a horizontal position, the outward tip of the pointer may be brought to rest on the forward swing of the arm at a point 10 ±1 mm below the horizontal, the point corresponding to the zero position on the attached circular scale.

The mass of the swinging arm including the slider shall be 1.50 ±0.03 kg with the centre of gravity lying on the axis of the arm at a distance of 410 ±5 mm from the centre of suspension.

The slider shall be mounted on an axis set at an angle of 26 ±3° to the horizontal when the pendulum is at the lowest point of its swing, so that only the rear edge of the slider contacts the test surface and the nominal static force on the slider is set by the calibration procedure.

Where required, a device for rigidly locating the specimens shall be provided so that—

(A) the specimen is bisected by a vertical plane perpendicular to the frame of the instrument and passing through the axis of suspension of the pendulum; and

(B) the full width of the slider backing plate will align with the specimen over a length of 124 ±1 mm (see Figure A3).

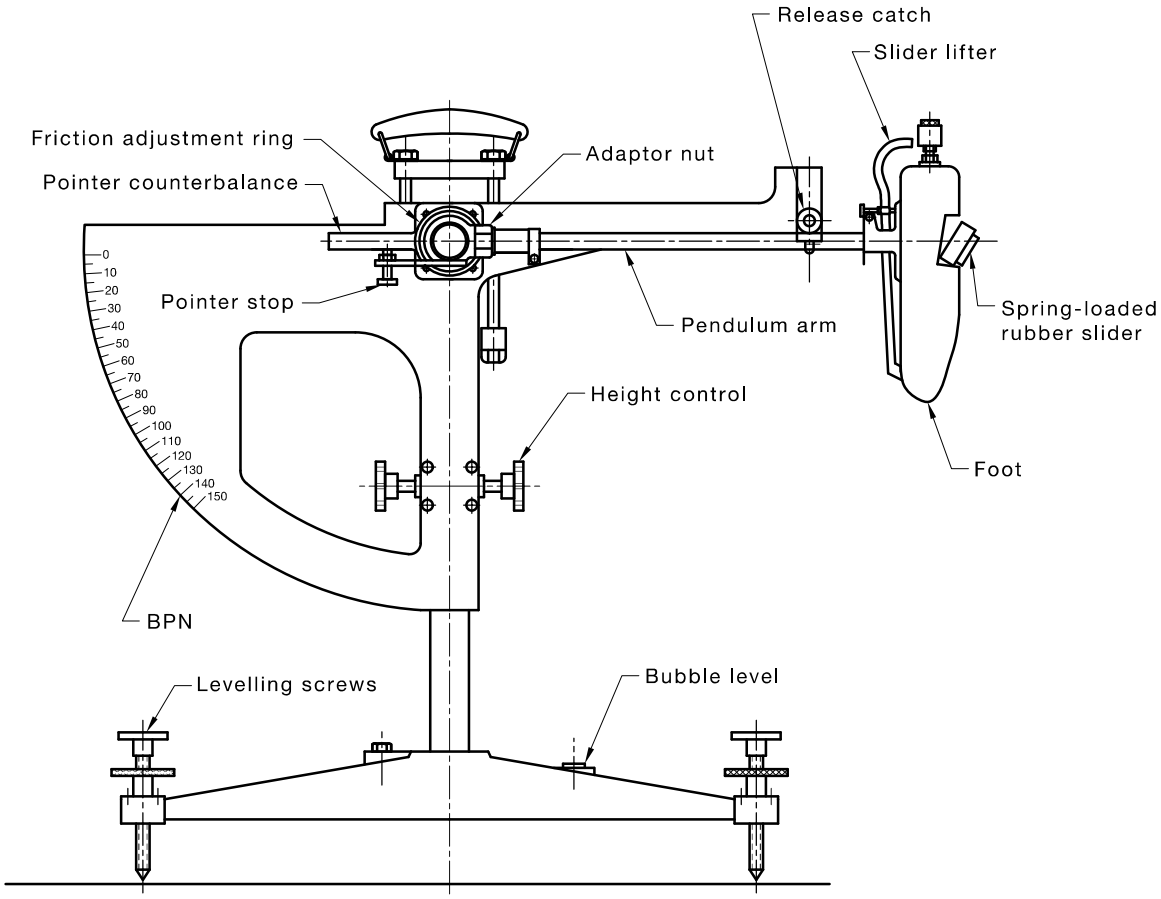


FIGURE A1 EXAMPLE OF PENDULUM FRICTION TESTER

A5.2 Sliders

A5.2.1 *General*

Sliders used in the friction tester shall be 25.4 ±1.0 mm wide and 6.4 ±0.50 mm thick and rigidly backed. The sliding edges shall be square, clean cut and free from contamination. Sliders shall be 76 ±1.0 mm long and, with the rigid backing plate, shall have a total mass of 39 ±2 g for Slider 96 and 35 ±2 g for Slider 55.

A5.2.2 *Slider material*

The standard slider material shall be either Slider 96 (IRHD 96 ±2 at 23 ±3ºC) or Slider 55 (IRHD 55 ±5 at 0 to 40°C).

When not in use, sliders shall be stored in the dark at a temperature below 25ºC and preferably below 15ºC. They shall be discarded when—

(a) they are more than 12 months past the date of release by producer, unless they comply with the hardness requirements of ISO 7619-1;

(b) they do not comply with the hardness requirements of ISO 7619-1; or

(c) the chamfers worn on the two trailing edges of the slider are in excess of 4 mm wide.

The chamfer measurement shall be made on the most representative portion of the trailing edge.

NOTE: An example of a maximum permissible chamfer is shown in Figure A2.

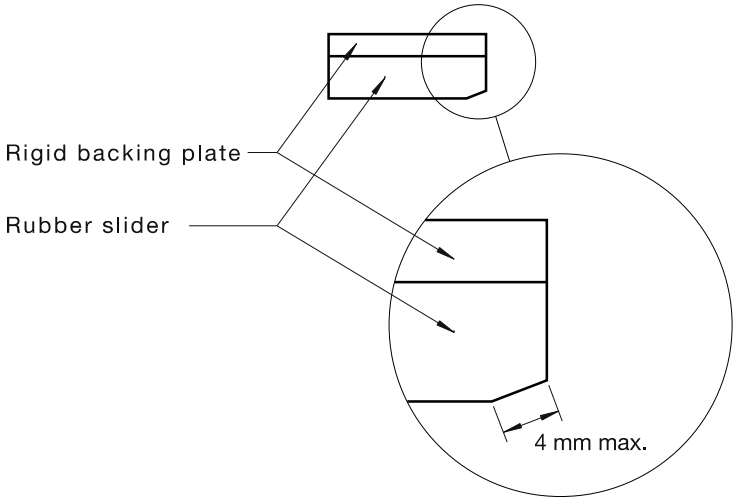


FIGURE A2 EXAMPLE OF THE MAXIMUM PERMISSIBLE EDGE CHAMFER

A5.3 Water spray bottle

Water spray bottle containing clean water at ambient temperature.

A5.4 Thermometer

Thermometer with a range of 0ºC to 50ºC.

A5.5 Abrasive paper

Wet and dry abrasive paper, Grade P 400, mounted on a flat rigid surface.

A5.6 Lapping film

Sheet of 3M 261X Imperial Lapping Film Grade 3MIC, mounted on a flat rigid surface.

NOTE: Equivalent products may be used, provided they can be shown to lead to the same results.

A5.7 Cleaning agents

Where it is assessed that the product is to be cleaned, appropriate cleaning agent(s) shall be used, depending on the state and type of contamination to be removed from the surface.

A6 PREPARATION OF SPECIMENS FOR LABORATORY TESTING

A6.1 Equipment adjustment

The equipment shall be adjusted as follows:

(a) Where possible, bring the apparatus (including the slider), specimens, contents of the water spray bottle and the temperature of the room in which friction testing is to be carried out to 20 ±5ºC at least 10 min before testing and maintain them at this temperature until testing is completed.

(b) Record the room temperature at the time of testing.

(c) Mount the tester on its base and adjust the levelling screws so that the levelling bubble is centred and the tester is appropriately aligned with the specimen.

(d) Install a rubber slider (see Paragraph A5.2) in position.

(e) Raise the axis of suspension of the pendulum so that the arm swings freely.

(f) Adjust the friction rings in the pointer mechanism so that, when the pendulum arm and pointer are released from the right-hand horizontal position, the pointer will zero repeatedly.

A6.2 Conditioning of sliders

Before testing each sample, each slider shall be conditioned as follows:

(a) Secure a piece of abrasive paper (see Paragraph A5.5) beneath the slider.

(b) Secure the slider on its pivot ensuring the correct positioning of the two washers and spring.

(c) Check that the trailing edge of the slider is parallel to the minor axis of the abrasive paper when the pendulum hangs freely at rest.

(d) Adjust the height of the axis of suspension of the pendulum so that the top trailing edge of the aluminium backing of the slider is aligned over the abrasive paper over a length of 124 ±1 mm (see Figure A3).

(e) Return the pendulum to its horizontal position and move the pointer against its horizontal stop.

(f) Swing the pendulum along the dry surface of the abrasive paper as follows:

(i) Release the pendulum and pointer from the horizontal position, allowing them to swing over the abrasive paper.

(ii) Catch the pendulum as it falls back from its peak after the slider has traversed the abrasive paper.

NOTE: If the pendulum is not caught and the slider is not lifted before it hits the abrasive paper on the return swing, the slider will be damaged.

(iii) Return the pendulum and pointer to the horizontal position.

(iv) Repeat at least twice more (i.e. a minimum number of three swings) so that the rubber has a consistently chamfered surface.

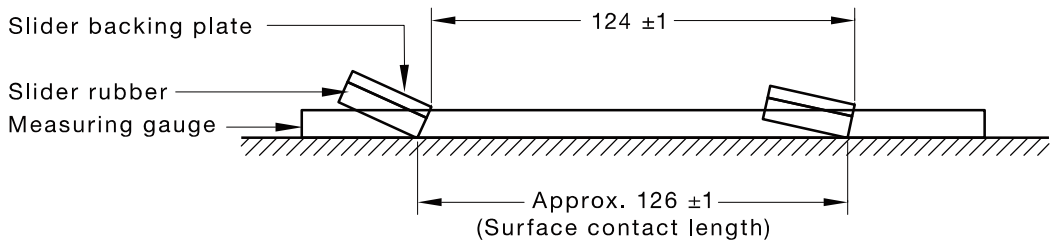
(v) The surface of the abrasive paper should be brushed with a soft clean brush to remove any rubber particles.

The readings on the scale shall be within ±2 of a consistent number lying within the range of 85 ±10 for Slider 96 or 115 ±10 for Slider 55 during the conditioning of the slider.

New sliders shall be given a chamfered edge by passing the slider 10 times across the abrasive paper which has been mounted on a flat rigid surface.

(g) Condition the slider further using 10 swings over wet lapping film (see Paragraph A5.6).

NOTE: The readings on the scale for the last 5 readings should be in the range 61 ±3 for Slider 96 and 55 ±6 for Slider 55.



DIMENSIONS IN MILLIMETRES

FIGURE A3 SLIDER SURFACE CONTACT ALIGNMENT

A6.3 Test specimen

A6.3.1 *General*

The test specimen shall be mounted on a horizontal surface in such a way as to prevent its movement during the test.

For materials having a surface pattern or non-uniform texture (with regard to direction), testing shall be carried out in the direction expected to give the lowest British Pendulum Number (BPN). In such cases, testing in directions at 0º, 90º and 45º shall be carried out to determine if there is a bias due to anisotropic characteristics that may affect the reported SRV.

Testing shall be in the direction most likely to result in the lowest BPN, as follows:

(a) Tiled surfaces or surfaces with many joints shall be tested at an angle of approximately 10º to 20º to the direction of the joints.

NOTE: This reduces the effect of grout joints and planarity within the test specimen.

(b) Timber surfaces shall be tested parallel to the grain.

(c) When testing other highly profiled surfaces such as tactile ground surface indicators (TGSIs), including directional indicators, the effect of the slider striking the sides of TGSIs shall be minimized. Testing shall be conducted at an angle of 30° to the line of indicators to maximize continuous contact with the top surface of TGSIs and minimizing slider drop-down between TGSIs.

(d) If a step tread has a slip-resistant feature strip near the nosing that has a severe profile, such as castellated blocks, the direction of the testing shall be offset by about 10°.

(e) Step treads shall be tested in the direction of pedestrian movement on stair descent, that is from the back of the product towards the nosing, including as much as possible of any slip-resistant feature strip near the edge of the nosing.

NOTE: Due to the physical geometry of stairs it may not be possible to conduct tests in the appropriate direction on a stair tread within a stair flight. However, if the top nosing of a flight of stairs and the associated landing surface treatment is the same as a typical stair, testing of the landing, nosing and surface may produce a test result similar to that which could be expected on a stair tread if testing were possible. For an example of testing stair tread or stair landing nosing, see Figure A8.

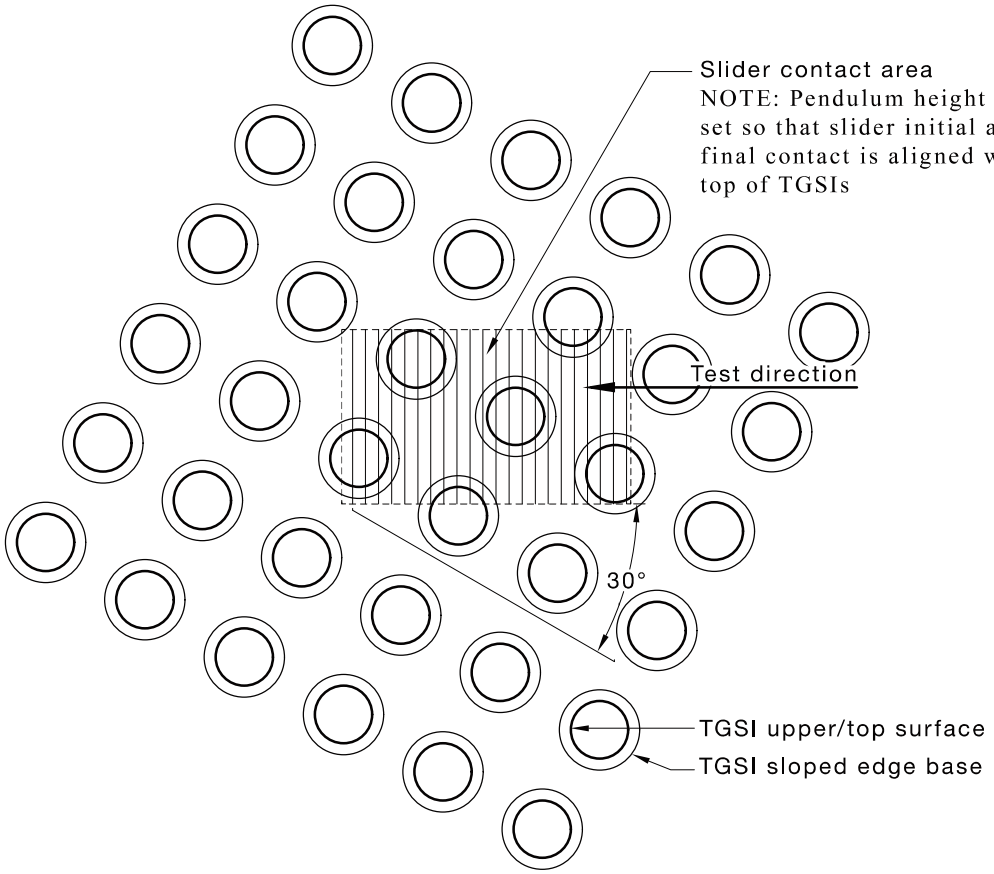


FIGURE A4 EXAMPLE OF TESTING TACTILE GROUND SURFACE INDICATORS (TGSIs)

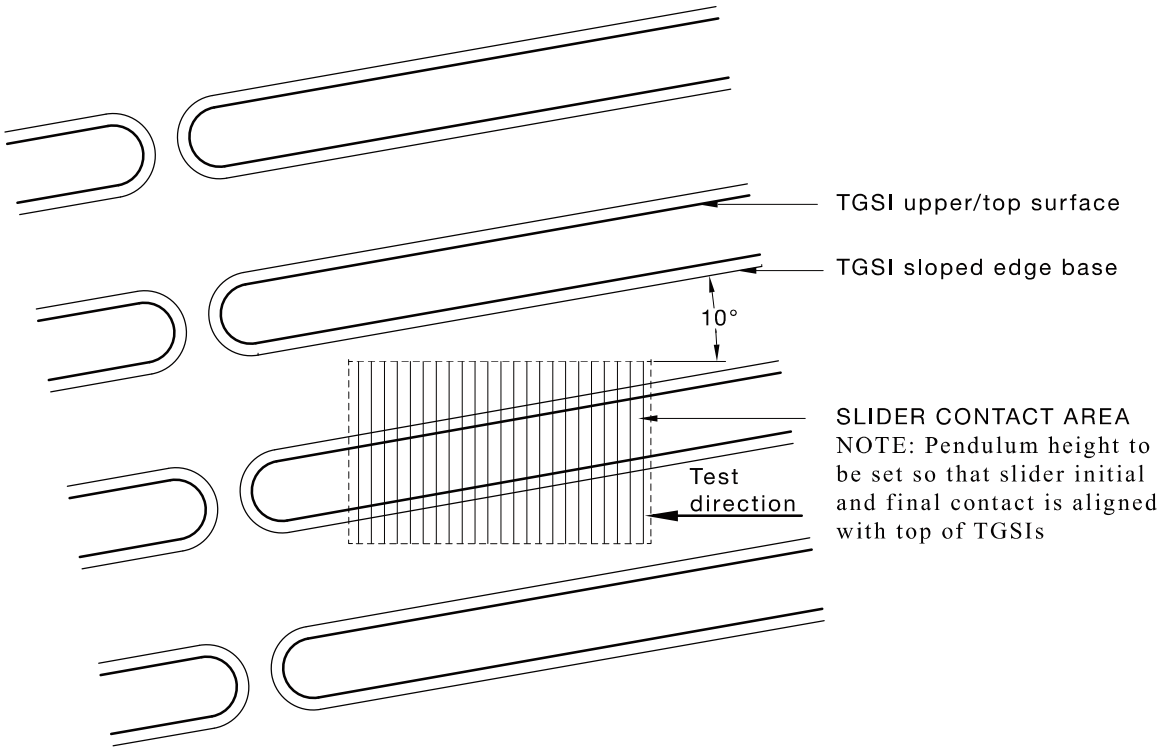


FIGURE A5 EXAMPLE OF TESTING DIRECTIONAL TACTILE GROUND SURFACE INDICATORS (TGSIs)

A6.3.2 *Test sample*

A minimum of five individual specimens shall be selected at random from the lot. If a sheet product, a single specimen shall be of a sufficient size to enable testing at five locations.

A6.3.3 *Size of test specimen*

The minimum size of the specimen shall be 100 mm × 150 mm. Where the specimen size is smaller, additional specimens shall be fixed to a suitable surface to provide the minimum required specimen size.

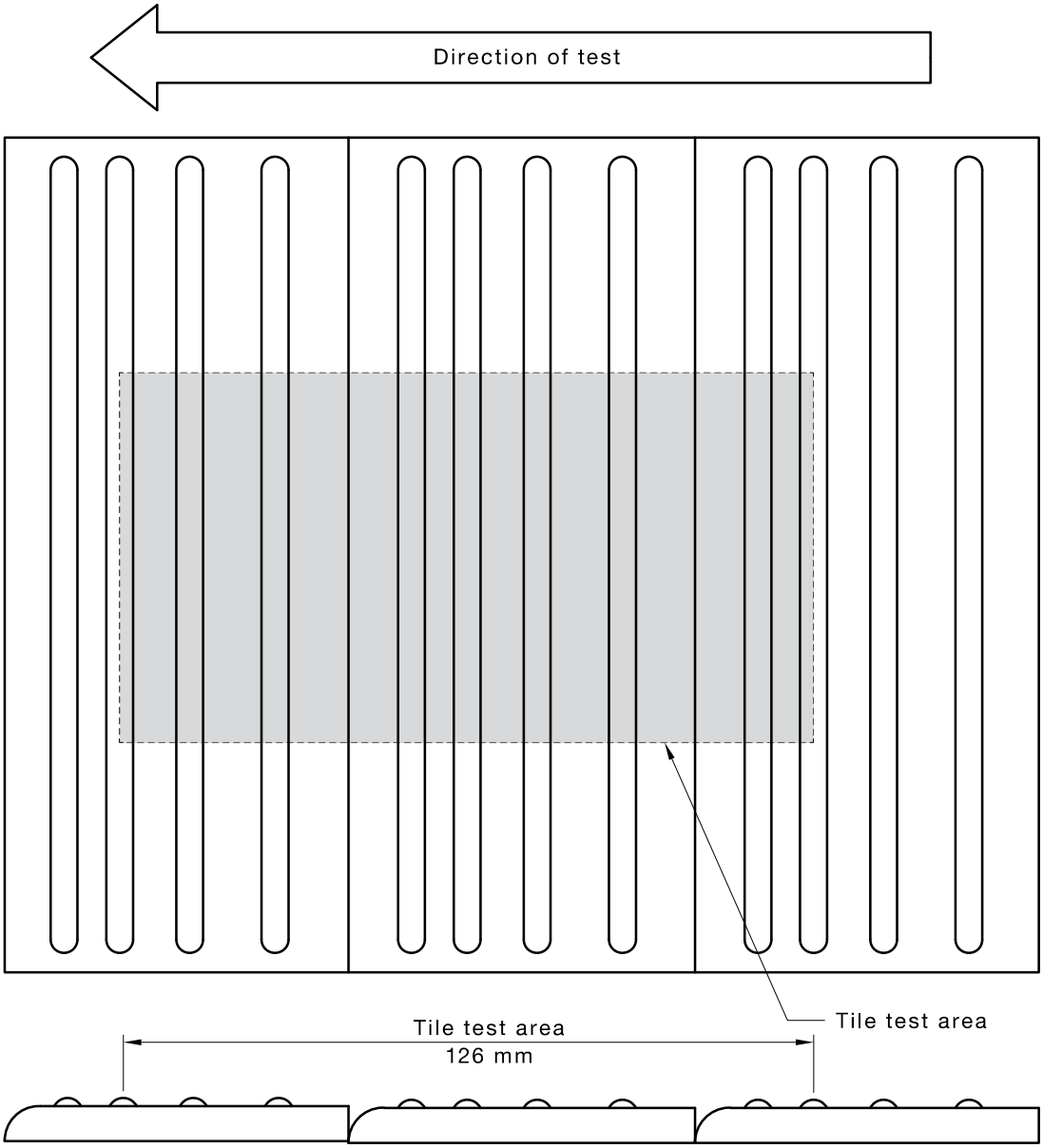
If the pedestrian surface materials consist of small, discrete elements such as mosaic tiles (50 mm × 50 mm or less), they shall be fixed to a suitable surface, spaced and grouted to manufacturer's specifications as they would be on a finished pedestrian surface.

If nosing sections have been cut from stair treads for testing, they shall be fixed to a suitable substrate, adjacent to each other to form a continuous surface. The sections shall be arranged back to nose, and shall be tested in accordance with Figures A6 and A7.

NOTE: When setting the measurement length of 124 mm, the slider should start on the top of the profile; this may mean moving the instrument.

A6.3.4 *Preparation of test specimen*

Prior to testing, the surface shall be free of dust, grease, grout and other contaminants.



NOTE: Where larger products contain a slip-resistant feature strip near the nosing, this portion shall be cut to provide sufficient product for testing; however, if testing in situ the operator shall include a portion of the tread together with the nosing section, where the test is conducted on the landing at the top of the stairway (see Figure A8).

FIGURE A6 MEASUREMENT ON 60 × 200 mm INTEGRAL NOSE STEP TREADS THAT HAVE A RAISED PROFILE AT AN IRREGULAR SPACING

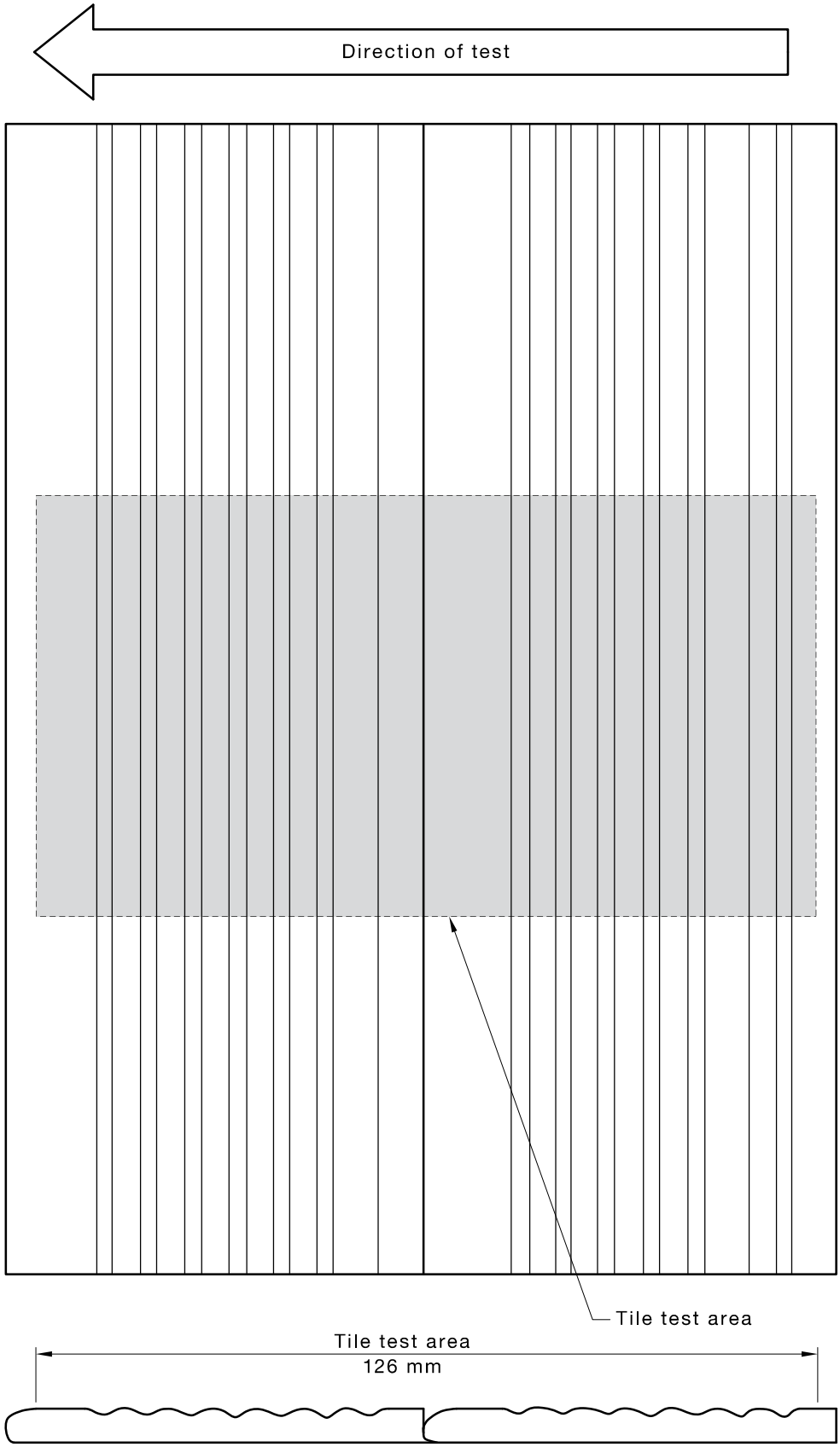


FIGURE A7 MEASUREMENT ON PORTIONS CUT FROM INTEGRATED 300 × 300 mm STAIR TREAD TILES THAT HAVE A RAISED RECESSED PROFILE AT A REGULAR SPACING

A7 PREPARATION FOR IN SITU TESTING OF NEW SURFACES

A7.1 Preparation of equipment

The equipment shall be acclimatized to room temperature for a minimum of 10 min and shall be adjusted in accordance with Paragraph A4.

A7.2 Environmental conditions

Environmental conditions in the test area (e.g. temperature, weather conditions and condition of the surface) shall be recorded.

A7.3 Conditioning

The sliders shall be conditioned in accordance with Paragraph A6.2.

A7.4 Test surface

The test sample shall reflect the nature and purpose of the test. A minimum of five locations shall be used for each site condition that is tested.

If the surface is contaminated with oil, grease or the like, it shall be cleaned with an appropriate cleaner and rinsed to remove all residues. The cleaning procedure shall be recorded.

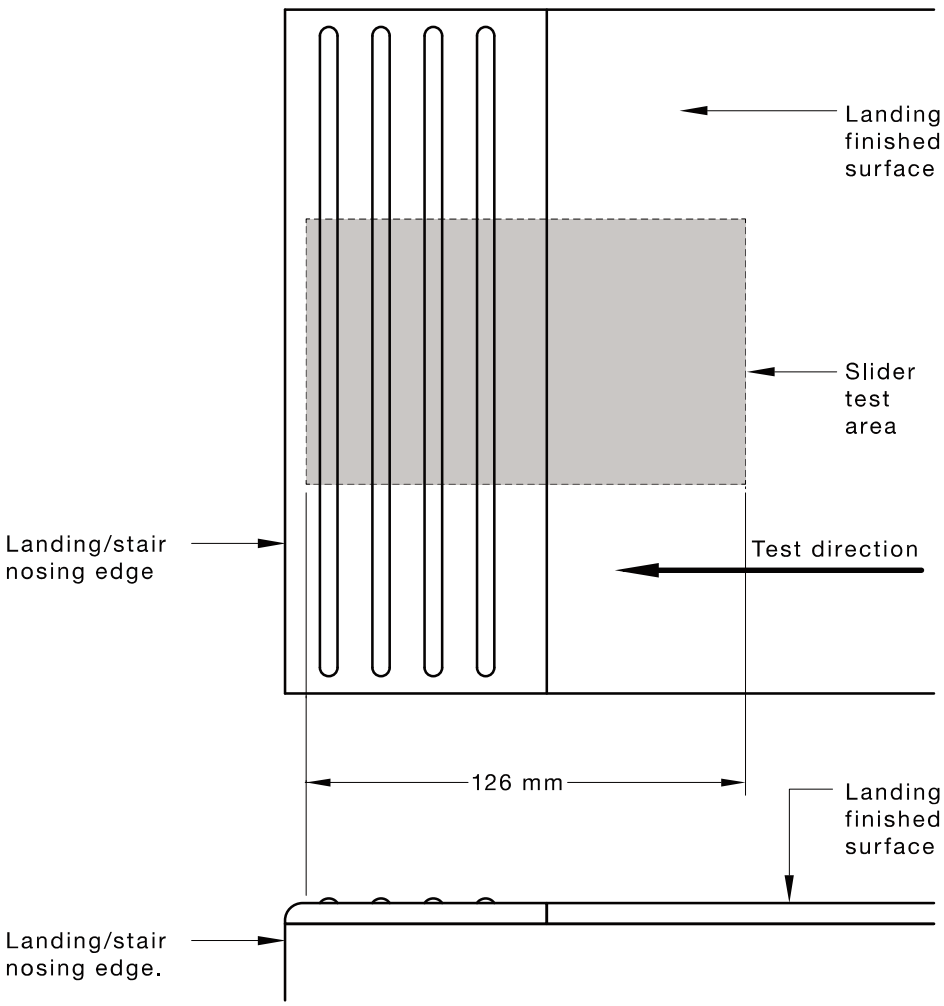


FIGURE A8 IN SITU TESTING STAIR TREAD OR STAIR LANDING NOSING—ELEVATED PROFILE TILE NOSING

A7.5 General

Testing to evaluate the frictional characteristics of the pedestrian surface shall be carried out on a horizontal surface, where possible.

Where it is desired to determine the frictional characteristics on sloping surfaces, the precise method and direction of testing shall be recorded.

A8 PROCEDURE

The procedure shall be as follows:

(a) For each sample, carry out preparation for testing in accordance with Paragraph A6.

(b) Ensure there is no movement of the apparatus during testing.

NOTE: When testing outdoors it may be necessary to protect the instrument from effects of wind, or movement of air caused by trains or traffic. For example, a bag of lead shot, sand or other suitable material may be placed across the rear foot stay. High friction pads may also be placed under the pendulum feet. In both cases, the base of the pendulum has to remain level.

(c) Check that the trailing edge of the slider is parallel to the surface of the specimen being tested when the pendulum hangs freely at the bottom of its swing.

(d) Adjust the height of the axis of suspension of the pendulum so that the aluminium backing edge of the slider is aligned over a length of 124 ±1 mm while traversing the flat surface.

(e) Return the pendulum to its horizontal position and move the pointer against its stop.

(f) Saturate the surface of the specimen with potable water so that water remains visible on the surface to be tested.

(g) Operate the pendulum and point in the manner described in Paragraph A6.2(f) for five swings, rewetting the specimen before each swing.

(h) Read and record the value on the main scale from each swing until the readings for the last three swings differ by no more than three units of the scale.

NOTE: As an example, a difference of three units means that results of 33, 31 and 30 would be acceptable.

When testing some highly profiled surfaces, it may not be possible to obtain results that differ by no more than three units in the last three swings. In such cases, if a minimum number of eight swings have been made, the three lowest of the last five values shall be used for the purpose of calculating the mean for that specimen. This deviation from the standard procedure shall be reported.

For all specimens, ensure that the direction chosen is appropriate (see Paragraph A6.3.1).

(i) Calculate and record as the SRV the specimen mean value from the last three recorded values for each specimen to the nearest whole number. When a Slider 55 is used, apply the temperature corrections specified in Table A1.

(j) After conducting the test in accordance with Steps (a) to (h), raise the head of the instrument such that it swings clear of the test surface and check the free swing to determine whether the zero setting is still correct (see Paragraph A6.1). If the zero setting is not correct, adjust it in accordance with Paragraph A6.1, repeat the appropriate test procedure [Steps (a) to (h)] then check the free swing again to determine whether the zero setting is correct (see Paragraph A6.1). If the zero setting is not correct, partially or completely recalibrate the apparatus.

TABLE A1

TEMPERATURE CORRECTIONS FOR SLIDER 55

Temperature °C	Adjustment to the measured SRV
34–40	+3
27–33	+2
24–26	+1
18–23	0
15–17	−1
12–14	−2
8–11	−3
6–7	−4
3–5	−5
1–2	−6
0	−7

A9 REPORT

The following shall be reported:

(a) Identification of the test sample.

(b) Date and location of test.

(c) Name(s) of the personnel that conducted the test.

(d) A description of the test sample, including identity of test surfaces or designation, manufacturer, product, quality class (where applicable), colour and dimensions of products used for the surface (if this information is known) and any surface coating, grouts or treatments and, for carpet or 'carpet-like' surface materials, the presence of any underlay, condition of the surface and whether the surface was tested wet or dry.

(e) Type of test, including whether the specimen is tested loose or fixed in situ, the direction of test and slope of specimen.

(f) If appropriate, extent and type of cleaning performed on the specimens.

(g) The air temperature, in degrees Celsius, and relevant environmental conditions.

(h) The type of slider used and its method of preparation.

(i) If testing in situ, a description of the site condition, including any contamination, coatings or wear and slopes.

(j) The mean BPN for each test specimen, including the direction of test and slope corrected values, where appropriate.

(k) The SRV for the sample, accurate to the nearest whole number, and after temperature correction in the case of Slider 55 being used.

(l) Classification achieved in accordance with Table 2.

(m) Reference to this Australian Standard and test method, i.e. Appendix A, AS 4586—2013.

APPENDIX B

DRY FLOOR FRICTION TEST METHOD

(Normative)

B1 SCOPE

This Appendix sets out the method for measuring of the coefficient of friction (COF) of pedestrian surface materials using a floor friction tester (FFT).

B2 PRINCIPLE

The coefficient of friction of the specimen is assessed by determining the dynamic friction between the specimen and a slider moving at a constant speed of 1 ±0.1 m/min. across the surface by measuring the ratio of the tangential force to the vertical load.

B3 APPARATUS

B3.1 Floor friction tester (FFT)

The FFT shall be a portable self-powered mobile apparatus such that its measurement module is as shown in Figure B1, or as subsequently modified in accordance with the principles shown herein. It shall include a means of recording the output data such as a continuous chart record or other means of electronic data capture capable of capturing at least five data points per second.

The vertical load shall be 200 ±20 g.

The performance of the apparatus shall be verified by comparing the measurement to a known result by not more than 0.05.

NOTE: The control specimens should be stable with time and be of a range of surface roughnesses typical of the materials that the apparatus is used for measuring.

B3.2 Slider material

The standard slider material shall be Slider 96 (IRHD 96 ±2 at 23 ±3°C).

Sliders shall be discarded when—

(a) they are more than 12 months past their date of issue, unless they comply with the IRHD requirements of ISO 7619-1;

(b) they do not comply with the IRHD requirements of ISO 7619-1; or

(c) they are less than 2 mm thick.

NOTE: Unused sliders should be stored in the dark at a temperature at or below 15ºC.

B3.3 Slider size and shape

The size and shape of the slider shall be a disk of 9 ±0.5 mm in diameter.

B3.4 Abrasive paper

Wet and dry abrasive paper, Grade P 400, shall be used to prepare the slider before testing each specimen.

B3.5 Cleaning agents

Where it is assessed that the product is to be cleaned, appropriate cleaning agent(s) shall be used depending on the state and type of contamination to be removed from the surface.

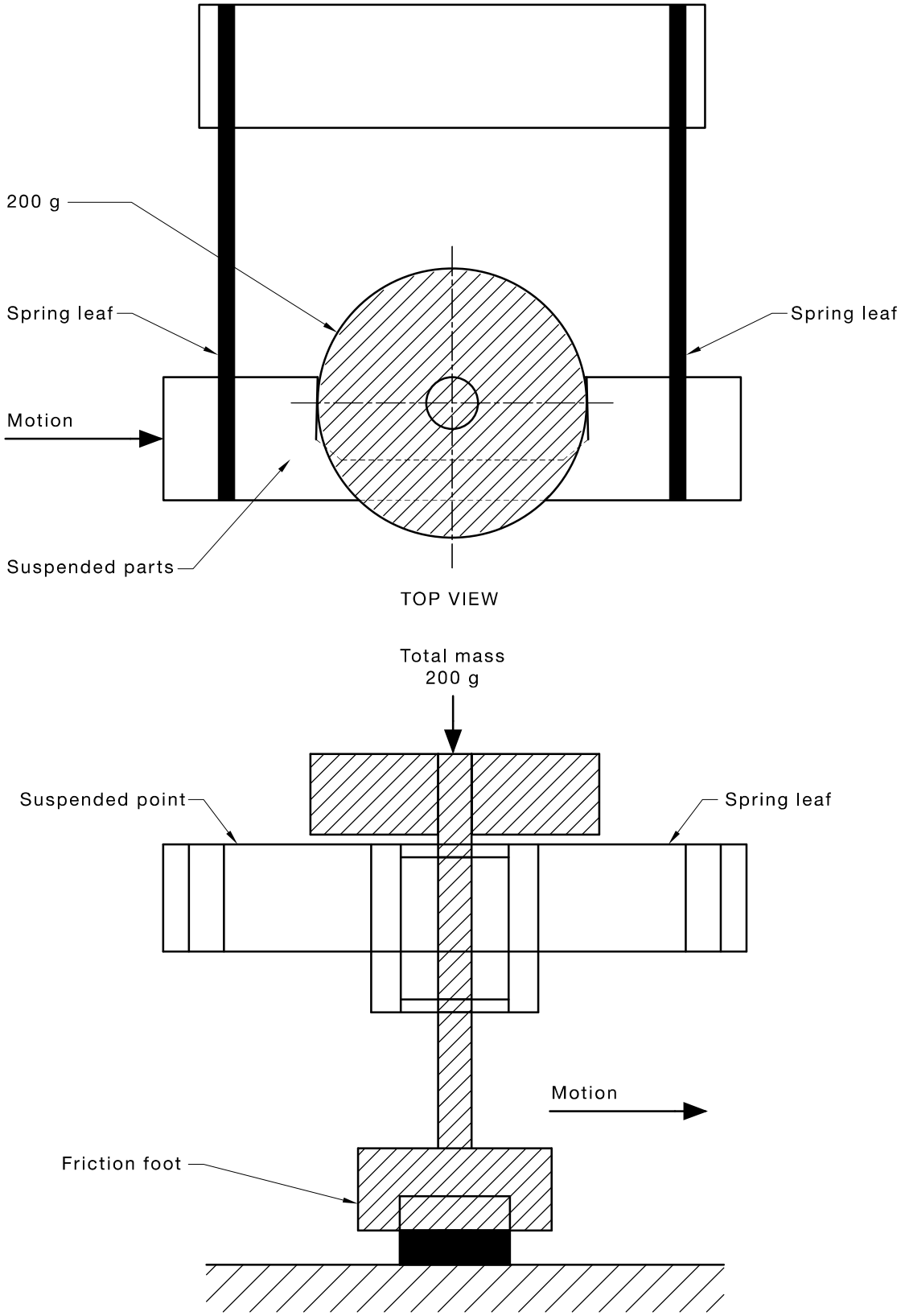


FIGURE B1 FLOOR FRICTION TESTER

B4 SLIDER ASSEMBLY

The slider shall be assembled as follows:

(a) Cut 9 mm diameter disc sliders from standard 6 mm nominal rubber sheet.

(b) Attach them to a metallic slider holder by means of a rapid pressure contact adhesive or other suitable adhesive.

B5 PREPARATION FOR LABORATORY TESTING

B5.1 Equipment conditioning

Where possible, bring the temperature of the room containing the apparatus slider and specimens to 20 ±5°C at least 10 min before testing and maintain them at this temperature until testing is completed.

B5.2 Calibration of FFT

The FFT shall be calibrated at the start of each day's measurements and again when it is moved from one test site to another, in accordance with manufacturer's instructions.

B5.3 Conditioning of slider

Before testing each sample, the slider shall be run over the abrasive paper for a distance of about 200 mm. To clean the slider, loose particles shall be removed with a clean dry brush.

B5.4 Test specimen

B5.4.1 *General*

The test specimen shall be mounted on a horizontal surface in such a way as to prevent its movement during the test.

For materials having a surface pattern or non-uniform texture, with regard to direction, testing shall be carried out in the direction expected to give the lowest coefficient of friction.

The environmental laboratory conditions shall be recorded.

B5.4.2 *Test samples*

The test samples shall be such that they provide a cumulative minimum test path length of 800 mm and shall reflect the nature and purpose of the test. A minimum of two runs, each of cumulative path length of 800 ±50 mm, shall be used.

B5.4.3 *Size of test samples*

The minimum size of the sample shall be sufficient to give an 800 mm path length. Where the sample size is smaller than this, additional samples shall be fixed to a suitable surface to provide the minimum required specimen size.

If the pedestrian surface material consists of small discrete elements such as mosaic tiles (50 mm × 50 mm or less), they shall be fixed to a suitable surface, spaced and grouted to manufacturer's specifications as they would be on a finished pedestrian surface.

NOTE: Tiles other than mosaics may be butted against each other with no spacing required; however, tiles should be laid flush in order to prevent the slider catching at joints.

B5.4.4 *Preparation of test specimen*

If the surface is contaminated with oil, grease, grout or the like, it shall be cleaned with an appropriate cleaner, rinsed to remove all residues, and thoroughly dried.

B6 PREPARATION FOR IN SITU TESTING

B6.1 Preparation of the equipment

Where possible, the apparatus, including the slider, shall be brought into the test area at least 10 min before testing.

B6.2 Conditioning

Before testing each sample, the slider shall be run over the abrasive paper for a minimum distance of 200 mm. To clean the slider, loose particles shall be removed with a clean-dry brush.

B6.3 Test surface

B6.3.1 *General*

The test surface shall be tested in its specified condition. If the surface is contaminated with oil, grease or the like, it shall be cleaned with an appropriate cleaner and rinsed to remove all residues. The cleaning procedure shall be recorded. For materials having a surface pattern or non-uniform texture, with regard to direction, testing shall be carried out in the directions giving the lowest COF.

B6.3.2 *Coefficient of friction (COF)*

Testing to evaluate the COF of the pedestrian surface shall be carried out on a horizontal surface, where possible.

To determine the coefficient of friction of a sloping surface, the pedestrian surface shall be tested—

(a) in both upward and downward direction with the individual measurements being corrected for slope; or

(b) across the slope with tests being done in opposite directions and readings averaged, if there is insufficient room for testing in accordance with Item (a).

The result shall be given by averaging the readings from both directions rather than by either direction taken alone.

NOTE: Limitations on testing up and down the slope or across sloped surfaces are mainly due to the ability of the instrument to traverse the surface without slipping. If adequate traction is available, testing can generally be conducted up to an angle of 20° up and down a sloped surface.

B6.3.3 *Test sample*

The test sample shall reflect the nature and purpose of the test. The environmental conditions at each test site shall be recorded. A minimum of two runs, each of cumulative path length of 800 ±50 mm shall be used for each site condition.

NOTE: It may be necessary for the 800 mm path length to be formed by a number of passes across a closely related surface.

B7 PROCEDURE

The procedure shall be as follows:

(a) Place the test specimen on a stable flat surface, if necessary by placing other materials that are not being measured around it, to provide a flat area that will allow the FFT to move forward at least 800 mm.

(b) Place the FFT on the test area in such a position that forward movement will take the slider across the surface that is to be measured.

(c) Operate the equipment in accordance with the manufacturer's instructions.

(d) Determine the average value over a cumulative distance of 800 ±50 mm, within which the recorded measurements are not adversely influenced by obvious external influences such as initial abrasion of the slider by rough textures, or catching of the slider in grout joints.

For purposes of assessing individual test results, each length of 100 ±10 mm shall be considered as giving a separate result.

If testing in situ on a slope, measurements shall be made 180º to one another in order to counter the effects of gravity with the individual measurements corrected for slope.

(e) Assess the cleanliness of the slider and record its condition if contaminated. Clean the slider on the abrasive paper, remove loose particles with a clean dry brush, and repeat the procedure along at least one different path across the test sample. If the 800 mm test path length has been obtained by multiple passes, no conditioning of the slider between passes is permitted.

When making measurements on surfaces prepared in accordance with Paragraphs B5.4.4 or B6.3, and if the slider has been contaminated, clean the test specimen and discard the result, then repeat the test.

(f) Record the average values of at least two passes (each pass being 800 ±50 mm), retaining either a trace of the test or individual results over lengths of 100 ±10 mm.

B8 REPORT

The following shall be reported:

(a) Identification of the test sample.

(b) Date and location of test.

(c) Name(s) of personnel that conducted the test.

(d) A description of the test sample, including identity of test surfaces or designation, manufacturer, product, quality class (where applicable), colour and dimensions of products used for the surface (if this information is known) and any surface coating, grouts or treatments.

(e) Type of test, including whether the specimen is tested loose or fixed in situ, the direction of test and slope of specimen.

(f) If testing in situ, a description of the site condition, including any contamination, wear and slopes.

(g) If appropriate, extent and type of cleaning performed on the test specimens.

(h) The air temperature at time of test, in degrees Celsius, and relevant environmental conditions.

(i) The two average values and the mean coefficient of friction (COF) for the test sample, rounded to the nearest 0.05, including the direction of test, where appropriate.

(j) Any individual test result below 0.40.

(k) The classification achieved according to Tables 1 and 3.

(l) Slope corrected values, where appropriate, rounded to the nearest 0.05.

(m) Reference to this Australian Standard, i.e. Appendix B, AS 4586—2013.

APPENDIX C

WET-BAREFOOT INCLINING PLATFORM TEST METHOD

(Normative)

C1 SCOPE

This Appendix sets out a method for the measurement of the friction characteristics of pedestrian surface materials using the wet-barefoot inclining platform method.

C2 PRINCIPLE

Two test persons are used to determine the angle of inclination at which safe walking no longer occurs, when the pedestrian surface material being tested is subjected to a continuous stream of water containing a wetting agent. The test persons, each in turn, facing downhill and with an upright posture, move backwards and forwards over the test surface, as they increase their angle of inclination, until they reach their safe limit of walking. The angles of inclination obtained at such limits are used to assess the friction characteristics of the test surface.

C3 TEST PERSONS

Each test person shall be an adult, whose bare feet shall have been soaked in the test fluid at 23 ±5ºC for at least 10 min prior to the test.

In order to reduce subjective influences on the test result, the test persons shall prepare themselves for testing by first making comparative measurements by walking on verification surfaces of known inclination values (see Paragraph C4.3).

C4 APPARATUS

C4.1 Inclined platform

A flat torsion-resistant platform, typically 600 mm wide and 2000 mm long, the pitch of which can be adjusted in the longitudinal direction from 0° to 45º. An angle measurement indicator fitted to the assembly shall have an accuracy of ±0.2°. It shall not be visible to the test person.

NOTE: The apparatus should be capable of inclining at a rate of 1º/s for practical reasons.

For the safety of the test persons, railings shall be fitted along the longitudinal sides of the test assembly. When walking on the platform apparatus, the test person shall also be secured against falling by an appropriate safety device that allows the test person to move naturally during the test.

C4.2 Test fluid

The test fluid shall be an aqueous solution of sodium dodecyl sulfate (SLS) in a concentration of 1 g/L. The test fluid shall be prepared shortly before the test using potable water and the temperature maintained between 15ºC and 30ºC.

Since the use of recirculated test fluid results in its contamination, the use of recirculated test fluid shall be minimized. Where recirculated test fluid is used, a separate batch of test fluid shall be prepared for each sample to avoid cross-contamination.

C4.3 Verification surfaces

Three verification surfaces shall be used as follows:

(a) WB-A, verification angle = 12°.

(b) WB-B, verification angle = 18°.

(c) WB-C, verification angle = 24°.

NOTE: Verification surfaces are standardized test panels, the slip resistive properties of which have previously been assessed at angles of 12°, 18° and 24° respectively, in accordance with this Appendix. Verification surfaces can be obtained from Saurefliesner-Vereinigung e.V., Im Langen Felde 4, 30938 Burgwedel, Germany.

C4.4 Test panels

The following apply:

(a) Test panels shall be approximately 1000 mm × 500 mm in size. They shall be made from the pedestrian surface material to be tested, either as a whole unit cut from a larger sheet, or as an assembly of segmental units, such as individual tiles, or the nosing sections cut from stair treads.

NOTE: Additional 500 mm × 500 mm sub-panels may be prepared to facilitate testing for properties that vary with the orientation of panels.

(b) The surface shall be either self-supporting or securely mounted on a suitable flat surface, such that there is no movement of any of the test surfaces during the conduct of the test.

(c) The surface to be tested shall be clearly identifiable or shall be marked as such.

(d) All panels shall be clearly identified by marking on a surface other than that which is to be tested.

(e) Pedestrian surface materials with directional profiles or roughness shall be positioned in such a way that the direction of minimum slip resistance corresponds to the direction of movement.

(f) Segmental pedestrian surface materials that are rectangular in shape and without directional profiles or roughness shall be positioned in such a way that the short edge is parallel to the rotary axis of the test apparatus.

(g) Tiles longer than 100 mm × 100 mm may be butted up against each other with no spacing required.

NOTE: The minimization of grout joints represents the worst case scenario, where the heel of a pedestrian strikes the front of a tile such that an uncontrollable slip may occur without encountering a grout joint.

(h) The upper surface of the test panels shall be cleaned, as appropriate, before testing, to remove any manufacturing residues, dirt, stripping agents or rough edges (which would normally be removed prior to the public being given initial access to a wet-barefoot area).

(i) In the case of step nosings from stairs and steps from ladders, the test panel shall be prepared to correspond as near as possible to its use in practice.

(j) Joints between segmental units shall be filled with an appropriate material that enables consistent wetting throughout the test surface without causing the joints to become more slippery or more slip resistant than would normally be the case.

C4.5 Basic walking procedure

C4.5.1 *General*

During the test, a stream of the test fluid shall be applied using appropriate jets to ensure continuous and uniform wetting over the test piece at a rate of 6 ±1 L/min. The test fluid shall be applied and run across the surface for at least 30 s before testing begins. In the case of absorbent pedestrian surfaces, uniform wetting of the top surface shall be ensured by preliminary soaking.

C4.5.2 *Procedure*

The procedure shall be as follows:

(a) Facing down the platform and looking at their feet, the test person, using a half-step gait, shall take a minimum of four steps down the test surface (walking forwards), and then take half-steps up the test surface (walking backwards) to return to their starting position. The test person shall walk up and down the test surface twice before raising the platform by a small amount. This shall continue until a slip occurs.

(b) Each test person shall record a set of five results from each of three verification surfaces. The arithmetic mean of the five readings shall be calculated. This arithmetic mean shall be within 2° of the known value for the verification surface in question. If the mean is more than 2° from the known value of the verification surface, that test shall be repeated. A test person shall only be used in further tests on that day if the result for that person from each of the three verification surfaces is within the 2° acceptability range.

(c) A rhythm of about approximately 144 half-steps per minute shall be maintained.

NOTES:

1 A metronome or similar device should be used to pace the steps.

2 Above a platform angle of 15° the pace is less important.

(d) The angle of the test piece shall remain inclined until a slip occurs. The test person shall then walk again at this angle and if a further slip occurs the point of slip shall be recorded to the nearest 0.1°.

(e) If the test person does not slip a second time at the same angle, the test piece shall be inclined further by a small amount and repeated until two slips occur at the same angle, to determine the point of slip. The angle shall be increased in small increments close to the angle of slip. If it is suspected that the point of slip has been exceeded significantly, the angle shall be reduced below the point of slip and walking repeated using smaller increments.

(f) The angle of inclination of each verification surface and the test panel shall be determined by each of the two test persons determining the point of slip five times each, each time starting with the test piece in the horizontal position.

C4.6 Evaluation

The arithmetic mean of each test panel shall be calculated from the two sets of five results.

C4.7 Quality group

Each test panel shall be allocated to a quality group as shown in Table C1 on the basis of the mean angles of inclination of both the test panel and verification surfaces. Assignment to a quality group is on the basis of the mean angle reached on the verification surfaces rather than on their assigned angles.

If the test panel is within 1° of the calibration board, both the test panel and the calibration board shall be walked on again.

TABLE C1

ALLOCATION OF MEAN ANGLE OF INCLINATION TO QUALITY GROUPS FOR FRICTION CHARACTERISTICS

Mean angle of inclination, degrees	Quality group
≤12	No classification
≥ 12	A
≥ 18	B
≥ 24	C

The acceptance angle of test person 1 shall be calculated to the nearest 0.1° by the average of the five points of slip recorded by test person 1.

The acceptance angle of test person 2 shall be calculated to the nearest 0.1° by the average of the five points of slip recorded by test person 2.

The critical angle $\alpha_{barefoot}$ is the mean of the acceptance angle of test person 1 and test person 2, rounded down to the nearest whole number.

C5 REPORT

The following shall be reported:

(a) Identification of the test sample.

(b) Date and location of test.

(c) Name(s) of the personnel that conducted the test.

(d) A description of the test sample, including identity of test surfaces or designation, manufacturer, product, quality class (where applicable), colour and dimensions of products used for the surface (if this information is known) and any surface coating, grouts or treatments.

(e) Type of test, i.e. fixed or unfixed specimen, giving details of the surface configuration and the type and joint width of any grouting.

(f) Surface structure (e.g. smooth, profiled, structured).

(g) If appropriate, extent and type of cleaning performed on the test specimens.

(h) The critical angle $\alpha_{barefoot}$ of verification surfaces and the test panel.

(i) The classification achieved according to Table 4.

(j) Quality group.

(k) Reference to this Australian Standard, i.e. Appendix C, AS 4586—2013.

APPENDIX D

OIL-WET INCLINING PLATFORM TEST METHOD

(Normative)

D1 SCOPE

This Appendix sets out the method for the measurement of the frictional characteristics of pedestrian surface materials using the oil-wet inclining platform method.

D2 PRINCIPLE

Two test persons, wearing standard test shoes, are used to determine the angle of inclination at which safe walking no longer occurs, after the pedestrian surface material being tested has been coated with engine lubricating oil. The test persons, each in turn, facing downhill and with an upright posture, move backwards and forwards over the test surface, as they increase their angle of inclination, until the safe limit of walking is reached. The angles of inclination obtained at such limits are used to assess the friction characteristics of the test surface. The mean acceptance angle obtained is used to assess the degree of slip resistance. Subjective influences on the acceptance angle are limited by means of a calibration procedure.

D3 TEST PERSONS

Each test person shall be an adult wearing the prescribed shoes. To reduce subjective influences on the test result, the test persons shall prepare themselves for testing by first making comparative measurements by walking on verification surfaces of known inclination values (see Paragraph D5).

D4 APPARATUS

D4.1 Inclined platform (see Figure D1)

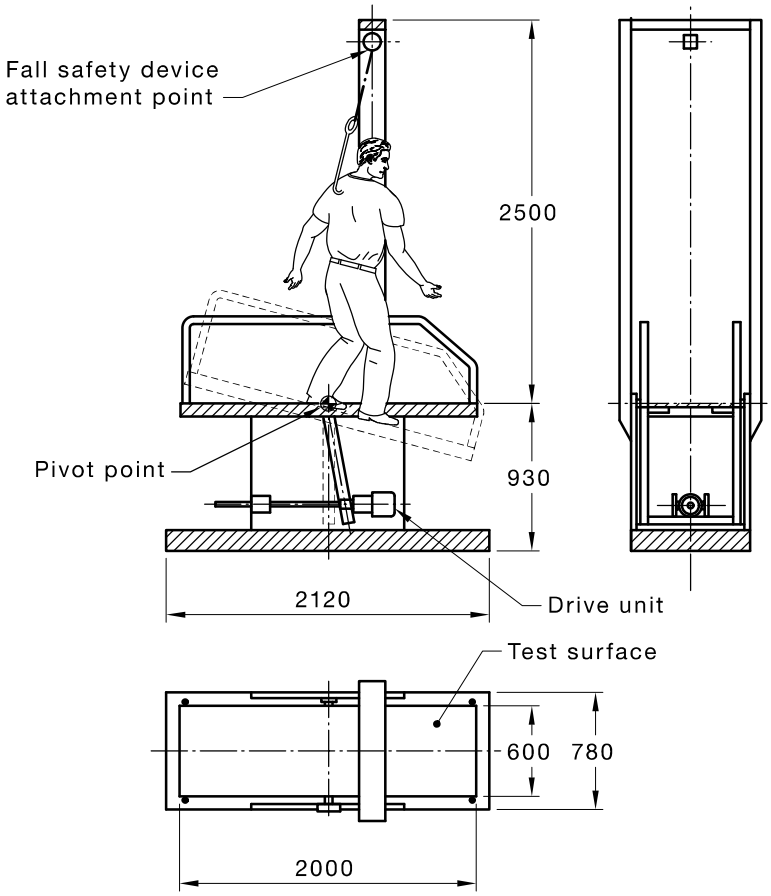
A flat torsion-resistant platform, typically 600 mm wide and 2000 mm long, the pitch of which shall be adjusted in the longitudinal direction from 0° to 45°. An angle measurement indicator fitted to the assembly shall have an accuracy of 0.5 ±0.2°. It shall not be visible to the test person.

For the safety of the test persons, railings shall be fitted along the longitudinal sides of the test assembly. When walking on the platform apparatus, the test person shall also be secured against falling by an appropriate safety device that allows the test person to move naturally during the test.

The rails shall not be held at any time during the test other than to arrest a slip.

D4.2 Test fluid

The test fluid shall be engine oil of SAE viscosity grade 10 W 30 according to SAE J300. The oil shall be stored in a tightly sealed container to prevent any change in viscosity.



DIMENSIONS IF MILLIMETRES

FIGURE D1 EXAMPLE OF TEST EQUIPMENT

NOTES:

1 The apparatus should be capable of inclining at a rate of 1°/s for practical reasons.

2 The lifting movement may be continuous or controllable in stages of 0.5°, by the test person.

D4.3 Verification boards

A1 Three verification surfaces ST-I, ST-II and ST-IIIA shall be standardized test panels, the slip resistive properties of which have previously been assessed at angles of 8.7°, 17.3° and 27.3° respectively.

D4.4 Test shoe

A1 Test shoes shall be sole form LeipzigV73-SP comprising nitrile rubber with Shore A hardness of 73 ±5.

NOTE: See Figure D2 for profiled sole.

After the test, the shoes shall be stored clean from oil and be dry. No solvent or gas oil shall be used while cleaning.

NOTE: A profiled sole is needed to determine the physical-interlock-slip-resistance which is provided by the profile of the test surface.

A1

NOTE:This image is reproduced with permission from Safe Environments Pty Limited.

FIGURE D2 OUTSOLE OF TEST SHOE
(LEIPZIGV73-SP)

D4.5 Test panels

The following apply:

(a) Test panels shall be approximately 1000 mm × 500 mm in size. They shall be made from the pedestrian surface material to be tested, either as a whole unit cut from a larger sheet, or as an assembly of segmental units, such as individual tiles, or the nosing sections cut from stair treads.

NOTE: Additional 500 mm × 500 mm sub-panels may be prepared to facilitate testing for properties that vary with the orientation of panels.

(b) The test surface shall be either self-supporting, or securely mounted on a suitable flat surface, such that there is no movement of any of the test surfaces during the conduct of the test.

(c) The surface to be tested shall be clearly identifiable or shall be marked as such.

(d) All panels shall be clearly identified by marking on a surface other than that which is tested.

(e) Pedestrian surface materials with directional profiles or roughness shall be positioned in such a way that the direction of minimum slip resistance corresponds to the direction of movement.

(f) Segmental pedestrian surface materials, rectangular in shape and without directional profiles or roughness, shall be positioned in such a way that the short edge is parallel to the rotary axis of the test apparatus.

(g) Tiles longer than 100 mm × 100 mm may be butted up against each other with no spacing required.

NOTE: The minimization of grout joints represents the worst case scenario, where the heel of a pedestrian strikes the front of a tile such that an uncontrollable slip may occur without encountering a grout joint.

(h) The upper surface of the test panels shall be cleaned, as appropriate, before testing, to remove any manufacturing residues, dirt, stripping agents or rough edges, which would normally be removed prior to the public being given initial access to a wet-barefoot area.

(i) In the case of step nosings from stairs and steps from ladders, the test panel shall be prepared to correspond as near as possible to its use in practice.

(j) Joints between segmental units shall be filled with an appropriate material that enables consistent wetting throughout the test surface without causing the joints to become more slippery or more slip resistant than would normally be the case.

D4.6 Basic walking procedure

D4.6.1 *General*

The temperature in the test area and the temperature of the shoe, lubricant and test covering shall be 23 ±5°C.

D4.6.2 *Procedure*

Handrails shall not be used when walking up or down the platform during the test.

The procedure shall be as follows:

(a) Before testing starts, 200 mL/m^2 of the lubricant shall be evenly brushed over the surface of the test covering. The outsole of the shoe shall be moistened with the lubricant.

(b) The test person shall maintain an upright posture, face down the platform looking at their feet and walk forwards using a half-step gait down the test panel from its top to its bottom. The test person shall then take half-steps backwards to the top of the test surface, returning to the starting position. The flooring test piece starts in a horizontal position and the incline is increased at a speed of approximately 1°/s until the limit of being able to walk safety occurs, i.e. just before a slip occurs. A1

(c) A rhythm of about 144 half-steps per min shall be maintained.

NOTES:

1 A metronome or similar device should be used to pace the steps.

2 Above a platform angle of 15° the pace is less important.

(d) The angle of the test piece shall be inclined until a slip occurs. The test person shall then walk again at this angle and if a further slip occurs, the point of slip shall be recorded to the nearest 0.2º.

(e) If the test person does not slip a second time at the same angle, the test piece shall be inclined further by a small amount and repeated until two slips occur at the same angle, to determine the point of slip.

NOTE: It is important that the angle be not increased too much in one increment. Small increases around the point of slip are required.

If it is suspected that the point of slip has been exceeded significantly, the angle shall be reduced below the point of slip and walking repeated using smaller increments.

(f) The point of slip shall be measured two more times with a total of three recorded points of slip, each time starting the panel shall be brushed to ensure an even spread of oil, with the test piece in the horizontal position or starting with an angle 10° below the acceptance angle of the previous measurement. A1

(g) The procedure shall be then repeated by the second test person.

D4.7 Calibration (selection and familiarization of test persons)

A1 The three standard pedestrian surfaces (ST-I, ST-II, ST-IIIA) shall be used for the calibration procedure. The acceptance angle (α) of these pedestrian surfaces are given in Table D1 and are specified as standard acceptance angles $\alpha_{s,\,(ST\text{-}I)}$, $\alpha_{s,\,(ST\text{-}II)}$ and $\alpha_{s,\,(ST\text{-}IIIA)}$.

A1

TABLE D1

STANDARD ACCEPTANCE ANGLES AND CRITICAL DIFFERENCES

Standard pedestrian surface	$\alpha_{s,i}$ degree	CrD_{95} degree
ST-I	8.7	3.0
ST-II	17.3	3.0
ST-IIIA	27.3	3.0

D4.8 Procedure

A1 On the same day, but prior to testing the test coverings, each test person (j) shall walk on each standard pedestrian surface three times and the mean values $\alpha_{K,\,(ST\text{-}I),j}$, $\alpha_{K,\,(ST\text{-}II),j}$, and $\alpha_{K,\,(ST\text{-}IIIA),j}$, shall be determined.

Each individual correction value $\Delta\alpha_{i,j} = \alpha_{s,I} - \alpha_{K,i,j}$ shall be calculated and shall give $\Delta\alpha_{(ST\text{-}I),j}$, $\Delta\alpha_{(ST\text{-}II),j}$, and $\Delta\alpha_{(ST\text{-}IIIA),j}$.

Each of the individual correction values shall be less than the corresponding critical differences CrD_{95} that are given in Table D1 (i.e. $\left|\Delta\alpha_{i,j}\right| \leq CrD_{95}$). If one of the absolute values is greater, the test person in question shall be excluded from the test and replaced by another test person for that day.

D4.9 Evaluation of test covering

Each accepted test person (j) shall walk on the test pedestrian surface three times and the mean value ($\alpha_{0,j}$) shall be determined.

A correction value D_j shall be calculated for each test person. Depending on the size of the mean test acceptance angle ($\alpha_{0,1}$ or $\alpha_{0,2}$) obtained, the calculation shall be carried out in accordance with one of the four cases given in Table D2.

The individual result, the corrected mean acceptance angle (α_j), for each test person (j) shall be the addition of correction value D_j to the mean test acceptance angle $\alpha_{0,j}$, as follows:

$$\alpha_j = \alpha_{0,j} + D_j \quad \ldots \text{D1}$$

A1

TABLE D2

CORRECTION VALUE DEPENDING ON THE SIZE OF THE MEAN TEST ACCEPTANCE ANGLE

Case	Correction value D_j for test covering
$\alpha_{0,j} < \alpha_{K,ST\text{-}I,j}$	$D_j = \Delta\alpha_{ST\text{-}I,j} \frac{1}{\sqrt{2}}$
$\alpha_{K,ST\text{-}I,j} < \alpha_{0,j} < \alpha_{K,ST\text{-}II,j}$	$D_j = \left[\Delta\alpha_{ST\text{-}I,j} + \left(\Delta\alpha_{ST\text{-}II,j} - \Delta\alpha_{ST\text{-}I,j}\right) \frac{\alpha_{0,j} - \alpha_{K,ST\text{-}I,j}}{\alpha_{K,ST\text{-}II,j} - \alpha_{K,ST\text{-}I,j}}\right] \frac{1}{\sqrt{2}}$
$\alpha_{K,ST\text{-}II,j} < \alpha_{0,j} < \alpha_{K,ST\text{-}IIIA,j}$	$D_j = \left[\Delta\alpha_{ST\text{-}II,j} + \left(\Delta\alpha_{ST\text{-}IIIA,j} - \Delta\alpha_{ST\text{-}II,j}\right) \frac{\alpha_{0,j} - \alpha_{K,ST\text{-}II,j}}{\alpha_{K,ST\text{-}IIIA,j} - \alpha_{K,ST\text{-}II,j}}\right] \frac{1}{\sqrt{2}}$
$\alpha_{0,j} \leq \alpha_{K,ST\text{-}IIIA,j}$	$D_j = \Delta\alpha_{ST\text{-}IIIA,j} \frac{1}{\sqrt{2}}$

D4.10 Product classification

The corrected mean acceptance angles α_1 and α_2 shall be added together and divided by two. The final result of the test by two test persons is the corrected mean overall acceptance angle (α_{ave}). This result shall be used to assign the floor covering to a slip resistance assessment group/classification in accordance with Table D3.

For determining the slip resistance characteristics of pedestrian surfaces with directional surface profiles or texture, the direction with the lowest total acceptance angle shall be used for classification purposes.

TABLE D3

CLASSIFICATION OF PEDESTRIAN SURFACE MATERIALS ACCORDING TO THE OIL-WET INCLINING PLATFORM TEST

Classification	Corrected mean overall acceptance angle (α_{ave}), degrees
No classification	<6
R9	≥6<10
R10	≥10<19
R11	≥19<27
R12	≥27<35
R13	≥35

D5 REPORT

The following shall be reported:

(a) Identification of the test sample.

(b) Date and location of test.

(c) Name(s) of the personnel that conducted the test.

(d) A description of the test sample, including identity of test surfaces or designation, manufacturer, product, quality class (where applicable), colour and dimensions of products used for the surface (if this information is known) and any surface coating, grouts or treatments.

(e) Test shoe used.

(f) Type of test, giving details of the surface configuration and the type and joint width of any grouting.

(g) Surface structure (e.g. smooth, profiled, structured).

(h) If appropriate, extent and type of cleaning performed on the test specimens.

(i) Corrected mean overall acceptance angle (α_{ave}), rounded down to the nearest degree.

(j) The classification achieved according to Table 5.

(k) Displacement space, rounded off the nearest 0.5 cm^3/dm^2, or where applicable 'not tested'.

NOTE: For displacement volume test method, see Appendix E.

(l) Reference to this Australian Standard, i.e. Appendix D, AS 4586—2013.

APPENDIX E

DISPLACEMENT VOLUME TEST METHOD

(Normative)

E1 SCOPE

This Appendix sets out the method for measuring the size of the displacement space of pedestrian surface materials that have a severely profiled or structured surface, as are commonly used in industrial work areas.

E2 PRINCIPLE

The volume of the displacement space is determined by filling the open cavities beneath the true surface of the pedestrian surface material with a paste of known density. The volume is calculated from the mass difference before and after filling the cavities.

E3 MEASUREMENT OF DISPLACEMENT SPACE

E3.1 General

Pedestrian surfaces, the displacement space of which is more than 10 cm^3/dm^2 due to their open structure (e.g. grids), are assessed as V 10 without measuring the displacement space.

E3.2 Test apparatus

A baseplate with a flat surface, an adjustable metal frame to hold the test piece, scales with error limits of 0.05 g and a measuring device to determine the density of the paste, e.g. dispersion adhesive used for the test.

E3.3 Test piece

A piece of pedestrian surface measuring 100 mm × 100 mm shall be used as the test piece. The test piece shall be representative of the surface configuration of the pedestrian surface.

In the case of tiles and flags with an edge length less than 90 mm, the test piece shall be made up from individual tiles or flags. The tiles or flags shall be glued to a baseplate, close to each other without a joint gap and cut down to a test surface of 100 cm^2.

E3.4 Determination of density of paste

The density shall be determined in each case on two samples of the paste used for the test, before the start of each series of experiments.

For this purpose, a specimen tube shall be filled with the paste, ensuring there are no bubbles, and then smoothed off level with the top of the tube. The filling density shall then be determined from the mass difference between the filled and empty tube and the volume of the specimen tube, and this is given to two decimal places.

E3.5 Method

The test piece shall be laid with the profiled or structured side on the baseplate. Adhesive tape shall be attached along the top of the four sides, level with the surface. The weight of the test piece shall then be determined to the nearest 0.1 g. The test piece shall then be placed back onto the baseplate with the profiled or structured side downwards, and the metal frame adjusted around the edges of the test piece, ensuring the frame is flush with the baseplate.

The test piece shall then be turned over, the displacement space filled with the paste and levelled off smoothly at surface level. The second weighing shall be carried out once the frame has been removed. Filling, smoothing, frame removal and the second weighing shall all take place within 1 min. The volume of the displacement space shall be determined from the mass difference and the calculated density of the paste. The test shall be carried out on five test pieces for each profile or structure.

E3.6 Evaluation and assessment

The size of the displacement space shall be calculated as the arithmetic mean of the five volume determinations and rounded off to 0.5 cm^3/dm^2. Assignment to one of the displacement space assessment groups in Table E1 is based on the volume obtained.

TABLE E1

CLASSIFICATION OF DISPLACEMENT SPACE ACCORDING TO DISPLACEMENT VOLUME TEST METHOD

Surface-related minimum volume of displacement space cm^3/dm^2	Displacement space assessment group
4	V4
6	V6
8	V8
10	V10

E4 REPORT

The following shall be reported:

(a) Designation, manufacturer, product, where applicable quality class, colour and dimensions of products used for the pedestrian surface.

(b) Surface structure (e.g. smooth, profiled, structured).

(c) Displacement space, rounded off to the nearest 0.5 cm^3/dm^2.

(d) Where applicable, the displacement space assessment group.

(e) Test location.

(f) Date of test.

(g) Reference to this Australian Standard, i.e. Appendix E, AS 4586—2013.

APPENDIX F

EXAMPLES OF DETERMINING SLOPE DESIGN VALUE (SDV) AND SLOPE CORRECTION VALUE (SCV)

(Informative)

F1 SCOPE

This Appendix provides tables that can be used to calculate the SDV and the SCV.

The tables are based on the following relationship. It is presumed that the coefficient of friction requirement for a particular type of location has been established as μ_1. The frictional requirement (μ_r) for a ramp for the same type of location is approximately ($\mu_1 + 0.0125S$) or ($\mu_1 + 1.25 \tan \alpha$), where S is the slope (%) and α is the angle of the walking surface in degrees.

F2 EXAMPLES OF WET PENDULUM CALCULATIONS

Table F1 may be used for the calculation of the SDV and the SCV.

For example, assume a surface has a gradient of 4° and a minimum SRV of 45 is required, in order to calculate the SDV, refer to Table F1 to find the figure of 45 in the 4° slope column to arrive at a SDV of 52 BPN.

For example, the SRV of a 4° ramp has been determined to be 50 BPN. In this instance, the SCV is calculated by finding 50 in the left-hand BPN column of Table F1, and going across the row until the 4° column to arrive at a SCV of 43 BPN.

For example, assume a minimum SRV of 39 is required on a slope with a gradient of 7°. Refer to Table F1 to find the figure of 39 in the 7° slope column to arrive at a SDV of 52 BPN.

TABLE F1

SLOPE IN DEGREES

BPN	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
5	1	0																									
6	2	1	0																								
7	4	2	1	0																							
8	5	3	2	1	0																						
9	6	4	3	2	1	0																					
10	7	5	4	3	2	1																					
11	8	6	5	4	3	2	1																				
12	9	7	6	5	4	3	2	0																			
13	10	9	7	6	5	4	3	1	0																		
14	11	0	8	7	6	5	4	3	1	0																	
15	12	11	9	8	7	6	5	4	2	1	0																
16	13	12	0	9	8	7	6	5	4	2	1	0															
17	14	13	12	10	9	8	7	6	5	3	2	1	0														
18	15	14	13	11	10	9	8	7	6	5	3	2	1	0													
19	16	15	14	12	11	10	9	8	7	6	4	3	2	1	0												
20	17	16	15	14	12	11	10	9	8	7	6	4	3	2	1	0											
21	18	17	16	15	13	12	11	10	9	8	7	5	4	3	2	1											
22	19	18	17	16	14	13	12	11	10	9	8	7	5	4	3	2	1										
23	20	19	18	17	16	14	13	12	11	10	9	8	7	5	4	3	2	0									
24	21	20	19	18	17	16	14	13	12	11	10	9	8	6	5	4	3	2	0								
25	22	21	20	19	18	17	15	14	13	12	11	10	9	8	6	5	4	3	2	0							
26	23	22	21	20	19	18	17	15	14	13	12	11	10	9	7	6	5	4	3	1	0						
27	24	23	22	21	20	19	18	17	15	14	13	12	11	10	9	7	6	5	4	3	1	0					

(*continued*)

TABLE F1 (*continued*)

BPN	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
28	25	24	23	22	21	20	19	18	16	15	14	13	12	11	10	9	7	6	5	4	3	1	0				
29	26	25	24	23	22	21	20	19	18	16	15	14	13	12	11	10	9	7	6	5	4	3	1	0			
30	27	26	25	24	23	22	21	20	19	18	16	15	14	13	12	11	10	9	7	6	5	4	2	1	0		
31	28	27	26	25	24	23	22	21	20	19	18	16	15	14	13	12	11	10	9	7	6	5	4	2	1	0	
32	29	28	27	26	25	24	23	22	21	20	19	18	16	15	14	13	12	11	10	8	7	6	5	4	2	1	0
33	30	29	28	27	26	25	24	23	22	21	20	19	18	16	15	14	13	12	11	10	8	7	6	5	4	2	1
34	31	30	29	28	27	26	25	24	23	22	21	20	19	18	16	15	14	13	12	11	10	8	7	6	5	4	2
35	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	15	14	13	12	11	10	8	7	5	6	4
36	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	15	14	13	12	11	10	8	7	6	5
37	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	15	14	13	12	11	10	8	7	6
38	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	14	13	12	11	10	8	7
39	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	15	14	13	12	11	10	8
40	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	15	14	13	12	11	10
41	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	14	13	12	11
42	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	14	13	12
43	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	14	13
44	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15
45	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
46	43	42	41	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	21	20	19	18	17
47	44	43	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	20	19	18
48	45	44	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	19
49	46	45	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21
50	47	46	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
51	48	48	47	46	45	44	43	42	41	40	39	38	37	36	35	35	34	33	32	30	29	28	27	26	25	24	23

(*continued*)

TABLE F1 (*continued*)

BPN	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
52	49	49	48	47	46	45	44	43	42	41	40	39	39	38	37	36	35	34	33	32	31	30	29	27	26	25	24
53	50	50	49	48	47	46	45	44	43	42	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	25
54	51	51	50	49	48	47	46	45	44	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
55	52	52	51	50	49	48	47	46	45	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28
56	53	53	52	51	50	49	48	47	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29
57	55	54	53	52	51	50	49	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30
58	56	55	54	53	52	51	50	50	49	48	47	46	45	44	43	42	41	40	40	39	38	37	36	35	34	33	31
59	57	56	55	54	53	52	52	51	50	49	48	47	46	45	44	43	43	42	41	40	39	38	37	36	35	34	33
60	58	57	56	55	54	53	53	52	51	50	49	48	47	46	46	45	44	43	42	41	40	39	38	37	36	35	34
61	59	58	57	56	55	54	54	53	52	51	50	49	48	48	47	46	45	44	43	42	41	40	39	38	37	36	35
62	60	59	58	57	56	56	55	54	53	52	51	50	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36
63	61	60	59	58	57	57	56	55	54	53	52	51	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37
64	62	61	60	59	58	58	57	56	55	54	53	53	52	51	50	49	48	47	46	45	44	44	43	42	41	40	39
65	63	62	61	60	59	59	58	57	56	55	54	54	53	52	51	50	49	48	47	47	46	45	44	43	42	41	40
66	64	63	62	61	61	60	59	58	57	56	56	55	54	53	52	51	50	50	49	48	47	46	45	44	43	42	41
67	65	64	63	62	62	61	60	59	58	57	57	56	55	54	53	52	52	51	50	49	48	47	46	45	44	43	42
68	66	65	64	63	63	62	61	60	59	59	58	57	56	55	54	54	53	52	51	50	49	48	47	46	45	44	43
69	67	66	65	64	64	63	62	61	60	60	59	58	57	56	55	55	54	53	52	51	50	49	48	48	47	46	45
70	68	67	66	65	65	64	63	62	62	61	60	59	58	57	57	56	55	54	53	52	51	50	50	49	48	47	46
71	69	68	67	66	66	65	64	63	63	62	61	60	59	59	58	57	56	55	54	53	53	52	51	50	49	48	47
72	70	69	68	68	67	66	65	64	64	63	62	61	60	60	59	58	57	56	55	55	54	53	52	51	50	49	48
73	71	70	69	69	68	67	66	65	65	64	63	62	62	60	60	59	58	57	57	56	55	54	53	52	51	50	49
74	72	71	70	70	69	68	67	67	66	65	64	63	63	62	61	60	59	59	58	57	56	55	54	53	52	52	51
75	73	72	71	71	70	69	68	68	67	66	65	65	64	63	62	61	60	60	59	58	57	56	55	55	54	53	52

(*continued*)

TABLE F1 (*continued*)

BPN	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
76	74	73	72	72	71	70	69	69	68	67	66	66	65	64	63	62	62	61	60	59	58	57	57	56	55	54	53
77	75	74	73	73	72	71	70	70	69	68	67	67	66	65	64	64	63	62	61	60	59	59	58	57	56	55	54
78	76	75	74	74	73	72	72	71	70	69	69	68	67	66	65	65	64	63	62	61	61	60	59	58	57	56	55
79	77	76	75	75	74	73	73	72	71	70	70	69	68	67	67	66	65	64	63	63	62	61	60	59	58	57	57
80	78	77	77	76	75	74	74	73	72	71	71	70	69	68	68	67	66	65	64	64	63	62	61	60	60	59	58
81	79	78	78	77	76	75	75	74	73	72	72	71	70	69	69	68	67	66	66	65	64	63	62	62	61	60	59
82	80	79	79	78	77	76	76	75	74	74	73	72	71	71	70	69	68	68	67	66	65	64	63	63	62	61	60
83	81	80	80	79	78	77	77	76	75	75	74	73	72	72	71	70	69	69	68	67	66	65	65	64	63	62	61
84	82	81	81	80	79	79	78	77	76	76	75	74	74	73	72	71	71	70	69	68	67	67	66	65	64	63	63
85	83	82	82	81	80	80	79	78	77	77	76	75	75	74	73	72	72	71	70	69	69	68	67	66	65	65	64
86	84	83	83	82	81	81	80	79	79	78	77	76	76	75	74	73	73	72	71	70	70	69	68	67	67	66	65
87	85	84	84	83	82	82	81	80	80	79	78	77	77	76	75	75	74	73	72	72	71	70	69	68	68	67	66
88	86	85	85	84	83	83	82	81	81	80	79	79	78	77	76	76	75	74	73	73	72	71	70	70	69	68	67
89	87	86	86	85	84	84	83	82	82	81	80	80	79	78	78	77	76	75	75	74	73	72	72	71	70	69	68
90	88	87	87	86	85	85	84	83	83	82	81	81	80	79	79	78	77	76	76	75	74	73	73	72	71	70	70
91	89	88	88	87	87	86	85	85	84	83	82	82	81	80	80	79	78	78	77	76	75	75	74	73	72	72	71
92	90	89	89	88	88	87	86	86	85	84	84	83	82	82	81	80	79	79	78	77	77	76	75	74	73	73	72
93	91	90	90	89	89	88	87	87	86	85	85	84	83	83	82	81	81	80	79	78	78	77	76	75	75	74	73
94	92	92	91	90	90	89	88	88	87	86	86	85	84	84	83	82	82	81	80	79	79	78	77	77	76	75	74
95	93	93	92	91	91	90	89	89	88	87	87	86	85	85	84	83	83	82	81	81	80	79	78	78	77	76	75
96	94	94	93	92	92	91	90	90	89	89	88	87	87	86	85	85	84	83	82	82	81	80	80	79	78	77	77
97	95	95	94	93	93	92	91	91	90	90	89	88	88	87	86	86	85	84	84	83	82	81	81	80	79	79	78
98	96	96	95	94	94	93	93	92	91	91	90	89	89	88	87	87	86	85	85	84	83	83	82	81	80	80	79
99	97	97	96	95	95	94	94	93	92	92	91	90	90	89	88	88	87	86	86	85	84	84	83	82	82	81	80

(*continued*)

TABLE F1 (*continued*)

BPN	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
100	98	98	97	96	96	95	95	94	93	93	92	91	91	90	90	89	88	88	87	86	86	85	84	83	83	82	81
101	99	99	98	97	97	96	96	95	94	94	93	93	92	91	91	90	89	89	88	87	87	86	85	85	84	83	82
102	100	100	99	99	98	97	97	96	95	95	94	94	93	92	92	91	90	90	89	88	88	87	86	86	85	84	84
103	101	101	100	100	99	98	98	97	97	96	95	95	94	93	93	92	92	91	90	90	89	88	88	87	86	86	85
104	102	102	101	101	100	99	99	98	98	97	96	96	95	95	94	93	93	92	91	91	90	89	89	88	87	87	86
105	103	103	102	102	101	100	100	99	99	98	97	97	96	96	95	94	94	93	92	92	91	91	90	89	89	88	87
106	104	104	103	103	102	101	101	100	100	99	99	98	97	97	96	95	95	94	94	93	92	92	91	90	90	89	88
107	105	105	104	104	103	103	102	101	101	100	100	99	98	98	97	97	96	95	95	94	93	93	92	91	91	90	89
108	106	106	105	105	104	104	103	102	102	101	101	100	99	99	98	98	97	96	96	95	95	94	93	93	92	91	91
109	107	107	106	106	105	105	104	103	103	102	102	101	101	100	99	99	98	98	97	96	96	95	94	94	93	92	92
110	108	108	107	107	106	106	105	105	104	103	103	102	102	101	100	100	99	99	98	97	97	96	96	95	94	94	93
111	109	109	108	108	107	107	106	106	105	104	104	103	103	102	102	101	100	100	99	99	98	97	97	96	95	95	94
112	110	110	109	109	108	108	107	107	106	106	105	104	104	103	103	102	101	101	100	100	99	98	98	97	97	96	95
113	111	111	110	110	109	109	108	108	107	107	106	105	105	104	104	103	103	102	101	101	100	100	99	98	98	97	96
114	112	112	111	111	110	110	109	109	108	108	107	107	106	105	105	104	104	103	103	102	101	101	100	99	99	98	98
115	113	113	112	112	111	111	110	110	109	109	108	108	107	106	106	105	105	104	104	103	102	102	101	101	100	99	99
116	114	114	113	113	112	112	111	111	110	110	109	109	108	108	107	106	106	105	105	104	104	103	102	102	101	101	100
117	115	115	114	114	113	113	112	112	111	111	110	110	109	109	108	108	107	106	106	105	105	104	103	103	102	102	101
118	117	116	115	115	114	114	113	113	112	112	111	111	110	110	109	109	108	107	107	106	106	105	105	104	103	103	102
119	118	117	117	116	116	115	114	114	113	113	112	112	111	111	110	110	109	109	108	107	107	106	106	105	105	104	103
120	119	118	118	117	117	116	116	115	114	114	113	113	112	112	111	111	110	110	109	109	108	107	107	106	106	105	105
121	120	119	119	118	118	117	117	116	116	115	115	114	113	113	112	112	111	111	110	110	109	109	108	107	107	106	106
122	121	120	120	119	119	118	118	117	117	116	116	115	115	114	114	113	112	112	111	111	110	110	109	109	108	107	107
123	122	121	121	120	120	119	119	118	118	117	117	116	116	115	115	114	114	113	112	112	111	111	110	110	109	109	108

(*continued*)

TABLE F1 (*continued*)

BPN	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
124	123	122	122	121	121	120	120	119	119	118	118	117	117	116	116	115	115	114	114	113	112	112	111	111	110	110	109
125	124	123	123	122	122	121	121	120	120	119	119	118	118	117	117	116	116	115	115	114	114	113	113	112	111	111	110
126	125	124	124	123	123	122	122	121	121	120	120	119	119	118	118	117	117	116	116	115	115	114	114	113	113	112	111
127	126	125	125	124	124	123	123	122	122	121	121	120	120	119	119	118	118	117	117	116	116	115	115	114	114	113	113
128	127	126	126	125	125	124	124	123	123	122	122	121	121	120	120	119	119	118	118	117	117	116	116	115	115	114	114
129	128	127	127	126	126	125	125	124	124	123	123	123	122	122	121	121	120	120	119	119	118	118	117	116	116	115	115
130	129	128	128	127	127	126	126	125	125	125	124	124	123	123	122	122	121	121	120	120	119	119	118	118	117	117	116
131	130	129	129	128	128	127	127	127	126	126	125	125	124	124	123	123	122	122	121	121	120	120	119	119	118	118	117
132	131	130	130	129	129	128	128	128	127	127	126	126	125	125	124	124	123	123	122	122	121	121	120	120	119	119	118
133	132	131	131	130	130	130	129	129	128	128	127	127	126	126	125	125	124	124	123	123	122	122	122	121	120	120	119
134	133	132	132	131	131	131	130	130	129	129	128	128	127	127	126	126	126	125	125	124	124	123	123	122	122	121	121
135	134	133	133	132	132	132	131	131	130	130	129	129	128	128	128	127	127	126	126	125	125	124	124	123	123	122	122

F3 EXAMPLES OF DRY FLOOR FRICTION CALCULATIONS

Table F2 may be used to calculate the mean coefficient of friction required on a slope of a known maximum gradient.

For example, if a minimum mean coefficient of friction (COF) of 0.40 is required on a slope with a gradient of 7°, refer to Table F2 to find the figure of 0.40 in the 7° slope column to arrive at a required minimum mean coefficient of friction of 0.53 to 0.57. A minimum mean coefficient of friction of 0.55 may be specified.

Table F2 may also be used to calculate a slope mean coefficient of friction.

For example, if the mean coefficient of friction of a 5° ramp is determined to be 0.62, 0.62 is found in the left-hand 'COF' column of Table F2, and going across the row until the 5° column to arrive at a slope corrected mean coefficient of friction of 0.50.

TABLE F2
SLOPE IN DEGREES

COF	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
0.1	0.05	0.05	0.05	0.05																							
0.11	0.10	0.05	0.05	0.05	0.05																						
0.12	0.10	0.10	0.05	0.05	0.05	0.05																					
0.13	0.10	0.10	0.10	0.05	0.05	0.05	0.05																				
0.14	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05																			
0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05																		
0.16	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05																	
0.17	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05																
0.18	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05															
0.19	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05														
0.2	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05														
0.21	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05													
0.22	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05												
0.23	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05											
0.24	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05										
0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05									
0.26	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05								
0.27	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05							
0.28	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05						
0.29	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05						
0.3	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05					
0.31	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05				

(*continued*)

TABLE F2 (*continued*)

COF	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
0.32	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05			
0.33	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05		
0.34	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05	
0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.05
0.36	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05
0.37	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05	0.05
0.38	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.05	0.05
0.39	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.05
0.4	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10
0.41	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10	0.10
0.42	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10	0.10
0.43	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.10	0.10
0.44	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15	0.10
0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15	0.15
0.46	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15
0.47	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15	0.15
0.48	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.15	0.15
0.49	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.15
0.5	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20	0.20
0.51	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20
0.52	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20	0.20
0.53	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.20	0.20
0.54	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.20
0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25	0.25

(*continued*)

TABLE F2 (*continued*)

COF	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
0.56	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25	0.25
0.57	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25	0.25
0.58	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.25	0.25
0.59	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30	0.25
0.6	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30	0.30
0.61	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30
0.62	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30	0.30
0.63	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.30	0.30
0.64	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35	0.30
0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35	0.35
0.66	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35	0.35
0.67	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35	0.35
0.68	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.35	0.35
0.69	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.35
0.7	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40
0.71	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40
0.72	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40	0.40
0.73	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.40	0.40
0.74	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.40
0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45	0.45
0.76	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45	0.45
0.77	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45	0.45
0.78	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.45	0.45
0.79	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.45

(*continued*)

TABLE F2 (*continued*)

COF	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
0.8	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50
0.81	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50
0.82	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50	0.50
0.83	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.50	0.50
0.84	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55	0.50
0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55	0.55
0.86	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55	0.55
0.87	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55	0.55
0.88	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.55	0.55
0.89	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55
0.9	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60
0.91	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60	0.60
0.92	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60	0.60
0.93	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.60	0.60
0.94	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65	0.60
0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65	0.65
0.96	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65	0.65
0.97	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65	0.65
0.98	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.65	0.65
0.99	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.65
1	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70	0.70
1.01	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70	0.70
1.02	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70	0.70
1.03	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.70

(*continued*)

TABLE F2 (*continued*)

COF	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
1.04	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.70
1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75
1.06	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75
1.07	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75	0.75
1.08	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.75	0.75
1.09	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80	0.75
1.1	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.80
1.11	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80
1.12	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80	0.80
1.13	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.80	0.80
1.14	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85	0.80
1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85	0.85
1.16	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85	0.85
1.17	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85	0.85
1.18	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.85	0.85
1.19	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90	0.85
1.2	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90	0.90
1.21	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.90
1.22	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.90
1.23	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90
1.24	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.90
1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95
1.26	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95
1.27	1.25	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95	0.95

(*continued*)

TABLE F2 (*continued*)

COF	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5
1.28	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	0.95	0.95
1.29	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00	0.95
1.3	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00	1.00
1.31	1.30	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00	1.00`
1.32	1.30	1.30	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00	1.00
1.33	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.00	1.00
1.34	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05	1.00
1.35	1.30	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05	1.05
1.36	1.35	1.30	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05	1.05
1.37	1.35	1.35	1.30	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05	1.05
1.38	1.35	1.35	1.35	1.30	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.05	1.05
1.39	1.35	1.35	1.35	1.30	1.30	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10	1.05
1.4	1.35	1.35	1.35	1.35	1.30	1.30	1.30	1.30	1.30	1.25	1.25	1.25	1.25	1.20	1.20	1.20	1.20	1.20	1.15	1.15	1.15	1.15	1.10	1.10	1.10	1.10	1.10

AMENDMENT CONTROL SHEET

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REVISED TEXT

SUMMARY: This Amendment applies to Clause 3 and Appendix D.

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NOTES

NOTES

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