

भारतीय मानक

भवन उद्योग में माड्यूर समन्वय की सिफारिशें :  
दीवारों तथा फर्श-सिल्लियों की स्थिति

*Indian Standard*

RECOMMENDATIONS FOR MODULAR  
CO-ORDINATION IN BUILDING INDUSTRY:  
LOCATION OF STRUCTURAL WALLS AND  
FLOOR SLABS

UDC 721-013 : 006-78 : 692-2 : 692-522

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## FOREWORD

The Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Planning, Bye-laws and Dimensional Co-ordination Sectional Committee had been approved by the Civil Engineering Division Council.

The Bureau of Indian Standards has brought out series of recommendations on modular coordination in building industry which are intended to serve as an introduction to the modular concept and also a working reference for design and construction of buildings. The purpose of these standards is to describe the general theory and application of modular co-ordination for providing guidance to designers, manufacturers and builders. Some of the important Indian Standards relating to modular co-ordination are IS 7921 : 1987, IS 7922 : 1987 and IS 6820 : 1978 published by the Bureau. These explain the relationship between the dimensional frame work for controlling horizontal and vertical dimensions and also dimensional design requirements of components for all types of buildings.

This standard which is one of a series of standards on modular co-ordination provides general guidance and practical examples on different methods of placing of components and assemblies within dimensional framework. The information provided in this standard may extensively be used by all building designers for all types of constructional techniques employed in building design and execution of project work.

A distinction is made between placement of elements and components which constitute horizontal and vertical assemblies in a design of building carcass. The use of grid, as a tool for designers is recommended for horizontal and vertical co-ordination. When components are located on a grid, both their basic size and position are identified easily in relation to one another. The recommendations for doorsets and windowsets are given in IS 12073 : 1987 and for change of level are given in IS 7922 : 1987. The height of doorsets and windowsets are recommended from finished floor level.

In preparation of this standard, considerable assistance has been rendered by the National Building Organization, New Delhi.

In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following:

- a) DS/R-1049 Structural walls and floor slabs : placing of components — Ist Edition, November 1966.  
Danish Standards Association.
- b) Industrialized building and modular design  
— Henrik Nissen  
— Cement and Concrete Association, London ( 1972 )
- c) Going metric in the construction industry, 2 Dimensional co-ordination — Ministry of Building and Works HMSO — London ( 1963 )
- d) Recommendation for the co-ordination of dimensions in building — Basic spaces for structure, external envelope and internal sub-division.  
Part 1 — PD 6444 BRS — London.

## *Indian Standard*

# RECOMMENDATIONS FOR MODULAR CO-ORDINATION IN BUILDING INDUSTRY: LOCATION OF STRUCTURAL WALLS AND FLOOR SLABS

### 1 SCOPE

**1.1** This Standard lays down the rules for practical application of the modular co-ordination in building industry for fixing location of structural walls and floor slabs.

**1.2** The recommendations are limited to assembly system usually adopted between load-bearing walls and floor slabs in typical storeys in all types of buildings.

### 2 REFERENCES

**2.1** The Indian Standards listed in Annex A are necessary adjuncts to this standard.

### 3 GENERAL

**3.1** There are certain pre-requisites in design of jointing details, foundations and parapets in pre-fabrication/industrialized building systems as given in 3.1.1 to 3.1.3.

**3.1.1** The jointing of pre-fabricated elements is a critical element in pre-fabricated/industrialized building system and required to be carefully detailed out in keeping with resources, equipment, material and skill available to ensure structural stability and water proofing. It is necessary that the elements are placed in such a manner that they coincide horizontal and vertical co-ordinating planes.

**3.1.2** The water proofing of horizontal and vertical joints shall be carefully decided in consideration with the type of panels/units adopted, weather conditions and appropriate sealants being selected for the work.

**3.1.3** The plinth/sub-structure units shall be designed taking into consideration the height of floor level from reference plane (normal plinth), type of soil and foundation system employed. Similarly parapet units shall also be designed taking into consideration the water proofing, insulations and height of the parapet.

### 4 FIELD OF APPLICATION

**4.1** This standard deals with the principles of dimensional co-ordination to be applied in placing of load-bearing, horizontal and vertical members which divide the spaces, for example load-bearing walls and floor slabs either pre-fabricated elements and components or traditional brick walls and *in situ* concrete slabs ( *see* Fig. 1 ).

**4.2** This may also be applied to the load-bearing members such as columns, beams and slab, cast-in-situ or prefabricated elements and components.

**4.3** The design details for joints and components shall depend on construction techniques employed for structural stability.

### 5 TERMINOLOGY

**5.1** For purpose of this standard, the definitions given in IS 4993 : 1983, IS 7921 : 1987 and IS 7922 : 1987 shall apply.

### 6 HORIZONTAL LOCATION OF COMPONENTS

#### 6.1 Design of Structure

As horizontal components require to be located in two directions; it is convenient to introduce a grid to which they shall be related ( *see* Fig. 2 ).

**6.1.1** A modular planning grid of preferred dimensions in accordance with IS 7921 : 1987 shall be used for location of structural elements.

**6.1.2** The load-bearing members such as walls or beams shall be placed on lines in the modular planning grid.

**6.1.3** The joints between floor slabs shall be placed on lines in the modular planning grid.

**6.2 Design Details**

**6.2.1** The load-bearing cross walls shall be placed with axial planning principles unless the construction technique demands alteration in location that is, the axis of wall shall coincide with planning modular line.

**6.2.2** The external load-bearing walls shall be so placed that it fulfills the method adopted for linkage of components ( see Fig. 5 ).

**6.2.3** The floor slab components shall be placed within their modular zones ( see Fig. 3A and 4A ).

**6.2.4** Structural load-bearing exterior or spine wall shall be taken as  $M$ ,  $M/2$ ,  $M/4$  or  $n \times M/5$  into the wall which they meet measured from the inside surface, on the basis of a technical analysis of structure.

**6.3 Neutral Zone and Interrupted Planning Grids**

**6.3.1** Due to some technical considerations, it may be necessary to increase the gap between two floor slabs components, in such cases, the

modular zones of components may be displaced in relation to basic planning grids ( see Fig. 3B and 4B ).

**6.3.2** The space between two grids shall be bounded by two modular planning grid lines.

**6.3.3** The dimension of space shall be fixed from technical aspects. Bearing and placement of units shall be designed accordingly.

**7 VERTICAL LOCATION OF COMPONENTS**

**7.1 Design of Structure**

For vertical location, a component only requires a single dimensions, that is, distance from the floor plane as given in 7.1.1 to 7.1.5.

**7.1.1** A modular planning grid of  $3M$  horizontally and  $2M$  vertically shall be employed.

**7.1.2** The vertical controlling dimensions shall be selected in accordance with IS 7922 : 1987.

**7.1.3** This shall form rectangular mesh. Only necessary lines shall be indicated on drawings.

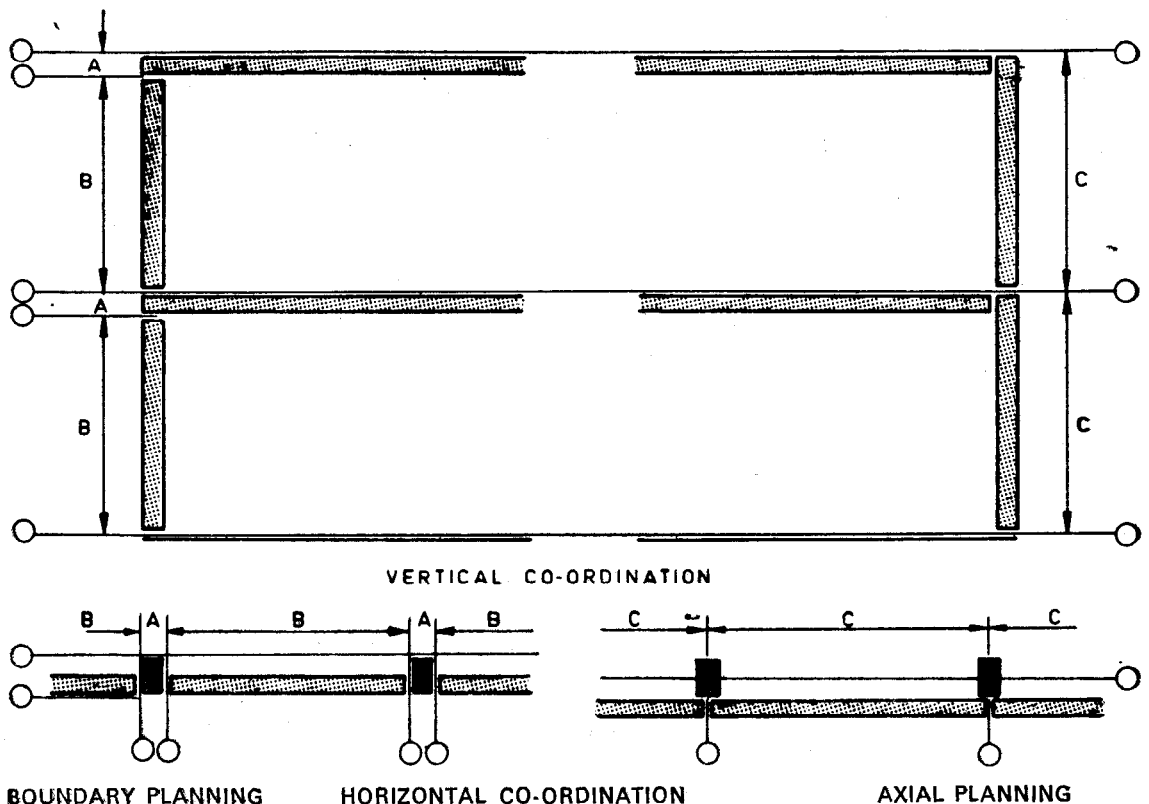
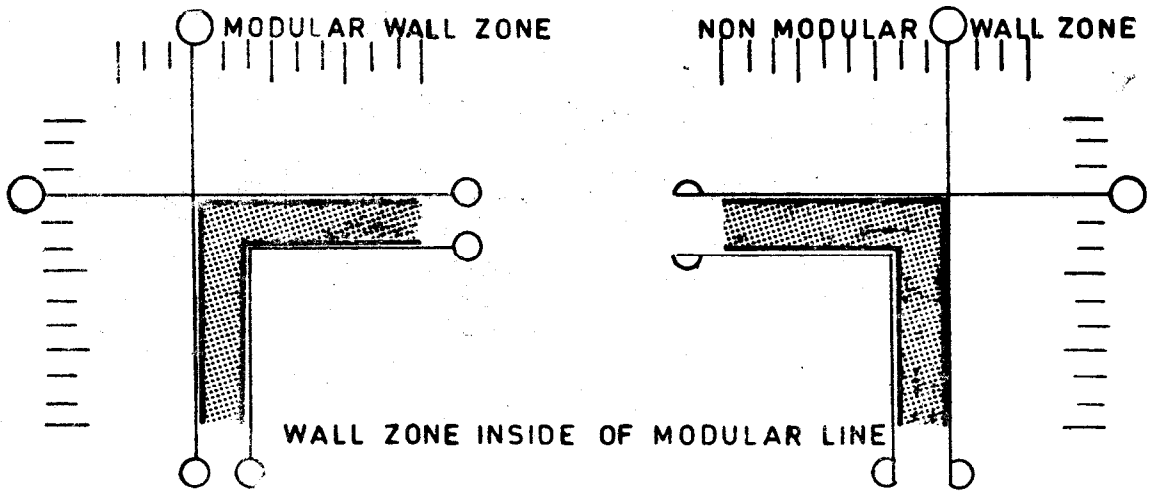
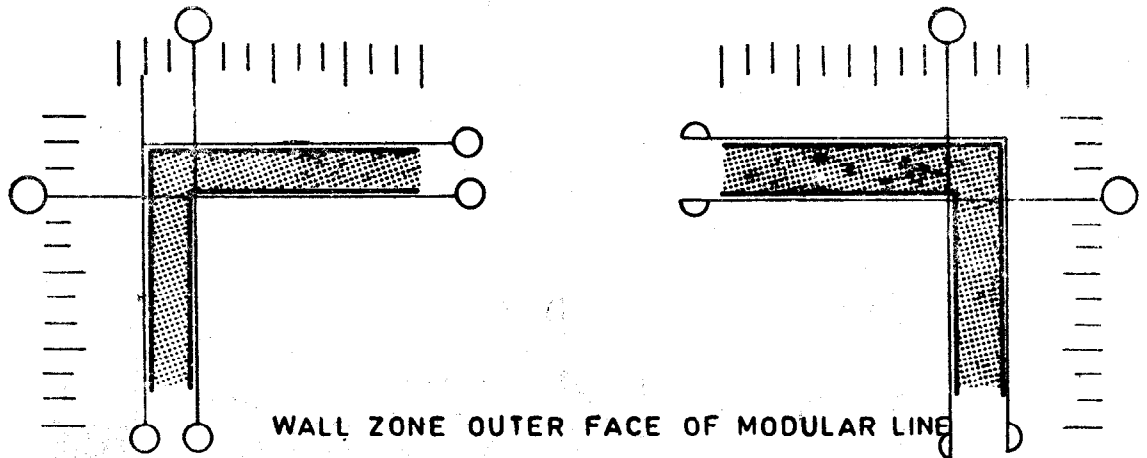


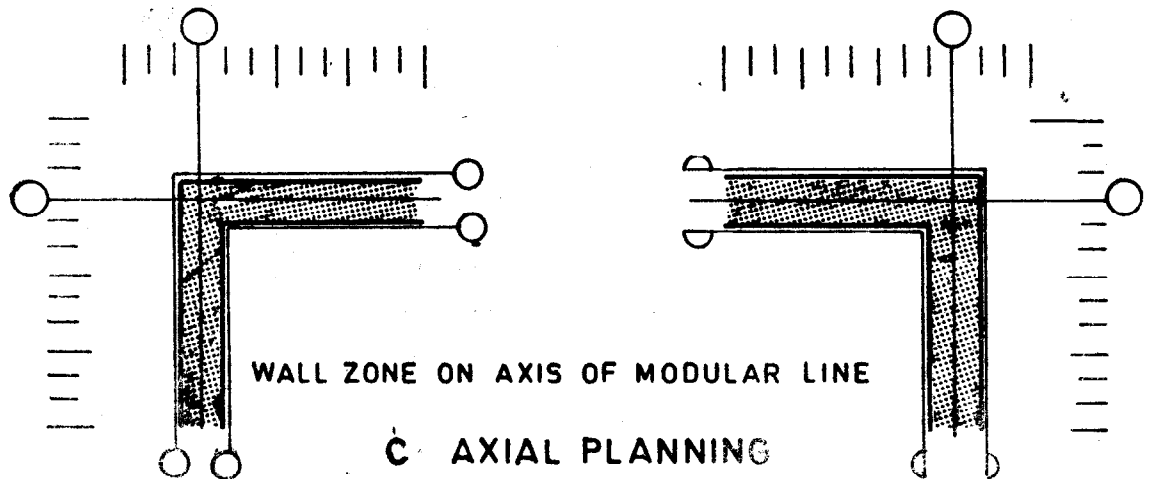
FIG. 1 LOCATION OF COMPONENTS



**A BOUNDARY PLANNING**

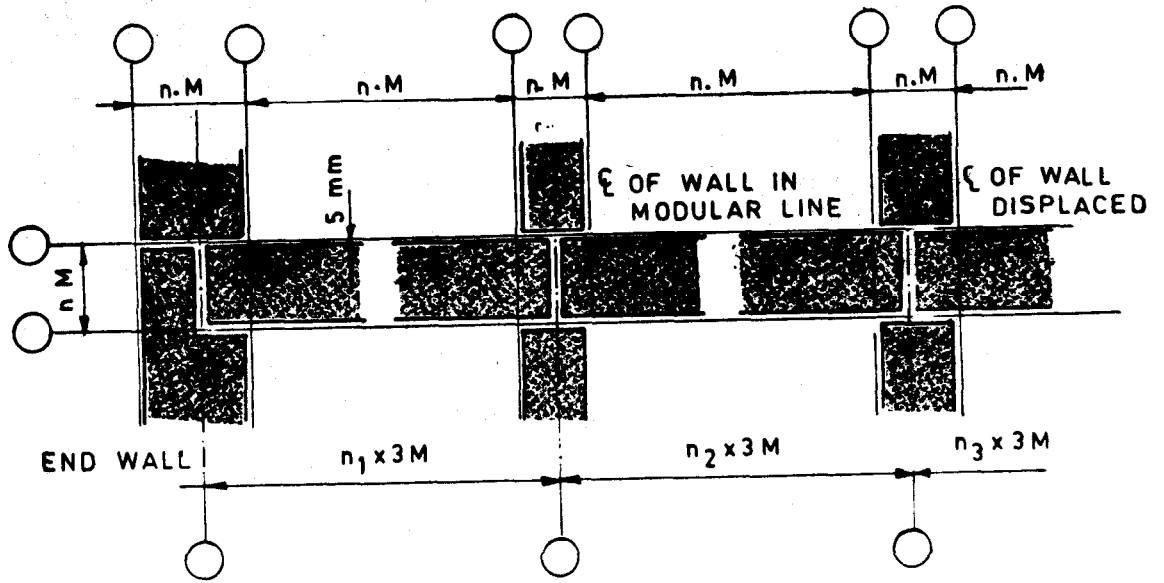


**B BOUNDARY PLANNING**



**C AXIAL PLANNING**

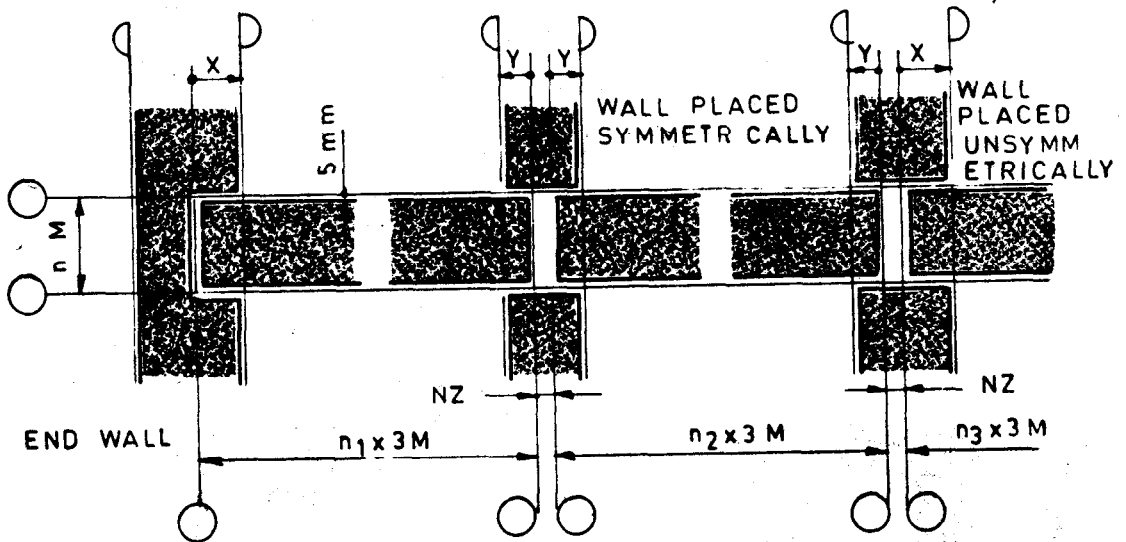
FIG. 2 LOCATION OF WALLS



**A CONTINUOUS MODULAR PLANNING GRID**

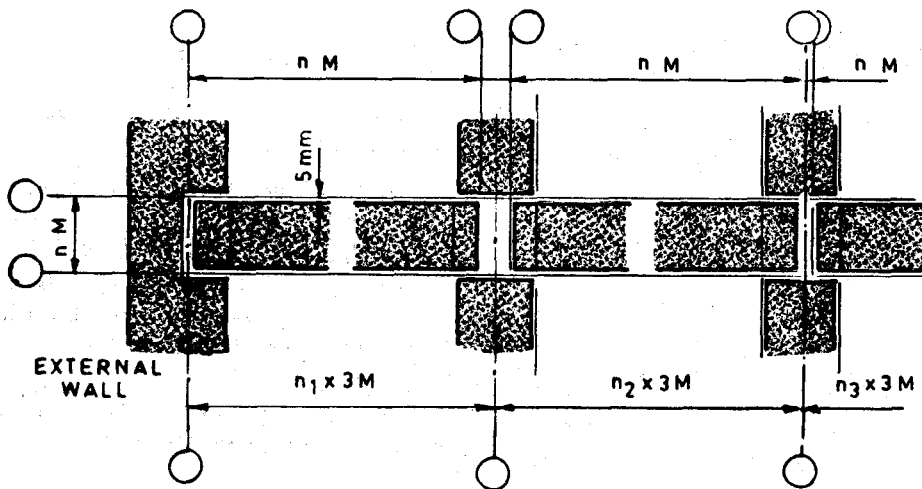
X AND Y ARE THE BEARINGS REQUIRED FOR STRUCTURAL STABILITY

NZ - NEUTRAL ZONE

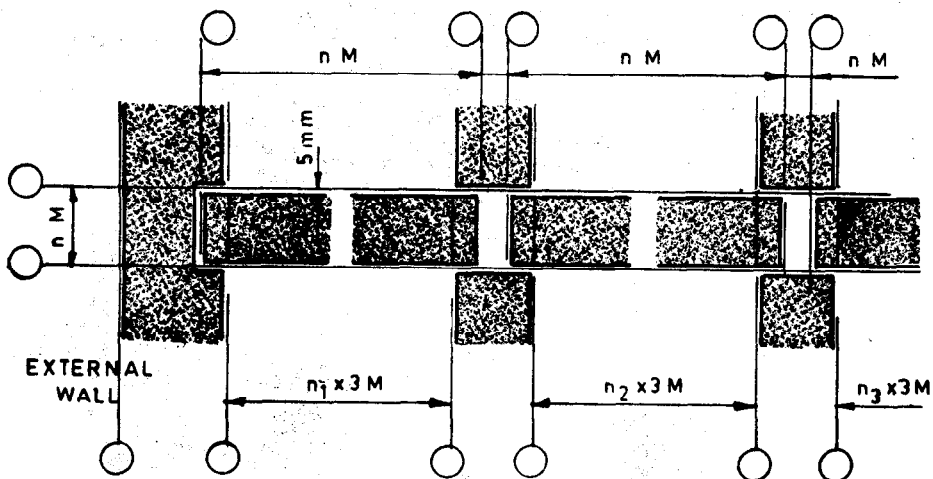


**B INTERRUPTED MODULAR PLANNING GRID**

FIG. 3 CONNECTION BETWEEN STRUCTURAL WALLS AND FLOOR SLABS  
VERTICAL SECTIONS ( END WALLS )



AXIAL PLANNING  
A CONTINUOUS MODULAR PLANNING GRID



BOUNDARY PLANNING  
B INTERRUPTED MODULAR PLANNING GRID

FIG. 4 CONNECTION BETWEEN STRUCTURAL WALLS AND FLOOR SLABS  
VERTICAL SECTIONS ( EXTERNAL WALLS )

**7.1.4** Load-bearing floor components shall be placed with their theoretical top surface in a horizontal plane.

**7.1.5** Load-bearing external and internal walls shall be placed in the truly vertical direction with due regard to assembly method employed for structural stability.

**7.2 Design Details**

**7.2.1** Only necessary modular lines shall be drawn.

**7.2.2** Load-bearing floor slabs shall be placed with their top surface 5 mm below the horizontal reference line, point or plane.

**7.2.3** The placement of load-bearing or non-load bearing or partiton external or internal wall shall be dimensioned in accordance with '5mm rule' ( see IS 7922 : 1987 ) and construction technique related to the joints and assemblies ( see Fig. 5 ).

**7.2.4** Location of structural floor slabs shall be selected on different positions of the modular floor plane to determine the modular room height.

**7.2.4.1** Typical situation of modular floor plane at floor covering sub/base floor and structural slabs is shown in Fig. 6.

**7.3 Modular Floor Height**

**7.3.1** Modular floor plane coinciding with upper surface of floor covering is shown in Fig. 6.

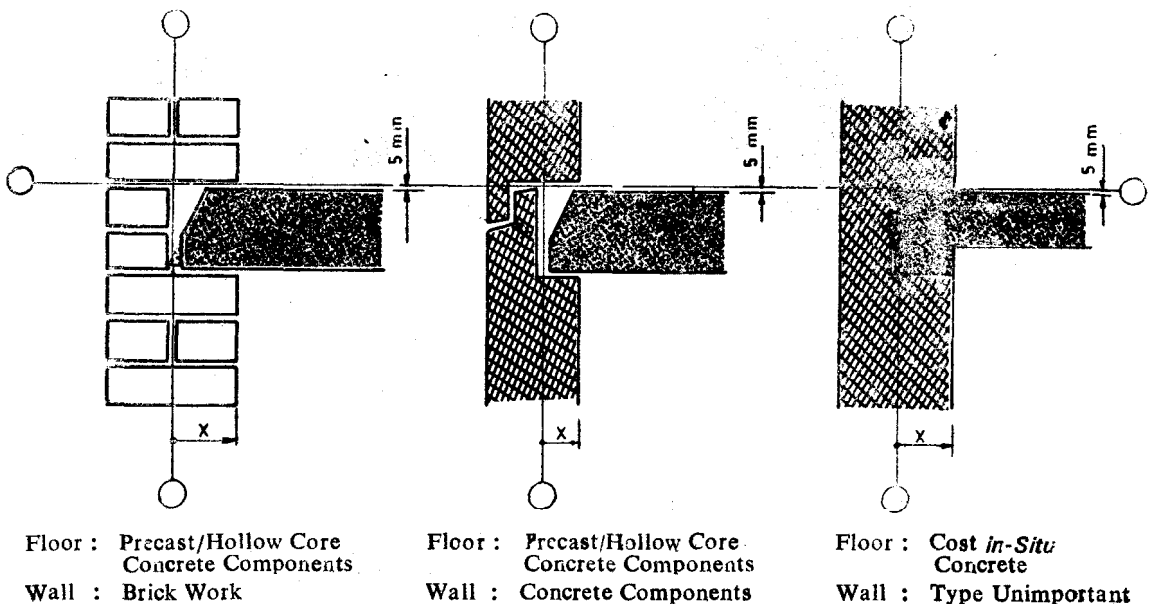
**7.4 Non-modular Floor Height**

**7.4.1** Following positions of modular floor plane are possible:

- i) Modular floor plane coinciding with upper surface of floor covering, having non-modular floor height;
- ii) Modular floor plane coinciding with upper surface sub/base floor having non-modular thickness; and
- iii) Modular floor plane coinciding with upper surface of structural slab, having non-modular thickness.

**8 CONNECTION BETWEEN STRUCTURAL WALLS AND FLOOR SLABS**

**8.1** The preferred dimensions in length or width of floor components and modular thicknesses of wall elements employed in a design of carcass of a building leads to placing of these components on continuous modular planning grid ( see Fig. 3A ).



THE DISTANCE 'X' DEPENDS ON THE LOADINGS, STRENGTHS OF THE MATERIALS AND CONSTRUCTION TECHNIQUES

**FIG. 5** PLACING OF LOAD-BEARING EXTERIOR WALLS ON MODULAR LINES



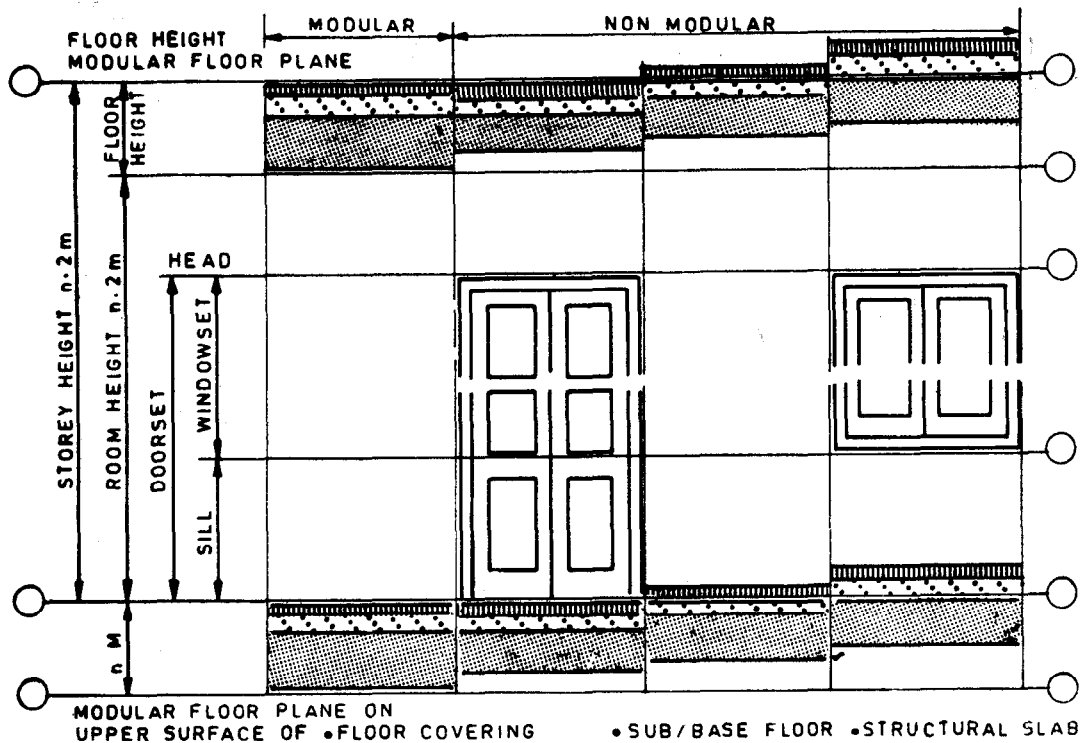


FIG. 6 LOCATIONS OF STRUCTURE FLOOR SLABS

**8.2** The preferred longitudinal or transverse dimensions of floor slab components and non-modular thicknesses of wall elements employed in a design of carcass of building leads to placing of these components on interrupted modular grid ( see Fig. 3B ).

**8.3** The modular longitudinal or transverse dimensions of floor slab components and modular or non-modular thicknesses of wall elements when employed in a design of carcass of a building leads to placement of these components on continuous preferred dimensions of planning grid ( see Fig. 4A ).

**8.4** The modular dimensions in length or width of floor components and non-modular thicknesses of wall elements when employed in design of structure, the location of these components shall be on preferred dimensions of interrupted planning that is boundary planning shall be used ( see Fig. 4B ).

## 9 EXTERNAL WALLS

**9.1** In order to apply principles of modular coordination in a project, external walls shall be placed with their inside faces at a distance of basic module with sub-modular increments for

distances greater from the line of planning grid ( see Fig. 5 ).

**9.2** The distance shall depend on the loadings, strength of materials and construction techniques employed in a project of stability of structure.

**9.3** Vertical joints between external wall components shall normally be located in relation to the planning grids ( see Fig. 7 ).

**9.4** In order to locate vertical joints correctly in relation to the grid, the use of special type components may be able to provide solution at corner connection ( see Fig. 7 ).

**9.5** In the detailed design of corner connections, the component and the grids shall be displaced in relation to each other for using only standard components within their modular zone and in accordance with wall-axis principle ( see Fig. 8 ).

## 10 SPINE WALLS

**10.1** The external spine walls shall be placed with their inside faces at a distance of basic-module ( with sub-modular increments for greater distances ) from the lines of planning grid ( see Fig. 9 ).

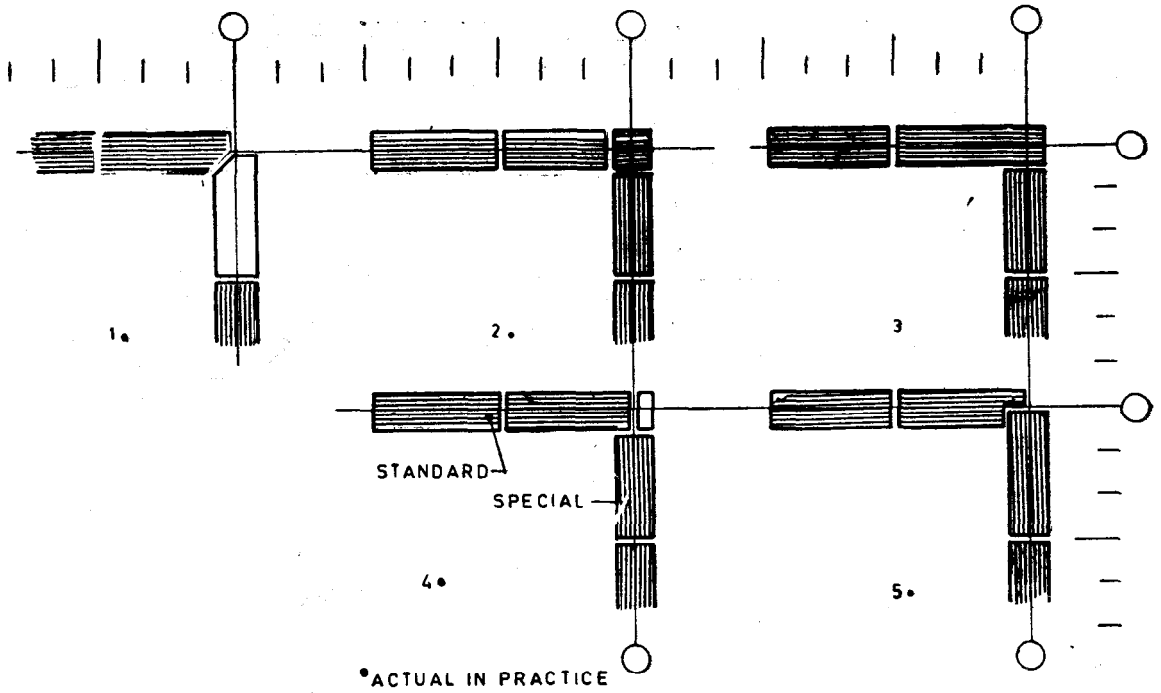


FIG. 7 MODULAR GRID AND SPECIAL WALL COMPONENTS AT CORNER CONNECTIONS

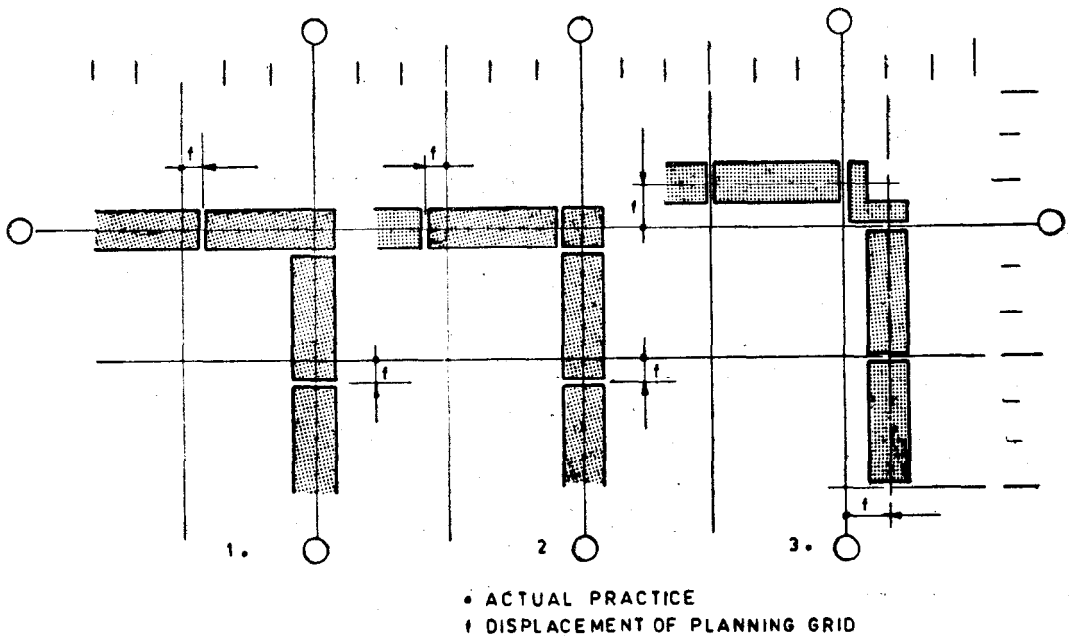
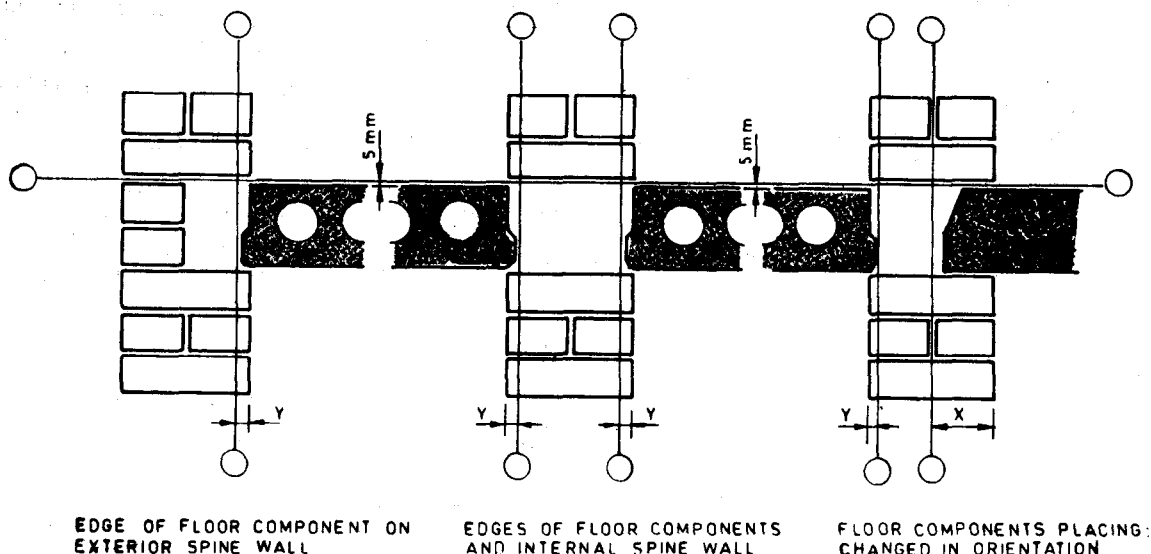


FIG. 8 DISPLACEMENT OF GRID AND STANDARD WALL COMPONENTS



Floor : Precast/Hollow Core Concrete Components  
 Wall : Type Unimportant

THE DISTANCE X OR Y DEPENDS ON 'TYPE OF FLOOR COMPONENTS' AND  
 THE CONSTRUCTION METHOD

FIG. 9 PLACING OF SPINE WALLS ON MODULAR LINES

**10.2** The distance shall depend on type of floor components and construction methods.

**10.3** Internal spine walls shall be placed symmetrically or unsymmetrically relative to planning grid. The choice shall depend on thickness of the wall, location of opposite wall and desired modular room dimension.

**10.4** To achieve systematic dimensional co-ordination, uniform location of spine walls shall be followed a project.

**10.5** Vertical joints between internal spine wall components shall be located on basis modular grid line.

## 11 STAIR, LIFT, ESCALATOR, SHAFT, DOORSET AND WINDOWSET OPENINGS

**11.1** Openings in floor slabs and walls ( internal or external shall preferably be so located that the edge is continuous with a line on space planning grid or at least on a line on space planning grid or at least on a line on basic modular grids.

## 12 COLUMNS

**12.1** Structural columns and internal load-bearing walls shall be centred on lines in planning grid.

**12.2** In certain situations, where an odd multiple of  $M$  or non-modular sectional dimensions of columns and internal load-bearing increments/components are used in a project components and the grid shall be displaced in relation to each other within their neutral zones and in accordance with axial planning principle ( see IS 7921 : 1987 ).

## 13 BEAMS

**13.1** Structural beams shall be positioned in accordance with axial planning principle, centred on lines in the planning grid.

**13.2** External structural beams shall be placed in relation to column and in accordance with rules for external walls as stated in 9.

**13.3** Secondary beams or subsidiary beams on purlins shall also be located in accordance with axial planning principle or on lines in basic module grid to accommodate the size of the components based on economic reasons.

## 14 FLOOR SLABS

**14.1** Structural floor slabs shall be positioned with their side face continuous with a line in planning grid.

14.2 Joints between floor slab components shall be located on lines of grid ( see Fig. 10A ).

14.3 In case of dimensionally smaller components, for example partially pre-cast floor components, the longitudinal joints between floor components shall be located on planning grid and transversely on the lines of basic modular grid.

14.4 The controlling height for the floor shall

be bounded on top and bottom by modular reference planes and the floor height shall preferably be multiple of 2M as first preference. The floor height may contain finishings, structural/slab services and ceiling and also sometimes beams ( see Fig. 10B ).

14.5 In exceptional cases, for users requirements and an economic structural solution, the introduction of a neutral zone shall be made to determine the modular room height.

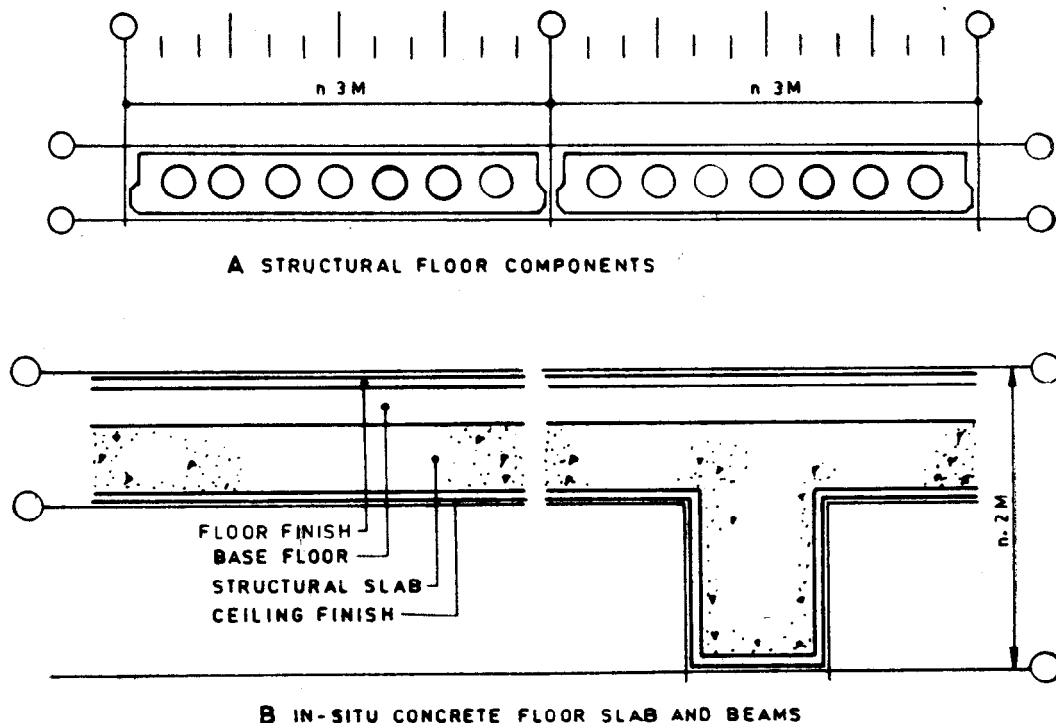


FIG. 10 MODULAR OR NON-MODULAR FLOOR HEIGHTS

## ANNEX A

( Clause 2.1 )

### LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
4993 : 1983	Glossary of terms relating to modular coordination ( <i>second revision</i> )	7922 : 1987	industry : Horizontal coordination ( <i>first revision</i> )
6820 : 1987	Recommendations for modular coordination building industry : Application ( <i>first revision</i> )	12073 : 1987	Recommendations for modular coordination in building industry : Vertical coordination ( <i>first revision</i> )
7921 : 1987	Recommendations for modular coordination in building		Recommendations for modular coordination, coordinating sizes for doorsets and windows

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### Amendments Issued Since Publication

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