IMPLEMENTATION SPECIFICATION FOR ROAD WORKS

SERIES IM/1100 (IMPLEMENTATION)

KERBS, FOOTWAYS AND PAVED AREAS

Date: **February 2021**
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1100 KERBS, FOOTWAYS AND PAVED AREAS

1100 General

1 This Series is part of the Specification for Highway Works. Whilst this Series is particularly relevant to the subject matter in its title it must be read in conjunction with the general requirements in Series 000 and 100 and with all other Series relevant to the specification for the particular works to be undertaken.

1101 Precast Concrete Kerbs, Channels, Edgings and Quadrants

1 Except where otherwise specified in this Clause, precast concrete kerbs, channels, edgings and quadrants shall conform to MSA EN 1340 and their dimensions, type designations and performances and classes shall be as described in this Clause and IM Appendix 11/1. They shall be laid and bedded in accordance with BS 7533-6 on a mortar bed on a concrete pavement slab, a base or a C6/8 or ST1 in accordance with BS 8500-2 concrete foundation. The mortar bed may be omitted if units are bedded onto a concrete slab or foundation that is still plastic. All precast units laid on a mortar bed or bedded onto plastic concrete shall be backed with a strength class C6/8 or ST1 concrete in accordance with BS 8500-2.

2 Precast concrete kerbs, which are to be bonded to the pavement surface, shall conform to MSA EN 1340. The bonding materials and methods of bonding shall be to the manufacturer's recommendations for this specific application. Bonded kerbs shall not be less than 100 mm in width at the base, their height shall not exceed their width and they shall be bonded over their full width. Kerbs shall be precast to the dimensions described in IM Appendix 11/1. The clear distance between unsupported pavement edge and back of kerb shall be not less than 100 mm. The bending strength of units shall be established by testing in accordance with MSA EN 1340 and shall not be less than class 2 in Table 3 of MSA EN 1340. Units shall be installed in accordance with the manufacturer's instructions. They shall be bonded to the pavement surface with a resilient adhesive compatible with the pavement materials and be capable of withstanding a static push-off load of 10 kN/m applied parallel to the pavement surface at right angles to the kerb.

3 Joints shall be provided in kerbs, channels, edgings and backing, which are laid on or adjacent to a concrete pavement to coincide with the pavement transverse contraction, warping and expansion joints. The joints shall be the same width as the joint sealing grooves of the pavement and shall be caulked and sealed as described in Clauses 1015 and 1016. Concrete foundations to kerbs, channels and edgings laid adjacent to a concrete pavement shall be provided with joint filler board complying with Clause 1014 placed vertically through the full extent of the concrete foundation at positions coinciding with the pavement joints. At expansion joints in bridge decks, the kerb joints shall be as described in IM Appendix 11/1. Where the details of bridge expansion joints are proposed by the Contractor, such details shall include the intended treatment at kerbs and footways.

4 For curves of radius 12 m or less, kerbs of appropriate radius shall be used as per MSA EN 1340.

5 The surface level of units of kerb, channel, edging and quadrant shall not deviate from the design level 6 mm, nor shall the longitudinal surface regularity deviate more than 3 mm in 3 m when checked with a 3 m straight edge. Horizontal alignment shall comply with Clause 702.

1102 Freestanding In-Situ Concrete Kerbs, Channels and Edge Details

1 Freestanding in-situ concrete kerbs, channels and edge details shall comply with the recommendations of BS 5931 except where otherwise specified in this Clause. They shall be laid by a machine capable of forming dense kerbs or surface water channels or edge details with regular sides, arrises and chamfers, finished to a fine surface free from blow holes and dragging and constructed to the dimensions described in IM Appendix 11/1.

2 For kerbs, channels and edge details:

a) Constructed before the adjacent road pavement surface, the surface level adjacent to the future road surface shall not deviate from the design level by more than ±5 mm.

b) Constructed after the adjacent road pavement surface, the surface level shall not deviate from the finished level of the adjacent pavement surface by more than +0-10 mm.

3 The longitudinal surface regularity shall not deviate by more than 5 mm in 3 m when measured with a 3 m straight edge.

4 The concrete shall be a strength class C28/35 to BS 8500-2 and air-entrained in accordance with BS 5931. Coarse aggregate used in kerbs and channels shall be partially crushed or crushed materials.

5 The concrete shall be cured by one of the methods specified in Clause 1024 unless otherwise described in IM Appendix 11/1.

6 Kerbs, channels and edge details shall be firmly secured to the surface on which they are laid. Vertical expansion and contraction joints shall be formed in kerbs, channels and edge details laid on, integral with or adjacent to unreinforced concrete slabs and jointed reinforced concrete slabs to coincide with the pavement transverse expansion, warping and contraction joints. Joints may be omitted from channels cast integral with a CRCP concrete pavement. Vertical expansion joints at 40 m spacings and intermediate contraction joints at 5 m spacings shall be formed in kerbs, channels and edge details laid on or adjacent to other types of concrete and flexible pavement. Expansion joints may be replaced by contraction joints and installed in accordance with the manufacturer's instructions during the summer period from 1 April until 31 October. All joints in kerbs, channels and edge details shall be sealed in compliance with Clauses 1015 and 1016.

1103 Footways and Paved Areas (Precast Concrete Flags and Natural Stone Slabs)

1 Precast concrete flags shall conform to MSA EN 1339. Natural stone slabs shall conform to MSA EN 1341. Type designations, thicknesses and performances and classes shall be as described in IM Appendix 11/1.

2 Precast concrete flags and natural stone slabs shall be laid to the required cross falls with a bond as described in IM Appendix 11/1 and with joints at right angles to the kerb. Flags and natural stone slabs shall be bedded on a layer of mortar not less than 10 mm and not more than 40 mm thick.

3 On circular work where the radius is 12 m or less all flags and natural stone slabs shall be radially cut on both edges to the required line.

4 The laying course shall be laid on subbase composed of one of the materials complying with Clause 802, 815 or 816 laid and compacted to Clause 801 or 810 as appropriate and to the thickness described in IM Appendix 11/1.

1104 Footways and Paved Areas (Flexible Surfacing)

1 Flexible surfacing and subbase for footways and paved areas shall be constructed using the materials and layer thicknesses described in IM Appendix 11/1.

2 Bituminous mixtures used in flexible surfacing shall be made in accordance with MSA EN 13108, the detailed requirements from the example specifications in BS PD6691 and Clause 902.

3 6 mm dense asphalt concrete surface course shall be asphalt concrete conforming to MSA EN13108-1, and requirements specified in this Clause. The mixture designation shall be one of the following AC 6 dense surf 70/100.

4 To ensure adequate resistance to polishing and abrasion, the coarse aggregate shall have a minimum declared PSV of ≥ 38, in accordance with MSA EN 13043:2002, clause 4.2.3. and shall have a minimum LA_{35}.

Table 1100-1: AC 6 dense surf 70/100 contents

Sieve Size	Percentage Passing (By Weight)
	AC 6 dense surf 70/100
10mm	100
6.3mm	98
2mm	42 – 56
1.0mm	24 – 46
0.250mm	11 – 19
0.063mm	4 – 8
Binder Content (% of total mix)	5.0 – 6.5

5 Flexible surfacing shall be laid and compacted in accordance with BS 594987. Subbase shall be composed of an unbound mixture conforming to Clause 802, or 804 or a cement bound granular mixture conforming to Clause 815, 816. Subbase shall be laid and compacted to Clause 801 or 810, as appropriate.

1105 Footways and Paved Areas (In-Situ Concrete)

1 In-situ concrete for footways and paved areas shall be made, laid and cured as described in IM Appendix 11/1. The grade of concrete and surface finish shall be as described in IM Appendix 11/1.

2 In-situ concrete shall be laid to true levels and crossfalls and be of the thickness described in IM Appendix 11/1.

3 In-situ concrete shall be laid on a subbase composed of one of the materials conforming to Clause 802, 815, or 816 laid and compacted in compliance with Clause 801 or 810 as appropriate, and to the thickness described in IM Appendix 11/1.

Imprinted Pattern Concrete

4 All surrounding surfaces, including but not limited to walls, kerbs, manhole covers, street furniture and similar must be protected to prevent colour contamination from the concrete.

5 The surface shall be struck off and floated to produce a smooth even surface. All edges and joints shall be rounded to the required radius with an approved finishing tool.

6 Existing damp proof courses shall be protected and additional protection installed at all upstands that may be affected by damp and moisture bridging.

7 A stretcher or soldier course imprint arrangement shall be installed along all kerbing, adjoining walls, manhole surrounds and selectively on both sides of the joints.

8 A schedule of imprint pattern concrete requirements is included in Table 1100-2

Table 1100-2:

Characteristic	Test Standard	Value
Sub-BaseRegularity		+/- 12mm
Sub-Base Grading and compaction		Series 800, Type 1, To refusal
Thickness of concrete		200mm
Colour Dye (with surface hardener)		As directed by the Overseeing Organisation
Grade of Concrete	EN 206	C25 / 30
Steel Reinforcement type		As directed by the Overseeing Organisation
Added Reinforcement		Fibre-reinforced
Surface Texture/pattern		To be approved by Overseeing Organisation
Expansion Joint Filler		Polysulphide. Manufacturer's data sheet to be submitted.
Surface Hardener		2 passes (Minimum 1.5kg/m2 per pass)
Sealant		Manufacturer's data sheet to be submitted.

Slip Resistance	BS 7932:2003	TRRL Pendulum (Four S rubber)– wet surface: ≥ 40(PTV) Note: Or equivalent (e.g. DIN 51130)
Surface Regularity		+/- 3mm in 3m (every direction)

9 Following spreading and accurate levelling the surface shall be bull-floated.

Colour and Hardener

10 The special colour dyes shall be combined and applied with a surface hardener.

Arrising

11 Edges of the pavement are normally arrissed (rounded) with a special finishing trowel while the body of the surface is flat-floated to a smooth finish with no trowel marks.

Release Agent

12 A release agent shall be broadcast over the surface to assist in the release of the pattern sheets.

13 As soon as the release agent has been applied, the imprinting must be started using the textured pattern mats.

Punnelling

14 The whole area of each mat must be punnelled to ensure edges and centre imprint evenly.

15 Care must be to taken to remove 'snots', the concrete matrix that can squeeze-up between adjacent mats when imprinting is being carried out.

Figure 1 Imprinting Patterns (Illustrative only)

16 The Contractor shall use a full 'row' of mats to span the pavement and to commence the next 'pass'. The mats from the first pass are then lifted in sequence and re-positioned for the next pass.

Wash Down

17 The hardened and patterned concrete shall be power-washed to remove excess release agents and any other detritus.

Sealant

18 The patterned concrete should be allowed to thoroughly dry after which 2 applications of a transparent sealant are made. Sealant shall be either acrylic or silicon-based

19 A protective top-coat of a urethane or epoxy-resin sealant shall be applied to the surface 6-8 weeks after completion of the work.

Jointing

20 Movement joints shall be created as described in Series 1000 or at a separation of approximately 30 times the slab thickness. Joints shall be regular and positioned to coincide with band courses or to be 'centred' within a slab for aesthetic reasons.

21 Crack control joints shall be installed either during the actual laying of the surface or sawn after the sealant has been applied.

22 For insertion during construction, the control joints may be pre-formed using a timber strip and/or a grooving trowel and include a crack inducer. Depending on the type of joint required, additional work may be necessary once the concrete has cured.

23 When constructed adjacent to a previously placed slab, transverse joints in the succeeding slab shall be aligned with the joints in the adjacent slab.

24 Sawn joints shall be cut after sealing and should be between 25% and 33% of the depth of the slab.

25 Wet-formed and sawn joints shall be sealed with a polysulphide sealant.

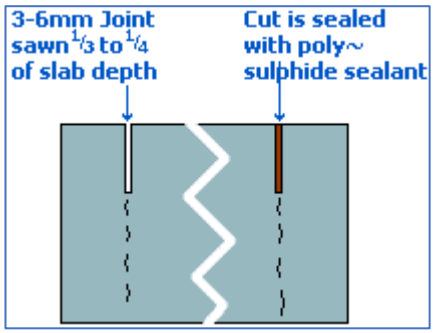

Figure 2 Sawn Joints

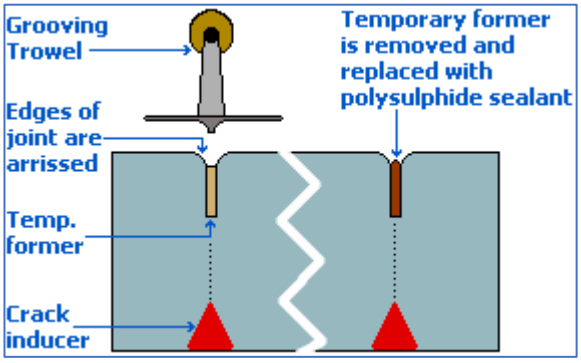

Figure 3 Wet-formed Joints

Re-Entrant Corner Angles

26 These shall be adequately reinforced as directed by the Overseeing Organisation.

1106 Footways and Paved Areas (Concrete Block Paving)

1 Precast concrete paving blocks shall be chamfered and shall conform to MSA EN 1338 and the shapes, dimensions, colours and performances and classes described in IM Appendix 11/1.

2 Precast paving blocks shall be laid in accordance with BS 7533-3, except that the subbase shall be one of the materials permitted in sub-Clause 1103.4.

3 The layout of blocks and details at edges, chamber covers, gullies and other openings shall be as described in IM Appendix 11/1.

1107 Footways and Paved Areas (Clay Pavers)

1 Clay pavers shall conform to MSA EN 1344 with chamfers. The shapes, dimensions, colours and performances and other required classes of clay pavers shall be as described in IM Appendix 11/1.

2 Clay pavers shall be laid in accordance with BS 7533-3, except that the subbase shall be one of the materials permitted in sub-Clause 1103.4.

3 The layout of pavers and details at edges, chamber covers, gullies and other openings shall be as described in IM Appendix 11/1.

1108 Grass Concrete Paving

1 Grass concrete paving shall consist of a reinforced perforated in-situ concrete slab or a precast panel system as specified in IM Appendix 11/1 and in the locations shown on the Drawings.

2 In-situ grass concrete paving shall be cast and cured as described in IM Appendix 11/1. The strength class of concrete and surface finish shall be as described in IM Appendix 11/1.

3 Perforations shall be formed in in-situ grass concrete paving as described in IM Appendix 11/1.

4 Concrete panels shall conform to the shape, dimensions and colour described in IM Appendix 11/1.

5 Concrete used shall have compressive strength class of 28/35 and panels when tested in accordance with MSA EN 1339, the characteristic bending strength shall be class 3 to Table 5 of MSA EN 1339.

6 The water absorption when tested in accordance with MSA EN 1339 shall be class 2 of Table 4.1.

7 The layout of panels and details at edges, chamber covers, gullies and other openings shall be as described in IM Appendix 11/1.

8 Grass concrete paving shall be laid to true levels and crossfalls and be of the thickness described in IM Appendix 11/1.

9 Grass concrete paving shall be laid on a bed of Type 1 unbound mixtures conforming to Clause 802 laid and compacted in accordance with Clause 801 and to the thickness described in IM Appendix 11/1. In addition, panels shall be bedded on a layer of sand conforming to MSA EN 12620 to the thickness specified in IM Appendix 11/1.

10 Perforations shall be filled with friable soil free from deleterious matter or with other material as described in IM Appendix 11/1, levelled off 30 mm below the top surface, sown with grass seed as described in IM Appendix 11/1, covered with a layer of fine soil and levelled. The seed shall be sown while soil is still loose after filling.

1109 Access Steps

1 The Contractor shall provide the access steps identified in contract specific IM Appendix 11/2

and where identified in contract specific IM Appendix 1/10 shall undertake the design of the access steps or elements thereof.

2 The access steps shall comply with the requirements of MSA EN ISO 14122-1 and MSA EN ISO 14122-3, contract specific IM Appendix 11/2 and the performance requirements described hereafter. Where required in contract specific IM Appendix 11/2 the steps shall be installed in accordance with the specific contract requirements.

3 For the purpose of this Clause:

a) The term ‘access steps’ shall mean access steps provided for highway maintenance purposes to communication cabinets and other roadside items and shall include landings and guardrails.

b) The term ‘Machinery’ referred to under

c) MSA EN ISO 14122-1 and MSA EN ISO 14122-3 shall mean communication cabinets and other roadside items.

4 Where required by contract specific IM Appendix 1/4, working and fabrication drawings indicating material and fabrication of components and fittings shall be submitted to the Overseeing Organisation for approval.

5 The alignment and location for access steps shall enable the safe access to and egress from any communication cabinet and other roadside items. The steps shall be located, where possible, such that they will not require removal for access to services or supplies including motorway communication systems.

Durability

6 The access steps must achieve, as a minimum, a serviceable life as detailed in contract specific IM Appendix 11/2. The serviceable life shall be obtained without the requirement for any maintenance other than that resulting from accidental damage and routine maintenance.

Materials

7 Material for access steps shall conform to MSA EN ISO 14122-3 section 4, requirements stated in contract specific 1100-2 and the following:

a) All components of the steps shall be resistant to theft, tampering and fire.

b) Where two or more materials are used they shall be compatible and include measures to avoid galvanic action and avoid differential movement. Materials shall be able to resist corrosion provoked by the surrounding atmosphere and ground conditions to achieve its serviceable life.

c) Unless otherwise stated in contract specific IM Appendix 11/2 materials listed in Table 1100-3 shall conform to the requirements of the relevant specifications, and shall comply with the standards and/or Clauses listed. Where materials are covered by the Construction Products Regulation the Declaration of Performance and CE marking

shall demonstrate that the product meets or exceeds the performance requirements of the specification.

Table 1100-3: Access Step Materials

Material	Requirements General	Detailed
Paving slabs or flags	MSA EN 1339 or MSA EN 1341 Laid in accordance with BS 7533-4	Concrete flags shall be Class 2 or Class 3 as detailed in Annex NA of MSA EN 1339, and shall have a minimum breaking strength of 3.2 MPa. Natural stone slabs shall have a minimum Class of 2 and minimum breaking load of 3.5 kN. Flags or slabs to be bedded on a layer of mortar of 10 mm to 40 mm thick, or sand 25mm ± 5 mm.
Engineering bricks	MSA EN 771-1	Class B Compressive strength ≥ 75 N/mm^2 Water absorption (% by mass) ≤ 7.0 Freeze/thaw resistance category F2 Active soluble salts content category S2
Mortar	MSA EN 1996-2 MSA EN 998-2	Durability designation M or S
Bedding sand	MSA EN 12620	Designation 0/4 mm
Precast concrete edgings	MSA EN 1340	–
Concrete Landings	Series 1700 MSA EN 8500	Exposure class: reinforced – XC3 or XC4, XD3, XF2 unreinforced – XF2 Minimum strength class C25/30 or greater Maximum aggregate size – 20mm
Ancillary concrete	BS 8500	Bedding and backing to precast concrete edgings ST2 Backing to steps ST2
Fill material	Series 600, Table 600-3 to 600-6	Class 1 General Fill

Galvanised steel guardrails	MSA EN 10255	–

Particular Access Step Criteria

8 Unless otherwise stated in contract specific IM Appendix 11/2 the design of access steps shall conform to the following:

a) The steps shall have a minimum clear width of 800mm.

b) Subject to the requirements of paragraph (f) below, no part of the steps, excluding guardrails, shall protrude more than the step rise height plus 50mm above or below the adjacent finished ground level, measured along a line at right angles to the embankment or cutting slope except where necessary to accommodate a landing.

c) In accordance with MSA EN ISO 14122-3 the steps shall have at least one guardrail unless the width of the steps is greater or equal to 1200mm when two guardrails are required. Where one guardrail is to be used it shall be located on the right hand side going up the steps.

d) The steps shall have a rise and going which achieves the safety requirements formulae of MSA EN ISO 14122-3 Steps with an angle of pitch greater than 45 degrees are not permitted.

e) The step going shall maintain the as-constructed finished level for the serviceable life of the steps.

f) Steps with solid edging shall have edging laid at the slope of batter with the top edge set slightly above but not more than 50mm above adjacent ground level measured perpendicular to the slope. The top edge shall also be 50mm minimum above the leading edge of the step going measured perpendicular to the slope.

g) There shall be a change in horizontal direction of not less than 30 degrees after not more than 16 steps or a climbing height of 6m, whichever is the lesser, by means of a landing.

h) Steps shall have adequate drainage for their safe use. There shall be no areas of standing water on the steps.

i) Open steps where a solid riser is not provided are not acceptable. The step going and landings shall also be solid.

j) Knee rails are required on landings and steps.

Environment

9 The access steps shall conform to the environmental requirements stated in contract specific IM Appendix 11/2. The access steps shall be visually acceptable, have a non-intrusive appearance and be suitable for the location. The alignment of the steps shall minimise the impact on the environmental assets in the soft estate.

Geotechnical Requirements

10 Where required in contract specific IM Appendix 11/2 the Contractor shall determine the geotechnical classification of the works in accordance with HD 22 Managing Geotechnical Risk (DMRB 4.1.2) and agree the classification with the Overseeing Organisation in accordance with HD 22.

Records

11 The Contractor shall provide as-built drawings of the access steps to the Overseeing Organisation. These shall include details of materials, fabrication components and fittings.

1110 Tolerances

1 The Contractor shall ensure compliance with the tolerances in

Table 1100-4 when constructing a paved area. Tolerances for bituminous and concrete construction in footways and other pedestrian areas are given in Clause 702.

Table 1100-4: Tolerances for Bituminous and Concrete Pavements in Footways

Parameter	Tolerances
Formation level / Sub-grade level	After completion of any drainage and immediately before laying sub-base the subgrade surface shall be within +10 mm and –30 mm of its design level.
Sub-base level	Where segmental surfacing is used the sub-base shall be within ± 10 mm of its design level. For other surfaces, the compacted sub-base surface shall be within +10 mm and –20 mm of its design level.
Sub-base thickness	The compacted sub-base shall be within ± 10 mm of its specified thickness.
Bituminous binder course	The compacted binder course level shall be within ± 10 mm of the design level.
Surface course and modular surfaces	Where adjacent to a kerb, edging strip or any ironwork the surface course level shall be within +5 mm and –0 mm of its design level.
Bituminous thickness	The total thickness of bituminous bound materials shall not be less than 5 mm of the specified thicknesses.
Laying course sand	The compacted laying course sand level shall be within ± 5 mm of the design level and the layer shall not be less than 40 mm thick.
Kerbs, channels and edging strips	The surface level shall be within ± 6 mm of the design level.
Joints between flags and pavers	Joints should be no less than 2 mm and no more than 5 mm wide. For pedestrian-only footways, flags can be laid with wide (6 - 10 mm) joints filled with mortar.
Slurry Jointing Mortar (Recessed Joints)	Recessed mortar joints shall be within 2 mm ± 1 mm of the finished surface level.
Surface regularity of modular surfaces (adjacent paving units including kerbs)	The maximum deviation of the footway surface under a 3 m straight edge shall not exceed 3 mm.
Surface regularity of modular surfaces (adjacent to a drainage channel or gulley)	The maximum deviation of the footway surface under a 3 m straight edge shall not exceed +10 mm and -0 mm.
Surface regularity of modular surfaces (adjacent to a lateral restraint)	The maximum deviation of the footway surface under a 3 m straight edge shall not exceed ± 6 mm.
Horizontal alignment accuracy of bituminous and concrete surfaces	Horizontal alignments of bituminous of concrete surfaces shall comply with clause 702.
Surface regularity of bituminous and concrete surfaces	Surface regularity of bituminous of concrete surfaces shall comply with clause 702 and 1118 for imprinted concrete.

1111 Natural Stone for Slabs, Setts, Kerbs, Channels, Edgings and Quadrants

1 Natural Stone for slabs, setts, kerbs, channels, edgings and quadrants shall comply with the requirements of this series and be from one of the following rock classifications:

a) Granite or Porphyritic – an igneous rock formed by the cooling and hardening of magma or molten lava.

b) Sandstone – a sedimentary rock formed by the deposition and subsequent cementation of that material close to the Earth's surface and/or within bodies of water. Sedimentation being the collective name for processes that cause mineral or organic particles (detritus) to settle in place.

c) Marble – A metamorphic rock arises from the transformation of existing rock types, in a process called metamorphism, which means change in form.

2 Natural Stone Slabs shall comply with the requirements of MSA EN 1341 and their dimensions, type designations, performances and classes shall be as described IM Appendix 11/1.

3 Natural Stone Setts shall comply with the requirements of MSA EN 1342 and their dimensions, type designations, performances and classes shall be as described IM Appendix 11/1.

4 Natural Stone Kerbs, Channels, Edgings and Quadrants shall comply with the requirements of MSA EN 1343 and their dimensions, type designations, performances and classes shall be as described in IM Appendix 11/1.

1112 Concrete Flags

1 Concrete Flags shall comply with the requirements of MSA EN 1339 and their dimensions, type designations, performances and classes shall be as described in IM Appendix 11/1.

1113 Modular Surface

1 For this specification, the term “modular surface” refers to Concrete Flags, Stone Slabs, Stone Setts, Concrete Blocks and Clay Pavers.

1114 Laying Kerbs, Channels, Edgings and Quadrants

1 Kerbs, channels, edgings and quadrants shall be laid and bedded in accordance with BS 7533-6 using a C6/8, Gen0 or ST1 in accordance with BS 8500 and Series 1000. The mortar bed may be omitted if units are bedded onto a concrete slab or foundation that is still plastic. All units laid on a mortar bed or bedded onto plastic concrete shall be backed with a strength class C6/8 or Gen0 or ST1 concrete in accordance with BS 8500 and Series 1000.

2 Joints shall be provided in kerbs, channels, edgings and backing, which are laid on or adjacent to a concrete pavement to coincide with the pavement transverse contraction, warping and expansion joints. The joints shall be the same width as the joint sealing grooves of the pavement and shall be caulked and sealed as described in Clauses 1015 and 1016. Concrete foundations to kerbs, channels and edgings laid adjacent to a concrete pavement shall be

provided with joint filler board complying with Clause 1014 placed vertically through the full extent of the concrete foundation at positions coinciding with the pavement joints. At expansion joints in bridge decks, the kerb joints shall be as described in scheme specific IM Appendix 11/1. Where the details of bridge expansion joints are proposed by the Contractor, such details shall include the intended treatment at kerbs and footways.

1115 Laying Course - for Unbound Modular Surface (Concrete Flags, Natural Stone Slabs, Concrete Blocks or Clay Pavers)

1 When the footway surface is modular as described in Clause 1113, and the surface is unbound the Contractor shall lay a minimum of 30mm and a maximum of 40 mm thick bed of sand or crushed glass complying with MSA EN 12620 Gf85 0/4 (MP) and to the grading in Table 1100-5.

Table 1100-5: Grading for Gf85 0/4 (MP)

Sieve size	% passing by mass
8 mm	100
6.3 mm	95 - 100
4 mm	85 - 99
0.5 mm	30 - 70
63 µm	0 - 3

2 For paving units requiring a bedding layer depth greater than 40 mm, a blended 0-6 mm crushed rock grading as shown in Table 1100-6.

Table 1100-6: Grading for 0/6 Blended Laying Course

Sieve size	% passing by mass
8 mm	100
6.3 mm	90 - 100
2 mm	30 - 75
1 mm	20 - 60
500 µm	10 - 50
125 µm	5 - 30
63 µm	2 - 9

3 Every unbound modular element shall be bedded for its full area on the laying course and

shall be flush with adjoining paving.

4 Joints in unbound modular paving shall be butt joints or close joints and shall be filled with a kiln-dried sand complying with Gf85 0/1 (FP) as shown in Table 1100-7.

Table 1100-7: Grading for Gf85 0/1 (FP)

Sieve size	% passing by mass
2 mm	100
1 mm	85 - 100
0.5 mm	55 - 100
63 µm	0 - 2

5 Concrete Flags and Natural Stone Slabs shall be carefully cut where necessary to allow for surface boxes, lamp columns, telegraph poles, trees, vehicular crossings, irregular boundary walls, laying to radius closers as required.

6 No frozen material shall be used in any works, nor shall material be laid on frozen or frost covered sub-bases or bedding materials.

7 Stockpiled materials shall be protected at all times. Saturated sand shall not be used in the work.

SuDS (Sustainable Drainage Systems)

8 When the footway surface is modular as described in Clause 1113, and the surface is unbound with requirements for SuDS as instructed by the Client or the design, the Contractor shall use a minimum of 50 mm of a 0-6 mm crushed rock coarse grading as shown in Table 1100-8 and shall use the same material for jointing.

Table 1100-8: Grading for 0/6 Coarse Graded Laying Course and Jointing

Sieve size	% passing by mass
14 mm	100
10 mm	98–100
6.3 mm	80–99
2 mm	0–20
1 mm	0–5

1116 Laying Course - for Bound Modular Surface (Concrete Flags, Natural Stone Slabs, Natural Stone Setts, Concrete Blocks or Clay Pavers)

1 When the footway surface is modular as described in Clause 1113, and the surface is bound

the Contractor shall use a minimum of 30 mm thick 3:1 sand: cement mortar complying with MSA EN 998-2, Table 1, designation M12 using sand or crushed glass complying with MSA EN 12620 Gf 85 0/4 (MP).

2 The modular surface shall be laid on a full mortar bed.

3 Where instructed by the Client, the Contractor shall use a mortar complying with Table 1100-10.

Table 1100-9: Laying Course Requirements

Properties	Category to BS 12620:2013
Grading	2/6 (preferred) or 2/8, Gc85/20 f4
Minimum % crushed surfaces	C70/10
Maximum fines content	f1.5
Shape – flakiness index	FI20
Shape – shape index	SI40
Resistance to fragmentation	SZ26
Acid-soluble sulfate content	AS0.2
Total sulfur	S1
Durability against freeze-thaw	F1
Constituents which alter the rate of setting and hardening of hydraulically bound mixtures	Recycled materials should not be used

Table 1100-10: Bedding Mortar

Requirement	Value
Minimum compressive strength when measured in accordance with MSA EN 1015-11	35 N/mm^2
Flexural strength	4.5 N/mm^2 (A)
Minimum adhesive strength when measured in accordance with MSA EN 1015-12	2.0 N/mm^2
Modulus of elasticity when measured in accordance with MSA EN 13421	(18 000 ± 3 500) N/mm^2
Maximum shrinkage when measured in accordance with MSA EN 445	not greater than 0.10%
(A) - Includes the use of slurry primer.	

4 When required for sub-surface drainage and the design, permeability of the mortar shall be in excess of $2x10^{-3}$ m/s when measured in accordance with the test method specified in MSA EN 12697-19.

5 Every bound modular element shall be bedded for its full area on the laying course and shall be flush with adjoining paving.

6 Whenever natural stone slabs are to be laid on a bedding mortar with compressive strength of ≥ 35 MPa, a bonding primer shall be used. A Bonding slurry primer shall be a blend of cementitious binder and fine aggregate; it shall not contain chemical admixtures which reduce the water permeability of the cured bonding layer. It shall be applied as a liquid slurry having a thick creamy consistency to the underside of the stone slab.

1117 Jointing Mortars for Bound Modular Surface (Concrete Flags, Natural Stone Slabs, Natural Stone Setts, Concrete Blocks and Clay Pavers).

1 Joints in bound modular paving shall be between 6 mm and 10 mm as instructed by the Client.

2 Joints shall either be hand pointed using a 3:1 sand: cement mortar complying with MSA EN 998-2, Table 1, designation M12 using sand or crushed glass complying with MSA EN 12620 Gf 85 0/4 (MP); or shall be slurry grouts complying with the specification set in Table 1100-11.

Table 1100-11: Jointing Mortar for Bound Modular Surface

Requirement	Value
Min. compressive strength (A)	40 N/mm^2
Min. flexural strength (A)	6 N/mm^2
Min. adhesive strength (B)	1.5 N/mm^2
Modulus of elasticity (C)	(20000 ± 4000) N/mm^2
Min. density (A)	2000 kg/m^3
Max. shrinkage (D)	not greater than 0.10%
(A) - Measured in accordance with MSA EN 1015-11 (B) - Measured in accordance with MSA EN 1015-12 (C) - Measured in accordance with MSA EN 13421 (D) - Measured in accordance with MSA EN 445	

Table 1100-12: Recommended design joint widths for stone slabs and setts in bound construction

Paving unit according to MSA EN 1341 & 1342	Thickness (mm)	Dimensional tolerance	
		Class 2	Class 1

Sawn sided slabs	≤70	6 mm	8 mm
Sawn sided slabs	≤100	7 mm	10 mm
Sawn sided slabs	>100	8 mm	12 mm
Slabs having fettled or cropped/guillotined edges	All	5 to 15 mm	5 to 15 mm
Sawn-sided setts	≤70	6 mm	8 mm
Sawn-sided setts	≤100	8 mm	10 mm
Sawn-sided setts	>100	10 mm	12 mm
Cropped-sided setts	≤70	6 mm	10 mm
Cropped-sided setts	≤100	8 mm	12 mm
Cropped-sided setts	>100	10 mm	15 mm

1118 Pattern Imprinted Concrete Surfacing

1 Pattern Imprinted Concrete Surfacing, for this specification, is defined as a single homogenous surfacing material. The material is of a concrete which is mouldable allowing a pattern to be impressed into the surface.

Protection of Surrounding Surfaces

2 All surrounding surfaces, including, but not limited to walls, should be protected to prevent discoloration from the concrete. All clean-up and reports shall be responsibility of the contractor.

3 The surface shall be struck off and floated to produce a smooth even surface. All edges and joints shall be rounded to the specified radius with an approved finishing tool.

Damp Proof Course

4 Existing DPC shall be protected and additional protection installed at all upstands that may be affected by damp and moisture bridging.

Stretcher or Soldier Course

5 A stretcher or soldier course imprint arrangement shall be installed along all kerbing, adjoining walls, manhole surrounds and selectively on both sides of joints.

Joints

6 The control joints shall be sawed as soon as the concrete has hardened such that no ravelling

or spalling occurs, but before any random uncontrolled cracking develops.

7 Joints shall be sawed with their faces perpendicular to the surface of the footpath and shall not vary more that 5mm from their designated position. Transverse joints shall be constructed at right angles to the centerline of the sidewalk and longitudinal joints parallel to the centerline. Locations for longitudinal and transverse joints shall be as directed by the Overseeing Organisation. When the sidewalk is constructed adjacent to a previously placed slab, transverse joints in the succeeding slab shall be aligned with like joints in the adjacent slab.

8 Expansion joint filler shall extend to the full depth of the joint with its top surface 6mm to 12mm below the finished surface.

Traffic

9 The concrete shall not be opened to pedestrian traffic until at least 24 hours after the sealer has been applied. During such period, entrance to all residents and businesses shall be maintained at all times. Construction should be phased to allow for such access.

Materials and Performance

Table 1100-13: Performance Requirements of Imprint Concrete

Characteristic	Test Standard	Value
Substrate Regularity		+/- 12mm
Thickness of concrete		150mm (min)
Grade of Concrete	MSA EN 206	C30 (min) – Fibre-reinforced
Reinforcement type		B503
Surface Texture/pattern	To be approved by Contracting Authority	1m x 1m Sample to be made available for assessment
Surface Texture depth		consistent
Expansion Joints frequency		5m bays
Expansion Joint widths		3mm
Expansion Joint depths		35mm (min)
Expansion Joint Filler		Polysulphide. Manufacturer's data sheet to be submitted.
Surface Hardener		3 passes (Minimum 1.5kg/m^2 per pass)
Sealant		Acrylic. Manufacturer's data sheet to be submitted.

Slip Resistance	BS 7932:2003	TRRL Pendulum (Four S rubber)– wet surface: ≥ 40(PTV)
Surface Regularity		+/- 3mm in 3m (every direction)
Colour Dyes (with surface hardener)		To be approved by Overseeing Organisation

1119 Resin Bound Mixtures

1 All resin bound surfacing shall be installed using UV stable resin. The surface course system will comprise of a two-component, cold-applied binder, and fine and coarse 2 mm and 6 mm sized kiln dried aggregates with a glass grit surface finish.

2 Every site batch produced is to be consistently replicated during application according to the manufacturer's recommendation.

3 The specific blend as stated by the manufacturer is to be followed and measured on application.

a) Using a Tensometer held on a three-point bending test rig, the resin system must meet the requirements of Table 1100-14.

Table 1100-14: Tensile Strength Requirements

Parameter	Resin Bound
Min Strength	≥ 300 kPa

b) Using the MSA EN 13036-4 method of testing. The initial skid resistance (prior to trafficking) measured in accordance with TRL Report 176, IM Appendix E (pendulum test using sliders applicable to both vehicular and foot traffic), indicates that initial measurements of greater than 45 can be achieved as shown in Table 1100-15.

Table 1100-15: SRV values for Resin Bound Surface Mixtures

Parameter	Resin Bound
Dry Conditions	≥ 85
Wet Conditions	≥ 45

c) Vertical permeability testing is performed following LPU STM 208 which is based on MSA EN 12697-19. The required range for vertical permeability is as stated in Table 1100-16.

Table 1100-16: Vertical Permeability of Resin Bound Mixtures

Nominal Blend Size	Parameter	Flow rate litres/m^2/second)

6 mm / 10 mm Resin Bound	Minimum	22
6 mm / 10 mm Resin Bound	Maximum	30
3 mm Resin Bound	Minimum	16
3 mm Resin Bound	Maximum	19

d) Erosion Index for scuffing at 45o C to be ≥3

e) Good resistance to being installed on typical exterior surfaces, such as paths, carparks etc, in accordance to BS 5284

f) UV Resistance – colour stable during and after UV exposure 400 mJm^2 at 50°C (10 years equivalent)

4 The resin shall be applied to a consistent finish and to a depth no lower than the minimum shown in Table 1100-17.

Table 1100-17: Minimum Depth of Installation for Resin Bound Mixtures

Max stone size	Min blend depth
3 mm	12 mm
6 mm	16 mm
10 mm	25 mm

5 Resin Bound surfacing shall be an aggregate compliant with MSA EN 13242 and graded to MSA EN 12620.

1120 Resin Bonded Surfacing

1 Resin Bonded Surfacing system is a non-permeable two-component, cold-applied binder, with fine and coarse, 3 mm to 5 mm sized kiln-dried aggregates (washed and dried).

2 The resin bonded system is to be applied to pre-sealed asphalt surface or a primed smooth concrete surface. Resin bonded surfacing is not permitted on brand new asphalts or concretes.

3 The binder coverage thickness shall in no way fall below or exceed one third (± 3%) of the largest aggregate.

4 Resin bond test measures:

a) The tensile strength is to be no less than 0.5 MPa

b) Adhesion to substrate of 1.5 MPa

c) Erosion Index for scuffing at 45°C to be ≥ 3

d) Resistance:

i) Skid ≥ 65

ii) Freeze-thaw

iii) Diesel

iv) Thermal Movement compatible

1121 Resin Bound Tree Pit Mixtures

1 All resin bound surfacing shall be installed using UV stable resin. The surface course system will comprise of a two-component, cold-applied binder, and fine and coarse 2 mm and 6 mm sized kiln-dried aggregates with a glass grit surface finish.

2 Every site batch produced is to be consistently replicated during application according to the manufacturer's recommendation.

3 The specific blend as stated by the manufacturer is to be followed and measured on application.

a) Using a Tensometer held on a three-point bending test rig, the resin system must meet the requirements of Table 1100-14.

b) Using the MSA EN 13036-4 method of testing. The initial skid resistance (prior to trafficking) measured in accordance with TRL Report 176, IM Appendix E (pendulum test using sliders applicable to both vehicular and foot traffic), indicates that initial measurements of greater than 45 can be achieved as shown in Table 1100-15.

c) Vertical permeability testing is performed following LPU STM 208 which is based on MSA EN 12697-19. The required range for vertical permeability is as shown in Table 1100-18.

Table 1100-18: Vertical Permeability of Tree Pit Resin Bound Mixtures

Parameter	Vertical Permeability (m/s)
Minimum	0.5×10^{-3}
Maximum	5.0×10^{-3}

d) Erosion Index for scuffing at 45°C to be no higher than 3.

e) Good resistance to typical exterior surfaces, such as paths, carparks etc, in accordance to BS 5284.

4 The resin shall be applied to a consistent finish and to a depth no lower than the minimum shown in Table 1100-19.

Table 1100-19: Minimum Depth of Installation for Resin Bound Tree-pit Mixtures

Max stone size	Min blend depth
10 mm	30 mm

5 Resin Bound surfacing shall be an aggregate compliant with MSA EN 13242 and graded to MSA EN 12620.

1122 Re-using Material

1 When instructed by the *Client* or the design, kerbs or paving units shall be reused and supplemented by reclaimed or new components as instructed. Re-used materials must be undamaged and shall be cleaned on all faces before being re-laid**.**

1123 Geo-Cellular Units for the Replacement of Sub-base

1 Geo-cellular units used in footways shall comply with the requirements set in Table 1100-20.

Table 1100-20: Properties of Geo-cellular Units

Element	Value
Compressive strength Vertical Lateral	700 kN/m^2 150 kN/m^2
Deflection Vertical Lateral	1 mm per 126 kN/m^2 1 mm per 15 kN/m^2
Ultimate tensile strength of a single joint	2.25 kN
Tensile strength of a single joint at 1% secant modulus	1 kN
Bending resistance of unit	0.7 kNm
Bending resistance of single joint	0.16 kNm
Minimum void ratio	95%

1124 Filter Fabric

1 Filter fabric used in footways shall comply with the requirements set inTable 1100-21 below.

Table 1100-21: Filter Fabric

Characteristics	Standard	Woven filter	Non-woven filter
Weight	MSA EN 965	H 200 g/m^2	H 400 g/m^2
Ultimate tensile strength Longitudinal Transverse	MSA EN ISO 10319	H 30 kN/m H 30 kN/m	H 15 kN/m H 15 kN/m
Strain at norm tensile strength Longitudinal Transverse	MSA EN ISO 10319	G 25% G 25%	— H 70%

CBR puncture	MSA EN ISO 12236	H 2 000 N	H 3 000 N
Opening size	MSA EN ISO 12956	H 0.2 mm	H 0.1 mm
Water permeability	MSA EN ISO 11058	H 200 × 10^{-3} m/s	H 6× 10^{-3} m/s

1125 Precast Concrete High Containment Kerb

1 A high containment kerb is a kerb designed to redirect vehicles on to their intended path and prevent the overrun of vulnerable areas adjacent to the carriageway. High containment kerbs may be used as vehicle restraint systems only if they are tested to MSA EN 1317, in which case they must comply with all requirements set in Series 0400.

1126 Bus Stop Boarder Kerbs

1 Bus boarder kerbs shall allow improved bus docking by providing a reduced gap between pavement and the bus platform, resulting in safer, faster and easier passenger, wheelchair and pushchair access, and providing a more efficient and accessible community transport service.

1127 Re-Entrant Corner Angles

1 These shall be adequately reinforced as directed by the Overseeing Organisation.

1128 Terrain Retaining Geocell (Plastic)

1 The terrain retaining geocell shall be proprietary and capable of supporting a traffic load ≥ 500 tonne/m^2.

2 It shall permit the placement of either organic topsoil or unbound aggregate.

3 The Contractor shall submit test data from a reputable test entity demonstrating the load bearing resistance of the geocell.

4 The Contractor shall place a regulating layer of well-graded granular fill material having a maximum nominal size of not more than 40mm. This shall be compacted to a modified proctor (4.5kg) site density of ≥ 95%. A layer of filter drain material to Series 500, Type A as in Table 500-6 shall then be placed on the regulating fill and compacted to refusal.

5 Laying course fine aggregate to the requirements specified by the producer of the geocell shall be placed and levelled onto the compacted filter layer and compacted.

6 The geocell shall be positioned in place and levelled – markers shall be installed as required.

7 The geocell shall then be backfilled with either one of the following:

a) Organic topsoil with seed insemination as required by the producer for a surface turf concentration of at least 92%;

b) Graded aggregate as specified by the producer.

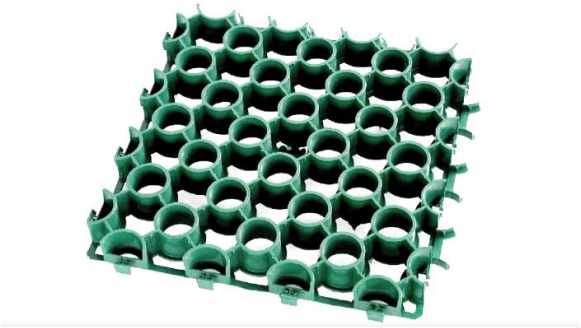

Figure 4 Terrain Retaining Geocell

1129 Grasscrete

1 The grasscrete matrix shall be proprietary and capable of withstanding heavy vehicle loading as indicated in this clause.

2 The system shall be composed of a plastic void former which shall permit the placement of mesh reinforcement.

3 Concrete incorporating an approved superplasticizer shall be poured onto the voids. The compressive strength shall be ≥ 35 MPa. The slump shall be between 100mm and 140mm.

4 The system shall be laid to the gradient and crossfall specified in the Drawings or as directed by the Overseeing Organisation.

5 The mesh reinforcement shall be A252 complying with BS 4483.

Figure 5 Void Formers

6 The system shall be installed in strict compliance with the producer's method statement. This will generally include the following:

a) Excavation to the required levels;

b) Compaction of the subgrade to a minimum EV2 (DIN 18134) ≥ 45. Weaker subgrades shall be capped using suitable fill material as a regulating layer and compacted to refusal.

c) Granular Type 1 Subbase to Series 800 shall be placed and compacted (mod. Proctor density ≥ 95%) to a thickness of 150mm.

d) Well-graded fine aggregate is levelled and compacted – the formers are then positioned, the mesh reinforcement is placed in the voids and concreted.

Figure 6 Mesh Reinforcement and Void Formers

e) Once the concrete sets the formers are melted to expose the openings.

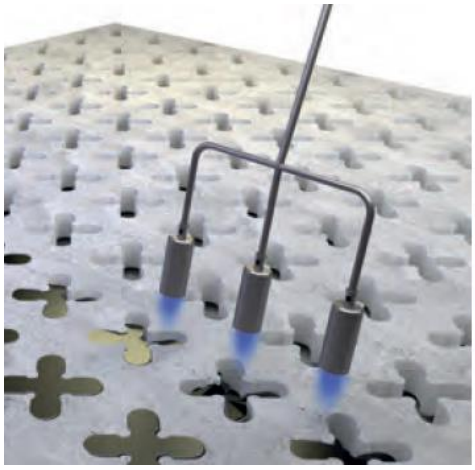

Figure 7 Melting of the Void Formers to exposed openings

f) Organic topsoil is then deposited into the former openings. This shall have a seeding rate ≥ 35g/m2 and using a seed variant specified by the producer.