Techno India NJR Institute of Technology

B.Tech. III Semester

Course File

COMPUTER AIDED CIVIL ENGINEERING DRAWING

(3CE4-23)

Session 2022-23

Nishit Jain
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Department of CE

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

II Year - III Semester: B.Tech. (Civil Engineering)

3CE4-23: COMPUTER AIDED CIVIL ENGINEERING DRAWING

Credit: 1.5 **Max. Marks: 75 (IA:45, ETE:30)**
0L+0T+3P

List of Assignments

To study and draw the labelled sketch of different Building Components on sheets with exposure to CAD:

1. Drawing of walls
    a. Brick and Stone masonry
    b. Cross section of external wall from foundation to parapet
    c. Partition wall, cavity wall and
2. Pointing, Arches, Lintels and Floors
3. Doors and Windows
4. Stairs, Cross section of Dog legged stairs
5. Roofs: Flat and Pitched roof (Steel truss)
6. Development of Front Elevation and Sectional Elevation from a given plan
7. Development of Plan, Front Elevation and Sectional Elevation from line diagram

Course Overview:

Computer-aided Design (CAD) Course is the process of creation, modification, analysis and optimization of designs with the help of a computer or workstation is termed computer-aided design (CAD). There are many software solutions that are used for this purpose; they are called CAD software. The productivity of a designer has been enhanced manifold by the use of this Computer-aided Design (CAD) software. They are also used for improving the quality of design and communication. The database for manufacturing is created using CAD software.

Course Outcomes:

CO.NO.	Cognitive Level	Course Outcome
1	**Comprehension**	To understand the basic command, principles and features behindAutoCAD.
2	**Application**	Execute skills to draft the plan, elevation and sectional views of buildings.
3	**Analysis**	Students can Sketch or draft 2D and 3D views of buildings
4	**Synthesis**	Understand development of front elevation and sectional elevationfrom a given plan
5	**Evaluation**	Understand development of plan, front elevation and sectional elevation from line diagram.

Prerequisites:

1. Fundamentals knowledge of Computer.
2. Fundamentals knowledge of Drawing fundamentals.
3. Fundamentals knowledge of planning.

Course Coverage Module Wise:

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Faculty Lab Manual Link:
https://drive.google.com/drive/folders/14E9Z6UjJxNu_mZ-5USoU6QdMEl5vFq_M

Viva QUIZ Link

1. https://www.thesourcecad.com/autocad-quiz-with-answers/
2. https://www.mycadsite.com/quizzes.html
3. https://www.proprofs.com/quiz-school/topic/autocad
4. https://quizizz.com/admin/quiz/5cee714ad4d101001cdaab04/auto-cad-quiz
5. https://quizlet.com/102925191/autocad-quiz-questions-flash-cards/

Assessment Methodology:

Practical exam using AutoCAD software.

Internal exams and Viva Conduct.

Final Exam (practical paper) at the end of the semester.

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2

CHAPTER

CONVENTIONAL REPRESENTATIONS SCALE & ABBREVIATIONS

- Sizes of drawing sheets.
- Scales
- Graphical Symbols, for doors, windows etc., drains and sewers
- Abbreviations.
- Title block
- Lettering and dimensioning
- Alphabetical Symbols

2.1 INTRODUCTION

Architectural and building drawing office-paractices followed in the various civil engineering departments are based on certain basic principles as laid down by I.S.I. These principles are called "Code of Practice". They include size of drawing papers, layout of drawings, conventional representation, sizes of letters and numerals on drawings, graphic symbols and abbreviations. An architect/draughtman is required to know all these codes of practice. Following paragraphs deal with the same.

2.2 SIZE OF DRAWINGS

Drawing sheets are cut from rolls and are made into different sizes so that each size can be worked upon. Table 1 gives sizes of drawing sheets.

TABLE 1: SIZES OF DRAWING SHEETS

S. No. (1)	*DESIGNATION SIZE* (2)	*TRIMMED SIZE* (3) mm	*UNTRIMMED SIZE Min.* (4) mm
(i)	A_0	841 × 1189	880 × 1230
(ii)	A_1	584 × 841	625 × 880
(iii)	A_2	420 × 594	450 × 625
(iv)	A_3	297 × 420	330 × 450
(v)	A_4	210 × 297	240 × 330
(vi)	A_5	148 × 210	165 × 240

2.3 LAYOUT OF DRAWING

Border lines are drawn all round the drawing sheet leaving a margin of 10 mm. A margin of 25 or 30 mm is left on left hand side so as to facilitate filing. Title block is drawn on the right hand side or right hand side bottom corner. The remaining space is utilised for making drawings.

2.4 TITLE BLOCK

A title block normally carries the following information:

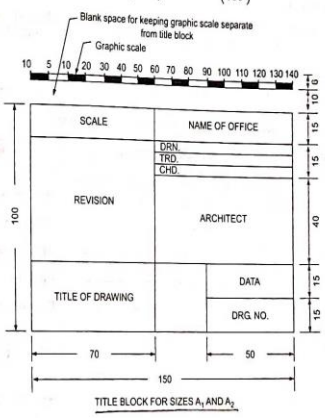
(i) Title of drawing,
(ii) Name of organisation,
(iii) Drawing number,
(iv) Scale,
(v) Date of drawing, etc. See Fig. 2.1.

2.5 SCALES

Following scales are used for different drawings.

(a) Working drawings, plans, elevations and sections.

$$1\,\text{cm} = 2\,\text{m}\left(\frac{1}{200}\right);\ 1\,\text{cm} = 1\,\text{m}\left(\frac{1}{100}\right)$$



TITLE BLOCK FOR SIZES A_1 AND A_2

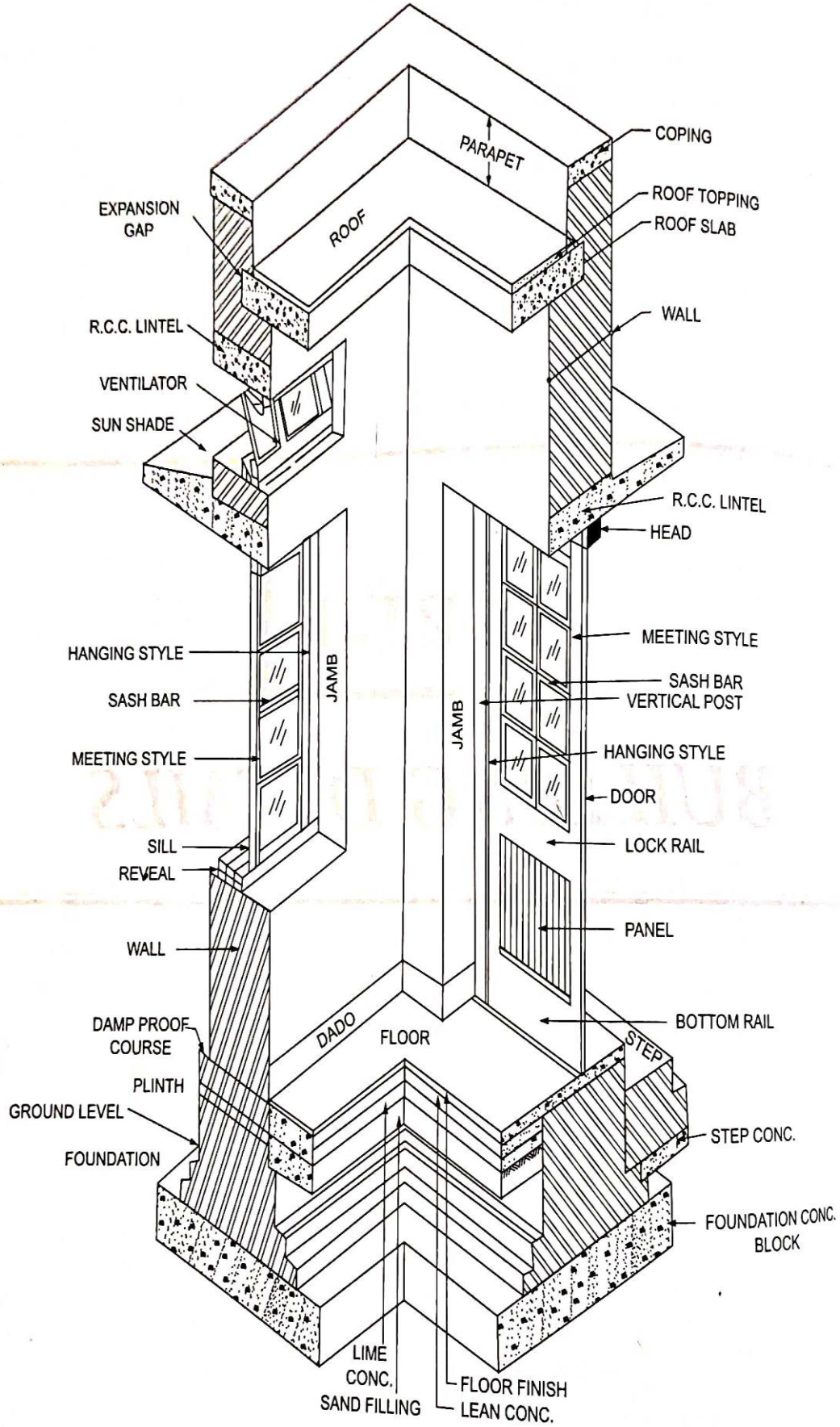
Fig. 2.1

(b) Large scale drawings—General details.

$$1\,\text{cm} = 20\,\text{m}\left(\frac{1}{20}\right);\ 1\,\text{cm} = 10\,\text{cm}\left(\frac{1}{10}\right)$$

2.6 LETTERING AND DIMENSIONING

The writing of details, references and naming of different views is done with letters of uniform sizes. Sizes of letters for such details are given in Table 2.



BUILDING DETAILS
TECHNICAL TERMS USED IN BUILDINGS

3

CHAPTER

MASONRY

- Masonry, Brick,
- Precast cone. solid or hollow blocks
- Copings, Jambs and reveals.
- Stone joints.
- Stone and composite.
- Brick bonds, —in walls, pillars.
- Herring and diagonal bonds.

3.1 MASONRY

The art of construction in brick or stone is known as masonry. When bricks are laid in mortar, it is known as brick masonry; and if stones are used, it is called stone masonry.

Bricks and stones, if used together at the same "constructional place is called composite masonry. Mudorlime or cement mortars is used for binding bricks or stones.

3.2 BRICK MASONRY

It is completely built with bricks and mortars. Walls of uniform thickness and shape can be built with this type of masonry as the bricks used are of uniform sizes. Walls built in brick masonry are stronger, durable and give a good appearance and can be built in correct sizes.

3.2.1 Brick Work

The art of laying bricks and embedding them in mortar to form a homogenous mass is called brick work.

3.2.2 Size of Brick

Bricks are moulded into standard dimensions. The standard size of a brick in metric system is 90 × 90 × 190 mm without taking into account the thickness of mortar joints. The brick is provided with a cavity, called as *frog*; which acts as a key for holding mortar. See Fig. 3.1.

3.2.3 Technical Terms

Following terms are generally used in brick work.

(i) **Course:** This is a term applied to the row of bricks laid between bed or horizontal joints. See Fig. 3.2. The thickness of each course is taken as 100 mm i.e., 90 + 10 = 100 mm (thickness of brick and thickness of joint).

(ii) **Bed joint:** These are mortar joints normal to the pressure.

(iii) **Quoins:** The external corner joints of walls are called quoins. Bricks or stone used to form such joints are known as quoins.

(iv) **Perpends:** The vertical joints on the face of wall are called perpends.

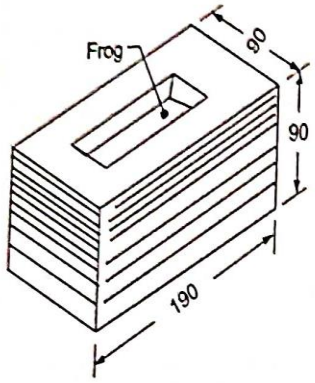
(v) **Stretcher:** These are bricks laid on the face of walls with their length parallel to the face. A course in which the face bricks are stretcher is known as *stretcher course*. See Fig. 3.2.

(vi) **Headers:** These are bricks laid on the face of the walls with their width parallel to the face. A course in which the face bricks are headers is known as header course. See Fig. 3.2.

(vii) **Bats:** Pieces of bricks ate called bats. ½ brick is called half bat end ¾ brick is known as ¾ bat. Fig. 3.3.

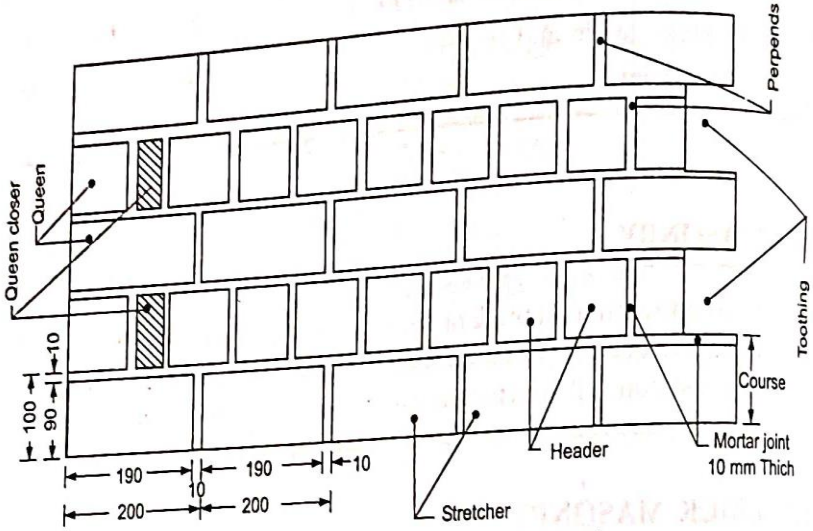
(viii) **Queen Closer:** A brick cut length wise into half is known as queen closer. See Fig. 3.4. It is used next to quoin header io get is proper bond.

(ix) **King Closer:** These are bricks cut in such a way that one end is half the width of a brick and other end is full width. These are used for lambs and reveals of doors and windows. These are also used as drip course. See Fig. 3.5, Fig. 3.6 and Fig. 3.7 show coping bricks.



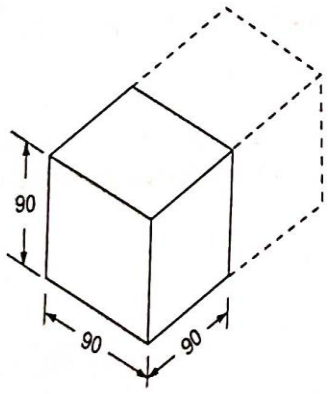
A STANDARD BRICK

Fig. 3.1



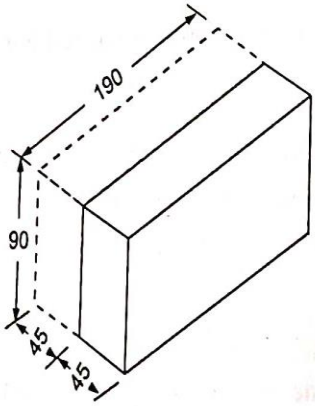
COMMON TERMS USED IN BRICK WORK

Fig. 3.2



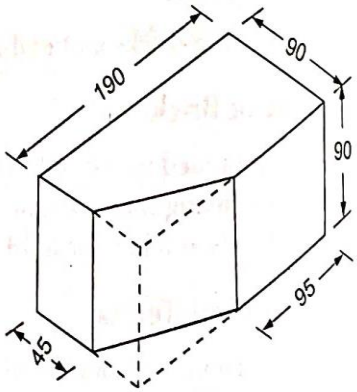
SNAP HEADER

Fig. 3.3



QUEEN CLOSER

Fig. 3.4



KING CLOSER

Fig. 3.5

Fig. 3.1 to 3.5

Fig. 3.7

3.2.4 Bonds

The systematic arrangement of laying bricks while making brick work is known as bond.

The bricks, owing to their uniform size and shape, can be arranged in a variety of patterns; which give rise to different types of bonds. Bonding is essential to eliminate vertical joints. A wall or pillar having vertical joints in one line does not behave as a homogenous mass to distribute superimposed loads. Following are the different types of bonds.

(i) English bond.
(ii) Flemish bond.
(iii) Heading bond.
(iv) Stretching bond.
(v) Garden wall bond.
(vi) Facing bond.
(vii) Racking bond.
(viii) Dutch bond, and
(ix) English cross bond

(i) English Bond

The following illustrated examples deal with laying of bricks at corner joints in English bond.

Q. 1. Draw two consecutive courses for corner joints of the following walls in English bond.
(a) One brick thick wall i.e. 200 × 200.
(b) One and half brick i.e. 300 × 300.
(c) Two brick thick wall i.e. 400 × 400.

Ans: For solutions see Figs. 3.8 to 3.10.

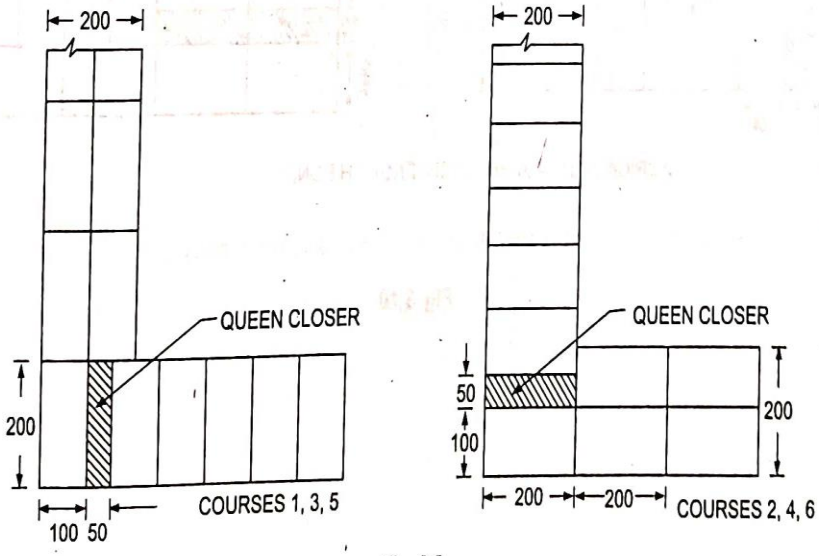
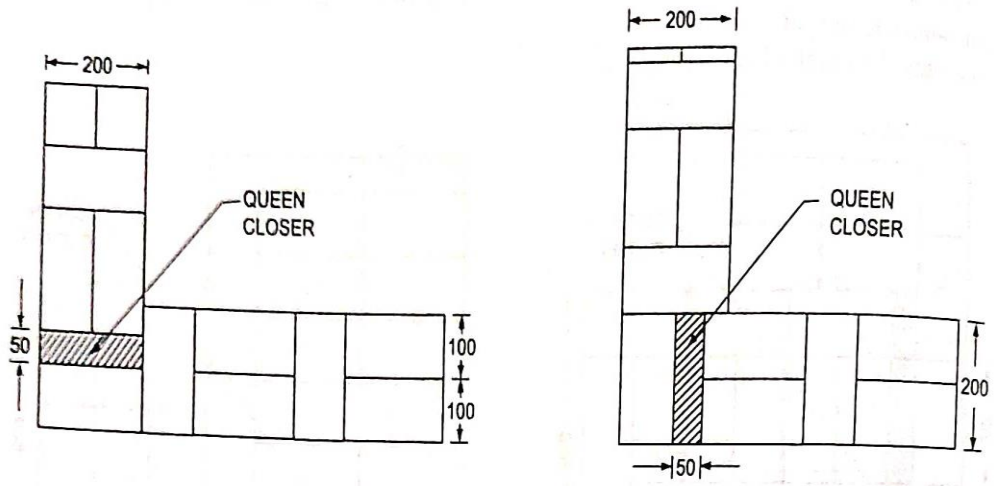


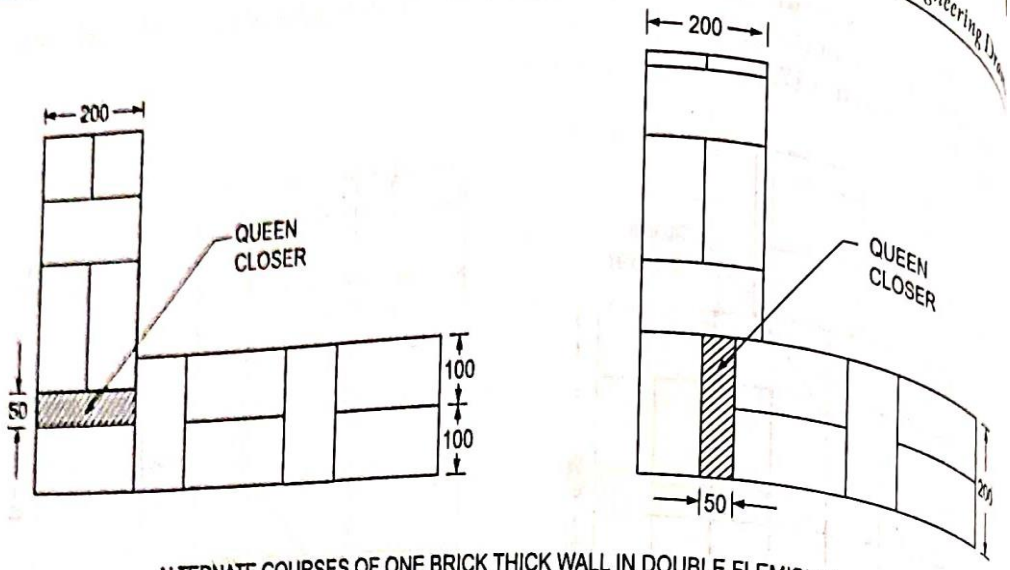
Fig. 3.8



ALTERNATE COURSES OF ONE BRICK THICK WALL IN DOUBLE FLEMISH BOND

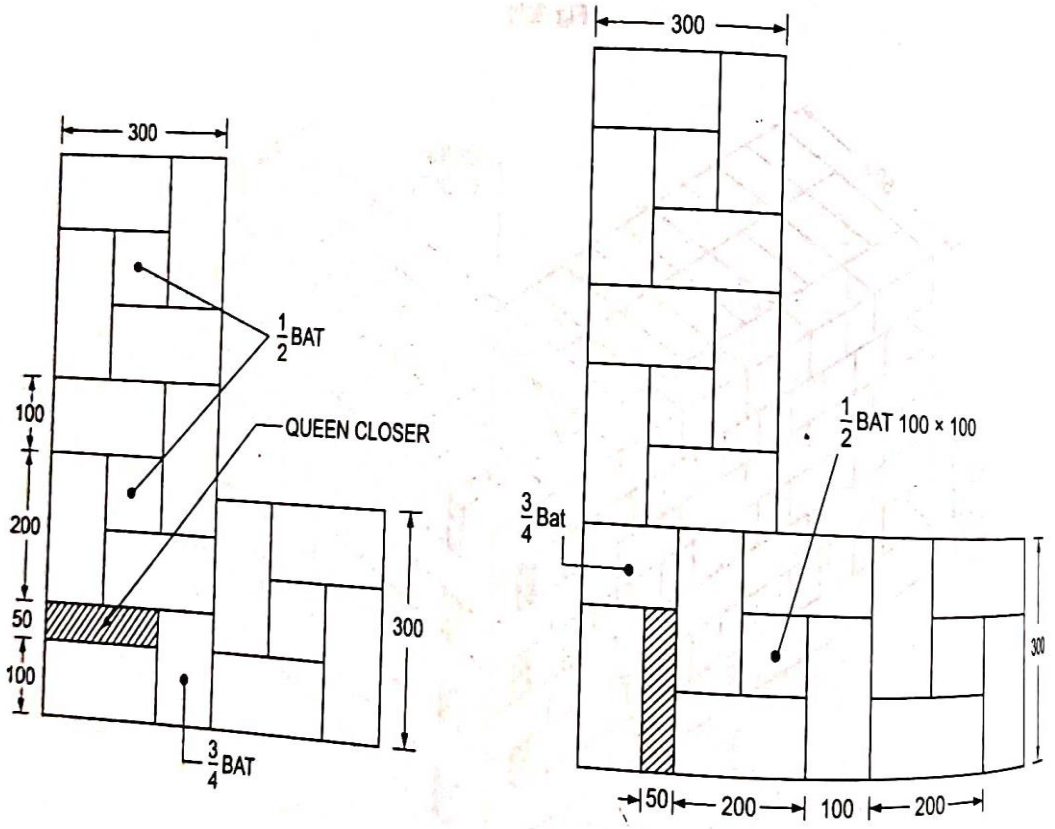
Fig. 3.13

300



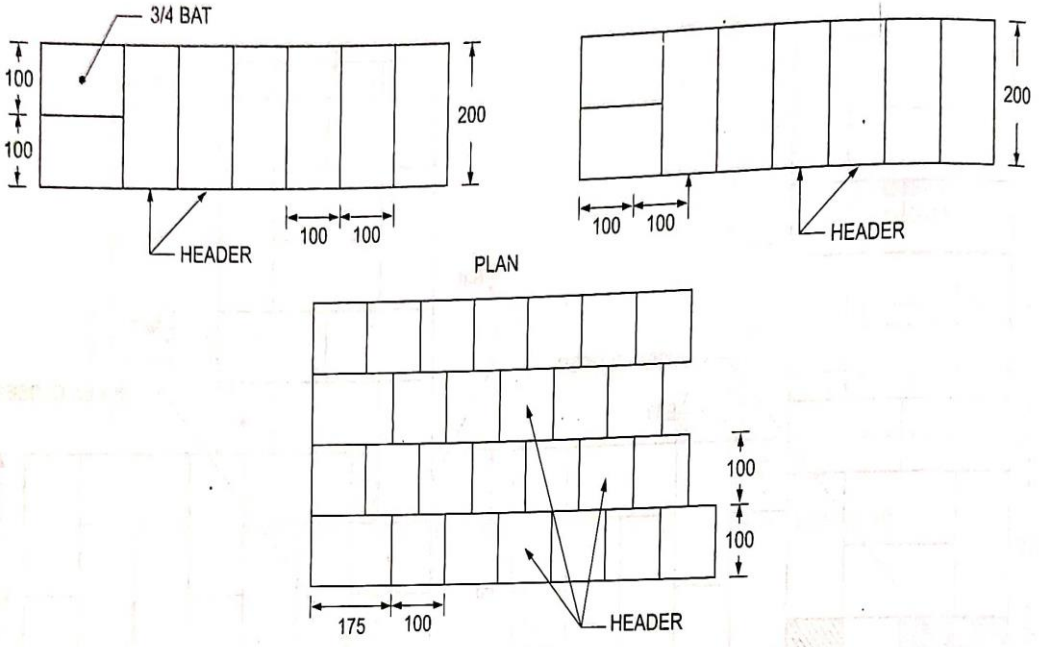
ALTERNATE COURSES OF ONE BRICK THICK WALL IN DOUBLE FLEMISH BOND

Fig. 3.13



ALTERNATE COURSES OF 1½ BRICK (300 THICK) WALL IN DOUBLE FLEMISH BOND

Fig. 3.14



ALTERNATE COURSES OF HEADERS BOND AND ITS ELEVATION

Fig. 3.17

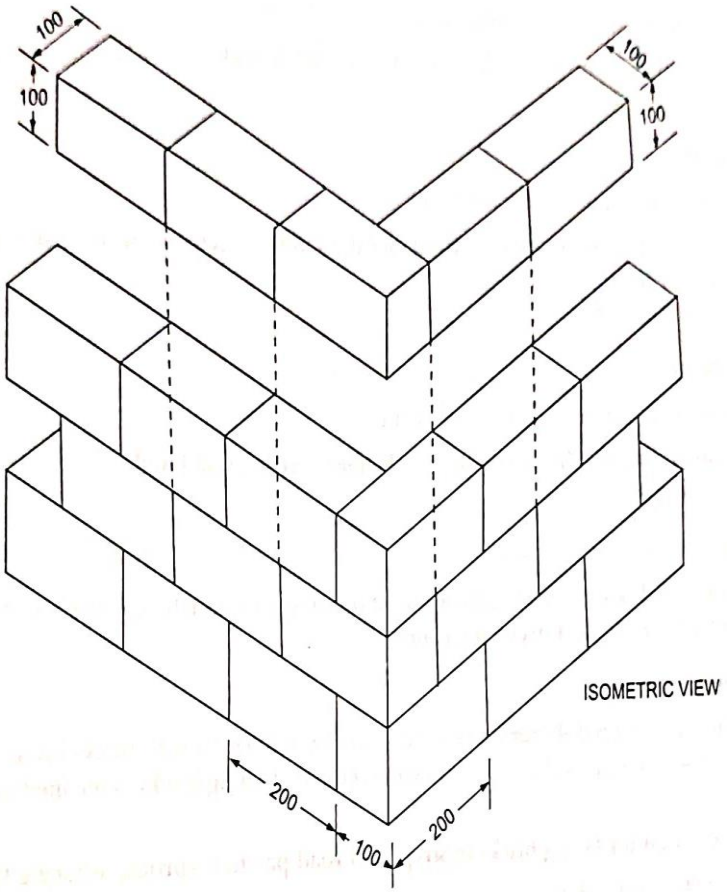

100
100
100
100
ISOMETRIC VIEW
200
100
200
ISOMETRIC OF STRETCHER BOND

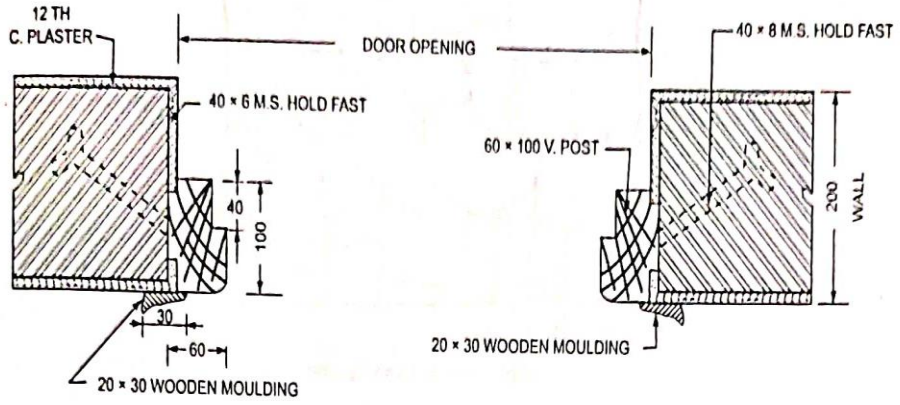
Fig. 3.19

3.5 STONE MASONRY

The art of construction with stones and mortar is known as stone masonry. Stones when created by nature rocks are very irregular in shape and size. Quarries, from where rocks are taken out by blasting or other means provide this natural material for construction purposes. Other stones, known as boulders, are also

from river and stream beds or dislodged from earthen mountains are also used in construction work. These may be used in their natural form or broken into handable sizes for construction purposes. Small bebbles and crushed boulders form the stone ballast or coarse aggregate in forming cement concrete.

Cutting of stones, giving them semi-finished or finished regular even size shapes give them the following type of masonry classifications:



DOOR FRAME WITHOUT REVEAL, FRAME FLUSHED WITH WALL FACE (FRAME MOULDING MOUNTED)

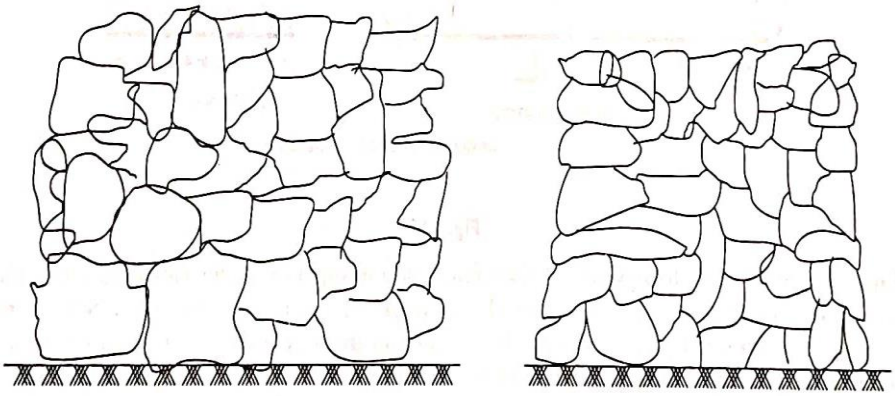
Fig. 3.43

Note: Door is without sill

1. **Random rubble masonry:** Collected are broken stones are placed one above the other without any mortar to form this type of masonry. Stones are just wedged into place to obtain a type of stone wall or barrier. Fencing of houses, farms and crops, animal sheds and even kucha houses have such walls in areas, where such stones are available. This construction with random rubble masonry is cheap and involves no technical skill in its laying. See Fig. 3.44.

   Stones are collected and placed at random just forming a wall type barrier. No mortar is used. Stones are just wedged in place to attain stability. Fencing of crops, by formers, in hilly areas mainly use this method. Terraced fields are provided with such type of breast walls. See Fig. 3-44.

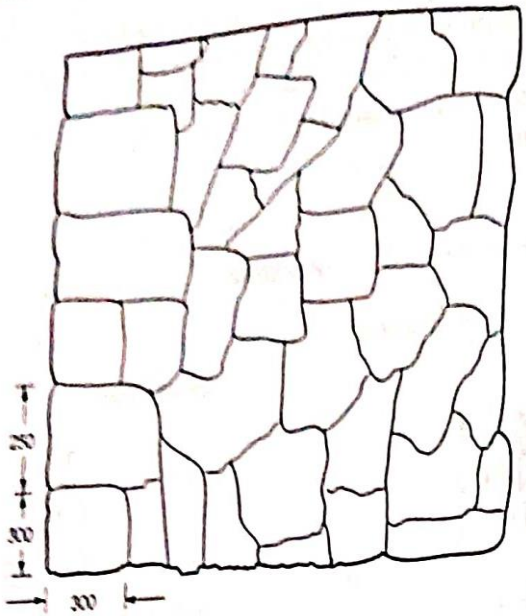
2. **Uncoursed random rubble masonry:** In this type of stone masonry, stones are dressed with a hammer and chisel. These are made a bit regular and placed in irregular courses. Walls of 300 to 500 mm thickness can be built with this type of masonry. The only consideration is that the height of each stone should not be more than its horizontal dimension. See Fig. 3.45.



WITH BROKEN ROCKS WITH BOULDERS IN NATURAL FORM

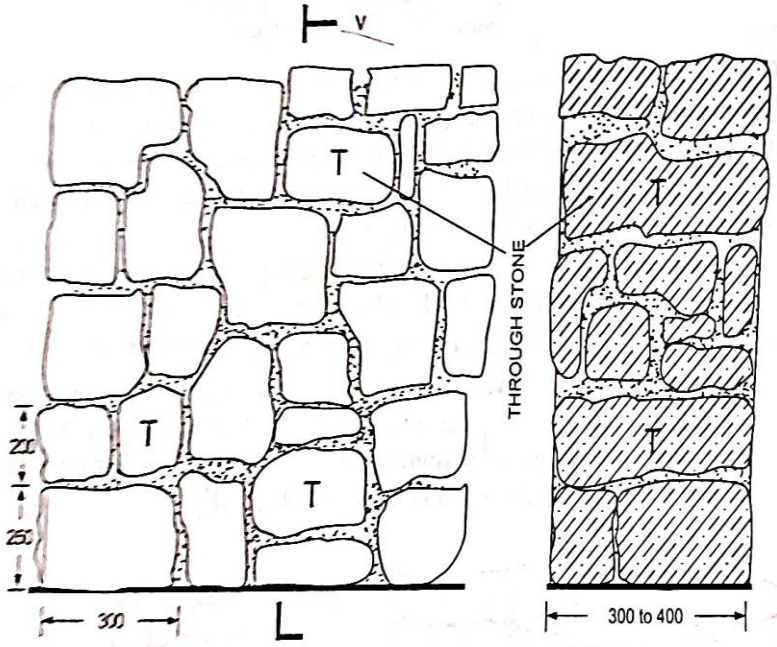
RANDOM RUBBLE MASONRY

Fig. 3.44(A)



UNCOURSED RUBBLE MASONRY

Fig. 3.44(B)



'T' = THROUGH STONE

SECTION AT V-V

UNCOURSED RANDOM RUBBLE

Fig. 3.45

3. ***Coursed random rubble masonry:*** *This is a durable and superior quality rubble masonry. The stones faces are squared or made rectangular like with sizes of 150 to 250 mm edges. Stones are laid in courses. Stones do not project beyond the thickness of the wall. Through stones are used at regular intervals in the entire construction. Thickness of joints is no doubt variable. See Fig. 3.46.*

4. ***Ashlar masonry:*** *Stones are properly finished into rectangular blocks of uniform sizes and laid with proper bonds in the body of the constructional work. Joints are made uniformly thick of 3 mm thickness. It is an expansive form of stone masonry. It can be used from 100 to 300 mm thick walls. See Fig. 3.47.*

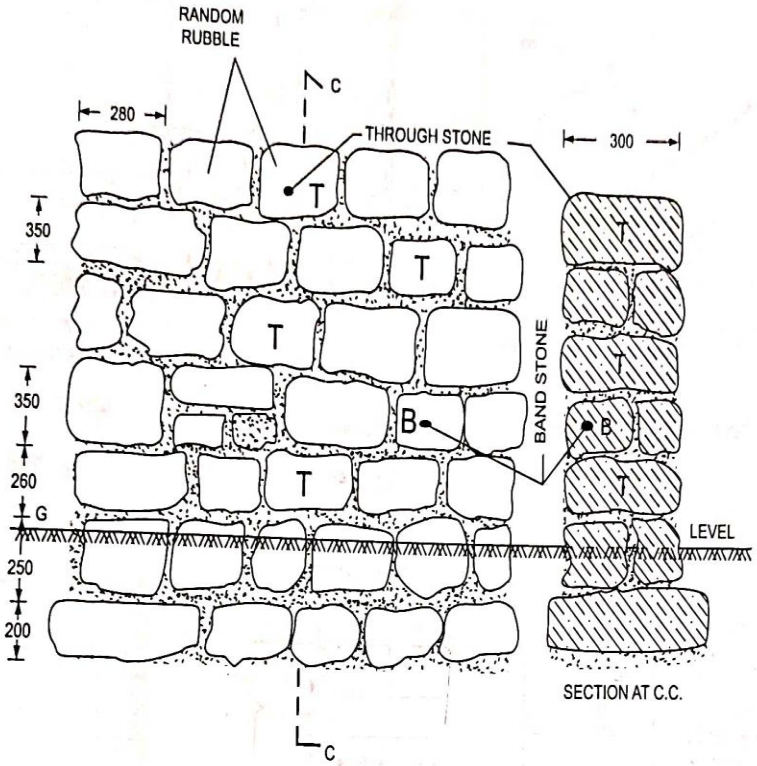


Fig. 3.46

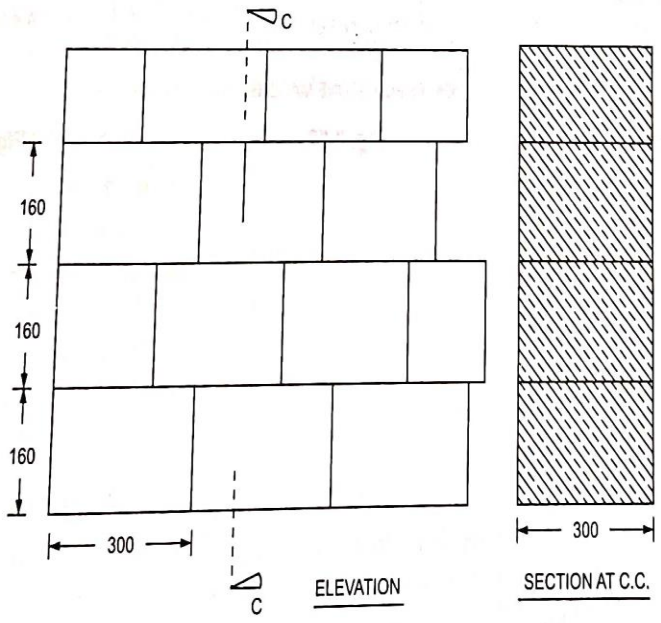
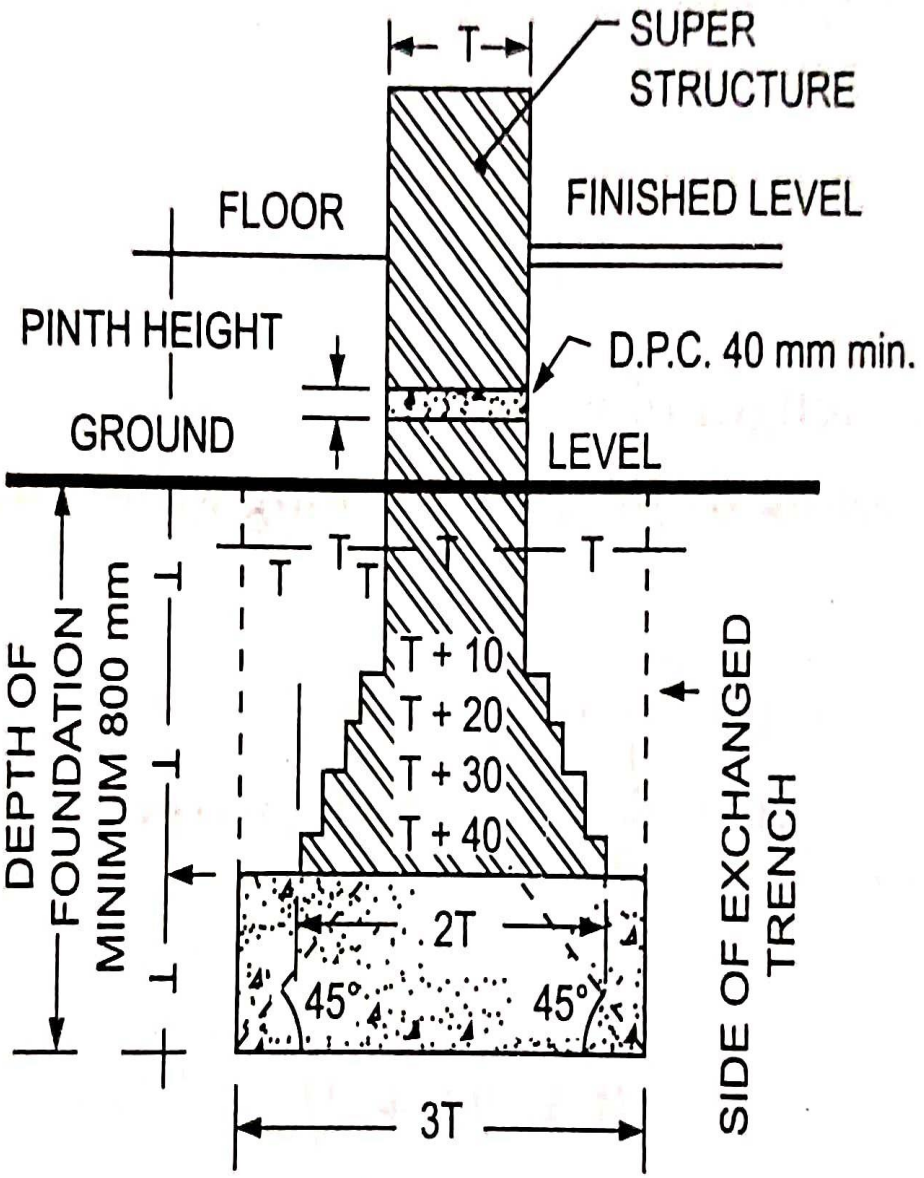


Fig. 3.47



SPREAD FOOTINGS FOUNDATION GIVING PROPORTIONAL SIZES

Fig. 4.1

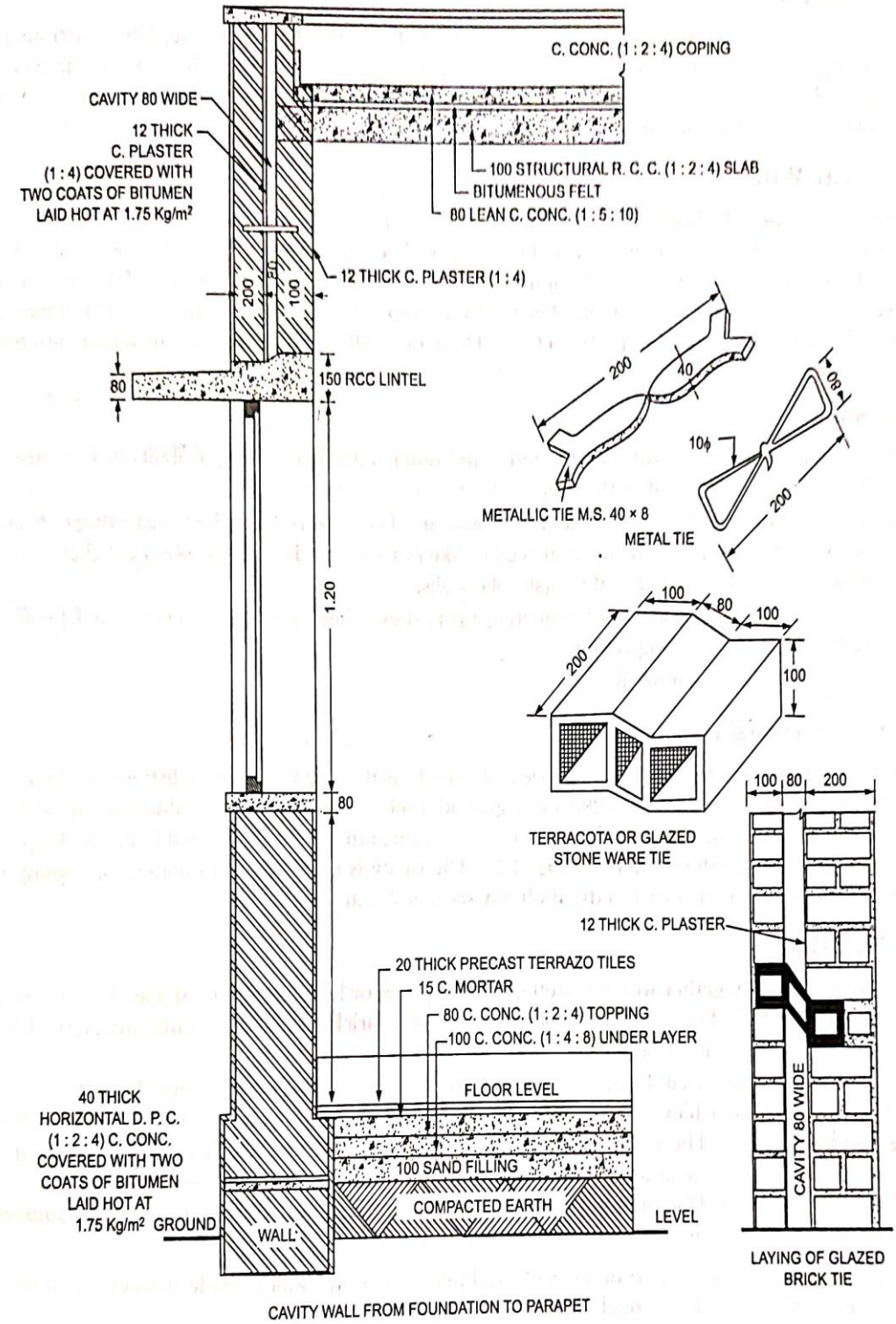

C. CONC. (1 : 2 : 4) COPING
CAVITY 80 WIDE
12 THICK C. PLASTER (1 : 4) COVERED WITH TWO COATS OF BITUMEN LAID HOT AT 1.75 Kg/m²
100 STRUCTURAL R. C. C. (1 : 2 : 4) SLAB
BITUMENOUS FELT
80 LEAN C. CONC. (1 : 5 : 10)
12 THICK C. PLASTER (1 : 4)
200
20
100
80
150 RCC LINTEL
1.20
80
METALLIC TIE M.S. 40 × 8
METAL TIE
TERRACOTA OR GLAZED STONE WARE TIE
12 THICK C. PLASTER
20 THICK PRECAST TERRAZO TILES
15 C. MORTAR
80 C. CONC. (1 : 2 : 4) TOPPING
100 C. CONC. (1 : 4 : 8) UNDER LAYER
FLOOR LEVEL
40 THICK HORIZONTAL D. P. C. (1 : 2 : 4) C. CONC. COVERED WITH TWO COATS OF BITUMEN LAID HOT AT 1.75 Kg/m²
GROUND
WALL
100 SAND FILLING
COMPACTED EARTH
LEVEL
CAVITY 80 WIDE
LAYING OF GLAZED BRICK TIE
CAVITY WALL FROM FOUNDATION TO PARAPET

Fig. 4.17

4.3.4 Cavity Walls

The walls having their thickness constructed in two separate parts with a uniform gap in between are known as cavity or *hollow* walls. Cavity wall consists of two walls with a 50 to 80 mm gap or cavity between them. The outer wall is known as outer leaf. It is 100 mm thick. The inner wall is thick and strong. It carries the super-imposed loads of beams, trusses roofs etc. The minimum allowed thickness for inner walls is 100 mm. These walls are always laid in C. mortar (1 : 4) to (1 : 5). These two walls are held together by impervions material ties.

Advantages:

(i) As there is no contact between the inner and outer walls there is no possibility of moisture travelling from the outer leaf to the inner wall.

(ii) The layer of air in between the walls acts as an insulator and reduces the transferring of heat. Such walls are most suitable for tropical region, like our country India. It is observed that cavity walls have 25% more insulating value than solid walls.

(iii) These walls have good sound insulating properties. These are thus recommended for libraries, radio and T.V. recording rooms.

(iv) These walls are economical.

CHAPTER

FLOORS
(Ground and Upper Floors)

- Brick
- Flag stone,
- Cement concrete or conglomerate
- Terrazo, False ceiling
- Wooden floors at ground and upper flow level.

5.1 FLOORING

The horizontal surfaces encased and supported on necessary walls and pillars in a structure to provide accommodation to its users are termed as floors. These floors divide a structure into storeys.

The first floor is made about 400 to 600 mm. above ground level and is known as **ground floor**. Any floor below this floor is called basement floor or underground floor and denoted as FLOOR–01; and the immediate next floor above the ground floor is known as first floor, it is denoted as FLOOR-1. The other successive floors above first floor are known as second, third, fourth etc. Similarly the stages at these floors levels are termed as storeys.

5.2 TYPES OF FLOORS

Following are the main types of floors. Each type of floor has its own particular merits and thus different type of floors may be used in different rooms at the same floor level.

(i) Brick flooring.
(ii) C. Conc. inter locking tiles (precast).
(iii) Flag stone flooring.
(iv) Cement concrete or conglomerate flooring.
(v) Terrazo flooring and terrazo precast tiles flooring.
(vi) Mosaic flooring.
(vii) Wooden flooring.
(viii) Ceramic, vitreous tiles with different designs and colours floors. (Flooring tiles are stronger than wall tiles.)

There are other types of floors, like Muram, asphalt, rubber, glass, linoleum floors etc., also. But these are specially used for specific purposes.

5.3. TECHNICAL TERMS USED IN FLOORING

(*a*) **Base:** The prepared surface on which the floor topping or under layer is laid is known as base. This normally consists of 100 mm thick sand for ground floors. It is also known as base course.

(*b*) **Under layer:** The course of material laid between topping and base is called under layer. It normally consists of lean c. concrete or lime concrete. Its thickness may vary between 80 to 100 mm.

(*c*) **Topping:** The topmost layer of a floor laid over the under layer is known as topping. Sometimes, it forms the finished surface of the floor also. Its normal thickness is taken as 40 mm.

(*d*) **Floor finish:** The special layers laid to form their upper surface or wearing surface, which normally render surface finish is called floor finish e.g. Mosaic or terrazo finish. It is normally 10 mm. to 30 mm. thick.

(i) Brick Floors

The floor having its topping laid in bricks is called a brick floor. It is used for cheap type of constructions. Bricks are laid in herring bone or diagonal bond. See Fig. 5.1. It is, when used in open surfaces, is called brick paving. See Fig. 5.2.

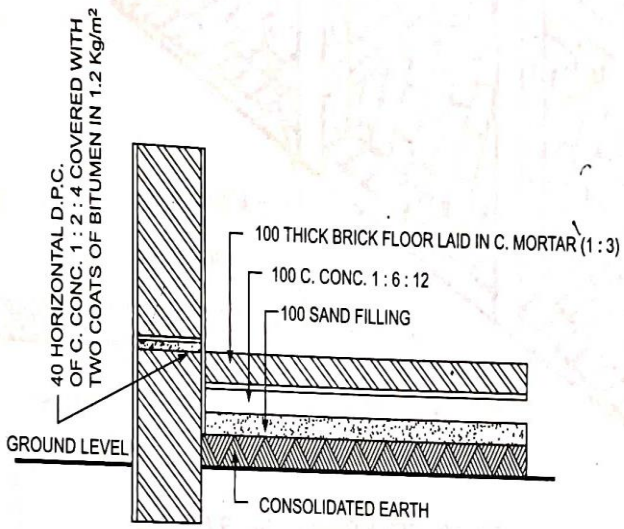


Fig. 5.1 BRICK FLOOR

(ii) Flag Stone Flooring

Thin slabs of stones are called flag stones. The thickness of stones vary from 20 to 50 mm. The stone are available in rectangular or square shapes. Following types of stones are normally used in our country for flooring.

(*a*) Marble stones.

(*b*) Kota stone.

(*c*) Dhaulpur stone.

(*d*) Red stone.

(*e*) Graphite-Granite

(*f*) Imported stones e.g. Italian stone.

Stones are hard to wear and can thus with stand heavy traffic. These are preferably used in public buildings. It is prepared by laying 100 to 150 mm thick under layer overhand packed rubble or sand filling. The stone surface is grounded with grinding stones by machine or hand. It is then finished with wax-polish. For details see Fig. 5.3.

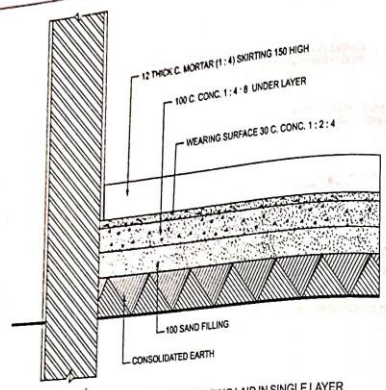


Fig. 5.6 BLENDED FLOOR FINISH TOPPING LAID IN SINGLE LAYER

Terrazo tile flooring is laid similar to terrazo floor. It is easier and saves lot of time in laying terrazo tiles. Terrazo tiles are manufactured under hydraulic pressure. These are available in the following sizes. The tiles are laid in white cement mortar.

(i) 200 × 200 × 20 mm.
(ii) 250 × 250 × 22 mm.
(iii) 300 × 300 × 25 mm.

For details of this type of floor see Fig. 5.12 (B).

(iii) Cement Concrete Floors

This is the most commonly used type of floor. It has the following merits.

1. It can be easily laid.
2. It is non-observant.
3. It is fire resistive.
4. It is durable.
5. It has less maintenance cost and can be easily cleaned.
6. If laid in blocks, can be easily repaired by replacing the whole worn out block.
7. It can be laid at ground floor or upper R.C.C. slab floors.

It consists of 40 mm. thick cement concrete (1 : 2 : 4) topping laid over 100 mm. lean cement concrete of (1 : 6 : 12) or (1 : 4 : 8) mix. under layer. Under layer is laid over 100 mm. sand filling. Figure 5.4 to 5.10 show different firms of cement concrete conglomerate ground and upper floors laid on R.C.C. slabs.

Note: Monolithic floors continue under the walls also; whereas bonded floors just butt the walls.

(vi) Terrazo Floors

It is a commonly used decorative type of floor. It consists of 100 mm. base of sand covered with 100 mm c.c. (1 : 4 : 8) under layer with 40 mm. thick topping of c.c. (1 : 2 : 4). Floor finish is made up of a mixture of 3 part of marble chips (size 0 to 4 number) and 1 part cement. Coloured cements can also be used. This mixture is laid in thickness varying from 6 to 12 mm. The wering surface is grounded with a grinding machine and then polished with wax-polish.

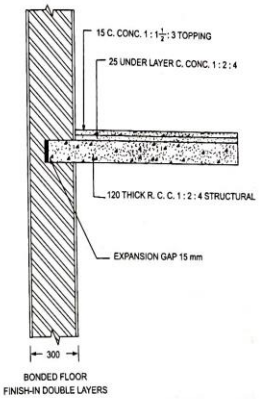


Fig. 5.7

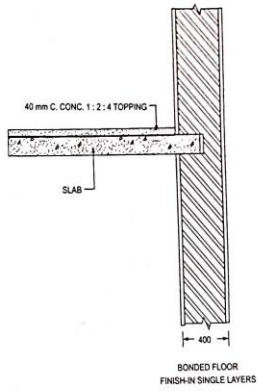


Fig. 5.8

This type of floor is mainly used in Bathroom. W.C.'s Kitchens, Drawing and Dining rooms, Verandahs, Hospitals, Lounges and Foyers of cinema halls etc. See Fig. 5.11 and Fig. 5.12 (A) & (B).

(v) Wooden Floors

Wooden floors are not used commonly in our country. However, these are used for skating or dancing halls. These are also used at hill-stations. These are also used for indoor games hall and gymnasium hall.

Wooden floors consists of fixing boards to the bridging joists which rest on wall plates and transmit the load on flooring to the walls. The floor area is divided into small spans by constructing dwarf walls in case of ground floors and by placing beams in case of upper floors. The span of joists is limited to 3.50 metres so that lighter section can be used. The space between the ground floor and flooring boards is properly ventilated by providing air bricks or wire-guage covered small openings so as to protect wood against dry rots. These floors are classified into three types.

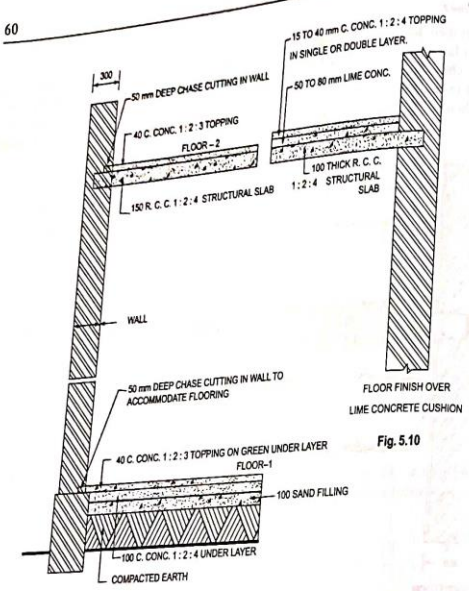


Fig. 5.10

Fig. 5.9 FLOOR-AT UPPER FLOOR LEVEL

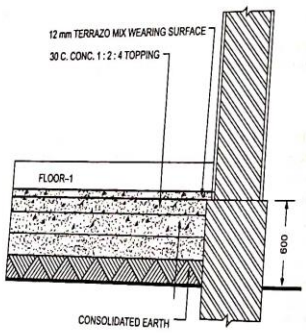


Fig. 5.11 TARRAZO FLOOR

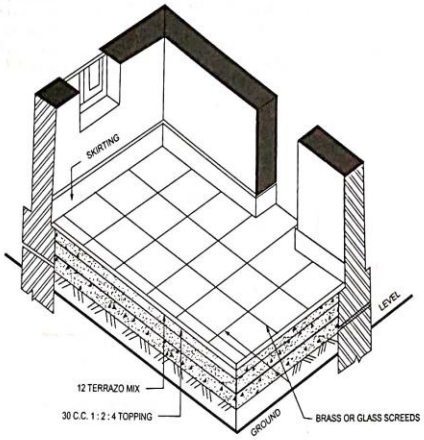


Fig. 5.12(A) TERRAZO FLOOR LAID IN SQUARE BLOCKS

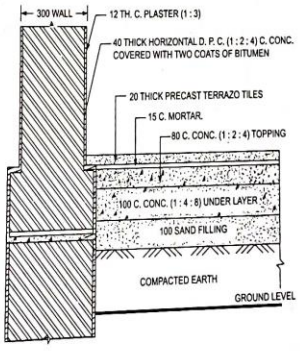


Fig. 5.12 (B) PRECAST TERAZZO TILE FLOORING

6

CHAPTER

FORMS OF ARCHES CENTERING AND LINTELS

- Technical terms, flat arch, semi-circular brick or stone arch
- Horse shoe, stilted arch, circular, segmental brick or stone arch, two centered, three centered elliptical arch
- Ogee and relieving arch
- Wooden and M.S. centering for arches.
- Wooden, stone, reinforced brick and R.C.C. Lintels.

6.1 INTRODUCTION

The openings provided in walls for passages, doors, windows, etc. are to be bridged over at a certain height so as to continue the construction of the wall above the opening. The bridging is achieved by providing masonry work in a curved form or a straight monolithic structural member. The curved masonry work is known as arch and the straight structural member as Lintel.

6.2 ARCHES

An arch is a structural member built of bricks, stones or concrete blocks joined together with mortar in the form of a curve.

The bed joints of an arch meet at the centre of the arch.

6.3 TECHNICAL TERMS

The following technical terms are related with arches. See Fig. 6.1. Which clearly shows different parts of an arch.

1. **Arcade:** A series of arches supporting a wall above is known as arcade.
2. **Abutment:** The end support of an arch or an arcade is known as abutment.
3. **Arching:** The curved ring of masonry forming the arch is known as *arch ring*.
4. **Bed joints:** The radial joints of an arch are known as bed joints.
5. **Extrados or back:** The upper surface or convex side of an arch is called back or extrados.
6. **Centre of an arch:** The geometrical centre from which the intrados and extrados of an arch are drawn is known as centre.

   An arch may have one or more centres depending upon the geometrical shape of the arch.

7. **Crown:** The highest point of the extrados is known as crown.
8. **Thickness of arch ring or depth:** It is the normal distance between the extrados and intrados.
9. **Haunch:** The lower half of an arch between the midway of crown and springer is known as haunch.
10. **Interados:** The underside or concave of the arch is called intrados.
11. **Impost:** The projection at the top of a pier or an abutment is called impost. It is normally finished in a moulded fashion.
12. **Jambs:** The inner faces of piers or abutments below the springing line are known as jambs.
13. **Key:** The central voussoir of an arch ring is known as key.
14. **Piers:** The intermediate support in a series of arches is called a pier.
15. **Rise:** The vertical distance between the springing line and the highest point of intrados is known as rise.
16. **Springers:** The first voussoir placed adjacent to the skew back of an arch is called a springer.
17. **Springing point:** The point from which the curve of an arch commences or springs is known springing point.
18. **Springing line:** This is the imaginary horizontal line joining the two springing points.
19. **Skew-back:** The splayed or inclined surface of an abutment or pier from which the arch ring commences is known as skew-back.
20. **Span:** The horizontal distance between the springing points is called span.
21. **Spandril:** The irregular triangular space between the extrados and a horizontal line drawn through the crown is known as spandril.
22. **Voussoirs:** The wedge shaped bricks or blocks forming the courses of an arch ring are known as voussoirs.

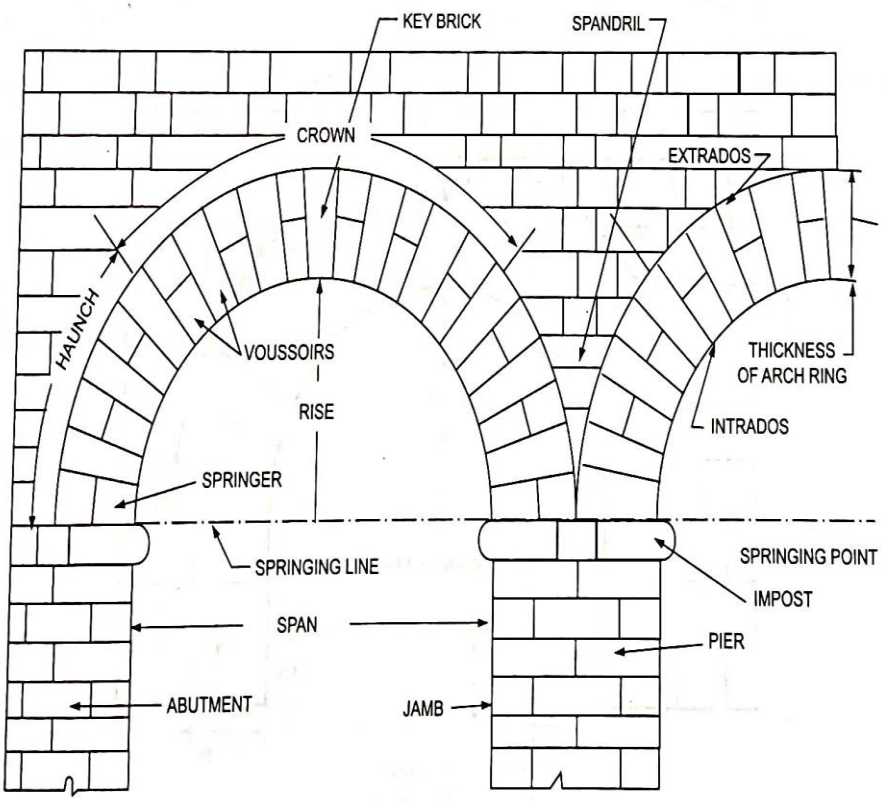


Fig. 6.1 TECHNICAL TERMS OF AN ARCH

6.4 CLASSIFICATION OF ARCHES

Arches are named according to their geometrical shape of intrados. Following are its main types.

1. **Flat, straight, square or camber arch:** It is an arch having its extrados horizontal but intrados having a slight camber. The rise in the centre is normally 1 cm per meter of span. See Fig. 6.2. The bed joints are obtained by joining them to the centre.

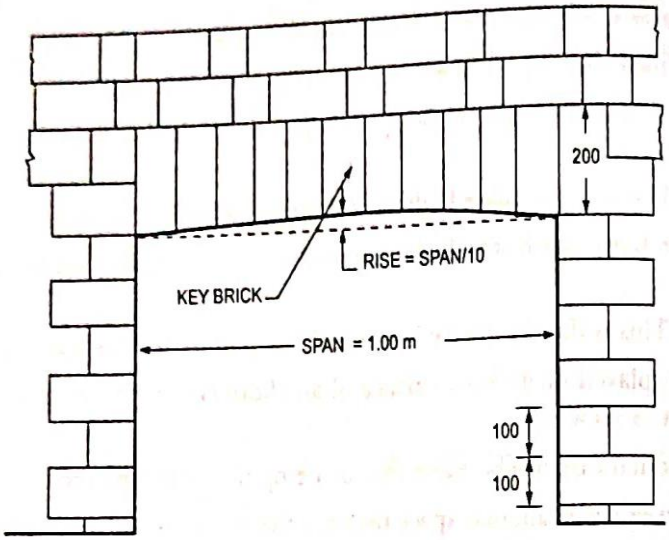


Fig. 6.2 FLAT BRICK ARCH

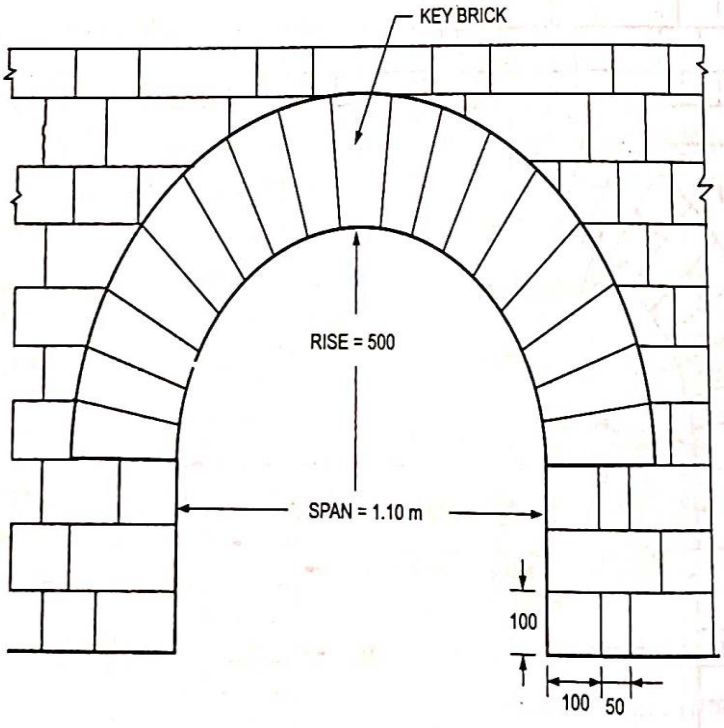


Fig. 6.3 SEMI CIRCULAR BRICK ARCH—BRICKS LAID ON END

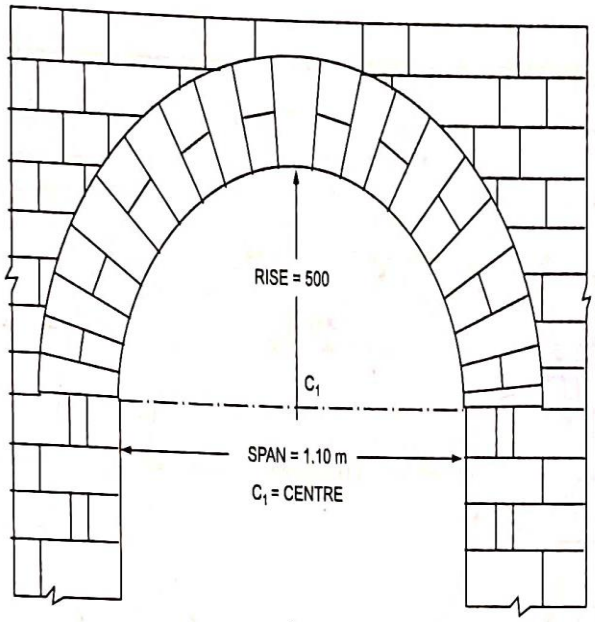


Fig. 6.4 SEMI CIRCULAR ARCH—ALTERNATE BRICKS LAID ON END

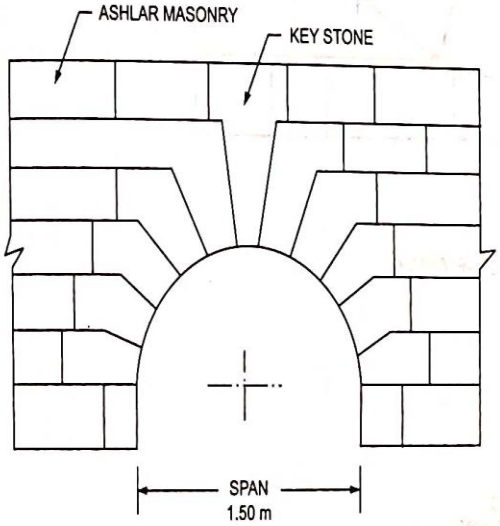


Fig. 6.5 SEMI-CIRCULAR STONE ARCH

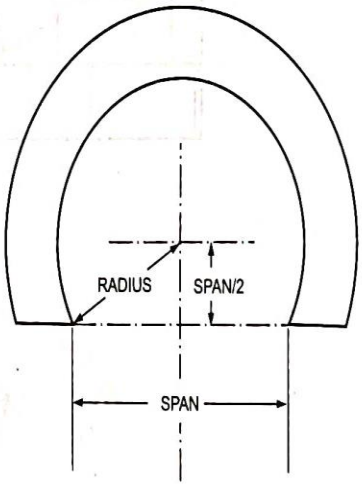


Fig. 6.6 HORSE-SHOE ARCH CENTRE IS ABOVE THE SPRINGING LINE

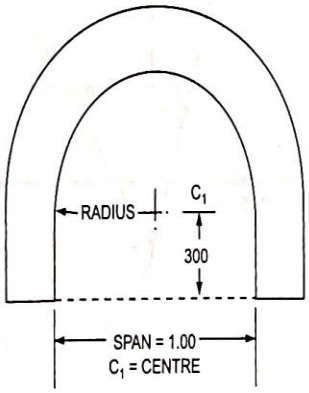


Fig. 6.7 STILTED ARCH CENTRE ABOVE SPRINGING LINE

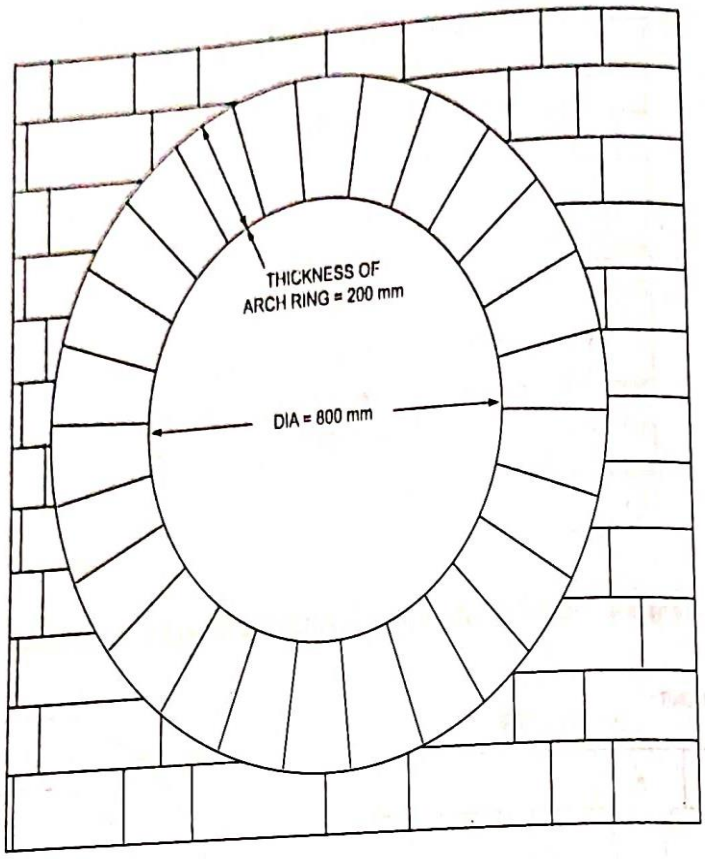


Fig. 6.8 CIRCULAR ARCH

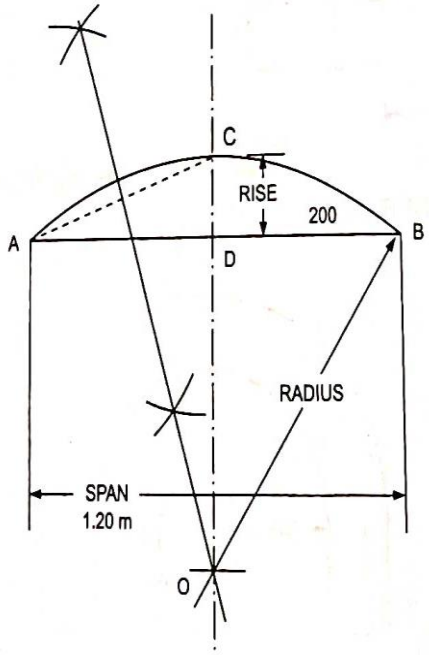


Fig. 6.9 GEOMETRICAL CONSTRUCTIONAL DETAIL OF SEGMENTAL ARCH SPAN = 1.20 RISE 200

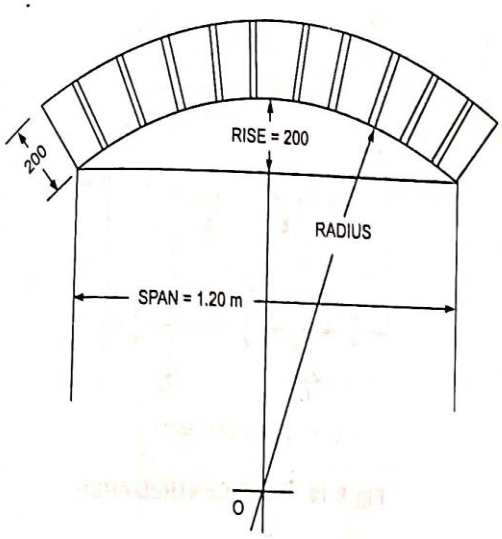


Fig. 6.10 SEGMENTAL BRICK ARCH

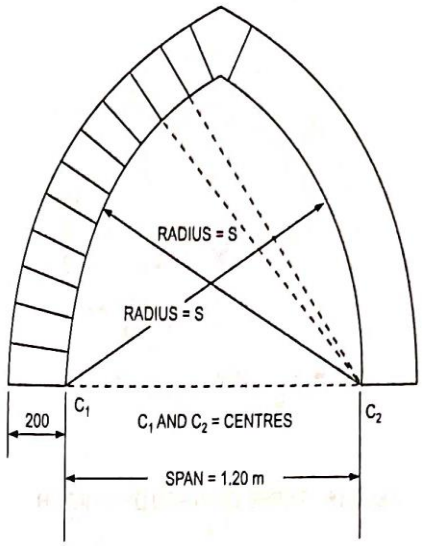


Fig. 6.11 EQUILATERAL ARCH

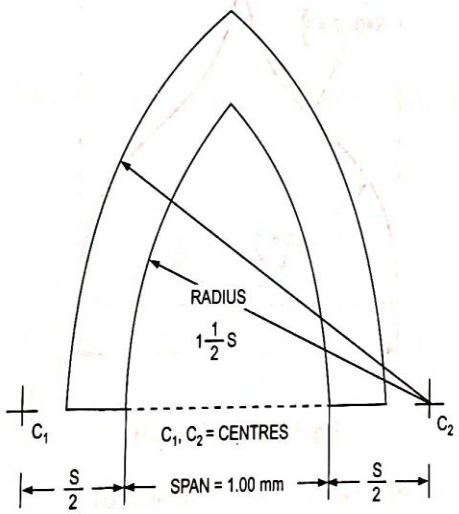


Fig. 6.12 LANCET OR ACUTE ARCH

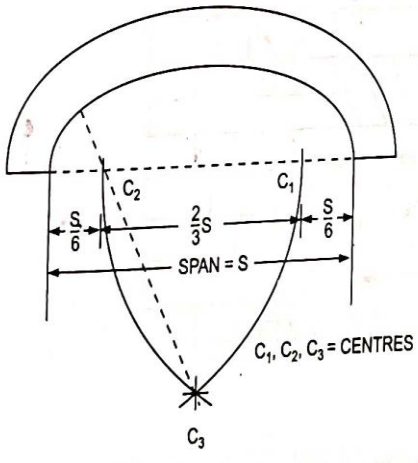


Fig. 6.13 SEMI ELLIPTICAL ARCH

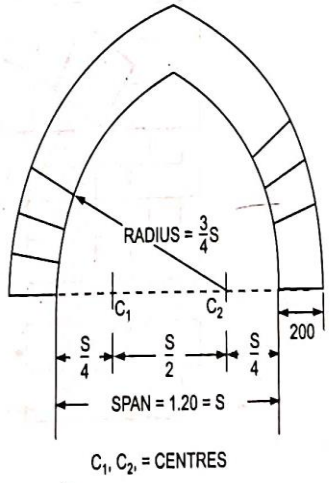


Fig. 6.14 DROP OR OBTUSE ARCH

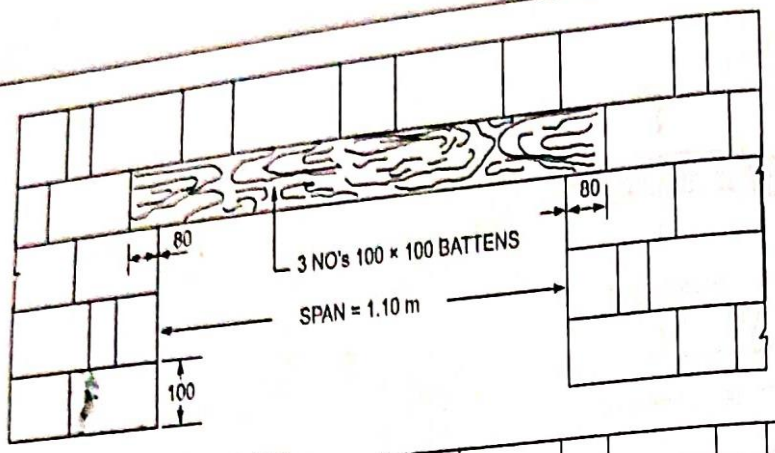


Fig. 6.21 WOODEN LINTEL

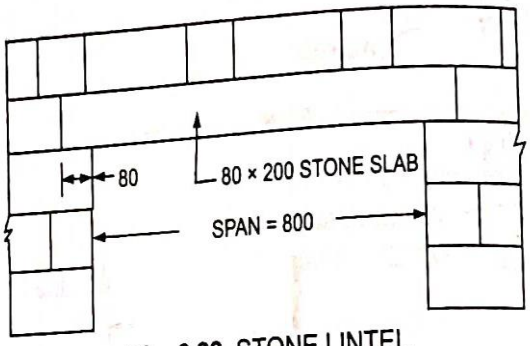
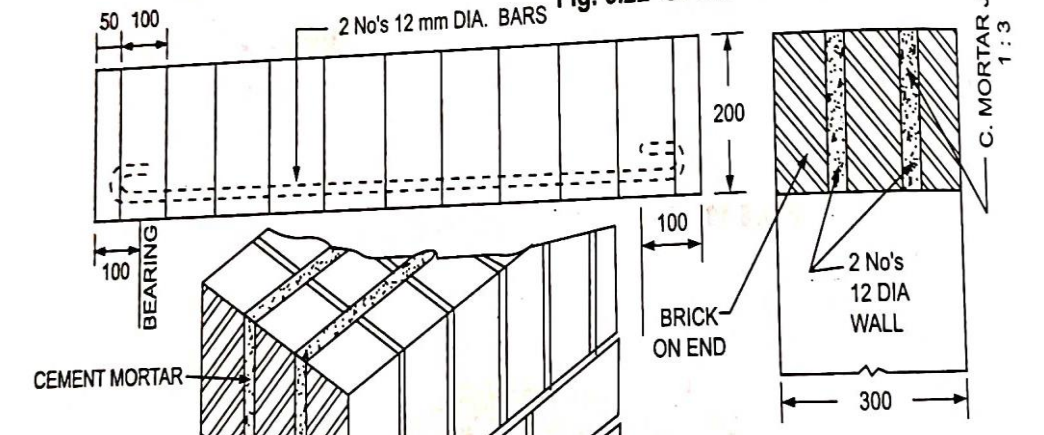
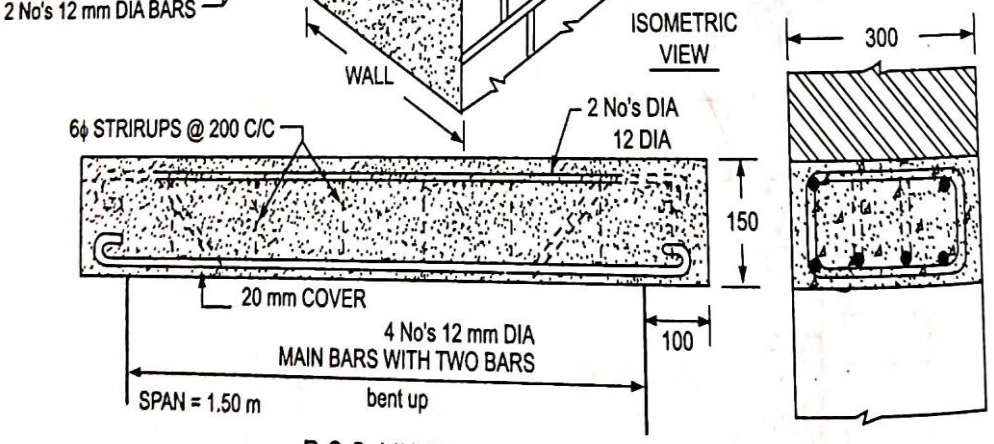


Fig. 6.22 STONE LINTEL



REINFORCED BRICK LINTEL

Fig. 6.23



R.C.C. LINTEL

Fig. 6.24

Fig. 6.21 to 24

o

6.6 LINTELS

Horizontal members which are placed over the openings of doors, windows or almirah, etc. to support the structure above the opening are called lintels.

These are generally rectangular in shape. These can be made with any of the following materials.

(i) Wooden lintel. See Fig. 6.21.
(ii) Stone lintel. See Fig. 6.22.
(iii) Reinforced brick lintel. See Fig. 6.23.
(iv) R.C.C. lintel. See Fig. 6.24.

❑❑❑

7

CHAPTER

PARTITION WALLS

- Different types of partition walls, necessity, qualities, types and details of wooden partition walls.

7.1 PARTITION WALLS

The walls, claddings or screens, which are used to divide a hall into rooms, corridors and cuboids are known as partition walls.

Partition walls are basically non load bearing divide walls. Partitions have become a necessity these days Most of the multistoreyed structures are made by a combination of columns and beams frames. The spaces between the columns and beams are built with divide walls. A big hall with a single roof overhead can be divided into number of rooms by providing partitions. Partitions walls can be made permanent or semi-permanent. But the basic requirements of a good partition wall are numerated below.

(i) It should be light in construction.
(ii) It should be easy to install and dismental.
(iii) It should be light and sound proof.
(iv) It should be fire-resisting.
(v) It should be elegant in looks.
(vi) It should be cheap or economical in construction.
(vii) It could be taken upto the ceiling level or 2.5 to 3 metre height without the use of heavy props or stays.

7.2 TYPES OF PARTITION WALLS

The following types of partition walls are generally used.

(i) Brick partitions—plain, brick noggings, or reinforced brick work.
(ii) Clay or terracotta hollow blocks partitions.
(iii) Cement concrete hollow blocks.
(iv) Foam cement concrete blocks partitions.
(v) Cement concrete slab partitions i.e. claddings.
(vi) Reinforced cement concrete partitions.
(vii) Asbestos-plain sheet partitions.
(viii) Metal partitions.
(ix) Glass partitions.
(x) Plastic or acrylic partitions.
(xi) Fibre glass partitions.
(xii) Compressed boards, thermocol, card boards, plywood, hard board partitions.

(xiii) Lath-wooden or steel, with plaster on both sides.
(xiv) Gypsum block partitions.
(xv) Wooden partitions.

7.1.1 Common Partitions

These partitions are in common use and are explained by detailed drawings. See Figs. 7.1 to 7.14.

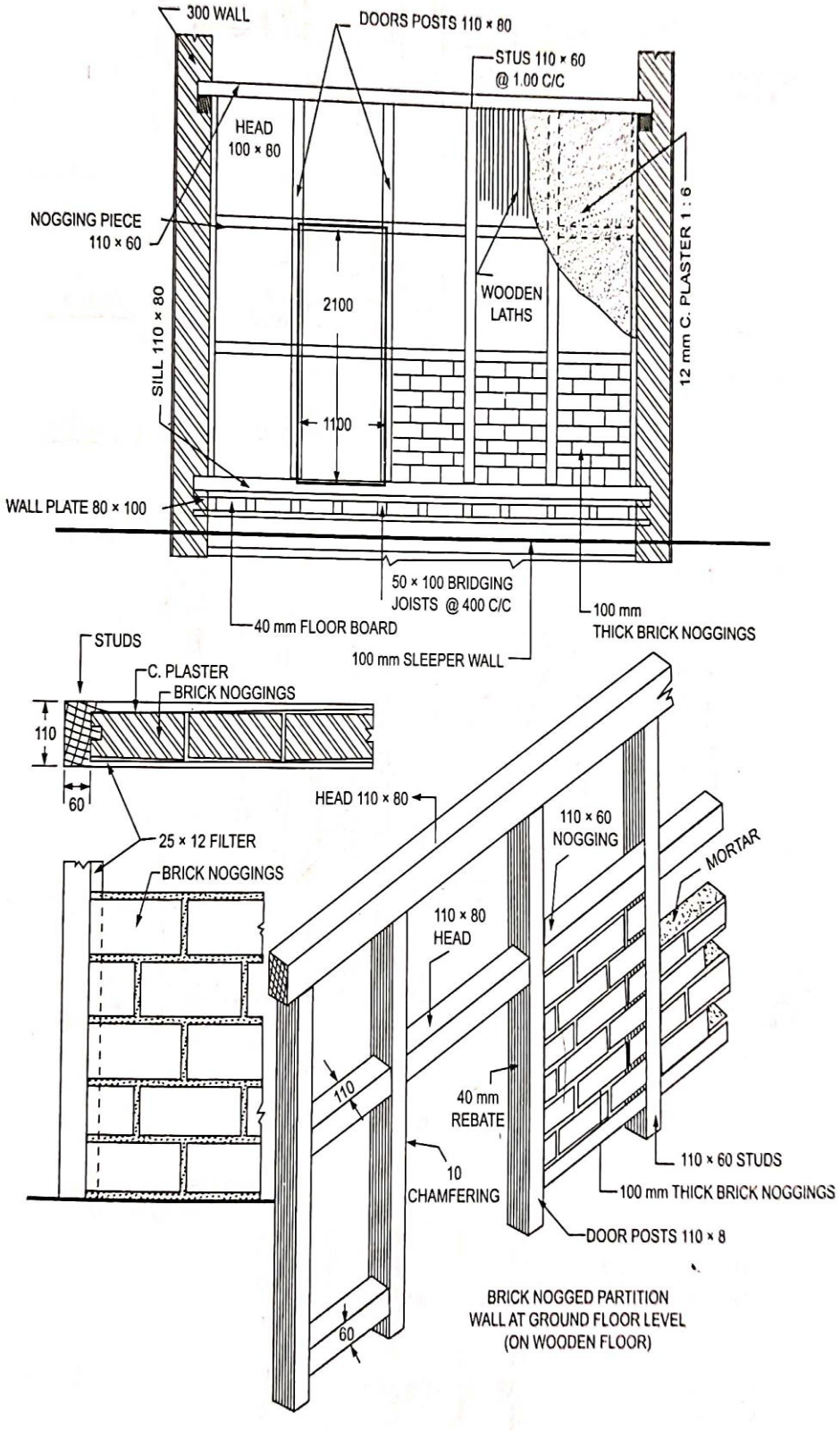


Fig. 7.1 to Fig. 7.3

9

CHAPTER

DOORS AND WINDOWS

- **Doors:** Single and double leafed, Sizes of doors, Fixing door frames in masonry walls, ISI recommended sizes for chowkhat i.e. frame. Ledged and battened, Lodged battened and braced, Ledged, battened, braced and framed, Panelled, wooden panels, board panels with headings. Panelled and glazed, Fully glazed. Flush doors, Wiregauge shutters, Revolving doors, Rolling shutters. Collapsible steel shutters. Fan lights and Ventilators.
- **Widows:** Panelled, Fully glazed with sash bars or without sash bars, Bay window, Corner window, Dormer. Steel frame windows. Window with folding shutters. R. C.C. and steel chowkhats, steel and Aluminium doors, window and ventilators. Symbolic designation of direction of closing and faces of doors, windows and shutters.

9.1 DOOR

For movement and access between different rooms of a building and with the outside doors are provided. A door consists of a frame to which either one or two leaves are hung by means of metal-hinges.

If one shutter is used the door is named a Single leaf door; and if two leaves are fitted, it is called Double leafed. Each type has its merits. Single—leafed doors, if provided close to corners of rooms occupy less space on opening. Double-leafed doors are easy to operate and can be made from small scantlings.

9.2 SIZES OF DOORS

There is no specific rule which can fix the size of a door. It is preferable if the height and width conform to the brick size so that it can be fixed between proper courses. Basically it depends upon the necessity of the requirement of its uses. Rooms in which furniture, beds, etc. are to be moved in and out may have door openings not less than 1.00 m. Stores, kitchen, bath and W.c's may have narrow door openings. For residential buildings, the following sizes are recommended.

1. Living room 1200 × 2100 mm.
2. Drawing room 1200 × 2100 mm.
3. Dining room 1200 × 2100 mm.
4. Lounge 1200 × 2100 mm.
5. Bedrooms 1200 × 2100 mm.
6. Kitchen 900 × 2100 mm.
7. Bath or W. C. of combined. 900 × 2100 or 800 × 2100 mm.

Following sizes are recommended by ISI for doors, windows are ventilators. See Fig. 9.1. It avoid collusion doors, Windows ventilatory.

9.4 FRAME OR CHOWKHAT

The head member is projected on each end to give anchorage to chowkhat (frame). The... termed as **horns**. The vertical posts are embedded in the floor upto a minimum of 40 mm depth. Sometimes metallic dowel pins are used to hold vertical posts in position. The vertical posts and head are joined together by dove-tail or tongued and grooved or tongued, grooved and stepped joints.

The finished dimensions of timber sections in frames of doors, windows and ventilators are given below. See Figs. 9.2, 9.3, 9.4 and 9.5. Door frames (chowkhat) are fixed to walls by hold fasts of mild steel. See Fig. 9.6.

Requirement	*Dimension (mm)*
Width of frame carrying one set of shutters	100
Width of frame carrying two sets of shutters	120 to 140
Thickness	60

9.5 CLASSIFICATION OF DOORS

Classification of doors depend upon the arrangement and pattern of placing of different members forming the door shutter; accordingly these are classified into the following types.

1. Ledged and battened door.
2. Ledged, battened and braced door.
3. Framed, ledged, battened and braced door.
4. Framed and panelled door.
5. Panelled and glazed door.
6. Fully glazed or sash door.
7. Louvered or Ventian door.
8. Flush doors.
9. Wire gauged door.
10. Collapsible door.
11. Rolling steel shutters.
12. Half door with double action hinges.
13. Special doors.

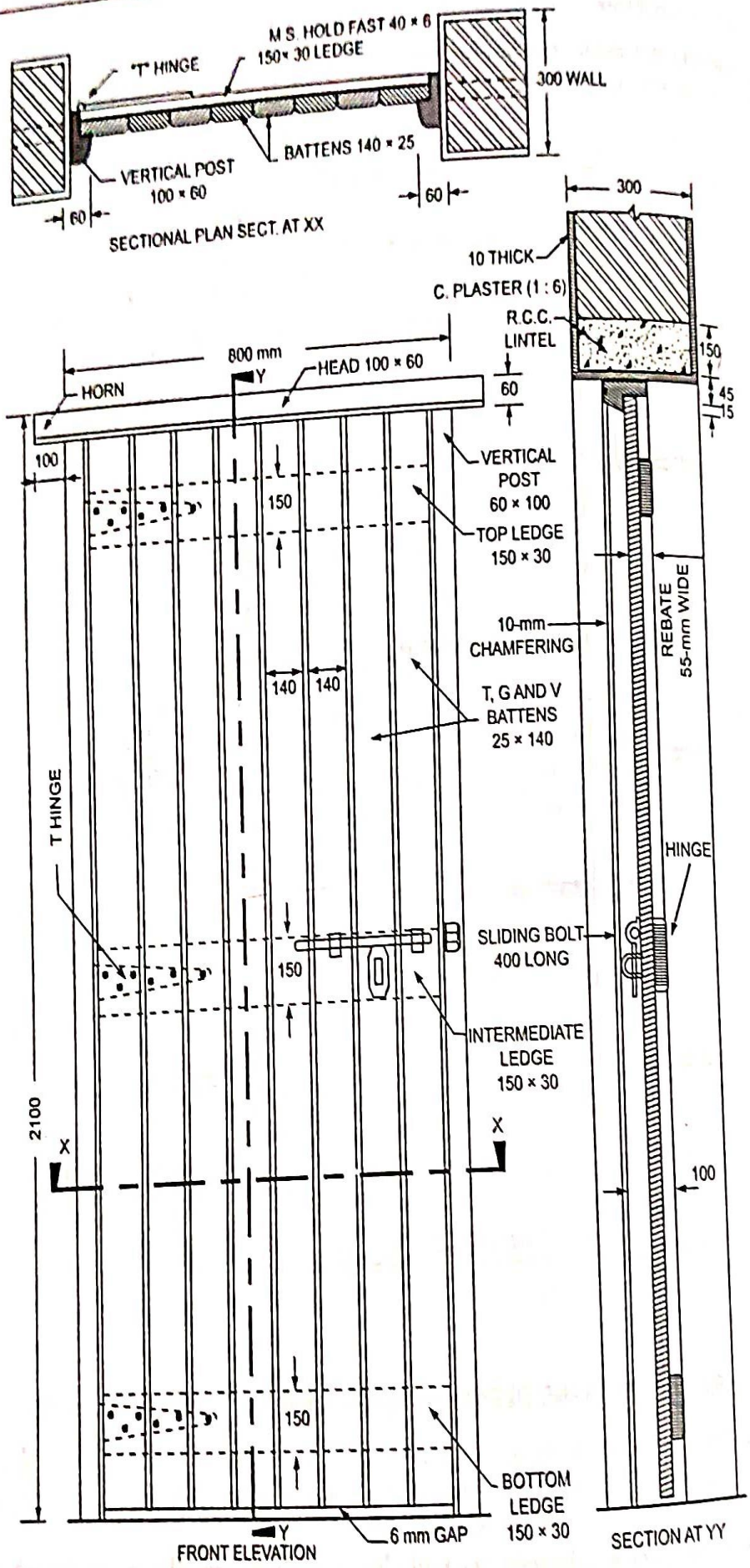


Fig. 9.7 LEDGED AND BATTENED DOOR

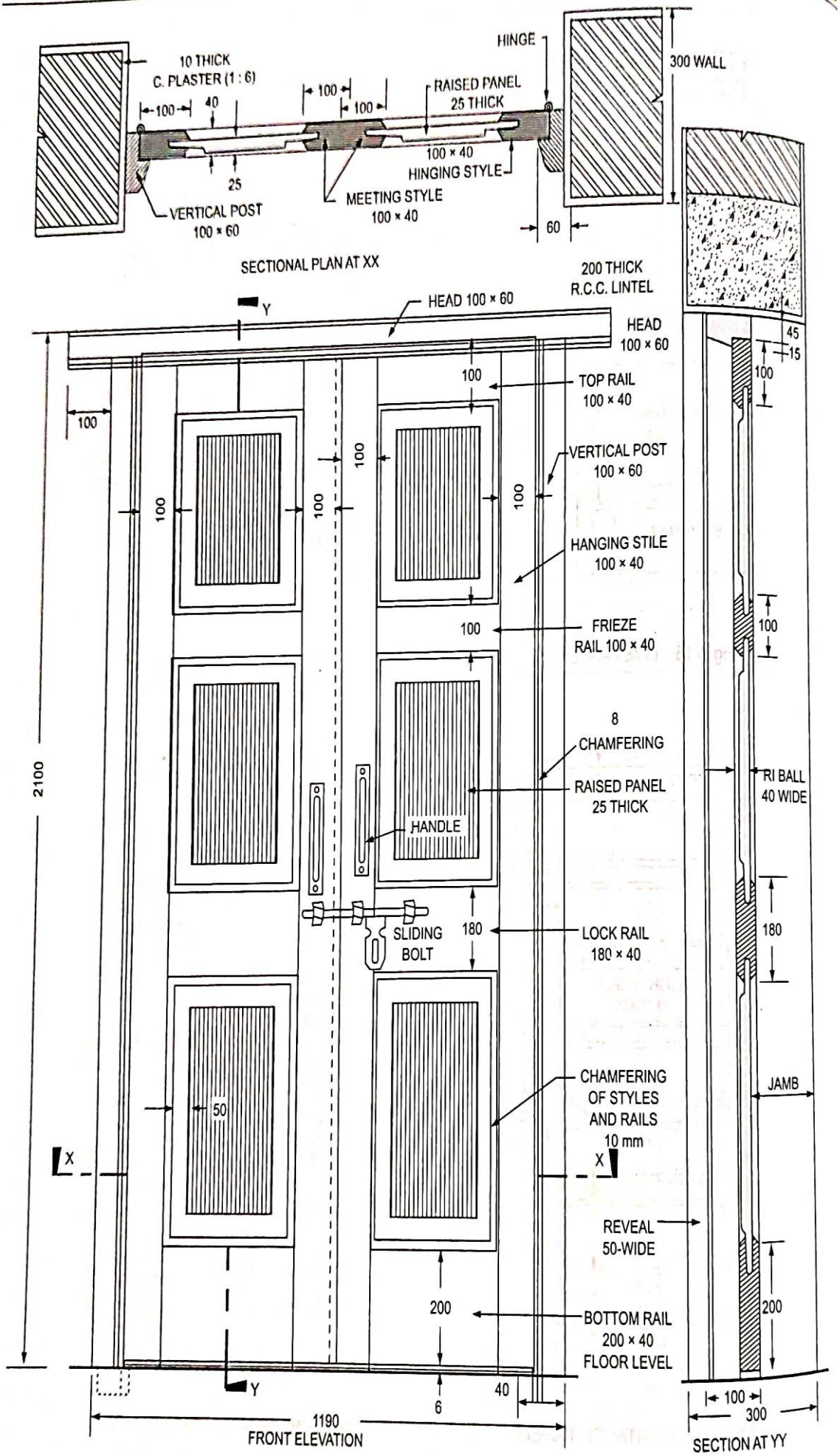


Fig. 9.20 FULLY PANELLED DOUBLE LEAFED DOOR

9.6 WINDOWS

Windows are provided in rooms for the admission of light and ventilation. For cross-ventilation purposes windows should preferably be located opposite to each other. The top level of the window is kept in line with that of doors. Window sill should, therefore, be 750 to 900 mm. above floor level.

Window's frames and shutters are made just like those for doors except the thickness of leafs, which is restricted to 40 mm. The leafs are mainly double-shutters with meeting stiles, hanging stiles, top and bottom rail with sash bars for glazing or intermediate rails for fixing of panels.

Window area for general use is limited to one-tenth of floor area. But for special purposes, like colleges, libraries, hospitals, offices, laboratories, etc. it may be one-fifth of the floor area.

The size and shape of window depend upon the purpose of the room for which they are to be used. Position and location of windows depends upon the orientation of the building. For details of the following types of windows see Fig. 9.41 to 9.46.

(i) Panelled window.

(ii) Panelled and glazed window.

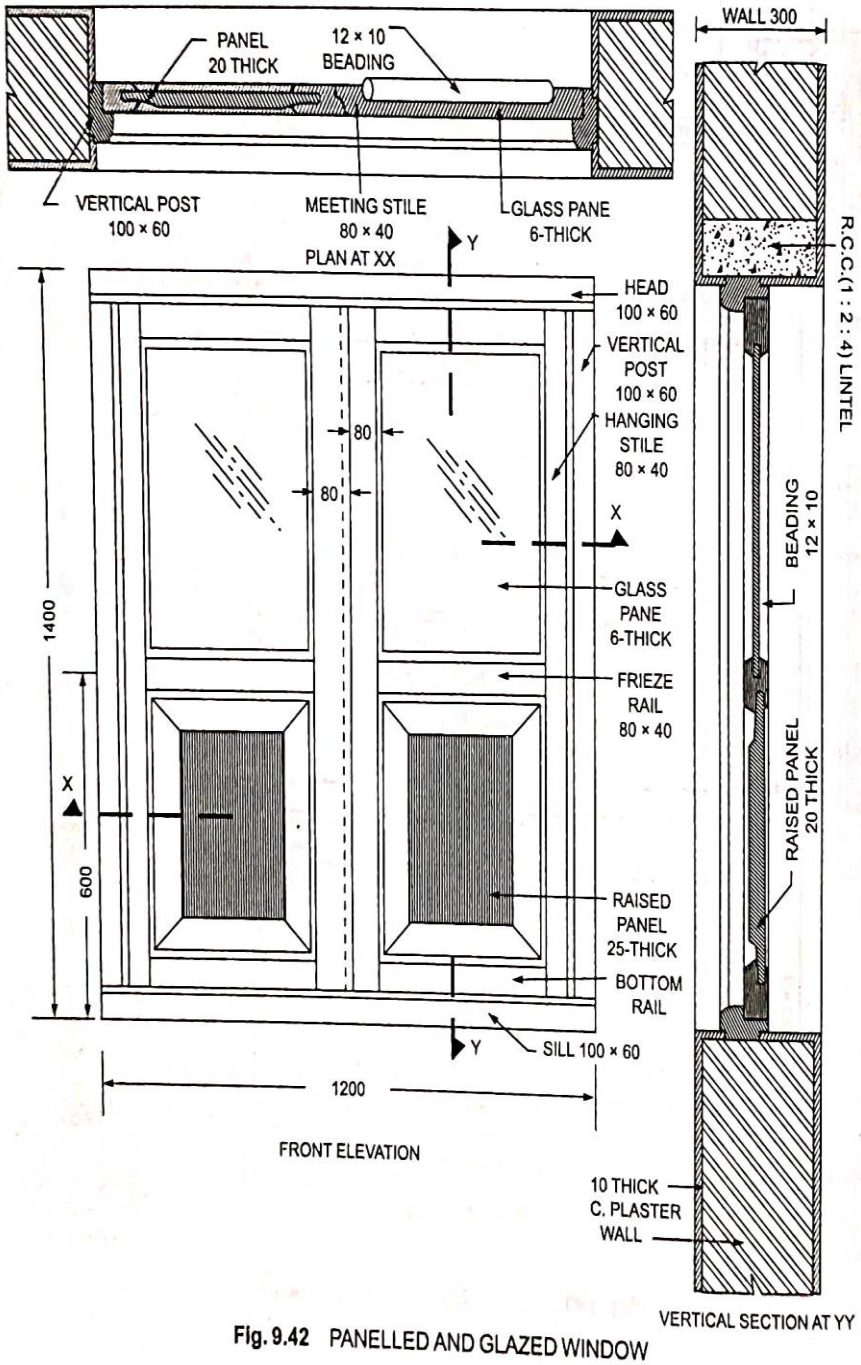


Fig. 9.42 PANELLED AND GLAZED WINDOW

holding down pins. See Fig. 10.24.

10.4 FLAT ROOFS

Flat roofs are suitably used in plain areas. They are simpler in construction. They keep out heat from rooms during daytime and help in proper circulation of air. The terrace i.e. top surface of a flat roof is given a nominal slope for draining the rain water.

Following are the main types of flat roofs:

(i) Second class mud roof. Fig. 10.26.
(ii) First class mud roof. Fig. 10.27.
(iii) Madras terrace roof. Fig. 10.28.
(iv) Jack arch roof. Fig. 10.29.
(v) Reinforced Brick slab (R.B. Slab) Fig. 10.30.
(vi) R.C.C. slab with mud phuska top finish. Fig. 10.31.
(vii) R.C.C. slab with lime conc, finish. Fig. 10.32.
(viii) R.C.C. slab with lime conc, finish (alternative arrangement). Fig. 10.33.
(ix) R.C.C. slab with lime conc, finish extending to full width of wall. Fig. 10.34.
(xi) R.C.C. SLAB ROOF
  (*a*) R.C.C. slabs with mud phuska and tile terracing,
  (*b*) R.C.C. slabs with lime concrete roof finishings.

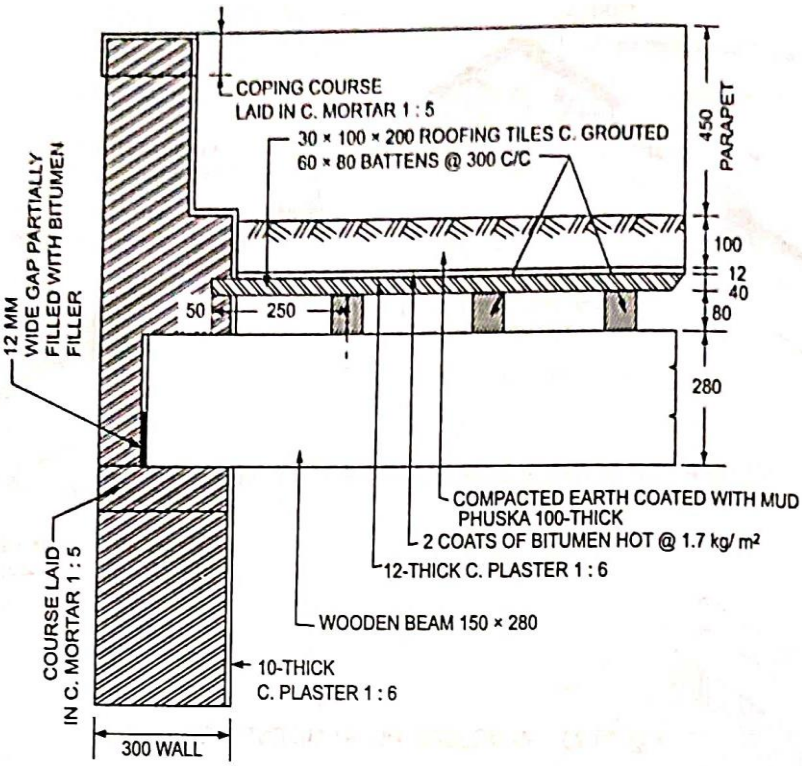


Fig. 10.26 SECOND CLASS MUD ROOF

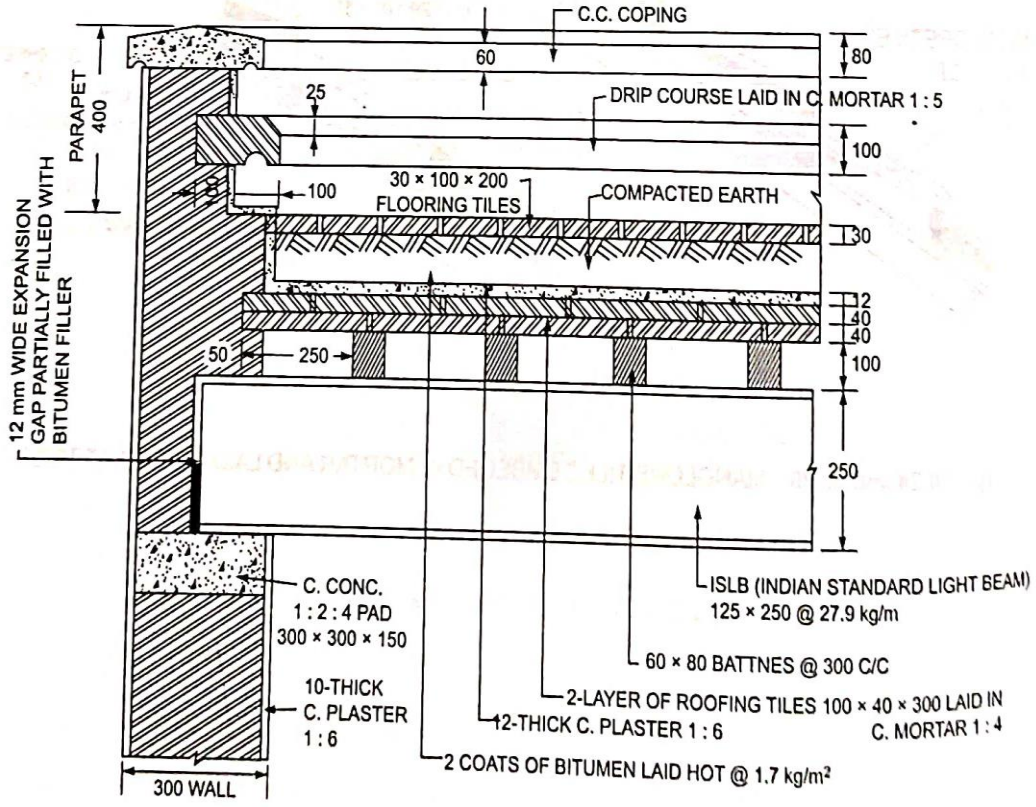


Fig. 10.27 FIRST CLASS MUD ROOF

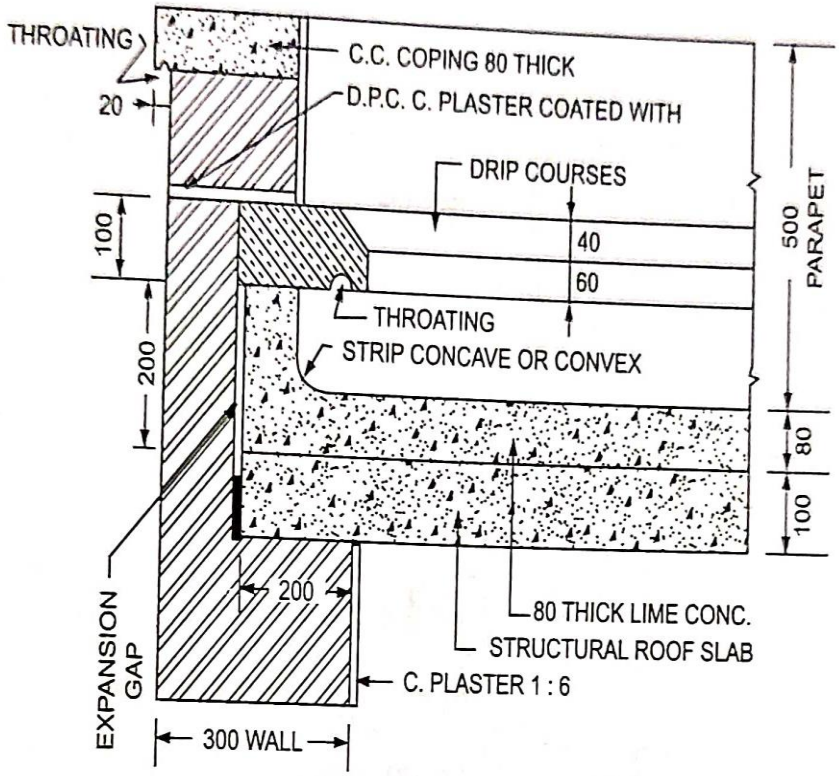


Fig. 10.32 R.C.C. STRUCTURAL SLAB WITH LIME CONCRETE FINISH

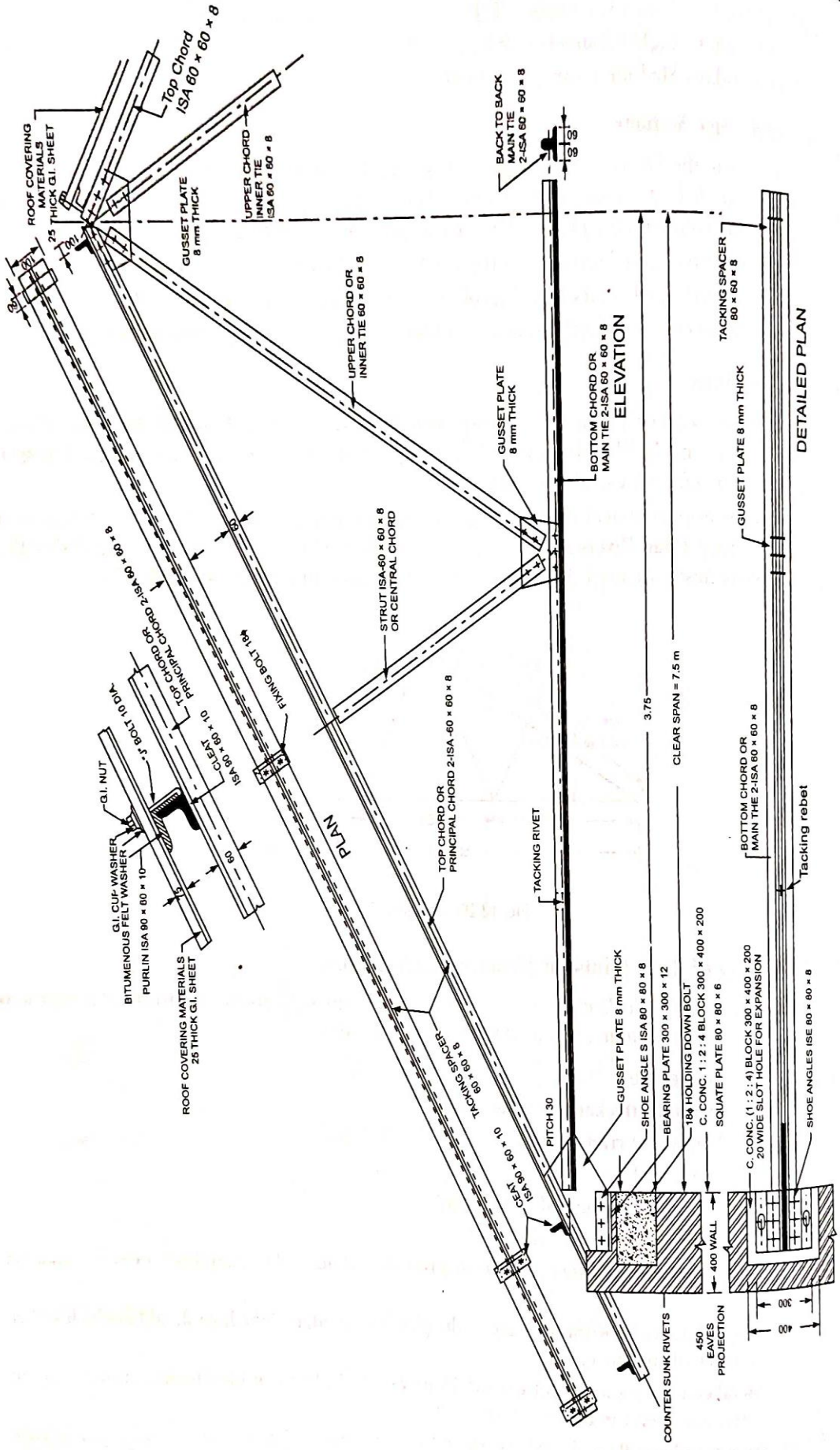


Fig. 12.21 A SIMPLE FINK STEEL ROOF TRUSS

14.2 STAIRS

Technical Terms:

1. **Stair:** Steps arranged in a series for communicating between two floors is known as a stair.
2. **Tread:** The horizontal member which forms the upper surface of a step is called tread.
3. **Riser:** It is the vertical front portion of a step.
4. **Rise:** It is the vertical distance between two upper surfaces of two successive steps.
5. **Nosing:** The front edge of a tread is termed as nosing.
6. **Line of nosing:** Imaginery line joining the nosings and parallel to the slope of stairs is termed as line of nosing.
7. **Flier:** A regular and rectangular step is known as flier.
8. **Flight:** A series of continuous steps between two floors, or floor to landing or landing to landing is termed as flight.
9. **Landing:** This is a horizontal platform which is provided between two flights to serve as a rest. It also helps in turning of stair.
10. **Slope or Pitch**: The angle between the line of nosing and floor is known as slope.
11. **Strings or stringers:** These are inclined members which support the steps. The strings my be provided on each side of a step or in the centre to support steps as cantilever extending on each side.
12. **Soffit or Planter:** Under surface of a flight is called soffit.
13. **Balusters:** Vertical members which support the hand rail are known as balusters.
14. **Hand rails:** Hand rails are provided on top of balusters. It safe guard's the persons using the stairs. Hand rails may be made of wood, masonry. R.C.C. or synthetic materials. It can be fixed even to the walls of staircase. Toughened glass is also being used as a railing these days.
15. **Head room:** The vertical distance between the line of nosings and the soffit or landing of a flight immediately above it is known as head-room. Head-room should not be less than 2.20 metres.

14.3 LOCATION OF STAIR

Stair should be placed at a centeral place in the building so as to give shortest access to all rooms. It should be well ventilated and airy.

14.4 TYPES OF STAIRS

Following are the different forms of stairs.

1. Straight flight stair.
   (*a*) Straight flight on solid spandril filling.
   (*b*) Straight flight on hollow-arched or lintelled opening spandril.
   (*c*) Straight flight on inclined R.C.C. slab.

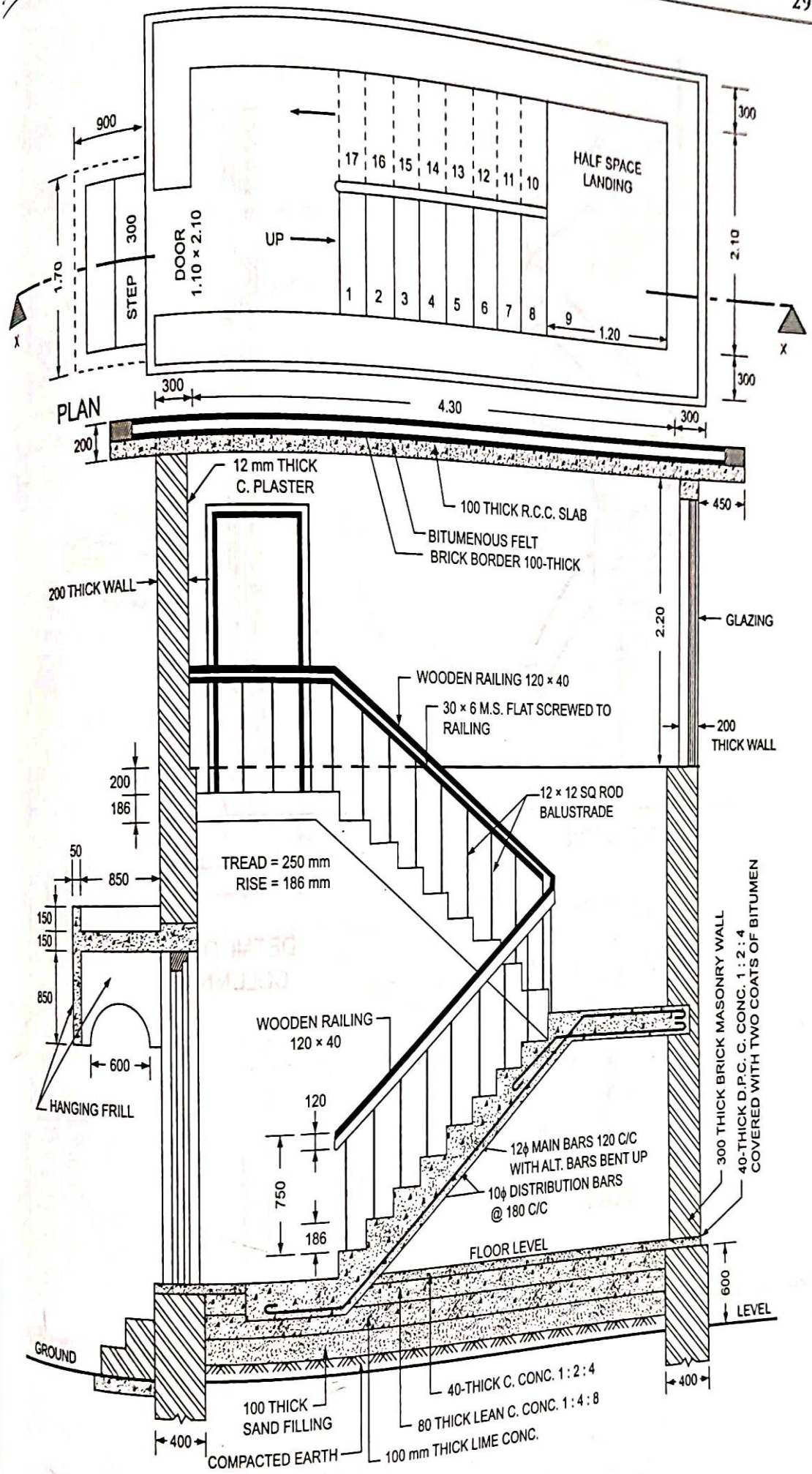
(*d*) Straight flight on two-side-strings.

(*e*) Straight flight on centeral-single string.

(*f*) Straight flight stair made of cantilever steps projecting from a wall. Figs. 14.1 to 14.6.

2. Dog-legged stairs. Fig. 14.7.
3. Open well stairs or open newel stairs Fig. 14.8.
4. Newel stairs.
5. Geometrical stairs. Fig. 14.10.
6. Circular stairs with open well. Fig. 14.10.
7. Spiral stairs. Fig. 14.11.
8. Bifurcated stairs. Fig. 14.12.

These stairs can be made out of masonry, wood, composite masonry, R.C.C., steel and alloys or synthetic materials. Stairs from serial 2 to 8 can also be built on stringers-beams. For details of these stairs see Fig. 14.13.


PLAN
900
300
STEP
1.70
DOOR
1.10 × 2.10
UP
17 16 15 14 13 12 11 10
1 2 3 4 5 6 7 8 9
1.20
HALF SPACE
LANDING
300
2.10
300
X
X
300
4.30
300
200
12 mm THICK
C. PLASTER
100 THICK R.C.C. SLAB
BITUMENOUS FELT
BRICK BORDER 100-THICK
450
200 THICK WALL
2.20
GLAZING
WOODEN RAILING 120 × 40
30 × 6 M.S. FLAT SCREWED TO
RAILING
200 THICK WALL
200
186
12 × 12 SQ ROD
BALUSTRADE
50
850
TREAD = 250 mm
RISE = 186 mm
150
150
850
600
HANGING FRILL
WOODEN RAILING
120 × 40
120
750
186
12ϕ MAIN BARS 120 C/C
WITH ALT. BARS BENT UP
10ϕ DISTRIBUTION BARS
@ 180 C/C
300 THICK BRICK MASONRY WALL
40-THICK D.P.C. C. CONC. 1 : 2 : 4
COVERED WITH TWO COATS OF BITUMEN
FLOOR LEVEL
600
LEVEL
GROUND
400
40-THICK C. CONC. 1 : 2 : 4
80 THICK LEAN C. CONC. 1 : 4 : 8
100 mm THICK LIME CONC.
100 THICK
SAND FILLING
400
COMPACTED EARTH

B.Tech. III Semester

COMPUTER AIDED CIVIL ENGINEERING DRAWING

(3CE4-23)

Viva

- Define Masonry
- type of bonds
- Define Stone masonry
- what do you mean by cavity walls?
- what are advantages of cavity wall
- explain flooring
- explain type of flooring
- what do you mean by arches?
- what do you mean by crown of arch?
- explain classification of arches
- Define lintels
- what do you mean by partition wall
- basic requirement of good partition wall
- explain type of partition wall
- explain classification of door
- type of roofs
- what do you mean by landing?
- which location you chose for stair placement

B.Tech. III Semester

COMPUTER AIDED CIVIL ENGINEERING DRAWING(3CE4-23)

Quiz

1. The commands Erase, Copy, Mirror, Trim, Extend, Break etc belongs to which tool bar?

a) Layer tool bar

b) Style tool bar

c) Modify tool bar

d) Draw tool bar

Answer: (C)

2. The commands Donut, Block, Spline, Polygon, and Arc etc belong to which tool bar?

a) Layer tool bar

b) Style tool bar

c) Modify tool bar

d) Draw tool bar

Answer: (D)

3. The command which works on two lines or a single poly line to create a beveled edge is _____

a) Chamfer

b) Fillet

c) Stretch

d) Extend

Answer: (A)

4. The command which is used to create a round corner between two lines is _____

a) Chamfer

b) Fillet

c) Stretch

d) Extend

Answer: (B)

5. The command 'Oops' is used to _____

a) create one or more copies of selected objects at another location

b) creates mirror image of selected objects about specified line

c) retrieves all objects erased by the last erase

d) deletes the selected entities

Answer: (C)

6. The command ‘pedit’ is used for _____

a) erases a portion of line, arc, circle or a 2D poly line between two selected points

b) reverses the effects of a series of previously used commands

c) breaking a poly line into individual segments

d) editing of poly line properties

Answer: (D)

7. The command ‘break’ is used for _____

a) erases a portion of line, arc, circle or a 2D poly line between two selected points

b) reverses the effects of a series of previously used commands

c) breaking a poly line into individual segments

d) editing of poly line properties

Answer: (A)

8. The command ‘U’ is used for _____

a) erases a portion of line, arc, circle or a 2D poly line between two selected points

b) reverses the effects of a series of previously used commands

c) breaking a poly line into individual segments

d) editing of poly line properties

Answer: (B)

9. The command ‘Explode’ is used for _____

a) erases a portion of line, arc, circle or a 2D poly line between two selected points

b) reverses the effects of a series of previously used commands

c) breaking a poly line into individual segments

d) editing of poly line properties

Answer: (C)

10. The command which is used to set a new coordinate system by shifting the working XY plane to be the desired location is?

a) 3DFACE

b) VPOINT

c) UCS

d) ELEV

Answer: (C)

11. The command which is used for making planar unmeshed surfaces that have three or four sides is _____

a) 3DFACE

b) VPOINT

c) UCS

d) ELEV

Answer: (A)

12. The command which is used to set the viewpoint in 3D space for viewing the 3D models is _____

a) 3DFACE

b) VPOINT

c) UCS

d) ELEV

Answer: (B)

13. The command which is used to set elevation and thickness properties for 2D wireframe objects such as line, point, circle, polygon, arc is _____

a) 3DFACE

b) VPOINT

c) UCS

d) ELEV

Answer: (D)

14. The command which identifies the points on drawing entities that are visible on screen is _____ and this option allows the user to pick-up the points very accurately with respect to drawing displayed.

a) OSNAP

b) TABSURF

c) SNAP

d) GRID

Answer: (A)