SRI LANKA STANDARD 863: PART 1 : 1989
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SPECIFICATION FOR
CEMENT CONCRETE TILES
PART 1: SPECIFICATION FOR MANUFACTURE

SRI LANKA STANDARDS INSTITUTION

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SLS 863 : PART 1 : 1989

Gr, 7

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SRI LANKA STANDARD
SPECIFICATION FOR CEMENT CONCRETE TILES
PART 1: SPECIFICATION FOR MANUFACTURE

FORWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1989-10-11, after the draft, finalized by the Drafting Committee on Cement concrete tiles, had been approved by the Civil Engineering Divisional Committee.

Cement concrete floor tiles and wall tiles are available with no pigments or with one or more pigments used on the wearing surface. The wearing surface can be plane or can have a pattern embossed on the surface.

For floorings, cement concrete tiles are popular due to moderate cost free availability, pleasant appearance, ease with which intricate decorative or non-slip patterns can be incorporated, possibility of using colours, improved hardness compared to in-situ construction, facility for quick installation and easy replacement during repairs. Also it performs better in service as a cement concrete tiled floor adapts itself easily to slight settlement of the foundation and backfill or to drying shrinkage, and any cracks so developed will be imperceptibly localized at the joints. In addition, they have good strength, durability and resistance to wear. There is also a recent trend of using cement concrete tiles, particularly decorative patterned tiles, as a wall finish at moderate cost.

A Sri Lanka Standard on cement concrete tiles was considered useful to

(a) encourage quality control by manufacturers;
(b) overcome the main shortcomings, such as liability to bloom or effloresce, non-durability of colour, crazing and poor strength, by specifying appropriate requirements;
(c) provide a smooth transition to metric sizes;
(d) specify suitable test procedures and a sampling method;
(e) encourage production of a variety of patterns and colours so as to provide a good selection to the user;
(f) encourage manufacturers to innovate to reduce costs; and
(g) stimulate healthy competition among large number of manufacturers scattered island wide, using semi-automatic and manual pressing machines.

This part of the standard covers the specification for manufacture and requirements for compliance of cement concrete floor or wall tiles. Part 2 of this standard deals with test methods.

Metric modular sizes are specified along with a single non modular size which is in use at present. It is hoped that, with the gradual adoption of modular dimensions the use of non-modular size of tiles will cease in due course.

Inclusion of a resistance to wear test was also considered. However, after careful deliberations and some preliminary tests, it was decided to exclude it as:

a) In this country resistance to wear is less critical than other modes of failure of tiled floor finishes;
b) Cement concrete tiles are superior to many other alternative floor finishes as regard wear;
c) Cost of such a test is high; and
d) Special equipment is required.

Test procedures reviewed were those in IS 1237: 1959, ASTM C 944: 1980, ASTM C 418 : 1981 and ASTM C 779 : 1982, while the experimental work was based on IS 1237: 1959.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or an analysis shall be rounded off in accordance with CS 102. The number of significant figures to be retained in the rounded off value shall be the same as that of the specified value in this standard.

In the preparation of this standard the assistance derived from the publications of the British Standards Institution, The Bureau of Indian Standards and the American Society for Testing Materials is gratefully acknowledged.

1 SCOPE

This part of the standard covers requirements for cement concrete floor tiles and wall tiles, made with cement and aggregate, commonly referred to as pressed cement tiles, but excludes terrazzo tiles

2. REFERENCES.

BS	1014	Portland cement and Portland cement products
CS	102	Presentation of numerical values
SLS	107	Ordinary Portland cement
SLS	428	Random sampling methods
SLS	522	Water for making concrete
SLS	863	Cement concrete tiles, Part 2 – Test methods

3 DEFINITIONS

For the purpose of this specification the following definitions shall apply

3.1 back : The side opposite the face of a tile

3.2 cement tile : Tile in the manufacture of which no pigments are used and having a plane wearing surface.

3.3 chequered tile: A patterned tile with the pattern made wholly of squares of side 25mm to 50mm measured from center to center of 'V' grooves and arranged parallel to the side of the tile.

3.4 coloured cement tile: Tile in the manufacture of which one or more pigments are used and having a plane wearing surface.

3.5 face: The wearing surface of a tile

3.6 patterned tile: Tile having a pattern embossed on the wearing surface

3.7 plane tile: Tile having a plane wearing surface

4 CLASSIFICATION

Cement concrete flooring tiles shall be of three classes as given below depending on the duty they perform.

4.1 General purpose floor tiles

Tiles used for flooring in such places where normally light loads are taken up by the floors; such as office buildings, schools, colleges, hospitals, residential buildings, etc.

4.2 Special purpose floor tiles

Tiles used for heavy traffic conditions where light loads are imposed, such as footpaths, entrances and stairways of public buildings, and passages in auditoriums.

4.3 Wall tiles

Tiles used as a wall finish

5. TYPES

5.1 Plane tiles

5.1.1 Plane tiles with ordinary grey cement only

5.1.2 Plane tiles with single colour

5.1.3 Plane tiles with two or more colours

5.2 Patterned tiles

5.2.1 Patterned tiles with ordinary grey cement only

5.2.2 Patterned tiles with single colour

5.2.3 Patterned tiles with two or more colours

6 MATERIALS

6.1 Cement

The cement used in the manufacture of tiles shall be ordinary Portland cement conforming to the requirements of SLS 107. White or coloured Portland cement, if used in the manufacture of tiles shall also conform to the requirements of SLS 107.

6.2 Aggregate

Aggregate used shall be natural river sand, crushed rock (quarry dust) or both. It shall not contain harmful materials like pyrites, salts, coal or other organic impurities, shale, mica or similar laminated materials, or flaky elongated particles in such a form or in sufficient quantity to affect adversely the hardening, strength or durability of the tile.

Aggregate which is coarser, shall be used for the backing layer while finer aggregate shall be used for the wearing layer. Maximum size of aggregate for any layer depends on the thickness of that layer and shall not exceed one quarter of the thickness of that layer.

6.3 Pigment

6.3.1 Pigments shall normally comply with the requirements of BS 1014 or any other national standard acceptable to Sri Lanka Standards Institution, until such time a Sri Lanka Standard is available. Pigments may also be used by agreement between the purchaser and the supplier, but most pigments not complying to any of the above standards may fade, especially if exposed to direct sunlight, rain, temperature variations etc.

6.3.2 In order to achieve the best staining power and homogeneity, pigments should be milled in with dry cement before adding to the mix, or alternatively, coloured cement should be used.

NOTE: *All colours, including the natural grey colour of ordinary cement, may become obscured or reduced in intensity to varying degrees, if conditions during the manufacture and storage of the tiles are not so arranged as to avoid formation of 'lime' or efflorescence. The incorporation of an integral waterproofed, such as metallic soap, know not to give rise to damaging side effects may be considered to inhibit fading due to lime bloom. (see 6.5)*

6.4 Water

Water used shall be clean and free from oil, acid, alkali, organic or vegetable matter and it shall conform to SLS 522. Potable water shall normally be used; sea water shall not be used.

6.5 Additives or admixtures

Additives or admixtures other than pigments may be incorporated by agreement between the purchaser and the supplier, in special circumstances.

7. MANUFACTURE

7.1 Cement concrete tiles shall be manufactured using materials specified under **6** by a pressure process. Pressure applied shall be sufficient to bond the wearing layer to the backing and to enable the tile to meet the performance tests specified in this standard.

7.2 The proportion of cement to aggregate in the backing of the tiles shall be not leaner than 1:5 by volume.

7.3 The proportion of cement to aggregate in the wearing layer of tiles shall be not leaner than 1 : 2 by volume. Where colouring material is used in the wearing layer, it shall not exceed 10 per cent by mass of cement used in the mix.

7.4 On removal from mould, the tiles shall be kept in moist condition continuously at least for seven days and subsequently, if necessary, kept moist for a further period that would ensure their conformity to the requirements of **15** and **16** and would minimize shrinkage and cracking. Tiles shall be stored under cover so as to provide adequate protection against damage.

8 SHAPE AND DIMENSIONS

8.1 Cement concrete tiles shall normally be square shaped. Half tiles, rectangular or diagonal in shape, shall also be available. The dimensions of the sides and the thickness of the full tiles, measured in accordance with **4** of **SLS 863 : Part 2 : 1989**, shall comply with Table **1**.

TABLE 1 : Dimensions of sides and thickness of tiles

Dimensions	**Modular size mm**	**Non-modular size mm**
Basic size Center to center mm x mm	200 x 200 300 x 300 400 x 400	150 x 150
Length of each side	197 ±1 297 ±1 397 ±1	147±1
Thickness	20±3 30±3 35±3	15±3

NOTES

1. *As the above non-modular size is in use at present it has been included in the standard. It is hoped that, with the gradual* adoption of modular dimensions the use of this size of tiles will cease in due course.

2 *Thickness of joints is considered to be 3.0 mm*.

8.2 Half-tiles for use with the full-tiles in the floor shall have dimensions which shall be such as to make two half-tiles, when joined together, match with the dimensions of one full-tile.

8.3 A 2 mm tolerance (see Table **1**) shall be allowed for the length of a side of a tile and also, a 6 mm tolerance (see Table **1**) shall be allowed for the thickness of tiles. Nevertheless, for each batch or delivery of tiles, which ever is less the tolerance shall not exceed 1 mm for length and 3 mm for thickness between any two tiles.

8.4 All tiles, other than diagonal and rectangular half-tiles, shall be square. The difference of the diagonal dimensions of a full tile measured in accordance with **4.5** of **SLS 863 Part 2: 1989** shall not exceed 3 mm.

9 WEARING LAYER

9.1 Thickness and groove depth

The minimum thickness of the wearing layer for different classes and types of cement concrete tiles, measured in accordance with **4** of **SLS 863: Part 2: 1989**, shall be as specified in Table **2**. Where patterned or chequered tiles are specified the minimum thickness of the wearing layer measured from top of the tile shall be as above and the maximum groove depth measured from the wearing surface, in accordance with **4** of **SLS 863 : Part 2 : 1989**, shall also comply with Table **2**.

TABLE 2- Thickness of the wearing layer and the groove depth (where applicable)

Class of tile	**Side of square tile (mm)**	**Patterned and chequered tiles**		**Minimum thickness of wearing layer of plane tiles (mm)**
		Minimum thickness of wearing layer (mm)	**Maximum groove depth (mm)**	
General purpose floor tile	150	5.0	3.0	4.0
	200	5.0	3.0	4.0
	300	5.0	3.0	4.0
	400	5.0	3.0	4.0
Special purpose floor tile	150	5.0	3.0	4.5
	200	5.0	3.0	4.5
	300	5.0	3.0	4.5
	400	5.0	3.0	4.5
Wall tile	150	5.0	3.0	3.5
	200	5.0	3.0	3.5

9.2 Colour and texture

The colour or colours shall be uniform over the wearing surface of each tile in any one delivery, except where special random effects are ordered.

The colour and texture of the wearing layer throughout its thickness, shall be uniform.

10 GENERAL QUALITY

10.1 The wearing face of plane tiles shall be free from projections, depressions, flakes and crazes. Further, in the case of patterned tiles the patterns shall also be uniform throughout the face of the tile.

10.2 The wearing layer of the tiles shall be firmly bonded to its base layer.

10.3 All tiles shall be free from cracks other than any hair line cracks.

10.4 The edges of the tile shall be perpendicular to the surface. The planes of the upper and lower surfaces of the tile shall be parallel and adjacent vertical edges of square tiles shall be at right angles to each other.

10.5 All arises shall be sharp and true.

11 LAYING OF TILES

The tiles shall not be laid until a period of at least 28 days have elapsed after pressing.

NOTE : *There is an inherent danger in the laying of insufficiently cured products arising from drying shrinkage*

12 PROTECTION IN TRANSIT

The manufacturer shall provide adequate protection to tiles against abrasion and breakage and shall ensure that tiles do not contact material likely to cause discolouration or reduction in strength.

13 MARKING

Each tile shall be legibly and indelibly marked with the following information:

a) Name of the manufacturer or the registered trade mark;
b) Code number to indicate Class of tile; and
c) Batch number.

NOTE: Attention is drawn to certification facilities offered by SLSI. See the inside back cover of this standard.

14 AGE AT TESTING

The minimum age at testing shall be 28 days.

15 TRANSVERSE STRENGTH

The average transverse strength of the tiles sampled in accordance with 17, when tested by the method described in **5** of **SLS 863 : Part 2: 1989**, shall be not less than the values specified in Table **3**.

TABLE 3 : Transverse strength requirements

Class of tile	Average transverse strength MPa	
	Wet test	Dry test
General purpose floor tile	2.0	3.0
Special purpose floor tile	3.0	4.5
Wall tile	2.0	3.0

16 WATER ABSORPTION

The average water absorption by tile face and the average total absorption of the tiles sampled in accordance with **17**, when tested by the method described in **6** of **SLS 863: Part 2 : 1989**, shall not exceed the requirements specified in Table **4**.

TABLE 4 : Water Absorption requirements

Class of tile	Average water absorption by the tile face kg/m	Total Absorption as percentage
General purpose Floor tile	4.0	10.0
Special purpose Floor tile	3.0	8.0
Wall tile	4.0	10.0

17 SAMPLING AND CRITERIA OF CONFORMITY

17.1 Lot

All cement concrete tiles of the same class, type, size and belonging to one batch of manufacture shall constitute a lot.

17.2 Scale of sampling

17.2.1 Samples shall be tested from each lot for ascertaining its conformity to the requirements of this specification.

17.2.2 The number of cement concrete tiles to be selected from a lot shall be in accordance with column 1 and column **2** of Table **5**.

TABLE 5 – Scale of Sampling

Number of cement Concrete tiles in a lot	Number of cement tiles to be selected	Acceptance number	Sub Sample size
Up to 1 000	20	2	15
1 001 – 3 000	32	3	18
3 001 – 10 000	50	5	24
10 001 and above	80	7	30

17.2.3 The cement concrete tiles shall be selected at random. In order to ensure randomness of selection, random number tables as given in **SLS 428** shall be used.

17.3 Number of tests

17.3.1 Each tile selected as in **17.2.2** shall be inspected for requirements, given in **8**, **9** (except the thickness of the wearing layer), **10** and **13**.

17.3.1 A sub sample of size as given in column **4** of Table **5** shall be selected from the tiles selected as in **17.2.2** and shall be divided into three equal portions. The three portions thus obtained shall be tested in the following way.

Portion 1 transverse strength test (dry test).
Portion 2 transverse strength test (wet test) and measurement of wearing layer thickness
Portion 3 water absorption test.

17.4 Criteria for conformity

A lot shall be declared as conforming to the requirements of this specification if the following conditions are satisfied.

17.4.1 Each tile inspected as in **17.3.1** satisfies the marking requirements

17.4.2 The number of tiles not conforming to any one or more requirements given in **8**, **9** (except the thickness of the wearing layer) and **10** when inspected as **17.3.1** is less than or equal to the corresponding acceptance number given in Table **5**.

17.4.3 Each tile of the sub sample when tested as in **17.3.2** satisfies the relevant tests.

18 CERTIFICATE OF TEST AND COST OF TESTS

18.1 The manufacturer/supplier shall satisfy himself by regular periodical tests that the material conforms to this standard and a certificate to this effect shall be provided free of charge at the request of the purchaser or his representative.

18.2 When the purchaser requires tests to be carried out, the cost of such tests shall be borne as follows:

a) By the manufacturer / supplier in the event of the results indicating that the material does not conform to this standard: and

b) By the purchaser in the event of the results indicating that the material does not conform to this standard.

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SRI LANKA STANDARDS INSTITUTION

The Sri Lanka Standards Institution (SLSI) is the National Standards Organization of Sri Lanka established under the Sri Lanka Standards Institution Act No. 6 of 1984 which repealed and replaced the Bureau of Ceylon Standards Act No. 38 of 1964. The Institution functions under the Ministry of Science & Technology.

The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

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All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

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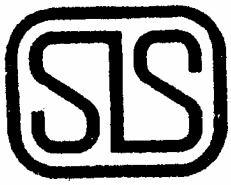

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