

IS: 5491 - 1969

Indian Standard

CODE OF PRACTICE FOR
LAYING *IN SITU* GRANOLITHIC CONCRETE
FLOOR TOPPING

(Fourth Reprint JUNE 1990)

UDC 69.025.331.5 : 69.001.3

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

Indian Standard

CODE OF PRACTICE FOR LAYING *IN SITU* GRANOLITHIC CONCRETE FLOOR TOPPING

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CODE OF PRACTICE FOR LAYING *IN SITU* GRANOLITHIC CONCRETE FLOOR TOPPING

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 October 1969, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Granolithic concrete floor topping is adopted for floors of heavy engineering factories, workshops, garrages, warehouses, etc, where the floor is subjected to heavy loads, and severe abrasion combined with impact. The granolithic concrete essentially consists of a rich concrete made with specially selected aggregate of high hardness, surface texture and particle shape suitable for use as a wearing finish to floors. Although plain concrete as laid conforming to IS:2571-1963* would be satisfactory for many purposes, granolithic concrete is chosen because of its high abrasion resistance and used for floor toppings wherever abrasion combined with impact is likely to be severe. In this standard the method of laying the granolithic concrete topping is only given and all other details up to the laying of base concrete or suspended slab shall conform to the procedure laid down in IS:2571-1963* which is an adjunct to this standard.

0.3 There are two methods of laying the *in situ* granolithic concrete floor topping. The topping shall either be laid within three hours of the laying of the base, that is, monolithically with the base concrete; or alternatively, it shall be laid at any time after the base had begun to harden, in such a way as to produce the maximum possible bond between the base and topping, that is, it shall be laid separately from the base. A high standard of workmanship is essential and skilled floor layers should be employed for the job. Inferior work often leads to curling, breaking of bond between the base and topping concrete, cracking and dusting of the top surface. In ground floors, it is advisable to lay the granolithic concrete topping monolithically with the base concrete. Depending upon the nature of use and performance expected from the floor topping, the floor finish has to be laid

*Code of practice for laying *in situ* cement concrete flooring (Since revised).

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in various thicknesses and a careful selection has to be made regarding mix proportions, panel sizes and the type of construction. This code has been prepared with a view to providing the necessary guidance in the selection of materials, method of laying and finishing of granolithic concrete topping for obtaining satisfactory performance of the flooring.

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. This has been met by deriving assistance from the following publications published by the British Standards Institution:

B.S.CP 204: 1965 *In situ* floor finishes.

B.S. 882 and 1201: 1965 Aggregates from natural sources for concrete (including granolithic).

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, 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 relates to the laying of granolithic concrete floor topping laid *in situ*.

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS: 2571-1963† and the following shall apply.

2.1 Base Concrete—The layer of concrete on which the granolithic concrete floor topping is laid.

2.2 Granolithic Concrete—Concrete made with specially selected aggregate of high hardness, surface texture and particle shape suitable for use as a wearing finish to floors.

2.3 Surface Hardener—A substance which may be applied to the surface of hardened concrete to increase the wear resistance of the concrete.

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

†Code of practice for laying *in situ* cement concrete flooring (*Since revised*).

3. MATERIALS

3.1 Cement—Cement used shall conform to IS:269-1967* or IS:455-1962† or IS:1489-1967‡.

3.2 Aggregates

3.2.1 The aggregates for granolithic concrete floor topping shall consist of crushed rock of one or more of the following groups:

- a) Granite, b) Basalt, c) Trap, and d) Quartzite.

The aggregate shall conform to the requirements of IS:383-1963§. The aggregate crushing value, when determined in accordance with IS:2386 (Part IV)-1963||, shall not exceed 30 percent. The grading of the aggregates for granolithic concrete floor topping shall conform to Tables 1 and 2.

3.2.1.1 Coarse aggregate—The grading of coarse aggregate for granolithic concrete floor topping shall be within the limits given in Table 1.

TABLE 1 COARSE AGGREGATE

IS SIEVE DESIGNATION	PERCENTAGE BY WEIGHT PASSING IS SIEVES
12.5-mm	90 to 100
10-mm	40 to 85
4.75-mm	0 to 10
2.36-mm	—

3.2.1.2 Fine aggregate—The grading of fine aggregate for granolithic concrete floor topping shall be within the limits of one of the two zones given in Table 2. The fine aggregate shall be described as fine aggregate of the grading zone into which it falls.

3.3 Water—Water used shall be clean and free from oil, acid, alkali, organic or vegetable matter. Sea water shall not be used. Generally potable water will be suitable.

*Specification for ordinary, rapid hardening and low heat portland cement (*second revision*). (Since revised).

†Specification for portland blast furnace slag cement (*revised*). Since revised.

‡Specification for portland pozzolana cement (*revised*).

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

||Methods of test for aggregates for concrete : Part IV Mechanical properties.

TABLE 2 FINE AGGREGATE

(Clause 3.2.1.2)

IS SIEVE DESIGNATION	PERCENTAGE BY WEIGHT PASSING IS SIEVES	
	Grading Zone 1	Grading Zone 2
10-mm	100	100
4.75-mm	90 to 100	90 to 100
2.36-mm	60 ,, 95	75 ,, 100
1.18-mm	30 ,, 70	55 ,, 90
600-micron	15 ,, 34	35 ,, 59
300-micron	5 ,, 20	8 ,, 30
150-micron	0 ,, 10	0 ,, 10

3.4 Admixtures— Integral additions, either as hardeners or accelerators, or other surface hardening treatments are not normally required, but their application may be advantageous in certain circumstances. Caution should be exercised in the use of admixtures and the manufacturer's recommendations should be followed wherever required.

3.5 Abrasives— Metallic or non-metallic materials of high abrasion resistance may be incorporated in the floor topping mix to increase the abrasion resistance of the floor topping.

3.6 Surface Hardening Solutions— These may be solutions of sodium silicate, magnesium silicofluoride, or zinc silicofluoride or proprietary materials consisting mainly of one or more of these compounds. Proprietary materials may be used only in accordance with the manufacturer's instructions (*see* Appendix A).

4. DESIGN CONSIDERATIONS

4.1 Abrasion Resistance— Although plain concrete is satisfactory for many purposes, granolithic concrete has higher abrasion resistance and should be used for floor topping wherever abrasion is likely to be severe.

4.2 Size of Panels— The floor topping shall be divided into suitable panels so as to reduce the risk of cracking. Size of the panel is governed by the thickness of floor finish, the type of construction (monolithic or separate), local conditions of temperature, humidity and the season in which flooring is laid. For floor finish laid in exposed situations or in hot and dry climates, the size of the panels shall be smaller as compared to the floor finish laid in less exposed situations or in cold and humid climates;

the size of panels laid monolithically with the base may be larger than that of floor finish laid separately on the hardened base. Generally, in the case of suspended slabs no dimension of a panel shall exceed 4 m in case of floor topping laid monolithically with the structural slab and 2 m in case of floor topping laid separately on a hardened base. In case of ground floors, the size of the topping panel may synchronize with that of the base concrete. Length of a panel shall not exceed one and a half times its breadth.

4.3 Joints— Construction joints between bays of the floor finish need only be plain untreated vertical butt joints and should be placed over any joints in the base.

Where expansion joints are necessary in the walls and roof of a building, there should be corresponding joints in the floor. The floor finish should not be allowed to cover the joint filler of the expansion joint in the base concrete; either the joint filler should extend through the full thickness of the base concrete and finish or the space above it should be filled with a suitable sealing compound.

4.4 Mix Proportions— Mix proportion for the granolithic concrete floor topping for different types of floor finish shall be 1:1:2 (cement: fine aggregate: coarse aggregate, by volume).

4.5 Protection Against Dampness— The layer of coarse sand or boulder soling provided under the base concrete will generally serve the purpose of damp-proofing required for ordinary floors under normal conditions. However, in more severe conditions, where it is expected that the dampness may find its way on the top of the floor in the course of usage of floor, a more effective damp-proof treatment shall be given underneath the floor by either of the methods given below:

- a) Laying the base concrete in two layers and painting the top of the lower layer with two coats of bitumen conforming to IS:1580-1969* applied at the rate of 1.5 kg/m². The surface of the lower layer shall be finished smooth while laying the concrete so that bitumen can be applied uniformly. The bitumen shall be applied after the concrete has set and is sufficiently hard.
- b) Sandwiching a waterproofing membrane, such as bitumen felt conforming to IS:1322-1965† in the base concrete laid in two layers. The surface of the lower layer shall be finished smooth while laying the concrete so as to provide an even surface and thus prevent damage to the surface of waterproofing membrane.

*Specification for bituminous compounds for waterproofing and caulking purposes (first revision).

†Specification for bitumen felts for waterproofing and damp-proofing (revised). Since revised.

4.5.1 Where it is expected that the dampness may find its way from the surrounding walls, the same shall also be effectively damp-proofed up to at least 150 mm above the level of the base or sub-floor, and the damp-proof treatment below the floor shall be extended over the walls. Basement floors shall be damp-proofed according to recommendations of IS: 1609-1966*.

5. COMPACTION EQUIPMENT

5.1 Compacting Plant—The tampers used shall be capable of compacting the full thickness of each layer of concrete and of producing the desired surface finish. The following types of compactor may be used:

- a) Hand tamper having a tamping edge shod with steel strip 75 mm wide fixed to the tamper by countersunk screws.
- b) Hand tamper to which are attached vibrating units operated either electrically or by an internal combustion engine.
- c) Pneumatic tamper in which pneumatic hammers operate on a steel plate.
- d) Pan vibrator.

6. LAYING FLOOR TOPPING OVER BASE CONCRETE

6.1 Floor Topping Laid Monolithically with the Base Concrete (see Table 3)—On the clean, green surface of the base concrete laid in accordance with the procedure given in IS: 2571-1963† the topping shall be placed in position as soon as possible but generally not later than two to three hours of laying the base concrete, depending upon the temperature and the atmospheric conditions. The base concrete at the time of laying the topping shall be still green but sufficiently firm to enable the workmen to work over it by placing planks on its surface. The granolithic concrete mix (1:1:2) for the topping shall be deposited on the base concrete in the screed strips already laid and thoroughly compacted to the finished thickness. The surface shall be tested with a straightedge and mason's spirit-level to detect any undulation in the surface which, if any, shall be made good immediately. The topping shall then be floated with a wooden float to render the surface even and after the surface is slightly hardened, it shall be finished smooth as described in IS: 2571-1963†.

6.2 Floor Topping Laid Separately on Hardened Base Concrete (see Table 3)—Before the operation for laying the topping is started, the surface of base concrete shall be thoroughly cleaned of all dirt, loose particles, caked mortar droppings, and laitance, if any, by scrubbing with coir or steel wire brush. Where the concrete has hardened so much that

*Code of practice for laying damp-proof treatment using bitumen felts (*revised*).

†Code of practice for laying *in situ* cement concrete flooring. **Since revised.**

roughening of surface by wire brush is not possible, the surface shall be roughened by chipping or hacking at close intervals. Before laying the topping, the surface shall be wetted with water for several hours and surplus water shall be removed by mopping immediately before the topping is laid in position.

The screed strips shall be fixed over the base concrete dividing it into suitable panels as recommended in 4.2. The screed strips shall be so arranged that the joints, if any, in the base concrete shall coincide with the joints in the topping. Before placing the granolithic concrete mix (1:1:2) for topping, neat cement slurry shall be thoroughly brushed into the prepared surface of the base concrete. The topping shall be laid in accordance with 6.1, very thoroughly tamped, struck off level and the surface floated with a wooden float. The top surface of the granolithic concrete shall be tested with the straightedge and mason's spirit-level to detect any inequalities in the surface which, if any, shall be made good immediately. The top surface shall be finished smooth as described in IS: 2571-1963*.

7. LAYING FLOOR TOPPING ON SUSPENDED SLABS

7.1 Floor Topping Laid Monolithically with the Suspended Slab (see Table 3)—The form-work for suspended slab shall be erected to the finished thickness of floor finish. Structural concrete shall be deposited in the forms, thoroughly consolidated and surface finished below the top edge of the form to accommodate the required thickness of the topping. Any slope required in the floor finish shall be given in the structural concrete itself, and any laitance or scum shall be brushed away from the surface of concrete when it is still green. The surface shall not be finished smooth but kept rough to provide an adequate bond for the topping.

On the green surface of the structural concrete, granolithic concrete (1:1:2) shall be placed in position immediately after the structural concrete has stiffened enough (but is still plastic) to allow for the workmen to tread over it by placing planks. Laitance and foreign matter, if any, shall be removed before the granolithic concrete topping is placed in position. The topping shall be thoroughly compacted and screeded to the finished grade. The mix for the structural concrete as well as the topping shall be as stiff as possible consistent with workability so as to prevent accumulation of excess of water or laitance on the surface. The topping shall then be floated with a wooden float to render

*Code of practice for laying *in situ* cement concrete flooring. (Since revised).

the surface even. After the surface is slightly hardened, it shall be finished in accordance with **6.1**.

NOTE 1 — In the monolithic method of construction the granolithic concrete floor topping may be regarded as contributing to the structural strength of the suspended floor.

NOTE 2 — The monolithic construction of granolithic concrete floor topping presents certain difficulties in construction due to other activities, such as plastering of walls and ceilings, fixing of joinery, movement of scaffoldings, ladders, etc, which are likely to damage the floor finish.

7.2 Floor Topping Laid Over the Hardened Suspended Slab (see Table 3) — When the topping is to be laid separately over the suspended slab, the slab shall be thoroughly brushed with a coir or steel wire brush to remove any scum or laitance and swept clean to expose the coarse aggregates and leave the surface rough. Where the concrete has hardened so much that roughening of surface by wire brush is not possible, the surface shall be roughened by chipping or hacking at close intervals. Before laying the topping, the surface of the slab shall be wetted with water for several hours and surplus water shall be removed by mopping immediately before the topping is laid in position.

The screed strips shall then be fixed over the suspended slab dividing it into suitable panels as recommended in **4.2**. Immediately before depositing the granolithic concrete (1:1:2) for the topping, neat cement slurry shall be thoroughly brushed into the prepared surface of the suspended slab. The granolithic concrete topping shall be then laid in accordance with **6.2**, thoroughly tamped struck off level and surface floated with wooden float. The surface shall then be tested with a straightedge and mason's spirit-level to detect any inequalities and undulations in surface which, if any, shall be made good immediately. The top surface shall be finished smooth.

7.3 Floor Topping Laid Over Cushioning Layer (see Table 3) — Before laying the cushioning lime concrete (see Note), the surface of the suspended slab shall be prepared as in **7.2**. On the clean damp surface of the suspended slab, lime concrete shall be evenly spread between forms, thoroughly tamped and levelled. Lime concrete shall be prepared in accordance with IS: 2541-1965*.

Before laying the granolithic concrete topping, the surface of lime concrete shall be thoroughly clean and prepared as recommended for base concrete in **6.2**. Immediately before spreading the granolithic concrete (1:1:2) for topping, the surface shall be brushed with a thin layer of neat cement slurry. The granolithic concrete shall then be laid and finished smooth as given in **6.2**.

NOTE — Where lime and good quality of bricks are not available 1:4:8 cement concrete may be used.

*Code of practice for use of lime concrete in buildings. Since revised.

**TABLE 3 DIFFERENT TYPES OF GRANOLITHIC
CONCRETE FLOOR TOPPING**

(Clauses 6.1, 6.2 and 7.1 to 7.3)

SL No.	TYPE OF FLOOR TOPPING	THICKNESS OF GRANO- LITHIC CONCRETE FLOOR TOPPING IN mm, <i>Min</i>	REMARKS
<i>A. Floor Topping Laid Over Base Concrete on Ground</i>			
1.	Floor topping laid monolithically with the base concrete	20	Granolithic concrete floor topping shall be laid monolithically with the base concrete
2.	Floor topping laid separately on hardened base concrete	40	Granolithic concrete floor topping shall be laid separately over specially prepared surface of set and hardened base concrete
<i>B. Floor Topping Laid Over Suspended Slabs</i>			
3.	Floor topping laid monolithically with the suspended slab	20	The granolithic concrete topping shall be laid and finished monolithically with the suspended slab. For this purpose the topping shall be laid immediately after the structural concrete of the suspended slab has stiffened enough (but is still green) to allow the workmen to tread over it by placing planks
4.	Floor topping laid over the hardened suspended slab	40	The topping shall be laid separately over the specially prepared surface of set and hardened suspended slab
5.	Floor topping laid over cushioning layer	40	Cushioning layer of lime concrete of 40 to 50 mm thickness shall be laid over the prepared surface of suspended slab. Granolithic concrete topping shall be laid as in 4

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8. CURING

8.1 Immediately after the flooring surface is finished it shall be protected from rapid drying, by erecting barriers against wind or draught and strong sunlight. As soon as the surface had hardened sufficiently to prevent damage to it, it shall be kept continuously moist for at least ten days by means of wet gunny bags, 50 mm thick layer of damp sand spread over the surface or pooling water on the surface. During this period the flooring shall not be exposed to any traffic. Premature exposure to traffic will lead to damage to the surface which cannot be satisfactorily repaired.

9. INSPECTION

9.1 The work should be inspected during progress and after completion, special attention being paid to the following points:

- a) Preparation of the base, where the floor finish is laid separately;
- b) Proper compaction;
- c) Correct finishing; and
- d) Correct curing.

10. MAINTENANCE

10.1 Except where oil and grease are likely to be spilt frequent washing of the surface with water may be sufficient to maintain the floor finish in a clean condition. Grease stains may be removed by means of sodium metasilicate, caustic soda, some phosphates or other proprietary materials.

A P P E N D I X A

(Clause 3.6)

SURFACE TREATMENT TO GRANOLITHIC CONCRETE FLOOR TOPPING

A-1. GENERAL

A-1.1 It is not necessary, generally, to apply any further treatment to the granolithic concrete floor top surface, but dusting may be reduced by the application of one of the surface hardening solutions described in **3.6**. These treatments are likely to need renewal at intervals of one year. Where proprietary materials are to be used, advice should be obtained from the manufacturers.

A-2. CLEANING THE SURFACE

A-2.1 The top surface of the granolithic concrete should be clean and free from grease or oil to enable the hardening solutions to penetrate. Sweeping to remove dust and dirt may be adequate only in some cases of new floors and additional cleaning may be necessary. The top surface shall be wetted with water and scrubbed with coir or steel wire brush and thoroughly cleaned by washing with clean water. The floor should be allowed to dry so that the hardening solution can be absorbed into the surface.

A-3. TREATMENTS

A-3.1 Sodium Silicate—A solution containing one part by volume of sodium silicate and four to six parts of water should be spread evenly over the granolithic concrete top surface with a mop or soft brush, the stronger solution being used on a less absorptive surface. Any excess material should be wiped off and the floor allowed to dry. After the floor has been washed with clean water, a second coat, containing one part of sodium silicate to three or four parts of water, should be applied, and this should be allowed to dry similarly. A third coat may be applied after washing if the floor is still porous. After drying, the floor should be washed with hot clean water. Effective results are obtained if the treatment is applied seven to ten days after the end of curing.

A-3.2 Silicofluoride—The crystals of magnesium silicofluoride or of zinc silicofluoride should be dissolved in water at the rate of 0.1 g/cm^3 for the first coat and 0.2 g/cm^3 for subsequent coats. Three coats are usually applied at 24-hour intervals. There is no need to wash the top surface of the floor between coats, but it is advisable to wash with clean water after the final treatment.

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 331 01 31, 331 13 75

Telegrams: Manaksanstha
(Common to all Offices)

Regional Offices:

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	{ 331 01 31 331 13 75
*Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	36 24 99
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	{ 2 18 43 3 16 41 41 24 42
Southern : C. I. T. Campus, MADRAS 600113	{ 41 25 19 41 29 16
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117/418 B Sarvodaya Nagar, KANPUR 208005	{ 21 68 76 21 82 92
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Inspection Offices (With Sale Point):

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