

भारतीय मानक

फर्श एवं छत बनाने के लिए पूर्व ढली प्रबलित काँक्रीट
चैनल इकाईयाँ — विशिष्ट

Indian Standard

**PRECAST REINFORCED CONCRETE CHANNEL
UNITS FOR CONSTRUCTION OF FLOORS
AND ROOFS — SPECIFICATION**

UDC 691.328.413 : 692.41.5

© BIS 1994

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

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.

Considerable shortage of houses in the country, which is also increasing continuously, has led to increasing stress being laid in the development programmes of Central and State governments, on facilitating speedy and economical construction of houses. Problem of housing being gravest amongst the lower income groups, both rural and urban, the greatest stress is being laid on housing for these target groups.

This calls for development and standardization of new building materials and construction techniques which are simple and economical, commensurate with structural and hygienic safety and durability, in order to ensure speedy and economical construction.

This standard is one of a series of standards being processed by BIS on new materials and techniques of roof/floor construction which, when implemented, are likely to result in substantial savings in materials and cost of construction, in addition to achieving speedy construction. The other standards in the series are:

- a) Prefabricated brick panel and partially precast concrete joist for flooring and roofing — Specification
- b) Design and construction of roofs and floors with prefabricated brick panel — Code of practice
- c) Design and construction of floor and roof with precast reinforced channel units — Code of practice
- d) Precast reinforced concrete planks and joist for flooring and roofing — Specification
- e) Design and construction of floor and roof with precast reinforced concrete planks and joist — Code of practice
- f) Precast reinforced concrete L-panel for construction of roofs — Specification
- g) Design and construction of roofs using precast reinforced concrete L-panel — Code of practice
- h) Construction of walls with precast concrete stone masonry blocks — Code of practice

The reinforced concrete channel units are channel (inverted trough) shaped precast beams which can be used for intermediate floors and roofs supported on walls or RCC beams. Their shape ensures more area of concrete in compression zone where it is required and less area on tension side and thus they have an efficient section. Further, being precast, use of these units also saves the cost of shuttering, ensures better quality control on concrete and speeds up construction work.

The recommended width of the channel units has been selected keeping in view the requirements of modular co-ordination.

Considerable assistance has been rendered in the preparation of this standard by the Central Building Research Institute, Roorkee.

The composition of the committee responsible for the formulation of this standard is given at Annex B.

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

PRECAST REINFORCED CONCRETE CHANNEL UNITS FOR CONSTRUCTION OF FLOORS AND ROOFS — SPECIFICATION

1 SCOPE

This standard covers the requirements for precast reinforced concrete channel units having a length of up to 4.5 m used for construction of floors and roofs.

2 REFERENCES

2.1 The Indian Standards listed below are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
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 (<i>third revision</i>)
456 : 1978	Code of practice for plain and reinforced concrete (<i>third revision</i>)
1786 : 1985	Specification for high strength deformed steel bars and wires for concrete reinforcement (<i>third revision</i>)
4905 : 1968	Methods for random sampling
14215 : 1994	Code of practice for design and construction of floors and roofs with precast reinforced concrete channel units

3 MATERIALS

3.1 Concrete

The concrete used for making precast units shall conform to grade M 15 or higher in accordance with IS 456 : 1978. Coarse aggregate used for making concrete shall be well graded with maximum size of 12 mm.

3.2 Reinforcement

The reinforcing steel shall be as recommended in IS 456 : 1978.

4 SHAPE AND DIMENSIONS

4.1 Shape

4.1.1 The precast units shall be channel (inverted trough) shaped, having outer sides corrugated and grooved at ends to provide shear key action and transfer of moments between adjacent units (see Fig. 1 and 2).

4.1.2 Inner sides of the channel shall be kept sloping, as shown in Fig. 2 to simplify easy demoulding. The slope may be kept between 1/8 to 1/16.

4.2 Dimensions

4.2.1 Length

Length of the channel unit shall vary according to room dimensions, but the maximum length of the unit shall be restricted to 4.5 m from stiffness considerations.

4.2.2 Width

The nominal width of channel unit shall be 300 or 600 mm.

4.2.3 Depth

The depth of the channel unit shall be kept either 130 mm or 200 mm.

4.2.4 Thickness of Flange

The minimum thickness of flange shall be 30 mm for 300 mm wide channel units and 35 mm for 600 mm wide channels.

4.2.5 Thickness of Web (Legs of Channel Unit)

The minimum thickness of the channel leg shall be not less than 25 mm.

4.3 Tolerances on Dimensions

4.3.1 Tolerances on various dimensions of channel shall be as given below:

<i>Dimension</i>	<i>Tolerance</i>
Length	± 5 mm
Width	± 3 mm
Bow (deviation from intended line or plane)	± 3 mm
Twist (distance of any corner from the plane containing other three corners)	± 3 mm

4.3.2 Squareness

When considering the squareness of the corner, the longer of the two sides being checked shall be taken as the base line. The shorter length shall not vary in length from the perpendicular by more than 3 mm.

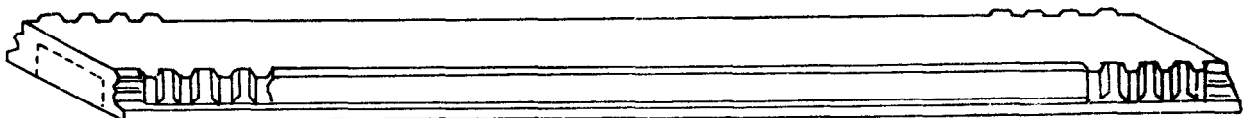


FIG. 1 A CHANNEL UNIT

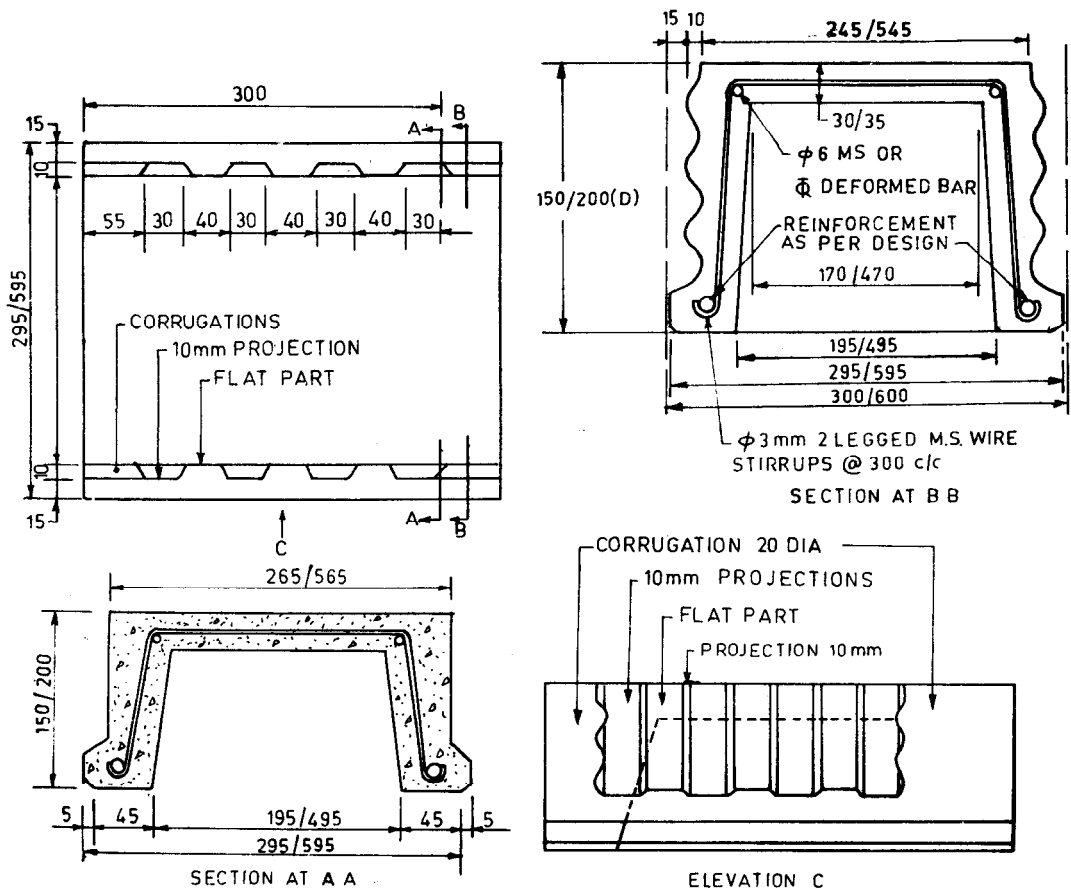


FIG. 2 TYPICAL DETAILS OF CHANNEL UNIT

4.3.3 Flatness

The maximum deviation from a 1.5 m straight edge placed in any position on a nominal plane surface shall not exceed 2 mm.

5 DESIGN DETAILS

5.1 The channel units shall be designed in accordance with IS 14215 : 1994.

5.2 Reinforcement

5.2.1 Main reinforcement of the channel units shall comprise two bars of required diameter as per the design placed at the bottom of two legs of channel unit. Two bars of mild steel grade I conforming to IS 432 (Part 1) : 1982, 6 mm ϕ shall be provided at top corners to support the stirrups (see Fig. 2). Stirrups of 3 mm ϕ at the rate of 300 mm c/c along the length of the channel unit (see Fig. 2) shall be provided.

5.2.2 Cover to Reinforcement

The minimum cover to reinforcement shall be 15 mm.

6 MANUFACTURING OF PRECAST UNITS

6.1 Mould

6.1.1 The mould consists of two parts – the outer frame

and the inner trough frame. Typical sketches showing details of various components of mould are given in Fig. 3.

6.1.2 The mould shall be made from well seasoned timber or steel or other rigid, non-corrodible and non-absorbant materials such as fibre reinforced plastic. In case timber mould is used for the inner trough frame, the surface shall be lined with GI sheet.

6.1.3 Dimensions of the mould shall be selected depending upon the size of the channel units. Tolerances on mould shall be as given below:

Dimension	Tolerance (mm)
Length	± 4 mm
Width and thickness	± 2 mm
Warp/Bow	± 2 mm

6.2 Manufacturing of Channel Units

6.2.1 The inner side of the outer mould frame shall be applied with a bond release agent and placed on a smooth and level concrete platform on which a bond release agent has been applied.

6.2.2 The reinforcement cage shall be placed in position. It shall be ensured that the reinforcement is not

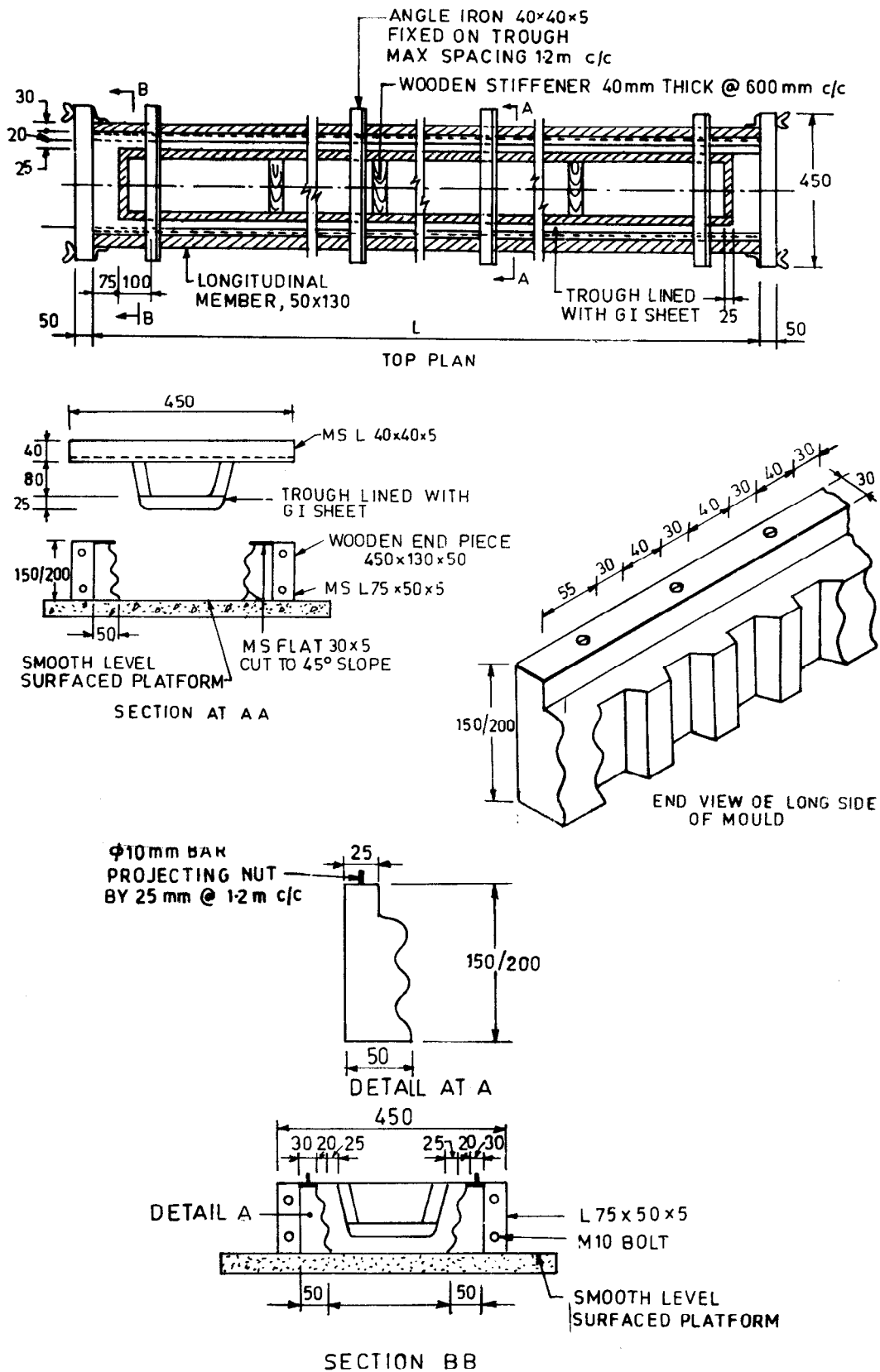


FIG. 3 DETAILS OF MOULD FOR CHANNEL UNIT

distorted, in any way, during storage, handling, placement and concreting.

6.2.3 The concrete shall be placed in the flange portion of the unit in such a way as to avoid segregation up to such a height that it achieves a thickness equal to the flange of the unit after compaction. The concrete shall then be compacted with a plate vibrator.

6.2.4 The trough frame, applied with a bond release agent on the outer surface (that is, the surface facing concrete) shall then be kept inside the outer frame and the flange concrete shall be levelled by moving the trough to and fro. Afterwards the trough shall be fixed in position with outer frame.

6.2.5 The web (leg) portion of the channel unit shall now be filled with concrete, compacted by vibration with a plate vibrator/needle vibrator and finished level.

6.2.6 The trough frame may be removed gently after about an hour (depending upon the weather) after casting. The outer frame may also be stripped off after about three hours (depending upon the weather) after casting. The units shall be left undisturbed for about 48 hours and shall be kept wet during this period by occasional sprinkling of water or by covering by wet gunny bags.

6.3 Curing

After about 48 hours the units shall be turned upside down so that the flange is brought to the top. The units shall then be transported to curing yard by supporting near the ends and stacked with the trough (flange) facing up. The units shall be cured for at least 12 days by keeping the trough filled with water and further air-cured for another 14 days before placing it in position in a building.

7 SAMPLING

7.1 All the precast reinforced concrete units of the same size, manufactured from similar materials and under similar conditions of production shall be grouped together to constitute a lot.

7.2 Five units shall be selected at random out of a lot consisting of 300 units or less. For lots bigger than 300 units 5 units shall be selected for every 300 units or part thereof. In order to ensure randomness of selection, procedure given in IS 4905 : 1968 may be followed.

7.3 The sample shall be marked for future identification of the lot it represents.

8 TESTS

Tests shall be conducted on samples of the units as given in Annex A.

9 CRITERIA FOR CONFORMITY

9.1 If four out of the five samples satisfy the dimensional requirements given in 4.2, the lot represented by the sample shall be deemed to have passed the dimensional requirements. If more than one unit fails to satisfy the dimensional requirements given in 4.2, the lot represented by the sample shall be rejected.

9.2 In the deflection recovery test as per Annex A, if the deflection 24 hours after the removal of the imposed load is at least 75 percent of the deflection under the load for 24 hours, the unit shall be deemed to have passed the test. If the deflection recovery is less than 75 percent, the lot represented by the unit shall be rejected.

If the maximum deflection in mm shown during 24 hours under load is less than $40 l^2/D$, where l is the effective span in mm and D , the overall depth of the section in mm, it is not necessary for the deflection recovery to be measured and the recovery provision mentioned in this clause earlier will not apply.

9.3 In the failure load test as per Annex A, the unit shall carry a load at least equal to 1.33 times the characteristic load to pass the test. If the load at failure is less than twice the characteristic load, the lot represented by the sample shall be rejected.

10 MARKING

10.1 Each channel units manufactured in accordance with this specification shall legibly and indelibly marked with the following:

- a) Identification of the source of manufacture, and
- b) Month and year of manufacture.

10.2 BIS Certification Marking

The components may also be marked with Standard Mark.

10.2.1 The use of Standard Mark is governed by the provisions of Bureau of Indian Standards Act 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Clauses 8 and 9)

TESTS FOR PRECAST REINFORCED CONCRETE CHANNEL UNITS

A-1 AGE OF TESTING

The precast reinforced concrete channel units shall be tested as soon as possible after expiry of 28 to 33 days after casting.

A-2 DIMENSIONAL CONFORMITY

Five samples of precast reinforced concrete channel units selected in accordance with 7.2 shall be checked for conformity with the shape and dimensional requirements as given in 4. Length of the units shall be measured with a steel tape at least 5 m long having graduation in mm. Other dimensions shall be measured with 1 m long steel scale having graduation in mm.

A-3 DEFLECTION RECOVERY TEST

A-3.1 One unit selected at random out of the units which have satisfied dimensional requirement as per 4.2 and 9.1 shall be subjected to deflection recovery test. The precast unit shall be simply supported with a bearing of 75 mm on either end of the unit over concrete walls with a 6 mm thick M.S. steel plate fixed in level at top of the wall as shown in Fig. 4. Design dead load other than due to self weight of the unit shall be applied uniformly over the units through loading blocks or by other means. A dial gauge having a least count of 0.02 mm or less and a range of 50 mm or more shall be fixed at midspan of the unit. The dial gauge shall be adjusted to indicate zero reading under self weight of the unit and applied dead load.

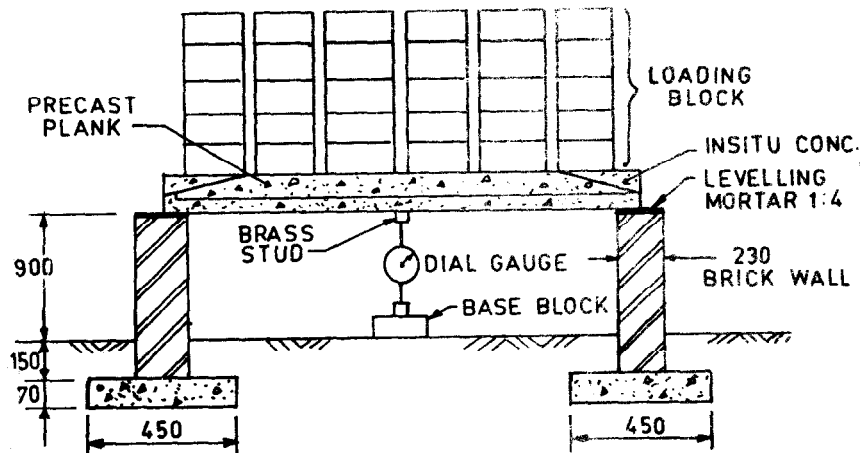
A-3.2 The unit shall be subjected to a uniformly distributed load equal to 1.25 times the imposed load, that is, 1.25 times the design live load applied through loading blocks of concrete or steel. Alternatively, uniform load could be applied by hydraulic jacks through a self reacting frame and a set of beams to distribute the load. The load shall be retained for 24 hours. After recording deflection at the end of this period, the load shall be removed.

A-3.3 Twenty four hours after removal of the load, the deflection shall be recorded again.

A-4 FAILURE LOAD TEST

A-4.1 The unit, which has passed the deflection recovery test shall be subjected further to failure load test. Loading shall be done uniformly through loading blocks or through hydraulic jacks and a set of beams to distribute the load. If loading is done through blocks, sufficient gap shall be provided between adjacent tiers of blocks to ensure that they do not touch each other even at the final stages of loading, to prevent transfer of load to supports of units through arch action. Loading shall preferably be done from an independent scaffold as a safety precaution.

A-4.2 The loading shall continue till the unit fails. If no failure occurs by crushing for breaking of the unit, the load causing a deflection equal to 1 in 60 of clear span of the unit shall be considered as the failure load. To check that the limiting deflection is not exceeded, a steel marker shall be fixed below the unit at midspan, leaving a gap of 1 in 60 of clear span before the start of the test.



All dimensions in millimetres.
FIG. 4 DEFLECTION RECOVERY TEST

ANNEX B
(*Foreword*)

COMMITTEE COMPOSITION

Housing Sectional Committee, CED 51

<i>Chairman</i>	<i>Representing</i>
DR P. S. A. SUNDARAM	Ministry of Urban Development, New Delhi
<i>Members</i>	
SHRI G. R. AMBWANI	Municipal Corporation of Delhi, Delhi
SHRI AROMAR RAVI	The Action Research Unit, New Delhi
PROF H. P. BAHARI	School of Planning and Architect, New Delhi
PROF SUBIR SAHA (<i>Alternate</i>)	
SHRI K. K. BHATNAGAR	Housing and Urban Development Corporation, New Delhi
SHRI M. N. JOGLEKAR (<i>Alternate</i>)	
SHRI H. U. BILLANI	In personal capacity (1, <i>Sadhna Enclave, Panchsheel Park, New Delhi 110017</i>)
SHRI S. N. CHATTERJEE	Calcutta Municipal Corporation, Calcutta
CHIEF ARCHITECT	Central Public Works Department, New Delhi
SENIOR ARCHITECT (H & TP-1) (<i>Alternate</i>)	
CHIEF ENGINEER, AUTHORITY	Maharashtra Housing and Area Development Authority, Bombay
ARCHITECT, AUTHORITY (<i>Alternate</i>)	
CHIEF ENGINEER (D)	Central Public Works Department, New Delhi
SUPERINTENDING ENGINEER (D) (<i>Alternate</i>)	
ENGINEER MEMBER, DDA	Delhi Development Authority, New Delhi
SHRI Y. K. GARG	National Housing Bank, New Delhi
SHRI CHETAN VAIDYA (<i>Alternate</i>)	
SHRI O. P. GARYALI	National Council for Cement and Building Materials, New Delhi
DR N. K. JAIN (<i>Alternate</i>)	
SHRI T. N. GUPTA	Building Materials & Technology Promotion Council, New Delhi
SHRI HARBINDER SINGH	Public Works Department, Government of Rajasthan, Jaipur
SHRI R. N. AGRAWAL (<i>Alternate</i>)	
DR K. S. JAGDISH	Centre for Application of Science and Technology to Rural Areas (ASTRA), Bangalore
DR B. V. VENKATARAMA REDDY (<i>Alternate</i>)	
SHRI N. N. JAVDEKAR	CIDCO, Maharashtra
SHRI P. M. DESHPANDE (<i>Alternate</i>)	
SHRI T. P. KALIAPPAN	Tamil Nadu Slum Clearance Board, Government of Tamil Nadu, Madras
SHRI J. BHUVANESWARAN (<i>Alternate</i>)	
MISS NINA KAPOOR	The Mud Village Society, New Delhi
SHRI A. K. M. KARIM	Housing Department, Government of Meghalaya, Shillong
SHRI K. R. S. KRISHNAN	Department of Science & Technology (DST), New Delhi
COL. D. V. PADSALGIKAR	B. G. Shirke & Co, Pune
SHRI RAJA SINGH	IRCON, New Delhi
SHRI S. SELVANTHAN (<i>Alternate</i>)	
DR A. G. MADHAVA RAO	Structural Engineering Reasearch Centre (CSIR), Madras
SHRI I. K. MANI (<i>Alternate</i>)	
SHRI T. K. SAHA	Engineer-in-Chief's Branch, New Delhi
SHRI R. K. MITTAL (<i>Alternate</i>)	

(*Continued on page 7*)

(Continued from page 6)

Members

SHRI J. S. SHARMA

SHRI B. B. GARG (*Alternate*)SHRI J. VENKATARAMAN,
Director (Civ Engg)*Representing*

Central Building Research Institute (CSIR), Roorkee

Director General, BIS (*Ex-officio Member*)*Member Secretary*SHRI J. K. PRASAD
Joint Director (Civ Engg), BISPanel for Modular Coordination and Prefabrication
for Mass Scale Housing, CED 51 : P2*Convener*

SHRI T. N. GUPTA

Ministry of Urban Development

Members

SHRI Y. K. GARG

National Housing Bank, New Delhi

SHRI SUNIL BERRY (*Alternate*)

SHRI M. N. JOGLEKAR

Housing and Urban Development Corporation, New Delhi

PROF V. P. RAORI

School of Planning & Architects, New Delhi

PROF P. K. CHOUDHARY (*Alternate*)

SHRI G. S. RAO

National Building Construction Corporation, New Delhi

REPRESENTATIVE

M/s B. G. Shirke & Co, Pune

DR A. G. MADHAVA RAO

Structural Engineering Research Centre, Madras

SHRI K. MANI (*Alternate*)

SHRI S. ROY

Hindustan Prefab Ltd, New Delhi

SHRI M. KUNDU (*Alternate*)

SHRI J. S. SHARMA

Central Building Research Institute, Roorkee

SHRI M. P. JAISINGH (*Alternate*)

SUPERINTENDING ENGINEER (D)

Central Public Works Department, New Delhi

EXECUTIVE ENGINEER (HQ) (*Alternate*)

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

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.

This Indian Standard has been developed from Doc No. CED 51 (5055)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

Telephone
{ 331 01 31
{ 331 13 75

Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola
CALCUTTA 700054

{ 37 84 99, 37 85 61
{ 37 86 26, 37 86 62

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022

{ 60 38 43
{ 60 20 25

Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113

{ 235 02 16, 235 04 42
{ 235 15 19, 235 23 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
BOMBAY 400093

{ 632 92 95, 632 78 58
{ 632 78 91, 632 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.
COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD.
JAIPUR. KANPUR. LUCKNOW. PATNA. THIRUVANANTHAPURAM.