इंटरनेट मानक

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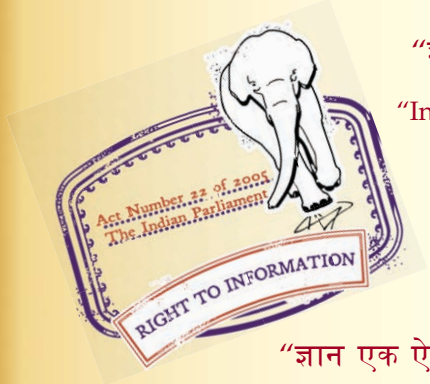
IS 14143 (1994): prefabricated brick panel and partially precast concrete joist for flooring and roofing [CED 51: Planning, Housing and pre-fabricated construction]



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IS 14143 : 1994
(Reaffirmed 2005)

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Indian Standard

PREFABRICATED BRICK PANEL AND PARTIALLY PRECAST CONCRETE JOIST FOR FLOORING AND ROOFING — SPECIFICATION

UDC 691·328-413 : 692·4

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

November 1994

Price Group 2

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, for facilitating speedy and economical construction of houses. Problem of housing being enormous amongst the lower income groups, both rural and urban, the maximum stress is being laid on housing for these target groups.

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

a) Design and construction of roofs and floors with prefabricated brick panel — Code of practice

b) Precast reinforced concrete channel unit for construction of floors and roofs — Specification

c) Design and construction of floors and roofs with precast reinforced channel units — Code of practice

d) Precast reinforced concrete planks and joists for flooring an d roofin g — Specification

e) Design and construction of floor and roof with precast reinforced concrete planks — Code of practice

f) Precast reinforced concrete L-panel for roofing — Specification

g) Design and construction of roofs using precast reinforced concrete L-panel — Code of practice

The use of reinforced brick roofs had been quite common in Northern parts of India. Its design was based on the crushing strength of brick. The large variation in crushing strength of bricks had, however, inhibited their use and raised doubts about the feasibility and performance of reinforced brick roofing/flooring slab. Further, the corrosion of reinforcement due to contact between mild steel bars and bricks caused reduction in the life of roof. Also, the crushing strength of bricks usually being low, the thickness of slab increases causing an increase in dead load too.

The Central Building Research Institute, Roorkee has developed prefab brick panel system which is a combination of concrete, bricks and reinforcement such that concrete is used in the zone of maximum compressive stresses thereby permitting the use of lower compressive strength bricks and T-beam action develops between partially precast joist and the *in-situ* concrete.

The 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

PREFABRICATED BRICK PANEL AND PARTIALLY PRECAST CONCRETE JOIST FOR FLOORING AND ROOFING — SPECIFICATION

1 SCOPE

This standard lays down requirements for prefabricated brick panel and partially precast joist for flooring and roofing.

2 REFERENCES

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

IS No.	*Title*
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*)
456 : 1978	Code of practice for plain and reinforced concrete (*third revision*)
1077 : 1991	Specification for common burnt clay building bricks (*fifth revision*)
2180 : 1988	Specification for heavy duty burnt clay building bricks (*third revision*)
4905 : 1968	Methods for random sampling
12894 : 1990	Specification for fly ash lime bricks
13757 : 1993	Specification for burnt clay fly ash building bricks
14142 : 1994	Code of practice for design and construction of roofs and floors with prefabricated brick panel

3 MATERIALS

3.1 Concrete

The concrete used for making prefabricated brick panels and joists shall conform to grade M-15 of IS 456 : 1978. Coarse aggregate used for making concrete shall be well graded with maximum size of 12 mm for brick panels and well graded with maximum size of 20 mm for joist.

3.2 Reinforcement

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

3.3 Bricks

Bricks used for making prefabricated panels shall conform to IS 1077 : 1991 or IS 12894 : 1990 or IS 13757 : 1993. Bricks of higher strength conforming to IS 2180 : 1988 may also be used.

4 DIMENSIONS AND TOLERANCES

4.1 Prefabricated Brick Panel (*see* Fig. 1)

4.1.1 *Length*

Length of panel shall not exceed 1·1 m for bricks having strength less than 40 N/mm². For bricks having strength more than 40 N/mm² conforming to IS 2180 : 1988 the length of panel shall not exceed 1·2 m. From economic point of view, the minimum recommended length of panel is 0·9 m. Thickness of transverse joints may be varied within the range specified in **4.3.2** for varying the length.

4.1.2 *Width*

Width of the panel shall be 53 cm for panels made of conventional size (230 mm × 110 mm × 75 mm) bricks and 45 cm for panels made of modular size (190 mm × 90 mm × 90 mm) bricks.

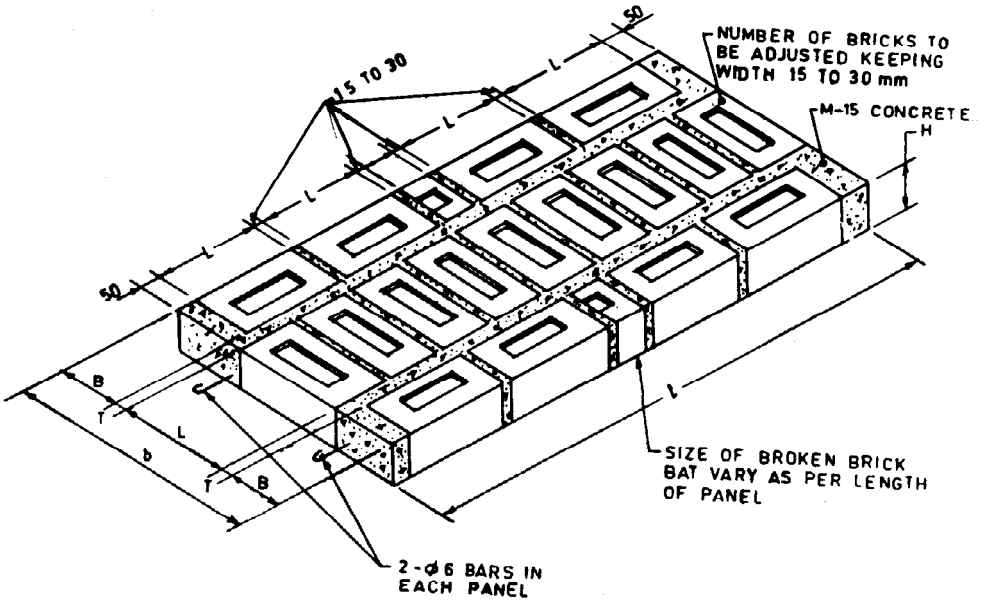
4.1.3 *Thickness*

Thickness of the panel shall be equal to thickness of a brick, that is, 75 mm for conventional size bricks and 90 mm for modular size bricks.

4.2 Partially Precast Joist

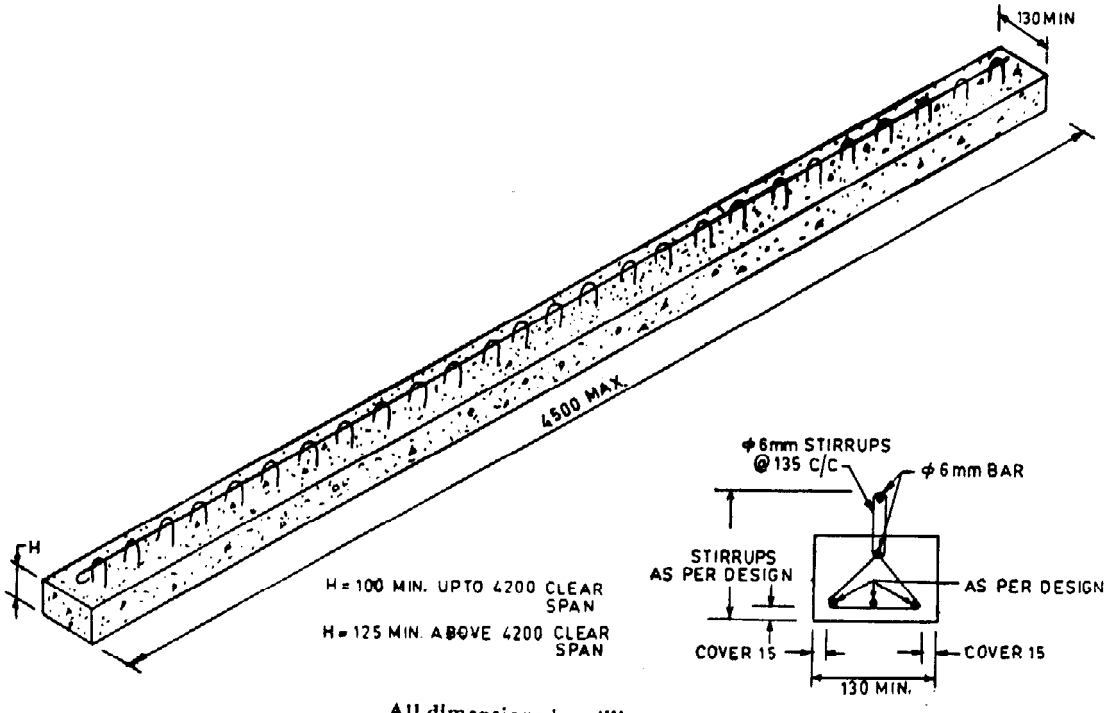
4.2.1 *Shape*

Partially precast joist shall be rectangular in shape with steel stirrups kept projecting out which shall be tied with reinforcement along the joist to achieve monolithicity with concrete (*see* Fig. 2).



All dimensions in millimetres.

FIG. 1 ISOMETRIC VIEW OF PREFAB BRICK PANEL



All dimensions in millimetres.

FIG. 2 TYPICAL PARTIALLY PRECAST JOIST

4.2.2 *Width*

Width of partially precast joists shall be sufficient to support two successive spans of brick panels with sufficient bearing, leaving an adequate gap between them. The minimum recommended width is 13 cm, which may be increased if required for structural strength.

4.2.3 *Depth*

The recommended depth for precast joist, for clear span of joist up to 4·2 m shall be 100 mm for both conventional and modular size bricks, Accordingly overall depth of joist with *in-situ* concrete of 35 mm shall be 210 mm for conventional bricks and 225 mm for modular bricks.

4.3 Thickness of Joints

4.3.1 *Longitudinal Joints*

Thickness of longitudinal joints shall be 40 mm to accommodate one 6-mm reinforcing bar with adequate cover (*see* Fig. 1). However, the thickness of joints may vary to compensate for variation in brick dimensions, so that specified panel dimensions remain the same.

4.3.2 *Transverse Joints*

Thickness of transverse joints shall vary from a minimum of 15 mm to a maximum of 30 mm. However in a single panel unit, this shall be kept uniform for all transverse joints. The range of 15 mm to 30 mm has been permitted to facilitate variation in panel length, using same number of bricks to suit room dimensions.

4.4 Tolerances

Tolerances on various dimensions of the panel shall be as given below:

Dimension	*Tolerance*
Length of panel	±10 mm
Width of panel	± 5 mm
Thickness of panel	± 4 mm

NOTE — Recommended dimensions of the panel have been decided so that the panels are light enough to be handled manually and are safe structurally and economical. Dimensions other than those recommended, if required, shall be designed as per 5 and tested as per 8.

5 REINFORCEMENT

5.1 Reinforcement required for brick panel shall be provided as per design along the length. This shall consist of 2 bars of required diameter embedded in the longitudinal joints as shown in Fig. 1.

5.1.1 For span and dimensions of brick panels covered in this standard a reinforcement with two mild steel Grade I bars of 6 mm conforming to IS 432 (Part 1) : 1982 may be used in residential building without needing calculations.

5.1.2 Reinforcement for RC joist shall be provided as per design (*see* IS 14142 : 1994).

5.2 Cover to Reinforcement

A minimum clear cover of 15 mm shall be provided to reinforcement in the panel while for the joist the minimum clear cover shall be 25 mm.

6 MANUFACTURE OF PRECAST ELEMENTS

6.1 Prefabricated Brick Panel

6.1.1 *Mould*

The moulds should generally be made from well-seasoned good quality timber or an equivalent wood substitute. In case of mass production, mild steel or other rigid, non-absorbant and non-corrodible materials such as FRP may be used with advantage.

6.1.2 *Casting*

The moulds which are open at bottom shall be kept on a levelled ground having thin layer of sand or *pucca* floor or platform. The bricks shall be properly wetted and arranged in the mould with outermost bricks touching the sides of mould and the specified gaps for joints shall be left between bricks. For breaking (staggering) transverse joints, broken brick bats may be used as shown in Fig. 2. The frogs of the bricks shall face upward to provide shear key to deck concrete (*in-situ* concrete). About 15 mm thick layer of concrete or 1 : 3 cement coarse sand mortar shall then be placed in the longitudinal gaps between the bricks and two reinforcing bars shall be placed over it. All the gaps between the bricks shall then be filled with concrete or mortar. The mould may be removed just after casting.

6.1.3 *Curing*

The panel shall be cured for at least 14 days by sprinkling water and dried for 14 days thereafter, before it is used for construction.

6.2 Partially Precast Joist

6.2.1 *Mould*

The mould should generally be made of well seasoned good quality timber or an equivalent wood substitute. In case of mass production, use of mild steel or other rigid, non-absorbant, non-corrodible materials such as FRP may be advantageous.

6.2.2 *Casting*

Mould shall be placed on a smooth and levelled surface and a 25 mm thick layer of concrete shall be laid in the mould. The reinforcement cage shall then be placed in the mould over the concrete layer. The concrete shall be poured in the mould and compacted well by vibration. The mould may be stripped off after about 2 to 3 h (depending upon weather) after casting.

6.3 Tolerances on dimensions of moulds shall be as given below:

Dimension	*Tolerance*
Length	±8 mm
Width	±3 mm
Depth	±3 mm

6.4 Curing

The panel and joists shall be water-cured for a minimum of 2 weeks followed by air-curing for another 2 weeks before using them in construction.

7 SAMPLING

7.1 All prefabricated brick panels and joists of the same size manufactured from similar materials and under similar conditions of production shall be grouped together to constitute the lot.

7.2 Five units of prefabricated brick panel and joist shall be selected at random out of a lot consisting of 300 units or less. For a lot 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 samples shall be suitably marked for future identification of the lot it represents.

8 TESTS

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

8.1 Dimensional test and deflection recovery test shall be routine tests whereas failure load test shall be a type test. Type test is intended to prove the suitability and performance of a new design and size of a component. Failure load test is applied at the time of any change in the design/size.

9 CRITERIA FOR CONFORMITY

9.1 If four out of five samples satisfy the shape and dimensional requirements given in 4, the lot represented by the sample shall be deemed to have passed the dimensional requirements. If more than one panel fails to satisfy the dimensional requirements given in 4.1.1 to 4.1.3, the lot represented by sample shall be rejected.

9.2 In the deflection recovery test as per Annex B, if the deflection 24 h after the removal of imposed load is at least 75 percent of the deflection under the load for 24 h, the units 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 h under load is $40\,l^2/D$, where l is the effective span in mm and D, the overall depth of the section in mm, it is not necessary for deflection recovery to be measured and the recovery provision mentioned in this clause earlier shall not apply.

9.3 In the case of the failure load performed in accordance with Annex B, 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 1·33 times the characteristic load, the load represented by the sample shall be rejected.

10 MARKING

10.1 Each component shall be 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 product may also be marked with the Standard Mark.

10.2·1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of the conditions under which the 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

(*Foreword*)

COMMITTEE COMPOSITION

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CHIEF ENGINEER, AUTHORITY	Maharashtra Housing and Area Development Authority, Bombay
ARCHITECT, AUTHORITY (*Alternate*)	
CHIEF ENGINEER (D)	Central Public Works Department, New Delhi
SUPERINTENDING ENGINEER (D) (*Alternate*)	
ENGINEER MEMBER, DDA	Delhi Development Authority, New Delhi
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	SHRI J. K. PRASAD Joint Director (Civ Engg), BIS

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ANNEX B

(*Clauses* 8, 9.2 *and* 9.3)

TESTS FOR PREFABRICATED BRICK PANEL

B-1 AGE OF TESTING

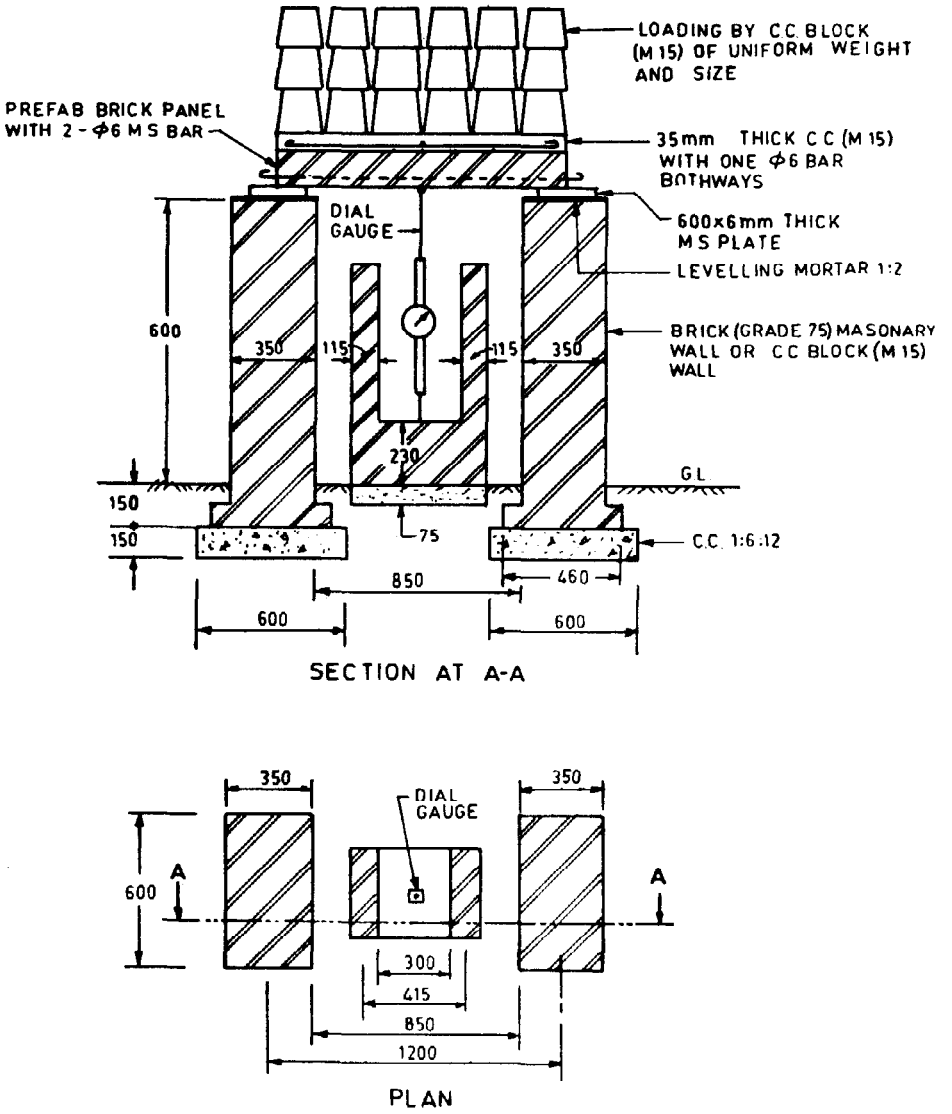
The prefabricated brick panel and joist shall be tested as soon as possible after expiry of 28 days from the time of casting. Precast joist shall be tested at an age of 28 to 33 days after casting.

B-2 DIMENSIONAL CONFORMITY

Five samples of prefabricated brick panel and joist selected in accordance with 7.2 shall be checked for conformity with the shape and dimensional requirements as given in 4. Length of the unit 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

B-3 DEFLECTION RECOVERY TEST

B-3.1 One panel selected at random out of panels which have satisfied dimensional requirements as per **9.1** shall be subjected to deflection recovery test. The panel shall be simply supported with a bearing of 40 mm on either end of the panel over a concrete/brick walls with 6 mm thick M. S. steel plate fixed in level at top of the walls as shown in Fig. 3.



All dimensions in millimetres.

FIG. 3 A TYPICAL LOAD TEST SETUP

Distribution/temperature reinforcement in the form of one 6-mm mild steel Grade I bar conforming to IS 432 (Part 1) : 1982 shall be laid parallel and perpendicular to the length of the panel. Cement concrete (M 15) 3·5 cm thick shall be laid over the panel and it shall be cured by sprinkling water for 14 days and dried for 14 days thereafter, before testing, 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 mid span of the panel. The dial gauge shall be adjusted to indicate zero reading under self weight of the panel and applied dead load. Design dead load other than due to self weight of the unit shall be applied uniformly over the panel through loading blocks or by other means.

B-3.2 The panel shall be subjected to a uniformly distributed load equal to 1·25 times the imposed designed load, applied through loading blocks of concrete or steel. Alternatively uniform load may 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 h and after recording deflection at the end of this period, the load shall be removed without disturbing the dial gauge.

The residual deflection shall be recorded again after 24 h of the removal of the load for deflection recovery.

B-4 FAILURE LOAD TEST

B-4.1 The prefabricated brick panel, which has passed the deflection recovery test shall be further subjected to failure load. 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/bricks, sufficient gap shall be left between adjacent blocks/bricks to ensure that they do not touch each other even at the final stage of loading, to prevent transfer of load to supports of the panels through arch action. The loading shall preferably be done by making an independent scaffolding to provide safety to the labourers.

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

B-5 LOAD TEST FOR PARTIALLY PRECAST R. C. JOIST

The test shall be done similar to the test for prefabricated brick panel, except that instead of uniform load, two point loads shall be applied at middle third points.

Bureau of Indian Standards

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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 a 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'.

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Amendments Issued Since Publication

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