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SRI LANKA STANDARD 419 : 1977

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SPECIFICATION FOR TERRAZZO TILES

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BUREAU OF CEYLON STANDARDS

SPECIFICATION FOR TERRAZZO TILES

S. L. S. 419 : 1977

Gr. 6

BUREAU OF CEYLON STANDARDS
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SRI LANKA STANDARD SPECIFICATION FOR TERRAZZO TILES

FOREWORD

This Sri Lanka Standard Specification has been prepared by the Drafting Committee of the Bureau on Terrazzo Tiles. It was approved by the Civil Engineering Divisional Committee of the Bureau of Ceylon Standards and was authorized for adoption and publication by the Council of the Bureau on 1977-05-11.

As the production of terrazzo tiles is now a well established industry the need for a Sri Lanka Standard has been felt for sometime.

Rational metric and inch sizes of terrazzo tiles (which are not equivalent to one another and therefore not interchangeable) are specified in this standard. Both sets of sizes are to be considered as 'standard' until such time the inch set is withdrawn after the industry changes over completely to the metric system.

Clause 10.2 enables dimensionally co-ordinated sizes to be covered by this standard if they are provided by agreement between the purchaser and the supplier. Appendix C gives further information on dimensionally co-ordinated sizes.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test, shall be rounded off in accordance with CS 102 : 1971*. The number of figures to be retained in the rounded off value shall be the same as that of the specified value in the standard.

The assistance derived from the publications of the British Standards Institution and the Indian Standards Institution in the preparation of this standard is acknowledged.

1. SCOPE

This Sri Lanka Standard specifies requirements for terrazzo floor and wall tiles.

* CS 102 : 1971 - Presentation of Numerical Values.

2. TERMINOLOGY

For the purpose of this standard the following definition shall apply.

2.1 Terrazzo — A cement based polished exposed aggregate floor or wall surface, whether in pre-cast form or laid in-situ. The aggregate may be chips of marble, dolomite, serpentine, granite, chert, miocine limestone, dolomitic marble or any other similar material.

3. DESIGNATION FOR SPECIFYING TILES

3.1 When specifying or making an enquiry, tiles shall be designated by referring to the following :

(a) The size of the aggregate in the facing layer (see Clause 3.2),

(b) The size and thickness of tile (see Clause 10),

(c) The shape of tile if other than square,

(d) The finish of the tile (see Clause 12).

The colour of tiles and the type of aggregate shall be designated by referring to the manufacturer's sample.

3.2 The sizes of the terrazzo aggregate for the purpose of specifying tiles shall be described by either of the following :

(a) Upto 5 mm	or	(a) Upto 3/16 in
(b) Upto 13 mm		(b) Upto $\frac{1}{2}$ in
(c) Upto 25 mm		(c) Upto 1 in
(d) Upto 32 mm		(d) Upto $1\frac{1}{4}$ in
(e) Random		(e) Random
(f) Pebble aggregate		(f) Pebble aggregate.

Selection of aggregate sizes shall take into consideration the finished thickness of the tile.

4. CEMENT

The cement shall be ordinary, white or coloured Portland cement complying with the requirements of CS 107 : 1971*.

* CS 107 : 1971—Ceylon Standard Specification for Ordinary Portland Cement. (Metric Units)

5. PIGMENTS

5.1 Pigments used shall normally comply with the requirements of any accepted international or national standard 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 may fade, especially if exposed to sunlight and weathering.

5.2 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 waterproofer, such as a metallic soap, known not to give rise to damaging side effects may be considered to inhibit fading due to lime bloom (see Clause 7).

6. AGGREGATE

6.1 **Facing Layer** — The aggregate shall consist of good quality marble, or other natural stone of similar characteristics such as Serpentine, Chert, Miocine Limestone, Dolomitic marble, etc. They shall be of adequate hardness, (see Appendix D) angular in shape as distinct from elongated and flaky. Aggregate shall not contain clay, iron oxide, pyrites or other harmful foreign matter in such a form or in sufficient quantity to affect adversely the bond or strength, or cause surface failure. Aggregate should preferably be graded and it is important to avoid a high fines or dust content. The approximate sizes of aggregate corresponding to commercial grades are given in Table 1.

6.2 **Base Layer** — The aggregate shall consist of naturally occurring materials complying with the requirements of SLS.....* such as crushed or uncrushed gravel, or crushed stone, with natural sand, crushed stone sand or crushed gravel sand.

* Sri Lanka Standard on aggregates is under preparation.

Table 1 — Sizes of Facing Aggregate Corresponding to Commercial Grades

No.	mm	in
0	less than 3	less than $\frac{1}{8}$
1	3 — 5	$\frac{1}{8}$ — $\frac{3}{16}$
2	5 — 7	$\frac{3}{16}$ — $\frac{1}{4}$
3	7 — 10	$\frac{1}{4}$ — $\frac{3}{8}$
4	10 — 13	$\frac{3}{8}$ — $\frac{1}{2}$
5	13 — 19	$\frac{1}{2}$ — $\frac{3}{4}$
6	19 — 25	$\frac{3}{4}$ — 1
7	25 — 32	1 — $1\frac{1}{4}$
8	greater than 32·0	greater than $1\frac{1}{4}$

7. ADDITIVES OR ADMIXTURES

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

8. MANUFACTURE

8.1 The tile shall be vibrated or tamped to an extent which allows the entrapped air to escape to the surface and compacts the aggregate at the wearing face and it shall be pressed with a pressure depending on the area of the tile but sufficient to mould the facing to the backing and to enable the tile to meet the performance tests specified in this standard.

8.2 The base layer shall consist of not less than 3 and not more than $3\frac{1}{2}$ parts of aggregate as specified in Clause 6.2, to one part of cement as specified in Clause 4 proportioned by mass.

8.3 The facing layer shall be such as to provide a minimum wearing thickness of 6 mm (0·25 inches) after grinding.

8.4 The surface treatment shall be by grinding. Any slight surface imperfections shall be filled by grouting with a neat cement paste coloured to match the original mix and well worked into the surface.

9. SHAPE

Tiles shall be square with flat top and of rectangular cross section. Other shapes may be supplied by agreement between the purchaser and the supplier.

10. DIMENSIONS

10.1 The dimensions of square tiles shall be as given in Table 2M or 2.

10.2 Other sizes and thickness may be supplied by agreement between the purchaser and the supplier. This applies particularly to dimensionally co-ordinated sizes on which further guidance is given in Appendix C.

SIZES OF TILES

Table 2M

Basic Size Centre to centre	Length of each side	Thickness
mm × mm	mm	mm
150 × 150	147 ± 1	15 ± 3
200 × 200	197 ± 1	20 ± 3
300 × 300	297 ± 1	30 ± 3

Table 2

Basic size centre to centre	Length of each side	Thickness
in × in	in	in
6 × 6	5 7/8 ± 1/32	5/8 ± 5/8
8 × 8	7 7/8 ± 1/32	7/8 ± 1/8
12 × 12	11 13/16 ± 1/32	1 1/8 ± 1/8

11. TOLERANCE

Tolerance as specified above shall in general apply. Nevertheless, for each delivery of tiles, the tolerance shall not exceed 1 mm or 1/32 in for lengths and 3 mm or 1/8 in for thicknesses between any two tiles.

12. FINISH

By agreement between the purchaser and the supplier tiles shall be supplied either,

(a) ground and grouted, or

(b) ground, grouted and re-ground to a fine grit finish and acid treated for floors and walls, or

(c) ground, grouted and high polish finished and acid treated for walls.

Note: Treating is normally done with oxalic acid.

13. FREEDOM FROM DEFECTS OR FLAWS

13.1 The aggregate shall be evenly distributed.

13.2 The face shall be free from projections, depressions, flakes and crazes.

13.3 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.

13.4 All arises shall be sharp and true.

14. UNIFORMITY OF COLOUR

The overall colour of tiles shall be uniform in any one delivery, except where special random effects are ordered.

15. AGE AT TESTING

The minimum age at testing shall be 28 days.

16. WATER ABSORPTION

When tested by the method described in Appendix A, the tiles sampled in accordance with Clause 19 shall comply with the following requirements :

(a) Water absorption by tile-face : No single result shall be more than 4 kg/m^2.

(b) Total absorption : No single result shall be more than 8%.

17. TRANSVERSE STRENGTH

When tested by the method described in Appendix B, the tiles sampled in accordance with Clause 19 shall comply with the following requirement :

Transverse strength : No single result shall be less than 3 MPa.

18. INDEPENDENT TESTS

If the purchaser or his representative requires independent tests, the sample shall, at the option of the purchaser or his representative, be taken before or immediately after delivery, and the tests shall be carried out in accordance with the requirements of this Sri Lanka standard.

19. SAMPLING

19.1 Samples for independent tests shall be taken at random by the purchaser or his representative at the time of delivery, identified and marked by the supplier, at the rate of 3 tiles from the first 100 tiles or less and 2 further tiles from each additional 200 tiles or part thereof in each delivery.

19.2 Before testing, each tile so sampled shall be carefully examined for damage. Any tile which is found to be damaged shall be rejected and another tile sampled from the bulk delivery in its place.

20. COMPLIANCE

Compliance of tiles submitted for independent tests shall be assessed as follows :

(a) If two or more tiles from the sample taken in accordance with Clause 19 fail to pass any of the tests specified in Clauses 16 and 17, all the tiles comprising the delivery represented by the sample shall be deemed not to comply with the requirements of this standard.

(b) If one tile fails to pass, then the consignment shall only be deemed to comply if the tiles in a further sample of double the number of tiles from the same delivery all satisfy the requirements of the test which the one tile previously failed.

21. AGE AT DELIVERY

The tiles shall not be delivered until a period of at least 7 days after pressing has elapsed.

Note : There is inherent danger in the delivery and laying of insufficiently cured products arising from drying shrinkage. Where possible the minimum period between pressing and laying should be 21 days to 28 days.

22. PROTECTION IN TRANSIT

The manufacturer shall provide protection adequate to the nature of the tiles and which shall be free from material likely to cause discoloration of them.

23. SUPPLIER'S CERTIFICATE

The supplier shall satisfy himself that the tiles at the time of their delivery by him, comply with the requirements of this Sri Lanka Standard and, if requested, shall forward a certificate to this effect to the purchaser or his representative.

APPENDIX—A

METHOD OF DETERMINING WATER ABSORPTION

A - 1 Apparatus — The following apparatus shall be provided :

(a) A balance capable of weighing up to 10 kg to an accuracy of 5 g.

(b) A well ventilated oven in which the temperature shall be controlled between 100°C and 110°C.

(c) A water tank at least 75 mm deep in which the tiles may be immersed.

(d) One or more dishes in which tiles may be immersed face downwards with at least 99% of each tile-face exposed to water. For this purpose the bottom inside of each dish should be suitably ribbed. Alternatively, glass rods or beads on which specimens can be supported may be provided.

A - 2 Number of Specimen tiles — The number of tiles to be used as test specimens shall be determined in accordance with Clause 19.

A - 3 Age of Tiles when Tested — The test for water absorption shall be commenced between 28 and 35 days after tiles have been pressed.

A - 4 Test Procedure for Water Absorption by Tile-face — All test specimens shall be placed in the oven at the same time. They shall be arranged so that they are separated from each other and from any heating surface by a distance of at least 25 mm. They shall be dried in the oven until they attain a constant mass. Constant mass shall be considered as having been reached when the variation in total mass of any three tiles does not exceed 2 g over a period of 8 hours.

The tiles having been removed from the oven should preferably be cooled for 24 $\pm$ $\frac{1}{2}$ h, in the air of a room free from draughts and rapid temperature changes. Tiles shall then be weighed and the dry mass (M_1) of each shall be recorded.

At the corners of each tile mark the edges 5 mm below the tile face. Tiles shall be placed face downwards in the dishes (see paragraph A - 1. d). Water shall be poured carefully into each dish until the water level is within $\pm$ 2 mm of the mark on the four edges of each tile. The water shall not surge more than 2 mm above these marks, nor shall it wet the back of tiles. The specified level of the water shall be maintained for a period of 24 $\pm$ $\frac{1}{2}$ h.

At the end of that time each tile shall be taken out of the water, care being taken to prevent the tile backing becoming wet. Surface water shall be removed from the wetted parts of the tile by dabbing them with a slightly dampened cloth. Each tile shall then be weighed in air and the mass (M_2) shall be recorded.

A - 5 **Calculation of Water Absorbed by the Tile-face** — The water absorbed by the face of each tile shall be calculated and reported. The result shall be expressed in kilogrammes of water absorbed per square metre of tile-face and shall be determined as shown below.

Let

A = face-area of tile in square metres.

M_1 = dry mass of tile in kilogrammes.

M_2 = mass of tile in kilogrammes after absorption of water by face (see Clause A - 4).

m = mass of water absorbed by tile-face in kg/m^2.

Thus

$$m = \frac{M_2 - M_1}{A}$$

Each result shall be expressed to the nearest 0·1 kg/m^2.

A - 6 **Test Procedure for Total Absorption of Water** — On completion of the previous test, tiles shall again be dried and cooled as described in A - 4. Immediately afterwards tiles shall be

immersed once more in water. As far as possible, their main places shall be parallel to the surface of the water. The depth of water over the top of each tile shall be between 25 mm and 50 mm. Tiles shall remain immersed under the above conditions for a period of $24 \pm \frac{1}{2}$ h.

At the end of that time each tile shall be taken out of the water. Surface water shall be removed by dabbing the tiles with a slightly dampened cloth. Each tile shall then be weighed in air and its mass (M_3) shall be recorded.

A - 7 Calculation of Total Absorption of Water — The total absorption of water by each tile shall be calculated and reported. The result shall be expressed as a percentage of each tile's dry mass and shall be determined as shown below.

Let

M_1 = dry mass of tile, in kilogrammes (see Clause A - 4).

M_3 = mass of tile, in kilogrammes, after total absorption of water.

T = total absorption of water expressed as a percentage.

Then

$$\text{T per cent} = \frac{M_3 - M_1}{M_1} \times 100$$

Each result shall be expressed to the nearest 0·1%.

A - 8 REPORT

The following information shall be recorded in all reports.

(a) The identification mark of each sample.

(b) The date on which each test was commenced.

(c) The age of each sample on the date each test was commenced.

(d) The mass of water absorbed by each tile-face in kg/m².

(e) The total absorption of water by each tile expressed as a percentage (T).

APPENDIX—B

METHOD OF DETERMINING TRANSVERSE STRENGTH

B - 1 Testing Machine — Sectional views of the end and sides of a testing machine for determining transverse strength are illustrated in Figs. 1a, 1b and 1c.

A testing machine shall be able to impose loads 300% greater than is required to attain the value of transverse strength specified (3 MPa) in Clause 17.

The bed of the testing machine shall contain two round steel bars each 38 mm to 40 mm in diameter for supporting a tile in two places across its full width. The distance between the axes of the round steel bars shall be two-thirds of the length of the tile which they support.

One support shall be fixed horizontally. The other shall be pivoted as shown in Fig. 1b so that the linear reactions at the two supports shall be evenly distributed to the tile without imposing any torsional forces on it.

The upper frame of a testing machine shall contain a round steel bar of 38 mm to 40 mm in diameter and of sufficient length to overlap a tile on each side. The round steel bars shall be pivoted as shown in Figs. 1b and 1c so that the linear reaction between it and a tile shall be evenly distributed and shall not impose any torsional forces on the tile. The line of contact between the round steel bar and the tile shall bisect the distance between the axes of tile-supports.

When a tile is mounted for testing, it shall be placed on the supports squarely and not askew. When a load is applied, care should be taken to ensure that it sets truly perpendicular to the tile.

B - 2 Sequence of Testing — A tile should normally be tested for transverse strength immediately after it has been tested for water absorption. However, a tile need only be tested for transverse strength and the test for water absorption may be omitted, if all the following conditions have been fulfilled :

(a) The tile is one of a sample being re-tested in accordance with Clause 20 (b).

(b) The tiles from the original sample have complied with Clause 16 regarding water absorption by tile-face and total absorption of water.

(c) The tile itself has undergone the procedure for water absorption by tile-face and total absorption of water described in A - 4 and A - 6 respectively immediately before transverse testing.

B - 3 Testing Procedure — Each tile shall be placed on the supports of the testing machine symmetrically and face upwards. The load shall be applied to the tile continuously and at a uniform rate until the tile breaks.

B - 4 Calculation — The transverse strength of each tile shall be calculated and reported, using the following formula.

Let

P = breaking load on tile, in newtons.

S = test span of tile, in mm.

b = width of tile, in mm.

t = thickness of tile, in mm.

f = transverse strength of tile, in MPa.

Then

$$f = \frac{3\,PS}{2\,bt^2}$$

Each result shall be expressed to the nearest 0·05 MPa.

B - 5 Report — The following information shall be recorded in all reports :

(a) The identification mark of each sample.

(b) The date the test was commenced.

(c) The age of each sample on the date the test was commenced.

(d) The breaking load of each tile, in newton (P).

(e) The test span of each tile, in mm (S).

(f) The width of each tile, in mm (b).

(g) The thickness of each tile, in mm (t).

(h) The transverse strength of each tile, in MPa (f).

APPENDIX—C

DIMENSIONALLY CO-ORDINATED SIZES

C - 1 Clause 10.2 makes provision for tiles manufactured to sizes which are the subject of an agreement between the purchaser and the supplier. In the event of such an agreement being necessary to fulfil the requirements of a building designed to controlling dimensions, the sizes to be used should be selected from those given in Table C - 1. A joint width of 3 mm, has been used in determining these sizes.

TABLE C - 1 Dimensionally Co-ordinated Sizes for Tiles

	mm	mm
Co-ordinating size	400	500
Joint Clearance	3	3
Work size	397	497
Permissible deviation from work size	± 1	± 1
Maximum limit of manufacturing size	398	498
Minimum limit of manufacturing size	396	496
Thickness (work size)	35 ± 3	40 ± 3

Note: The tile of size 300 mm is also a Dimensionally Co-ordinated size.

APPENDIX—D
HARDNESS OF AGGREGATE

D - 1 The hardness of aggregates used in terrazzo tiles could only be compared with each other by means of Mohs Scale of Hardness. These hardness values are on fresh samples, without weathering. Table D - 2 is a table for guidance which gives information pertaining to the type of chemicals found in the aggregates mentioned in Table D - 1. It does not form part of the standard.

Table D - 1 Hardness of Aggregates

Type of Aggregate	Hardness Value
Dolomite Chips	Between 3 and 4
Black Chips	Between 6 and 7
Jaffna Yellow	Between 2 and 3
Red Chips	Between 6 and 7
Green Chips	Between 3 and 4
Felspar	6

Table D - 2 MOHS Scale of Hardness

Chemical Compound in Aggregate	Hardness Value
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Felspar	6
Quartz	7
Topaz	8
Corrundum	9
Diamond	10

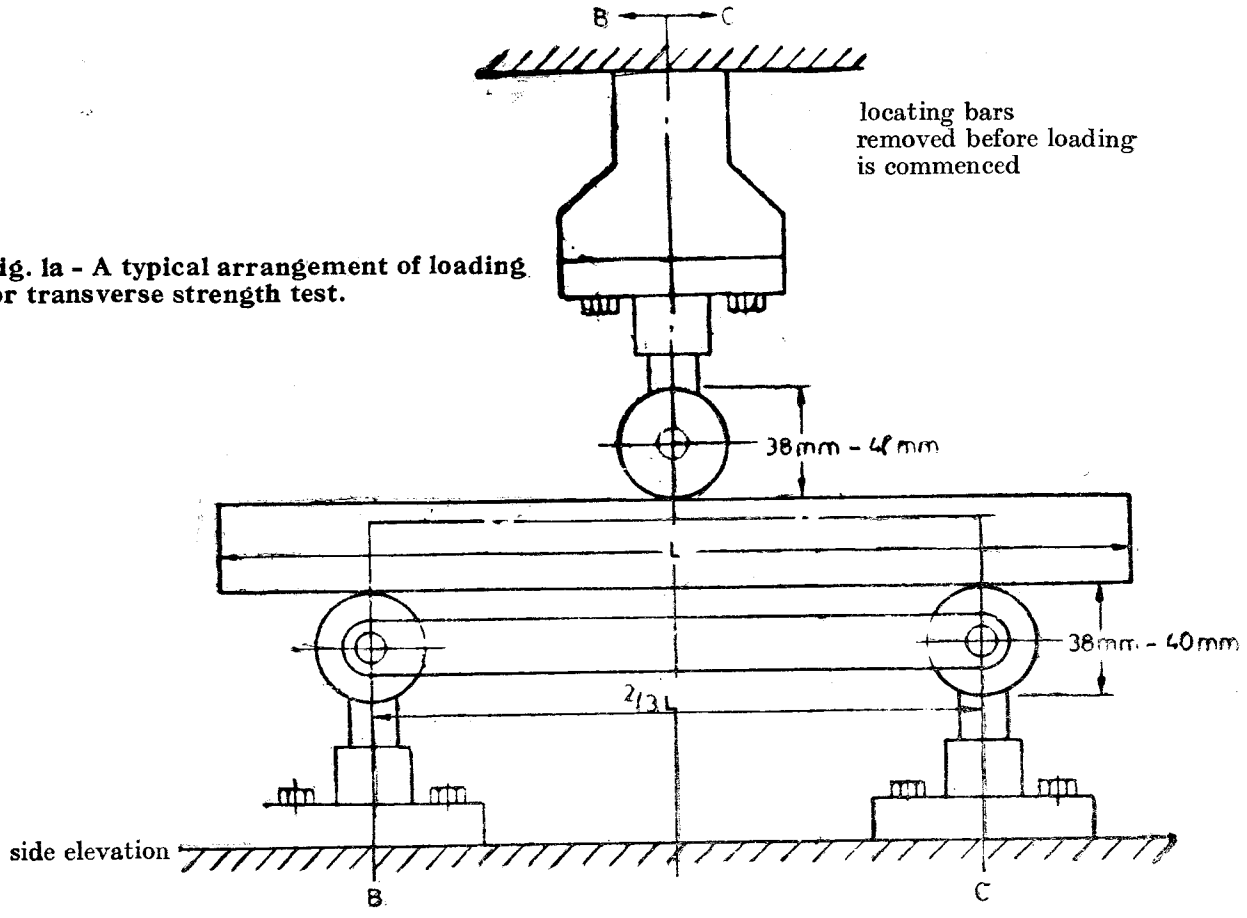
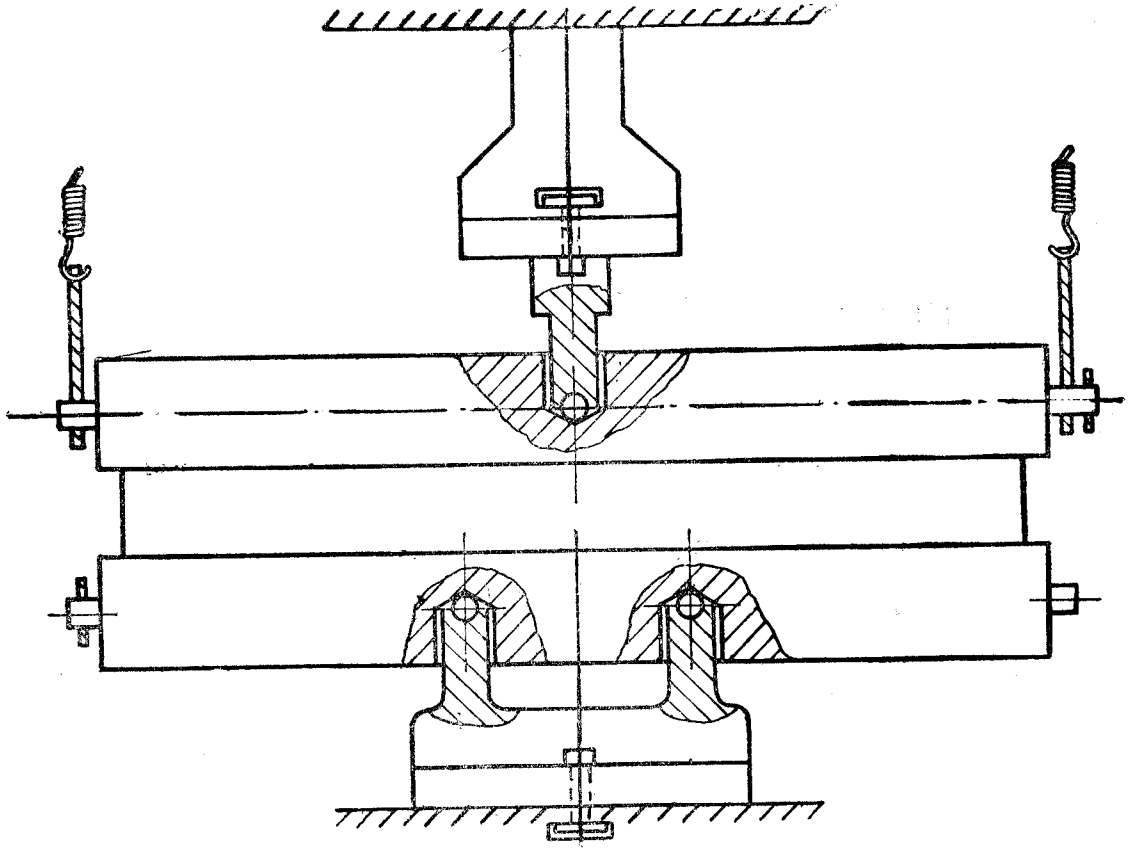
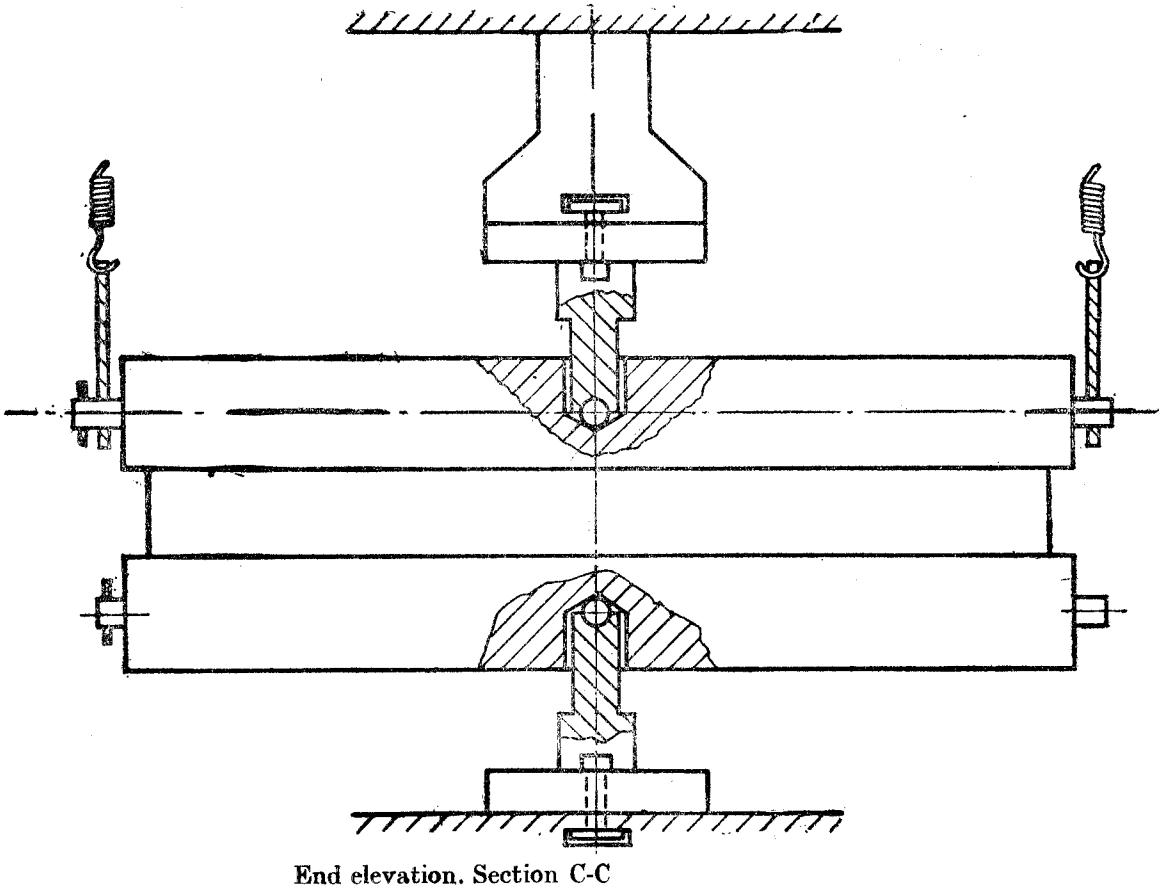


Fig. 1a - A typical arrangement of loading for transverse strength test.



End elevation. Section B-B

Fig. 1b-A typical arrangement of loading for transverse strength test.



End elevation. Section C-C

Fig. 1c-A typical arrangement of loading for transverse strength test.

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