भारतीय मानक

# पूर्व ढली कंक्रीट के पत्थर के चिनाई खण्डों की दिवारों का निर्माण — रीति संहिता

*Indian Standard*

# CONSTRUCTION OF WALLS USING PRECAST CONCRETE STONE MASONRY BLOCKS — CODE OF PRACTICE

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

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Price Group 4

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Housing Sectional Committee had been approved by the Civil Engineering Division Council.

Stone is a potential building material in those areas where it is available in abundance. Stones of irregular shape and size, when used in the form of random rubble masonry for construction of walls, consume excessive materials and are undesirably massive. Besides such construction is time consuming and requires skilled labour.

The use of stone spalls of varying size and shape in the form of precast concrete stone masonry blocks ensures consistent quality, uniform strength, increase in speed of construction, reduction in materials requirement, lower foundation loads, better aesthetic look and performance and saves the floor space in building. Hence, use of precast concrete stone masonry blocks leads to substantial economy because of following aspects:

a) Fewer joints, due to uniform shape and size, result in considerable saving in mortar as compared to normal random rubble masonry construction;

b) The true plane surface obtained obviate the necessity of plaster for unimportant buildings situated in low rainfall areas and wherever plastering is required lesser thickness can be used.

c) Because of uniform shape and size of the units, considerably thinner walls are possible as compared to random rubble masonry, thus increasing the effective floor space and reducing the load on foundation, and ensures speedy construction which reduces the cost of construction substantially.

In the construction with these blocks, it is also possible to have stone texture exposed in walls and thus giving an attractive appearance. It lends itself to a wide variety of surface finishes for both exterior and interior walls. The precast units, used in this construction, provide a strong mechanical bond, uniting the masonry units and finish ( that is, mortar ) in a strong permanent bond.

The composition of the technical committee responsible for the formulation of this standard is given in Annex A.

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.

*Indian Standard*

# CONSTRUCTION OF WALLS USING PRECAST CONCRETE STONE MASONRY BLOCKS — CODE OF PRACTICE

## 1 SCOPE

This standard lays down recommendations for construction of walls using precast concrete stone masonry blocks.

## 2 REFERENCES

The Indian Standards listed in Annex B are necessary adjuncts to this standard.

## 3 TERMINOLOGY

For the purpose of this standard, the definitions, given in IS 1905 : 1987, IS 2212 : 1991 and IS 12440 : 1988 shall apply.

## 4 MATERIALS/COMPONENTS

**4.1** The precast concrete stone masonry units shall conform to IS 12440 : 1988.

### 4.2 Mortar

The mortar used for laying the blocks should be of relatively lower strength than that of the mix used for making precast units in order to avoid formation of cracks. Guidance for preparation and use of mortars may be taken from IS 2250 : 1981. Cement sand mortar not leaner than 1 : 6 mix or where good quality lime ( *see* **4.2.1** ) is available, lime *surkhi* or lime cinder mortar not leaner than 1 : 3 mix or equivalent composite mortar may be used. It is preferable to use a composite mortar of mix not leaner than 1 : 1 : 9 cement lime sand. The selection of mortar shall also be governed by the strength required for the masonry and reference may be made for this to IS 1905 : 1987.

**4.2.1** *Lime*

Hydraulic and semi-hydraulic limes corresponding to classes A, B and E of IS 712 : 1984 may be conveniently used in masonry mortars, whereas fat limes, corresponding to classes C and D will require mixing of burnt clay pozzolana and other pozzolanic material. Quick lime shall not be used. Slaking in case of quick lime may be done at site in accordance with IS 1635 : 1992 before using it for preparing mortar.

**4.2.2** *Fine Aggregate*

Sand shall conform to IS 2116 : 1980.

**4.2.3** *Water*

Water used for making masonry mortars shall be clean and free from injurious quantities of deleterious materials. Potable water is generally considered satisfactory. Requirements regarding permissible limits of deleterious materials in the water shall be as given in IS 456 : 1978.

### 4.3 Reinforcement

Any of the reinforcing materials recommended in IS 456 : 1978 may be used.

## 5 PLANNING CONSIDERATIONS

### 5.1 Building Dimensions

As the cutting of these blocks is not possible, building dimensions shall be planned to suit block dimensions, which in turn have been selected keeping in view the requirements of modular co-ordination. Hence, all lengths of walls, openings, spaces between openings, etc, should be in multiples of 10 cm and all heights in multiples of 15 cm. However, in cases where the height does not fall in multiple of 15 cm, cement concrete having a strength at least equal to the strength of precast concrete stone masonry blocks shall be laid on the top course of the wall for a depth not exceeding 15 cm.

### 5.2 Thickness of Joint

The thickness of the bed joints shall be such that four blocks and three joints taken consecutively in vertical direction shall measure equal to four times the height of precast blocks plus 3 cm. However, no bed joint shall be thicker than 12 mm.

### 5.3 Structural Stability and Strength

Design with regard to structural stability shall be done as per recommendations given in IS 1905 : 1987.

### 5.4 Resistance to Moisture Penetration

**5.4.1** The performance of walls made of precast concrete stone masonry block against penetration of moisture is comparable to that of brick wall using bricks of water absorption of about 12 percent. Rain penetration can be further checked

by filling the junctions between exposed stone pieces and lean concrete with cement sand mortar not leaner than 1 : 6 ( cement : sand ) and plastering the external face. In areas of high rainfall, the outer face of the wall shall be plastered rendered with mortar.

**5.4.2** Walls 15-20 cm and above in thickness may be made as external walls while partition walls shall have minimum thickness of 10 cm. Cavity walls as recommended in **5.5.2** may also be used for reducing moisture ingress.

### 5.5 Thermal Performance

**5.5.1** Recommendations for satisfactory thermal performance of non-industrial buildings are covered in IS 3792 : 1978. If thinner walls are provided, their thermal performance can be improved by applying white wash or light colour wash on external face and/or by providing shading devices. Hence, from thermal consideration only the external wall, facing west may be made 30 cm thick while other external walls may be made 20 cm thick with other treatment for improving thermal performance, if required.

**5.5.2** For achieving recommended level of thermal comfort, cavity walls may also be used in place of 30 cm or more thick walls. For a thermal performance index ( T.P.I. ) equivalent to that of 30 cm thick wall, a cavity wall with two leaves each of 10 cm thickness separated by a 5 cm thick airgap are sufficient.

**5.5.3** *Control of Shrinkage Cracking*

In order to confine cracks due to shrinkage to the joints and to dissipate these into a large number of fine joints, it is desirable that the mortar used shall be weaker than the blocks.

**5.5.3.1** Cracking due to shrinkage normally occurs at openings or other points where the vertical or horizontal section of a wall changes. Metal reinforcements may be embedded in masonry at points where cracking is likely to occur.

### 5.6 Footings

For design and construction of foundation footings in precast concrete stone blocks, reference may be made to IS 1080 : 1986. Same provisions as applicable to brick or stone masonry foundations shall apply for precast concrete stone blocks also. The width of the footing in this case shall be in multiple of 10 cm.

## 6 STORAGE AND HANDLING OF MATERIALS

### 6.1 Precast Blocks

Blocks shall not be dumped at site. These shall be stacked in regular tiers even as they are unloaded, to minimize breakages and defacement. The supply of blocks shall be so arranged that, as far as possible about two days requirement of blocks are available at site at any time. Blocks to be used for different situations of use in work shall be stacked separately.

### 6.2 Cement

Cement shall be stored above ground level in perfectly dry and watertight sheds. Cement shall be stacked not more than eight bags high. The bags shall be stacked in a manner to facilitate removal and use in the order in which they are received.

### 6.3 Lime

Quick lime shall be slacked soon after it is received. Storage of unslacked fat or semi-hydraulic lime is not desirable as the lime deteriorates by absorption of moisture from the atmosphere. Slacked lime shall be stored in the manner described in IS 4082 : 1977.

### 6.4 Mortars

**6.4.1** Lime mortars using hydraulic limes which sometimes require to be used after a day or two of their grinding, shall be prevented from drying out by occasional sprinkling of water and/or protective covering. Mortars with cement, cement lime or hydraulic lime shall be used immediately after preparation.

**6.4.2** Mixing and transportation of mortars shall be such as to avoid seggregation and formation of laitance.

## 7 SETTING OUT OF WALLS

Setting out of walls shall be done in accordance with IS 2212 : 1991.

## 8 SCAFFOLDING

**8.1** Only double scaffolding shall be used and no holes in the masonry for supporting scaffolding shall be allowed.

**8.2** Scaffolding shall be designed to withstand all the dead, live and impact loads which are likely to come on them. They shall be so designed as to ensure the safety of the workmen using them and shall conform in all respects to the requirements of the relevant building regulations on safety, health and welfare and also the local building bye-laws.

## 9 WETTING OF BLOCKS

Wetting may generally not be necessary and blocks should be dry at the time of being laid in

the wall. Consistency of mortar used should be adjusted to suit suction of the block rather than the blocks being wetted to suit the mortar. However, in dry hot climate, the blocks should be wetted on the surface only, by sprinkling water in order to reduce suction of moisture from the mortar.

## 10 LAYING OF BLOCKS

### 10.1 General

Recommendations for laying of blocks shall, in general be similar to those for laying of brickwork covered in IS 2212 : 1991. However, for laying of brickwork, which are shape specific ( that is, which are based on the shape and size of brick/cut bricks/closers ) shall not apply for laying of blocks and in place of such provisions, recommendations as given in this standard shall apply. Such other provisions as are recommended in **10.6** to **10.9** shall also apply.

### 10.2 Provision of Reinforcement

**10.2.1** Recommendations for reinforced masonry as applicable to brickwork shall apply to construction with precast concrete stone masonry blocks also. Reference for this may be made to IS 2212 : 1991.

**10.2.2** *Reinforcement Against Seismic Forces*

Vertical reinforcement at corners and openings for seismic forces may be provided by using special blocks with recess ( *see* IS 12440 : 1988 ).

**10.3** Recommendations in relation to provision of damp-proof courses, cavity walls, bearing of floors and roofs and beams, masonry work around openings, parapets and copings, pilasters, arches, fixing of door and window frames shall be as applicable to brickwork, covered in IS 2212 : 1991.

### 10.4 Protection Against Damage

Care shall be taken during construction that edges of jambs, sills, heads, etc, are not damaged. In inclement weather, newly built work shall be covered with gunny bags or tarpaulin so as to prevent the mortar from being washed away.

### 10.5 Curing

For curing, the mortar in the joints shall be moistened lightly, preferably by sprinkling water at the joints with a pump. However, the masonry shall not be made excessively wet.

### 10.6 Bonds

**10.6.1** Vertical joints shall be broken in alternate courses by using smaller length blocks ( *see* IS 12440 : 1988 ) depending upon the wall length. Masonry bonds for various wall thicknesses at corners and junctions shall be made in accordance with **10.6.1.1** to **10.6.1.4**.

**10.6.1.1** At T-junction of two-20 cm walls or two-15 cm walls, a vertical joint at the centreline of cross wall is provided in alternate courses by providing 2/3 size blocks in case of 20 cm thick walls and 3/4 size blocks in case of 15 cm thick walls as shown in Fig. 1A and 1B respectively.

**10.6.1.2** At T-junction of 20 cm wall and 10 cm wall with 10 cm wall the joints are staggered by using 1/3 size and 2/3 size block respectively as shown in Fig. 1C and 1D respectively.

**10.6.1.3** At T-junction of 15 cm wall to 20 cm wall and 10 cm wall to 15 cm wall, where block to block bonding is not practicable, bonding is achieved by providing 20 cm long 6 mm diameter bars in alternate courses. For embedding the metallic ties, only cement mortar shall be used. Arrangement for 15 to 10 cm wall junction is as shown in Fig. 1E.

**10.6.1.4** Bonding of 30 cm to 30 cm wall shall be done as shown in Fig. 1F.

**10.6.1.5** Bonding of corner and T-junction of 30 cm and 20 cm wall shall be done as shown in Fig. 1G.

**10.6.2** A 30 cm or 40 cm pilaster may be provided on 20 cm walls as shown in Fig. 2A and 2B respectively.

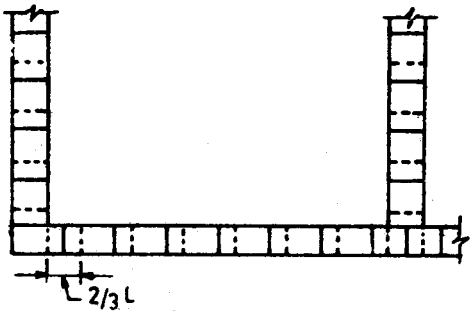
**10.6.3** Bonding of special blocks, with recess for providing vertical reinforcement at corner and door-opening ( for seismic forces ) shall be as shown in Fig. 3.

### 10.7 Service Pipes and Electrical Fittings

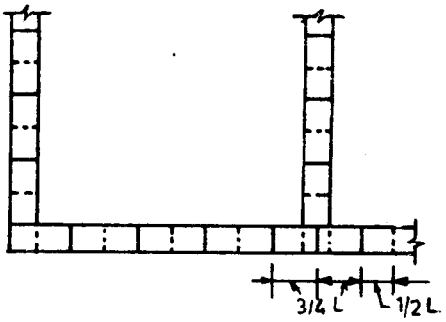
The plugs for fixing service pipes and electrical fittings, etc, should be preferably inserted at the joints in the masonry. Where large openings are required for sanitary fittings, full or half block should be left without mortar during wall construction. In case the opening is required to be made after construction, full block should be taken out and the gap filled with lean cement concrete after providing the fittings through the walls. Space for nitches or fixing electric switch board, etc, should be created by using thinner ( 10 cm thick ) precast blocks.

### 10.8 Bearing of Lintel

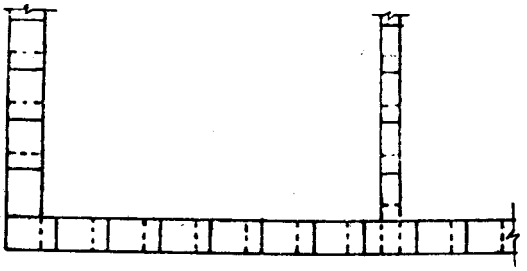
Bearing of lintel shall be at least 10 cm on each



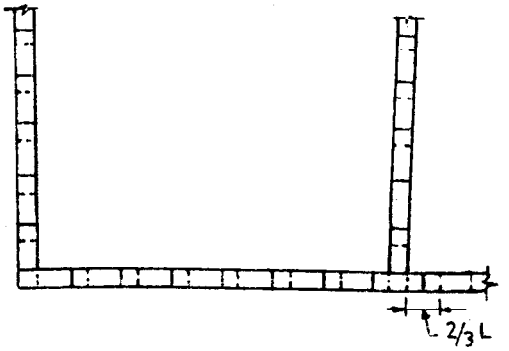

1A CORNER AND T-JUNCTION OF 20 × 20 cm WALL



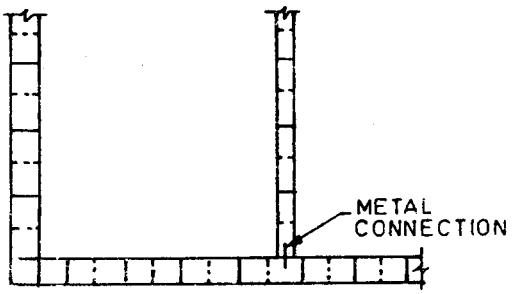

1B CORNER AND T-JUNCTION OF 15 × 15 cm WALL



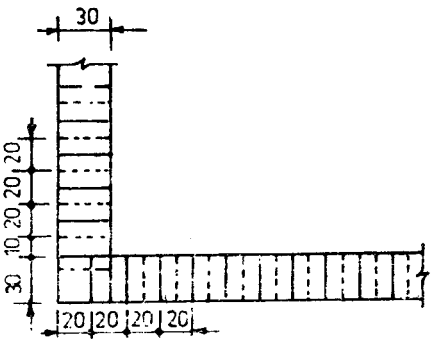
1C CORNER AND T-JUNCTION OF 20 × 10 cm WALL



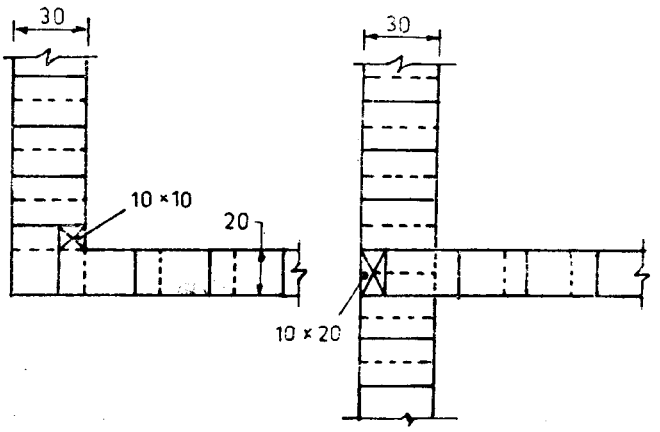

1D CORNER AND T-JUNCTION OF 10 × 10 cm WALL




1E JUNCTION OF 15 TO 10 cm WALL




1F BONDING FOR 30 cm WITH 30 cm WALL




1G CORNER AND T-JUNCTION OF 30 × 20 cm WALL WHEN 30 cm WALL IS PROVIDED ON WEST SIDE OF BUILDING

FIG. 1 DETAILS OF BONDS IN STONE MASONARY BLOCK WALLING

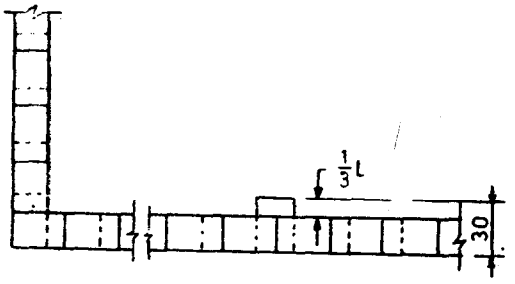



FIG. 2A 30 cm PILASTER WITH 20 cm WALL

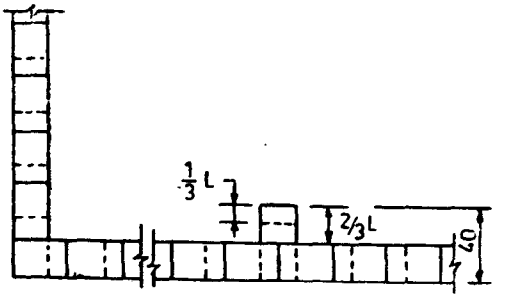



FIG. 2B 40 cm PILASTER WITH 20 cm WALL

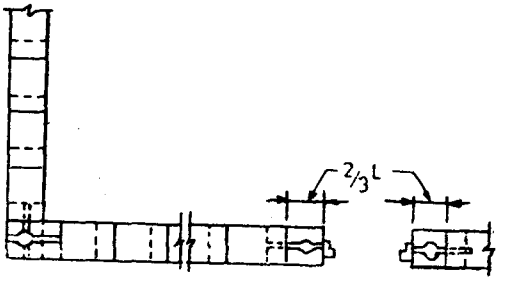



FIG. 3 BONDING AT CORNER AND DOOR OPENING FOR VERTICAL REINFORCEMENT

end. In order to match the top level of precast lintel with the surrounding course height, *in-situ* concrete of required thickness shall be provided at the bearing.

**10.9 Finishing of Walls**

Mortar joints on the external face should be finished with any desirable, sunk in pointing. To cover any crevices between exposed stone pieces and surrounding concrete, a sufficiently wide layer of mortar should be applied to conceal the same and it should be finished level with the rest of the wall. Internal face may also be plastered as given in **5.4.1**.

## 11 MEASURES TO PREVENT CRACKING IN BLOCK MASONRY

**11.1** The block shall be laid dry preferably, using composite mortars of suitable mix proportions of cement : lime : sand depending upon loading. In hot climate, the blocks may be slightly wetted at the surface before laying.

**11.2** For curing, the mortar joints shall be moistened lightly and not made excessively wet as done in brick masonry.

**11.3** To accommodate the changes in length due to shrinkage of blocks, joints called controlled joints shall be provided at suitable intervals, for example, at 8 to 10 m spacing in free standing walls, at 15 to 18 m intervals in walls which are connected by cross walls, etc.

**11.4** Two number 6 mm dia mild steel bars may be provided above and below windows and above doors in horizontal bed joints throughout the length of walls in order to distribute concentration of the shrinkage stresses occurring at the corners more uniformly.

**11.5** The partition walls shall be suitably reinforced in the lower courses to strengthen them against any excessive deflection that may occur in the floor slabs supporting them.

**11.6** The partition walls shall be separated from the ceiling by a layer of resilient material. Where this cannot be done, a cut be formed between the ceiling plaster and the wall plaster.

## 12 INSPECTION

As the correct strength of masonry cannot be ascertained without destruction, a close supervision during the course of construction is essential to ensure satisfactory performance. The inspection shall be carried out as per broad recommendations given for brickwork in IS 2212 : 1991.

## 13 MAINTENANCE

Defects in the masonry may occur, inspite of using proper materials and workmanship, due to any of the following causes:

a) Aggressive atmosphere/sulphate attack/sea water spray,

b) Corrosion of embedded reinforcement, and

c) Defects due to shrinkage on drying.

For proper preventive measures against the above defects recommendations given in IS 2212 : 1991 may be followed.

## 14 REPAIRING

Recommendation given in IS 2212 : 1991 for brickwork shall be followed for repairing.

# ANNEX A

*( Foreword )*

## COMMITTEE COMPOSITION

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*Secretary*

SHRI J. K. PRASAD
Joint Director ( Civ Engg ), BIS

( *Continued on page 7* )

( *Continued from page 6* )

Panel for Modular Coordination and Prefabrication for Mass Scale Housing, CED 51 : P 2

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# ANNEX B

( *Clause* 2 )

## LIST OF REFERRED INDIAN STANDARDS

| *IS No.* | *Title* | *IS No.* | *Title* |
|---|---|---|---|
| 456 : 1978 | Code of practice for plain and reinforced concrete ( *third revision* ) | 2116 : 1980 | Specification for sand for masonry mortars ( *first revision* ) |
| 712 : 1984 | Specification for building limes ( *third revision* ) | 2212 : 1991 | Code of practice for brickwork ( *first revision* ) |
| 1080 : 1986 | Code of practice for design and construction of shallow foundations on soils ( other than raft, ring and shell ) ( *second revision* ) | 2250 : 1981 | Code of practice for preparation and use of masonry mortars ( *first revision* ) |
| 1635 : 1992 | Code of practice for field slaking of building lime and preparation of putty ( *second revision* ) | 3792 : 1978 | Guide for heat insulation of non-industrial buildings ( *first revision* ) |
| 1905 : 1987 | Code of practice for structural use of unreinforced masonry ( *third revision* ) | 4082 : 1977 | Recommendations on stacking and storage of construction materials at site ( *first revision* ) |
| | | 12440 : 1988 | Specification for precast concrete stone masonry blocks |

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

This Indian Standard has been developed from Doc No. : CED 51 ( 5189 )

**Amendments Issued Since Publication**

| Amend No. | Date of Issue | Text Affected |
|---|---|---|
| | | |
| | | |
| | | |

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