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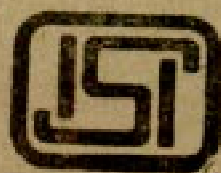
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Indian Standard

CODE OF PRACTICE FOR
CONSTRUCTION OF RB AND
RBC FLOORS AND ROOFS

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INDIAN STANDARDS INSTITUTION

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NEW DELHI 110002

Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF RB AND RBC FLOORS AND ROOFS

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Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF RB AND RBC FLOORS AND ROOFS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 31 January 1983, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division, Council.

0.2 Reinforced brick and reinforced brick concrete floors and roofs are widely adopted, particularly in the Northern parts of the country. This type of construction consists of laying high strength bricks directly over the formwork with reinforcements in between the joints and filling up the joints with concrete. This type of construction has been found to be strong, durable and it also facilitates quick construction. However, investigations had established that this type of floor or roof slabs deteriorate rapidly due to corrosion of the reinforcements. This code has been prepared to provide guidance for laying of such RB and RBC slabs. Further, measures to prevent and protect the reinforcements from corrosion have also been recommended, adoption of which would ensure durability and better performance of the slabs.

0.3 This code has emerged as a result of investigations carried out and recommendations made by CBRI, Roorkee and covers the construction practices that are in general use in the country.

0.4 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.

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

1. SCOPE

1.1 This code covers the design and construction of reinforced brick (RB) and reinforced brick concrete (RBC) floors and roofs.

2. TERMINOLOGY

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

2.1.1 Reinforced Brick Slab (RB Slab) — Reinforced brick slab is particularly same as reinforced concrete slab in all its essential features except that brickwork is substituted partly or fully for cement concrete (see Fig. 1).

2.1.2 Reinforced Brick Concrete Slab (RBC Slab) — These are reinforced brick slab using concrete in the joints and on the top of bricks (see Fig. 1).

3. MATERIALS

3.1 Bricks — These shall be of at least Class 75 for RB and Class 35 for RBC construction and conforming to IS : 1077-1976*. Overburnt bricks having vitrified surface shall not be used.

3.2 Cement Concrete — Cement concrete used in filling the interstices in reinforced brick slabs and for providing top decking of reinforced brick concrete slabs shall be of grade not less than M 15 and shall conform to IS : 456-1978†. It shall contain just enough water to flow freely without segregation of the aggregates. The size of the aggregates may be suitably selected to suit the construction.

3.3 Reinforcement — It shall conform to IS : 432 (Part I)-1982‡ or IS : 1139-1966§ or IS : 1786-1979||. Reinforcements shall be free from rust scale or other coating.

3.4 Centering and Formwork — The formwork shall consist of timber or steel possessing sufficient strength so as to carry the superimposed load. Unless otherwise specified formwork shall consist of platforms composed of planks or sheets supported on runners or beams. The props and bracings supporting the platforms shall have sufficient lateral stability.

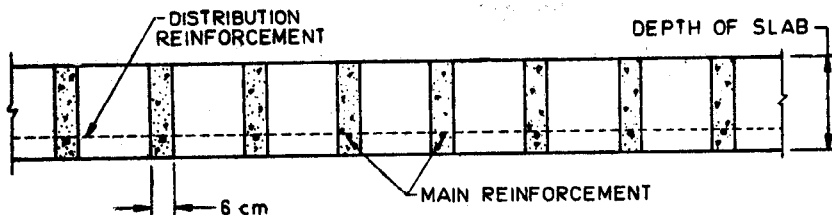
*Specification for common burnt clay building bricks (*third revision*).

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

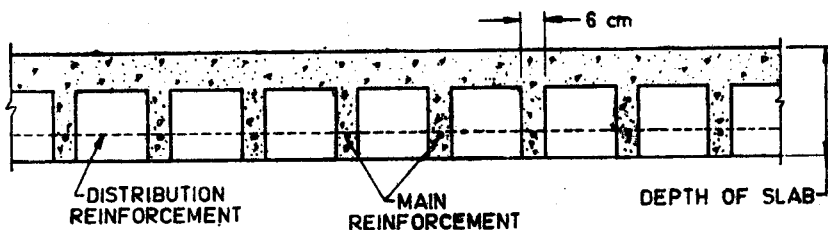
‡Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part I Mild steel and medium tensile steel bars (*third revision*).

§Specification for hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcements (*revised*).

||Specification for cold-worked steel high strength deformed bars for concrete reinforcement (*revised*).



1A CROSS SECTION OF RB SLAB



1B CROSS SECTION OF RBC SLAB

FIG. 1 TYPICAL RB AND RBC SLAB

4. NECESSARY INFORMATION

4.1 For the efficient construction of the work, detailed information with regard to the following is necessary:

- a) Size and dimensions to be covered and loading conditions;
- b) Type of supporting elements and restrictions if any to their arrangement;
- c) Level to which the terrace should be brought to receive floor or roof finish;
- d) Treatment of junctions with adjacent floors, walls, etc,
- e) Provision to be made for roof slope and other requirements for drainage; and
- f) Provision for fixing of services, ceilings, etc.

4.2 All information as in 4.1 shall be made available to those who are responsible for laying the roof or floor. Necessary drawings and illustrations for preparatory work shall be given.

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

5. PREPARATORY WORK

5.1 Storage, Transport and Handling of Materials — Necessary precautions shall be observed in storage, transport and handling of cement, sand, bricks and aggregates. The materials shall be stored on the building site in such a way as to prevent deterioration or loss of their structural and other essential properties (*see* IS : 4082-1977*).

5.2 Mixing of Cement Concrete — Cement concrete shall be prepared in accordance with IS : 456-1978†.

5.3 Cutting and Bending of Reinforcement — Reinforcements shall be bent and fixed in accordance with the procedure specified in IS : 2502-1963‡, and shall not be straightened in a manner that will injure the material.

5.4 Preparation of Bricks — Bricks shall be kept immersed in water for 4 to 6 hours and removed about 15 to 20 minutes before they are used so that their skin is dry when cement concrete is poured.

6. DESIGN CONSIDERATIONS

6.1 The general design of RB and RBC slab shall be in accordance with the principles laid down in IS : 456-1978†.

NOTE — It is recommended that in case of RB slabs, working stress method of design may be followed.

6.1.1 Compressive Strength of Brick Masonry — All permissible stresses shall be related to the compressive strength of bricks as given in Table 1 depending upon the crushing strength of bricks. Alternatively, allowable stresses may be based on the results of prism test (*see* Appendix B of IS : 1905-1980§), on masonry made from masonry units and mortars with the same bonding arrangement as for the slab.

6.1.2 Having determined the compressive strength, the permissible stresses to be followed in the design shall be as given in Table 2.

6.1.3 One way RB slabs with freely supported ends, shall be designed to resist a bending moment near midspan of $WL/8$, where W is the total uniformly distributed load over the span and L is the effective span. For slabs continuous over supports and for slabs spanning in two directions at right angles, bending moment shall be calculated as given in IS : 456-1978†.

6.1.4 RBC slab shall be designed in the same way as RCC slab as given in IS : 456-1978†.

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

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

‡Code of practice for bending and fixing of bars for concrete reinforcement.

§Code of practice for structural safety of buildings: Masonry walls (*second revision*).

NOTE — A continuous RBC slab at the support shall be designed like a RB slab and the bottom reinforcement shall be continued over the support. Reinforcement for taking negative moment over the support shall be provided in the top concrete.

6.2 Reinforcement

6.2.1 Design — The reinforcement in RB and RBC slabs shall be designed according to the provision of IS : 456-1978* taking the spacing of bricks into consideration. The reinforcement in either direction shall however not be less than 0.20 percent of the cross sectional area of the slab where plain steel bars are used and not less than 0.16 percent where high strength deformed bars are used.

6.2.2 Spacing — The horizontal distance between two parallel main reinforcement shall not be more than three times the effective depth of the slab or 450 mm whichever is smaller. The pitch of the distribution bars shall not be more than five times the effective depth or 450 mm whichever is smaller.

6.2.3 Protection Against Corrosion — Reinforcements shall be so placed that they do not touch bricks at any point. A minimum cover of 25 mm shall be provided all round the reinforcement. Further measures for preventing corrosion of reinforcements shall be taken as recommended in IS : 9077-1979†. In general, two bars shall not be used in the same joint.

7. CONSTRUCTION OF REINFORCED BRICK ROOF OR FLOOR

7.1 Erection of Centering and Formwork — Centering shall be erected to support the RB floor or roof from below. The centering shall be smooth, clean and to correct alignment. The top surface of formwork shall be given an upward camber of 1 mm for every 150 mm of span subject to a maximum of 30 mm to allow for initial settlement. Before laying the slab, the formwork and the supports shall be checked to prevent undue sag and to ensure overall safety and stability of the formwork.

7.2 Detailing of Reinforcement — All main and distribution reinforcement shall be placed in the position shown in Fig. 1 and shall be completely embedded in concrete. They shall be rigidly secured against any displacement and arrangement shall be made to ensure proper cover to the reinforcements. Splices in adjacent bars, if needed shall be staggered.

7.3 Spacing of Bricks — The bricks prepared as in 5.4 shall be laid as shown in Fig. 1 with cement mortar 1:3. Preferably a minimum spacing of 60 mm in between the bricks should be maintained for preventing corrosion.

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

†Code of practice for corrosion protection of steel reinforcement in RB and RCC construction.

TABLE 1 COMPRESSIVE STRENGTH OF MASONRY

(Clause 6.1.1)

SL No.	AVERAGE COMPRESSIVE STRENGTH OF BRICK, N/mm ²	ASSUMED COMPRESSIVE STRENGTH OF MASONRY (f_m)*, N/mm ²	
		With Proper Control	Without Proper Control
(1)	(2)	(3)	(4)
i)	3.5	3.0	2.0
ii)	5.0	4.5	3.0
iii)	7.5	6.25	4.25
iv)	10.0	8.0	5.5
v)	15.0	9.5	6.5
vi)	17.5	11.0	7.5
vii)	21.0	12.25	8.25
viii)	25.0	13.25	9.00
ix)	28.0	14.0	9.5
x)	35.0	15.5	10.5

*In no case, assumed f_m shall be greater than the average compressive strength of mortar or grout whichever is less.

TABLE 2 PERMISSIBLE STRESSES

(Clause 6.1.2)

SL No.	TYPE OF STRESS	PERMISSIBLE STRESSES, N/mm ²
(1)	(2)	(3)
i)	Flexural compression	0.23 f_m
ii)	Flexural tension	0.10 f_m
iii)	Shear (without shear reinforcement)	0.02 f_m , but shall not exceed 0.3
iv)	Shear (with shear reinforcement)	0.05 f_m , but shall not exceed 0.8
v)	Bond:	
	a) Plain bars	0.6
	b) Deformed bars	0.8
vi)	Modulus of elasticity	1 000 f_m but shall not exceed 2×10^4

7.4 Laying of Bricks and Reinforcements — The bricks for single brick thickness of floor or roof shall be laid directly on the forms without bedding of any kind. After one row of bricks has been laid the next row is similarly laid providing the gap for concrete joint. Concrete as prepared in 5.2 shall be then poured in the gaps to fill the bottom of the joint to a uniform thickness equal to the clear bottom cover to the reinforcing bars. Concrete should be poured into the joints after the placement of reinforcement. Concrete shall be fluid enough to run freely around the reinforcing bars and fill the joints completely. The joints shall be puddled sufficiently with a trowel or a sharp ended 16 mm diameter rod to aid the flow of concrete to every corner and to fill any void space left in the joint due to entrapping of air or otherwise. A typical cross section of RB and RBC floor or roof is shown in Fig. 1. If a slab of two courses of brick is laid, a fresh layer of concrete shall be spaced over the first course to make the middle horizontal joints and screeded properly to the desired thickness of the joint. The top course of brick is then laid in the same manner as in the first course.

7.5 Curing — The brickwork shall be kept wet by means of wet straw or wet sand or merely by sprinkling water gently over the surface for about 24 hours after finishing. The slab shall then be watered profusely and allowed to set for a period of atleast 10 days.

7.6 Removal of Formwork — The formwork for the RB and RBC floor or roof shall not be removed before 14 days after laying.

7.7 Finishing — The completed floor or roof shall be further finished with a waterproofing course of lime concrete (*see* IS : 3036-1980*) or MUD PHUSKA with tiles (*see* IS : 2115-1980†). The ceiling shall be rendered or plastered after drying with cement mortar (1 : 3) or lime mortar (1 : 2) as specified. The plaster may be in a single coat of 12 mm thick, and shall be done in accordance with IS : 1661-1972‡. The finished surface of the floor or roof shall be cured with water for a period of not less than 3 weeks.

8. INSPECTION

8.1 Inspection shall be done at every stage to avoid unsatisfactory work.

*Code of practice for laying lime concrete for a waterproofed roof finish (*first revision*).

†Code of practice for flat-roof finish, MUD PHUSKA (*second revision*).

‡Code of practice for application of cement and cement-lime plaster finish (*first revision*).

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