

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

CIRTIIFICATE COURSE

BUILDING DRAWING

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CHAPTER 1 Terms Used in Drawings as per NBC

FOUNDATION AND FLOORING

1.1 Introduction

Every structure consists of two parts *i.e.* foundation and superstructure. Foundation distribute the load of super structure and prevents the lateral movement of the supporting materials. In this way it provides stability to the structure against many disturbing forces *i.e.* wind, rain and earthquake etc.

1.2 Components of a Building

A building, whether residential or non-residential, can be broadly divided into two parts *i.e.* sub-structure and super-structure. The part of a building below the ground level is called sub-structure where as above the ground level is called super-structure.

The main components of a building are as under:

- | | |
|------------------------|--------------------------------------|
| (i) Foundation | (ii) Plinth |
| (iii) Walls | (iv) (a) Pier (b) Columns |
| (v) Floors | (vi) Doors, windows and ventilators. |
| (vii) Roof | (viii) Stairs |
| (ix) Building finishes | (x) Building services |

(i) **Foundation:** The lowest part of a structure below the ground level is called Foundation. Foundation provides a base for the super-structure and transmits all the dead, live and other types of loads to the soil on which the structure rests.

(ii) **Plinth:** The part of the building above the ground level and the floor immediately above the ground is called Plinth.

The purpose of the plinth is to stop the entry of rain water from ground level in to the building.

(iii) **Walls:** An enclosure or a division of floor space in desired pattern to act as partitions for providing security, privacy and to give protection against sun, rain and other adverse effects of weathering agencies are called Walls.

Walls are constructed of materials like bricks, stone, concrete blocks etc.

- (iv) **(a) Pier:** A vertical load bearing member similar to a column but bonded into load bearing wall at the sides to form an integral part extending upto full height of the wall is called an Pier.

Pier resists lateral pressure without buckling and also strengthens the wall and also increases the stiffness of wall.

A door mainly consists of two components.

- (b) Column:** An isolated vertical load bearing member whose width is neither less than its thickness nor more than four times its thickness is called an column.

- (v) **Floor:** A horizontal flat supporting element of a building is called a Floor.

It also divides a building into different levels. Floor provides firm dry platform to the people.

It is used to place items like furniture and house hold or other equipments.

A floor consists of two parts:

- (a) Sub Floor:** The structural component of floor which supports all loads is called Sub-floor.

- (b) Flooring:** A covering layer of required specifications provided over sub floor to serve as finishing layer is called Flooring.

Flooring can be of tiles, cement concrete, terrazzo marble etc.

- (vi) **Doors, Windows, and Ventilators:** A barrier provided in an opening in a wall to provide means of access to a building is called a Door. It may be of glass, wood, aluminium, or of other material.

- (a) Door Frame:** A frame permanently held in position and fixed to the sides of its masonry of the wall opening with help of hold fasts is called a door frame.

- (b) Door Shutter:** The moving part of the door provided inside the door frame is called door shutter. An opening left in a wall for providing sunlight, ventilation and vision is called a Window.

Window has also a frame and one or more shutters.

An opening provided below and near the main roof for the purpose ventilation is called Ventilator.

- (vii) **Roof:** An uppermost component of a building which mainly covers the space below it and acts a protection from rain, snow and sun is called a Roof

Genally, roof consists of following two components:

- (a) Roof Decking:** The structural component of a roof which supports the roof covering is called Roof Decking.

The structural component or roof decking in flat roof is slab, for sloping or Pitched roof and for curved roof is shell or done.

(b) **Roof Covering:** A layer of varying thickness of different materials like; lime tile sloping concrete, mud phuska for flat roof and GI Sheets, A.C. sheets, tiles, slates etc. for sloping roof is called Roof Covering.

In case of flat roofs the roof covering is termed as terracing, which serves the purpose of providing slopes on the roof for roof drainage of rain water and as insulation layer for thermal comfort to the user.

(viii) **Stair:** A structure consisting of a number of steps provided for movement from one floor to another or connecting one floor to another is called a Stair. The construction of it should be safe comfortable for the users. Materials for stairs can be timber, bricks, reinforced cement concrete, stone or steel etc.

(ix) **Building Finishes:** Giving appropriate treatment to the surface of components of a building is called Building Finishes.

Building finishes protect the surface of a building from the adverse effects of weathering agencies and also it gives decorative effect to the building.

Plastering, pointing, colour washing, white washing, painting, varnishing and distempering are some of the main building finishes.

(x) **Building Services:** Water supply, sanitary, electricity, drainage, ventilation, lighting, heating, acoustics, air conditioning, fire detection and control etc. are called building services.

1.2.1 Some Technical Terms

Following are some of the technical terms used in planning of a building:

(i) **Basement or Cellar:** A storey of a building fully or partly below ground level is called a Basement or Cellar.

(ii) **Building Line:** The plinth line of a building which may be lawfully extend upto adjoining a street or extension of street is called Building Line.

(iii) **Balcony:** Generally a passage or sitting place in the form of a horizontal cantilever projection including hand rail is called a Balcony.

(iv) **Barsati:** A room on the top floor of a building is called a Barsati.

(ix) **Stair Cover or Mumti:** A structural enclosure with roof covering provided over a staircase and its landing is called a Mumti or Stair Cover.

(v) **Courtyard:** An open to sky space enclosed fully or partially by a building is called a Courtyard.

(vi) **Sunshade or Chhajja:** An horizontal or inclined structure overhang generally provided over openings on external walls for the purpose of protection from rain and sun is called a Chhajja or Sunshade.

(vii) **Gallery:** An inter-mediate floor projection from a wall of a hall or auditorium providing extra floor area is called a Gallery.

- (viii) **Front:** The portion of a building facing the street from which it has access is called Front.
- (x) **Loft.** An intermediate floor area created by putting a slab between floor and ceiling of a room or passage or store is called a Loft. Loft should have maximum clear height of 1.5 metre and may be used for storage purpose only.
- (xi) **Porch:** A vehicular approach of a building, covered and supported on pillars or otherwise is called a Porch.
- (xii) **Mezzanine Floor:** An intermediate floor between two floors above ground floor, having atleast one side as an integral of space floor below is called a Mezzanine Floor.
- (xiii) **Ceiling:** The underside of roof is called Ceiling.
- (xiv) **Room Height:** Vertical clear height or distance from finished floor surface to ceiling of a room is called Room Height.
- (xv) **Service Road or Service Lane:** A road or lane provided at the back side of a Plot or building for service purposes is called a Service Road or Surface Lane.

1.3 Foundation

The lowest part of structure which is provided below the ground surface and transmits the load of structure to the ground and to provide a levelled surface.

1.3.1 Types of Foundation

The following are the different types of foundations-

1. Spread foundations
2. Pile foundations
3. Pier foundations

Spread foundations are further classified as-

1. Wall footing
2. Isolated or column footing
3. Combined footing
4. Cantilever footing
5. Continuous footing
6. Grillage footing
7. Raft or Mat footing
8. Stepped foundation

Wall footing: When the width of foundation is more than the wall width it is economical make the brick flooring stepped over a level concrete bed and simple footing are provided to carry light loads and have only one projection outside the width of wall on both sides. Depth of concrete is atleast twice the projections and projection provided in the footing is 15 cm.

1.3.2 Design of Wall Footing

1. **Width of footing:** It is obtained by dividing the total load including dead load, live load and wind load by the allowable bearing capacity of soil.

$$B = \frac{T}{P}$$

B = Width of footing in metre

T = Total load per meter run in kg

P = Safe bearing capacity of soil in kg/m²

2. **Depth of footing:** The minimum depth of footing is given by Rankine's formula is

$$D = \frac{P}{W} \left(\frac{1 - \sin \phi}{1 + \sin \phi} \right)^2$$

P = Safe bearing capacity of soil in kg/m²

W = unit wt. of soil in kg/m³

ϕ = Angle of repose of soil in degrees

D = Minimum depth of footing in metre

By Thumb Rule method

Depth of foundation is generally taken as 3-times the thickness of wall *i.e.* $3T$.

1.3.3 Depth of Concrete Block

By thumb rule, the thickness of concrete block may be taken as $\frac{5}{6}T$. For single storey walls it is taken as 300 mm where T = thickness of wall fig 1.1 (a) shows a foundation with Plinth Projection as per thumb rule.

Table 1: Angle of Repose of Various Soils

S.No.	Kind of Soil	Angle of Repose in Degree
1.	Loose earth	30 to 45
2.	Dry sand	25 to 35
3.	Wet sand	15 to 30
4.	Moist sand	30 to 45
5.	Dry clay	25 to 30
6.	Damp or well drained clay	30 to 45
7.	Gravel and sand	25 to 30
8.	Wet clay	15 to 20

Table 2 : Modulus of Rupture of Various Grades of Concrete Mix

S.No.	Grades of Concrete Mix	kg/mm ²	N/mm ²
1.	Pure lime and surkhi concrete (1 mortar: 3 stone Ballast)	1.55	0.155
2.	Moderately hydraulic lime and sand concrete (1 mortar : 3 stone Ballast)	1.55	0.155
3.	1 : 4 : 8 Plain cement concrete	2.46	0.246
4.	1: 3 : 6 Plain cement concrete (M10)	3.52	0.352
5.	1: 2 : 4 Plain cement concrete (M15)	5.27	0.527

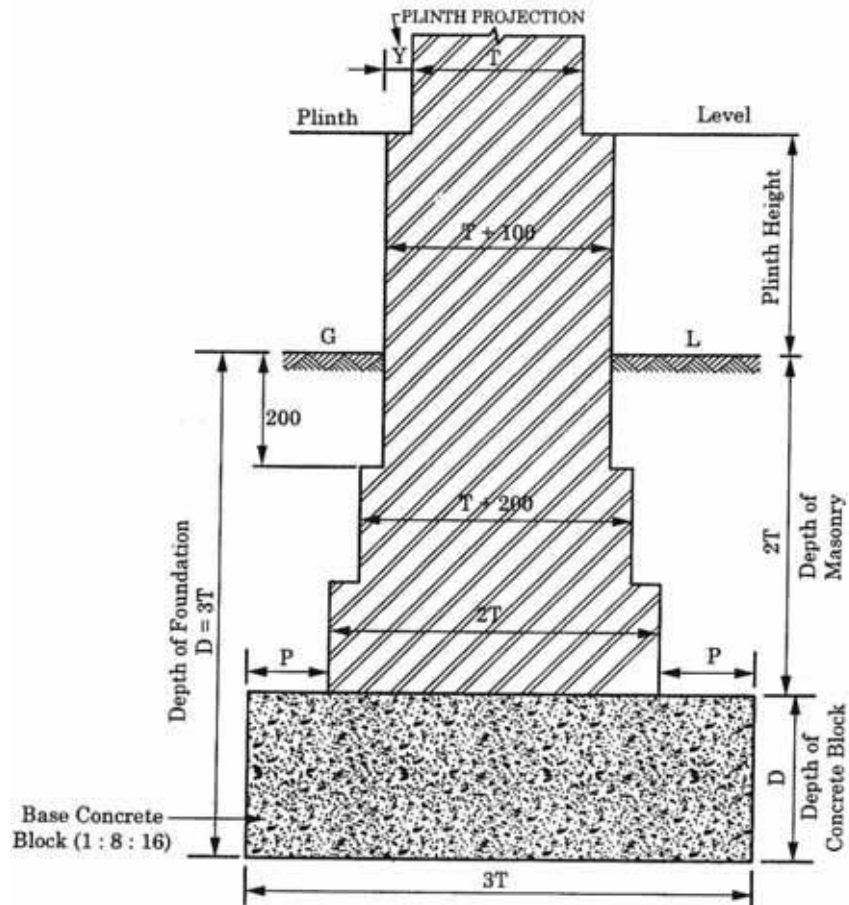


Fig. 1.1(a): Foundation with Plinth Projection

Thickness, Depth of foundation and Depth of Concrete block by Thumo Rule method:

Table 3

<i>Thickness of Wall = T (mm)</i>	<i>Depth of foundation = 3T (mm)</i>	<i>Depth of concrete block = T (mm)</i>
200	600	200
300	900	300
400	1200	400
500	1500	500
600	1800	600

1.4 Open space, Building requirements and Minimum dimensions

If the square plots are not convenient, then rectangular plots should be formed in the ratio 2 : 1 for small plot and 1½ : 1 for bigger plots. For residential building the covered area should be as given below:

<i>Size of Plot</i>	<i>Covered Area</i>	<i>Space left in metres</i>		
		<i>Front</i>	<i>Rear</i>	<i>Sides</i>
Plot less than 200 sqm	66% of sides area	3.00	3.60	1.50
Plot 201 to 500 sqm	50% of site area or 150 sqm whichever is more	4.50	6.00	2.00
Plot 501 to 1000 sqm	40% of site area or 250 sqm whichever is more	6.00	7.50	3.00
Plot more than 1000 sqm	33 % of the site area or 400 sqm whichever is more	9.00	7.50	3.00

For Designing Area

$$\text{Total plinth area } A = \frac{\text{Total cost}}{\text{Plinth area rate of locality}}$$

$$\text{Floor area of room and verandah} = (A - A/5A)$$

**APPROXIMATE AREA, CUBIC SPACE, VERANDAH AREA FOR VARIOUS
TYPES OF BUILDING**

<i>Types of Building</i>	<i>Floor Area in sqm/head</i>	<i>Cubic space in cum/head</i>	<i>Verandah Area in Percentage of Plinth Area of Building</i>
1. Office Building	2.5 to 3.0	12 to 15	25 to 35
2. School Building	1.0 to 2.0	4.0	10 to 20
3. Hospital Building	8.0 to 10.0	28.5	25 to 35
4. Factory Building	2.5 to 3.0	9 to 11.5	---
5. Residential Building	2.5 to 3.0	8.5	10 to 20

Planning Institution/School Building: The planning of Institution/School Building should be done in such a way, as to get maximum useful area. The floor area may be taken as 55 % to 70% of the plinth area. The room should be arranged on both sides of the corridor i.e., class-rooms may be provided on one side and laboratories on the other side of the corridor.

1.4.1 Drawing Instruments and Equipments

The drawings are prepared by the help of various instruments and equipment. These instruments should be of best quality and accurate as the quality of drawing mainly depends upon these instruments. Following is the list of drawing instruments and equipments commonly used in the drawing office.

List of Drawing Instruments and Equipments

1. Drawings Board with Tee-square
2. Set Square
3. Drafting Machine/Mini Drafter
4. Set of Engineering Scales
5. Protractor
6. French Curves
7. Drawing Sheets
8. Drawing Pins
9. Cello Tape
10. Tracing Cloth/Tracing Paper
11. Rubber

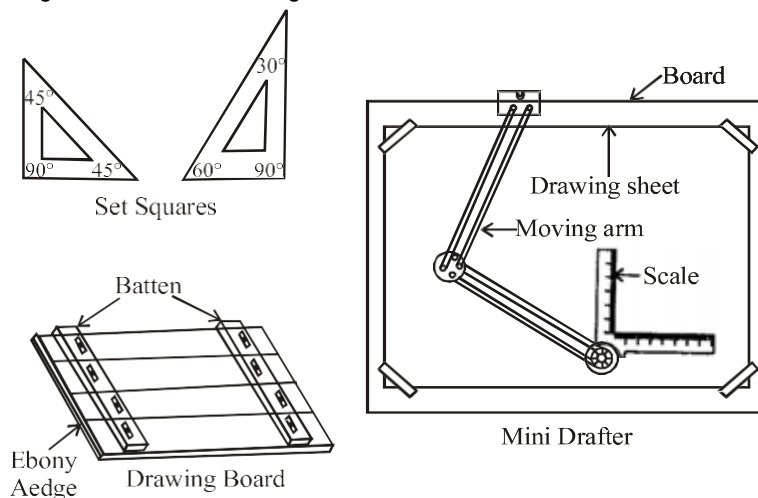
12. Clinograph
13. Pentagraph
14. Sand paper block
15. Pencil and Pencil Sharpener.
16. Drawing ink
17. Stencil Sets with pens
18. Instrument Box containing large and small size compasses with interchangeable pencil and pen legs with lengthening arms, large and small size divider, small bow pen, small bow divider, inking pen, screw divider.
19. Beam compass.
20. Tracing Tables.
21. PC-At for AutoCad with plotter and Dot-Matrix printer (for drawing in computers).

1.5 Drawing Board

Drawing board is made of well seasoned soft wood. It has a smooth surface at top and back side is frixed with two battens. On one side of the board a straight ebony edge is fixed in the groove made for it. The stock of T-square slides on the this ebony side. It is called the working edge of the board. The standard size of the drawing boards as per I.S. 962-1967 are given as under:

S. No.	Designation	Size in mm
1.	B ₀	1500 × 1000
2.	B ₁	1000 × 700
3.	B ₂	700 × 500
4.	B ₃	500 × 350

Fig. 1.2 Shows a drawing board



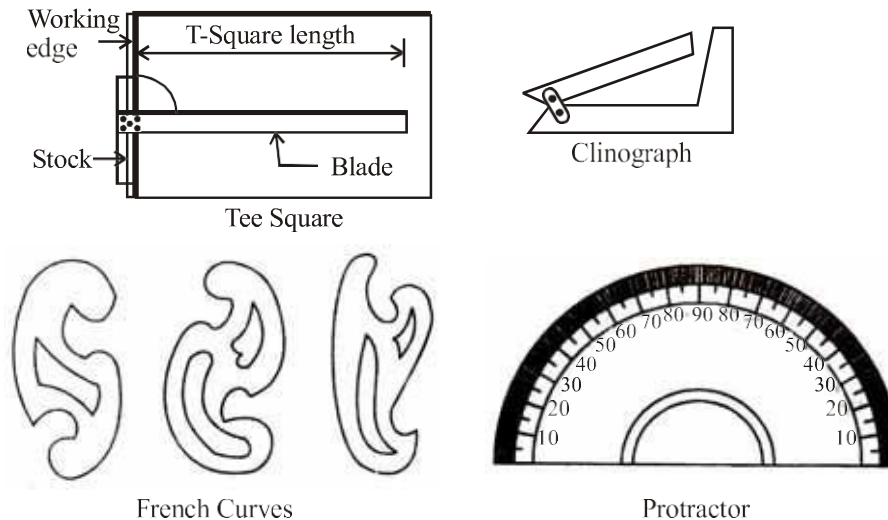


Fig. 1.2

Tee-square: A Tee-square is shown in Fig. 1.2. The name Tee is given to it because it resembles with the English Word '7'. It is made of well seasoned wood or metal. It consists of a stock and a blade connected rigidly and angle between working edge and blade is strictly kept as 90° . It slides on the board up and down and is used to draw horizontal parallel lines.

Set-square: These are made from thick transparent plastic sheets. These are used to draw angles of 30° , 60° , 45° , 90° . These are in the shape of triangles of 30° - 60° , and 45° - 45° . These are also used for drawing vertical parallel lines. (Fig. 1.2)

Mini Drafter: A mini drafter is shown in Fig. 1.2. It is fixed on the upper edge of the board. It is combination of Tee-square, set squares, protractor and scales. Horizontal and vertical lines are drawn with scales fitted to it. Angles are drawn by the protractor fitted with the scales. It increases the efficiency of the drawing. Hence it is becoming more and more popular.

Set of Scales: These scales are made of wood, plastic or metals and are available in various sizes and shapes. But commonly used are 30 cm long flat plastic scales with clear markings and bevelled edges.

Protractor: This is also made of transparent plastic sheet of full or half round shape. These are used for measuring angles. It has marking upto 0.5° .

French Curves: These are used for drawing curves by joining various points. These are also made of transparent plastic sheets. These are of various sizes and shapes. These are available in set of various shapel Fig. 1.2.

1.6 Drawing Sheets

Drawing sheets to be used should be pure white or any other colour with uniform thickness It should be tough and strong. No impression should be left if some line is

rubbed off with eraser. It should produce good drawings. Generally card board sheets having 30.5 kg per ream weight are used for drawing purposes. These drawing sheets are available in standard sizes. As per IS : 962-1967 the following are the sizes of drawing sheets:

S.No.	Designation	Trimmed sizes in mm	Untrimmed sizes in mm
1	A ₀	841 × 1149	880 × 1230
2	A ₁	594 × 841	625 × 880
3	A ₂	420 × 594	450 × 625
4	A ₃	297 × 420	330 × 450
5	A ₄	210 × 297	240 × 330
6	A ₅	148 × 210	165 × 240

1.6.1 Tracing Paper and Tracing Cloth

When it is desired to make out ferro or ammonia prints of a drawing, it is prepared on the tracing paper or tracing cloth. Tracing paper/cloth is transparent paper/cloth of best quality. In almost all the drawing offices, the drawings are prepared on the tracing papers in pencil. Main headings and titles are made in ink. When permanent record of drawings is required to be kept, these are prepared on tracing cloth in ink only. Ferro or Ammonia prints are then made from these drawings. Tracing paper/cloth is available in 100 cm width of rolls of various lengths.

1.6.2 Drawing Pins, Cello Tape and Clips

All the above three materials are used to fix the drawing sheets/tracing sheets in position for making drawings. The pins are least used nowadays because these make holes in the drawing board which spoil the drawings. As such cello-tapes are most commonly used for the purpose.

Pentagraph: It is used for enlarging and reducing the drawings. It has been described in survey part of this book.

Clinograph: As shown in Fig. 1.2, it is used for drawing parallel lines at any angle. It is used with T-square and set squares.

Rubber Eraser: A good quality eraser rubber is used for erasing pencil work if required. It should not leave any impression on the sheet.

Pencil: Pencils are available in various grades with respect to the hardness of lead. So as such pencils may be hard, soft, or medium. Soft pencils are graded as B, 2B, 3B, 4B, 5B, 6B, 7B and are used for art work medium pencils are graded as HB, F, H, 2H, 3H and are used for drawing work and tracing work. Hard pencils are further divided

