IS 6061-3 (1981): Code of Practice for Construction of Floor and Roof with Joists and Filler Blocks, Part 3: With Precast Hollow Clay Block Joists and Hollow Clay Filler Blocks [CED 13: Building Construction Practices including Painting, Varnishing and Allied Finishing]

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IS : 6061 (Part III) - 1981
(Reaffirmed 2002)

Indian Standard

CODE OF PRACTICE FOR CONSTRUCTION OF FLOOR AND ROOF WITH JOISTS AND FILLER BLOCKS

PART III WITH PRECAST HOLLOW CLAY BLOCK JOISTS AND HOLLOW CLAY FILLER BLOCKS

UDC 69·024/·025 : 693·28 : 691·421-478 : 69·001·3

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

Price Rs 7·00

April 1982

Indian Standard

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PART III WITH PRECAST HOLLOW CLAY BLOCK JOISTS AND HOLLOW CLAY FILLER BLOCKS

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CODE OF PRACTICE FOR CONSTRUCTION OF FLOOR AND ROOF WITH JOISTS AND FILLER BLOCKS

PART III WITH PRECAST HOLLOW CLAY BLOCK JOISTS AND HOLLOW CLAY FILLER BLOCKS

0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 29 December 1981, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The construction of floor and roof using structural clay blocks has been found to be a suitable substitute for *in-situ* RCC slab construction. This type of slab is comparatively cheaper and saves scarce materials like cement and steel. The slab is lighter in weight and provides better thermal insulation. Since the slabs are prefabricated, they lead to quicker construction also. Further, with the setting up of a number of mechanised plants for manufacture of clay blocks in different parts of the country, this kind of prefabricated floor or roof construction, where structural clay blocks are used both as an element of joist and filler, will find greater application. In the joist and infill scheme, clay blocks are used in conjunction with concrete to serve as structural component in carrying flexural compression. The shape of the structural clay blocks are so designed that the same clay block can be used as an element of joist and infill material. This standard is intended to provide guidance for construction of floor and roof with hollow clay blocks and is one of a series of Indian Standards on construction of floor or roof with joists and hollow blocks.

0.3 In the formulation of this standard, assistance has been rendered by the Central Building Research Institute, Roorkee, which supplied valuable technical information.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

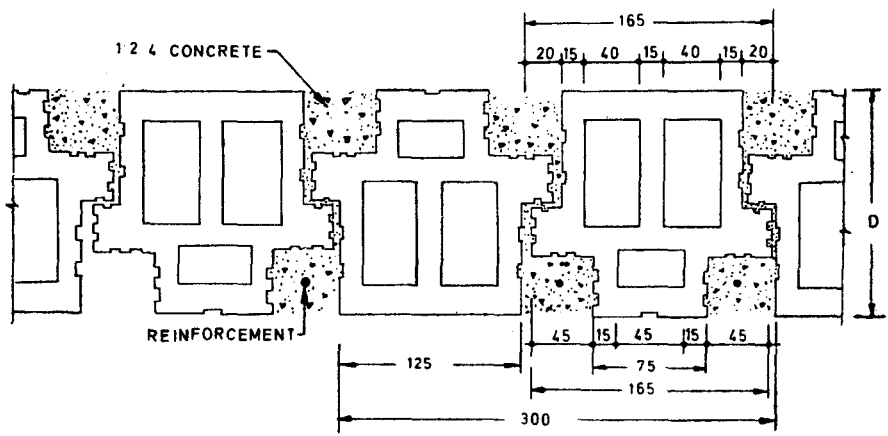
*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part III) covers the design and construction of joist and infill type precast floor or roof using hollow clay blocks.

2. MATERIALS

2.1 Hollow Clay Blocks (Structural Type) — These shall conform to the requirements of IS : 3951 (Part II)-1975* with dimensions preferably as given in Fig. 1.



All dimensions in millimetres.

FIG. 1 TYPICAL CLAY BLOCK

2.1.1 Average crushing strength of the blocks shall not be less than 20 N/mm^2 on the net area with an individual minimum value of 15 N/mm^2 when tested in accordance with IS : 3951 (Part II)-1975*.

2.2 Cement Concrete — Cement concrete to be used in conjunction with structural clay blocks shall be minimum of Grade M 15 conforming to IS : 456-1978†.

2.3 Mortar — Mortar used shall be either cement mortar or cement-lime mortar with a minimum compressive strength of 10 N/mm^2 and shall conform to IS : 2250-1981‡.

*Specification for structural hollow clay tiles for floors and roofs: Part II Structural type (*first revision*).

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

‡Code of practice for preparation and use of masonry mortars (*first revision*).

2.4 Reinforcement — These shall conform to either IS : 432 (Part I)-1966* or IS : 1139-1966† or IS : 1786-1979‡.

3. PREPARATORY WORK

3.1 All supporting elements like walls, pillars, main beams, secondary beams, frames, etc, shall be completed sufficiently early and cured well before the flooring or roofing work is taken up. Plain cement concrete or mortar bed block may be provided over load-bearing walls, if necessary. The top surface of the supporting elements shall be level finished. Attention shall be paid for arrangements necessary for fixing all service pipes, conduits, fixtures, etc, passing through the floor or roof.

4. CASTING, CURING AND MATURING OF STRUCTURAL CLAY BLOCK JOISTS

4.1 The joists shall be cast on a level platform protected from direct sun as well as quick drying action of strong wind.

4.2 The joists shall be precast by placing hollow clay blocks end to end and jointing them with 1 : 3 (1 cement : 3 sand) or equivalent cement-lime mortar, having the desired strength as mentioned in **2.3** (*see* Fig 2). The clay blocks shall be thoroughly wetted and they shall be skin-dry at the time of use. The hollow clay blocks shall be placed with the wider base on the platform and a row of them shall be built up to the desired length of the joist. Two wooden planks, cleaned and oiled, shall then be placed on the two sides of the joist. The wooden planks shall be held tight with the help of mild steel clamps. Designed reinforcement shall then be placed within the two hollow spaces between the planks and clay blocks, ensuring proper cover from the top and the ends. The hollow spaces shall then be filled to the top level of the clay blocks with cement concrete of minimum M 15 grade (*see* Fig. 2). Side planks may be removed after 45 to 90 minutes, depending on weather conditions.

4.3 One day after precasting the joists, they shall be cured with water at the precasting platform itself. After about 4 days, when the concrete has developed sufficient strength to withstand handling stresses, the joists shall be inverted upside down and removed to a curing yard and shall be kept continuously moist for at least 14 days from the day of casting.

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

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

‡Specification for cold worked steel high strength deformed bars for concrete reinforcement (*second revision*).

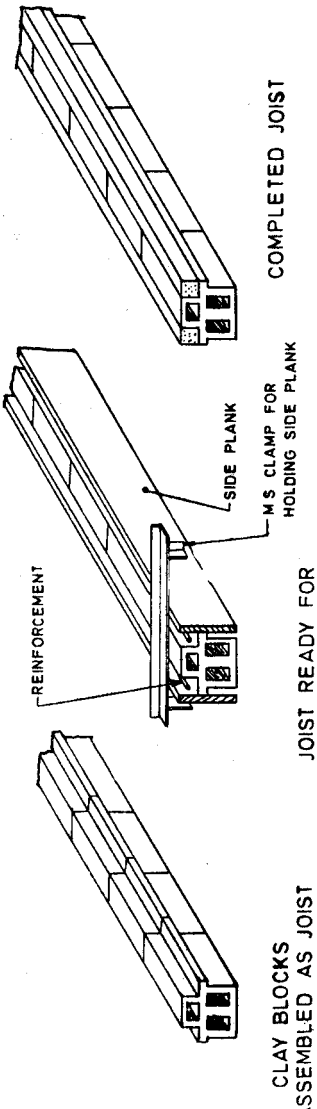

FIG. 2 DIFFERENT STAGES OF PREFABRICATION OF JOIST

4.3.1 After water curing, the joists shall be further cured in the shade for another 14 days before they are used in construction.

4.3.2 Lifting of joists from the platform shall be done with care. While stacking and transporting, temporary supports shall be given at the points as indicated by the Engineer-in-Charge. Joists shall be stacked on firm and even ground or platform. If stacked vertically in more than one row, all the props shall be in the same vertical plane. The joists shall not be stacked directly on ground to avoid contamination with clay.

5. GENERAL DESIGN REQUIREMENTS FOR STRUCTURAL CLAY BLOCK SLAB

5.1 The design of structural clay block slab shall be based on general structural analysis and requirements laid down in **5.2** to **5.9**.

5.2 Design Load — Live load shall be taken as given in IS : 875-1964*.

5.3 Design for Two Stages of Loading — Being a prefabricated scheme, clay block slabs shall be designed for two different stages of loading conditions as given in **5.3.1** and **5.3.2.**

5.3.1 *First Stage of Loading* — In the first stage of loading when *in-situ* infill concrete has not attained full strength, joists shall have to carry, as a simply supported member, its own weight, dead load due to infill blocks, cement concrete and some incidental live load. In cases where joists are not sufficiently strong to carry this load, suitable intermediate proppings shall be provided underneath the joists.

5.3.2 *Second Stage of Loading* — When *in-situ* infill cement concrete has attained full strength, the complete slab assembly shall resist the total design load as follows:

i) Self weight of clay block assembly as simply supported slab, and

ii) Other superimposed loads like floor finish and live loads under appropriate end conditions.

5.4 Effective Span — The effective span of the slab shall be taken as clear span plus the effective depth of slab or centre to centre distance between the two supports, whichever is less.

5.5 Span to Depth Ratio — The effective span to depth ratio of slab shall be as given in IS : 456-1978†.

*Code of practice for structural safety of buildings: Loading standards (*revised*).

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

5.6 Loading Arrangement — In case of continuous slab over several spans, consideration may be limited to the following combinations of loading:

i) Bending moment due to self weight of slab simply supported,

ii) Moment due to superimposed dead load on all spans with full design live load on two adjacent spans, and

iii) Moment due to superimposed dead load on all spans with full design live load on alternate span.

5.6.1 *Moment and Shear Coefficients for Continuous Slabs* — Unless more exact estimates are made, the slabs which support uniformly distributed load over three or more spans and which do not differ by more than 15 percent of the longest, the bending moment and shear forces shall be obtained by using the coefficients given in Tables 1 and 2 respectively.

5.6.1.1 For moments at supports, where two unequal spans meet or in case where the spans are not equally loaded, the larger of the two values for negative moment at the support shall be taken for design.

5.7 Simply Supported Slab — Simply supported slab shall be designed to resist a positive bending moment of W 1/8 near midspan, where W is the total uniformly distributed load over the span and l is the effective span. In addition, where the slab is built into a masonry wall which develops only partial restraint, the slab shall be designed to resist a negative moment of W 1/24 at the face of the support, or such other restraining moment as may be applicable.

5.8 The average crushing strength of structural hollow clay blocks shall be reduced by 20 percent to take into account the non-uniformity of fired clay products and the lesser of the crushing strength values of cement concrete and structural hollow blocks shall be adopted for design purpose. Based on this crushing strength, permissible stresses shall be taken as given in IS : 456-1978*.

5.9 Shear Stress — The shear stress q at any section shall be calculated as below:

$$q = V/bd$$

where

V = shear force at the section,

b = minimum width of the web, and

d = effective depth.

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

TABLE 1 BENDING MOMENT COEFFICIENTS

(*Clause* 5.6.1)

Sl No.	Type of Load	Span Moments		Support Moments	
		Near Middle of End Span	At Middle of Interior Span	At First Interior Support	At All Other Interior Supports
(1)	(2)	(3)	(4)	(5)	(6)
i)	Dead load and imposed load (fixed)	$+\frac{1}{12}$	$+\frac{1}{24}$	$-\frac{1}{10}$	$-\frac{1}{12}$
ii)	Moments due to imposed load (not fixed)	$+\frac{1}{10}$	$+\frac{1}{12}$	$-\frac{1}{9}$	$-\frac{1}{9}$

NOTE — For obtaining the bending moments, the coefficients shall be multiplied by the total design load and effective span.

TABLE 2 SHEAR FORCE COEFFICIENTS

(*Clause* 5.6.1)

Sl No.	Type of Load	At End Support	At First Interior Support		At All Other Interior Supports
			Outer Side	Inner Side	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Dead load and imposed load (fixed)	0·4	0·6	0·55	0·5
ii)	Imposed load (not fixed)	0·45	0·6	0·6	0·6

NOTE — For obtaining the shear force, the coefficients shall be multiplied by the total design load.

5.9.2 Shear stress in structural clay block slab shall be within the permissible value.

6. CONSTRUCTION OF ROOF OR FLOOR

6.1 The joists shall be placed at required intervals over the support (generally, 300 mm centre to centre). In the intervening space of the joist, structural clay blocks shall be placed with mortar joint with the wider base towards the ceiling of the slab (*see* Fig. 3).

6.1.1 While placing infill clay blocks, the joints in the joist members and infill blocks shall be broken by the use of half length units.

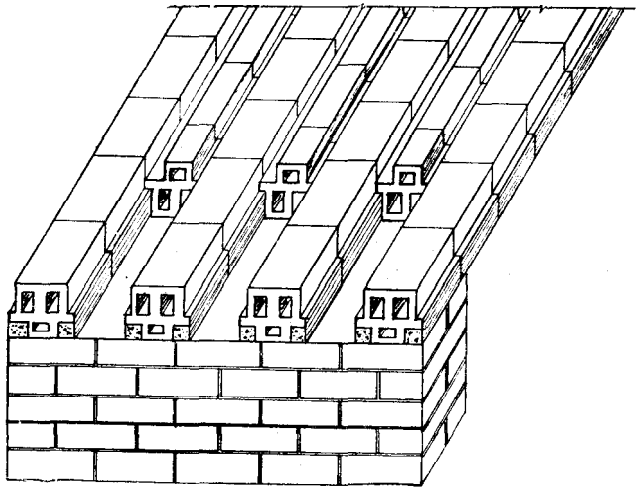

FIG. 3 JOIST AND INFILL CLAY BLOCK SLAB ASSEMBLY

6.2 The spaces between the joists and blocks shall be filled with minimum M 15 grade concrete (*see* Fig. 3). For continuity on partial fixity over support, negative reinforcement shall be provided in the space with proper cover from all sides. In case of joists used as cantilevers, they shall be supported from the bottom all along the length. Negative reinforcement for cantilever moment shall be provided in the space before filling with concrete. The bottom support shall be removed only when the infill concrete has attained proper strength to sustain the cantilever action.

6.3 Bearing — Bearing for the slab shall be minimum 75 mm in the direction of spanning and minimum 20 mm at end.

6.4 Temporary intermediate props shall be provided for supporting the joists if required. Temporary props, if provided, shall be kept in position

for 28 days after laying *in-situ* concrete in the intervening space between joists and infill rows of clay blocks. The completed slab shall be cured for at least 14 days.

6.5 Constructional Details

6.5.1 Structural clay blocks shall be immersed in water for about 20 to 30 minutes before use and shall be skin-dry at the time of use. Thickness of the mortar joint shall be as small as possible, and in no case shall be more than 12 mm.

6.5.2 Fixtures like fan hooks, wooden plugs, junction boxes, floor traps, etc, shall be located in the infill rows of clay block by omitting one of them at the desired location. The fixture shall be placed in position and the remaining space shall be filled with cement concrete. Concealed electrical conduit shall be placed inside the hollow bottom portion of the filler blocks. At the draw-off point, *in-situ* concreting shall be done.

6.5.3 Splicing of reinforcement shall be avoided and minimum cover to reinforcement shall be 15 mm.

7. FINISH

7.1 The roof or floor may be further finished with the specified roof or floor in accordance with the relevant Indian Standards mentioned in **7.1.1**.

7.1.1 Indian Standards covering floor or roof finishes so far published are enlisted below:

Sl No.	*Type*	*IS:*
i)	Magnesium oxychloride	658-1962*
ii)	Bitumen mastic	1196-1978†
iii)	Rubber	1197-1970‡
iv)	Linoleum	1198-1958§
v)	Cement concrete tiles	1443-1972‖
vi)	Terrazzo	2114-1962¶

*Code of practice for magnesium oxychloride composition floors (*revised*).

†Code of practice for laying bitumen mastic flooring (*second revision*).

‡Code of practice for laying of rubber floors (*first revision*).

§Code of practice for laying and maintenance of linoleum floors.

‖Code of practice for laying and finishing of cement concrete flooring tiles (*first revision*).

¶Code of practice for laying *in-situ* terrazzo floor finish.

Sl No.	*Type*	*IS:*
vii)	Mud *PHUSKA*	2115-1980*
viii)	*In-situ* cement concrete	2571-1970†
ix)	Epoxy resin	4631-1968‡
x)	PVC	5318-1969§
xi)	Brick	5766-1970‖

7.2 The ceiling may be rendered (*see* IS : 2402-1963¶) or plastered (*see* IS : 1661-1972**) as may be necessary. The blocks shall be thoroughly wetted before rendering or plastering.

7.3 The waterproofing of the roof may be done in accordance with either IS : 1346-1976†† or IS : 3036-1980‡‡ or IS : 4365-1967§§ or IS : 7290-1973‖‖.

*Code of practice for flat roof finish: *mud PHUSKA* (*second revision*).

†Code of practice for laying *in-situ* cement concrete flooring (*first revision*).

‡Code of practice for laying of epoxy resin floor toppings.

§Code of practice for laying of flexible PVC sheet and tile flooring.

‖Code of practice for laying burnt clay brick flooring.

¶Code of practice for external rendered finishes.

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

††Code of practice for waterproofing of roofs with bitumen felts (*second revision*).

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

§§Code of practice for application of bitumen mastic for waterproofing of roofs.

‖‖Recommendation for use of polyethylene film for waterproofing of roofs.

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FLOOR AND ROOF CONSTRUCTION

IS:

2118-1980 Code of practice for construction of jack-arch type of built-up floor or roof (*first revision*)

2119-1980 Code of practice for construction of brick-cum-concrete composite (Madras terrace) floor or roof (*first revision*)

2792-1964 Code of practice for design and construction of stone slab over joist floor

2858-1964 Code of practice for roofing with Mangalore tiles

6061 (Part I)-1971 Code of practice for construction of floor and roof with joists and filler blocks : Part I With hollow concrete filler blocks

6061 (Part II)-1981 Code of practice for construction of floor and roof with joists and filler blocks: Part II With hollow clay filler blocks (*first revision*)

6061 (Part IV)-1981 Code of practice for construction of floor and roof with joists and filler blocks: Part IV With precast hollow clay block slab panels

6332-1971 Code of practice for construction of floors and roofs using precast doubly-curved shell units

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Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	$1\ N = 1\ kg.m/s^2$
Energy	joule	J	$1\ J = 1\ N.m$
Power	watt	W	$1\ W = 1\ J/s$
Flux	weber	Wb	$1\ Wb = 1\ V.s$
Flux density	tesla	T	$1\ T = 1\ Wb/m^2$
Frequency	hertz	Hz	$1\ Hz = 1\ c/s\ (s^{-1})$
Electric conductance	siemens	S	$1\ S = 1\ A/V$
Electromotive force	volt	V	$1\ V = 1\ W/A$
Pressure, stress	pascal	Pa	$1\ Pa = 1\ N/m^2$

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Printed at Arcee Press, New Delhi, India