IS 2119 (1980): Code of practice for construction of brick-cum-concrete composite (madras terrace) floor and roof [CED 13: Building Construction Practices including Painting, Varnishing and Allied Finishing]

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CODE OF PRACTICE FOR CONSTRUCTION OF BRICK-CUM-CONCRETE COMPOSITE (MADRAS TERRACE) FLOOR AND ROOF

(First Revision)

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Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF BRICK-CUM-CONCRETE COMPOSITE (MADRAS TERRACE) FLOOR AND ROOF

(First Revision)

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Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF BRICK-CUM-CONCRETE COMPOSITE (MADRAS TERRACE) FLOOR AND ROOF

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 September 1980, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A composite floor construction consisting of terrace bricks and lime concrete is widely adopted particularly in the southern parts of this country. This is commonly known as ' Madras Terrace Construction '. As a result of experience gathered through centuries, this construction has been found to be quite strong, durable and waterproof. It also facilitates quick construction but requires reasonable skill in workmanship. The supporting action of the terrace results from the arch action in the bricks which are packed in rows to form a flat layer over closely spaced joists; and the support is further enhanced by the super-incumbent lime concrete layer which by virtue of the bond developed with the bricks acts integrally with them.

0.2.1 This standard provides guidance for laying such brick-cum-concrete composite floors and also includes specifications for materials such as crude oil, lime concrete, etc, that go into its construction. This Indian Standard was first published in 1962. The present revision has been taken up mainly to incorporate the modifications necessary as a result of experience gained during the use of this standard and publication of separate standards of materials.

0.3 The Sectional Committee responsible for the preparation of this standard has taken into consideration the views of the builders and technologists and has related the standard to the building practice followed in the country.

0.4 This standard is intended chiefly to cover the technical provisions relating to floor and roof construction and it does not include all the necessary provisions of a contract.

0.5 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 analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the design and construction of brick-cum-lime concrete composite floor or roof, which is known as Madras terrace.

1.2 This standard covers the construction practices that are in general use in this country.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Broken Brick Coarse Aggregate — Aggregate prepared from the well burnt or slightly over burnt broken bricks conforming to IS : 1077-1976†.

2.2 Hand Beater — A wooden piece of triangular cross section, used manually for beating and compacting lime concrete.

2.3 Lime — For definitions relating to building lime reference may be made to IS : 6508-1972‡.

2.4 Lime Concrete — A mixture of lime, broken brick aggregate (no sand) and water.

2.5 Madras Terrace — This is a flat roof or floor consisting of a coarse of terrace-brickwork set in lime mortar and over it a coarse of lime broken brick aggregate concrete, the terrace being supported on closely spaced joists.

2.6 Terracing Bricks — Bricks thinner than the normal size bricks and prepared similar to common building bricks and tiles.

*Rules for rounding off numerical values (*revised*).

†Specification for common burnt clay building bricks (*third revision*).

‡Glossary of terms relating to building lime.

2.7 Terrace Brickwork — Brickwork that has been laid so as to be self-supporting by arch action between closely spaced joists, the bricks being laid on edge in diagonal rows spanning between the joists. The self-supporting action of the brickwork is further enhanced by the layer of lime concrete laid over it, which bonds itself to the brickwork.

3. MATERIALS AND TOOLS

3.1 Broken Brick Coarse Aggregate — It shall conform to the requirements as given in IS : 3068-1975* (*see also* **2.1**).

3.2 Cement — This shall conform to either IS : 269-1976† or IS : 455-1976‡ or IS : 1489-1976§.

3.3 Crude Oil — Crude oil shall conform to the requirements given in Appendix A.

3.4 Lime — This shall conform to IS : 712-1973‖.

3.5 Lime Broken Brick Aggregate Concrete — Lime broken brick aggregate concrete for use in Madras terrace shall conform to the requirements given in Appendix B.

3.6 Precast Reinforced Concrete and Prestressed Concrete Sections — The materials and construction shall conform to IS : 456-1978¶ and IS : 1343-1960**.

3.7 Rolled Steel Sections — These shall conform to IS : 808-1964††. Steel used in the manufacture of these sections shall conform to IS : 226-1975‡‡.

NOTE — Rolled steel sections are not usually used in Madras terrace roof. It would be cheaper to adopt RCC roofing.

3.8 Sand

3.8.1 Sand for terrace-brickwork shall conform to IS : 383-1970§§.

3.8.2 Sand for plaster finish shall conform to IS : 1542-1977‖‖.

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*Specification for broken brick (burnt clay) coarse aggregate for use in lime concrete (*first revision*).

†Specification for ordinary and low heat Portland cement (*third revision*).

‡Specification for Portland slag cement (*third revision*).

§Specification for Portland-pozzolana cement (*second revision*).

‖Specification for building limes (*second revision*).

¶Code of practice for plain and reinforced concrete (*third revision*).

**Code of practice for prestressed concrete.

††Specification for rolled steel beam, channel and angle sections (*revised*).

‡‡Specification for structural steel (standard quality) (*fifth revision*).

§§Specification for coarse and fine aggregates from natural sources for concrete (*second revision*).

‖‖Specification for sand for plaster (*first revision*).

3.9 Terracing Bricks — Terracing bricks shall be 150 × 75 × 25 mm and shall conform to the requirements given in IS : 2690 (Part II)-1975*.

3.10 Timber Joist — Timber joists shall conform to the requirements given in IS : 3629-1966†.

3.11 Water — Water used for making mortars and concrete shall conform to the requirements given in IS : 456-1978‡.

3.12 Materials for Floor or Roof Finish

3.12.1 *Clay Tiles* — These shall conform to IS : 2690 (Part I)-1975§.

3.12.2 *Cement Concrete Tiles* — These shall conform to IS : 1237-1980||.

3.12.3 *Bituminous Felts* — These shall conform to IS : 1322-1970¶.

3.13 Hand Beater — The hand beater used for compacting lime broken brick aggregate concrete shall conform to the requirements given in Appendix C.

4. NECESSARY INFORMATION

4.1 For the efficient design and construction of Madras terrace, detailed information with regard to the following is necessary:

a) Surface area to be covered;

b) Type of supporting elements and restrictions, if any, to their arrangements;

c) Level to which the terrace should be brought to receive floor or roof finish;

d) Treatment at junction with adjacent floors, walls, etc;

e) Provisions to be made in the terrace itself for roof slope and other requirements for drainage; and

f) Provisions for fixing of services, ceiling, etc.

4.2 All information as in **4.1** shall be made available to those who are responsible for laying the terrace. Necessary drawings and instructions for preparatory work shall be given.

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*Specification for burnt clay flat terracing tiles : Part II Hand-made (*first revision*).

†Specification for structural timber in building.

‡Code of practice for plain and reinforced concrete (*third revision*).

§Specification for burnt clay flat terracing tiles : Part I Machine made (*first revision*).

||Specification for cement concrete flooring tiles (*first revision*).

¶Specification for bitumen felts for water-proofing and damp-proofing (*second revision*).

4.3 Arrangements shall also be made for proper exchange of information between those engaged in laying the terrace and all others whose work will be affected.

5. DESIGN CONSIDERATIONS

5.1 General — The Madras terrace floor or roof shall consist of the following components:

a) A layer of terrace-brick work laid on edge in lime mortar mix 1 : 1½ (lime putty: sand, by volume) supported on closely spaced either timber, precast reinforced concrete, prestressed concrete or steel joists and having a suitable ceiling finish applied to the soffit of the terrace-brickwork;

b) A course of lime broken brick aggregate concrete laid to a specified thickness over the terrace-brickwork and having the required floor or roof finish at the top; and

c) Suitable floor and ceiling finish.

5.1.1 Typical details of Madras terrace are shown in Fig. 1.

5.2 Strength and Stability

5.2.1 The spacing of joists supporting Madras terrace shall be not more than 450 mm centre to centre. The joists shall be designed as beams supporting the portion of terrace coming over them (*see also* **5.2.3** to **5.2.5**). The terrace-brickwork shall have a bearing of at least 150 mm on the walls or support all round.

5.2.2 In no case shall be average thickness of Madras terrace excluding finishes, shall exceed 185 mm. Generally the dead load of Madras terrace may be taken as 370 kg/m² for purpose of design.

5.2.3 The deflection of the joists shall not exceed 1/480 of the span.

5.2.4 The design of steel joists shall be in accordance with IS : 800-1962*.

5.2.5 The design of precast reinforced sections for joists shall be in accordance with the principles laid down in IS : 456-1978†; and the design of prestressed concrete sections shall be in accordance with IS : 1343-1960‡.

*Code of practice for use of structural steel in general building construction (*revised*).

†Code of practice for plain and reinforced concrete (*third revision*).

‡Code of practice for prestressed concrete.

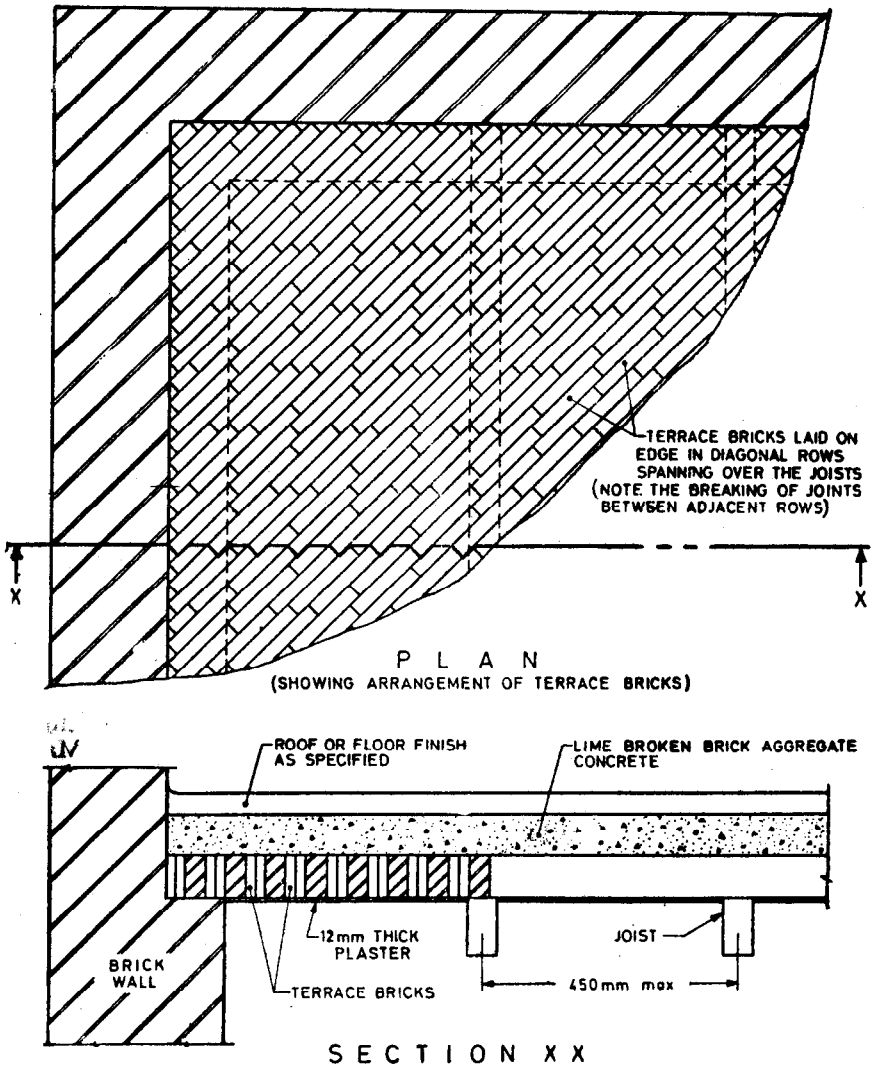

FIG. 1 TYPICAL DETAILS OF MADRAS TERRACE FLOOR OR ROOF CONSTRUCTION

5.2.6 The design of timber joists shall be in accordance with IS : 883-1970*.

5.3 Durability

5.3.1 It has been observed in experience that Madras terrace is free from temperature and shrinkage cracks apparently since there is no relative expansion between the terrace brickwork and lime concrete layer above it.

NOTE — With periodical maintenance of the roof finish, the ceiling finish and the supporting joists, in accordance with the relevant Indian Standards (*see* **11** to **14**), the terrace will be quite durable.

5.3.2 *Termite Proofing* — Timber shall be treated to withstand the attack of termites, fungi, dry rot, etc, as specified in IS : 6313 (Part III)-1971†.

5.4 Slope — The slope of the roof shall not be less than 1 in 48. The slope may be provided either in the joist or in the lime broken brick aggregate concrete layer or in both. It is preferable to provide the slope in the joist arrangement wherever possible.

5.5 Thermal Insulation and Acoustic Properties

5.5.1 As the thickness of the Madras terrace is more than 200 mm, thermal insulation properties are quite satisfactory and no special provision will therefore be necessary for this type of terrace.

5.5.2 No specific acoustic treatment for Madras terrace is generally done for ordinary domestic and office buildings. However, where required in special cases, suitable ceiling finishes for the purpose may be fixed to the underside of the joists in accordance with IS : 1950-1962‡.

5.6 Provision for Service Installations — Service pipes and conduits passing horizontally alongside the floor may also be embedded in the lime concrete of the terrace. Service pipes and conduits may also be conveniently fixed to the joists. When crossing from floor to floor the pipes, conduits, etc, shall be conducted along the side of a wall.

6. FACILITIES FOR THE WORK

6.0 The following facilities are necessary and shall be provided to the person entrusted with the Madras terrace construction for carrying out his work satisfactorily.

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*Code of practice for design of structural timber in building (*third revision*).

†Code of practice for anti-termite measures in buildings: Part III Treatment for existing buildings.

‡Code of practice for sound insulation of non-industrial buildings.

6.1 Completion of Preceding Work — All supporting elements like walls, pillars, main beams, frames, etc, shall be completed sufficiently early and cured well before the terracing work is taken up. The top surface of supporting elements shall be level finished.

6.2 Time Schedule

6.2.1 In preparing the time schedule for the construction of the whole building work, due attention shall be paid in connection with the particular work with regard to:

a) strength development in supporting elements; and
b) completion and fixing of service pipes passing through the floor, fixing of frames for openings in floor, etc.

6.2.2 The time schedule shall be so arranged that other constructions do not interfere with this work. The work shall, preferably, not be taken up during the rainy season.

7. PREPARATORY WORK

7.1 Storage, Transport and Handling of Materials — Necessary precautions shall be observed in storage, transport and handling of cement, lime, sand, broken brick aggregate, tiles, precast concrete, steel or wooden joists, in accordance with the relevant provisions in the Indian Standard specification covering the respective materials (*see* **3**). The materials shall be stored on the building site in such a way as to prevent deterioration or the loss or impairment of their structural and other essential properties (*see* IS : 4082-1977*).

7.2 Mixing of Mortars and Concrete

7.2.1 Lime mortars shall be prepared in accordance with IS : 2250-1965†.

7.2.2 Lime broken brick aggregate concrete shall be prepared as indicated in Appendix B.

7.3 Preparation of Terracing Bricks — The terracing bricks shall be kept immersed in water for at least 4 hours before use in the work. The skin shall then be allowed to dry. This treatment is necessary to develop adhesion with mortar in the terrace-brickwork.

8. JOIST WORK

8.1 The joists may be rolled steel beam sections, precast reinforced or prestressed concrete sections, or timber sections.

*Recommendation on stacking and storage of construction materials at site (*first revision*).

†Code of practice for preparation and use of masonry mortars.

8.2 All steel work shall be painted with one coat of primer before fixing.

8.3 In timber joists, the portion that is to be set in masonry shall be given a protective finish with two coats of hot boiled tar conforming to IS : 212-1961*. Before fixing the joist, a coat of primer paint conforming to relevant Indian Standard shall be applied to the exposed portion of the joists.

8.4 The joists shall be fixed in position at the designed spacing (*see* **5.2.1**) so as to span between the supporting elements such as walls, beams, etc.

8.5 The joists shall rest directly on the masonry of the wall or on a beam. The intermediate beams if provided in case of large spans, shall rest over cement concrete or stone bed block designed to spread the load sufficiently for safe bearing of the masonry.

8.5.1 The space between the ends of adjacent joists shall be filled with the same masonry or concrete as the one on which they rest, so that the filled in masonry or concrete and the joists present an even and level surface at top for bearing the terrace-brickwork.

8.6 Further, temporary supports may be given to the joists by wedged uprights so as to prevent sagging of joists during laying of the terrace.

9. LAYING OF TERRACING BRICKS

9.1 After preparation as in **7.3**, the terracing bricks shall be laid on edge in diagonal rows spanning over the joists. The laying shall start from one corner and proceed towards opposite corner. Each row shall be completed before the next one, adjacent to it, is started. The terrace-brickwork shall have a bearing of at least 150 mm on the walls or support all round.

9.2 The terracing bricks shall be laid in lime mortar of mix 1 : 1½ (lime putty : sand, by volume). The thickness of mortar joints shall not exceed 10 mm.

9.3 During laying, the bricks shall be pressed against the adjacent row already laid so that it bonds well with the mortar and also partially develops lateral adhesion preventing it from slipping. To enhance the self-supporting arch action of the brickwork, the bricks may be so laid as to obtain for the brickwork a slight rise between the joists, the rise being generally not exceeding 5 mm. The joists may be supported from below by wedged uprights while the roof is being laid to avoid cracks in the brickwork.

NOTE — Erection of centering is not needed in this type of terrace work.

*Specification for crude coal tar for general use (*revised*).

9.4 After laying, the brickwork shall be cured by keeping it moist for a period of not less than 10 days so as to set properly.

10. LAYING OF LIME BROKEN BRICK AGGREGATE CONCRETE

10.1 After the terracing bricks have set, a layer of lime broken brick aggregate concrete of mix 1 : 2½ (slaked lime : broken brick aggregate, by volume) and prepared according to the requirements given in Appendix B, shall be laid and spread to an average thickness of 100 mm.

10.2 After the lime concrete is laid, initial ramming shall be done with a wooden rammer of weight not exceeding 2 kg so that the layer of lime concrete is consolidated to a thickness of 75 mm. After this the consolidation shall further be done with the hand beater (*see* **3.13**) for at least 7 days so that the concrete hardens and the beater makes no impression on the concrete and readily rebounds from the surface when struck on it.

10.2.1 Hand beating shall be done by workers sitting closely together and beat the surface lightly and in rhythm and move forward gradually. During compaction by hand beating, the surface shall be wetted by sprinkling lime water and sugar solution (*see* Note 1) or a solution prepared by soaking in water the dry nuts of *Terminalia chebula* (*KADUKAI* or *HARARH*) (*see* Note 2) or a solution of jaggery (*GUR* and *GUGAL*) (*see* Note 3).

NOTE 1 — The sugar solution may be prepared in the northern parts of this country by mixing about 3 kg of jaggery and 1½ kg of '*BAEL*' fruit to 100 litres of water.

NOTE 2 — The solution of *KADUKAI* or *HARARH* may be prepared as follows:

The dry nuts shall be broken to small pieces and allowed to soak in water. The general practice is to have a proportion of 60 g of *KADUKAI* or *HARARH*, 200 g of jaggery and 40 litres of water for 10 m² work. The solution is brewed for 12 to 24 hours. The resulting liquor is decanted and used for the work.

NOTE 3 — The solution of *GUR* and *GUGAL* may be prepared as follows:

GUR shall be broken to pieces and allowed to soak in water. The general practice is to have a proportion of 50 g of *GUR*, 50 g of *GUGAL* and 40 litres of water for 10 m² work.

10.2.2 If the surface during the process of compaction becomes so uneven that water lodges in pools, the surface shall be pricked up, and fresh concrete spread and consolidated as necessary to obtain an even surface.

10.3 The concrete shall then be cured by sprinkling water and allowed to harden for a period of not less than six days before laying the floor or roof finish.

11. FINISHING

11.1 The completed terrace as in **10**, may be further finished with the specified roof or floor finish.

11.2 For tiled roof finish, two courses of flat clay tiles shall be laid in cement mortar 1 : 3 mixed with crude oil which shall be 10 percent by mass of cement. The flat clay tiles shall be immersed in water for two hours before being used. The tiles of first course shall be laid diagonally and the second course square to the parapet thus breaking the joint. The side joint of the tiles shall be more than 6 mm thick set full in mortar. The mortar layer bed over the roof slab shall not be less than 9 mm finished thickness after receiving the first layer of tiles and 9 mm thick mortar bed between the two layers of tiles. Before the work dries up completely, the tile joints shall be raked out and pointed with cement mortar 1 : 3 mixed with crude oil which shall be 10 percent by mass of cement. The joints shall be well rubbed, over with thin bar trowel and the excess of mortar scrapped off until the surface of the pointing attains a black polish and becomes hard. As the work proceeds it shall be kept thoroughly wetted until the mortar has set firm and hard. Watering shall be continued for 3 weeks after construction (*see* Fig. 2).

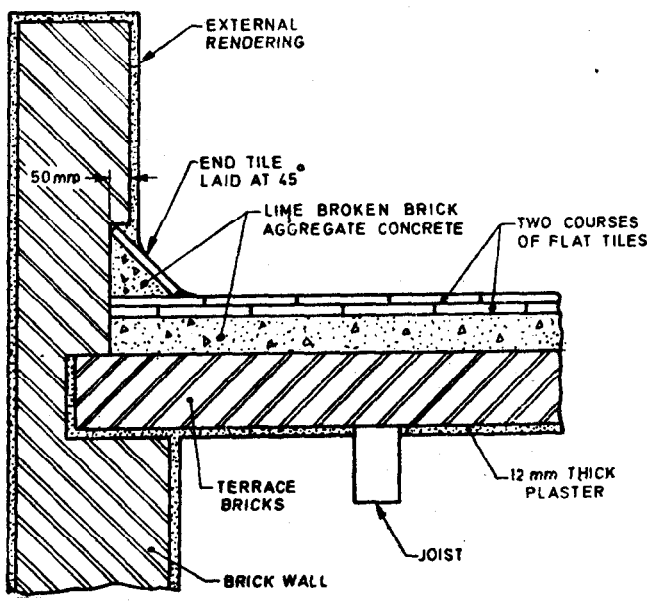


FIG. 2 TYPICAL DETAILS SHOWING THE METHOD OF LAYING TWO COURSES OF FLAT TILES FOR ROOF

Instead of two courses of flat clay tiles one course of pressed clay tiles may be used, the laying and finishing being similar to that of flat tiles (*see* Fig. 3).

NOTE 1 — When tiled roof finish is done with cement mortar, it may be necessary to render the mortar water-proof by a suitable additive. In existing practice crude oil has been found to be satisfactory additive, and the requirements for crude oil for use in this connection are given in Appendix A. The addition of crude oil to the mortar shall be 10 percent by weight of cement. The crude oil shall be added to the mixed mortar and not to the dry ingredients.

11.3 The ceiling shall be finished with lime plaster of mix 1 : 2 (slaked lime : sand), or cement plaster of mix 1 : 3 (cement : sand), as required. The plaster shall be in a single coat of 12 mm thickness.

The plastering shall be done in accordance with IS : 1661-1972*.

11.4 The finished surface of the terrace and ceiling shall be cured with water for a period of not less than 3 weeks.

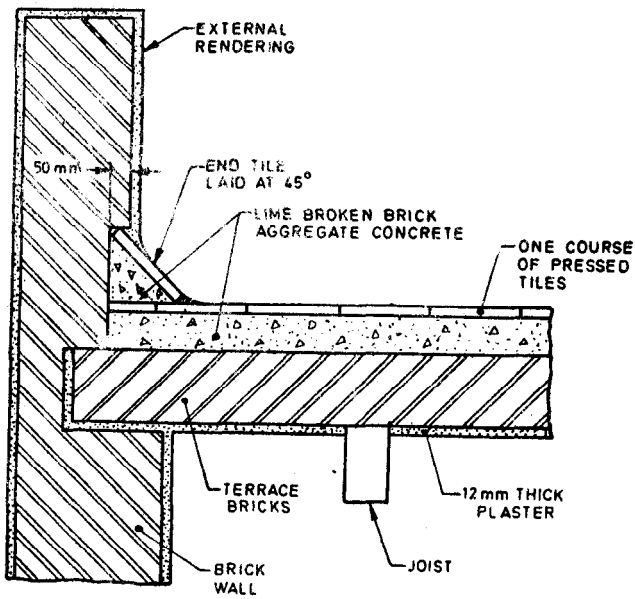


FIG. 3 TYPICAL DETAILS SHOWING THE METHOD OF LAYING ONE COURSE OF PRESSED TILES FOR ROOF

*Code of practice for application for cement and cement-lime plaster finishes.

12. TREATMENT OF JUNCTIONS

12.1 Along the junction of the parapet and roof, tiles shall be laid inclined at 45° to the face of the parapet after laying necessary broken brick aggregate concrete in the sloping portion. The inclined tiles shall also be taken inside the wall for a depth of 50 mm (*see* Fig. 2 and 3). Plastering of the parapet shall be done only after the tiles are laid.

13. INSPECTION

13.1 Inspection shall be done to avoid unsatisfactory construction, which may result in any one or more of the following defects in Madras terrace construction:

Stage	*Particulars of Inspection*	*Type of Failure That May Occur if (2) is not Satisfactory*
(1)	(2)	(3)
i) Before laying of terracing tiles	a) Even bearing surface after filling-up spaces between joists occurring over walls, beams, etc b) Adequate temporary supports for joists	Cracking
ii) During laying of terracing bricks	Soaking of bricks and general inspection	Improper adhesion
iii) After laying of lime broken brick aggregate concrete	Amount of beating	Sagging
iv) Curing	Number of days to be cured and general inspection	Lesser strength and cracking

14. MAINTENANCE

14.1 The roof finishes shall be maintained in accordance with the relevant Indian Standards on flat roof finishes.

14.2 The ceiling shall be white-washed at least once a year.

14.3 Wooden and steel sections used as joists shall be painted at least once in five years.

15. REPAIRS

15.1 Apart from regular maintenance as in **14**, repairs may be necessary when the roof is leaking. Leakage may be due to the development of cracks in terrace.

15.2 If a steel joist is corroded or wooden joist has deteriorated, such joist shall be dismantled after providing adequate support locally to the terrace. A new joist shall be introduced and the terrace work redone above the joist and in the neighbouring terrace portion which is found by inspection to have been affected as a result of the sagging of the joist.

APPENDIX A

(*Clauses* 3.3 *and* 11.2)

SPECIFICATION FOR CRUDE OIL FOR USE IN MORTARS FOR MADRAS TERRACE WORK

A-1. GENERAL

A-1.1 The crude oil shall be a petroleum oil conforming to the requirements of **A-2** to **A-7**.

A-2. SPECIFIC GRAVITY

A-2.1 The specific gravity shall be between 0·930 and 0·940 at a temperature of 25°C.

A-3. SOLUBILITY

A-3.1 The solubility of the crude oil in carbon disulphide shall be not less than 99·9 percent.

A-4. BITUMEN CONTENT

A-4.1 The content of bitumen, insoluble in 36° Bé paraffin naphtha shall be between 1·5 and 2·5 percent by mass.

A-5. RESIDUAL COKE CONTENT

A-5.1 The content of residual coke in the crude oil shall be between 2·5 and 4 percent by mass.

A-6. VISCOSITY

A-6.1 When tested by the procedure given in **A-6.2** the viscosity number of the crude oil shall be between 40 and 45.

A-6.2 The viscosity shall be tested in Englor's viscometer at 50°C. 240 ml of the oil shall be taken in the container maintained at 50°C for at least three minutes, and then allowed to flow out through the nozzle. The period of flow for the first 100 ml shall be noted as the viscosity number.

A-7. LOSS ON IGNITION

A-7.1 When tested in accordance with the procedure given in **A-7.2**, the loss in mass in the crude oil shall not exceed two percent by mass.

A-7.2 Twenty grams of the material shall be heated for 5 hours in cylindrical tin dish, 80 mm in diameter and 25 mm deep, and the temperature of ignition shall be 163°C.

APPENDIX B

(*Clauses* 3.5,7.2.2 *and* 10.1)

PREPARATION OF LIME BROKEN BRICK AGGREGATE CONCRETE FOR USE IN MADRAS TERRACE WORK

B-1. MATERIALS FOR LIME CONCRETE

B-1.1 The lime may be either class B or C conforming to IS : 712-1973*.

B-1.2 Broken brick aggregates shall be conforming to the requirements given in IS: 3068-1975†.

B-1.3 Water shall be in accordance with **3.11**.

B-2. PREPARATION

B-2.1 The broken brick aggregates shall be cleaned, thoroughly wetted and placed on a water-tight platform and spread to an even thickness.

B-2.2 Lime shall then be spread over the aggregates and the whole thoroughly mixed sprinkling water in just enough quantities. The mixing shall be done by turning the material backwards and forwards at least four times. The mixing shall be done until all the pieces of aggregates are covered with lime and a concrete of uniform appearance and consistency is obtained.

*Specification for building limes (*second revision*).

†Specification for broken brick (burnt clay) coarse aggregate for use in lime concrete (*first revision*).

B-3. STORAGE

B-3.1 The lime concrete may be temporarily stored on a water-tight platform, covering it with a water-tight membrane.

B-3.2 The lime concrete shall be used within 2 hours from the time of mixing of water to the concrete during preparation.

APPENDIX C

(*Clause* 3.13)

SPECIFICATION FOR HAND BEATER FOR USE IN MADRAS TERRACE WORK

C-1. GENERAL

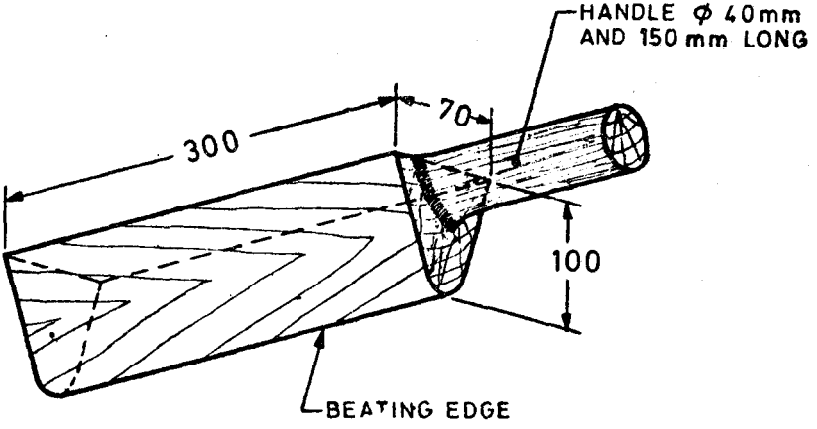
C-1.1 The hand beater shall be of triangular sectioned of the shape shown in Fig. 4. It shall be made of hard durable timber. The beating edge of the triangular cross section shall be rounded off.

C-2. SIZE

C-2.1 The hand beater shall be 300 mm long excluding the handle which shall be 150 mm long and 40 mm in diameter. The depth of the hand beater shall be 100 mm as shown in Fig. 4.

C-3. MASS

C-3.1 The mass of the hand beater shall be between 1 to 2 kg.



All dimensions in millimetres.

FIG. 4 HAND BEATER

(*Continued from page* 2)

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