IS 2572 (2005): Construction of hollow and solid concrete block masonry - Code of practice [CED 53: Cement Matrix Products]

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भारतीय मानक

खोखले एवं ठोस कंक्रीट ब्लाक चिनाई का निर्माण — रीति संहिता

(पहला पुनरीक्षण)

Indian Standard

CONSTRUCTION OF HOLLOW AND SOLID CONCRETE BLOCK MASONRY — CODE OF PRACTICE

(First Revision)

ICS 91.080.30; 91.100.30

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

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Price Group 8

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement Matrix Products Sectional Committee had been approved by the Civil Engineering Division Council.

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. This standard was, therefore, first formulated in 1963.

This standard is being proposed with a view to incorporate modifications found necessary as a result of experience gained with the use of this standard and to bring the standard in line with the present practices being followed. The principal modifications in this revision are as follows:

a) Provision for use of additional types of cements has been incorporated.

b) Reference to appropriate Indian Standards for different raw materials, guidelines for their stacking at site, etc, has been included.

c) For avoiding cracks in mortar joints additional provision of use of lime, preferably hydrated lime, marble powder, gypsum, etc, has been included.

d) Provisions along with the guidance for the use of special blocks at appropriate locations have been included.

e) Method for providing cement concrete gola in the parapet wall without cutting chase in the masonry has been included.

f) Provisions for door and windows have also been slightly modified for jambs and sills by providing reinforced concrete.

g) Additional methods of bonding the intersecting walls by using tie bars, have been suggested.

h) Provision of cement pointing in mortar joints of masonry for external as well as internal wall surfaces have been elaborated.

The Committee responsible for the formulation 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.

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

IS No.	*Title*
IS 1905 : 1987	Code of practice for structural use of unreinforced masonry (*first revision*)
IS 2212 : 1991	Code of practice for brickworks (*first revision*)
IS 6041 : 1985	Code of practice for construction of autoclaved cellular concrete block masonry (*first revision*)
IS 6042 : 1969	Code of practice for construction of light weight concrete block masonry

(*Continued on third cover*)

Indian Standard

CONSTRUCTION OF HOLLOW AND SOLID CONCRETE BLOCK MASONRY — CODE OF PRACTICE

(First Revision)

1 SCOPE

This standard covers the construction of walls and partitions with precast hollow and solid concrete blocks as per IS 2185 (Part 1) : 2004 'Specification for concrete masonry units : Part 1 Hollow and solid concrete blocks (*second revision*)'.

2 REFERENCES

The Indian Standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For general terms with regard to masonry works, reference may be made to IS 2185 (Part 1) and IS 2212.

4 NECESSARY INFORMATION

4.1 For efficient planning, design and execution of the work, detailed information with regard to the following shall be furnished to those responsible for 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, showing reinforced bands, ties, etc.

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

d) Details of fixing of door and window frames to masonry wall.

e) Location and other details of service lines, such as for water supply, drainage, sewerage, electrical installations, telephone, cable TV, etc.

f) The grade of blocks.

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

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

5 PROGRAMMING OF THE WORK

5.1 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.

5.2 Particular attention shall be paid to the following items:

a) 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) Installation of conduits and services within, on the face of or through the walls and partitions.

c) 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.

5.3 The time schedule shall include dates for the following:

a) Supply of drawings and specifications for materials to be used;

b) Delivery of materials, masonry units and accessories; and

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

5.4 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.

6 MATERIALS

6.1 Masonry Units

Hollow and solid concrete blocks used as masonry units shall conform to IS 2185 (Part 1).

6.2 Cement

Cement shall conform to IS 269 or IS 455 or IS 1489 (Part 1) or IS 1489 (Part 2) or IS 3466 or IS 8041 or IS 8043 or IS 8112 or IS 12269.

6.3 Lime

Lime shall conform to IS 712. The lime shall be of Class C, unless otherwise specified.

6.4 Water

Water shall be clean and free from injurious amounts of deleterious materials. Portable water is generally considered satisfactory for use in masonry mortar. For further requirements regarding limits of deleterious materials permitted in water, reference may be made to IS 456.

6.5 Sand

Sand for masonry work shall conform to IS 2116. Sand for concrete work shall conform for the requirements of IS 383.

6.6 Coarse Aggregate

Coarse aggregate, where used shall conform to IS 383.

6.7 Fly Ash

Fly ash conforming to IS 3812 (Part 1) may be used as part replacement of ordinary Portland cement up to a maximum of 20 percent, provided homogeneous mixing is ensured.

6.8 Additives

Additives used, if any, shall conform to IS 9103.

6.9 Mortar

6.9.1 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.

6.9.2 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 1.

6.9.3 All mortar shall be prepared in accordance with IS 2250.

6.10 Concrete

Concrete used for filling cells in hollow concrete block masonry when reinforced, shall be composed of one part of cement, two parts of sand, three parts of coarse aggregate and when unreinforced it shall be composed of one part of cement, three parts of sand, six parts of coarse aggregate. The cell containing reinforcement bars may alternatively be filled using cement coarse sand mortar 1 : 3. The mortar or concrete shall be properly pumped or rodded or vibrated for compaction.

Table 1 Mix Proportions of Mortar for Hollow and Solid Concrete Block Masonry

(*Clause* 6.9.2)

Sl No.	Type of Work	Normal Masonry Without Reinforcement			Masonry Where Reinforcement is Used	
		Cement	Lime	Sand	Cement	Sand
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Normal Work	1	1	9-10	1	7-8
ii)	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	6-7	1	4-5
iii)	Partitions of 100 mm nominal thickness	1	1	7-8	1	5-6

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 **6.5** the higher figure should be adopted, but where the sand is not graded and is rather fine, the lower sand content should be used.

7 DESIGN CONSIDERATIONS

7.1 Choice of Type of Wall

The type of wall for different situations of use concrete block masonry shall be as under:

a) External and internal load bearing wall shall be of hollow concrete blocks of appropriate thickness. Exposed walls shall be rendered externally with cement plaster in accordance with **12.1** or cement pointing be done with richer mortar to effect economy and retain the finish of the block surface.

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 **12**.

c) In block work below plinth level, where it is not required to use hollow blocks for reinforced block work purposes, solid block shall be used. Likewise in case of unreinforced load bearing hollow block structure, solid blocks shall be used below plinth level. In case hollow block are used below plinth level their cells shall be filled up with 1 : 3 : 6 concrete. The inner and outer leave shall be interconnected for stability by use of appropriate bands.

7.2 Strength and Stability

7.2.1 Unless otherwise specified, the design and construction of concrete block masonry walls shall conform to the requirements of IS 1905. The earthquake Resistant Design and Construction of Buildings shall be as per IS 4326.

7.2.1.1 The nominal thickness of load bearing masonry built with hollow concrete blocks shall be not less than 200 mm. The designer shall make assessment about the thickness of wall required based on level of wall (floor and number of storey), compressive strength of blocks, mortar, reinforcement, etc.

7.2.1.2 The minimum nominal thickness of non-load-bearing internal partitions shall be 100 mm.

7.2.1.3 The minimum nominal thickness of external panel walls in framed construction shall preferably be not less than 200 mm. However, depending upon the local conditions and the desired effect of thermal transmission and sound reduction, 150 mm thick panel walls may be used provided they are suitably braced and reinforced by lateral or vertical supports.

7.2.2 *Parapet Walls*

Unless adequately braced at intervals not exceeding 3 m, the height of the wall shall be limited to five times its thickness.

7.2.3 *Lateral Supports*

7.2.3.1 Lateral supports shall be as per **4.2** of IS 1905.

7.3 Modular Co-ordination

7.3.1 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.

7.3.2 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, window 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.

7.4 Avoidance of Crack Formation

7.4.1 The major causes of cracks in the structure of hollow concrete block wall or partition and measures for their preventions are described in **7.4.2** to **7.4.3.2**.

7.4.2 *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 **7.4.2.1** to **7.4.2.3**.

7.4.2.1 In the case of framed structure, 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.

7.4.2.2 *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 400 mm height. This can also be achieved by using joint reinforcement as per **7.5.5.1** of IS 6042.

7.4.2.3 *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.

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.

7.4.3 *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 given in **7.4.3.1** and **7.4.3.2**.

7.4.3.1 *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 blocks 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 m and about 15 to 18 m 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.

7.4.3.2 *For movement 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 m.

7.4.3.3 *For cracks in mortar joints*

So as to avoid this crack it is essential that the mortar used for hollow block masonry is not only leaner than the mix used for producing the blocks but should also contain lime, preferably hydrated lime, marble powder and gypsum, to make the mortar more workable by making it more plastic and imparting the property of autogenous healing.

8 STORAGE AND HANDLING OF MATERIALS

8.1 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 block shall be handled with care and damaged units shall be rejected (*see also* IS 4082).

8.2 Cement, lime, aggregates, and other masonry materials shall be stored and handled as laid down in the relevant Indian Standard specifications for these materials (*see also* IS 4082).

9 PREPARATORY WORK

9.1 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* **7.4.3.1**).

10 CONCRETE BLOCK MASONRY WORK IN FOUNDATION AND BASEMENT

10.1 Construction of Masonry

10.1.1 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.

10.1.2 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* **6.7.2** and Table 1). 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.

11 LAYING CONCRETE BLOCK MASONRY IN SUPERSTRUCTURE

11.1 Use of Mortar in Masonry

11.1.1 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* **6.7.2** and Table 1). Lesser proportion of sand should be adopted if the sand to be used is either not properly graded or is rather fine.

11.1.2 *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.

11.1.3 *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.

11.1.4 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 1 cm thick. Except in the case extruded joint construction described in **11.2.3**, the mortar shall be raked out from the joint with a trowel to a depth of about 1 cm as each course is laid so as to ensure good bond for the plaster.

11.1.5 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.

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

11.2 Operation for Laying Block Masonry

11.2.1 *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. Tools used for laying masonry are given in Fig. 1. For laying hollow block concrete masonry, figures are given for general guidance (*see* Fig. 2, 3, 4, 5, 6 and 7).

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 should 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 two corner blocks and the faces of intermediate one 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.

11.2.2 The construction of the walls may be started either at corners first or started from one end proceeding in 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 each 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 200 mm apart, provides an accurate method of finding the top of the masonry for each course. All mortar joints shall be 1 cm thick. Each course, in building the corners, shall be stepped back by a half-block and the horizontal spacing on the block shall be checked by placing a mason's level diagonally across the corners of the block.

11.2.3 When filling 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 bed to be reworked into 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.

11.2.4 *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.

11.2.5 The special blocks like U-block, J-block and C-block shall be appropriately used. U-blocks shall be used at DPC level and on cross walls just below the slabs. J-blocks shall be used below the slabs on outer walls so that the longer shell is on the outside face of the masonry wall. C-blocks may be used to encase the concrete columns to give the same aesthetic look as wall masonry.

11.2.6 Since chase can not be cut in hollow block masonry parapet wall the cement concrete 'gola' should be provided after making chase. First a low height block of 390 mm × 190 mm × 90 mm shall be placed flat with 90 mm height. On it another partition block of 390 mm × 190 mm × 90 mm shall be placed vertically at the outer edge with 190 mm height and 90 mm width. A fluted block with 190 mm height and 190 mm width shall be placed over it so as to create a cavity of 190 mm height and 100 mm width between the flat laid down block and the fluted block. The cavity shall be the filled up with cement concrete 1 : 2 : 4 and tapered at 45° from top to bottom at the open end to form the required 'gola' (*see* Fig. 8).

11.3 Provision for Door and Window Frames

11.3.1 A course of solid concrete block masonry shall be provided under doors and window openings or a 100 mm thick precast concrete fill-block under windows. The solid coarse shall extend for atleast 200 mm beyond the opening on either side and should be enforced with two numbers high strength deformed steel bars of 10 mm diameter.

11.3.2 For jambs of doors and windows where hollow blocks are used the hollow core adjacent to the joints shall be filled with concrete mix of 1:3:6 are reinforced with single high strength deformed steel bars of 10 mm diameter for each jamb.

11.3.3 Mild steel bar holdfasts should be so fastened to the door window frames that these occur at block course level and their ends be embedded in a hollow which shall be filled up with 1 : 3 : 6 cement concrete (*see* Fig. 9).

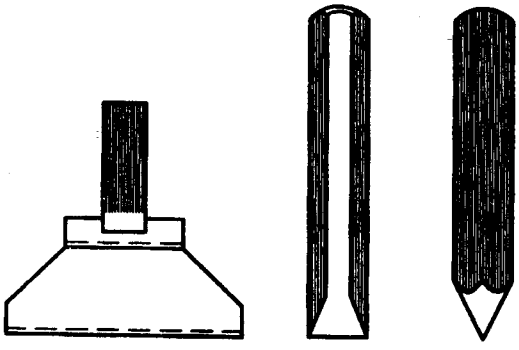
11.4 Provision for Lintels

11.4.1 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). When openings occur close to one another a continuous lintel shall be provided (*see* Fig. 10 for typical construction detail).

NOTE — A convenient method of construction of composite lintel is to form it with precast U-shaped units and providing the required reinforced bars in the hollow and filling the hollows with 1 : 2 : 3 concrete mix.

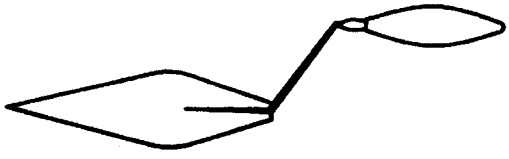
GRADUATED STRAIGHT EDGE

TOOLS FOR FINISHING THE MORTAR JOINTS

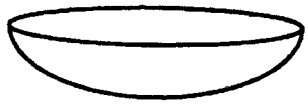


CHISELS

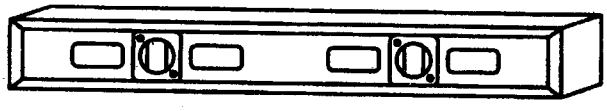
THREAD AND PLUMB BOB



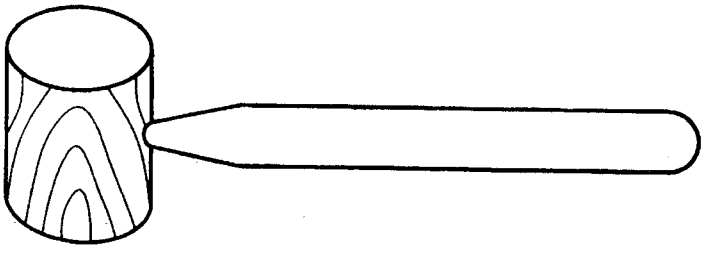
TROWEL



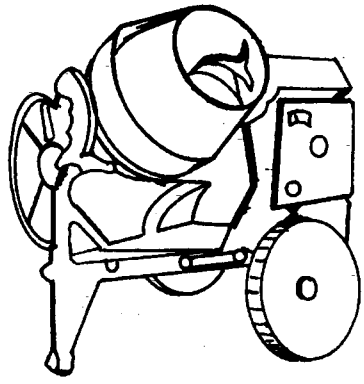
MORTAR PAN



SPIRIT LEVEL (WITH VERTICAL & HORIZONTAL BUBBLES)

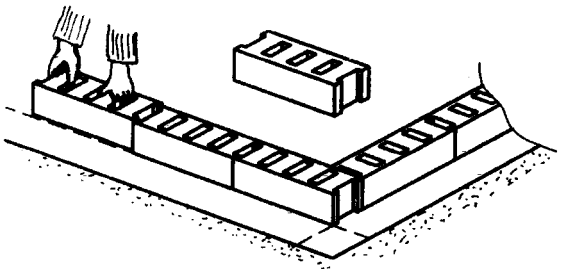


WOODEN MALLET

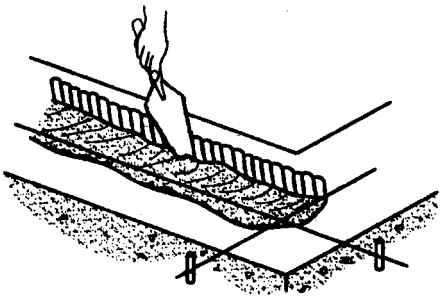


MORTAR MIXING MACHINE

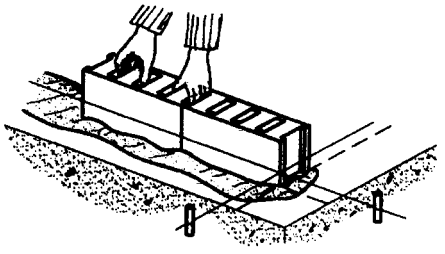
FIG. 1 TOOLS FOR CONCRETE MASONRY



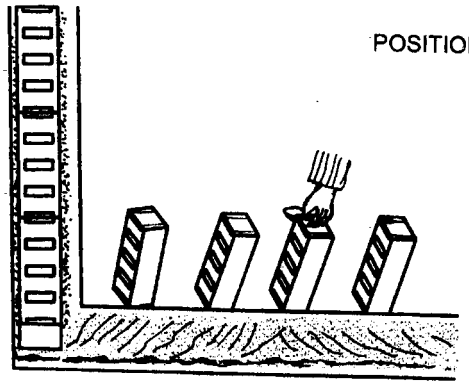
PLACING BLOCKS WITHOUT MORTAR



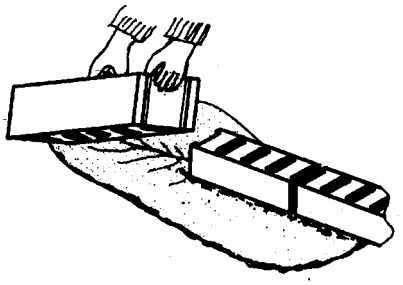
SPREADING AND FURROWING MORTAR BED



POSITIONING AND ALIGHNING CORNER BLOCK

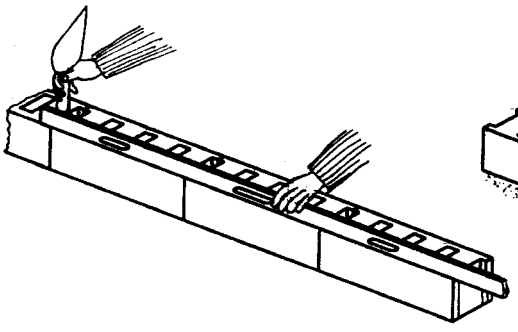


BUFFERING BLOCK FOR VERTICAL JOINTS

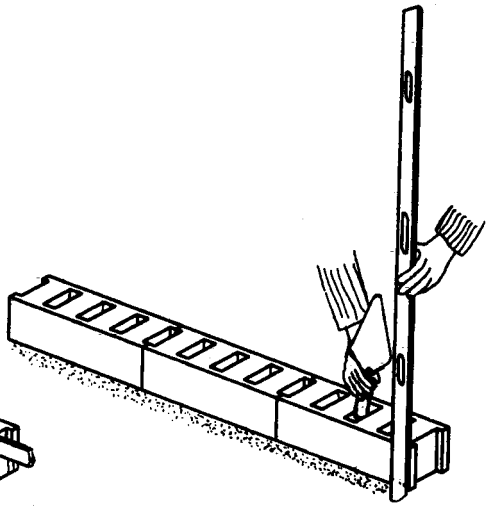


POSITIONING BLOCK

FIG. 2 LAYING FIRST COURSE OF BLOCKS FOR A WALL

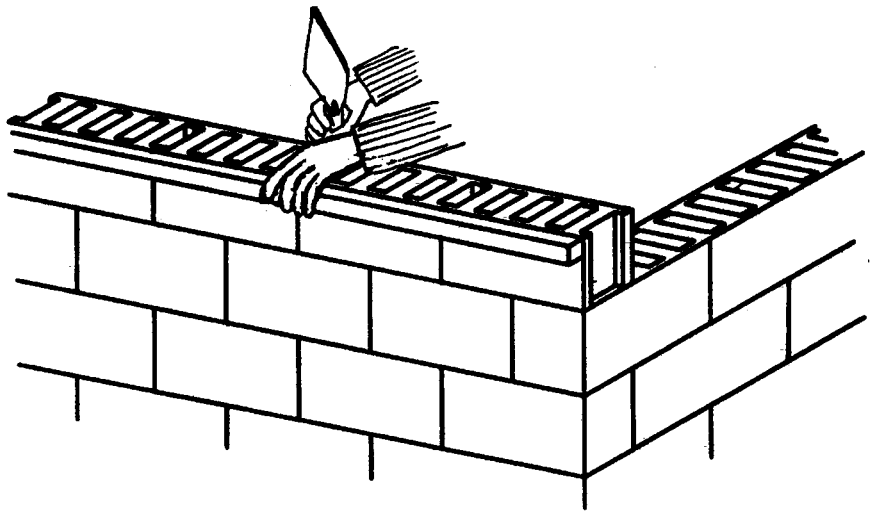


LEVELLING BLOCK

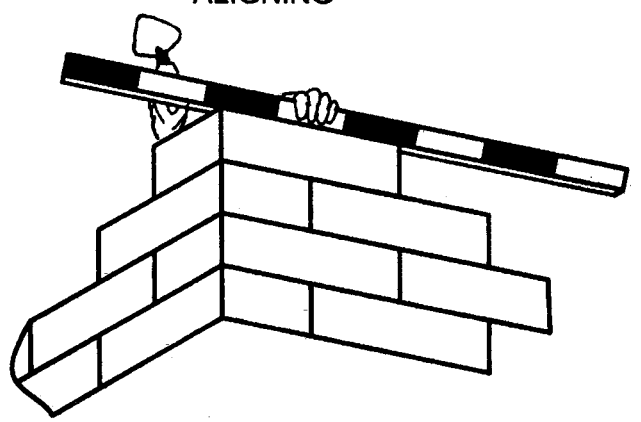


PLUMBING BLOCK

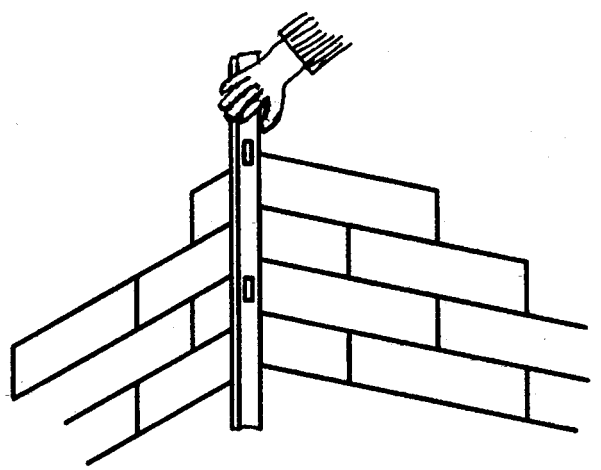
FIG. 3 LEVELLING AND PLUMBING FIRST COURSE OF BLOCKS FOR A WALL



ALIGNING

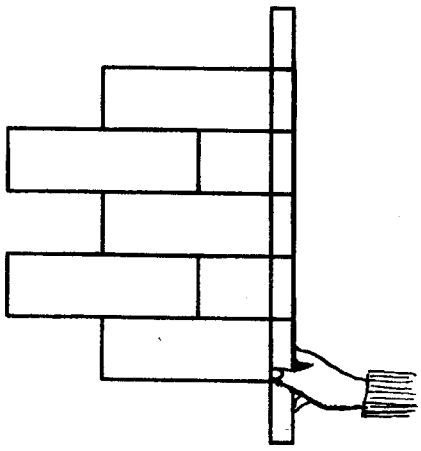


LEVELLING

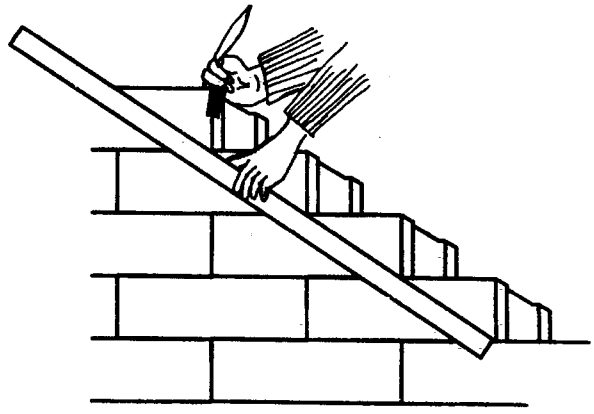


PLUMBING

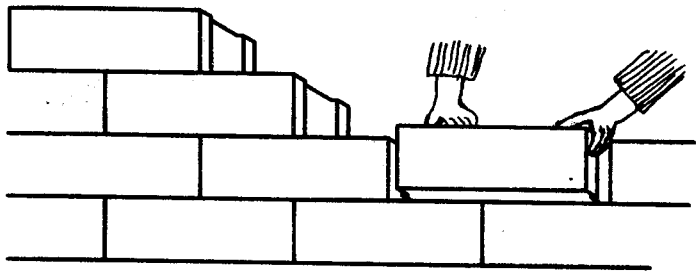
FIG. 4 CHECKING EACH COURSE AT THE CORNER



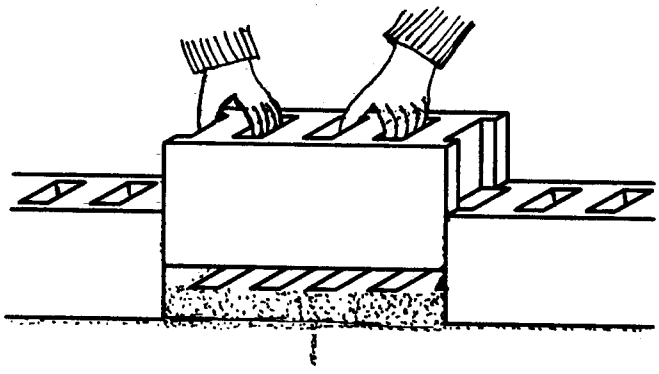
USING A STORY OR COURSE POLE



CHECKING HORIZONTAL BLOCK SPACING



FILLING IN THE WALL BETWEEN CORNERS



INSTALLING A CLOSURE BLOCK

FIG. 5 CONCRETE MASONRY LAYING DETAILS

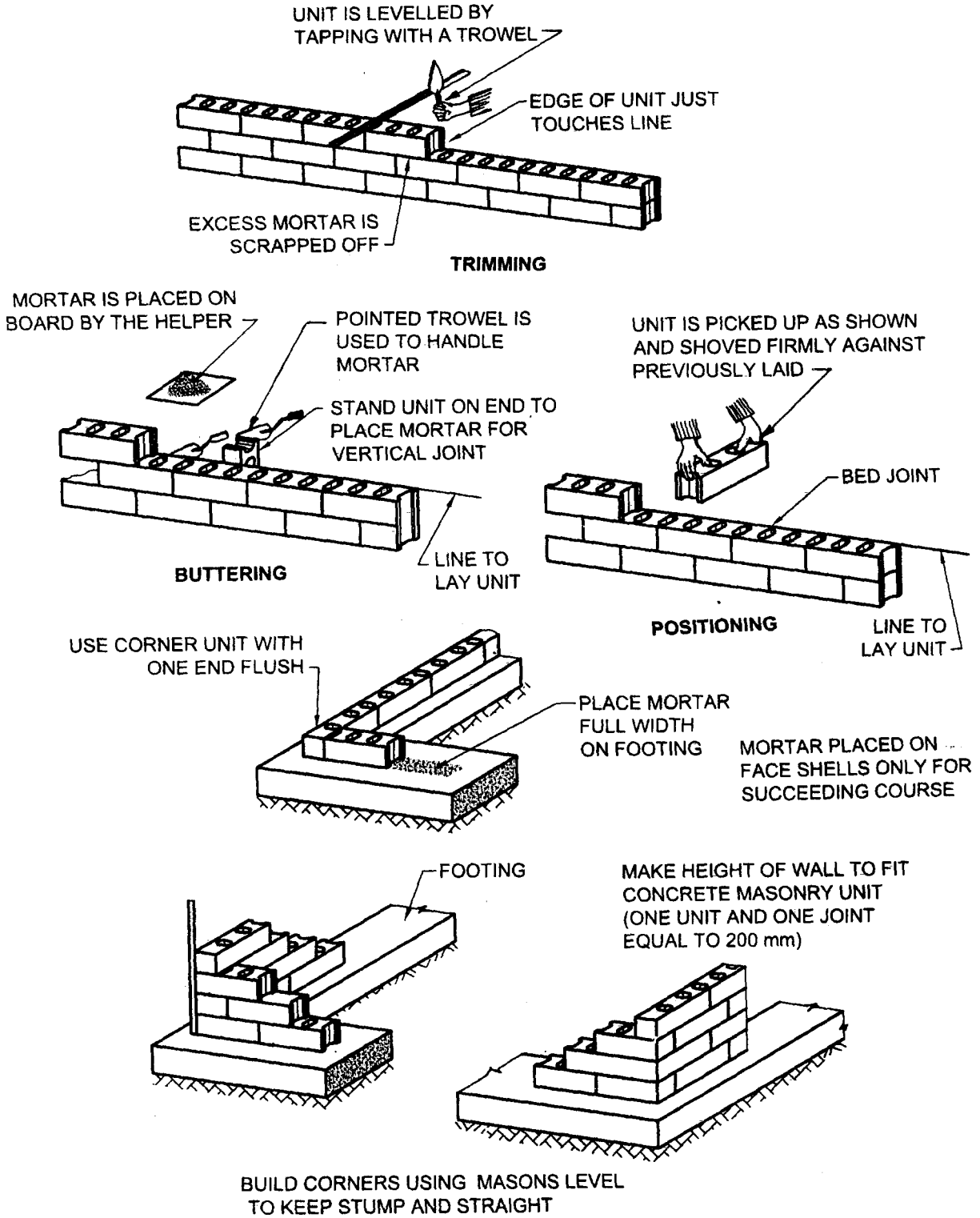
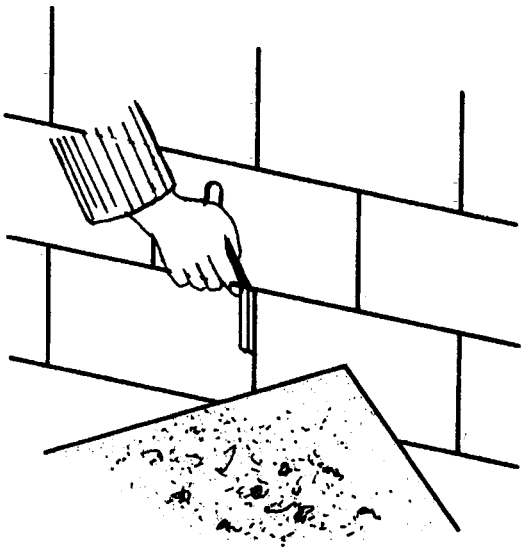
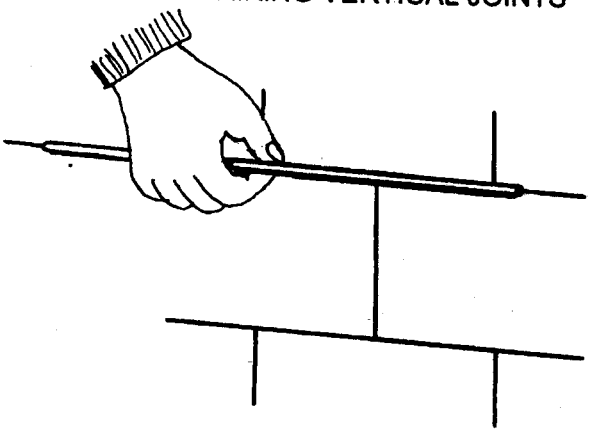


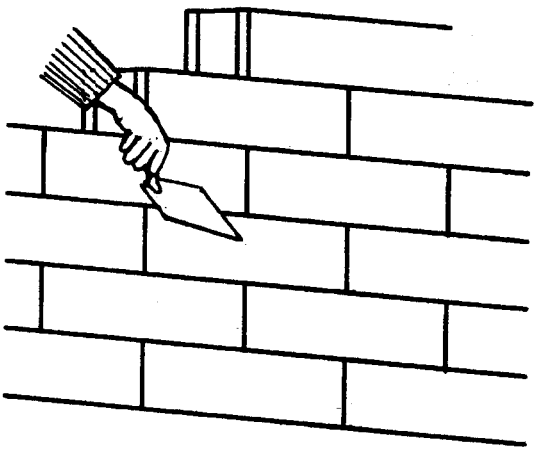
FIG. 6 CONCRETE MASONRY LAYING DETAILS



STRIKING VERTICAL JOINTS



STRIKING HORIZONTAL JOINTS



MORTAR BURRS ARE TRIMMED OFF AFTER THE JOINTS ARE TOOLED

FIG. 7 TOOLING MORTAR JOINTS

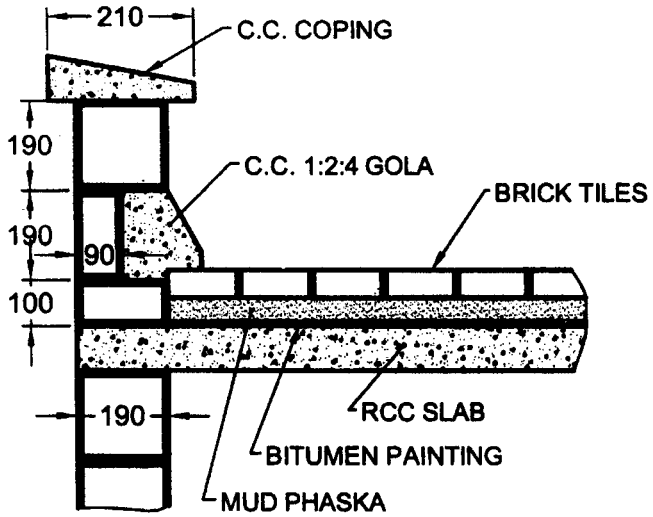
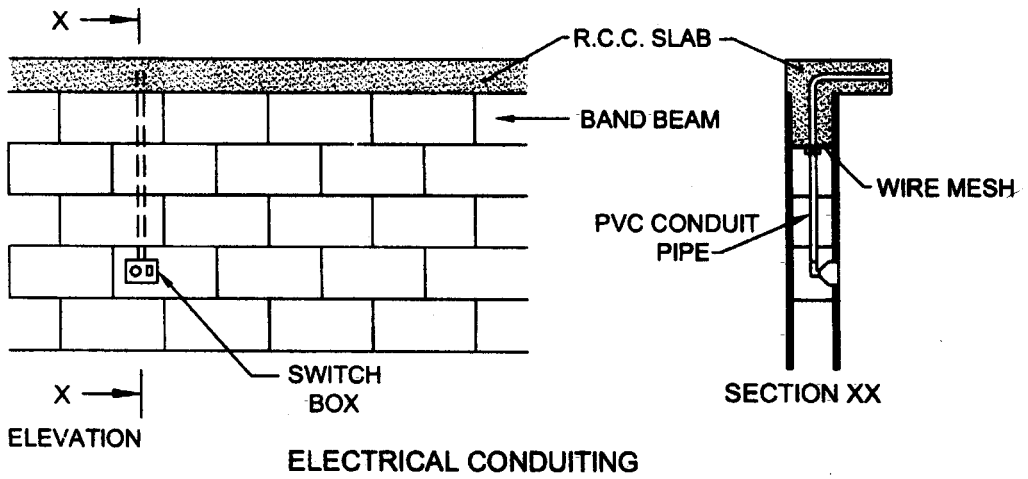


FIG. 8 DETAILS OF GOLA



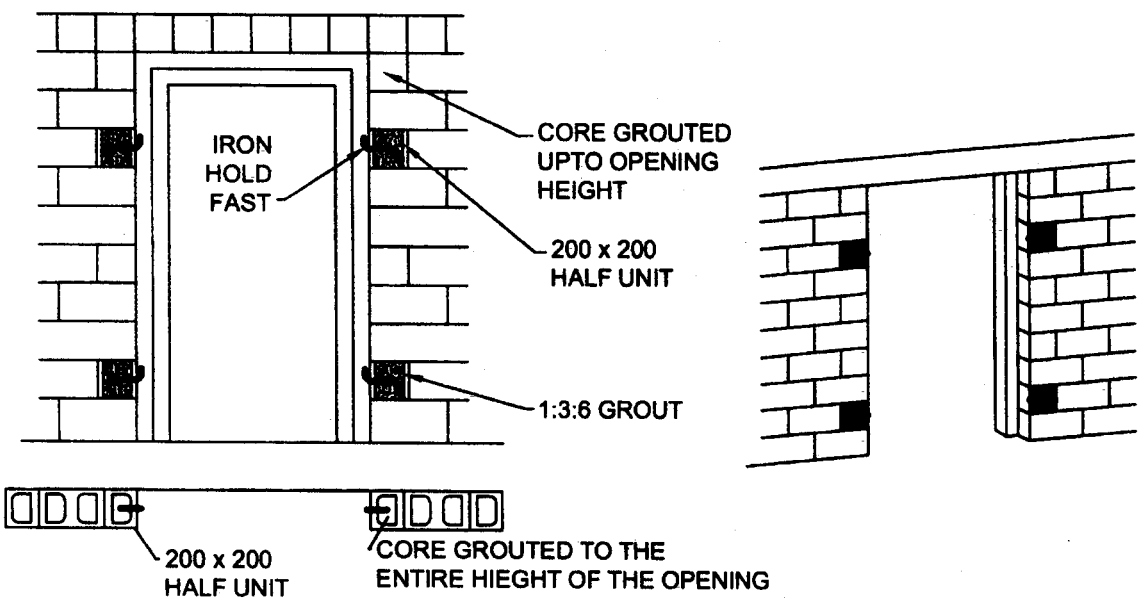
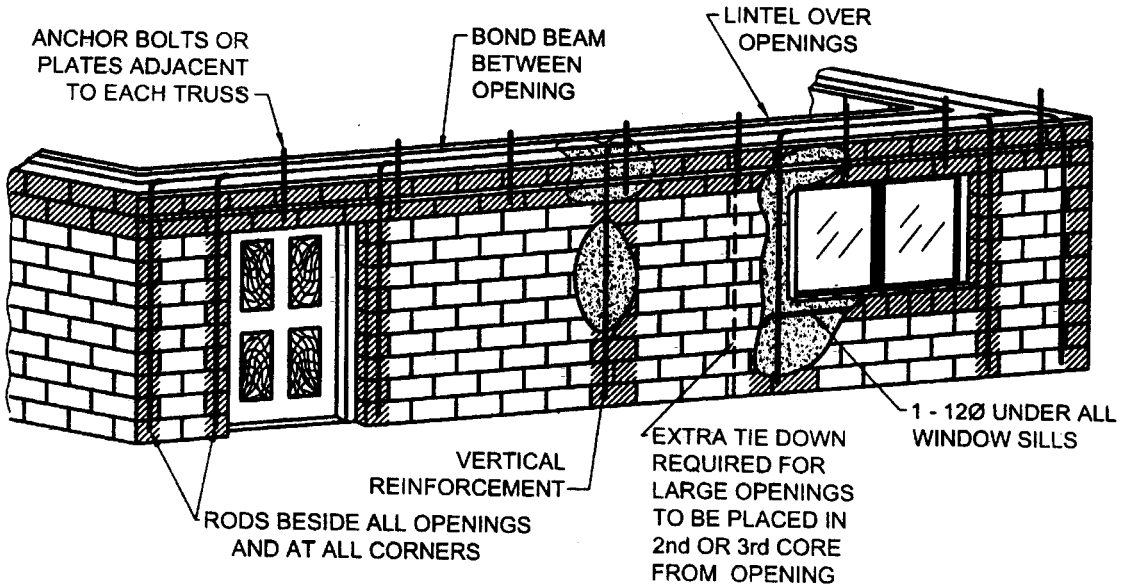


FIG. 9 DOOR FIXATION DETAIL



TYPICAL CONSTRUCTION DETAILS FOR REINFORCED SINGLE-LEAF MASONRY WALLING SYSTEM

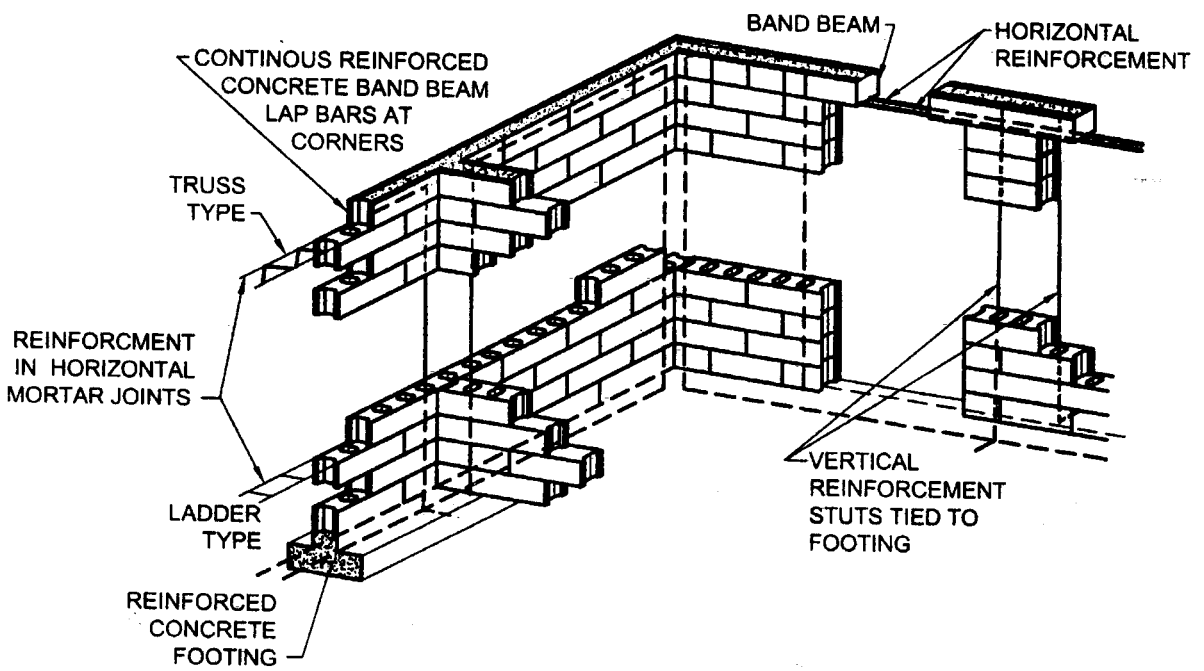


FIG. 10 REINFORCEMENT TYPICAL DETAILS

11.5 Provision for Roof

11.5.1 The course immediately below the roof slab shall be built with appropriate grade of solid blocks or U-shaped units may be used which shall be filled in with 1 : 2 : 4 concrete. If a reinforced roof band is required appropriate reinforcement shall be placed in U-blocks and 1 : 2 : 4 concrete laid.

11.5.2 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.

11.5.3 Where J-blocks are used just below the slabs, concrete should first be filled up to the top of the shorter shell wall and the top surface plastered with 1:3 cement mortar and finished with a coat of neat cement punning and white washed with lime. The slab should then be cast after a kraft paper is placed along the longer shell of the J-block.

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

11.6 Intersecting Walls

All walls wherever they meet or intersect shall be bonded or tied securely in accordance with **11.6.1** and **11.6.2**.

11.6.1 *Load Bearing Walls*

Intersecting load bearing block walls that depend upon one another for continuity and lateral support should be securely anchored to resist all forces that might tend to separate them. When two bearing walls meet or intersect and the courses are to be laid up at the same time, a true masonry bond at the intersection is necessary so that half of the unit of each wall are embedded in other wall.

When such intersecting bearing walls are laid up separately, pockets with 200 mm maximum vertical spacing shall be left in the first wall laid. The corresponding course of the second wall shall be built into these pockets.

Rigid connection to intersecting walls may also be provided by using the round bars in mortar joints or tie round-bars around vertical bars in abutting cores with solid grout in them (*see* Figs. 11A, 11B and 11C). Flexible connections for intersecting walls may also be provided by using steel tie bars as metal anchor (*see* Figs. 12A and 12B).

11.6.2 *Non-bearing Walls*

Meeting or intersecting non-bearing walls shall be bonded by either of the methods recommended for load bearing walls in **11.6.1**.

11.7 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 dimensions.

12 RENDERING AND OTHER FINISHES

12.1 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 wall shall, therefore, be made waterproof by treating the walls with different types of renderings as explained in **12.1.1** to **12.1.4** 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 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 8 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.

The sand used for the plaster finish shall conform to IS 1542. The plaster shall not be finished smooth, but provided with a coarse finish by means of a wooden float.

12.1.1 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.

12.1.2 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.

12.1.3 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 or cement painted.

12.1.4 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 cement paint (*see* IS 5410) of lime neeru finish may be applied. And if pointing is to be done, it shall be flush pointing. Thereafter one or two coats of white wash shall be applied. In either case the walls in heavy or moderate rainfall areas shall be pointed with 1:2 or 1 : 3 cement mortar for pointing on either or both faces, the mortar shall be raked out to a depth of atleast 4 to 8 mm and pressed with the joining tool so as to compact it properly while doing masonry work. However in such cases pointing shall be done as soon as possible on the same day or latest by the next day ensuring that no mortar sticks to face surface of the blocks.

12.2 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 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. If pointing is to be done it shall be flush pointing in accordance to **12.1.4**. Thereafter one or two coats of white wash shall be applied.

12.3 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 applied 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.

13 MAINTENANCE

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

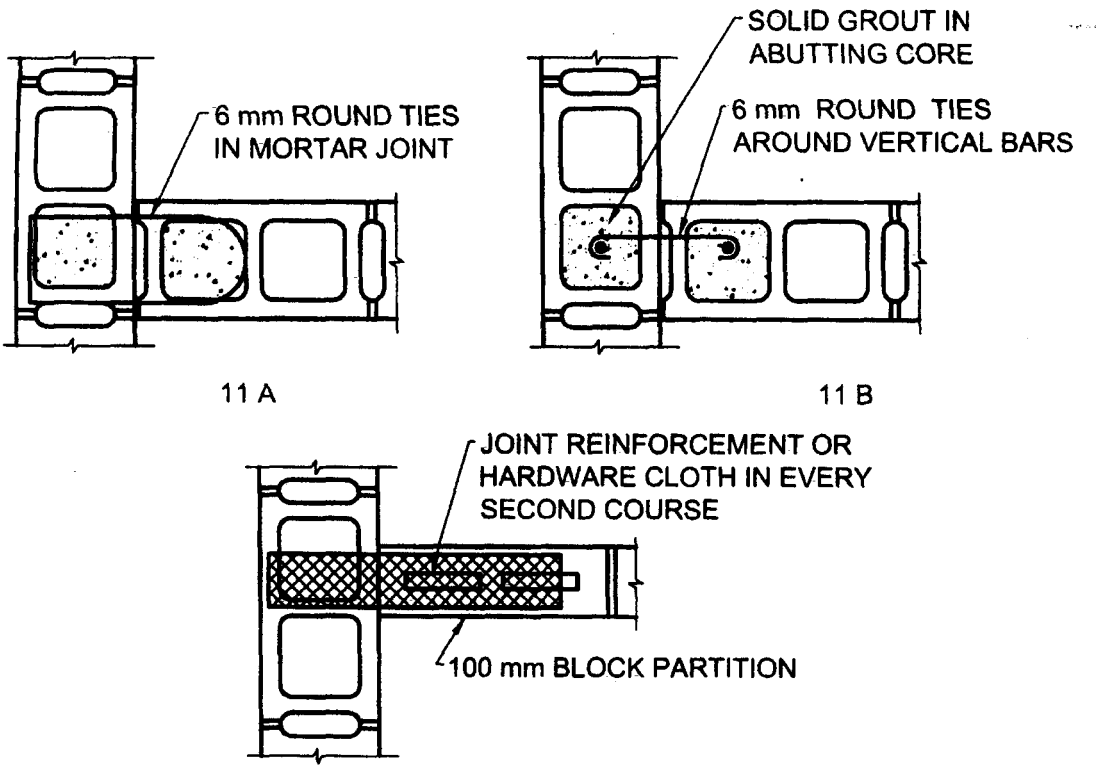


FIG. 11 RIGID CONNECTIONS FOR INTERSECTING WALLS

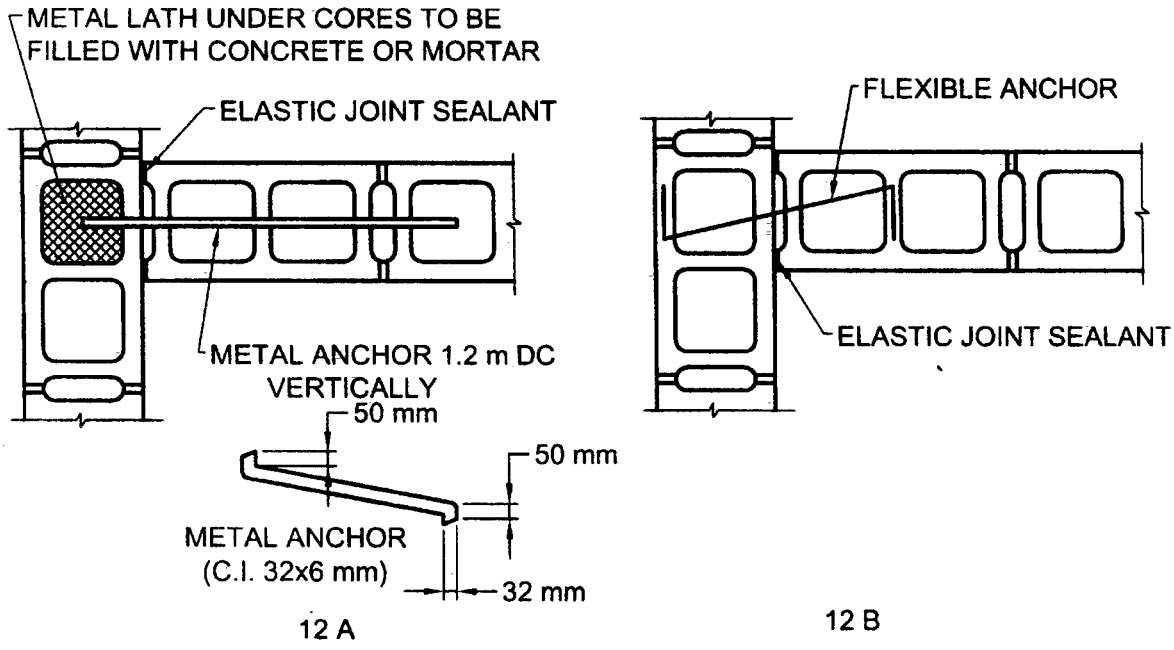


FIG. 12 FLEXIBLE CONNECTIONS FOR INTERSECTING WALLS

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
269 : 1989	Specification for 33 grade ordinary Portland cement (*fourth revision*)
383 : 1970	Specification for coarse and fine aggregates from natural sources for concrete (*second revision*)
432 (Part 1) : 1982	Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars (*third revision*)
455 : 1989	Specification for Portland slag cement (*fourth revision*)
456 : 2000	Code of practice for plain and reinforced concrete (*fourth revision*)
712 : 1984	Specification for building limes (*third revision*)
875 : 1987	Code of practice for design loads (other than earthquake) for buildings and structures
(Part 1) : 1987	Dead loads — Units weights of building material and stored materials (*second revision*)
(Part 2) : 1987	Imposed loads (*second revision*)
(Part 3) : 1987	Wind loads (*second revision*)
(Part 4) : 1987	Snow loads (*second revision*)
(Part 5) : 1987	Special loads and load combinations (*second revision*)
1489	Specification for Portland pozzolana cement:
(Part 1) : 1991	Fly ash based (*third revision*)
(Part 2) : 1991	Calcined clay based (*third revision*)

IS No.	*Title*
1542 : 1992	Specification for sand for plaster (*second revision*)
1635 : 1992	Code of practice for field slaking of building lime and preparation of putty (*second revision*)
1893 : 1984	Criteria for earthquake resistant design of structures (*fourth revision*)
1893 (Part 1) : 2002	Criteria for earthquake resistant design of structures: Part 1 General provisions and buildings (*fifth revision*)
1905 : 1987	Code of practice for structural use of unreinforced masonry (*third revision*)
2116 : 1980	Specification for sand for masonry mortars (*first revision*)
2185 (Part 1) : 1979	Specification for concrete masonry units: Part 1 Hollow and solid concrete blocks (*second revision*)
2212 : 1991	Code of practice for brick work (*first revision*)
2250 : 1981	Code of practice for preparation and use of masonry mortars (*first revision*)
2402 : 1963	Code of practice for external rendered finishes
3466 : 1988	Specification for masonry cement (*second revision*)
3812 (Part 1) : 2003	Pulverized fuel ash — Specification: Part 1 For use as pozzolana in cement, cement mortar and concrete (*second revision*)
4082 : 1996	Recommendations on stacking and storage of construction materials and components at site (*second revision*)
4326 : 1993	Code of practice for earthquake resistant design and construction of buildings (*second revision*)
5410 : 1992	Specification for cement paint (*first revision*)
6042 : 1969	Code of practice for construction of light-weight concrete block masonry
8041 : 1990	Specification for rapid hardening Portland cement (*second revision*)
8043 : 1991	Specification for hydrophobic Portland cement (*second revision*)
8112 : 1980	Specification for 43 grade ordinary Portland cement (*first revision*)
9103 : 1999	Specification for admixtures for concrete (*first revision*)
12269 : 1987	Specification for 53 Grade ordinary Portland cement

ANNEX B

(*Clause* 7.2.1)

DESIGN ANALYSIS AND WORKING STRESSES FOR CONCRETE HOLLOW BLOCK MASONRY

B-1 LOAD AND ITS DISTRIBUTION

Applied loading from gravity, impact, and wind, snow, etc, shall be assessed as specified in IS 875. Earthquake loadings shall be assessed as specified in IS 1893.

B-1.2 Distribution of Load

B-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 — Module 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 10.5×10 kg/cm^2 and the shear modulus shall be taken 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.

B-1.2.2 *Isolation of Components*

In distributing loading 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.

B-2 WORKING STRESSES

B-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:

Compression		4.2 kg/cm^2
With continuous	+ Tension	0.7 kg/cm^2
Inspection	+ Shear	0.7 kg/cm^2
Compression		2.8 kg/cm^2
With continuous	+ Tension	0.4 kg/cm^2
Inspection	+ Shear	0.4 kg/cm^2

B-2.1.1 The use of higher stresses in design than set out in **B-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.

B-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 **B-2.1**.

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

B-2.4 Stresses under Concentrated Loads

B-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.

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

B-2.5 Reduction in Stress for Slenderness of Components

The maximum working stresses in masonry shall be permissible values as determined from **B-2.1** to **B-2.3** multiplied by the appropriate slenderness factors (*see* IS 1905).

B-2.6 Partition Walls

Where masonry partition walls are used the allowable stresses in the tension due to laterally applied loads may be increased from twice the tensile stresses allowed by **B-2.1**.

B-2.7 Reinforcement Stresses

The tensile stress shall not exceed 1 400 kg/cm^2 for plain round rods conforming to IS 432 (Part 1) or deformed.

B-3 ASSESSMENT OF STRENGTHS

B-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.

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

B-3.3 Combined Stresses

Masonry subject to combined axial and flexural stresses shall be designed so that the quantity

$f_a/F_a + f_b/F_b$ does not exceed 1.

where

f_a = direct stress computed on net area;

F_a = maximum value of f_a permitted, multiplied by slenderness factors for axial loads;

f_b = actual stress due to bending; and

F_b = permissible stress in bending.

(*Continued from second cover*)

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

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.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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