11 KERBS, FOOTWAYS AND PAVED AREAS

11.1 GENERAL

11.1.1 Scope

1 Highway kerbs, edging kerbs for footways and other paved areas. Precast concrete paving slabs and precast interlocking concrete block areas.

2 Related Sections and Parts:

This Section

Part 3	Earthworks
Part 4	Unbound Pavement Materials
Part 5	Asphalt Works

Section 5, Concrete

Section 13, Masonry

11.1.2 References

1 The following standards and other documents are referred to in this Part:

BS 812.....Testing Aggregates

BS 1377 .....Methods of test for soil for civil engineering purposes

BS 7533 .....Code of practice for laying precast concrete units

BS 7533-3 .....Laying precast concrete paving blocks

EN 197-1 .....Cement composition specifications and conformity criteria for comments cements

EN 1338 .....Precast concrete paving blocks

EN 1339 .....Concrete paving flags

EN 1340 .....Concrete kerbs unit

EN 12620 .....Aggregates for concrete

EN 12878 .....Pigments for the colouring of building materials

11.1.3 Submittals

1 The Contractor shall submit samples of the various types of concrete kerbs and other pavement materials for approval by the Engineer before beginning the work.

11.1.4 Quality Assurance

1 Tests shall be carried out on the concrete mix before beginning manufacture of precast kerbs and other items to ascertain the strength and surface finish requirements can be met. If the required strength and surface finish are not obtained, the Engineer may order revisions to be made in order to achieve the designated requirements.

2 The Engineer shall, at all reasonable times, have access to the place where paving blocks and other items and their constituent materials are manufactured and stored, for the purpose of examining and sampling the materials and finished blocks, inspecting the process of manufacture and marking the blocks.

3 The laying of paving blocks shall comply with the requirements of the Code of Practice for Laying Precast Concrete Block Pavements and EN 1338 except where otherwise designated.

11.2 KERBS

11.2.1 General

1 The following are the types of precast kerbs to be constructed where designated together with associated channels, edgings and quadrants:

(a) Non-mountable.

(b) Dropped.

(c) Flush.

2 The dimensions and shapes of the different kerb types shall be as per the details in BS-Part 1 EN 1340 unless otherwise shown on the drawings or designated in the contract.

3 The bedding and support for such units shall be as shown on the drawings.

Except as modified in this Part, all precast concrete kerbs, channels, edgings and quadrants shall be hydraulically pressed complying with (EN 1340) BS 7263 Part 1

4 Kerbs shall be laid and bedded in accordance with BS 7533 on the concrete pavement slab, a mortar bed, the road base, or on a concrete foundation while it is still plastic or after it has set. All precast units shall be backed with concrete as per the designated details.

5 The use of cast-in-situ concrete for kerbs will not be permitted except with the express written approval of the Engineer.

11.2.2 Materials and Manufacture

1 Constituent concrete materials for kerbs shall conform to the requirements designated in Section 5. Kerbs shall be prepared with a concrete mixture containing sulphate resisting Portland cement and as per Section 5 Part 6.

2 Recycled aggregate may be used as per Section 5 Part 2.

Testing of concrete kerbs shall be carried out in accordance with the requirements of BS 7263 Part 1 (EN 1340) The 28-day compressive strength of the concrete shall be not less than 30 N/mm^2 determined on 150 mm cube specimens, and not less than 75 % of this figure after seven days.

3 Non-mountable kerb, dropped kerb, flush kerb and heel kerb elements shall only be precast from concrete produced in a fully automatic batching plant.

4 Before approval of elements of commercial manufacture, cores shall be taken from a random sample to ascertain that the concrete strength is not less than 25 N/mm^2 at 7 days.

5 Elements shall be manufactured to the designated dimensions as standard 900 mm lengths unless specified otherwise in the contract documents.

6 Non-mountable and dropped precast kerbs shall be formed by elements 500 mm long where required to be laid in straight lines but may be reduced to 250 mm long where required to be laid to curves, depending on the radii of the curves.

7 The finished product shall be of solid appearance with clean planar faces, be free of segregation, honeycombing, pits, broken corners or other defects and there shall be no evidence of external rendering.

8 Bull-nosed and curved faces shall be of constant radius with a smooth change from radius to straight.

9 Tolerances of manufacture shall be 3 mm in any one dimension and end faces shall be truly perpendicular to the base.

10 Transverse strength requirements shall be assessed in accordance with BS 7263 Part 1 appendix B. The loads at failure shall not be less than the appropriate value given in Table 11.1A.

Table 11.1A
Transverse strength of kerbs, channels and edgings

Depth as tested (mm)	Width as tested (mm)	Load at failure (kN)
150	305	22.2
125	150	8.0
125	255	13.3
50	255	5.1
50	205	4.5
50	150	3.3
Dropper kerbs 125	255 to 150	10.3

Bending strength shall be conducted as per EN 1340 Annex F and the class designation shall be declared by manufacturer.

11 Water absorption requirements shall be assessed in accordance with (EN1340) BS EN 7263 Part 1 appendix C. The water absorption shall not exceed the appropriate value given in Table 11.1B.

Table 11.1B
Water absorption of kerbs, channels and edgings

Water absorption in % by mass	
Kerbs, channels and quadrants	Edgings
4.0	5.0

11.2.3 Laying

1 Elements shall be set on to the designated lines and grades. Under no circumstances shall it be permitted for levels to be set by direct measurement from pavement layers.

2 Unless otherwise indicated, elements shall be laid either directly onto a wet-concrete base or onto a sand/cement (3:1) mortar bedding, 25 mm thick, on a previously laid concrete base or approved subbase. The dimensions of the base and concrete class shall be as designated.

3 After kerb units have been laid, a contiguous backing of concrete shall be poured for the elements using steel forms, unless otherwise designated. Lateral resistance shall be provided to the kerbs by placing dowel bars in the backing concrete in not more than 500mm intervals.

4 No pavement layers shall be laid against kerbing until such time as the backing is completed, backfilled and approved by the Engineer.

5 Joints between kerbs, shall have a width of 4 mm. These joints shall be filled completely with fluid sand cement mortar approved by the Engineer and the joints shall be formed again.

6 Immediately after any concrete is in place, and for seven days thereafter, the kerbs, base, and backing shall be fully cured and protected from drying out and against the harmful effects of weather, including rain and rapid temperature changes. The method of protection shall be subject to the Engineer's approval. The use of coloured curing membranes will not be permitted. Concrete not properly cured and protected will be rejected and shall be removed from the site.

7 At every 10 m interval movement joint 20 mm thick shall be formed through the concrete bed and backing. The joint filler shall be bitumen impregnated cork board. The filler shall extend through the kerb, bed, backing and channel, and shall be trimmed to the finished shape of the kerb and channel.

8 At access points, the kerbs, including the bed backing shall be dropped to show a face of 25 mm or as otherwise designated.

9 At the termination of any kerb run, the end kerb section shall be sloped down to ground level, if applicable, and angled away from the road at 30 degrees in accordance with BS 7533.

10 All kerbs shall be thoroughly cleaned of all extraneous materials.

11 Kerbs shall be laid within a tolerance of ± 3 mm, at each end of an element, to the designated lines and grades.

11.3 PRECAST CONCRETE PAVING BLOCKS

1 Standard rectangular precast concrete paving blocks would have a work size length of 200 mm and a work size width of 100 mm.

2 Paving blocks of any other shapes could be made provided they fit within a 295 mm square co-ordinating space.

3 The preferred work size thicknesses are 60 mm, 80 mm and 100 mm for all types of paving blocks.

4 The actual sizes of the paving blocks as determined in accordance with EN 1338 shall not deviate from the work size dimensions by more than the following tolerances:

Length	± 2 mm
Width	± 2 mm
Thickness	± 3 mm

5 The binder used in making the paving blocks shall be Ordinary Portland Cement, Sulphate Resisting Portland Cement or Moderate Sulphate Resisting Portland Cement which complies with BS 4027 or ASTM C150; respectively.

6 The aggregates used in making the paving blocks shall comply with section 5 Part 2 of the QCS.

7 The water used in the manufacturing of the blocks shall be in conformance with section 5 Part 4 of the QCS.

8 The pigments, which are used to give colour to the paving blocks, shall comply with section 5.

9 The average crushing strength of 16 paving blocks shall not be less than 49 N/mm^2 and the crushing strength of any individual block shall not be less than 40 N/mm^2. Higher strength classes may be requested by the Engineer. Up to 20% coarse recycled aggregate may be used as per Section 5 Part 2.

10 For walkway applications, lower compressive strength shall not be less than 40 N/mm^2 and for any individual block shall not be less than 32 N/mm^2. Recycled aggregate may be used as per Section 5 Part 2.

11 The plan areas of the specimens shall be determined by measure the length and width of the specimen across two opposite direction, the blocks shall be stored for 24 ± 4 h in water maintained at a temperature of 20° ± 5° C. The load shall be applied without shock and increased continuously at a rate of 15 + 3 N/mm2/min until no greater load can be sustained by the specimen or delamination occurs. The apparent compressive strength of individual specimen shall be calculated by dividing the maximum load (in N) by the plan area (in mm2). The compressive strength may be corrected by multiplying the apparent compressive strength by the appropriate correction factor from the table below.

Work size Thickness in mm	Correction factors	
	Plain block	Chamfered block [a]
60 or 65 80 100	1.00 1.12 1.18	1.06 1.18 1.24
[a] Blocks with chamfer of work size greater than 5mm in width		

12 The average tensile splitting strength of 16 paving blocks tested in accordance with EN 1338 shall not be less than 3.6MPa and the strength of any individual block shall not be less than 2.9MPa and the failing load not lower than 250N/mm.

13 The average water absorption of three tested samples shall not exceed 5% and no individual block shall have a water absorption greater than 6%.

11.4 LAYING PRECAST CONCRETE PAVING BLOCKS

1 The paving blocks shall be laid generally in accordance with BS 7533-3 and to a pattern approved by the Engineer.

2 A laying course consisting of fine aggregates (sand), which complies with the corresponding grading requirement given in Table 11.2, shall be constructed. The fine aggregates shall be placed in a moist but not a saturated condition so that a laying course thickness of 50 mm maximum is formed. This sand layer shall be placed on a compacted aggregate subbase or base as indicated in the project specifications/drawings.

3 The paving blocks shall be laid on the laying course and compacted using a plate compactor with a plate area of not less than 0.25 m2, transmitting an effective pressure of not less than 75 kN/m^2 of plate at a frequency of vibration in the range of 75 Hz to 100 Hz.

4 A maximum deviation for the block paving from design levels of ± 6 mm shall be maintained.

5 The joints between the paving blocks shall be filled with dry jointing sand by spreading it over the surface and brushing it into the joints. The dry sand shall be natural and shall comply with the corresponding grading requirement given in Table 11.2. The block paving shall be vibrated to ensure that the joints have been completely filled.

Table 11.2
Grading for laying course & jointing sand

Sieve Size	% Passing	
	Laying Course Sand	Jointing Sand
10 mm	100	
5 mm	90-100	100
2.36 mm	75-100	95-100
1.18 mm	55-90	90-100
600 µm	35-70	55-100
300 µm	8-35	15-50
150 µm	0-10	0-15
75 µm	0-3	0-3

11.5 PRECAST CONCRETE PAVING SLABS

1 Precast concrete paving slabs shall be hydraulically pressed, complying with EN 1339.

2 The dimensions of precast concrete paving slabs shall be as per Table 3 of EN 1339 unless shown otherwise on the contract drawings.

3 Where permitted by the Engineer as an alternative, slabs 450 mm x 450 mm and smaller may be bedded on a layer of clean sharp sand complying with EN 12620 Grading C or M, 25 mm ± 10 mm thick.

4 On circular work where the radius is 12 m or less, all slabs shall be radially cut on both edges to the required line.

5 Transverse strength and water absorption requirements shall be assessed in accordance with EN 1339 - appendix B and appendix C; respectively. The loads at failure shall not be less than the appropriate value given in Table 11.3 and the water absorption shall not exceed the limit given in the aforementioned Table.

Table 11.3
Transverse strength and water absorption of flags

Flag type	Minimum load at failure for thickness (kN)					Maximum water absorption in % by mass
	50 mm	60 mm	63 mm	65 mm	70 mm	
A	8.3	-	12.7	-	-	4.0
B,C,D	11.1	-	16.9	-	-	
E	9.6	-	-	-	18.8	
F	9.1	-	-	15.4	-	
G	9.6	13.8	-	-	-	

6 The mortar bed shall be spread only after the base has been approved by the Engineer. The subbase shall be tested for density and the minimum density shall be greater than 95% of the maximum dry density.

7 Slabs shall be laid in accordance with BS 7533 to the designated cross-section and with joints at right angles to the kerb.

8 Slabs shall be bedded on a sand/cement (3:1) mortar bedding not less than 10 mm and not more than 40 mm thick.

9 Unless designated elsewhere paving slabs shall be laid with close joints of between 2 to 4 mm. After laying the joints shall be filled with sand complying with clause 8.3.3.

10 Where designated paving slabs shall be laid with open joints of between 5 to 10mm laid in accordance with BS 7533.

11.6 CAST-IN-PLACE CONCRETE PAVED AREAS

1 Cast-in-place concrete for footways and paved areas shall only be permitted for small areas where it is awkward or impractical to use one of the alternative paving materials specified in this part of the specification.

2 The use of steel reinforcement bars or mesh in cast-in-place concrete slabs is not permitted.

3 Paving shall be cast in sizes to avoid the formation of shrinkage cracks. The actual maximum size of area to be cast at one time will be advised by the Engineer based on the mix design and layer thickness shown on the drawings. The Contractor may be permitted to cast larger areas at one time if non-metallic fibres are added to the concrete mix to eliminate cracking. In such cases the maximum pour size shall be proposed by the Contractor and approved by the Engineer.

4 Cast-in-place concrete for footways and paved areas shall be mixed, laid and cured as described in Section 5.

5 The grade of concrete, layout, thickness, position of joints and surface finish shall be as designated.

6 Cast-in-place concrete shall be laid on a designated sub-base in accordance with Part 4.

11.7 BITUMINOUS PAVED AREAS

1 Flexible surfacing for footways and paved areas shall be made and laid in compliance with Part 5.

2 Surfacing shall be laid to true levels and crossfalls and be of the designated thickness.

3 Surfacing shall be laid on a designated sub-base in accordance with Part 4.

END OF PART