CENTRAL BUILDING RESEARCH INSTITUTE, INDIA.

BUILDING RESEARCH NOTE 72

DESIGN DATA AND SPACE NORMS FOR PRIMARY SCHOOLS

Introduction

There is an acute shortage of primary schools in most of the Asian countries due to limited resources on the one hand and increase in demand for more and more schools on the other. The traditional, methods of planning and construction of schools in rural areas are expensive and time consuming. To meet the heavy back log of primary schools and the future needs, an innovative approach for design, construction, planning and management is necessary for making the best use of available resources. The Central Building Research Institute has taken up research on school buildings with a view to providing design data, reduce cost and, in addition, to help various organisations interested in the design and construction of school buildings. The design data developed at the Institute will help architects, educationists, planners and administrators to take decisions on size and shape of class room, requirement of natural light and ventilation, building specification and appropriate technology.

Research Programme

The research programme included the following studies which are useful for designing primary schools.

Anthropometrics

The anthropometric measurements of a large number of childern in the age group 5-16 years were obtained in the mass survey. The survey has furnished the basic anatomical dimensions to formulate necessary design data for arriving at the sizes and shapes of furniture, fittings and teaching spaces. The design data have been grouped as under :

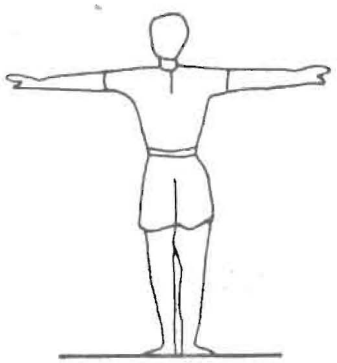
- Furniture design (table, chair and standing working surface)
- Reach extent (shelves, display board, chalkboard, etc.)
- Eye level (standing, sitting and squatting postures)

Further, the correlationship of body measurements with standing height has been worked out. This design data can be referred to determine spaces required for different activities (Fig. 1).

Teaching Spaces

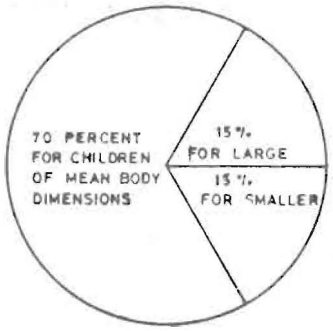
A detailed investigation regarding shape and size of class room was taken up in relation to seating pattern, and its effect on audibility and angle of vision on chalkboard, usefulness of wall area for display

STANDING FIGURE (H)

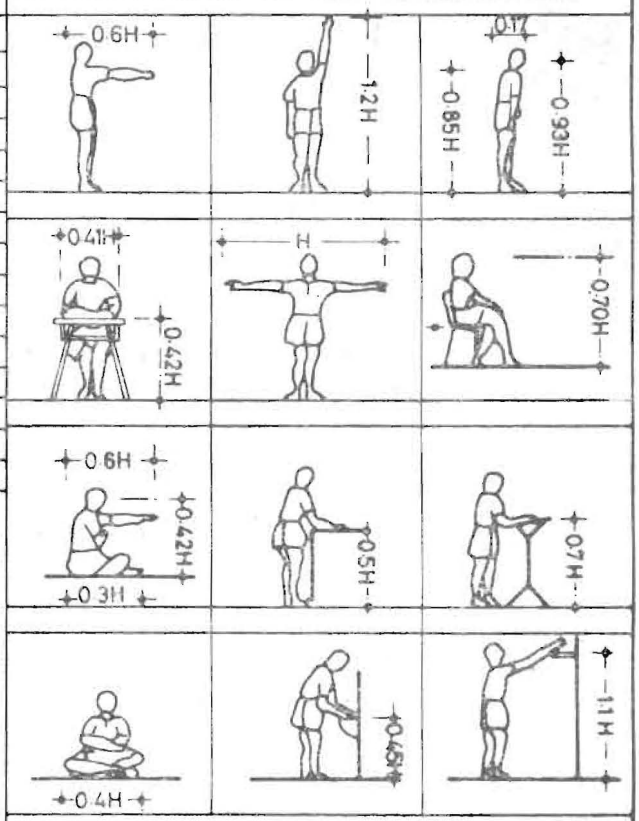


STANDING HEIGHT

AGE IN YEAR	HEIGHT IN MM		
	BOYS	GIRLS	MEAN
5	1016	1016	1016
6	1079	1079	1079
7	1134	1134	1134
8	1187	1187	1187
9	1233	1233	1233
1	1284	1284	1284
11	1334	1334	1334
12	1386	1386	1386
13	1442	1442	1442
14	1504	1474	1489
15	1557	1496	1527
16	1595	1510	1553
17	1515	1515	1565



CORRELATIONSHIP OF BODY MEASUREMENTS



NOTE - THE DATA SHALL BE USEFUL FOR DESIGN OF CLASS ROOM FIXTURES & FITTINGS

Fig. 1

purpose, unused area per pupil in a class room and the perimeter of the wall, structural economy, and lighting efficiency. The following optimum space requirements were worked out :

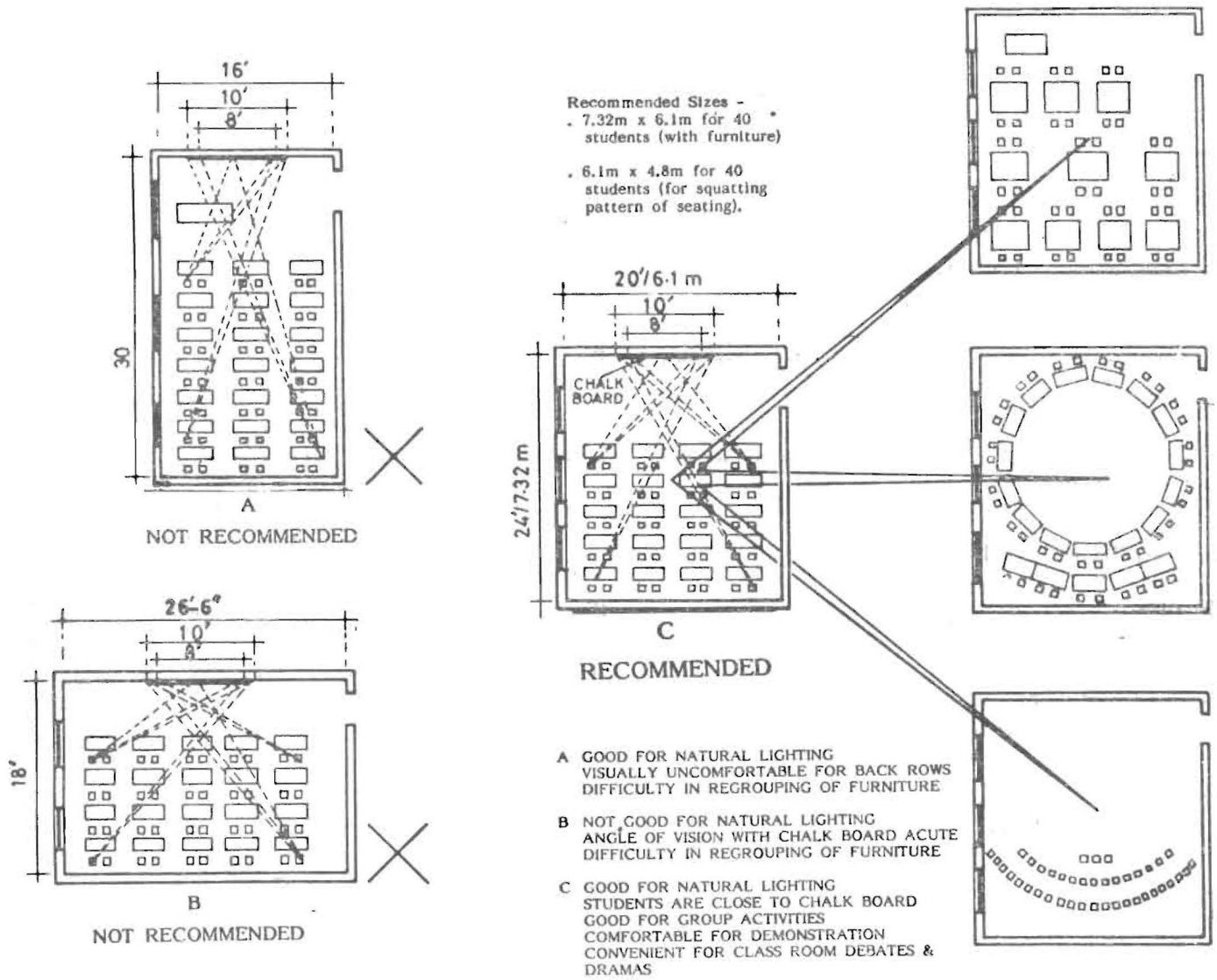
- A minimum space of 1.11 sq m per child is needed for the effective performance of all the activities in a class room.
- A class room size of 7.32m × 6.1m for 40 students (with furniture).
- A class room size of 4.8m × 6.1m for 40 students (for squatting pattern of seating) (Fig. 2).

Class Room Fittings

Following class room fittings are recommended :

Essential Fittings

Fitting	Area	Remarks
(a) Chalk-Board	1.20m × 2.40m	Its base should be 80cm above the floor plat form level. The location of the chalk board should be on the walls adjacent to the window wall so that the mid - vertical line of the board lies between one-half and two-thirds of the depth of the room. This is to ensure that glare, due to windows, at students seat area is minimised.



SHAPE & SIZE OF CLASS ROOM

Fig. 2

(b) Cup-board	1.5m²	Its depth should not be less than 45cm. It would serve as space for storage of maps, display material, etc. It should be located on/near chalk board wall.

Desirable Fittings

(a) Wooden Picture rail	Length of wall	The rail should be provided on the wall opposite to windows, chalk board, at window lintel level.

Sanitary Fittings

Fittings	Provision	Remarks
1. Latrines	1 per 40 pupil	Borehole type latrines should be provided with suitable water arrangement.
2. Urinals	1 per 40 pupil	Squatting plate type urinals, to be disposed of in one of the boreholes, should be provided.

3. Drinking water	Cement concrete tank or plastic tanks with two compartments. (smooth finish) with water tap and easily openable lid of suitable capacity should be provided.

- Toilet block may be without roof. In areas of heavy rains with roofs for adequate ventilation.
- Latrines should be above 30cm from ground level.
- Water tank/drum should be placed near the latrine block.

Building Efficiency Requirements

Lighting

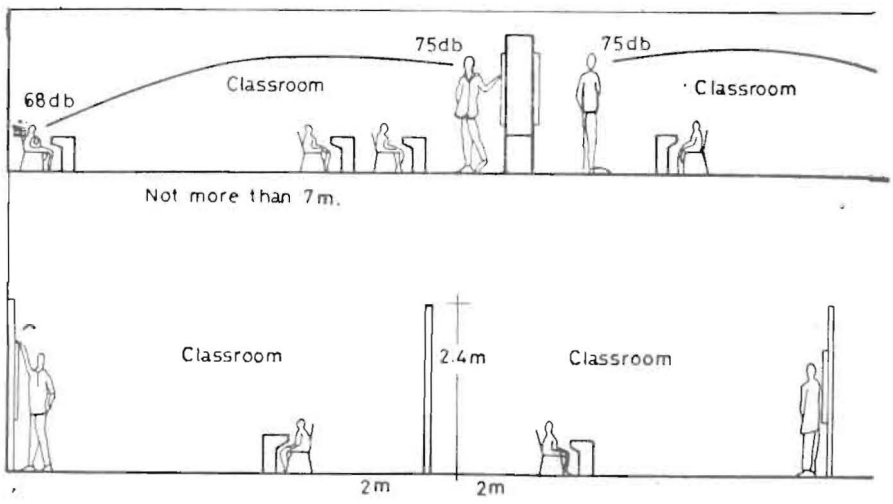
The orientation and siting of windows in relation to the availability of daylight is well established. The optimum relations between window sizes, the work place and wall surface illumination have been worked out.

It was found that, for obtaining a minimum level of 150 lux of daylight, requisite level of lighting for reading and writing on the work plane, a 15 per cent clear window opening has to be provided with a sill height of 80 to 100cm.

Acoustics

For good acoustics in the class rooms, the height of the flat reflective ceiling was found to be at least 3.4 m. In case of acoustical false ceiling or channel unit ceiling, the height could be reduced to 3.0 m.

Further, the partition height between two class rooms should be 2.0 m. when the blackboard in both the classes are positioned on either side of the partition wall. In case of teachers positioned near the opposite wall of partition, the height of the partition should be 2.4 m. The partition must have a minimum noise reduction of 5 db through it (Fig. 3).



Partition height 2.4m

A buffer zone 2 m wide near partition to avoid sound interference.

LOCATION AND HEIGHT OF PARTITION BETWEEN TWO CLASSROOMS

Fig. 3

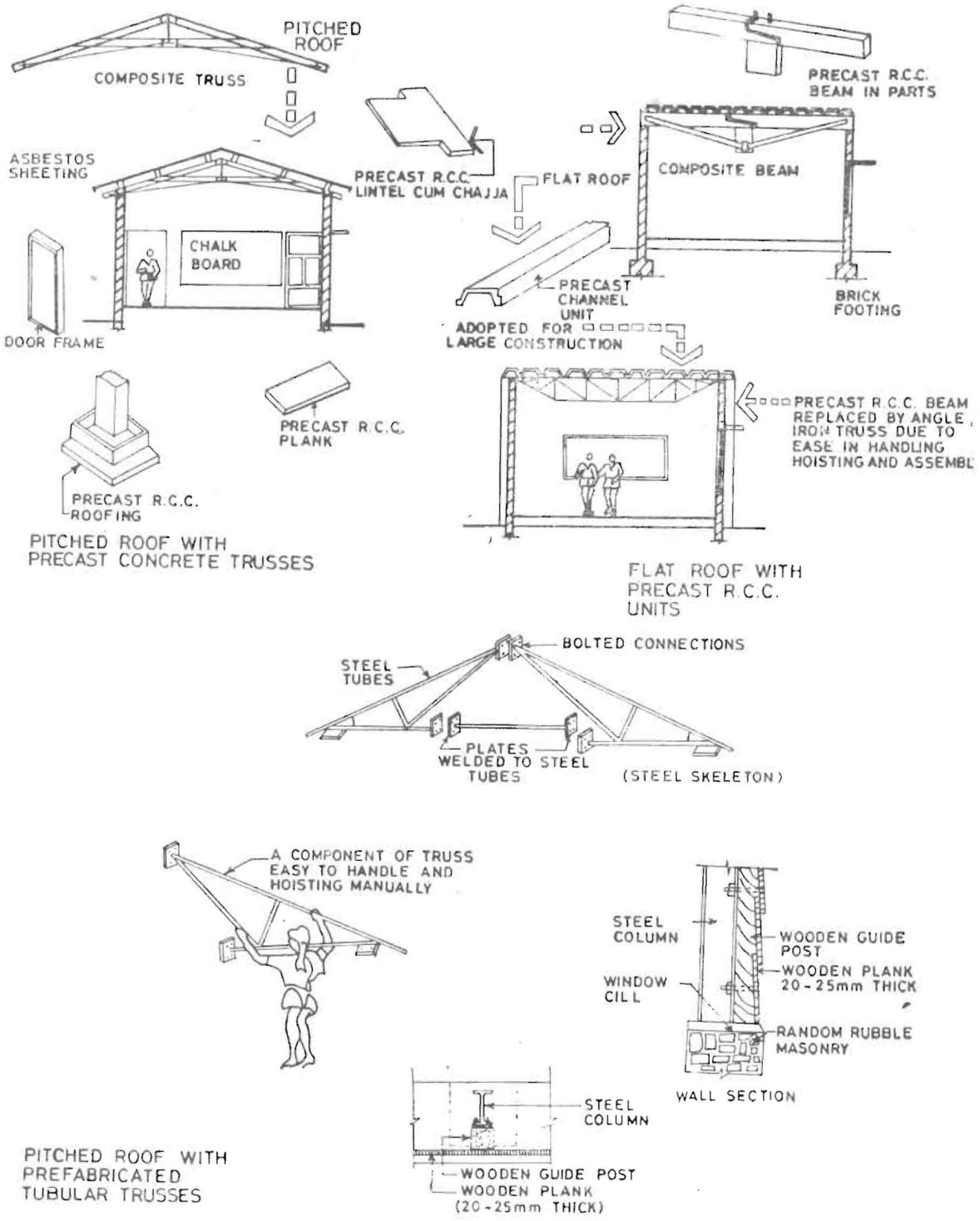


Fig. 4

Construction System

Rapid expansion of education programme demands a quicker and economical method of construction. Standardisation and system built constructions have shown great scope in achieving speed and economy in the construction of school buildings. The Institute had taken up

studies to develop system built standard building components for pitched roof and flat roof construction for school buildings. The system has been developed with the following considerations :

- Minimum number of standard components.
- Simplified casting method, minimising the use of skilled personnel.
- Bullock-carts employed as the main means of transportation in the rural areas.
- Light weight of individual components for easy handling and hoisting by labourers.
- Simplified joint details and erection methods.
- Economical construction.

Keeping in view the above parameters, construction systems were developed for pitched and flat roofs, specially to suit large scale construction programmes.

Pitched Roofs

The trusses are scissors type with all pe-cast concrete components and composite type, part precast concrete, part steel and steel tubes. These have been designed for 6.56 and 5.37m effective spans, both for Mangalore pattern tiles and for corrugated sheets roofing. The trusses consist of linear members which are easy to cast, handle, transport and erect. The individual members are jointed together with simple bolts. (Fig. 4).

Flat Roofs

The system consists of RCC prefabricated channel units 3.14 m long, 30cm wide and 10cm deep. It rests on steel truss 3.15 m centre to centre. The weight of the truss is 88 kg and that of channel unit 98kg. The joints between the units are filled with concrete, painted with bitumen and covered with traditional roof finish like lime concrete terracing or mud phuska laid to a suitable slope (Fig. 4).

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