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CODE OF PRACTICE FOR LAYING AND FINISHING OF CEMENT CONCRETE FLOORING TILES

(First Revision)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

CODE OF PRACTICE FOR LAYING AND FINISHING OF CEMENT CONCRETE FLOORING TILES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 26 June 1972, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The usefulness of tiles as flooring material consists mainly in their pleasant appearance as it eliminates the possibility of unsightly cracks and facility for quick installation. The appearance and the performance of the tiled floor will, however, depend not only on the quality of materials used but also on the care taken in bedding, laying and finishing of the tiles. This standard gives necessary guidance in the laying of cement concrete tile flooring to obtain good appearance, durability and finish.

0.3 This code of practice lays down procedures for the preparation of bedding and for the fixing and polishing of plain terrazzo and special types of cement concrete flooring tiles. Precautions necessary in the finishing of skirting, dado, staircase treads, etc, are also dealt with. The code includes the materials used in fixing, grouting and polishing of tiles, and in the maintenance of the tiled flooring. This standard which was first published in 1959 is now revised taking into account the experience gained in this work since then. The salient features of this revision are given below:

a) Preparation and use of cement mortar and lime mortar for bedding concrete tiles have been separately described,

b) Details pertaining to grinding and polishing of tiles after laying are given, and

c) Permissible tolerance in laying of tiles has been specified.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

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 laying, finishing and maintenance of cement concrete flooring tiles in floors, walls, staircases, pavings, etc.

2. TERMINOLOGY

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

2.1 General Terms

2.1.1 *Base* — The prepared surface on which the flooring is laid.

2.1.2 *Efflorescence* — Patches of whitish scum formed by the deposition of soluble salts which appear on the flooring particularly noticeable on plain tiles.

2.1.3 *Grout or Slurry* — Neat cement mixed with water to honey-like consistency; it may include pigments if used for grouting joints of tiled floor. Sand, stone dust or any other aggregate shall not be added.

2.1.4 *Matrix* — The binding constituent of the top layer of the tile which is chiefly Portland cement, either plain or mixed, with pigments.

2.1.5 *Pin Holes* — These are tiny air-cells in terrazzo tiles which open up during the polishing process and are too small to be filled.

2.1.6 *Pores* — Holes appearing in the surface of the hardened terrazzo tile after the initial grinding.

2.1.7 *Sub-floor* — The structural floor upon which the base is formed.

2.1.8 *Tiles* — The term 'tile' used in this code shall apply to the following:

a) Plain cement tiles;

b) Plain coloured tiles;

c) Terrazzo tiles;

d) Chequered, embossed or specially manufactured non-slip cement tiles; and

e) Precast staircase treads, risers, wall-slabs, etc.

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

2.2 Tools and Accessories

2.2.1 *Screed* — Narrow strips of wood, bands of plaster or pieces of tiles laid on the floor to act as guides for bringing the whole of the work to a true and even surface. The screeds shall be removed after laying all the floor area for which they have been applied as guides.

2.2.2 *Screeding Board* — A straight-edged wooden plank used for floating a plane surface. It is moved with a sawing action, the two ends resting on screeds or guides set at the correct height.

2.3 Site Operation

2.3.1 *Bedding* — A layer of mortar applied to the base or sub-floor and brought to a defined level.

2.3.2 *Damp-Proofing* — Covering the sub-floor with a continuous layer of impervious material so as to prevent penetration of moisture.

2.3.3 *Filling* — A plain or coloured cement paste with which the open pores of terrazzo tiles are filled or plastered after grinding. The term refers also to the operation of filling.

2.3.4 *Grinding* — The process by which the aggregate of tiles is exposed by means of mechanical or manual grinding.

2.3.5 *Polishing* — Rubbing of tiles mechanically or by hand with polishing stones after they have been laid, and bringing out their sheen.

2.3.6 *Screeding* — Bringing the floor to a true and even surface by means of screeding boards and screeds.

3. DESIGN CONSIDERATIONS

3.1 Tile flooring may be laid on most types of reasonably rigid base, provided that the sub-floor is of sufficient strength for the type of flooring proposed and is not liable to settlement at any time. Cement flooring tiles are not recommended for use where they will be exposed to the action of acids and alkalies. However, the cement tile flooring gives suitable service if it is exposed to sea water, vegetable oil or fats.

3.2 The range of tiles for flooring, dado work, facings, etc, is wide and the choice of any particular type or colour involves aesthetic as well as technical considerations. Their selection is dependent on the type of flooring required; the tile manufacturer should preferably be consulted for advice as to proper selection.

3.2.1 For the purpose of selecting tiles, floors are generally classified into the following types:

a) General purpose or light duty floors, that is those subject to pedestrian traffic as in offices, domestic buildings, hospitals, colleges, banks, etc;

b) Medium duty floors, that is those subject to heavy pedestrian and moderately heavy wheeled traffic from trolleys, carts, etc, as in factories, pavements, platforms, railway stations and driveways, etc; and

c) Non-slip floors (where chequered tiles are used), that is footpaths and pavements, special factory floors, platforms, ramps, etc.

4. MATERIALS

4.1 Sand — The sand to be used for mortar for laying the tiles shall conform to IS : 2116-1965* and the sand shall have minimum fineness-modulus 1·5.

4.2 Cement — The cement used for laying the tiles and grouting shall conform to IS : 269-1967† and IS : 455-1967‡.

4.3 Lime — Class B or C conforming to IS : 712-1964§.

4.4 Tiles — The cement concrete flooring tiles to be used shall conform to IS : 1237-1959‖.

4.5 Oxalic acid used in the polishing of tiles shall be such as to give a satisfactory performance without detrimental effects.

4.6 Pigments — Pigments incorporated in mortar or used for grouting shall conform to the requirements of Appendix A of IS : 2114-1962¶.

4.7 Water — Water used shall be clean and free from oil, acid, alkali, organic or vegetable matter. Sea water shall not be used.

5. NECESSARY INFORMATION

5.1 For the efficient planning and execution of the work, detailed information with regard to the following is necessary:

a) Floor and wall area to be covered;

b) Details of sub-floor;

c) Type of flooring and size of units of the covering to be fixed;

d) Type of grinding and polishing of surface;

e) Type of finishing treatment, if any, to be applied over the tiles;

*Specification for sand for masonry mortars.

†Specification for ordinary, rapid-hardening and low heat Portland cement (*second revision*).

‡Specification for Portland blastfurnace slag cement (*second revision*).

§Specification for building limes (*revised*).

‖Specification for cement concrete flooring tiles.

¶Code of practice for laying *in situ* terrazzo floor finish.

f) Any work consequent upon services passing through the flooring, walls, skirtings, etc; and

g) Type of bedding and jointing.

5.2 All the information stated in **5.1** shall be made available to those who are responsible for laying the tiles before the work is started. Necessary drawings and instructions for preparatory work shall also be given.

5.3 Arrangements shall also be made for the proper interchange of information between those engaged in laying the tiles and all others whose work will affect or will be affected.

6. TIME SCHEDULE

6.1 In preparing the time schedule, due attention shall be given to provide sufficient time for:

a) the completion of all preliminary operations, such as laying of services, affecting the schedule of commencement and completion of the flooring work; and

b) the hardening of any concrete in the base before laying of the flooring.

7. FACILITIES FOR THE WORK

7.1 The facilities mentioned in **7.2** to **7.4** are necessary and shall be furnished by the owner to the tile-laying contractor in order that the latter may carry out his work satisfactorily.

7.2 Completion of Work Preceding the Laying of Tiles

7.2.1 All the inside walls, ceiling and outside walls shall be plastered and door frames and windows fixed in position.

7.2.2 The sub-floor shall be finished to a reasonably true plane surface about 35 to 50 mm below the level of the finished floor, properly graded and free from loose earth, dirt or dust and lumps.

7.3 Before tiling work is started, all points of level for the finished tile surface shall be marked out. This is particularly necessary in the case of finished staircase landings. Wherever slopes in finished floors are desired' points of level and outlets shall be correctly marked and outlet openings made beforehand.

7.4 Protection Against Dampness — Wherever it is feared or suspected that dampness may percolate on to the top of the sub-floor or base during any time of the year, the same shall be treated or covered with any of the recognized damp-proofing methods to prevent dampness or water rising to the top of the sub-floor or base. Where it is suspected that water may percolate from the side walls, the same shall also be properly waterproofed up to at least 15 cm above the level of the sub-floor.

8. PREPARATORY WORK

8.1 Handling and Storage of Materials

8.1.1 The delivery of tiles shall be so arranged as to minimize handling. Adequate precautions shall be taken to prevent accidental damage to tiles while unloading.

8.1.2 Clean, dry storage shall be provided at the site for all materials. The tiles shall be stored in a room or under such cover as will prevent exposure to dampness, sun, rain or staining. The storage shall be in such a way that excessive handling and accidental damage is avoided. Cement shall be stored under cover. Lime mortar and sand may be stored in the open but as near as possible to the entrance of the building (*see* IS : 4082-1967*).

9. BEDDING

9.1 Preparation of Mortar — Both cement mortar as well as lime mortar can be used for preparation of bed for laying of tiles. The method of preparation and laying of each type of mortar shall be as given in **9.1.1**, **9.1.2**, **9.1.3** and **9.1.4**.

9.1.1 *Cement Mortar* — Cement mortar shall consist of one part of Portland cement and six parts of coarse sand by volume thoroughly mixed manually or by a mechanical mixer. The quantity of water added shall be the minimum necessary to give sufficient plasticity and workability for laying. A high water-cement ratio will produce a screeded bed with a high drying shrinkage and should be avoided.

9.1.2 *Spreading of Cement Mortar* — Before spreading of cement mortar, it is essential to ensure that the base is well compacted and the surface is rough to form suitable key. The base shall then be cleaned of all scum, laitance or plaster droppings or any other loose foreign matter. It shall be properly wetted without allowing any water pools on the surface. The mortar shall then be evenly spread over the base for two rows of tiles and about three to five metres in length with thread level fixed at both ends to act as a guide. The top of mortar shall be kept rough so that cement slurry can be absorbed. The thickness of the bedding shall normally be not less than 10 mm and not more than 30 mm in any one place. Immediately after, the laying of tiles shall start as described in **10**.

9.1.3 *Lime Mortar* — Lime mortar may be prepared in any of the following proportions:

a) 1 lime, 1 *SURKHI*, 2 coarse sand; or

b) 1 lime, 3 *SURKHI*; or

c) 1 lime, 3 Coarse sand.

*Recommendations on stacking and storage of construction materials at site.

The ingredients shall be thoroughly mixed by volume in dry form. Care shall be taken to ensure that there are no hard lumps present. Water shall then be added and the ingredients thoroughly mixed as in **9.1.1.**

9.1.4 *Spreading of Lime Mortar* — Cleaning and wetting of the base shall be done in the same manner as specified in **9.1.2.** Lime mortar shall then be evenly and smoothly spread over the base and levelled with a screed batten to a slightly rough surface for providing key for the tiles. The thickness of mortar shall be the same as in the case of cement mortar, that is, 10 mm minimum and 30 mm maximum at any one place. Screeds properly levelled shall be fixed at the correct height to suit the thickness of the screeded bed. The area of bedding should be as much as can be covered with tiles during the following day. The freshly laid portion of the mortar bedding shall be protected from damage by providing suitable barricading.

10. LAYING OF TILES

10.1 Laying of tiles should commence in the next morning by which time the bedding becomes sufficiently hard to offer rigid cushion for the tile and enables masons to place wooden planks and squat on them. Neat cement slurry of honey-like consistency shall be spread over the mortar bed, over such an area at a time as would accommodate about 20 tiles. The tiles shall be fixed in this grout one after the other, each tile being gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The mason shall keep the joints as close as possible and in straight lines. The joints between the tiles shall normally be 1·5 mm wide.

10.2 After the tiles have been laid in a room or the day's laying work is completed, the surplus cement slurry and the joints shall be cleaned and washed fairly deep with the help of a broom stick. It shall be seen that the cement slurry is cleaned before it sets hard.

10.3 The day after the tiles have been laid, the joints shall be filled with cement grout of the same shade as the colour of the matrix of the tile. The freshly laid portion of the tiles shall be prevented from damage by providing suitable barricading.

10.4 Tiles which are fixed in the floor adjoining the wall shall go about 10 mm under the plaster, skirting or dado as may be required by the designer. For this purpose, the wall plaster may be left unfinished by about 50 mm above the level of the proposed finished flooring and the unfinished strip may be plastered later on after the tiles are fixed.

10.5 In odd situations where a full tile cannot be provided, tiles shall be cut to size and then fixed.

10.6 After fixing, the flooring should be kept moist and allowed to mature undisturbed for seven days so that the bedding and joints set properly. After this, it may be used for light traffic. Heavy traffic shall not be allowed on the floor for at least 14 days after fixing the tiles.

10.7 Wherever big areas of floor are to be tiled, the level of the central portion of the floor shall be kept about 10 mm higher than the level marked at the walls unless specified otherwise. This is normally done to avoid the optical illusion of a depression in the central portion of the tiled hall.

11. GRINDING AND POLISHING

11.1 Grinding and polishing of the tiles shall be commenced only after the floor as well as the joints have properly set and in no case earlier than 14 days of laying.

11.2 Grinding should preferably be done using a machine except for skirting.

11.3 For grinding terrazzo tile flooring, the first grinding shall be with machine fitted with carborundum stones of 48 to 60 grit. When the floor is rubbed even and chips show uniformity it shall be cleaned with water making bare all pin holes. Grouting in the same shade is then briskly applied so that all pin holes are properly filled in. The grout shall be kept moist for a week for proper setting. Thereafter, the second grinding operation with carborundum of 120 grit is commenced. The floor is grouted again to fill in fine pin holes. After curing, the floor is left with this protective film till other works are completed and all workers quit. Before the final grinding the floor is swept clean. Final grinding is then done with carborundum of 220 to 350 grit using plenty of water and taking care that any foreign matter, particles of sand, etc, are prevented. When surface is rendered smooth, it is washed with water. Afterwards oxalic acid powder is vigorously applied with machine fitted with hessian bobs to bring out sheen. Wash the floor clean and apply dry linen to suck-in moisture. If desired, wax polish may finally be applied mechanically with clean hessian bobs. Superfluous wax is mopped-up with saw dust to prevent slipperiness. Saw dust may be allowed to remain on the surface till occupation. This will protect the surface and help to increase lustre. When saw dust is spread, water should not be spilled as this is likely to give stains on the polished surface.

11.4 When hand grinding and polishing has to be adopted the various processes in the same sequence shall be carried out as described in **11.3.**

11.5 In the case of plain cement and coloured tiles the process of polishing shall be the same as described in **11.3** except that initial grinding with carborundum stone of 48 to 60 grit may not be necessary.

11.6 Chequered or Grooved Tiles — These tiles normally do not require polishing. But where polishing is required, the same shall be done as in **11.5.**

12. LAYING OF ROUGH TILES

12.1 Where tiles have been supplied and fixed in rough condition (not ground and filled by the manufacturer), the first grinding shall be done not

less than 14 days after fixing the tiles. The initial grinding shall be done with carborundum stones of 36 to 48 grit. The remaining process shall be the same as given in **11.3**.

13. PERMISSIBLE TOLERANCE IN LAYING

13.1 The permissible deviation from datum depends on the area involved; for large open areas, a deviation of up to 15 mm may be tolerated. Localized deviations of 3 mm in any 3 m may be accepted in a nominally flat floor.

14. SKIRTING, DADO WORK AND STAIRCASE-TREAD WORK

14.1 Tile skirtings, where required, shall be fixed only after laying the tiles on the floor. If tiles are to be fixed on walls as dados, the portion of the wall to be so tiled shall be left unplastered. Also, dado work shall be done only after laying tiles on the floor.

14.2 Before fixing tiles on brick or concrete wall, the wall surface shall first be wetted with clean water. Thereafter, in case of dado the wall surface shall be evenly and uniformly covered with about 10 mm thick backing of cement mortar (1 cement : 4 coarse sand). In the case of skirting, the tiles shall be directly fixed with cement mortar (1 : 4) without initial backing. Before the cushioning mortar has hardened, the back of each tile to be fixed shall be covered with a thin layer of neat cement paste and the tile shall then be gently tapped against the wall with a wooden mallet. The fixing shall be done from the bottom of the wall upwards. Each tile shall be fixed as close as possible to the one adjoining, and any difference in the thicknesses of the tiles shall be evened out in the cushioning mortar or cement paste so that all the tile faces are set in conformity with one another.

14.3 Wherever possible, skirtings and dado shall be ground and polished just as for floor work with machine suitable for the purpose. Skirtings and dado may also be polished by hand.

14.4 Precast treads and risers for staircases shall be laid and polished as for flooring.

14.5 The laying and polishing of tiles for external paving shall be done similar to that of ordinary flooring.

15. APPEARANCE

15.1 The finished floor shall have an even, smooth and shining surface. Joints should be in correct alignment.

NOTE 1 — Normally, all freshly laid tile-floors and dado work may show efflorescence even after the tiles are polished. This may be particularly noticeable in plain-tile floors. This may not affect the quality of the tiles or of the finished floor; the same may acquire a natural sheen after two to three months of daily cleaning. When all the salts from the concrete have come to the surface and are washed off, there will be no more trouble from this cause and the floor will require less work for its upkeep. If quality tiles have been used, their natural gloss will improve with age and wear.

NOTE 2 — Minor variations may occur in the shades of cement used in the matrix, in the colour and shade of the marble chips and in the distribution of the chips over the tiles.

16. MAINTENANCE

16.1 Care Immediately After the Work

16.1.1 After laying, the floor shall be allowed to remain clean and free from cement, oil, paint, distemper, plaster droppings and all materials likely to stain or spoil the tiles. If appliances, such as trestles, ladders, steps, etc, have to be used for electrician's, plumber's and other light work, it shall be ensured that parts contact with the flooring are padded by the contractor doing such work and no sliding the appliances on the finished flooring is permitted. The owner shall also take care, when the floor is used for subsequent operations, that staining, damaging or pitting of the tile-work is entirely prevented.

16.1.2 Stair finishes, particularly nosings, are liable to be damaged by dragging or dropping of articles up or down the stairs. It is, therefore, necessary to protect the stairs against such causes of damage.

16.2 Subsequent Maintenance

16.2.1 Polished tile-floors shall be regularly swabbed with clean water followed by brisk rubbing with dry linen. If they are very dirty, water and soap may be used. Care shall be taken to remove any soap film deposited in washing, as failure to do so will result in the floor becoming slippery and dull-looking. Use of soda, acid, etc, shall be avoided.

16.2.2 Resistance to staining is, to a great extent, dependent upon the degree of maintenance. Where bad stains have occurred, the advice of the manufacturer of the tiles may perferably be sought for their removal.

16.3 Proper maintenance of the floor, after it has been completed with the final polish, rests with the owner and the owner should be furnished with the necessary information and instructions for such maintenance by the tile-laying contractor.

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