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Indian Standard

RECOMMENDATIONS FOR MODULAR CO-ORDINATION IN BUILDING INDUSTRY : VERTICAL CO-ORDINATION

(First Revision)

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

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Indian Standard

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RECOMMENDATIONS FOR MODULAR CO-ORDINATION IN BUILDING INDUSTRY: VERTICAL CO-ORDINATION

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 27 February 1987, after the draft finalized by the Modular Co-ordination Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Controlling dimensions are key dimensions of buildings for which sizes shall be established in relation to the functional and user requirements. These are preferred dimensions intended to be used in the design of buildings and also to assist in the selection of ranges of, co-ordinating sizes for standard modular building components. Since the range of preferred sizes are intended to be of universal application, a limited selection will be appropriate to the scale and function of individual building types.

0.3 This standard was first published in 1975. This revision has been prepared incorporating the advancement made in the modular planning and design since more than a decade. In this standard, the principles of vertical co-ordination have been explained and preferred sizes for various types of buildings, like residential, industrial, educational, health and office buildings as well as building components and built-in fixtures have been included.

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

0.5 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) AJ Metric Handbook. The Architectural Press, London (1969).

b) India. Ministry of Works & Housing. Development Group on Prefabrication and Modular Co-ordination in Building Report, 1978.

c) Henrik Nissen. Industrialised Building and Modular Design. Cement and Concrete Association, London (1972).

d) The Principles of Modular Co-ordination in Building (*revised*). CIBW-24, the International Modular Group, 1982.

1. SCOPE

1.1 This Standard specifies values of multimodules and ranges of preferred sizes for vertical co-ordinating controlling dimensions for all types of buildings and their components, such as height of doors, windows, built-in-furniture and fixtures, as well as height of buildings and its floors, storey and room heights.

2. FIELD OF APPLICATION

2.1 This standard is applicable to the construction of all types of buildings, materials and construction techniques and in accordance with the principle of modular co-ordination (*see* IS : 6820-1987* and IS : 10600-1983†).

2.2 These recommendations state the preferred vertical dimensions to be applied for the design of components as well as the design of buildings for which components may be used as parts. Primarily, the preferred dimensions shall be referred to the building structure.

2.3 The preferred vertical dimensions shall include sizes from 24 M and upwards.

3. TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS : 4993-1983‡ and IS : 6408-1971§, and the following shall apply.

3.1.1 *Storey Height* — The vertical distance between two consecutive upper surfaces of finished floor level measured vertically at right angle.

3.1.2 *Modular Storey Height* — The modular space between two modular controlling reference points, lines or planes related to the finished floor level, rough floor level or structural floor level of two consecutive floors measured vertically at right angle expressed in terms of basic modules,

*Recommendations for modular co-ordination in building industry: Applications (*first revision*).

†Recommendations for modular co-ordination — Principles and rules.

‡Glossary of terms relating to modular co-ordination (*second revision*).

§Recommendations for modular co-ordination — Application of tolerances in building industry.

multimodules or preferred modules. The case of roof, other than flat roof, the storey height shall be vertical dimension from finished surface of floor level to top of bed plate or bottom of tie beam, or springing level according to the type of roof.

3.1.3 *Room Height* — A vertical dimension between upper surface of finished floor level and bottom surface of any projected structural elements.

3.1.4 *Modular Room Height* — The modular space between two modular controlling reference points, lines or planes separated by lowest point of floor zone expressed in terms of basic module, multimodule or preferred module.

3.1.5 *Floor Height* — The vertical distance measured at right angle from face to top of structural floor element or elements.

3.1.6 *Modular Floor Height* — The modular space between two modular reference points, lines or planes related to the height of structural floor component or elements expressed in terms of basic modules, multimodules or preferred modules. This is commonly known as controlling zone for horizontal elements in vertical co-ordination.

3.1.7 *Controlling Lines* — Modular grid lines which establish the need for delineating the datum/reference lines in respect to load bearing elements of structures on the horizontal plane.

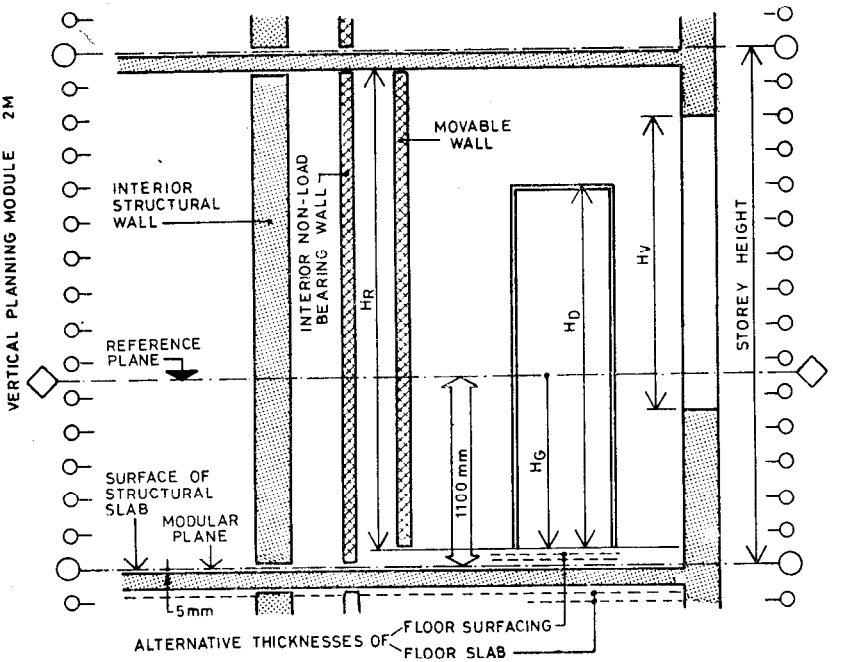
3.1.8 *Controlling Dimensions* — A modular co-ordinating dimension between controlling points, lines and planes (for example, storey height, distance between axis of columns and thicknesses of controlling zone).

3.1.9 *Controlling Zone* — A zone between controlling planes provided for floor, roof, load bearing walls or columns.

4. VERTICAL CO-ORDINATION — GENERAL CONCEPTS

4.1 In vertical section, the modular floor plane is the reference plane from which modular dimensions shall be taken. Representation of various modular dimensions in the vertical plane shall be as shwon in Fig. 1.

4.2 A horizontal modular plane continuous over the whole of each storey of a building and coinciding with upper surface of floor covering, the upper surface of the base floor, or the upper surface of the structural floor shall be selected as reference point, line or plane (*see* Fig. 2). This shall be called as controlling point, line or plane. The space between two such controlling planes, which is provided for the floor, shall be called as floor zone (*see* Fig. 3).



NOTE 1 — Surface of floor slab 5 mm below modular plane.

NOTE 2 — The heights of interior structural walls and interior non-load-bearing walls depends on thickness of floor slab.

NOTE 3 — Height H_R of movable wall depends on floor surfacing.

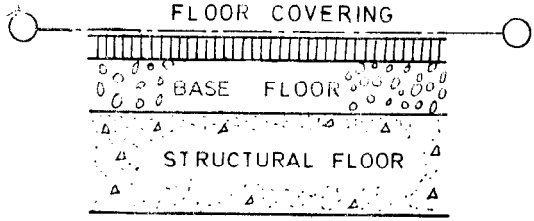
NOTE 4 — Storey height as per National Building Code.

NOTE 5 — H_G = Depth of floor surface marked out from reference plane.

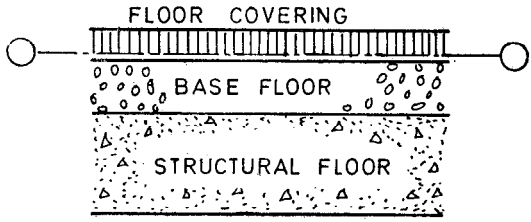
H_D = Door set height, which depends on height of the floor.

H_V = Window set height, which shall be modular.

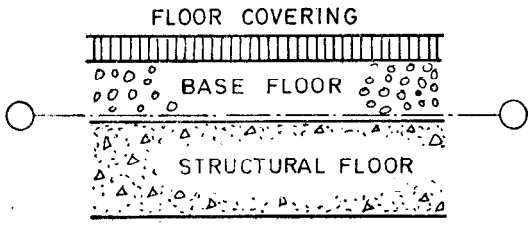
FIG. 1 REPRESENTATION OF MODULAR DIMENSIONS IN VERTICAL PLANE



2A Upper Surface of Floor Covering



2B Upper Surface of Base Floor



2C Upper Surface of Structural Floor

FIG. 2 MODULAR FLOOR PLANE

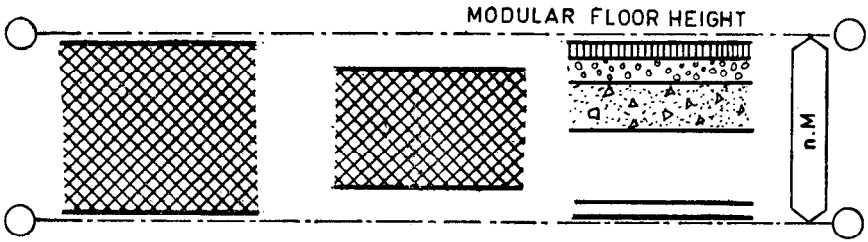
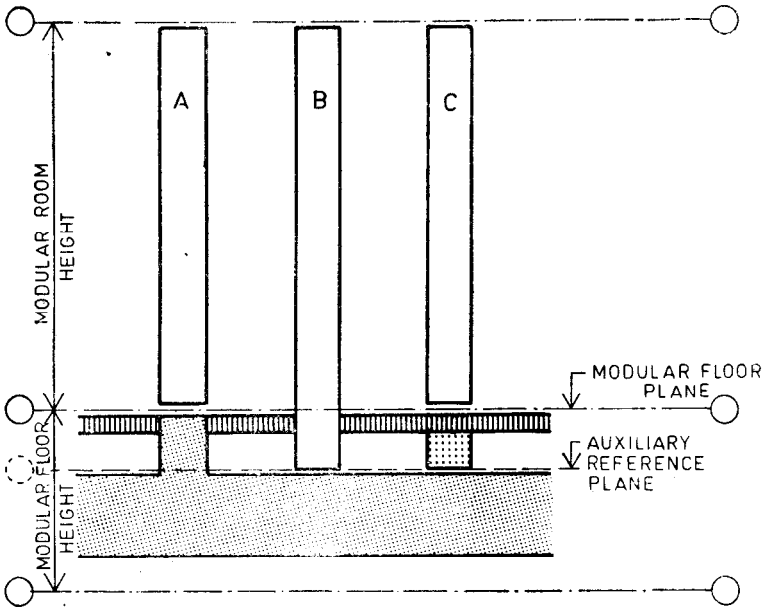


FIG. 3 FLOOR ZONE

4.3 At a particular storey level, changes in the level required to accommodate the specific functional need of structure may be met by further reference point, or line or plane. This auxiliary reference plane shall be shown on the drawing (*see* Fig. 4).



A — an upstand on structural slab reaches up to the modular floor plane.

B — the wall shows positive boundary condition in order to reach down to the auxiliary reference plane at the upper surface of the structural slab.

C — an adaptation piece fills the space between the modular floor plane and the auxiliary reference plane.

NOTE — Vertical section shows modular floor height, modular room height and modular floor plane at upper surface of floor covering.

FIG. 4 AUXILIARY REFERENCE PLANE

4.4 Due to some reason, need may arise to accommodate non-modular elements/components/assemblies, within a modular space by introducing additional reference plane to represent the co-ordinating reference planes of such elements/components/assemblies. Modular storey height with non-modular floor height leads to introduction of adaptation pieces (*see* Fig. 5).

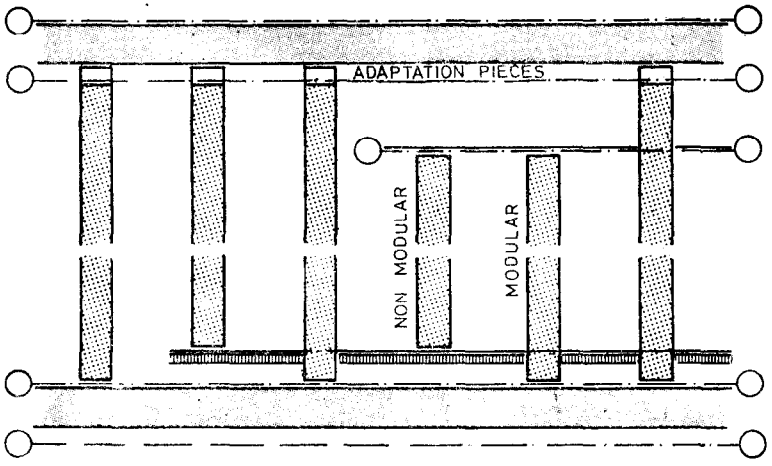


FIG. 5 MODULAR STOREY HEIGHT AND NON-MODULAR FLOOR HEIGHT TENDS TO ADAPTATION PIECES AND NON-MODULAR HEIGHTS

4.5 In the vertical section, only the main reference planes of the controlling zone containing external envelope and internal elements of construction which sub-divides the building, horizontally and vertically, shall be identified on drawings of vertical sections like modular storey height, modular room height and modular floor height along with modular doorset height, windowset height, windows sill height, etc (*see* Fig. 6).

5. PREFERRED VERTICAL DIMENSIONS

5.1 The preferred vertical dimensions for building component and building shall be such multiple of 1 M (*see* **5.2**) which shall be preferred against other multiple of basic modules.

5.2 The values of multimodules applied to vertical co-ordination in modular co-ordination shall be 2 M and 3 M.

5.3 Preferred vertical dimensions for building components and buildings shall be increased step by step.

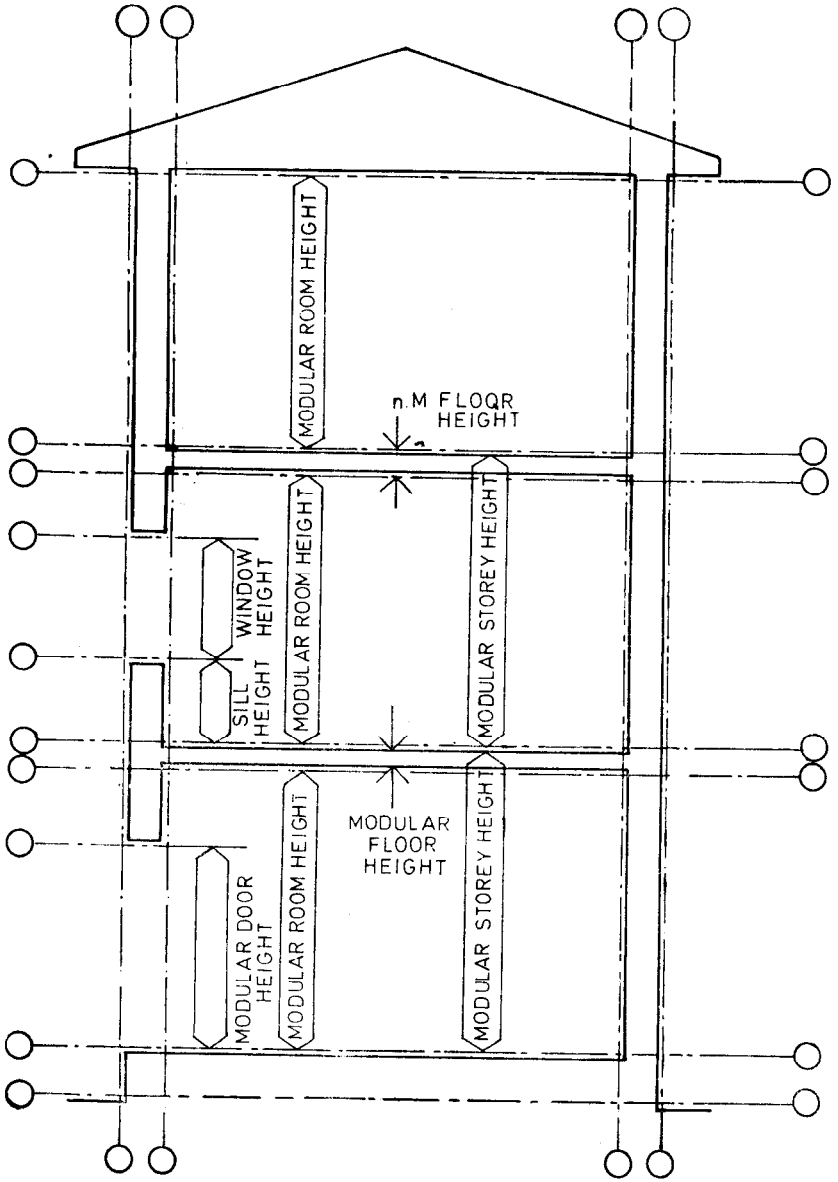


FIG. 6 MODULAR HEIGHT

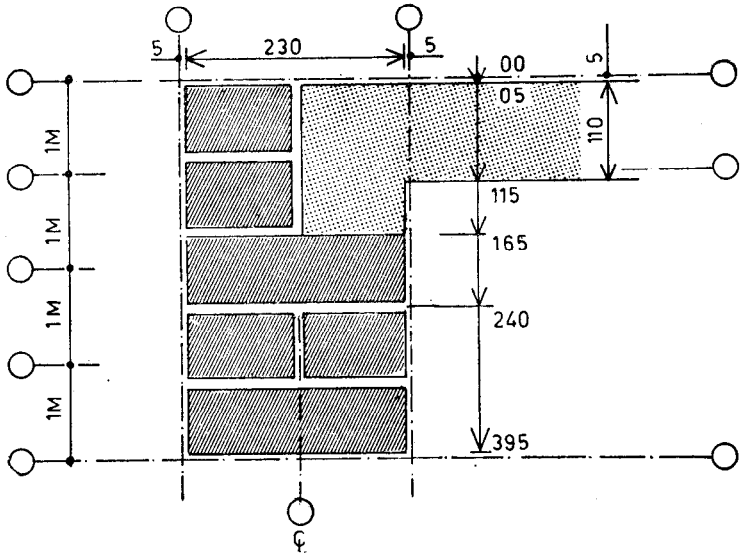
5.4 The preferred vertical controlling dimensions are to fix the storey heights.

5.5 The preferred dimensions may also be used for selecting height of external envelope walls for single storey as well as for multistoreyed buildings.

6. '5-mm RULE'

6.1 The vertical dimensions in all types of buildings shall be controlled by the planning module 2 M.

6.2 The floor slab, which is structural part of horizontal division, placed one joint proportion under a modular plane, shall be called as '5-mm rule' (*see* Fig. 7).



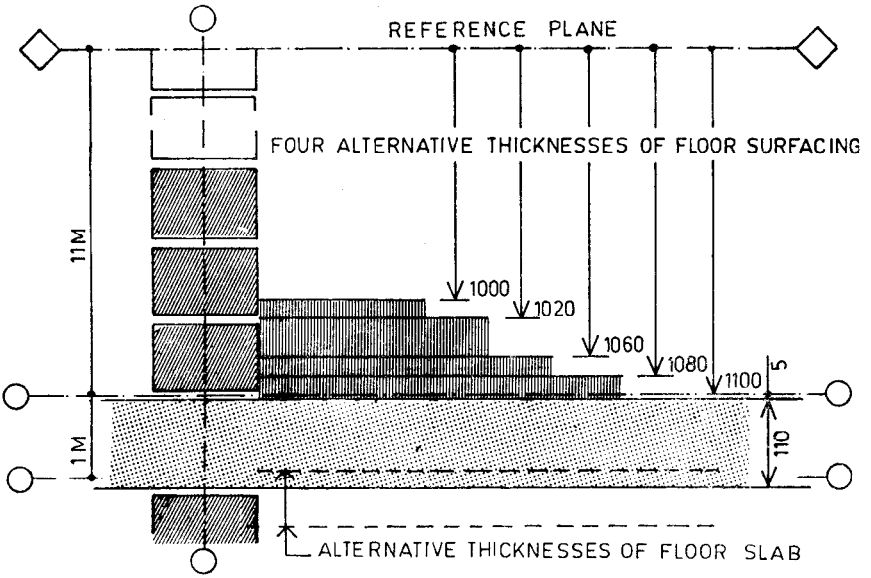
All dimensions in millimetres.

FIG. 7 5-mm RULE (VERTICAL DIMENSIONS)

6.3 All other vertical dimensions shall be taken from this plane.

6.4 There is a considerable development on number of new types of floors and floor surfacing having greatly varying thickness. These variations shall have direct influence on the room height and sometime, influence door

heights and a large number of vertical dimensions for fittings and installations (*see* Fig. 8). The controlling vertical dimensions shall be fixed on the basis of '5-mm rule' during the design process.



All dimensions in millimetres.

FIG. 8 FLOORS WITH VARYING THICKNESS OF SLAB AND SURFACING

7. CHANGES IN LEVEL

7.1 From the practical side of vertical dimensions in buildings, changes in level may require to meet a specific need such as in loft and installations of services pipe, Indian water-closet (squatting pan) and sunken-bath, etc. The controlling dimensions for change of level shall be as given in Table 1.

8. COMPONENT DIMENSIONS

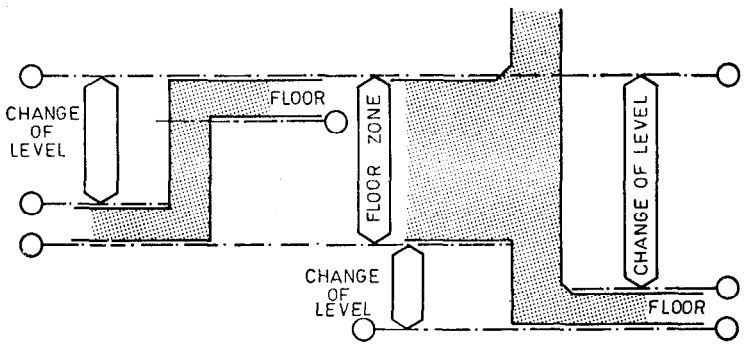
8.1 The controlling dimensions for heights of building components like doors, windows, built-in furniture and fixtures shall be in accordance with the sizes given in Table 2.

9. BUILDING DIMENSIONS

9.1 Primarily, the preferred dimensions shall be referred to the vertical heights of constructional elements which sub-divides the building horizontally and vertically as per preferred sizes.

TABLE 1 CONTROLLING DIMENSIONS FOR CHANGE OF LEVEL IN FLOORS

(Clause 7.1)



CONTROLLING SPACE mm		CHANGE OF LEVELS	
		1/5 M	2/5 M
20 mm STEP	20	●	
	40	●	
	60	●	
	80	●	
	100	●	
	120	●	
	140	●	
	160	●	
	180	●	
	200	●	
40 mm STEP	240		●
	280		●
	320		●
	360		●
	400		●
	440		●
	480		●
	520		●
	560		●
	600		●

NOTE — Symbol ● indicates preferred size.

TABLE 2 PREFERRED DIMENSIONS FOR HEIGHT OF BUILDING COMPONENTS

(*Clause* 8.1)

CONTROLLING SPACE mm		SERIES			CONTROLLING SPACE mm	
		1M	2M	3M		
1M STEP	100	●				3M STEP
	200		●			
	300			●	300	
	400		●			
	500	●				
	600		●	●	600	
	700	●				
	800		●			
	900			●	900	
	1000		●			
	1100	●				
	1200		●	●	1200	
2M STEP	1400		●			
				●	1500	
	1600		●			
	1800		●	●	1800	
	2000		●			
				●	2100	
	2200		●			
	2400		●	●	2400	

NOTE — Symbol ● indicates preferred size.

9.2 The preferred sizes of heights of controlling zones, storey heights and room heights for various types of buildings shall be as given in **10** to **14** and Table 3.

9.3 The vertical controlling dimensions, where both modular storey and room heights are selected in accordance with Table 3, it delimits the use of modular floor heights. This limitation shall be applied to the storey heights greater than 30 M.

9.3.1 The controlling dimensions of modular storey heights, in multiple of 3 M, shall not be combined with controlling zone of 2 M multiples (*see* Table 3).

9.3.2 The controlling modular storey heights selected as 3 M multiple above 36 M shall only be employed with controlling zone of 3 M.

9.3.3 The controlling modular storey heights up to 48 M and above, shall be selected with controlling zone of 2 M multiples.

9.4 There may be some instances where modular room height governs and the storey height is unimportant, in single storey buildings and apex floor of multistoreyed buildings. The upper surfaces of a roof need only be controlled where the co-ordination of other components are effected.

10. RESIDENTIAL BUILDINGS

10.1 The preferred vertical controlling dimensions in residential buildings shall be multiple of 2 M, that is, 20 M, 22 M, 24 M, 26 M, 28 M, 30 M, etc.

11. INDUSTRIAL BUILDINGS

11.1 The recommended preferred vertical dimensions for industrial buildings, single and multistoreyed, shall be applied to the design of structural component and building elements in increments of 2 M and 3 M; preferably larger sizes shall be selected from 6 M series.

12. HEALTH BUILDINGS

12.1 The vertical controlling dimensions for health buildings shall be 28 M, 30 M, 32 M, 34 M and 36 M.

TABLE 3 PREFERRED DIMENSIONS FOR STOREY HEIGHTS, ROOM HEIGHTS AND VERTICAL HEIGHTS OF CONSTRUCTION ZONES

(*Clauses* 9.2, 9.3 *and* 9.3.1)

CONTROLLING SPACE mm		SERIES		CONTROLLING SPACE mm	
		2M	3M		
2M STEP	2400	●	●	2400	3M STEP
	2600	●			
			●	2700	
	2800	●			
	3000	●	●	3000	
	3200	●			
			●	3300	
	3400	●			
	3600	●	●	3600	
4M STEP	4000	●			6M STEP
			●	4200	
	4400	●			
	4800	●	●	4800	
	5200	●			
			●	5400	
	5600	●			
	6000	●	●	6000	
	6400	●			
			●	6600	
	6800	●			
	7200	●	●	7200	
8M STEP	8000	●			12M STEP
			●	8400	
	8800	●			
	9600	●	●	9600	
	10400	●			
			●	10800	
	11200	●			
	12000	●	●	12000	
	etc			etc	

NOTE — Symbol ● indicates preferred size.

13. OFFICE BUILDINGS

13.1 The vertical controlling dimensions for office buildings shall be 28 M, 30 M, 32 M, 34 M and 36 M.

14. EDUCATIONAL BUILDINGS

14.1 The vertical controlling dimensions for educational buildings shall be 30 M, 36 M and 42 M.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

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	volts	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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