IS : 2572 - 1963
(Reaffirmed 1997)

Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF HOLLOW CONCRETE BLOCK MASONRY

(Seventh Reprint MARCH 1998)

UDC 691.327 - 478

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

Gr 5

February 1964

Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF HOLLOW CONCRETE BLOCK MASONRY

Building Construction Practices Sectional Committee, BDC 13

Chairman	*Representing*
SHRI N. G. DEWAN	Central Public Works Department
Members	
SHRI J. P. J. BILIMORIA	Indian Institute of Architects, Bombay
DEPUTY DIRECTOR (ARCHITECTURE)	Research, Designs and Standards Organization (Ministry of Railways)
SHRI DINESH MOHAN	Central Building Research Institute (CSIR), Roorkee
SHRI H. V. MIRCHANDANI (*Alternate*)	
DIRECTOR	Engineering Research Department, Government of Andhra Pradesh
SHRI C. M. GOVEAS	Atomic Energy Commission
SHRI S. K. JOGLEKAR	Central Public Works Department
SHRI S. B. JOSHI	S.B. Joshi & Co., Bombay
SHRI R. N. JOSHI (*Alternate*)	
SHRI V. S. KAMAT	Hindustan Construction Co. Ltd., Bombay
SHRI KEWAL KRISHAN	Public Works Department, Government of Punjab; *and* Soil Construction Subcommittee, BDC 13 : 8, ISI
SHRI N. M. MALKANI	Masonry Construction Subcommittee, BDC 13 : 7, ISI
SHRI N. J. MASANI	Forest Research Institute & Colleges, Dehra Dun; *and* Timber Engineering Subcommittee, BDC 13 : 4, ISI
SHRI K. K. NAMBIAR	The Concrete Association of India, Bombay; *and* Concrete Construction Subcommittee, BDC 13 : 9, ISI
SHRI N. H. MOHILE (*Alternate*)	The Concrete Association of India, Bombay
SHRI C. B. PATEL	National Buildings Organization (Ministry of Works, Housing & Rehabilitation); *and* Expansion Joints Subcommittee, BDC 13 : 14, ISI
SHRI M. A. HAFEEZ (*Alternate*)	National Buildings Organization (Ministry of Works, Housing & Rehabilitation)
SHRI D. J. PATEL	Hindustan Housing Factory, New Delhi
SHRI M. L. RAHEJA	Engineer-in-Chief's Branch, Army Headquarters
SHRI R. D. MATHUR (*Alternate*)	

(*Continued on page 2*)

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

(*Continued from page* 1)

Members	*Representing*
BRIG K. B. RAI	Institution of Surveyors, New Delhi
SHRI RAM BILAS	Institution of Engineers (India), Calcutta
SHRI N. S. L. RAO	Covering, Veneering and Glazing Subcommittee, BDC 13 : 10, ISI
REPRESENTATIVE	Builders' Association of India, Bombay
SHRI V. SANKARAN	National Buildings Construction Corporation Ltd New Delhi
SHRI J. D. SHASTRI	Directorate General of Health Services (Ministry of Health)
SUPERINTENDING ENGINEER (DESIGNS)	Public Works Department, Government of Madras; *and* Brick and Tile Floor and Roof Construction Subcommittee BDC 13 : 11 ISI
DR H. C. VISVESVARAYA, Deputy Director (Civ Engg)	Director, ISI (*Ex-officio Member*)

Secretary

SHRI S. P. RAMAN

Assistant Director (Civ Engg), ISI

Concrete Construction Subcommittee, BDC 13 : 9

Convener	
SHRI K. K. NAMBIAR	The Concrete Association of India, Bombay
Members	
SHRI JAL N. BHARUCHA	Nariman B. Bharucha & Sons, Bombay
SHRI D. S. BORKAR	Public Works Department, Government of Maharashtra
SHRI RUTON J. DUBASH	In personal capacity (*Prospect Chambers Annexe, Dadabhai Naoroji Road, Fort, Bombay*)
SHRI M. K. JADHAV	Public Works Department, Government of Maharashtra
SHRI M. K. JOSHI	Engineer-in-Chief's Branch, Army Headquarters
SHRI B. P. KAPADIA	Hindustan Construction Co Ltd, Bombay
SHRI H. V. MIRCHANDANI	Central Building Research Institute (CSIR), Roorkee
SHRI N. H. MOHILE	The Concrete Association of India, Bombay
SHRI T. N. S. RAO	Gammon India Ltd Bombay
SHRI P. M. APTE (*Alternate*)	
SUPERINTENDING ENGINEER, BOMBAY CENTRAL CIRCLE	Central Public Works Department
SHRI K. V. THADANEY	The Concrete Association of India, Bombay
SHRI G. S. THAKUR	Bombay Municipal Corporation
SHRI C. SOARES (*Alternate*)	

Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF HOLLOW CONCRETE BLOCK MASONRY

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 16 December 1963, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Building Division Council.

0.2 Hollow concrete block is an important addition to the types of masonry units available to the builder and its use for masonry work is on constant increase in this country. Some of the advantages of hollow concrete block construction are reduced mortar consumption, light weight and greater speed of work compared to brick masonry. Concrete masonry block is well known in many countries of the world and experience in these countries has added considerably to the knowledge and confidence about its role in building construction. A major difficulty with the use of concrete blocks has often been the development of cracks due to shrinkage but experience has shown that a few basic precautions during construction will ensure successful performance of the masonry with freedom from this defect. Since many builders in this country are yet to become familiar with the use of concrete blocks, guidance in the form of a code of practice will help them to appreciate the essential constructional details and adopt hollow concrete block masonry in a larger scale wherever it is economical.

0.3 The Sectional Committee responsible for the preparation of this standard has taken into consideration the views of producers, consumers and technologists and has related the standard to the trade practices followed in the country in this field.

0.4 This standard is one of a series of Indian Standard codes of practice covering masonry construction. Other standards in the series are:

*IS : 1905-1961 Code of Practice for Structural Safety of Buildings: Masonry Walls

IS : 2212-1962 Code of Practice for Brickwork

0.5 Wherever a reference to any Indian Standard appears in this code, it shall be taken as a reference to its latest version.

*Since revised.

0.6 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 Rules for Rounding Off Numerical Values (*Revised*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.7 This standard is intended chiefly to cover the technical provisions relating to construction of hollow concrete block masonry, and it does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This standard covers the construction of walls and partitions with precast hollow concrete blocks.

2. TERMINOLOGY

2.1 For general terms with regard to masonry work, reference may be made to IS : 2212-1962 Code of Practice for Brickwork.

3. NECESSARY INFORMATION

3.1 For efficient planning, design and execution of the work, detailed information with regard to the following shall be furnished to those responsible for the work:

a) Layout plans showing the walls, position of doors, windows and other openings, stairs, columns, etc.

b) Detailed dimensions of the structure with details of sections.

c) Full-sized details of architectural features, mouldings and other special work such as fittings attached to or embedded in the masonry.

4. PROGRAMMING OF THE WORK

4.1 In preparing a time schedule, the masonry work shall be considered in relation to other works and so ordered that the work of the various tradesmen do not interfere with each other.

4.2 Particular attention shall be paid to the following items:

a) The timing of the erection of adjacent structural work should correspond to the erection of the walls and partitions where the various operations are interdependent.

b) The installation of conduits and services within, on the face of or through the walls and partitions.

c) The application of finishes to adjacent walls, floors and ceilings which may be required to be finished, before the application of finishes to the walls and partitions concerned.

d) Time intervals as and when necessary, to allow parts of the masonry work and finishes to dry out and mature before the commencement of subsequent operation.

4.3 The time schedule shall include dates for:

a) the supply of drawings and specifications;

b) the delivery of materials, masonry units and accessories; and

c) the commencement and completion of the various operations involved in the construction and finish of the walls and partitions.

4.4 Internal walls and partitions, if non-load-bearing and bonded or tied to the flanking framework, shall preferably be erected simultaneously with it, but where it is not practicable to do so, they may be erected afterwards, the necessary provision for their support and for bonding or tying their ends to the main structure being made at the appropriate time.

5. MATERIALS

5.1 Masonry Units — Hollow concrete blocks used as masonry units shall conform to *IS: 2185-1962 Specification for Load Bearing Hollow Concrete Blocks.

5.2 Cement — Cement shall conform to *IS : 269-1958 Specification for Ordinary Rapid-Hardening and Low Heat Portland Cement (*Revised*).

5.3 Lime — Lime shall conform to *IS : 712-1956 Specification for Building Limes. The lime shall be of Class C, unless otherwise specified.

5.4 Water — Water shall be clean and free from injurious amounts of deleterious materials and of a quality fit for drinking purposes.

5.5 Sand — This shall generally conform to the requirements of *IS : 383-1963 Specification for Coarse and Fine Aggregates from Natural Sources for Concrete (*Revised*) except for particle size grading which shall be as specified in **5.5.1.**

5.5.1 The sand for mortar shall generally have particle size gradings

*Since revised.

as follows:

IS Sieve	*Percent Passing*
4·75-mm	98 to 100
2·36-mm	80 ,, 100
1·18-mm	60 ,, 80
600-micron	40 ,, 65
300-micron	10 ,, 40
150-micron	0 ,, 10

5.6 Mortar

5.6.1 Mortar shall be composed of cement, lime and sand, unless otherwise specified. All lime other than dry hydrated lime shall be fully slaked in accordance with IS : 1635-1960 Code of Practice for Field Slaking of Lime and Preparation of Putty.

5.6.2 Hollow concrete blocks shall be embedded with a mortar which is relatively weaker than the mix used for making blocks in order to avoid the formation of cracks. A rich or strong mortar tends to make a wall too rigid thus localizing the effects of minor movements due to temperature and moisture variations resulting in cracking of the blocks. The recommended proportions of mortar measured by volume are given in Table I.

TABLE I MIX PROPORTIONS OF MORTAR FOR HOLLOW CONCRETE BLOCK MASONRY

Sl No.	Type of Work	Normal Masonry without Reinforcement			Masonry Where Reinforcement is Used	
		Cement	Lime	Sand	Cement	Sand
1)	Normal work	1	1	9 to 10	1	7 to 8
2)	When exposed to severe conditions or where the intensity of load is high such as in foundations, pilasters or portions of wall directly below heavily loaded lintels and beams	1	1	6 to 7	1	4 to 5
3)	Partitions of 10 cm nominal thickness	1	1	7 to 8	1	5 to 6

Note — Alternative sand proportions are given for the mortar mixes in the table so that where the sand is well graded between the maximum and minimum particle sizes specified in **5.5.1**, the higher figure should be adopted, but where the sand is not graded and is rather fine, the lower sand content should be used.

5.6.3 All mortar shall be prepared in accordance with *IS : 2250- Code of Practice for the Preparation and Use of Masonry Mortars.

NOTE — All mortar when mixed shall have a slump of 75 mm when tested in accordance with the method described in IS : 1199-1959 Methods of Sampling and Analysis of Concrete.

5.7 Concrete

5.7.1 Concrete used for filling cells in hollow concrete block masonry when reinforced shall be composed of one part of cement, two-and-half parts of sand and three parts of coarse aggregate of size ranging from 4·75 mm to 12·5 mm. The water-cement ratio shall not exceed 0·6.

When the cells exceed 10 cm in the least side, the coarse aggregate size shall be graded between 4·75 and 20 mm and the proportion of mix shall be 1 : 2½ : 3½ for reinforced concrete and 1 : 3 : 6 for unreinforced concrete.

5.7.2 Generally, in making the concrete the requirements of †IS : 456-1957 Code of Practice for Plain and Reinforced Concrete for General Building Construction shall be complied with.

6. DESIGN CONSIDERATIONS

6.1 Choice of Type of Wall — The type of wall for different situations of use of concrete block masonry shall be as under:

a) External and internal load bearing wall shall be of load bearing hollow concrete blocks of appropriate thickness. Exposed walls shall be rendered externally with cement plaster in accordance with **11.2.**

b) In special cases where high thermal insulation is required, cavity walls having either both the inner and outer leaves of hollow concrete blocks or having the outer leaf of hollow concrete block and the inner of solid concrete block may be used. To ensure adequate impermeability for the walls the exterior surface of external walls shall be plastered with cement mortar in accordance with **11.2.**

6.2 Strength and Stability

6.2.1 Unless otherwise specified, the design and construction of hollow concrete masonry walls shall conform generally to the requirements of ‡IS : 1905-1961 Code of Practice for Structural Safety of Buildings : Masonry Walls. Some essential requirements are explained in Appendix A.

*Since published in 1965.

†Second revision in 1964.

‡Since revised.

6.2.1.1 The thickness (nominal) of load bearing masonry built with hollow concrete blocks shall be not less than the values specified in Table II.

TABLE II MINIMUM THICKNESS OF LOAD BEARING WALLS FOR HOLLOW CONCRETE BLOCK MASONRY

Wall Location	Wall Thickness in cm for					
	Residential			Non-residential		
	One-storey building	Two-storey building	Three-storey building	One-storey building	Two-storey building	Three-storey building
Third storey	—	—	20	—	—	30
Second ,,	—	20	20	—	30	30
First ,,	20	20	30	30	30	30
Plinth	20	30	30	30	30	40

6.2.1.2 The minimum nominal thickness of non-load-bearing internal partitions shall be 10 cm.

6.2.1.3 The minimum nominal thickness of external panel walls in framed construction shall preferably be not less than 20 cm. However, depending upon the local conditions and the desired effect of thermal transmission and sound reduction, 10 cm thick panel walls may be used provided they are suitably braced and reinforced by lateral or vertical supports.

6.2.2 *Parapet Walls* — Unless adequately braced at intervals not exceeding three metres, the height of the wall shall be limited to five times its thickness.

6.2.3 *Lateral Supports*

6.2.3.1 Hollow concrete block masonry walls shall be provided with horizontal or vertical lateral supports at right angles to the faces of the wall. Lateral supports may be obtained by cross-walls, pilasters, or buttresses where the limiting distance will be measured horizontally, and by floors and roofs where the limiting distance will be measured vertically.

6.2.3.2 The limiting horizontal distance shall be 24 times the nominal thickness of the wall, while the limiting vertical distances shall be 18 times the nominal thickness of the wall; the storey height permitted for a 20 cm wall will, therefore, be 3·6 m or less.

6.3 Modular Co-ordination

6.3.1 Hollow concrete block walls shall preferably be planned on the basis of modular co-ordination with a view to making the maximum use of full and half-length units.

6.3.2 The cutting of units at the site shall be restricted to the minimum. Attention shall be paid to modular co-ordination while fixing the overall length and height of the wall; width and height of door, window and other openings; and wall dimensions between doors, windows and corners. All horizontal dimensions shall be in multiples of nominal half-length of the units and all vertical dimensions shall be multiples of full-height units.

6.4 Avoidance of Crack Formation

6.4.1 The major causes of cracks in the structure of hollow concrete block wall or partition and measures for their prevention are described in **6.4.2** to **6.4.3.2**.

6.4.2 *Structural Movements* — Cracks may arise from alterations in length, curvature or orientation of the structural members enclosing a wall or partition due to load settlement, thermal expansion or changes in moisture content. The precautions to be taken for prevention shall be as in **6.4.2.1** to **6.4.2.4**.

6.4.2.1 In the case of framed structures, erection of partitions and panel walls shall be delayed wherever possible until the frame has taken up as much as possible any deformation occurring due to structural loads.

6.4.2.2 *For floor deformation and movement* — The floor upon which a partition is built may deflect under load brought upon it after the partition is built. Where such deflections tend to create non-continuous bearing, the partition shall be strong enough to span between the points of least floor deflection or shall be capable of adapting itself to the altered conditions of support without cracking. This may be achieved by embedding horizontal reinforcement such as 6 mm diameter bars or any other suitable reinforcement, or, if possible, by providing a reinforced concrete band at every 40 cm height.

6.4.2.3 *Ceiling deflection or movement* — A ceiling above a wall or partition may deflect under loads applied after its erection, or through thermal or other movements. The wall or partition shall be separated from the ceiling by a gap, or by a layer of resilient material, to avoid cracking as a result of such deflection. Where this cannot be done, the risk of cracking, in the case of plastered finishes, may be diminished to some extent by reinforcement of the joint between the ceiling and the wall or partition, or by forming a cut between the ceiling plaster and the wall plaster.

6.4.2.4 *Deflection or movement of structural abutments* — Walls, columns or other structural elements against which a wall or partition abuts may deflect or move because of load, settlement, shrinkage or thermal effects. In order to avoid cracking of walls or partitions as a result of such movements, a slip joint shall be provided where possible, preferably packed with a resilient material.

6.4.3 *Shrinkage or Expansion of Wall or Partition* — Cracking may occur from shrinkage, or, less frequently, from expansion of the wall or partition as a whole or of its elements due to changes in moisture content, thermal effects or unsoundness of the materials. The precaution or prevention shall be as in **6.4.3.1** and **6.4.3.2.**

6.4.3.1 *For movements due to changes in moisture* — Dimensional stability of hollow concrete blocks is greatly affected by variations of moisture content in the units. The shrinkage of cement concrete block is much greater at the time it dries for the first time than due to subsequent wetting and re-drying, it is therefore essential that care should be taken to dry them thoroughly so that their initial shrinkage is completed before the blocks are used in the wall. Not only well dried blocks should be used, but these should also be laid dry except slightly moistening their surfaces on which mortar is to be applied to obviate absorption of water from the mortar; and even during curing of the mortar joints, the walls should only be lightly moistened and shall not be allowed to become excessively wet till they are plastered or painted.

It is necessary that the moisture content of the blocks when used does not exceed 40 percent of their maximum water absorption capacity where the relative humidity of air does not average less than 60 percent. But when the relative humidity averages less than this amount, it would be advisable to use blocks with moisture content of not more than 25 percent of the maximum water absorption of the blocks.

Provision for shrinkage of hollow concrete block walls shall be made by means of suitably designed control joints. In free unsupported walls or partitions such joints shall be provided at intervals of 8 to 10 metres and about 15 to 18 metres in walls which are connected by cross walls at longer or closer intervals. Control joints shall also be provided at junctions of load bearing and non-load-bearing walls and at junctions of columns and partitions.

6.4.3.2 *For movements due to changes in temperature* — Small movements take place in hollow concrete block walls due to changes in temperature. It is, therefore, necessary to make provision for expansion and also, particularly, contraction in walls of long buildings or walls around cold rooms, boiler houses, etc. An expansion joint should be provided in walls exceeding 30 metres.

7. STORAGE AND HANDLING OF MATERIALS

7.1 The blocks shall be stored in such a way as to avoid any contact with moisture on the site. They shall be stock-piled on planks or other supports free from contact with the ground and covered to protect against wetting. The blocks shall be handled with care and damaged units shall be rejected.

7.2 Cement, lime, aggregates and other masonry materials shall be stored and handled as laid down in the relevant Indian Standard specifications for these materials.

8. PREPARATORY WORK

8.1 Wetting of Blocks — The blocks need not be wetted before or during laying in the walls. In case the climatic conditions so require, the top and the sides of the blocks may only be slightly moistened so as to prevent absorption of water from the mortar and ensure the development of the required bond with the mortar (*see also* **6.4.3.1**).

9. CONCRETE-BLOCK MASONRY WORK IN FOUNDATION AND BASEMENT

9.1 Construction of Masonry

9.1.1 For single storeyed houses, the hollow of blocks in the foundation and basement masonry shall be filled up with sand and only the top foundation course shall be of solid blocks. But for two or more storeyed houses generally solid concrete blocks should preferably be used in foundation courses, plinth, and basement walls. If hollow blocks are used, their hollows must be filled up with concrete comprising one part of cement, three parts of sand and six parts of gravel or crushed stone of 5 to 20 mm size.

In special cases, the hollows may be left unfilled if so approved by the appropriate authority.

9.1.2 In damp soils to prevent the rise of moisture from the ground due to capillary action, the foundation and basement masonry shall be laid in richer mortar (*see* **5.6.2** and Table I). In addition, a damp-proof course shall be provided which may consist of a 25-mm layer of 1 : 2 cement mortar, or an approved type of bituminous course.

10. LAYING CONCRETE-BLOCK MASONRY IN SUPERSTRUCTURE

10.1 Use of Mortar in Masonry

10.1.1 Hollow concrete block masonry in superstructure shall be laid in composite mortar comprising one part of cement, one part of lime

and nine to ten parts of sand depending upon the grading of sand (*see* **5.6.2** and Table I). Lesser proportion of sand should be adopted if the sand to be used is either not properly graded or is rather fine.

10.1.2 *Horizontal* (*Bedding*) *Joints* — Mortar shall be spread over the entire top surface of the block including front and rear shells as well as the webs to a uniform layer of one centimetre thickness. Normally full mortar bedding shall be adopted as it enables fuller utilization of the load-carrying capacity of the blocks. But where the walls carry light loads, such as panel walls, in a framed structure 'face-shell' bedding may be used. In this type of bedding the mortar is spread only over the front and rear shells and not on the webs, which helps to arrest the seepage of water through the joints penetrating to the interior surface of the walls.

10.1.3 *Vertical* (*Cross*) *Joints* — For vertical joints, the mortar shall be applied on the vertical edges of the front and rear shells of the blocks. The mortar may be applied either to the unit already placed on the wall or to the next unit to be laid alongside of it. But it will be more convenient to apply mortar on the edges of the succeeding unit when it is standing vertically and then placing it horizontally well-pressed against the previously laid unit. However, whatever the method used for applying mortar, care must be taken to produce well-compacted vertical joints.

In the case of two cell blocks, there is a slight depression on their vertical sides, which may also be filled up with mortar where it is considered necessary to secure greater lateral rigidity.

10.1.4 Mortar shall not be spread so much ahead of the actual laying of the units that it tends to stiffen and lose its plasticity, thereby resulting in poor bond. For most of the work, the joints, both horizontal and vertical, shall be one centimetre thick. Except in the case of extruded-joint construction described later (*see* **10.2.3**), the mortar shall be raked out from the joint with a trowel to a depth of about one centimetre as each course is laid so as to ensure good bond for the plaster.

10.1.5 When the mortar has stiffened somewhat, it shall be firmly compacted with a jointing tool. This compaction is important, since mortar, while hardening, has a tendency to shrink slightly and thus pull away from the edges of the block. The mortar shall be pressed against the units with a jointing tool after the mortar has stiffened to effect intimate contact between the mortar and the masonry unit and obtain a weather-tight joint.

10.1.6 It may be necessary to add mortar, particularly to the vertical joints, to ensure that they are well-filled.

10.2 Operation for Laying Block Masonry

10.2.1 *First Course* — The first course of concrete masonry shall be laid with great care, making sure that it is properly aligned, levelled and plumbed, as this will assist the mason in laying succeeding courses to obtain a straight and truly vertical wall.

Before laying the first course, the alignment of the wall shall be marked on the foundation footings. The blocks for this course shall first be laid dry, that is without mortar over the footing, along a string lightly stretched between properly located corners of the wall in order to determine the correct position of the blocks including those of the cross-walls joining it and also adjust their spacing. When the blocks are set in proper position, the two corner blocks shall be removed, a full mortar bed spread on the footing and these blocks laid back in place truly level and plumb. The string shall then be stretched tightly along the faces of the two corner blocks and the faces of the intermediate ones adjusted to coincide with the line. Thereafter each block shall be removed and relaid over a bed of mortar. After every three or four blocks have been laid, their correct alignment level and verticality shall be carefully checked.

10.2.2 The construction of walls may be started either at the corners first or started from one end proceeding in the other direction. If the corners of the wall are built first, they shall be built four or five courses higher than the centre of the wall. As each course is laid at the corner, it shall be checked for alignment and level and for being plumb. Each block shall be carefully checked with a level or straight-edge to make certain that the faces of the block are all in the same plane. This precaution is necessary to ensure truly straight and vertical walls.

The use of a storey-rod or course-pole, which is simply a board with markings 20 cm apart, provides an accurate method of finding the top of the masonry for each course. All mortar joints shall be one centimetre thick. Each course, in building the corners, shall be stepped back by a half-block and the horizontal spacing of the block shall be checked by placing a mason's level diagonally across the corners of the block.

10.2.3 When filling in the wall between the corners, a mason's line shall be stretched from corner to corner for each course and the top outside edge of each block shall be laid to this line. The manner of handling or gripping the block shall be such as to position the block properly with minimum adjustment.

To assure satisfactory bond, mortar shall not be spread too far ahead of actual laying of the block or it will stiffen and lose its plasticity.

As each block is laid, excess mortar extruding from the joints shall be cut off with the trowel and thrown back on the mortar board to be reworked into the fresh mortar. If the work is progressing rapidly, the extruded mortar cut from the joints may be applied to the vertical face-shells of the block just laid. Should there be any delay long enough for the mortar to stiffen on the block, the mortar shall be removed to the mortar board and reworked. Dead mortar that has been picked up from the scaffold or from the floor shall not be used.

10.2.4 *Closure Block* — When installing the closure block, all edges of the opening and all four vertical edges of the closure block shall be buttered with mortar. The closure block shall be carefully lowered into place. If any of the mortar falls out leaving an open joint, the closure block shall be removed, fresh mortar applied and the operation repeated.

10.3 Provisions for Door and Window Frames

10.3.1 A course of solid concrete block masonry shall be provided under doors and window openings or a 10 cm thick precast concrete sill-block under windows. The solid course shall extend for at least 20 cm beyond the opening on either side.

10.3.2 For jambs of very large doors and windows either solid concrete blocks shall be provided or, if hollow units are used, the hollows shall be filled in with concrete of mix 1 : 3 : 6.

10.3.3 Mild steel bar holdfasts should be so fastened to the door or window frames that these occur at block course level and their ends are embedded in a hollow which shall be filled up with 1 : 3 : 6 cement concrete.

10.4 Provisions for Lintels

10.4.1 Lintels may consist of either a single precast unit or a number of units. They shall be appropriately reinforced. *In-situ* concrete used for forming a composite lintel with the use of a number of units, shall preferably be of the same mix as of the concrete that is used in the precast units and the composite unit shall also be appropriately reinforced (*see* Note). Where openings occur close to one another a continuous lintel shall be provided.

NOTE — A convenient method of construction of composite lintel is to form it with precast U-shaped units, and providing the required reinforcement bars in the hollow and filling the hollows with 1 : 2½ : 3½ concrete mix.

10.5 Provision for Roof

10.5.1 The course immediately below the roof slab shall be built with solid blocks. Alternatively, U-shaped units may be used and filled in with 1 : 3 : 6 concrete later on.

10.5.2 The top of the roof course shall be finished smooth with a thin layer of 1 : 3 cement mortar and covered with a coat of crude oil, or craft or oil paper to ensure free movement of the roof.

10.5.3 Where the roof slab projects beyond the external wall face, it shall be provided with a drip.

10.6 Intersecting Walls — All walls wherever they meet or intersect shall be bonded or tied securely in accordance with **10.6.1** and **10.6.2**.

10.6.1 *Bearing Walls* — When two bearing walls meet or intersect and the courses are to be laid up at the same time, a true masonry bond between at least 50 percent of the units at the intersection is necessary.

When such intersecting bearing walls are laid up separately, pockets with 20 cm maximum vertical spacing shall be left in the first wall laid. The corresponding course of the second wall shall be built into these pockets.

10.6.2 *Non-bearing Walls* — Meeting or intersecting non-bearing walls shall be bonded in a manner approved by a specialist experienced on such construction. Either of the two methods recommended for bearing walls may be used.

10.7 Pilasters and Piers — The side walls of long buildings shall be stiffened at regular intervals with pilasters which are about twice the thickness of the wall. Piers often support the ends of long roof trusses such as may be used in machine sheds and other buildings. The top courses of block in the pier may be filled with concrete.

Hollow concrete block shall not be used for isolated piers unless their hollows are filled up with concrete. The unsupported height of such piers shall not exceed eighteen times their least horizontal direction.

11. RENDERING AND OTHER FINISHES

11.1 External Renderings — As hollow concrete blocks are almost invariably made of lean concrete mixes they will not be impervious and will become damp when exposed to rain. The exterior surface of all hollow concrete block walls shall, therefore, be made waterproof by treating the walls with different types of renderings as explained in **11.1.1** to **11.1.4** depending upon the intensity of rainfall, nature of exposure or other reasons.

Renderings shall not be applied to the walls when these are wet or in monsoon. The walls must be treated only after they are fully dried.

Satisfactory performance of any rendering depends entirely on the efficiency of the bond developed between the rendering and the wall surface. Extreme care shall therefore be taken to ensure effective bond with the wall by preparing the surface, roughening it if necessary, raking out the joints to a depth of at least 10 mm, cleaning the surface of all loose particles and dust, and lightly moistening it with water just prior to applying the rendering to prevent absorption of water from it.

The plaster finishes shall be applied in accordance with IS : 2402-1963 Code of Practice for External Rendered Finishes.

The sand used for the plaster finish shall be graded from 3 mm downwards. The plaster shall not be finished smooth, but provided with a coarse finish by means of a wooden float.

11.1.1 In localities where rainfall is heavy or the walls are exposed to sea weather, concrete block masonry shall be rendered with two coats each of 6 to 12 mm thickness of cement mortar as specified by the engineer; the base coat being of 1 : 3 mix and the finishing coat of 1 : 3 or 1 : 4 mix depending upon the severity of the exposure.

11.1.2 In moderate rainfall areas, concrete block masonry shall be rendered with at least one coat of 6 to 12 mm thickness of either 1 : 4 cement mortar or 1 : 1 : 6 cement-lime-sand mortar.

11.1.3 In areas of scarce rainfall, the exterior surface of concrete block masonry may only be pointed with 1 : 3 cement mortar, and white or colour washed.

11.1.4 Where for architectural or other reasons it is necessary to have the concrete block surface exposed, the walls shall either be built with block having richer facing mixture or treated with two coats of approved quality of cement-based paint. In either case the walls in heavy or moderate rainfall areas shall be pointed with 1 : 2 cement mortar.

11.2 Internal Renderings — As machine-made concrete blocks are of uniform size, walls built with them provide a very even surface. Where it is desired to have the block surface exposed, the walls may only be flush pointed and painted with any approved quality of paint including a cement paint. Otherwise the interior surface on walls shall be plastered with one coat of 6 to 12 mm thickness of either 1 : 4 cement mortar or 1 : 1 : 6 cement-lime-sand mortar. Where a very smooth finish is desired a second coat of 2 to 3 mm thickness of lime *neeru* finish may be applied.

11.3 Waterproofing Basement Walls below Ground Level — The portion of walls below ground level shall be waterproofed by application of 12 mm thick cement plaster 1 : 3 mix put on in two coats. The

plaster shall be started on the outside of the wall just below the ground line and continued down the wall and across the edge formed by the projection of the footing. In case the subsoil is wet, the plaster shall be coated with asphalt.

12. MAINTENANCE

12.1 The exposed wall shall be inspected closely every year before monsoons, and cracks, if any, shall be sealed properly with a cement grout and painted with two coats of cement-paint.

APPENDIX A

(*Clause* 6.2.1)

DESIGN ANALYSIS AND WORKING STRESSES FOR CONCRETE HOLLOW BLOCK MASONRY

A-1. LOAD AND ITS DISTRIBUTION

A-1.1 Applied loading from gravity, impact, and wind, shall be assessed as specified in *IS : 875-1957 Code of Practice for Structural Safety of Buildings : Loading Standards. Earthquake loadings shall be assessed as specified in *IS : 1893-1962 Recommendations for Earthquake Resistant Design of Structures.

A-1.2 Distribution of Load

A-1.2.1 The applied loadings and the induced loadings shall be distributed to the various resisting elements of the building, including masonry, in proportion to their rigidities (*see* Note).

Such distribution shall be considered firstly, according to the rigidities of the basic structure, and secondly, according to the rigidities of the complete building. For this purpose, unreinforced masonry shall be regarded as linearly elastic in tension, compression, and shear, while reinforced masonry shall be regarded as linearly elastic in both direct compression and in compression due to shear.

NOTE — *Moduli of Elasticity and of Rigidity of Masonry* — For masonry made of concrete hollow blocks, the modulus of elasticity in tension and compression shall be taken as $10{\cdot}5 \times 10^5$ kg/cm^2 and the shear modulus shall be taken as 4×10 kg/cm^2. Alternatively, the engineer may either require or permit the use of moduli of rigidity for calculation purposes as determined by standard tests conducted under his supervision and approval.

*Since revised.

A-1.2.2 *Isolation of Components* — In distributing loadings according to the rigidities of components full allowance may be made for efficient structural separations of components, provided no damage can occur through the deformations and relative displacements associated with the design loadings.

A-2. WORKING STRESSES

A-2.1 The applied and the induced stresses, calculated on net area, and in unreinforced concrete masonry, with or without continuous inspection, shall not exceed the following values:

With continuous inspection	Compression	4·2 kg/cm²
	*Tension	0·7 kg/cm²
	Shear	0·7 kg/cm²
Without continuous inspection	Compression	2·8 kg/cm²
	*Tension	0·4 kg/cm²
	Shear	0·4 kg/cm²

A-2.1.1 The use of higher stresses in design than set out in **A-2.1** shall be permitted only on the condition that continuous inspection of masonry work is maintained during construction by a competent Engineer-in-Charge.

A-2.2 Where masonry for filling panels is bounded and supported by either a steel, reinforced concrete, or reinforced masonry frame, which is able to resist at normal stresses the applied loading without assistance from the panel then the stresses from the loading components in the plane of the panel may be increased, but shall not exceed twice those given in **A-2.1**.

A-2.3 Where any excess in the stresses permitted by **A-2.1**, **A-2.2** and **A-2.7** is entirely due to wind or earthquake, the permissible stresses may be exceeded by one-third.

A-2.4 Stresses under Concentrated Loads

A-2.4.1 Local stresses resulting from concentrated loads and the maximum combined stresses resulting from these or other loadings shall not exceed the allowable stresses for that part of the structure by more than 50 percent.

A-2.4.2 Concentrated loads shall not be considered as being distributed by metal ties, nor across continuous vertical joints.

*Tension shall be allowed only in walls continuously supported laterally both top and bottom. A system of lateral supports spaced at not more than 1·6 m shall be considered as continuous support.

A-2.5 Reduction in Stress for Slenderness of Components — The maximum working stresses in masonry shall be the permissible values as determined from **A-2.1** to **A-2.3** multiplied by the appropriate slenderness factors (*see* *IS : 1905-1961 Code of Practice for Structural Safety of Buildings : Masonry Walls).

A-2.6 Partition Walls — Where masonry partition walls are used the allowable stresses in tension due to laterally applied loads may be increased to twice the tensile stresses allowed by **A-2.1.**

A-2.7 Reinforcement Stresses — The tensile stress shall not exceed 1 400 kg/cm^2 for plain round rods conforming to *IS : 432-1960 Specification for Mild Steel and Medium Tensile Steel Bars and Hard-Drawn Steel Wire for Concrete Reinforcement (*Revised*) or deformed bars conforming to *IS: 1139-1959 Specification for Hot Rolled Mild Steel and Medium Tensile Steel Deformed Bars for Concrete Reinforcement.

A-3. ASSESSMENT OF STRENGTH

A-3.1 Limitation on Strength of Unreinforced Masonry — A building incorporating reinforced masonry framing or other structural framing shall have its basic structure able to resist all applied loadings without any contribution to strength from unreinforced masonry.

A-3.2 Stresses shall be computed on the basis of the net thickness of the masonry, with considerations for reduction such as at raked joints.

A-3.3 Combined Stresses — Masonry subject to combined axial and flexural stresses shall be designed so that the quantity

$$\frac{fa}{Fa} + \frac{fb}{Fb} \text{ does not exceed } 1$$

where

fa = direct stress computed on net area;

Fa = maximum value of fa permitted, multiplied by slenderness factors for axial load;

fb = actual stress due to bending; and

Fb = permissible stress in bending.

*Since revised.

BUREAU OF INDIAN STANDARDS

Headquarters:
Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002
Telephones: 323 0131, 323 3375, 323 9402
Fax : 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanstha
(Common to all Offices)

	Telephone
Central Laboratory:	
Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad 201010	8-77 00 32
Regional Offices:	
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	323 76 17
*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054	337 86 62
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	235 23 15
†Western : Manakalaya, E9, Behind Marol Telephone Exchange, Andheri (East), MUMBAI 400093	832 92 95
Branch Offices:	
'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001	550 13 48
‡Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, BANGALORE 560058	839 49 55
Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar, BHOPAL 462003	55 40 21
Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001	40 36 27
Kalaikathir Buildings, 670 Avinashi Road, COIMBATORE 641037	21 01 41
Plot No. 43, Sector 16 A, Mathura Road, FARIDABAD 121001	8-28 88 01
Savitri Complex, 116 G.T. Road, GHAZIABAD 201001	8-71 19 96
53/5 Ward No. 29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003	54 11 37
5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001	20 10 83
E-52, Chitaranjan Marg, C-Scheme, JAIPUR 302001	37 29 25
117/418 B, Sarvodaya Nagar, KANPUR 208005	21 68 76
Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road, LUCKNOW 226001	23 89 23
NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010	52 51 71
Patliputra Industrial Estate, PATNA 800013	26 23 05
Institution of Engineers (India) Building 1332 Shivaji Nagar, PUNE 411005	32 36 35
T.C. No. 14/1421, University P.O. Palayam, THIRUVANANTHAPURAM 695034	6 21 17

*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, CALCUTTA 700072 — 27 10 85

†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007 — 309 65 28

‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square, BANGALORE 560002 — 222 39 71

Printed at Simco Printing Press, Delhi