EXPERIMENT NO: **Module:1**

TITLE: **DRAWING BASICS**

LEARNING OBJECTIVES:

- To concentrate on basics of AutoCAD, which is the base for drafting.
- To use the functions and commands of AutoCAD software to create, save, and print drawings that make use of multiple lines, geometric shapes, and curves.
- To locate and apply the many features of AutoCAD that automates the drafting process and facilitate the creation of more accurate drawings in less time than traditional drafting methods.
- To locate and apply the features of AutoCAD that provide for the accurate addition of dimensions, tolerances, and drawing notes and labels using symbols and placements recognized by multiple standards organizations.
- To use the functions and commands of AutoCAD software to create isometric and three dimensional drawings and models.

AIM:

- To study the basics of AutoCAD.

MATERIAL / EQUIPMENT REQUIRED:

- Computer with AutoCAD

THEORY / HYPOTHESIS:

- **AutoCAD** (**Auto**mated **C**omputer **A**ided **D**rafting) is the most widely used computer aided drawing / drafting package. AutoCAD is a 2 D and 3 D computer aided drafting software application used in architecture, construction and manufacturing to assist in the preparation of blueprints and other engineering plans. AutoCAD provides a common look and feel GUI facilities to the learner to make great use of windows environment. AutoCAD is simple to learn, use and draw which provides multiple document opening facility so the user can exchange data between different files and to compare files more easily.

- Start an AutoCAD session by double clicking on an AutoCAD icon.
- AutoCAD opens, loads the menu and AutoCAD editor screen which contains the drawing area, command line, standard tool bar, status bar, etc.
- Some of the basic commands used in AutoCAD are as follows.

DRAWING TOOLS

LINE

- Line command is used to draw straight line segment.
- Command: LINE or L
- Tool Bar: Draw line

- **CO ORDINATE SYSTEMS**
- **Absolute co ordinate system**
- In this system, location of a point is described with reference of a previous point and hence is called relative co ordinate system.
- **Relative co ordinate system**

- In this system, location of a point is described with reference of a previous point and hence is called relative co ordinate system.

Polar co ordinate system

- In this system, the location of a point is described in terms of the length of a line and direction with reference to a previous point.

POLY LINE

- Command: PO
- Tool bar: Draw Poly line

CIRCLE

- Circle command is used to draw a circle.
- Command: Circle
- Tool bar: Draw circle

Types can be drawn by using following methods.

- Center point:
- Specify the radius of circle or diameter, specify or point (P), enter a radius or enter a diameter by d
- Radius:
- Specify the centre of the circle and give the value of radius.
- Specify the value of diameter after d
- Diameter:
- Specify the center of circle and to give diameter press d . Specify the value of diameter of given circle.
- 3P (3 points):
- This method allows user to pick any three points randomly, then AutoCAD draws a circle touching all the three points.
- Specify the first point of the circle P1
- Specify the second point of the circle P2
- Specify the third point of the circle P3
- TTR (Tangent Tangent_Radius) allows the user to pick two tangent points and a radius.

- Specify the first tangent of given point(T1)
- Specify the second tangent of given object(T2)
- Specify the radius of circle
- TTT (tangent tangent tangent)
- Specify the first tangent (T1) second tangent(T2) and third tangent (T3) to draw the circle.

ARC

- Arc command is used to draw an arc. An arc is a portion of a circle. Therefore it is necessary to specify the centre, radius, start and end point of the arc.
- Command: NARC or a
- Tool bar: draw an arc.

Types of arc

- Three point:

  Arc passes through given three points. Pick start, second and end point.
- Start and direction:

  Pick start point, pick end point and pick direction through straight point.
- Start center end:
- Start end radius:

  Pick start point; pick end and type radius of arc or show radius on arc.
- Start center angle:

  Pick start point, pick center and end point.
- Center start end:

  Pick center, pick start point and end point.
- Start center length of chord

  Pick start, pick center and enter length of chord
- Center start angle

  Pick center, start point, center angle (counter clockwise from start point)
- Start end angle

  Pick start point, pick end point, specify angle.

DONUT

- The DONUT command can be used to create a solid filled Circle as well as the standard

object that the DONUT command is normally used for. The DONUT command normally is used to draw a circle with a thick outer edge and open in the middle, hence the command name DONUT. By changing the inside diameter to 0 (zero) you can make it create a solid filled circle.

- Command: DONUT or do
- Tool bar: Draw DONUT.
- Enter inside diameter of DONUT.
- Enter outside diameter of DONUT.
- Specify the centre of the DONUT.

ELLIPSE

- Command: ELLIPSE or El
- Tool bar: Draw ellipse
- Pick the centre point option of ellipse.
- Pick axis and point.
- Specify the distance to the other axis or rotation, pick a point P or specify a distance using key board and press .

POLYGON

- Polygons are multi sided closed figure with equal side lengths.
- Command: POLYGON or POLY
- Tool bar: Draw polygon.
- Inscribed or circumscribed polygons are available in AutoCAD.
- Specify the number of sides.
- Specify the centre of polygon or edges.
- Enter the option pick I or C from command bar.
- Pick the value of the radius and specify the radius.

MODIFYING TOOLS

ERASE

- Removes objects from a drawing.
- Command: E or Erase
- Tool bar: Erase and select the object to be erased.

MOVE

- Move helps to displace the objects to the specified distance in specified direction.

- Command: Move or M
- Tool bar: Move
- Select the required object and then and by selecting the base point, displace the selected object by scrolling the mouse and place it.

COPY

- Copy helps to duplicate or create a copy of a particular object.
- Command: CO or copy
- Tool bar: Copy
- Specified object is selected and then press and select the base point and press . If multiple copies are required and copied objects are placed in the destiny.

MIRROR

- Many drawings have identical elements, say for an example, twin house drawings or any mechanical drawings; you create one have or one quarter of a drawing and complete it simply mirroring what you have drawn already.
- Command: MI or mirror
- Tool bar: Mirror
- Select the object and press , then specify the first point of the mirror line and the second point and press Y if the copy is to be displayed and N for mirrored image.

OFFSET

- The offset command is used to create any entity parallel to one existing object.
- Command: O or offset
- Tool bar: Offset
- Select the object to offset, specify the distance or T to press the distance required for the user to place the object.

ARRAY

- It creates multiple copies of an object in a pattern.
- Command: Array
- Tool bar: Array
- Array menu bar will appear and select the type of array required.

POLAR ARRAY

- It creates an array defined by specifying a centre point or base point of the object

which it replicates the selected object.

RECTANGULAR ARRAY

- It creates an array defined by a number of rows or columns of copies of the selected object.

ROTATE

- It is used to rotate the selected group of objects about specified base point through a given angle.
- Command: Rotate or RO
- Tool bar: Rotate
- Select object to rotate and press . Specify the base point, pick a base point (point about which object rotates). Specify rotation angle (reference) or simply specify an angle.

REFERENCE

- The option is used to align object to another by specifying angle.

SCALE

- Enlarges or reduces the selected objects equally in x, y and z directions.
- Command: SC or scale
- Tool bar: Scale
- Select the objected which are to be scaled. Specify the base point on object, specify the scale factor and then enter the value for scaling.

SCALE FACTOR

- Multiplies the dimensions of the selected objects by the specified scale. A scale factor is greater than 1, enlarges the object and scale between 0 and 1, and shrinks the object.

STRETCH

- Moves or stretches the object.
- Command: Stretch or S
- Tool bar: Stretch
- Selecting the object by making crowing window and press specify the base point or pick a point to enlarge the shape and line of the object by pulling or pushing from

one side and also to move object from one place to another place.

TRIM

- Trim command is used to trim objects. To trim an object, you must specify the cutting edge, which defines the point at which the AutoCAD cuts the object you want to trim.
- Command: Trim or TR
- Tool bar: Trim
- By giving the trim command and press and select the object which should be discovered from the drawing.

EXTEND

- Extend is used for extension of a line or an arc to the destiny point.
- Command: Ex
- Tool bar: Extender

BREAKING OBJECTS

- The break command is used to break the object at the point or points you specify. To break line, choose break from modify tool bar and follow the prompts.
- Command: Break
- Select object: pick object to break.

CHAMFER

- The CHAMFER command creates corners from two non parallel lines. It allows the user to chamfer poly line, rays etc.
- Command: Chamfer

FILLET

The fillet command creates rounded corners replacing two lines with arc. It allows the user to chamfer poly lines, rays etc.

- Command: Fillet

DIVIDE

- This divides selected objects into specified number of equal distance by intersecting marker point on the object.
- Command: divide or div
- Explode

- Entities like rectangular

MEASURE

- Starts at one end of the object measure out segments of specified length between each point or block.
- Command: Measure
- Tool bar: Draw point measure
- Select object to measure: Pick an object
- Specify length of the segment: enter length of segment

EXPLODE

- Entities like rectangle, polygon and poly lines are considered as one entity even though they are made up of segments. To connect them into individual segment, explode command is used.
- Command: X
- Tool bar: Explode
- Select object to explode and press

CREATING TEXT OBJECT

- The text information is essential to understand any drawing. Text is used for title box, labeling of parts, to give specification or to make notations in the drawing. Broadly there are two types of text items used in AutoCAD.
- Single line text
- Double line text
- Command: Text
- Tool bar: Single line text
- A text style dialogue box will appear as follows.
- Select font name, font style and height of text.
- Also enter width factor and oblique angle. Click on apply and then on exit.

1. WRITING TEXT

- Command: Dtext or dt
- Tool bar: draw text single line text
- Dtext / justify / style <start point> pick a point rotation angle <0> Enter angle for

text line. Type the text required.

2. JUSTIFY

- Specify the start point of text or (justify/style) enter an option
- Allign/fit/centre/middle/right/TL/TC/TR/ML/MC/MR/BL/BC/BR; Enter any one of option for text.

3. ALLIGN

- Specify both text height and text orientation by designating the end point of base line.

4. FIT

- Specified text will fit in the specified area and at an orientation defined with two points and a height.
- Specify first end point of the base line: specify a point (1)
- Specify second end point of the base line: specify a point (2).

5. CENTRE

- Alligns the text from horizontal centre of base line, which you specify with points.
- Centre points: pick centre point for text line
- Rotation angle: specify the angle for text base line.
- Text: type the text and press

6. MIDDLE

- The selected midpoint is the exact midpoint of the text.
- Midpoint: pick a point.
- Rotation angle: specify an angle for line, enter text
- Right: The picked point will be extreme right end of text extend
- End point: Pick right end for text
- Rotation angle: specify an angle
- Text: type the text required

7. OTHER OPTIONS

- Other points are TL,TC,TR the texts are aligned with the top of text box and ML,MC,MR are the text which are aligned with a middle of text box and BL,BC,BR are the text which are aligned with bottom of text box.
- Multi line text:
- Command: mtext
- Tool bar: Multiline text
- It is a text in which the single style of text colour, its height can be adjusted according to the requirement. The arrangement will be displayed.
- Style: Select the style name.
- Font: Select the font style
- Height: set the height of letters
- We can even select the style of letter < bold/italic/underline>. We can select the

colour required also.

8. HATCHING:

- Hatches are shaded pattern which generally represents a cross section of component or object.
- Command: H
- Hatch tab: define the appearance of hatch pattern to be applied.
- Type: sets the pattern type. User defined patterns are based on current line type in user drawing**.**

9. PATTERN:

- List the available pre defined patterns. The fix most recently used pre defined patterns appears at the top of list.

10. SWATCH:

- Displays a previous selected pattern, you can click the swatch display the hatch pattern box**.**

11. ANGLE:

- Specify an angle for the hatch pattern, relative to the x axis of current use**.**

12. SCALE:

- You can add, delete and rename the layers change their properties and set layer property for layout view ports or add layers descriptions and apply changes.

13. SPACING:

- It specifies spacing of line in a used defined pattern.

14. LAYER:

- Layers are used to group information I a drawing, foundation and reinforcement line type, colour and other standards. Layers are equivalent to overlays used in paper based drafting. Layer is the primary organizational tool used in drawing. You can turn off the layers that you don't need and plot a drawing containing only the required information. You can add, delete and rename the layers change their properties and set layer property for layout view ports or add layers descriptions and apply changes.
- Layer filter controls the layers displayed and can also used to make changes to more than one layer at a time.

Function key Function defined in AutoCAD

F1 -Online help
F2 -Toggles between command window on and off
F3 -Toggles between OSNAP on and off
F4 -Toggles between Tablet on and off
F5 -Switches among Isoplanes Top, Right and Left
F6 -Toggles betweenco-ordinates on and off
F7 -Toggles between Grid on and off
F8 -Toggles between Ortho on and off
F9 -Toggles between Snap on and off
F10- Toggles between Polar Tracking on and off
F11 -Toggles between Object Snap Tracking on and off
F12 -Dynamic Input on and off

LEARNING OUTCOMES :

- Knowledge about basic commands and its usage of AutoCAD software

APPLICATION AREAS:

- Drafting
- Modelling

Module:2

TITLE:DRAWINGS RELATED TO DIFFERENT BUILDING ELEMENTS LEARNING OBJECTIVES:

- To draw the drawings of masonry wall footing and RCC column footing (isolated).
- To know the reinforcement details of RCC column footing (isolated).
- To study the detailing and drafting of stair cases.
- To study the reinforcement details of lintel and chhajja
- To know different types of slabs and beams.
- To know the detailing of slabs and beams.

AIM:

- To prepare the drawings of cross section of masonry wall and RCC column (isolated) foundation.
- Computer with AutoCAD software.

THEORY / HYPOTHESIS:

- Most of the structures built by us are made of reinforced concrete. Here, the part of the structure above ground level is called as the superstructure, where the part of the structure below the ground level is called as the substructure. Footings are located below the ground level and are also referred as foundations. Foundation is that part of the structure which is in direct contact with soil. The R.C. structures consist of various structural components which act together to resist the applied loads and transfer them safely to soil. In general the loads applied on slabs in buildings are transferred to soil through beams, columns and footings. Footings are that part of the structure which are generally located below ground Level. They are also referred as foundations. Footings transfer the vertical loads, Horizontal loads, Moments, and other forces to the soil.
- **Masonry wall foundation:** If you want a well built, sturdy brick wall, you must have a strong footing for proper support. Without a strong footing, the moisture from the ground will encourage your brick wall to crack. The footing should extend below the frost line. If your wall is a load bearing wall, your footing must be as deep as the wall is wide, and the width of the footing should be twice as wide as the wall.
- **RCC columns (Isolated):** Isolated column footings are the footings which are provided for each column. This type of footing is chosen when SBC is generally high, columns are far apart, and loads on footings are less. The isolated footings can have different shapes in plan. Generally it depends on the shape of column cross section. The isolated footings essentially consist of bottom slab. The bottom slab is reinforced with steel mesh to resist the two internal forces namely bending moment and shear force.

- Stairs consist of steps arranged in a series for purpose of giving access to different floors of a building. Since a stair is often the only means of communication between the various floors of a building, the location of the stair requires good and careful consideration. In a residential house, the staircase may be provided near the main entrance. In a public building, the stairs must be from the main entrance itself and located centrally, to provide quick accessibility to the principal apartments.
- **Types of stair cases**

Geometric classification;

1. Straight stairs (with or without intermediate landing).
2. Quarter turn stairs.
3. Dog legged stairs.
4. Open well stairs.
5. Spiral stairs.
6. Helicoidal stairs.
7. Slabless stair case.
8. Free standing stair case.

- **Lintel:** A lintel can be a load bearing building component, a decorative architectural element, or a combined ornamented structural item. It is often found over portals, doors, windows, and fireplaces. A lintel is defined as a structural horizontal block that spans the space or opening between two vertical supports.
- **Chhajja:** A chhajja is the projecting or overhanging **eaves** or cover of a roof, **usually** supported on large carved brackets.
- **Slab:** A slab is a flat two dimensional planar structural element having thickness small compared to its other two dimensions. It provides a working flat surface or a covering shelter in buildings. It primarily transfer the load by bending in one or two directions. Reinforced concrete slabs are used in floors, roofs and walls of buildings and as the decks of bridges.
- **Beam:** A structural member that support transverse (perpendicular to the axis of the member) load is called a beam. Beams are subjected to bending moment and shear force. Beams are also known as flexural or bending members. In a beam one of the dimensions is very large compared to the other two dimensions. Beams may be of the following types:
  a.Singly or doubly reinforced rectangular beams,
  b.Singly or doubly reinforced T beams,
  c.Singly or doubly reinforced L beams.

The drawings of different components of a building are to be prepared for the data given using AutoCAD software.

A. Cross section of masonry wall foundation, RCC columns with isolated and combined footings

Exercise 2.1

Draw a cross section of a S.S. Masonry foundation to be provided for a load bearing wall 300mm thick in Burnt Brick Masonry in superstructure of a residential building. Use following data:

i. Width of foundation = 1.20m
ii. Depth of foundation below GL = 1.20m
iii. Width of PCC = 1.20m
iv. Thickness of PCC in 1:3:6 = 75mm.
v. Width of first footing above PCC = 1.05m
vi. Depth of first footing above PCC = 0.375m
vii. Width of second footing = 0.90m
viii. Depth of second footing = 0.375m
ix. Width of third footing = 0.75m
x. Depth of third footing = 0.375m
xi. Width of plinth wall = 0.45m
xii. Depth of plinth wall = 0.60m
xiii. Thickness of DPC in 1:2:4 = 100mm.

Solution: Refer Fig. 2.1

Exercise 2.2

Draw a cross section of a S.S. Masonry foundation to be provided for a partition wall 150mm thick in Burnt Brick Masonry in superstructure of a residential building.

Solution: Refer Fig. 2.2

Exercise 2.3

Prepare a working drawing for an isolated column footing (RCC) for a column size 300mm x 300mm reinforced with #8 of 12mm HYSD- steel as main bars together with 2 legged 8ϕ stirrups at 200c/c.

Details of footing: Size of footing is 1.6m x 1.6m and the thickness of the footing at the face of the column is 450mm which reduces to 300mm at the edge of footing. The mat comprises of 10ϕ TOR- steel at 100 c/c both ways. The footing is provided with PCC bed in 1:3:6 of thickness 75mm.Depth of foundation is1.5m from natural ground level.

Solution: Refer Fig. 2.3

Exercise 2.4

Prepare a working drawing for an isolated rectangular RCC column and footing has the following details:

Column size: (400 x 600) mm.

Size of footing: 2m x 3m of uniform thickness 450mm.

Depth of foundation below GL = 1.5m

Height of column to be shown above GL = 1.0m

Thickness of PCC bed in 1:3:6 = 75mm

Details of reinforcement:

Column: #8 - 16ϕ as main bars with 2L - 8ϕ @ 150 c/c lateral ties

Footing: Longer direction steel - 12ϕ @ 130 c/c

Shorter direction steel - 12ϕ @ 220 c/c.

Solution: Refer Fig. 2.4

Exercise 2.5

Draw plan, sectional elevation and cross section of a slab type combined footing with the given details:

Size of columns = (400 x 400)mm

Size of footing =2m x 4m

Depth of footing = 600mm

Centre to centre distance between the columns =

2m Thickness of PCC bed in 1:3:6 = 100mm

Column reinforcement details – longitudinal steel of #8 - 20ϕ with lateral ties of 2L - 8ϕ @ 200 c/c

Footing reinforcement details – bottom reinforcement of 12ϕ @ 100 c/c both ways and top reinforcement of 12ϕ @ 150 c/c both ways

Solution: Refer Fig. 2.5

B. Different types of bonds in brick masonry

Exercise 2.6

Draw two consecutive courses for corner joints of the following walls in English bond.

(a) One brick thick wall i.e., 200 x 200

(b) One and half thick wall i.e., 300 x 300.

Solution: Refer Fig. 2.6a for one brick thick wall Refer Fig. 2.6b for one and half brick thick wall **Exercise 2.7**

Draw plan of two consecutive courses for corner joints of the following walls in Double

Flemish bond.
(a) One brick thick wall i.e., 200 x 200
(b) One and half thick wall i.e., 300 x 300.

Solution: Refer Fig. 2.7a for one brick thick wall Refer Fig. 2.7b for one and half brick thick wall **Exercise 2.8**

Draw plan and elevation of two alternate courses of a one brick thick wall in Header bond.

Solution: Refer Fig. 2.8

Exercise 2.9

Draw plan and elevation two alternate courses and elevation of a half brick thick wall in Stretcher bond.

Solution: Refer Fig. 2.9

C. Different types of staircases Exercise 2.10

Draw plan and sectional elevation of RCC dog legged staircase for an office building which measures 3m x 5.5m. The vertical distance between the floor is 3.3m (including landing). Thickness of the floor slab is 150mm. Provide steps with tread of 300mm and rise of 150mm. Thickness of waist slab and landing slab is 150mm. Width of stair is 1.5m. Reinforcement details: main steel: 10ϕ @125 c/c spacing and distribution: 8ϕ @ 250 c/c spacing.

Solution: Refer Fig. 2.10

Exercise 2.11

Draw plan and sectional elevation of an open newel stair with a rectangular well for an office building with the following data:
Inside dimensions of staircase = 4.5m x 5.4m.
Height between the floors is 3.6m.
Thickness of the floor slab and landing slab is 150mm. Width of landing=1.5m.
Width of stair = 1.5m.
Tread=300mm, riser=150mm.
Waist slab thickness = 150mm.
Reinforcement details: Main steel:12ϕ @150 c/c spacing and Distribution: 8ϕ @ 250 c/c spacing.

Solution: Refer Fig. 2.11

D. Lintel and chejja

Exercise 2.12

Draw the longitudinal section and cross section of RCC lintel monolithically cast with sunshade from following data:
Projection of the sunshade from the face of the wall = 600mm
Thickness at fixed end = 150mm
Thickness at free end = 75mm
Main tensile bars: 8ϕ @ 150 c/c
Distribution bars: 8ϕ @ 200 c/c
For RCC lintel (200 x 200)mm with #4 - 12ϕ at tension zone and stirrups of 2L - 8ϕ @ 150 c/c. The sunshade provided over a 3m wide window.

Solution: Refer Fig. 2.12

Exercise 2.13

Sketch the reinforcement details for the lintel beam with chejja for 3m wide opening. Size of lintel beam (300x300)mm. Lintel is provided with #5 of 12ϕ bars in tension zone

and 2 legged vertical stirrups of 8ϕ at 150 c/c.
Chejja details: projection- 1m; thickness at supports- 110mm and at end- 90mm; main steel provided is 12ϕ @ 150 c/c and distribution steel 10ϕ @ 150 c/c.

Solution: Refer Fig. 2.13

E. RCC slabs and beams

Exercise 2.14

Draw the longitudinal section and cross section of a rectangular RCC beam simply supported with the following data:
Clear span = 4.8m
Bearing at the supports = 300mm
Width of beam = 300mm
Overall depth of beam = 500mm
Main reinforcement consists of #5 - 20ϕ bars in two layers.
Provide #2 - 12ϕ as anchor bars.
Stirrups: 2L 8ϕ @ 180 c/c near the supports up to 1.20m and @ 220 c/c in the remaining portion.

Solution: Refer Fig. 2.14

Exercise 2.15

Draw a detailed longitudinal section, a cross section near the supports and a section at the middle of the span of a simply supported doubly reinforced beam for the following data:
Clear span = 5.4m
Bearing over the supports = 300mm
Size = 300 x 800 mm
Main reinforcement tensile: #7 - 25ϕ. 4 straight and 3 bent up @ 1400mm from support.
Compression reinforcement: #4 – 25ϕ.
Spacer bars=25 ϕ
Side face reinforcement=#2-12ϕ
Shear reinforcement: 2L - 12ϕ @ 150 c/c for a distance of 1.5m from the support and 2L - 12ϕ @ 300 c/c for remaining middle portion.

Solution: Refer Fig. 2.15

Exercise 2.16

Draw longitudinal section and cross section of a cantilever beam from the following data:
Clear projection from the face of RCC column = 2500mm Size of column = 300mm x 300mm
Size of beam at fixed end = 300mm x 300mm
Size of beam at free end = 300mm x 150mm
Reinforcement main bars: #5 - 20ϕ with 2 bars curtailed at 1500mm from the support and show the curtailment plan.
Compression bars: #3 - 16ϕ
Stirrups: 2L - 6ϕ @ 200 c/c up to 1000mm from support and @ 300 c/c in remaining length.

Solution: Refer Fig. 2.16

Exercise 2.17

Draw cross section and plan of one way roof slab showing the details of reinforcement for the following data:
Clear span = 4m
Length of slab = 10m

Thickness of slab = 130mm
Bearing wall = 200mm
Main reinforcement: 12ϕ @ 250 c/c with alternate bars bent up.
Distribution reinforcement: 8ϕ @ 200 c/c.
Solution: Refer Fig. 2.17

Exercise 2.18

One way continuous slab has been provided for a hall of clear dimensions 8mx14.25m.The slab is supported on RCC beams. The following details are given.
C/C distance of supporting beams=3.5m.
Column dimensions on which beam rest=250mmx500mm.
C/s of beams=250mmx600mm.
Slab thickness=150mm.
Beam depth is inclusive of slab depth.
Main positive reinforcement at the end and interior panels=10ϕ @120 c/c
Main negative reinforcement at all supports= 10ϕ @120 c/c.
Distribution steel =8ϕ @ 250 c/c.
Draw cross section and plan showing the details of reinforcement (Bottom & top).
Solution: Refer Fig. 2.18

Exercise 2.19

A simply supported two way slab is supported on all sides by using 230mm thick wall. The dimension of two-way slab is 3m x 4m (Clear). Following are the reinforcement details:
Along shorter span: 10ϕ @125 c/c.
Along longer span: 10ϕ @150 c/c.
Negative steel for shorter span: 10ϕ @250 c/c.
Negative steel for longer span: 10ϕ @300 c/c.
Alternative bars are cranked.
Corner mats are 8ϕ @150 c/c along shorter span and 8ϕ @200 c/c along long span.
Thickness of slab is 150mm.
Draw plan showing reinforcement and cross section along longer & shorter span. ***Solution: Refer Fig. 2.19***

F. Cross section of pavement

Exercise 2.20

Sketch the cross section of a flexible pavement having the following particulars:
Width of carriage way = 3.75m
Camber (@ 2%) = 38mm
Width of Shoulder = 1.5m
Granular sub-base (GSB)thickness = 300mm
Base course thickness = 225mm
Thickness of Binder course = 70mm
Thickness of Surface course = 40mm
Total thickness of the pavement = 635mm.
Solution: Refer Fig. 2.20

Exercise 2.21

Sketch the cross section of a rigid pavement in heavy rainfall area having the following particulars:
Width of carriage way = 3.75m
Camber (@ 2%) = 38mm
Width of Shoulder = 1.5m
Granular sub-base (GSB) = 250mm thick

Dry lean concrete sub-base = 150mm thick
Paving Quality Concrete layer = 240mm thick
Total thickness of the pavement = 640mm.

Solution: Refer Fig. 2.21

G. Septic tank and sedimentation tank

Exercise 2.22

Draw plan and cross section of the septic tank for 25 users. The details are given below:
Size (clear) of the septic tank (L x B) = (2m x 0.9m)
Depth of liquid = 1.4m
Free board = 0.3m
Thickness of PCC bed in 1:3:6 = 0.2m
Inlet and outlet pipe: 100mm diameter S. W. pipe
Thickness of brick wall up to 0.6m height is 300mm and for remaining height it is 200mm.
Thickness of RCC Baffle slab = 40mm
RCC slab of 75mm thick is provided with 50mm diameter C. I. ventilating pipe
Bed slope: 1 in 20

Solution: Refer Fig. 2.22

Exercise 2.23

Draw the cross section of the peripheral feed circular sedimentation tank mechanical sludge removal equipment for given data.
Diameter of the tank = 17.5m
Depth of the tank = 3.0m
RCC wall & slab thickness = 200mm
Diameter of influent pipe, effluent pipe and sludge pipe = 200mm.
Bed slope=8%.
Thickness of RCC Baffle slab = 40mm.

Solution: Refer Fig. 2.23

H. Layout plan of rain water recharging and harvesting system Exercise 2.24

Draw a layout plan of rainwater harvesting and recharging system for a (9 x 12)m area residential building leaving setback of 1.20m on all four sides as per bye laws. Show a cross section details for recharging pit.

Solution: Refer Fig. 2.24

I. Cross sectional details of a road for a residential area with provision for all services

Exercise 2.25

Draw the cross sectional details of a road for a residential area with provision for all services.

Solution: Refer Fig. 2.25

J. Steel truss (bolted connections)

Exercise 2.26

Draw the elevation of the given steel roof truss and show the connection details at joint A and E using the data given in figure.
i. 8mm thick gusset plate
ii. Use 2 numbers of 12ϕ HSFG bolts for each connection
iii. Truss is supported on a concrete column of size (500 x 500)mm
iv. Thickness of the base plate = 25mm
v. Anchor bolts of 450mm length and 25ϕ – 8 numbers at the connection of truss and column.

Solution: Refer Fig. 2.26

LEARNING OUTCOMES :

- Knowledge in drawing and calculating stair cases , slabs, footing and Combined footing.
- Also in gaining knowledge about cross section of pavement and Steel truss.

APPLICATION AREAS:

- Drafting , Modelling of the above said drawings.
- Detailing of Slabs, Beams Chejja and footings .

-

EXPERIMENT NO: **Module -3**

TITLE: DRAWING OF PLAN, ELEVATION AND SECTIONAL ELEVATION OF SINGLE STORIED RESIDENTIAL AND PUBLIC BUILDINGS GIVEN THE SINGLE LINE DIAGRAM AND PREPARING THE EXCAVATION PLAN

LEARNING OBJECTIVES:

- To know to draw the plan, elevation and sectional elevation of residential building.
- To understand to prepare the plan, elevation and sectional elevation of public building.
- To study the excavation plan for buildings.

AIM:

- To prepare the plan, elevation and sectional elevation of residential building, public building and the excavation plan.

- Computer with AutoCAD software.

THEORY / HYPOTHESIS:

- When architects design buildings, they have to do 2D drawings to show what the building will look like from each side. These drawings are called plans and elevations. The view from the top is called the planThe views from the front and sides are called the elevations.

3.1 Principles of planning

Plan of a building is the assembling or grouping of arranging of its component parts ina systematic manner and proper order so as to form a meaningful wholesome and homogeneous body.

Planning of building depends on its;

- Its functional object and requirements.
- Its component parts, their sizes and the relationship between the different rooms.
- Shape of the plot and topography
- Climatic conditions of the place.
- Its location and neighbourhood
- Type of the buildings like single storied/ multi storied or detached/ semidetached/ row houses.

The factors or principles which govern the theory of planning are Aspects, Prospect, Privacy, Furniture requirement, Grouping, Circulation, Sanitation, Flexibility, Elegance, Economy, Practical consideration.

3.2 Building Bye-laws

Minimum provisions designed from National Building Code by Town Planning Authorities, Urban Development Authorities and Municipalities. The building bye-laws and regulations should be enforced by proper authority to achieve following objectives.

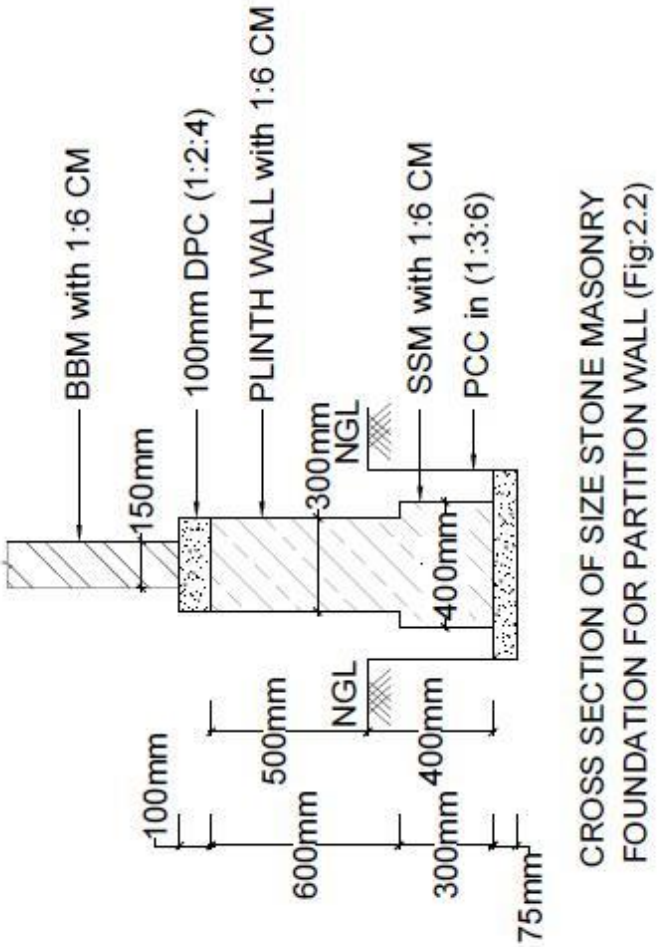
1. They prohibit and prevent haphazard and irregular growth as ribbon development and permit disciplined and systematic growth of buildings along roads by clearly earmarking residential, commercial, industrial areas, etc.
2. They regulate the open space around the building, window area and head rooms, thereby creating conductive conditions for natural lighting and ventilation.
3. The standard dimensions for various structural members are specified which give strength and long life for the building.
4. The bye-laws regulate the planning, designing and execution of building elements.
5. The bye-laws enable the inmates to easily get access to utilities as piped water

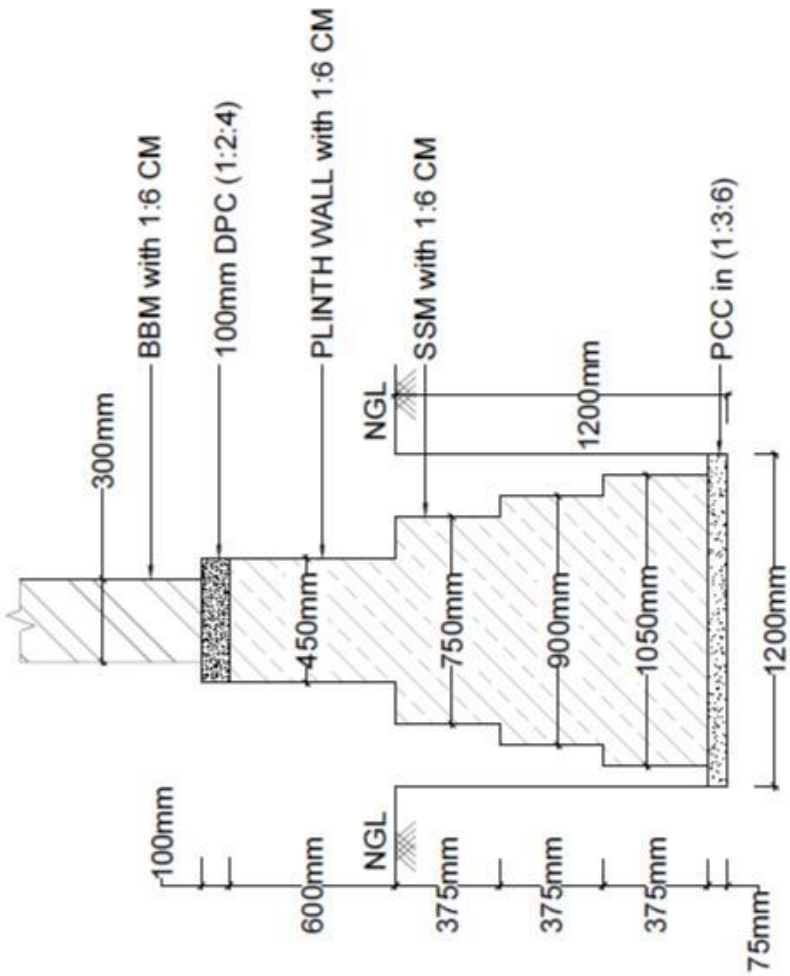
supply, electric power and connection to public sewer.
6. The growth of township is streamlined by maintaining uniform height of buildings, uniform frontage so that the abutting road is straight, gently sloping, free from blind corners and can be easily widened in future if required.

3.3 Drawing of plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for following exercises:

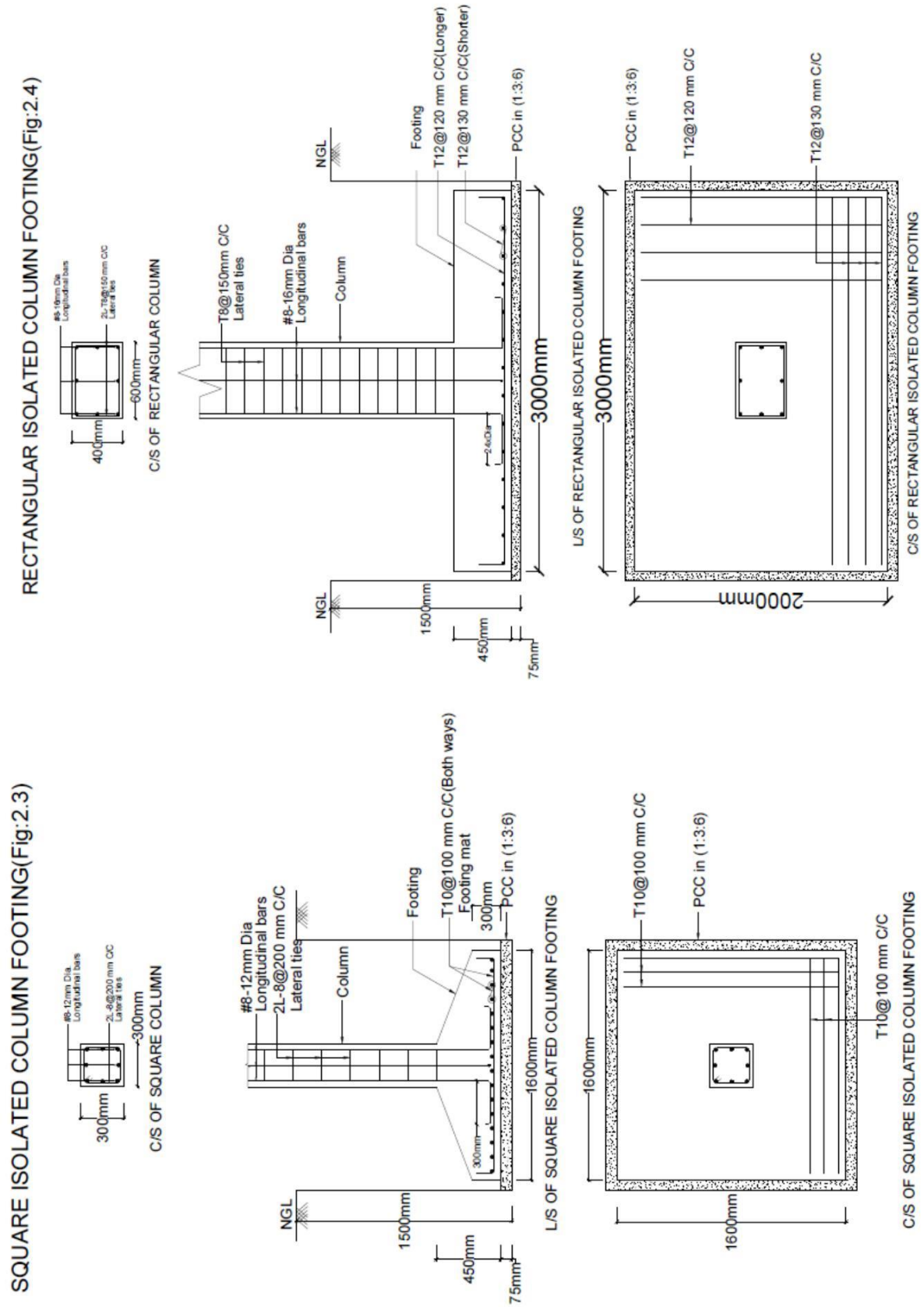
Exercise 3.1

Draw plan, elevation and sectional elevation including electrical plumbing and sanitary services for a given line diagram of single storey residential building in figure Q.no.3.1.

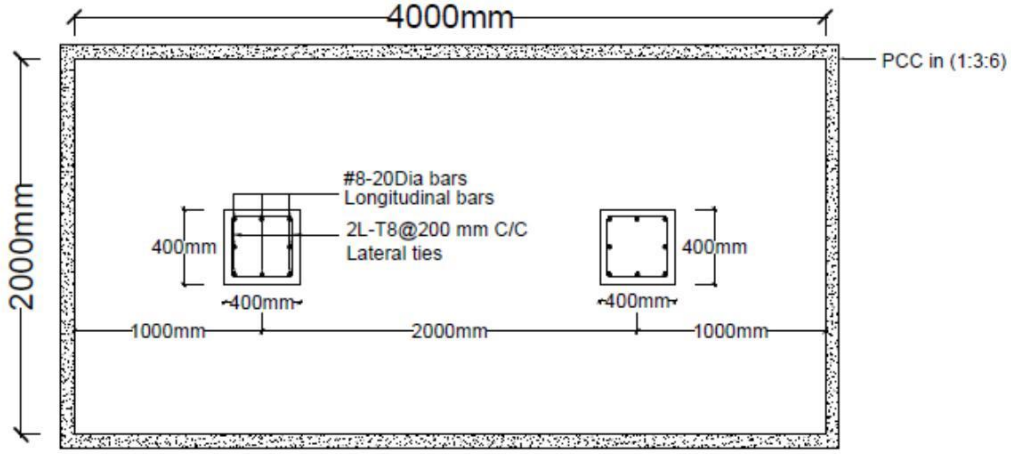




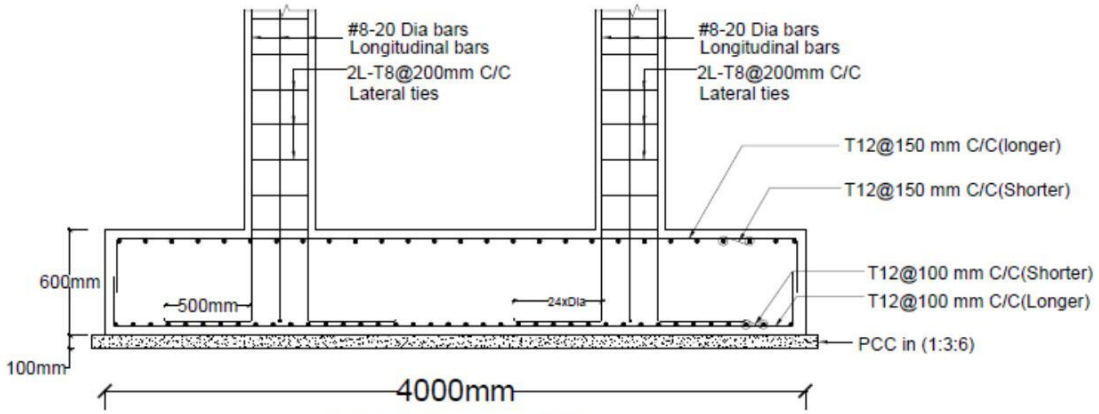
CROSS SECTION OF SIZE STONE MASONRY FOUNDATION FOR MAIN WALL (Fig:2.1)


RECTANGULAR ISOLATED COLUMN FOOTING(Fig:2.4)
#8-16mm Dia Longitudinal bars
2L-T8@150 mm C/C Lateral ties
400mm
600mm
C/S OF RECTANGULAR COLUMN
T8@150mm C/C Lateral ties
#8-16mm Dia Longitudinal bars
Column
NGL
Footing
T12@120 mm C/C(Longer)
T12@130 mm C/C(Shorter)
PCC in (1:3:6)
3000mm
NGL
1500mm
450mm
75mm
L/S OF RECTANGULAR ISOLATED COLUMN FOOTING
PCC in (1:3:6)
T12@120 mm C/C
T12@130 mm C/C
3000mm
2000mm
C/S OF RECTANGULAR ISOLATED COLUMN FOOTING
SQUARE ISOLATED COLUMN FOOTING(Fig:2.3)
#8-12mm Dia Longitudinal bars
2L-8@200 mm C/C Lateral ties
300mm
300mm
C/S OF SQUARE COLUMN
#8-12mm Dia Longitudinal bars
2L-8@200 mm C/C Lateral ties
Column
Footing
T10@100 mm C/C(Both ways)
Footing mat
300mm
PCC in (1:3:6)
1600mm
NGL
1500mm
450mm
75mm
L/S OF SQUARE ISOLATED COLUMN FOOTING
T10@100 mm C/C
PCC in (1:3:6)
1600mm
T10@100 mm C/C
1600mm
C/S OF SQUARE ISOLATED COLUMN FOOTING

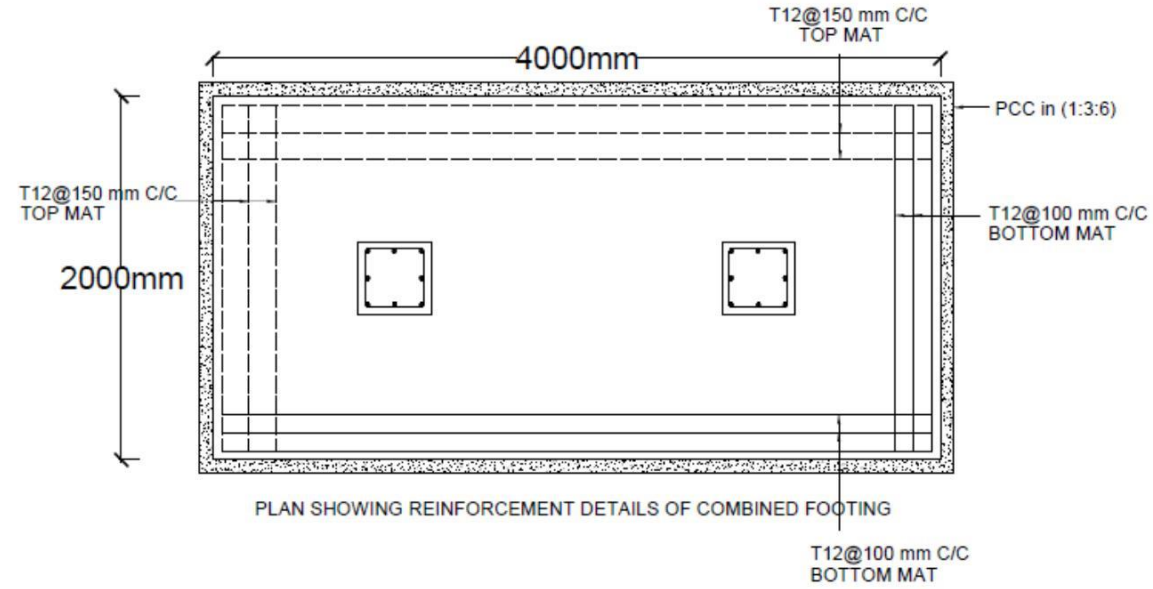
SLAB TYPE COMBINED FOOTING(Fig:2.5)



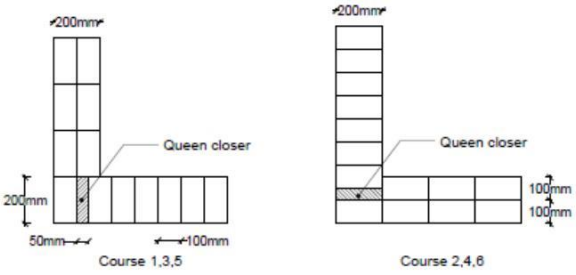
PLAN OF COMBINED FOOTING



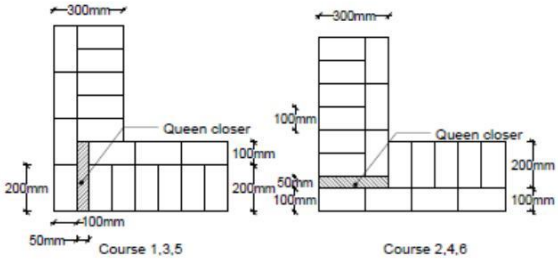
L/S OF COMBINED FOOTING



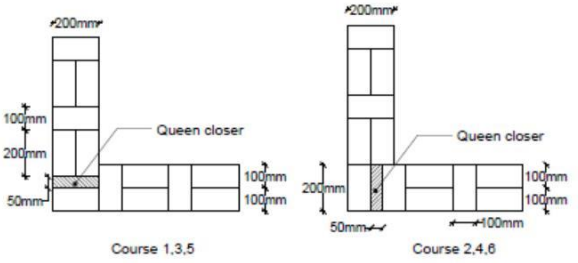
PLAN SHOWING REINFORCEMENT DETAILS OF COMBINED FOOTING



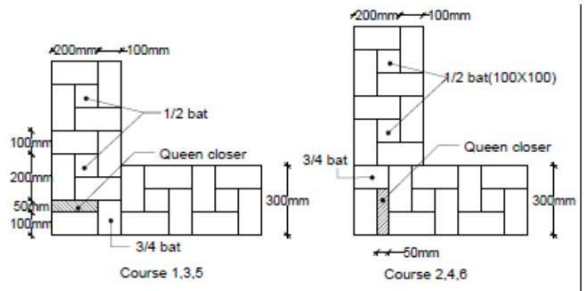
ENGLISH BOND
ONE BRICK WALL 200X200(Fig:2.6a)



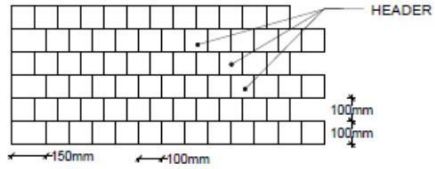
ENGLISH BOND
ONE AND HALF BRICK WALL 300X300(Fig:2.6b)



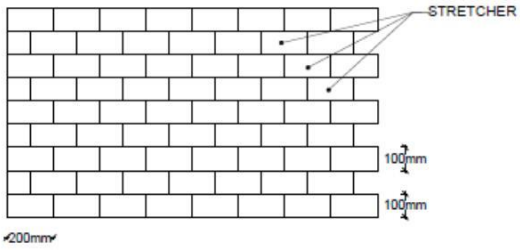
DOUBLE FLEMISH BOND
ONE BRICK WALL 200X200(Fig:2.7a)



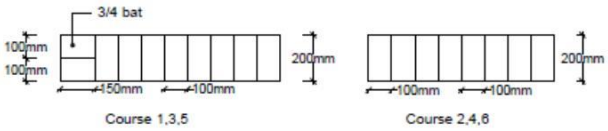
DOUBLE FLEMISH BOND
ONE AND HALF BRICK WALL 300X300(Fig:2.7b



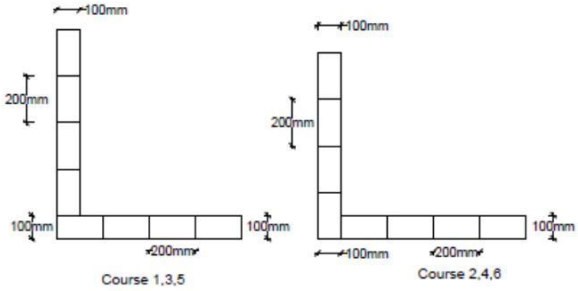
ELEVATION OF HEADER BOND



ELEVATION OF STRETCHER BOND

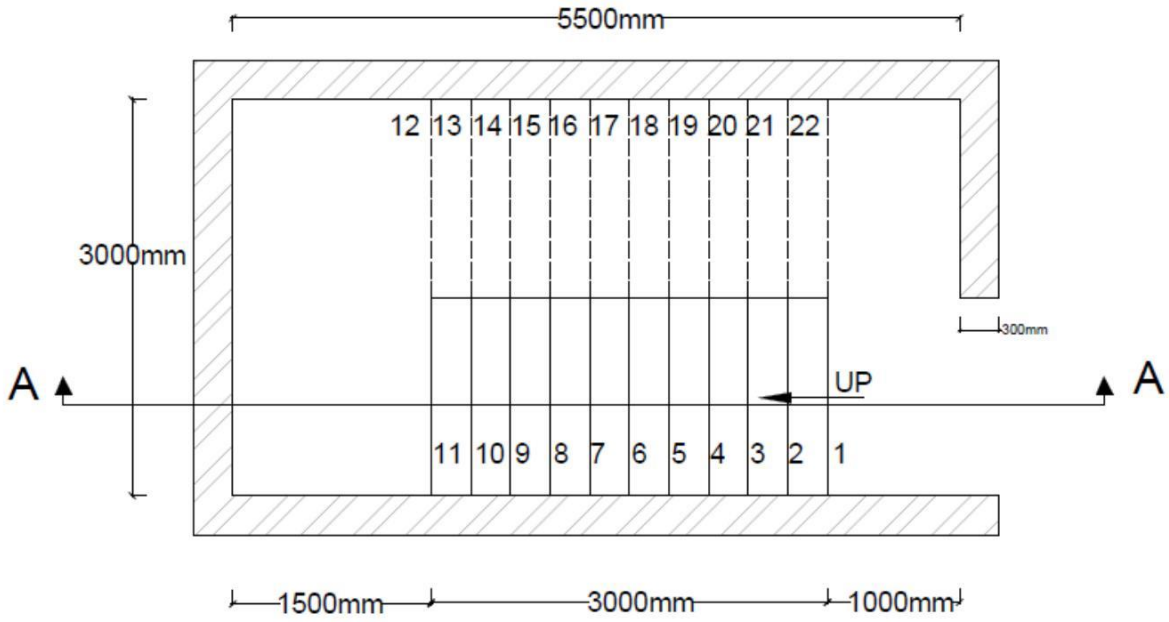


HEADER BOND
ONE BRICK WALL 200X200(Fig:2.8)

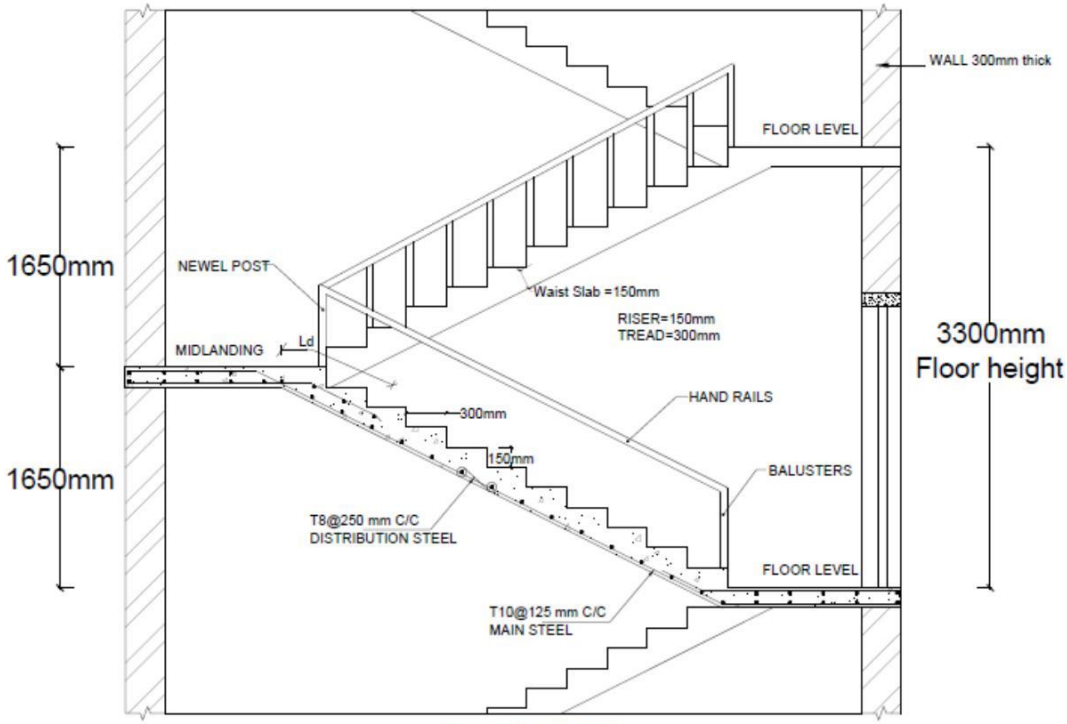


STRETCHER BOND
ONE BRICK WALL 200X200(Fig:2.9)

DOGLEGGED STAIR CASE (Fig:2.10)

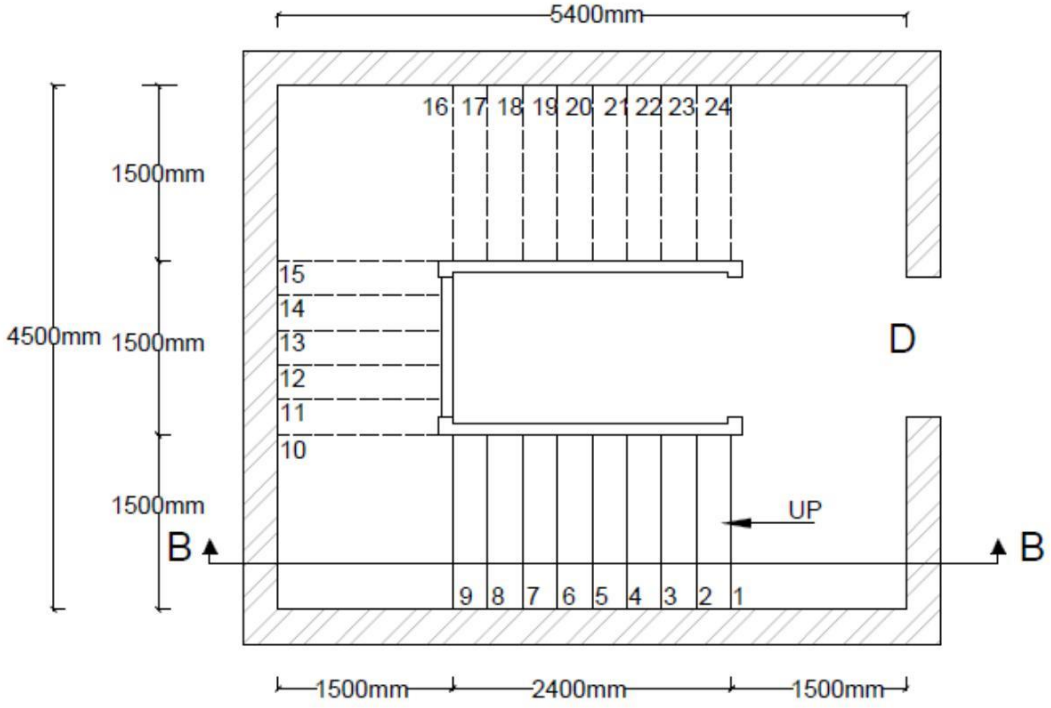


PLAN OF DOGLEGGED STAIRCASE

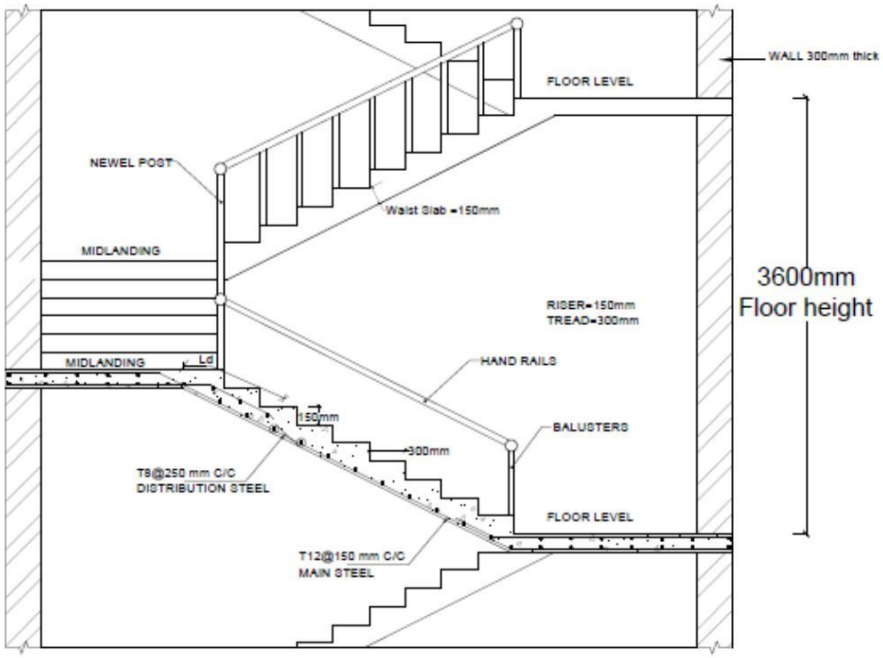


SECTION A-A
SECTIONAL ELEVATION OF DOGLEGGED STAIRCASE

OPEN NEWEL STAIR CASE (Fig:2.11)

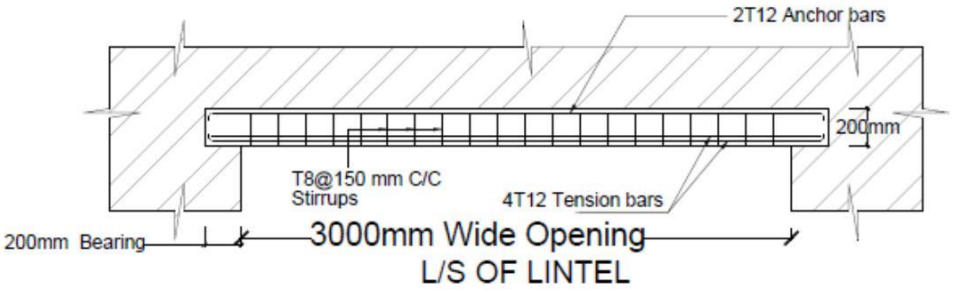


PLAN OF OPEN NEWELL STAIRCASE

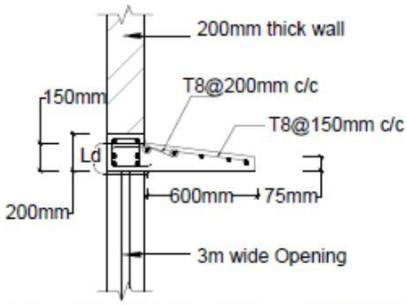


SECTION B-B
SECTIONAL ELEVATION OF OPEN NEWELL STAIRCASE

LINTEL AND SUNSHADE (Fig:2.12)

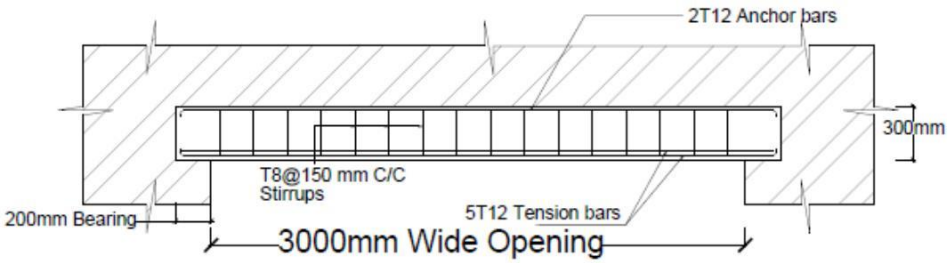


L/S OF LINTEL

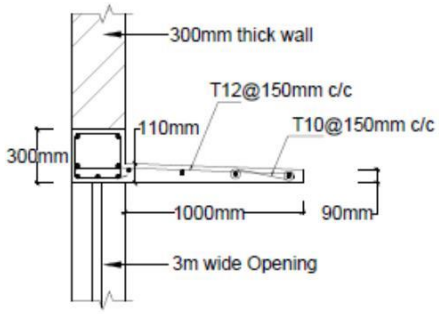


C/S OF LINTEL AND SUNSHADE

LINTEL AND CHEJJA (Fig:2.13)

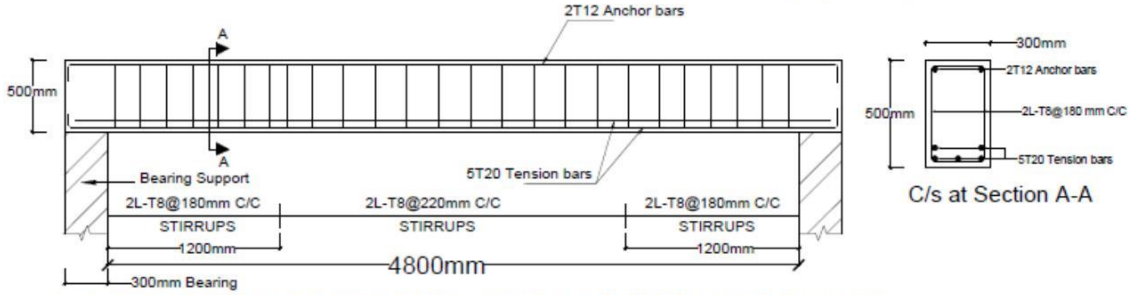


L/S OF LINTEL



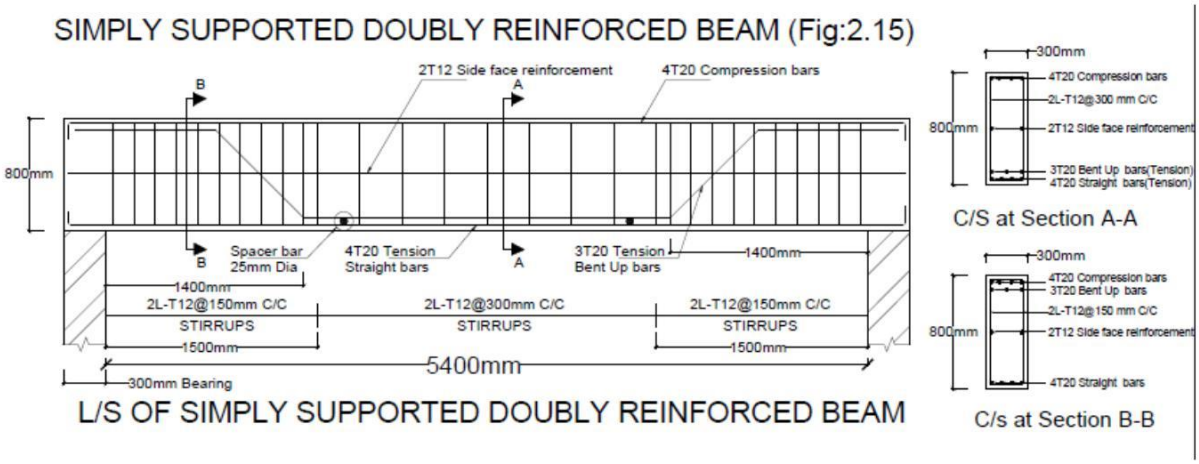
C/S OF LINTEL AND CHEJJA

SIMPLY SUPPORTED SINGLY REINFORCED BEAM (Fig:2.14)



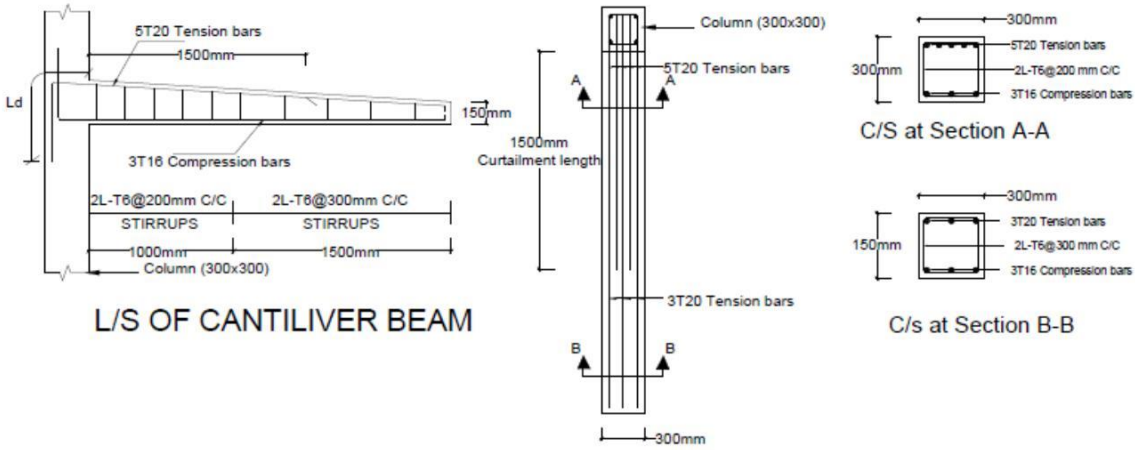
L/S OF SIMPLY SUPPORTED SINGLY REINFORCED BEAM

SIMPLY SUPPORTED DOUBLY REINFORCED BEAM (Fig:2.15)



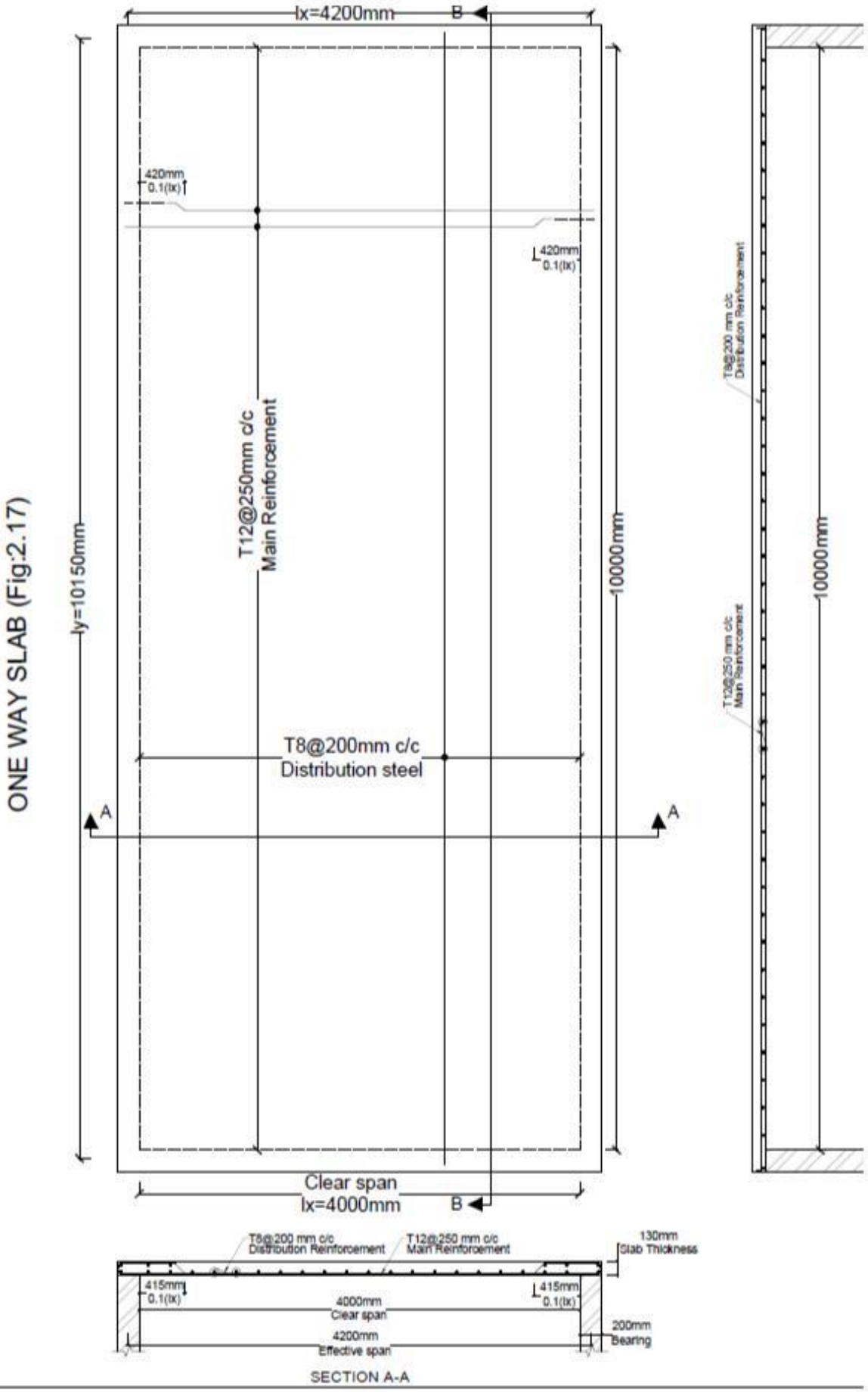
L/S OF SIMPLY SUPPORTED DOUBLY REINFORCED BEAM

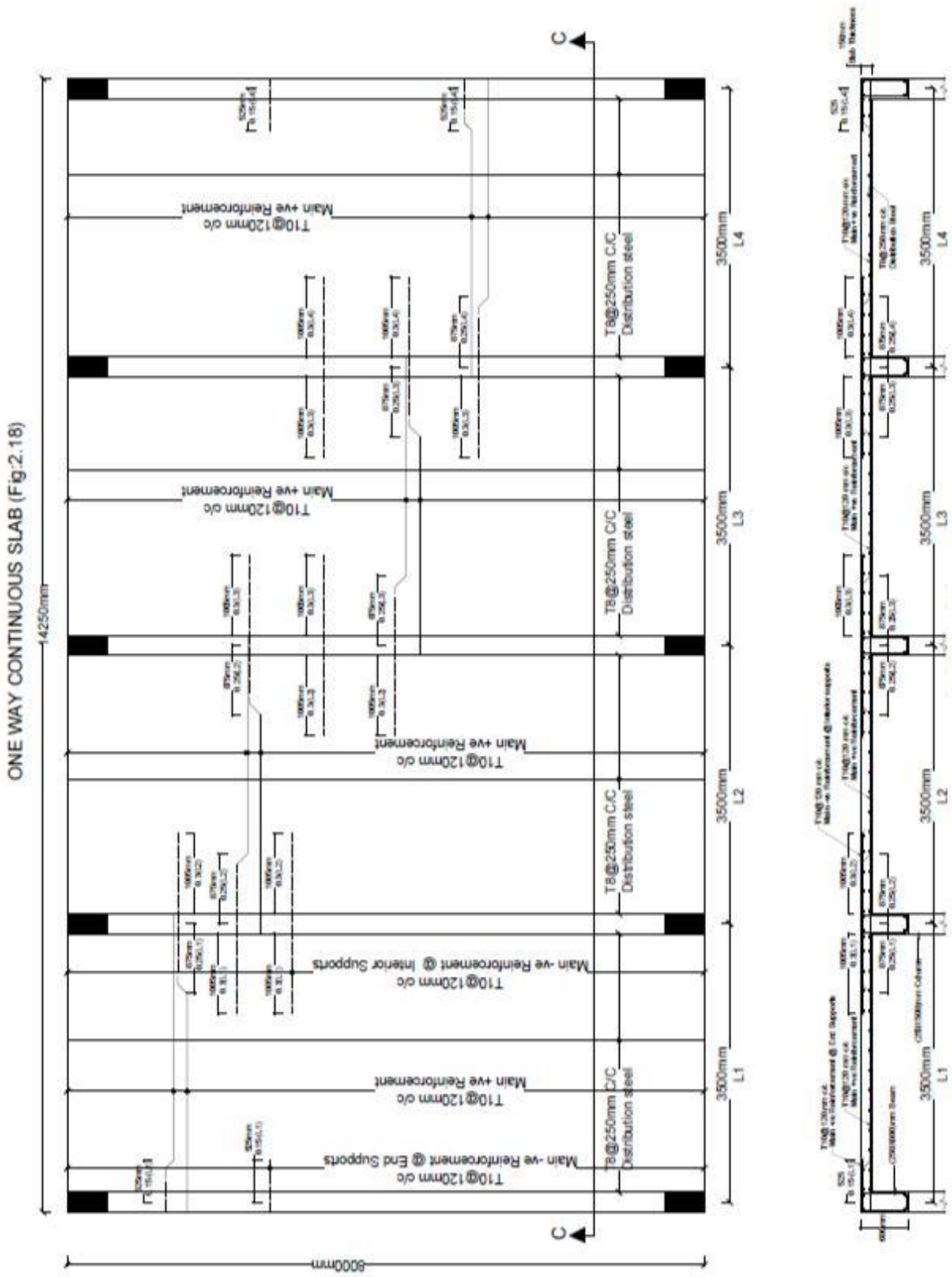
CANTILEVER BEAM (Fig:2.16)



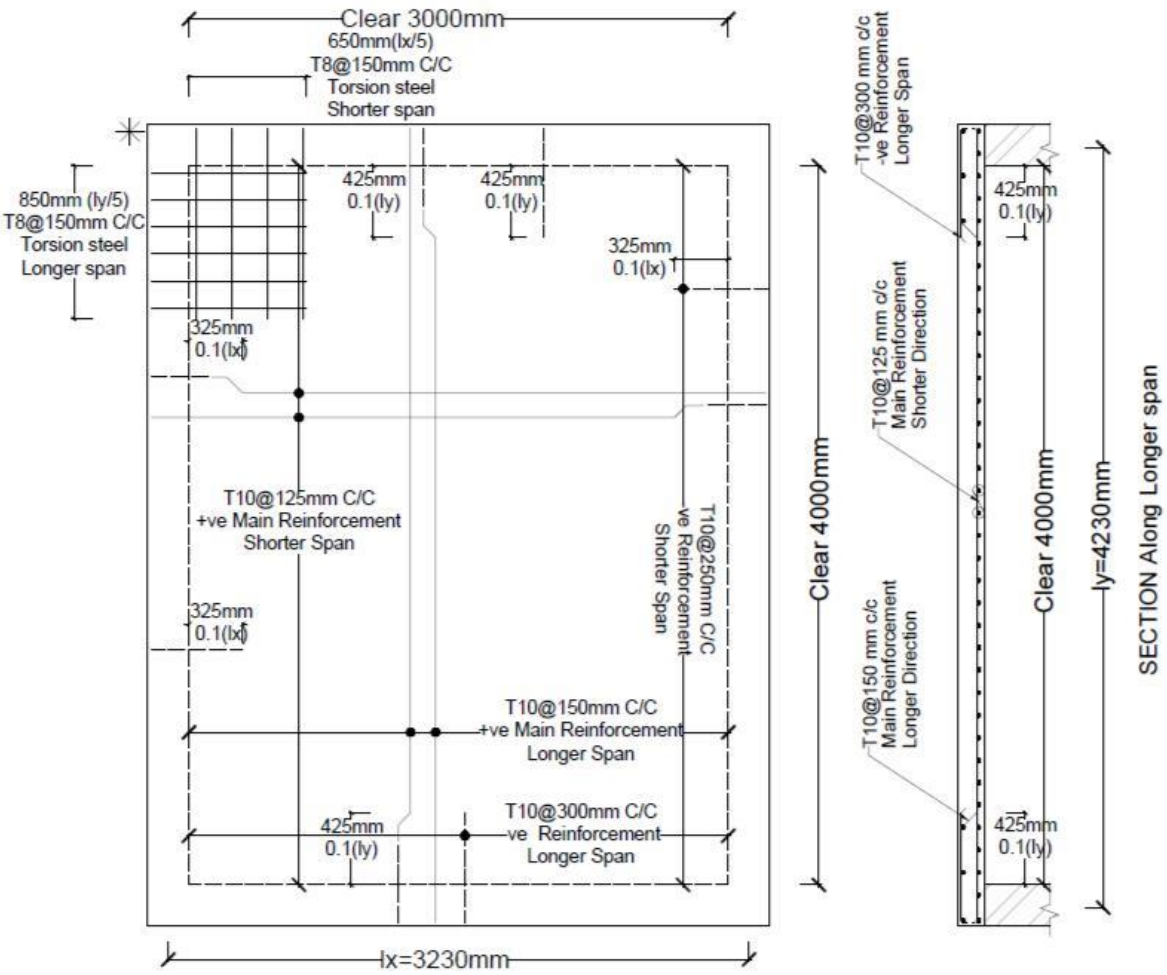
L/S OF CANTILIVER BEAM

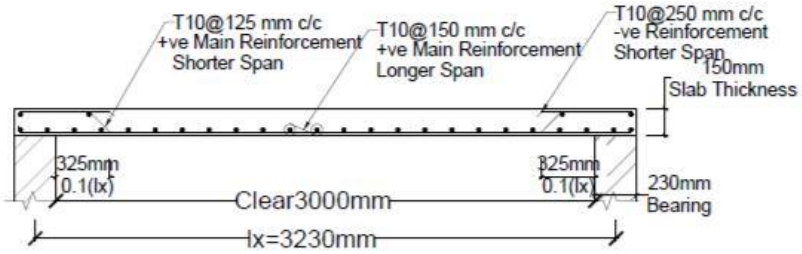
PLAN SHOWING CURTAILMENT DETAILS


ONE WAY SLAB (Fig:2.17)
lx=4200mm
B
ly=10150mm
420mm
0.1(lx)
420mm
0.1(lx)
T12@250mm c/c
Main Reinforcement
10000mm
T8@200mm c/c
Distribution steel
A
A
Clear span
lx=4000mm
B
T8@200 mm c/c
Distribution Reinforcement
T12@250 mm c/c
Main Reinforcement
130mm
Slab Thickness
415mm
0.1(lx)
415mm
0.1(lx)
4000mm
Clear span
4200mm
Effective span
200mm
Bearing
SECTION A-A
T8@200 mm c/c
Distribution Reinforcement
T12@250 mm c/c
Main Reinforcement
10000mm

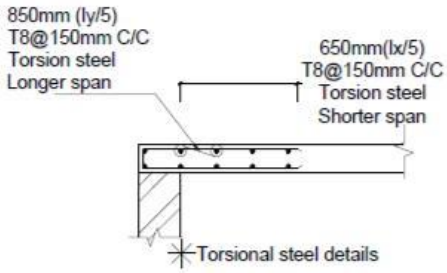

ONE WAY CONTINUOUS SLAB (Fig:2.18)
14250mm
8000mm
3500mm
L1
L2
L3
L4
T10@120mm c/c
Main -ve Reinforcement @ End Supports
T10@120mm c/c
Main +ve Reinforcement
T10@120mm c/c
Main -ve Reinforcement @ Interior Supports
T10@120mm c/c
Main +ve Reinforcement
T10@120mm c/c
Main +ve Reinforcement
T8@250mm C/C
Distribution steel
T8@250mm C/C
Distribution steel
T8@250mm C/C
Distribution steel
C
C

SIMPLY SUPPORTED TWO WAY SLAB (Fig:2.19)

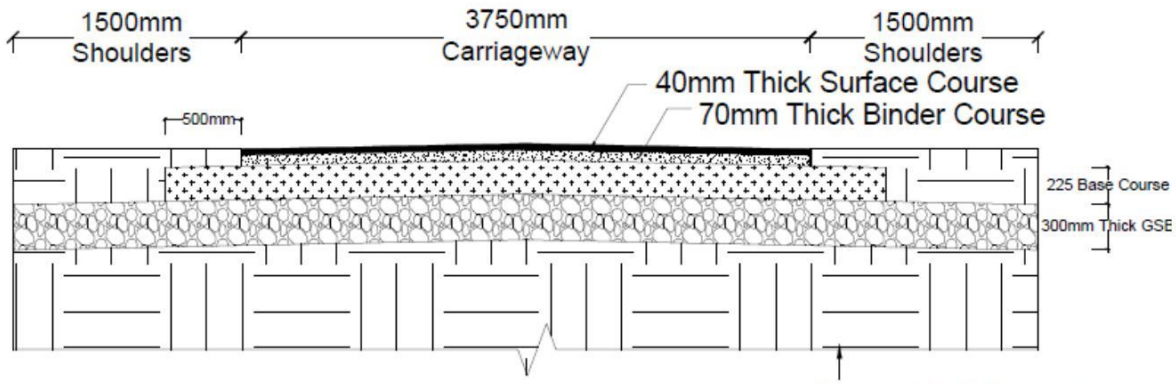




SECTION Along Shorter span

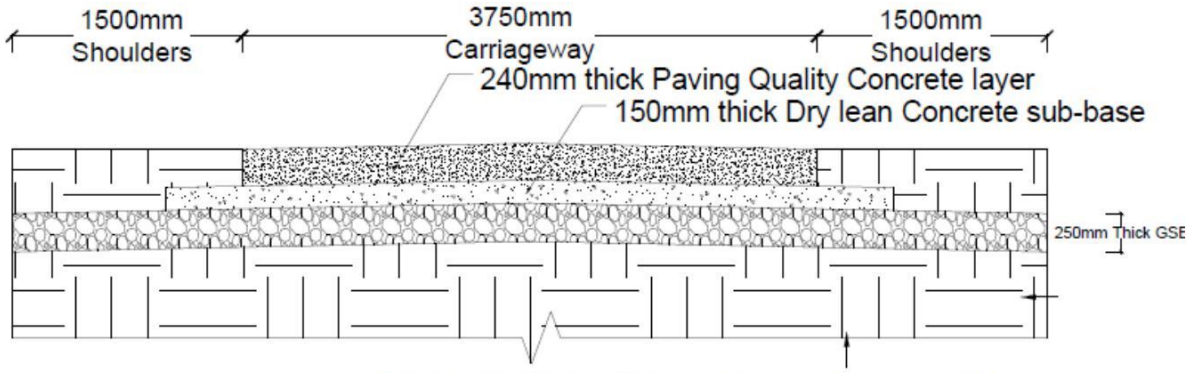


FLEXIBLE PAVEMENT (Fig:2.20)



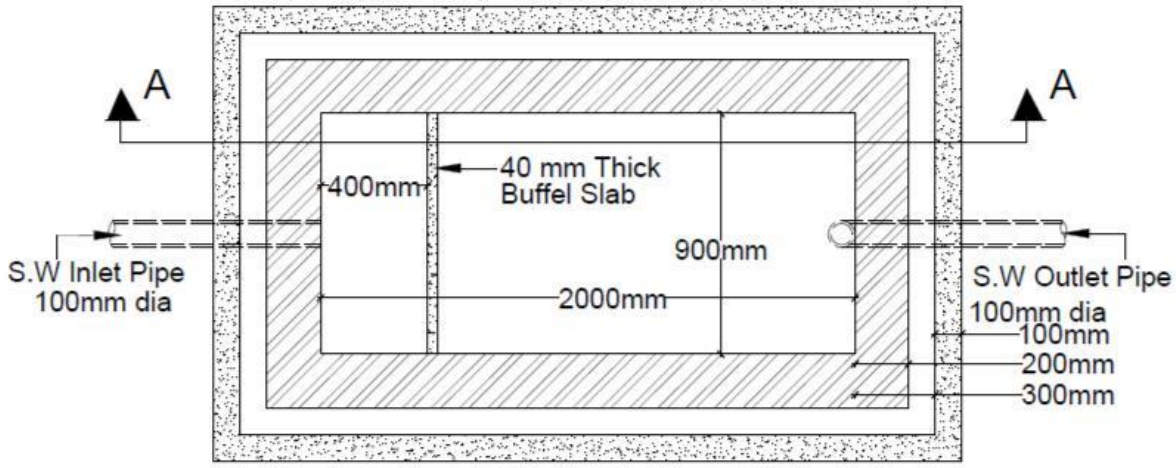
C/S OF FLEXIBLE PAVEMENT

RIGID PAVEMENT (Fig:2.21)

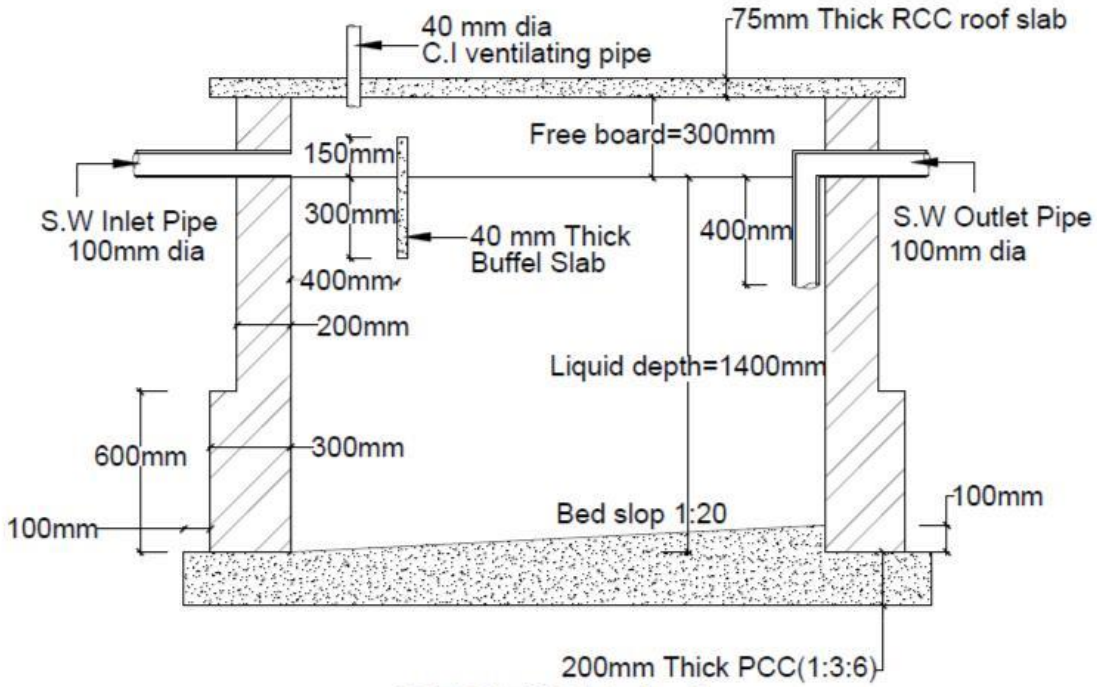


C/S OF RIGED PAVEMENT

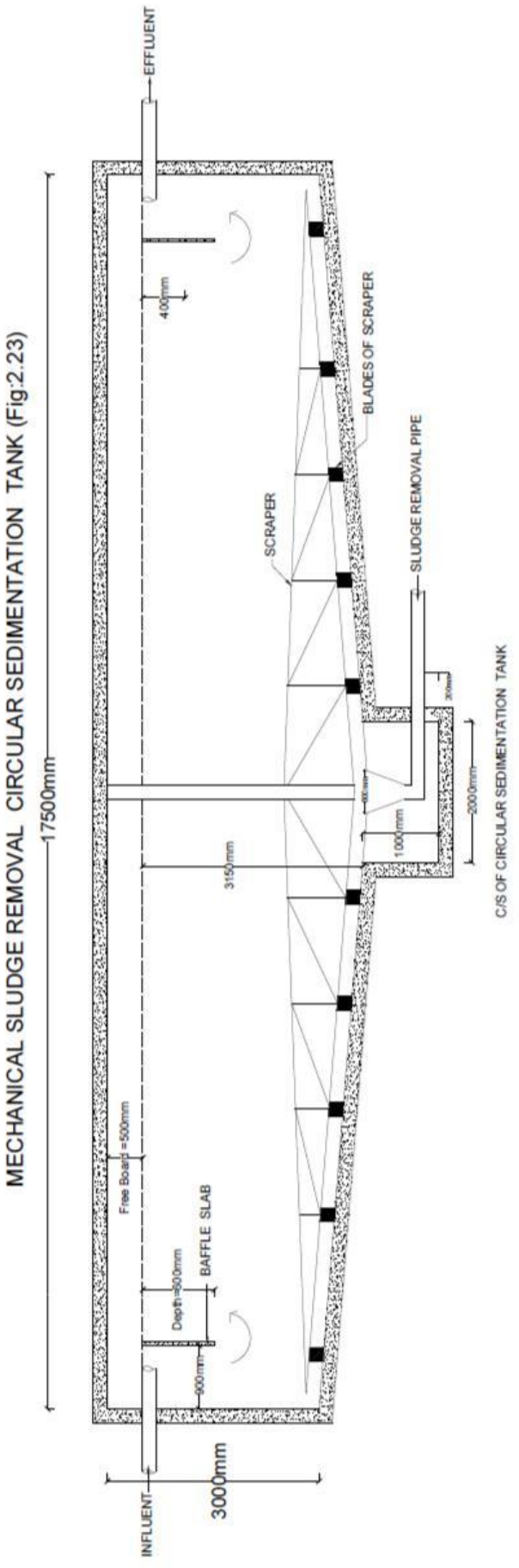
SEPTIC TANK (Fig:2.22)

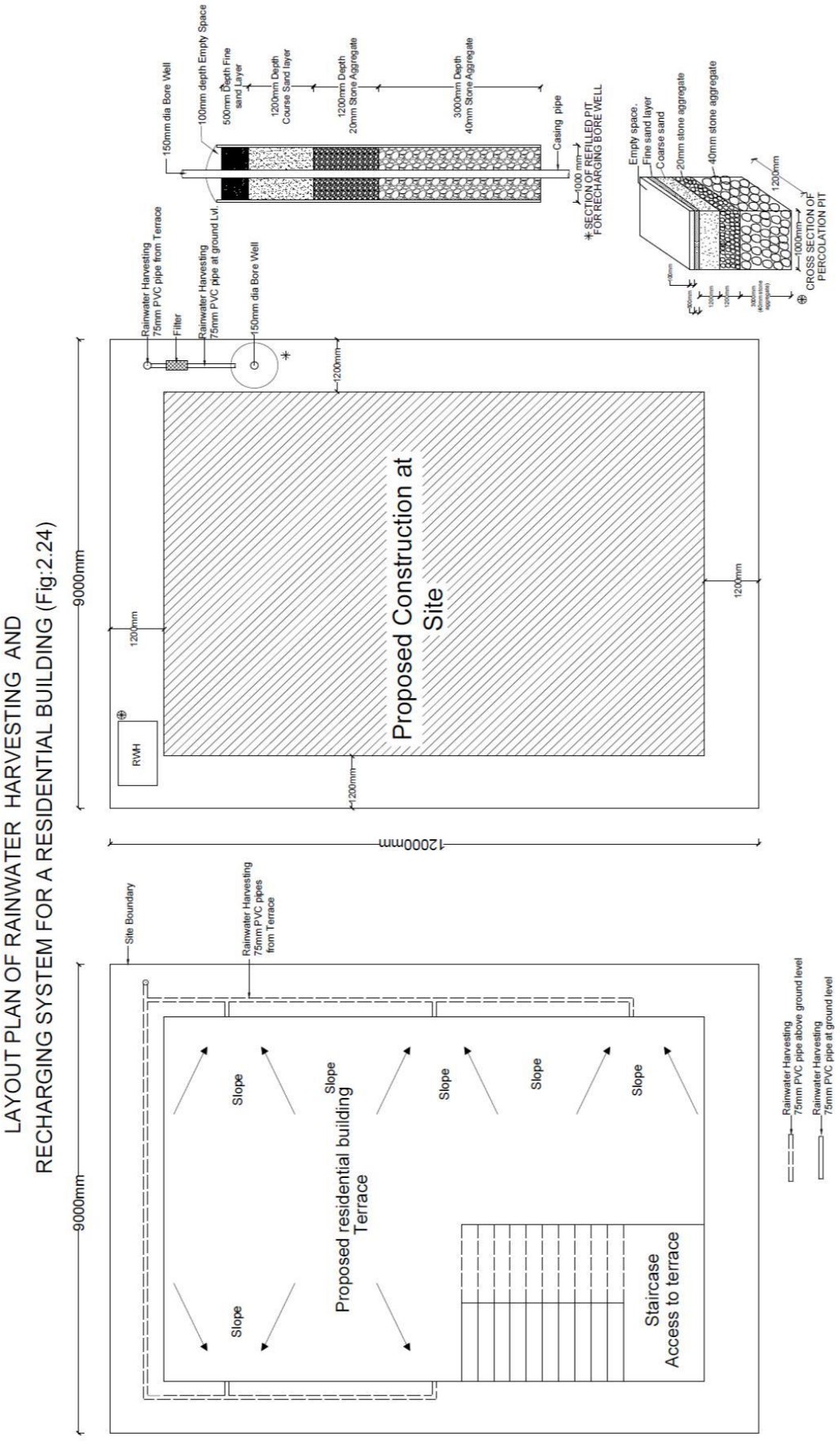


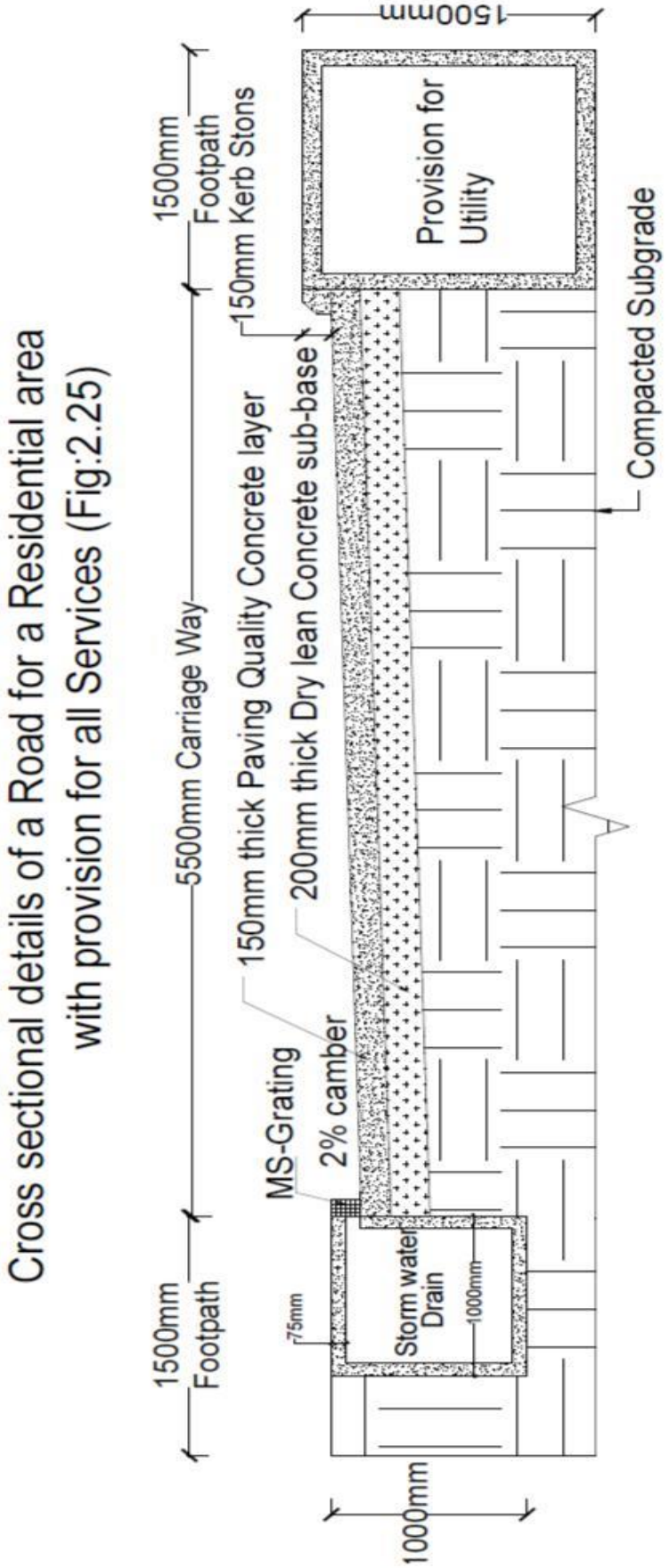
PLAN OF SEPTIC TANK

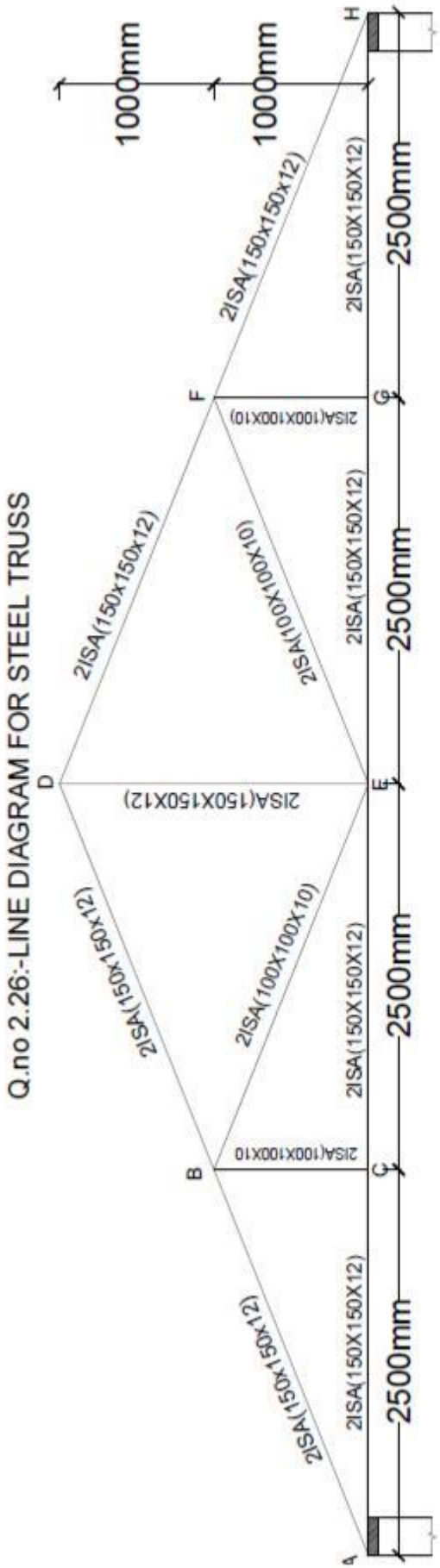


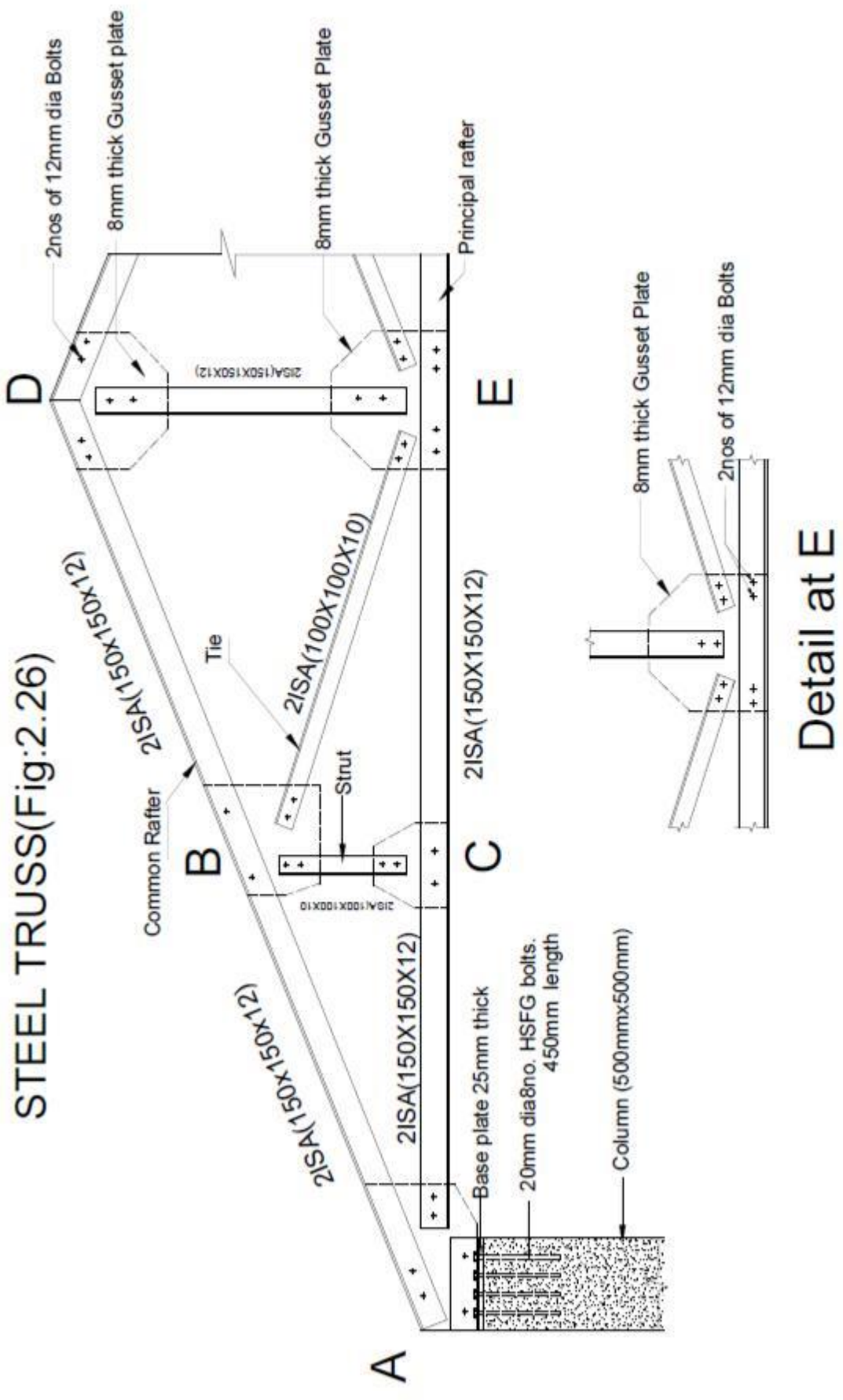
SECTION A-A


MECHANICAL SLUDGE REMOVAL CIRCULAR SEDIMENTATION TANK (Fig:2.23)
EFFLUENT
17500mm
400mm
BLADES OF SCRAPER
SCRAPER
SLUDGE REMOVAL PIPE
1000mm
2000mm
3150mm
C/S OF CIRCULAR SEDIMENTATION TANK
Free Board =500mm
BAFFLE SLAB
Depth=900mm
900mm
INFLUENT
3000mm

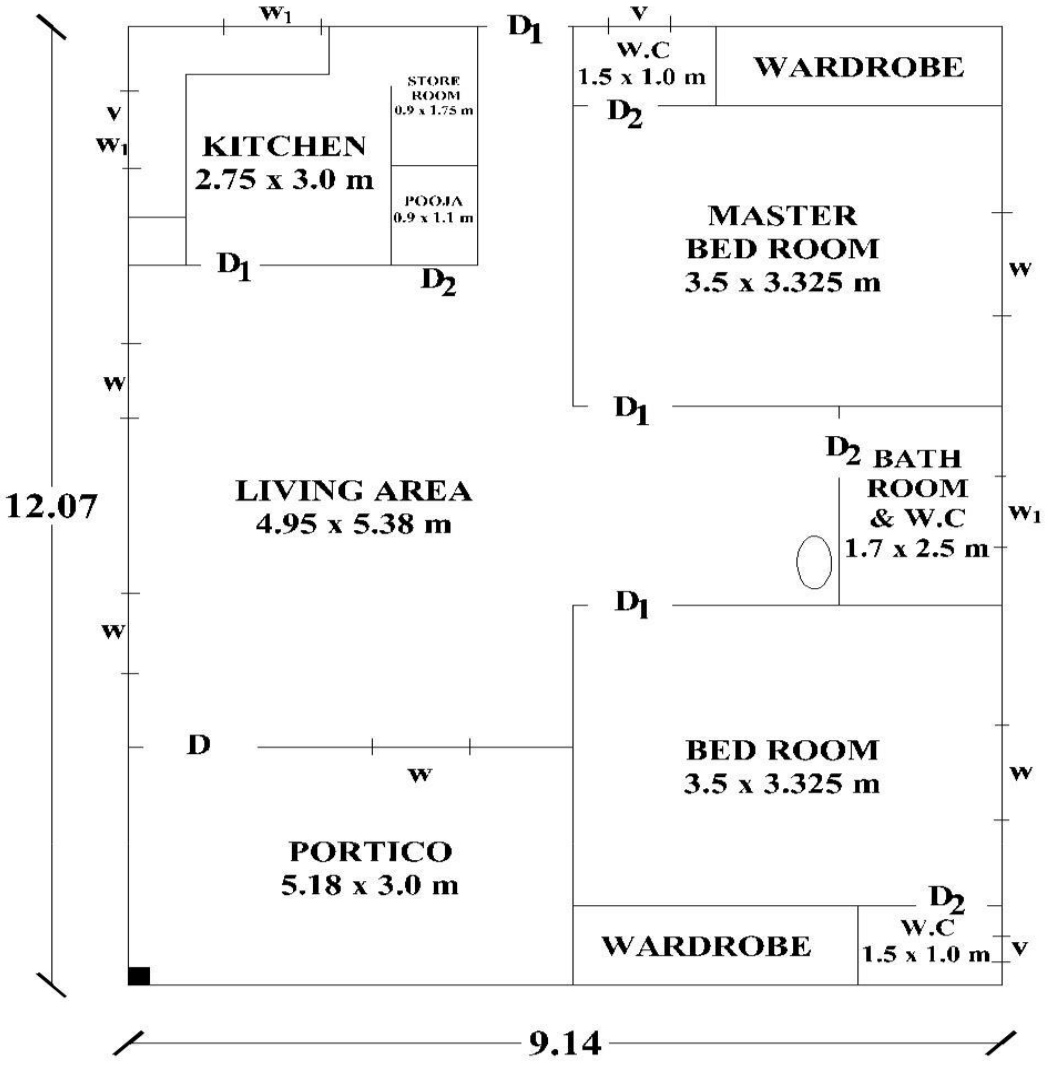

LAYOUT PLAN OF RAINWATER HARVESTING AND
RECHARGING SYSTEM FOR A RESIDENTIAL BUILDING (Fig:2.24)
Site Boundary
Rainwater Harvesting
75mm PVC pipes
from Terrace
Slope
Slope
Slope
Slope
Slope
Slope
Proposed residential building
Terrace
Staircase
Access to terrace
9000mm
12000mm
Rainwater Harvesting
75mm PVC pipe above ground level
Rainwater Harvesting
75mm PVC pipe at ground level
Proposed Construction at
Site
RWH
1200mm
Rainwater Harvesting
75mm PVC pipe from Terrace
Filter
Rainwater Harvesting
75mm PVC pipe at ground Lvl
150mm dia Bore Well
150mm dia Bore Well
100mm depth Empty Space
500mm Depth Fine
sand Layer
1200mm Depth
Course Sand layer
1200mm Depth
20mm Stone Aggregate
3000mm Depth
40mm Stone Aggregate
Casing pipe
1000 mm
SECTION OF REFILLED PIT
FOR RECHARGING BORE WELL
Empty space.
Fine sand layer
Coarse sand
20mm stone aggregate
40mm stone aggregate
1200mm
1000mm
CROSS SECTION OF
PERCOLATION PIT


Cross sectional details of a Road for a Residential area
with provision for all Services (Fig:2.25)
1500mm
Footpath
5500mm Carriage Way
1500mm
Footpath
150mm Kerb Stons
Provision for
Utility
Compacted Subgrade
150mm thick Paving Quality Concrete layer
200mm thick Dry lean Concrete sub-base
MS-Grating
2% camber
75mm
Storm water
Drain
1000mm
1000mm

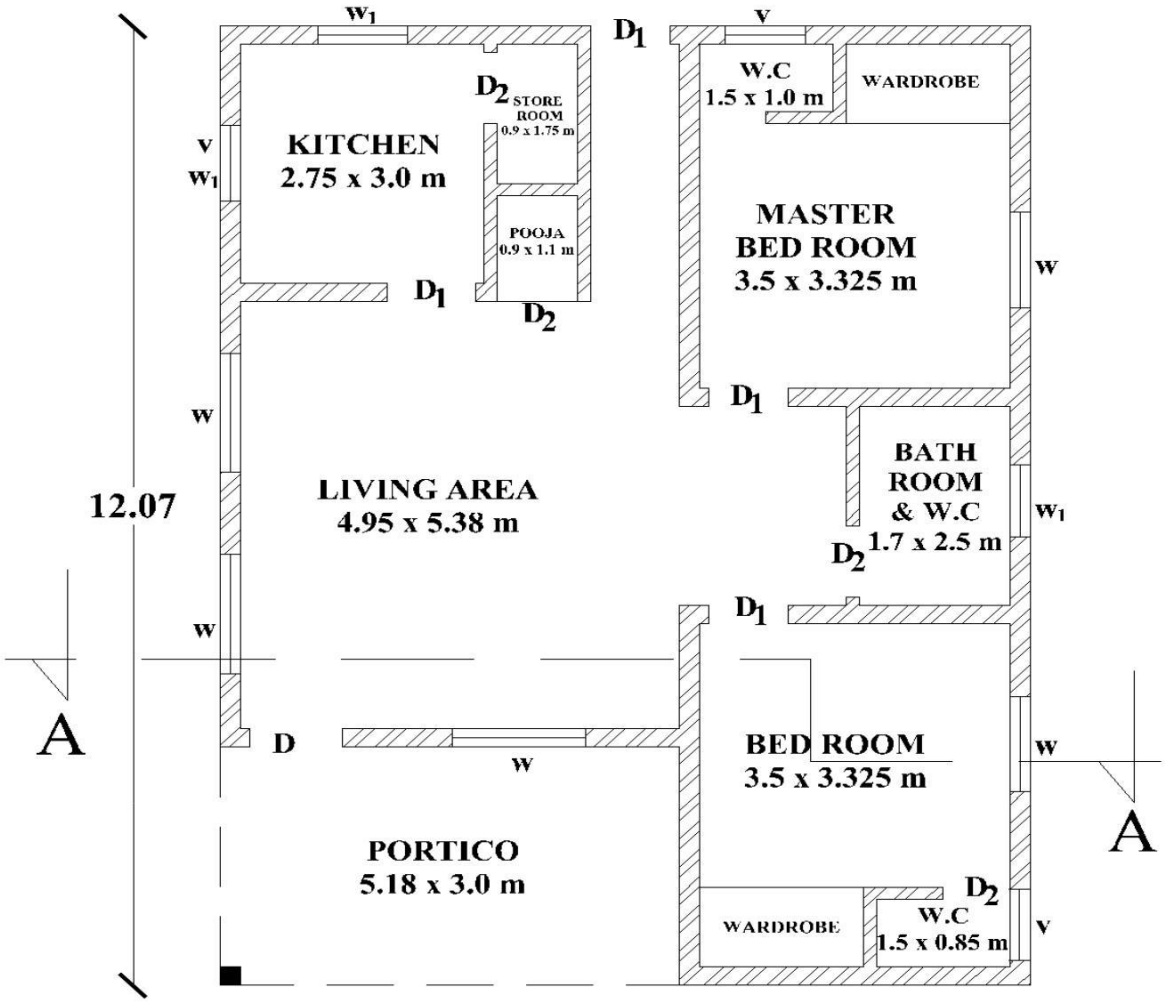

Q.no 2.26:-LINE DIAGRAM FOR STEEL TRUSS
1000mm
1000mm
2500mm
2500mm
2500mm
2500mm
2ISA(150X150X12)
2ISA(150X150X12)
2ISA(150X150X12)
2ISA(150X150X12)
2ISA(150x150x12)
2ISA(150x150x12)
2ISA(150x150x12)
2ISA(150x150x12)
2ISA(100X100X10)
2ISA(100X100X10)
2ISA(100X100X10)
2ISA(100X100X10)
2ISA(150X150X12)
A
B
C
D
E
F
G
H


STEEL TRUSS(Fig:2.26)
2nos of 12mm dia Bolts
8mm thick Gusset plate
8mm thick Gusset Plate
Principal rafter
D
E
2ISA(150x150x12)
Tie
2ISA(100X100X10)
Common Rafter
B
Strut
C
2ISA(150X150X12)
2ISA(150x150x12)
2ISA(150X150X12)
Base plate 25mm thick
20mm dia8no. HSFG bolts.
450mm length
Column (500mmx500mm)
A
8mm thick Gusset Plate
2nos of 12mm dia Bolts
Detail at E

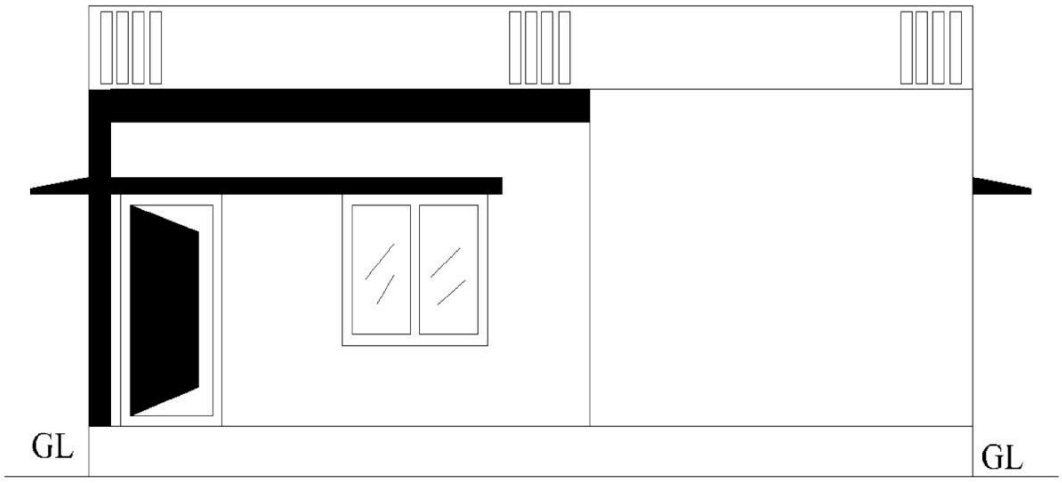
LINE DIAGRAM OF SINGLE STOREY RESIDENTIAL BUILDING



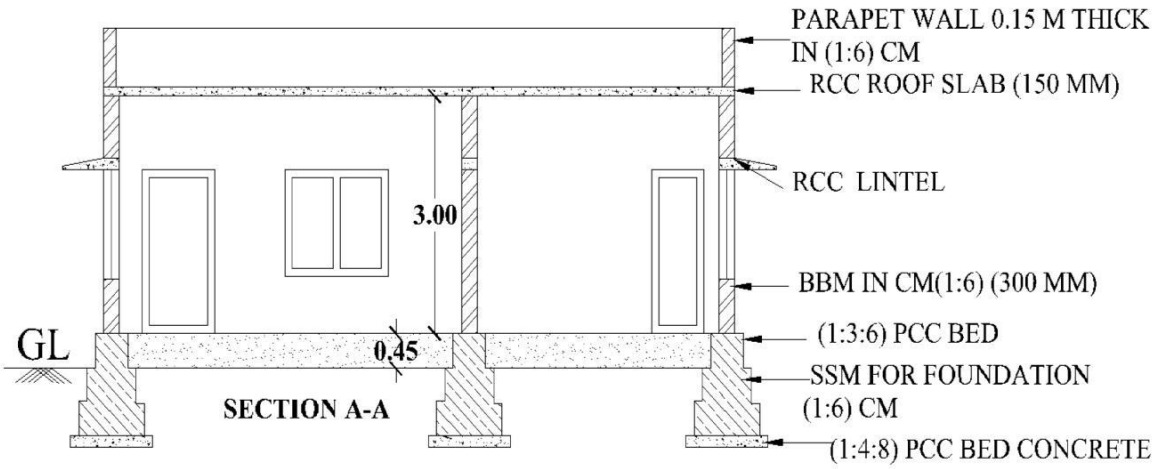
PLAN OF SINGLE STOREY RESIDENTIAL BUILDING



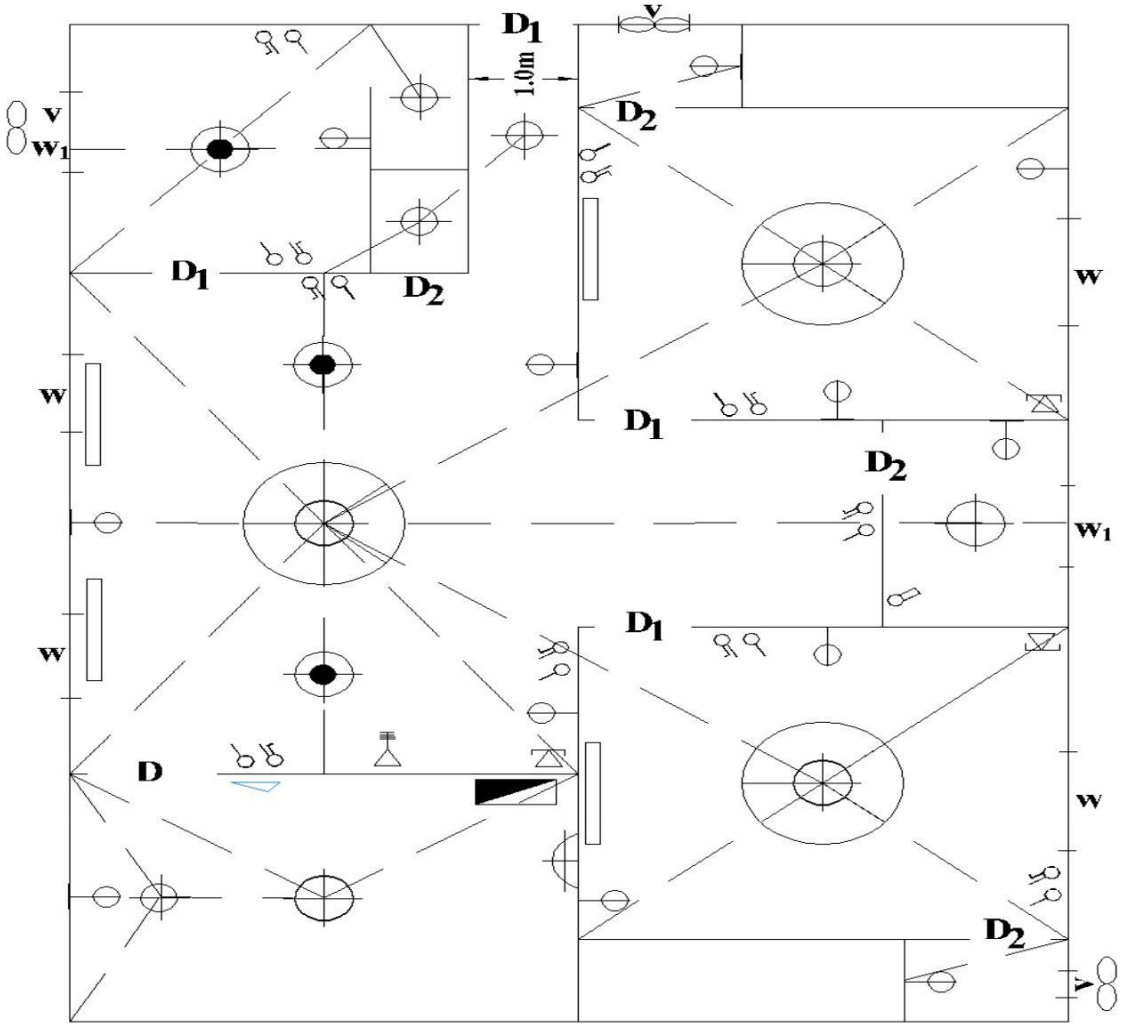
FRONT ELEVATION OF SINGLE STOREY RESIDENTIAL BUILDING



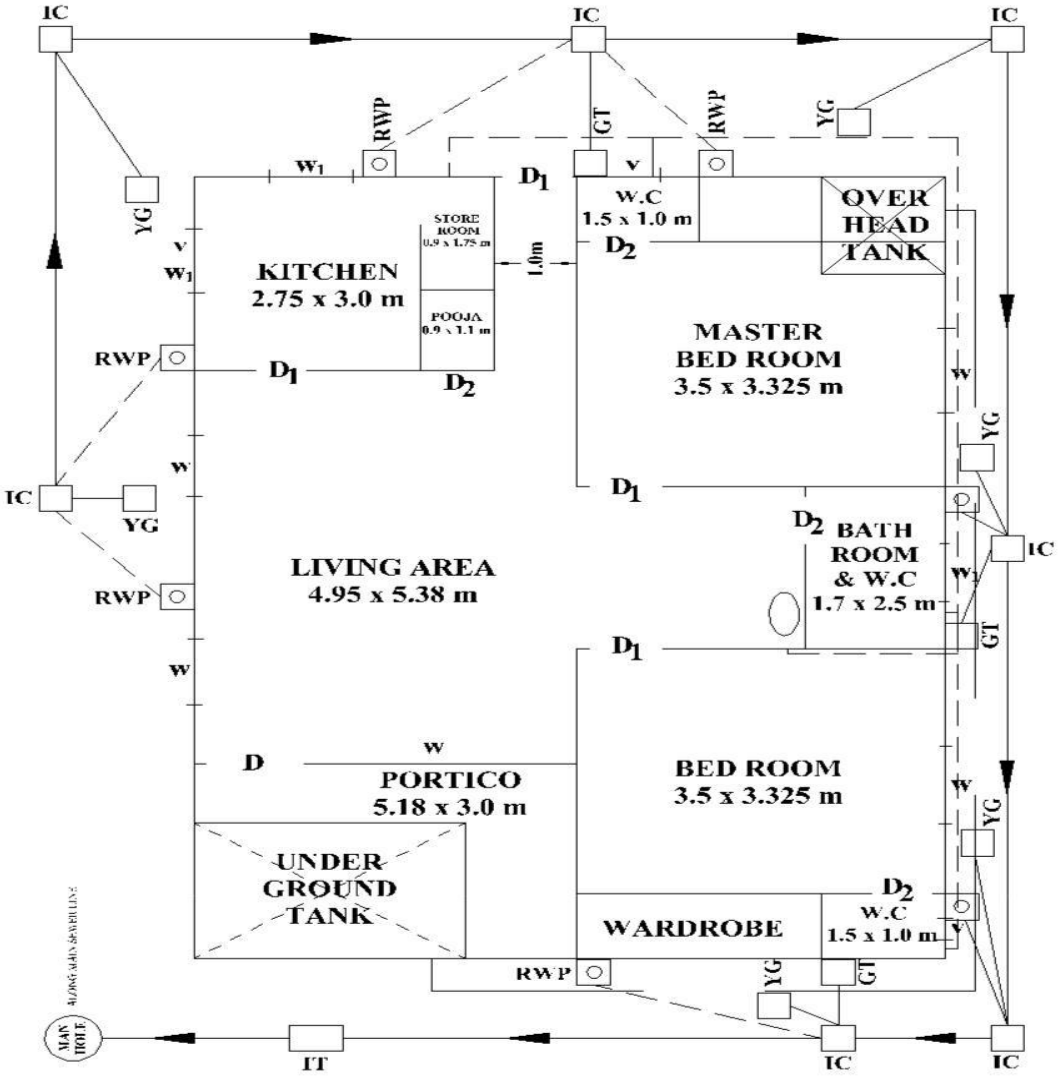
CROSS SECTION OF SINGLE STOREY RESIDENTIAL BUILDING



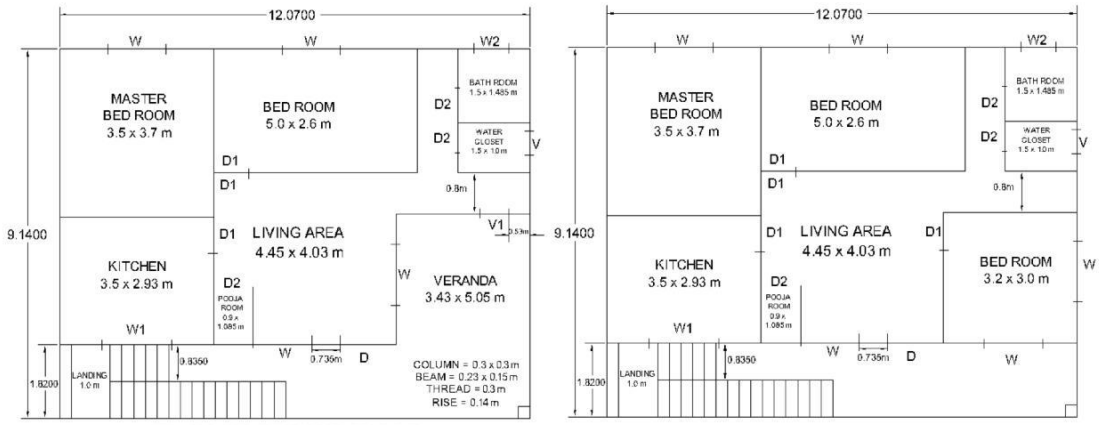
ELECTRICAL SUPPLY FOR SINGLE STOREY RESIDENTIAL BUILDING



WATER SUPPLY & SANITARY CONNECTION FOR SINGLE STOREY RESIDENTIAL BUILDING



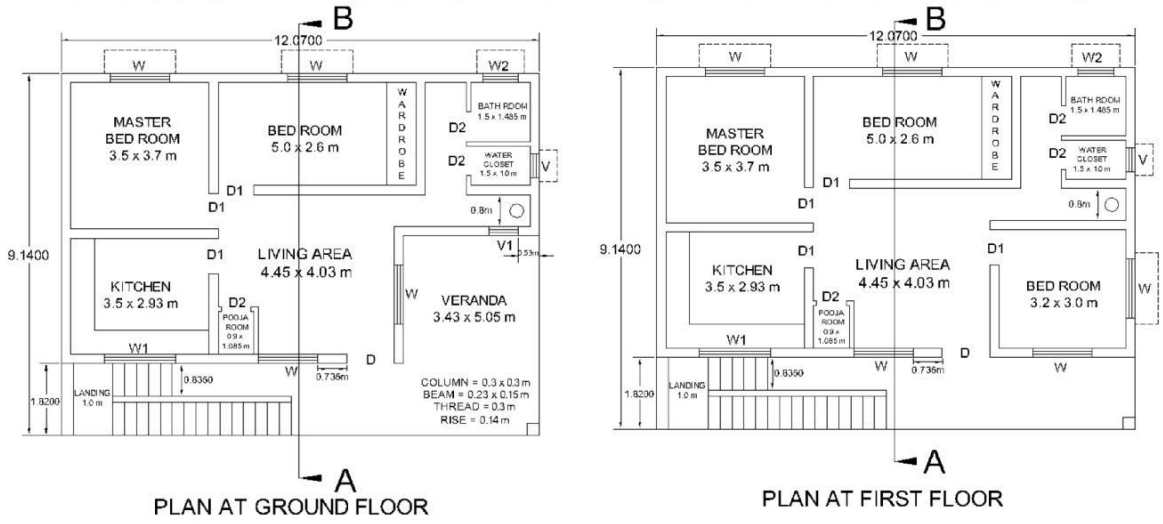
LINE DIAGRAM OF TWO STOREY RESEDENTIAL BUILDING



PLAN AT GROUND FLOOR

PLAN AT FIRST FLOOR

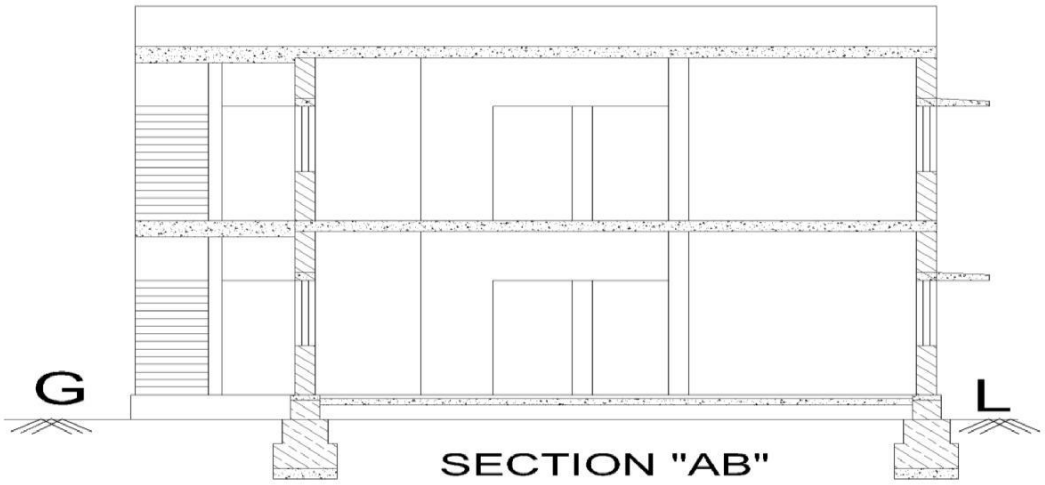
PLAN OF TWO STOREY RESEDENTIAL BUILDING



PLAN AT GROUND FLOOR

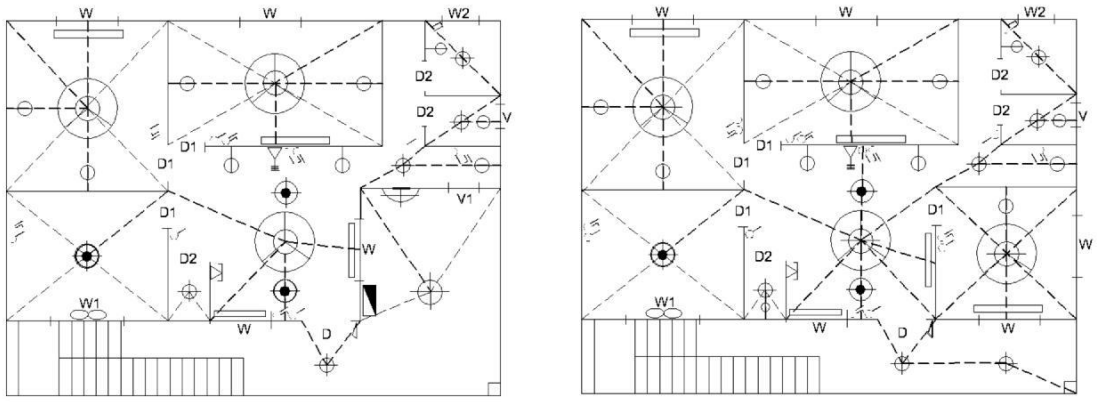
PLAN AT FIRST FLOOR

CROSS SECTION OF TWO STOREY RESEDENTIAL BUILDING



SECTION "AB"

ELECTRICAL SUPPLY FOR TWO STOREY RESEDENTIAL BUILDING

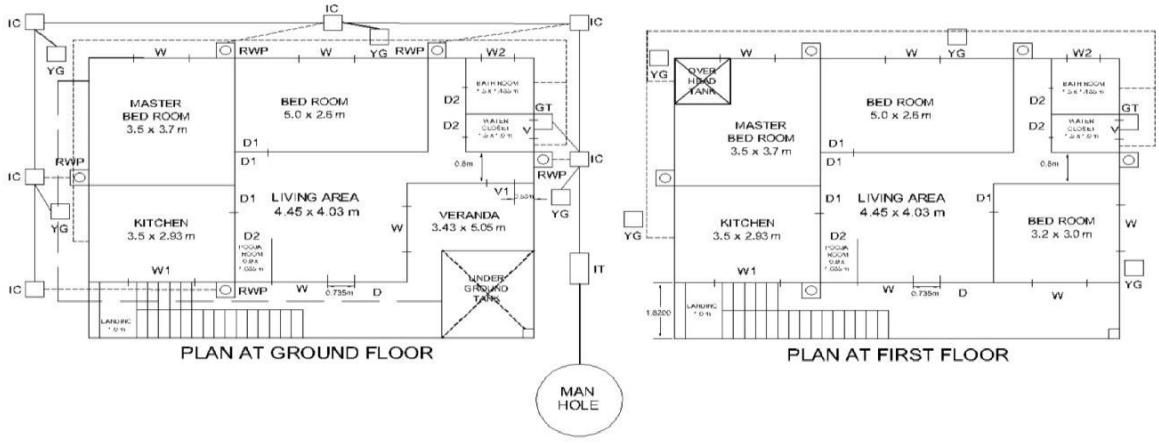


PLAN AT GROUND FLOOR

PLAN AT FIRST FLOOR

N

WATER & SANITARY SUPPLY CONNECTION FOR TWO FLOORS BUILDING

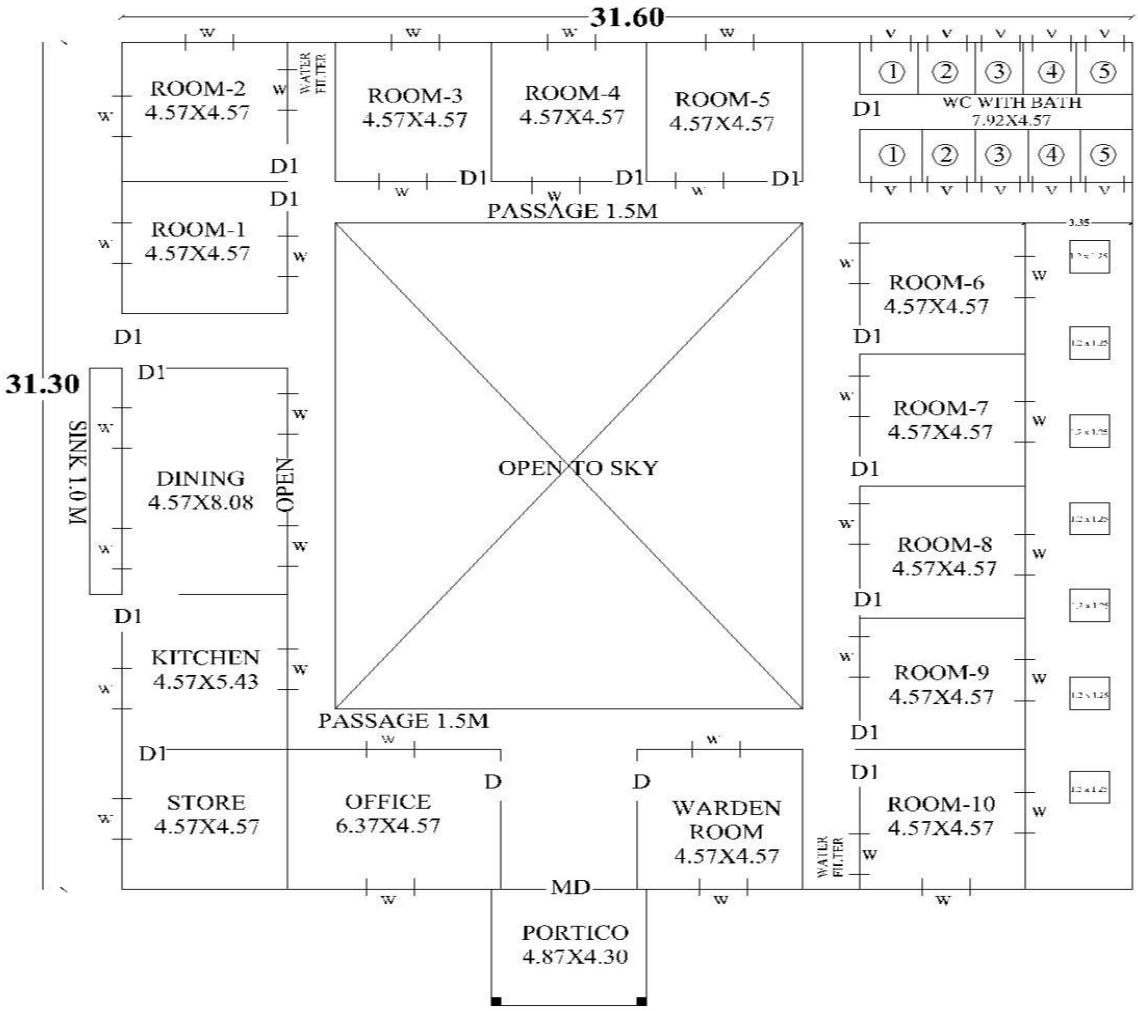


PLAN AT GROUND FLOOR

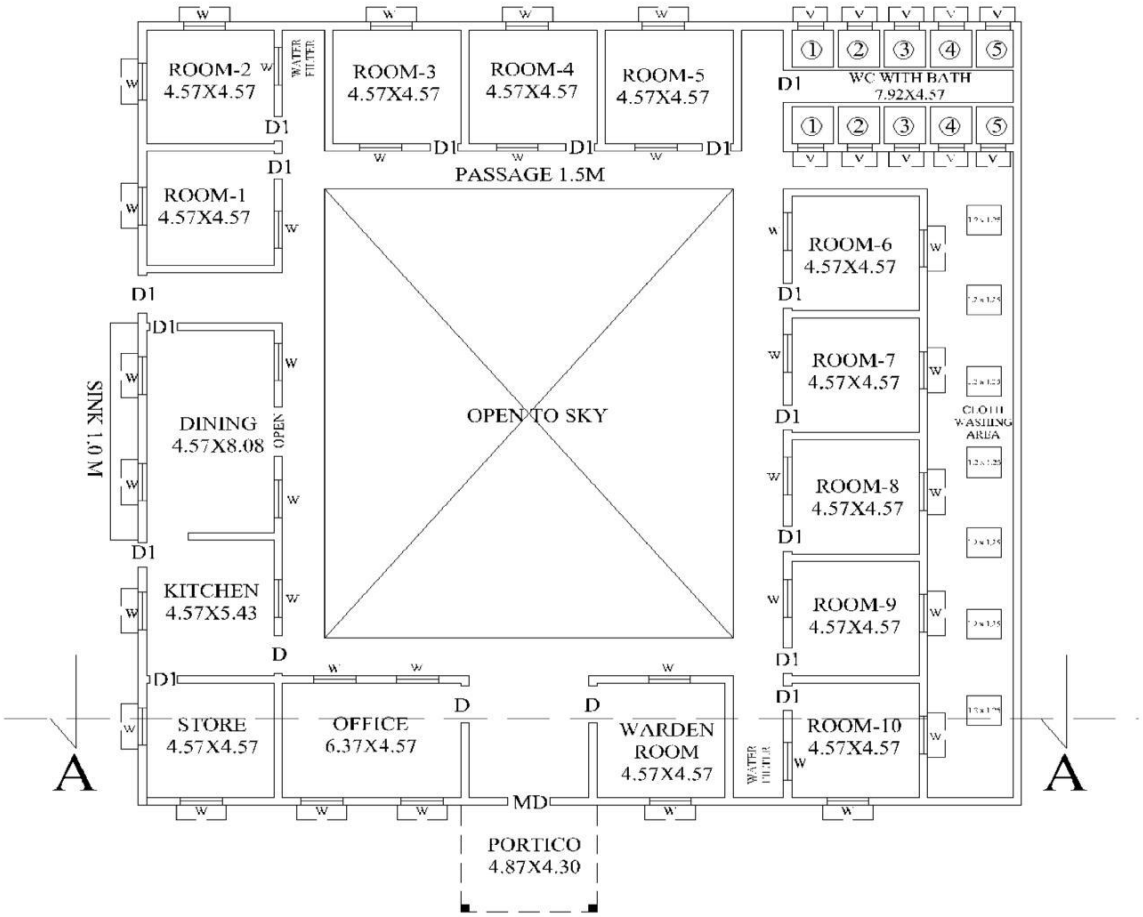
PLAN AT FIRST FLOOR

MAN HOLE

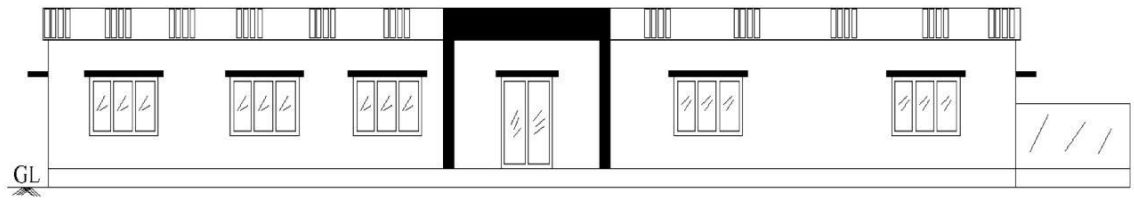
LINE DIAGRAM OF HOSTEL BUILDING



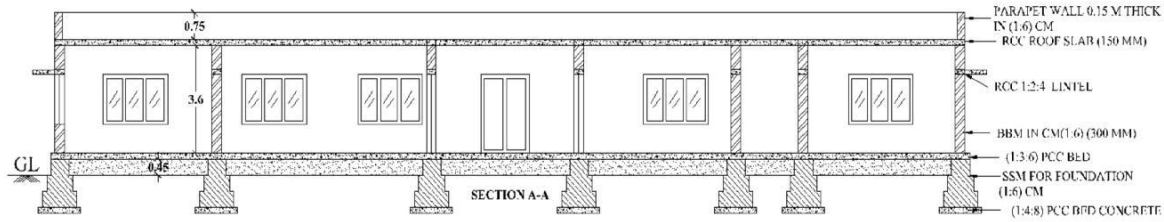
PLAN OF HOSTEL BUILDING



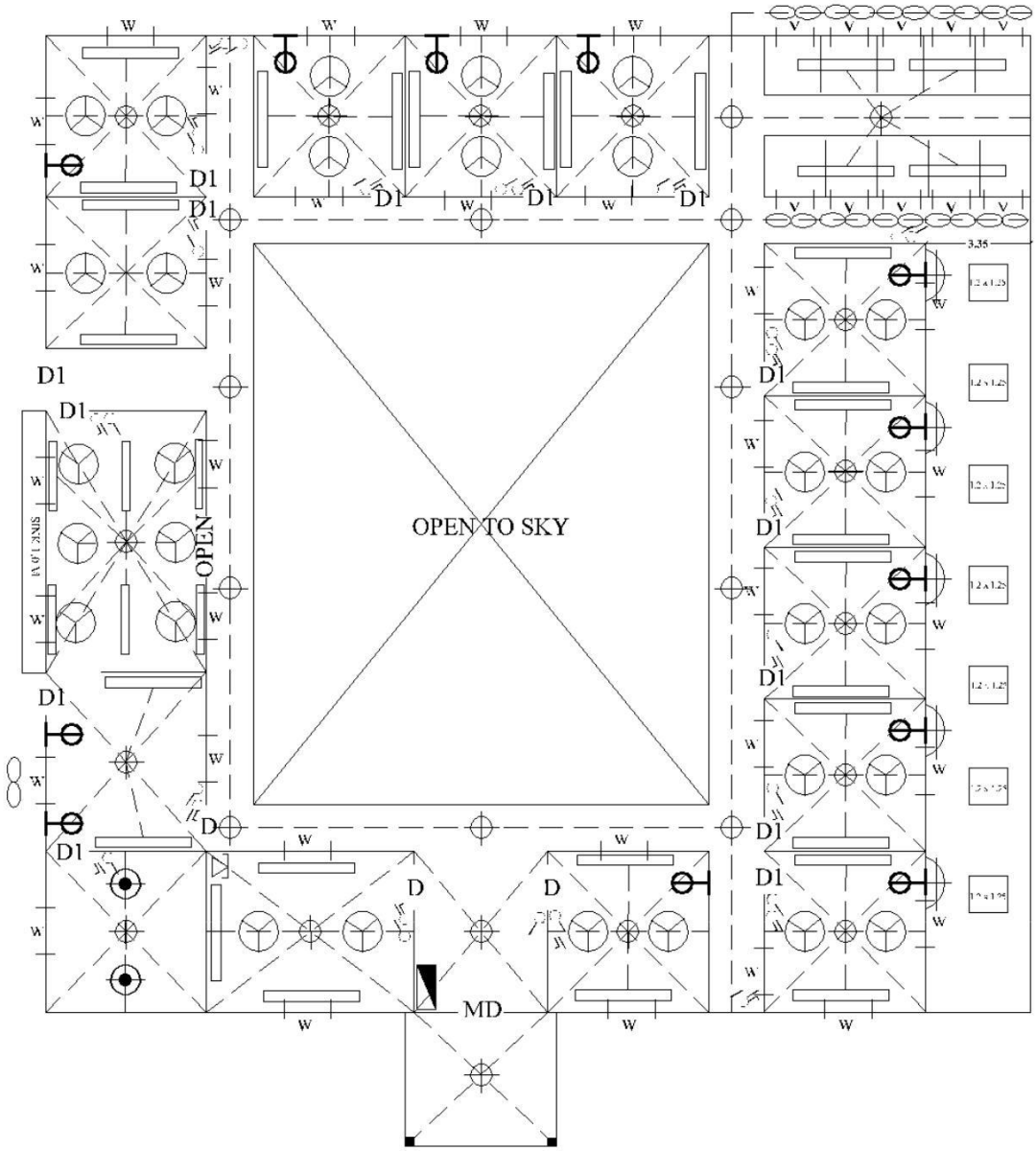
FRONT ELEVATION OF HOSTEL BUILDING



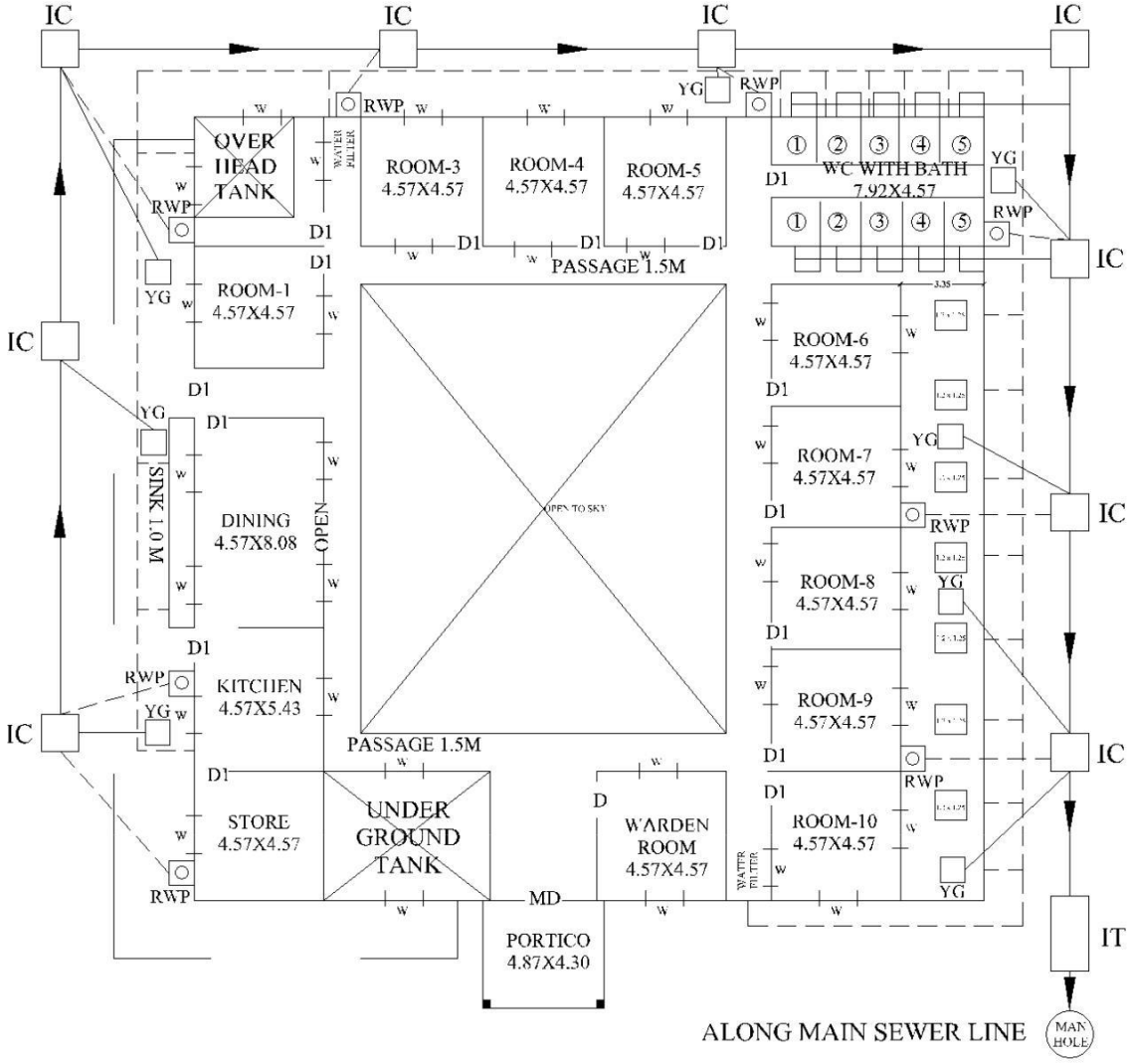
CROSS SECTION OF HOSTEL BUILDING



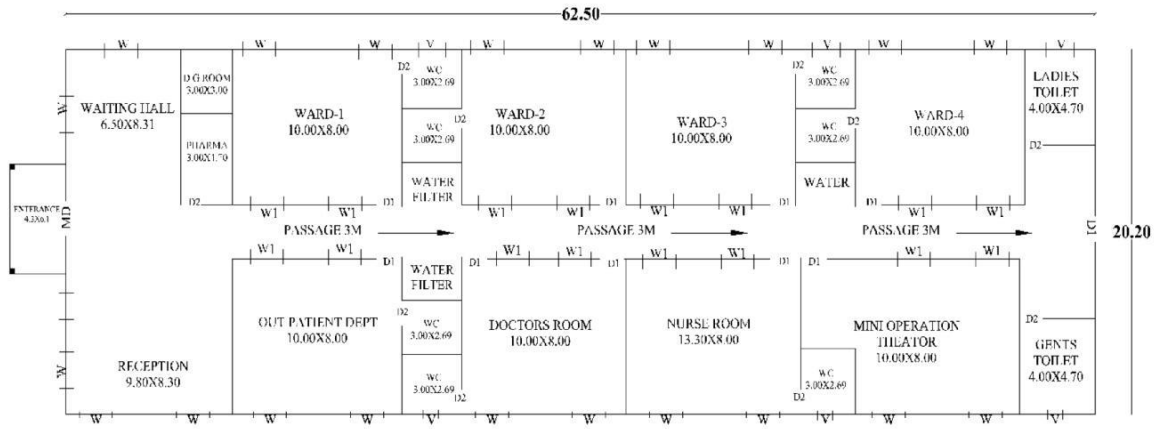
ELECTRICAL SUPPLY FOR HOSTEL BUILDING



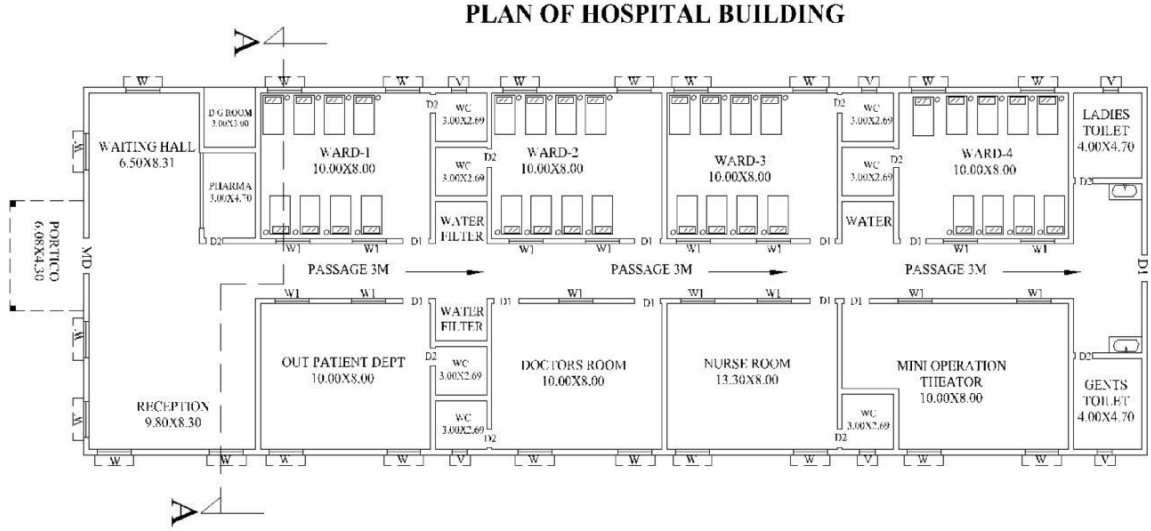
WATER SUPPLY & SANITARY CONNECTION FOR HOSTEL BUILDING



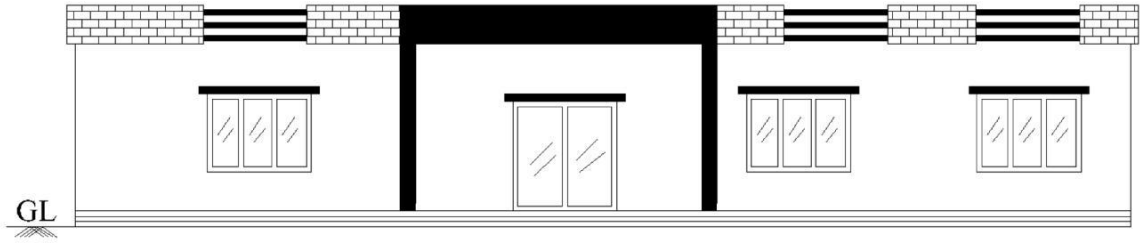
LINE DIAGRAM OF HOSPITAL BUILDING



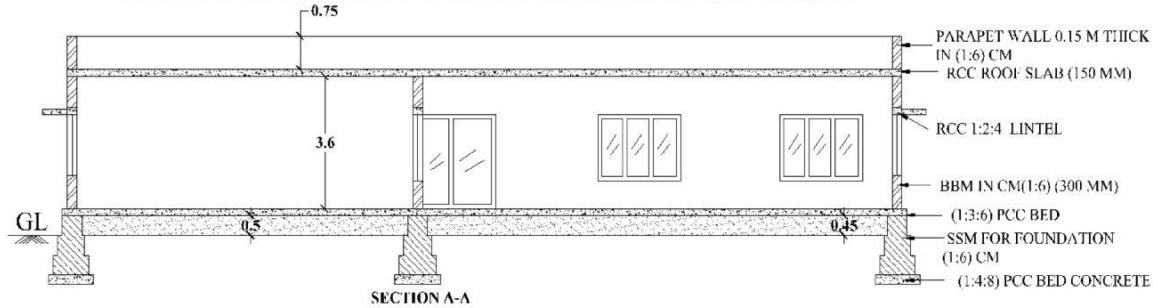
PLAN OF HOSPITAL BUILDING



FRONT ELEVATION OF HOSPITAL BUILDING

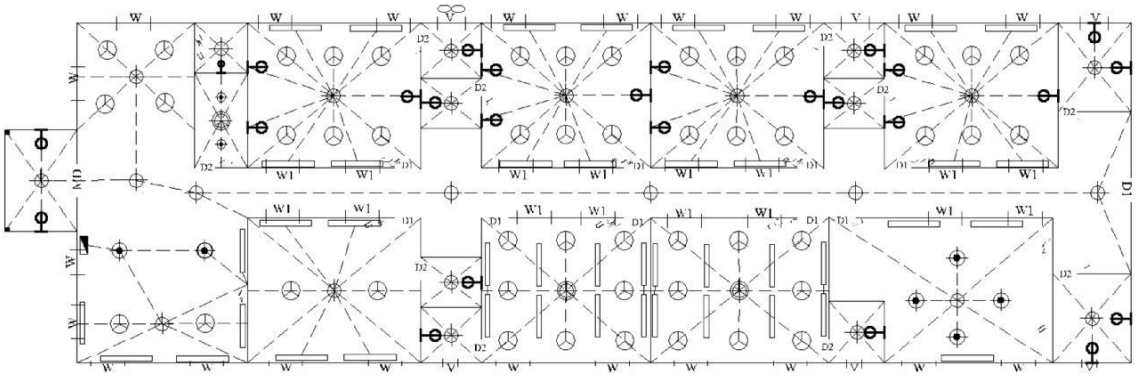


CROSS SECTION OF HOSPITAL BUILDING

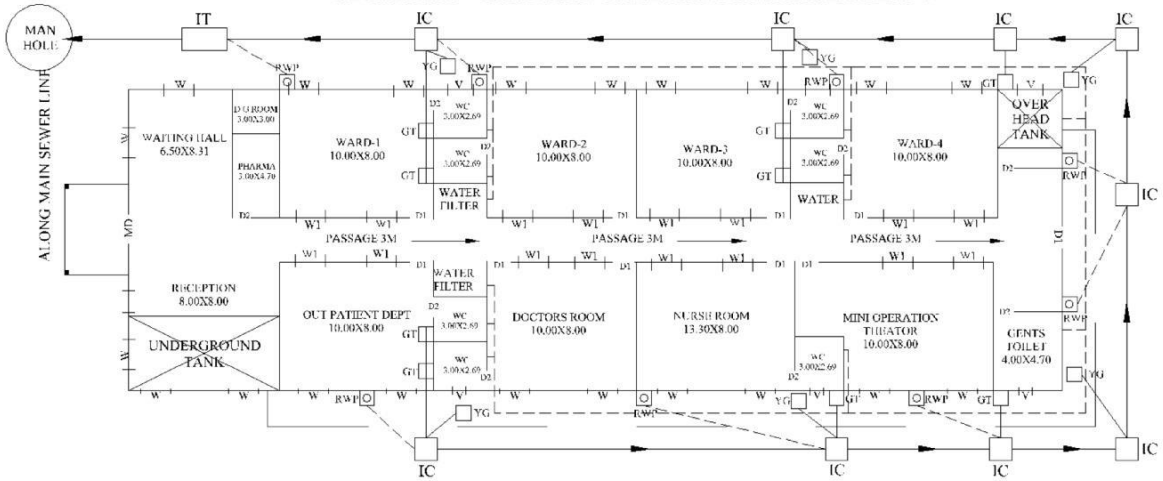


SECTION A-A

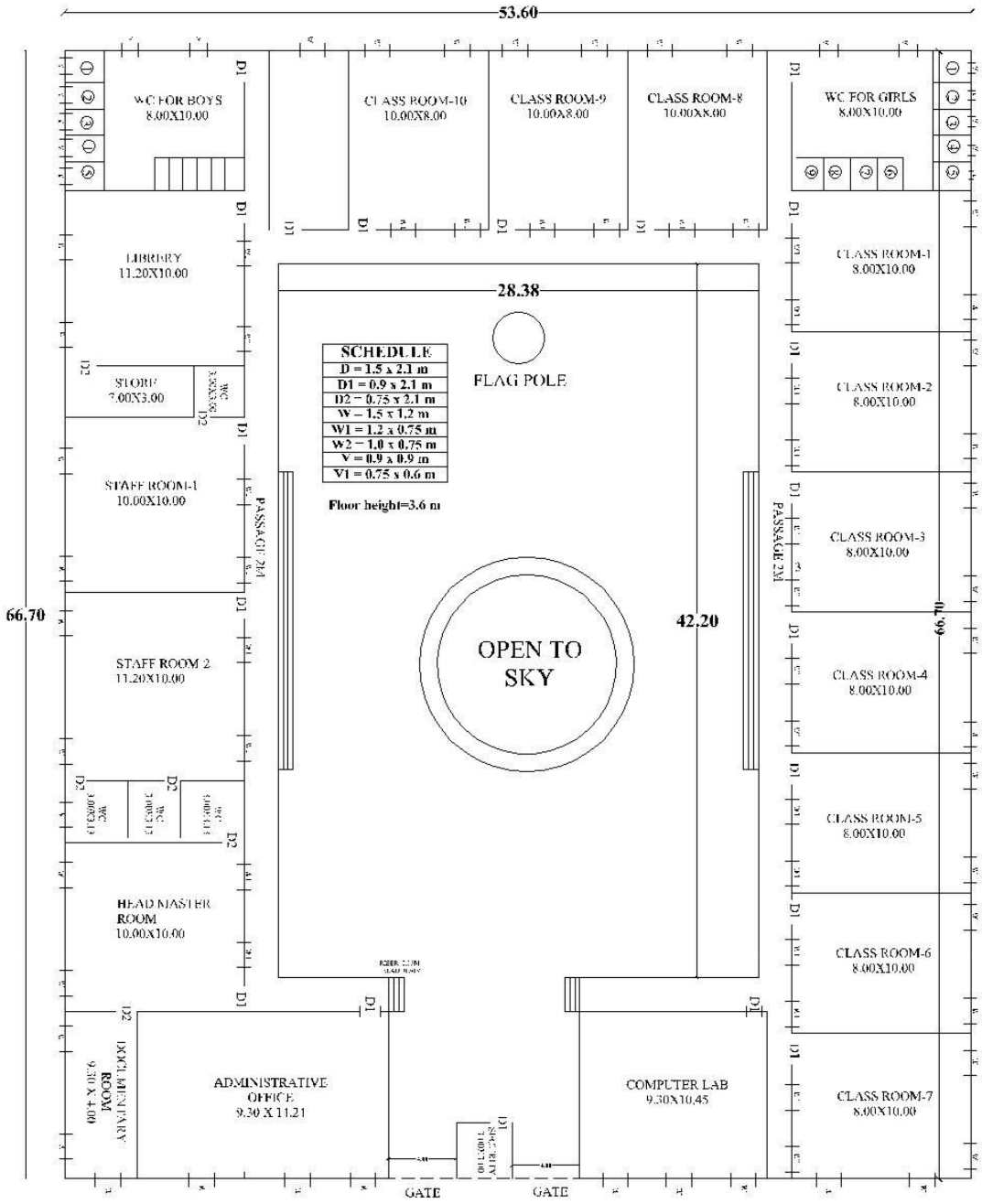
ELECTRICAL SUPPLY FOR HOSPITAL BUILDING



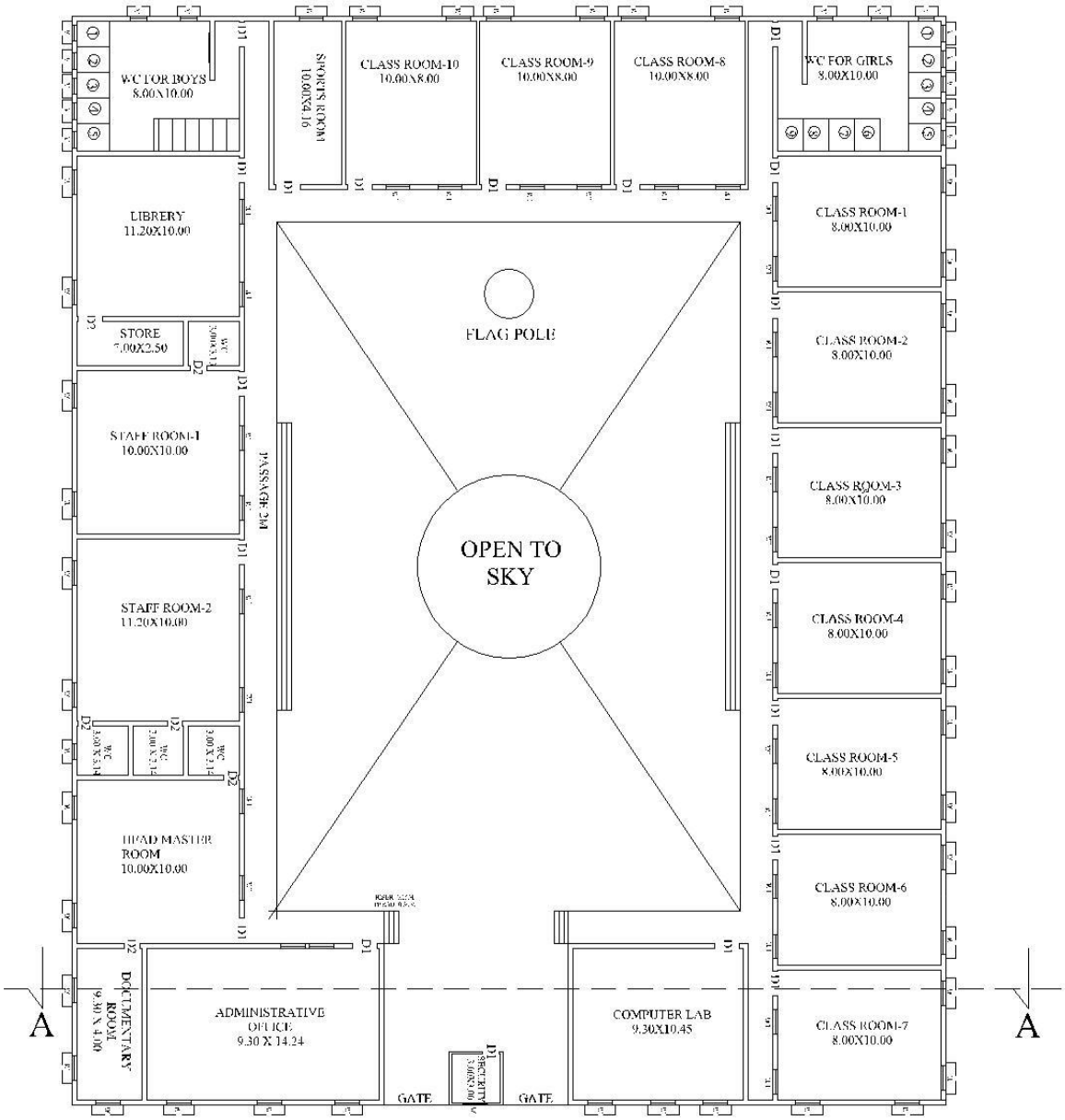
SANITARY AND WATER SUPPLY CONNECTION FOR HOSPITAL BUILDING



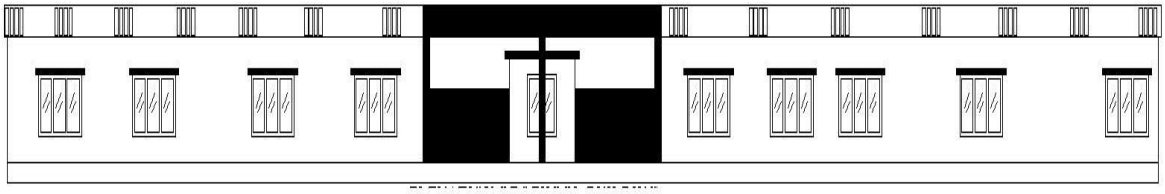
LINE DIAGRAM OF SCHOOL BUILDING



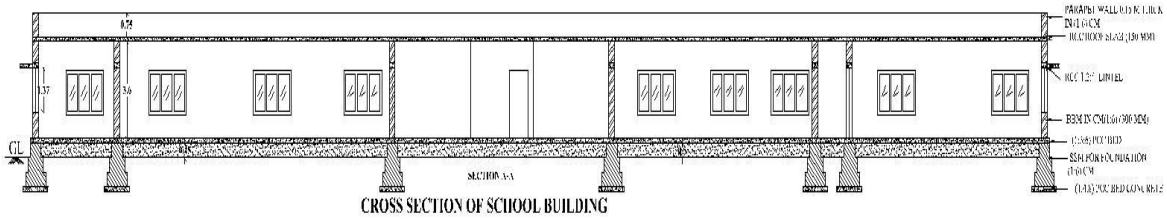
PLAN OF SCHOOL BUILDING



FRONT ELEVATION OF SCHOOL BUILDING

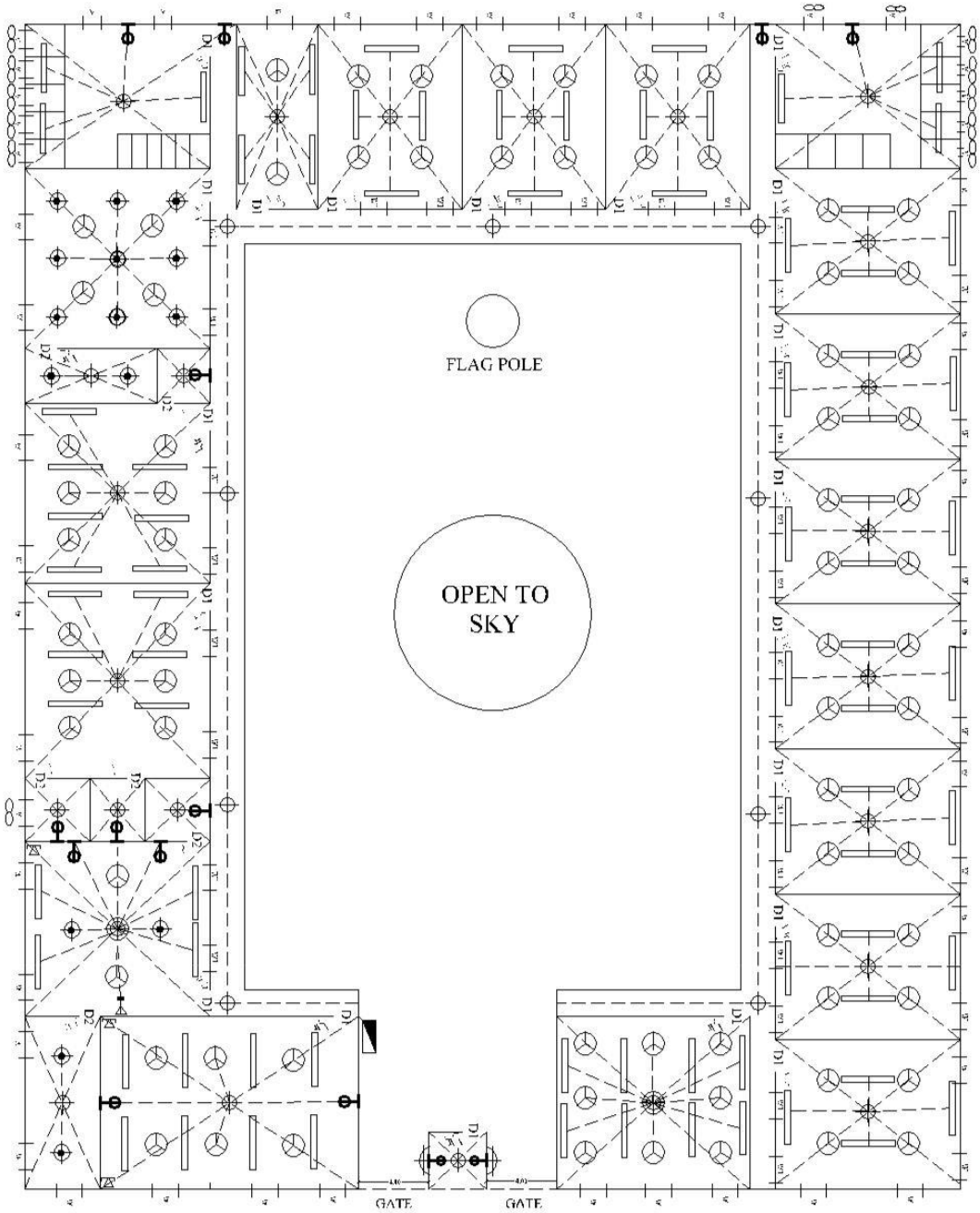


CROSS SECTION OF SCHOOL BUILDING

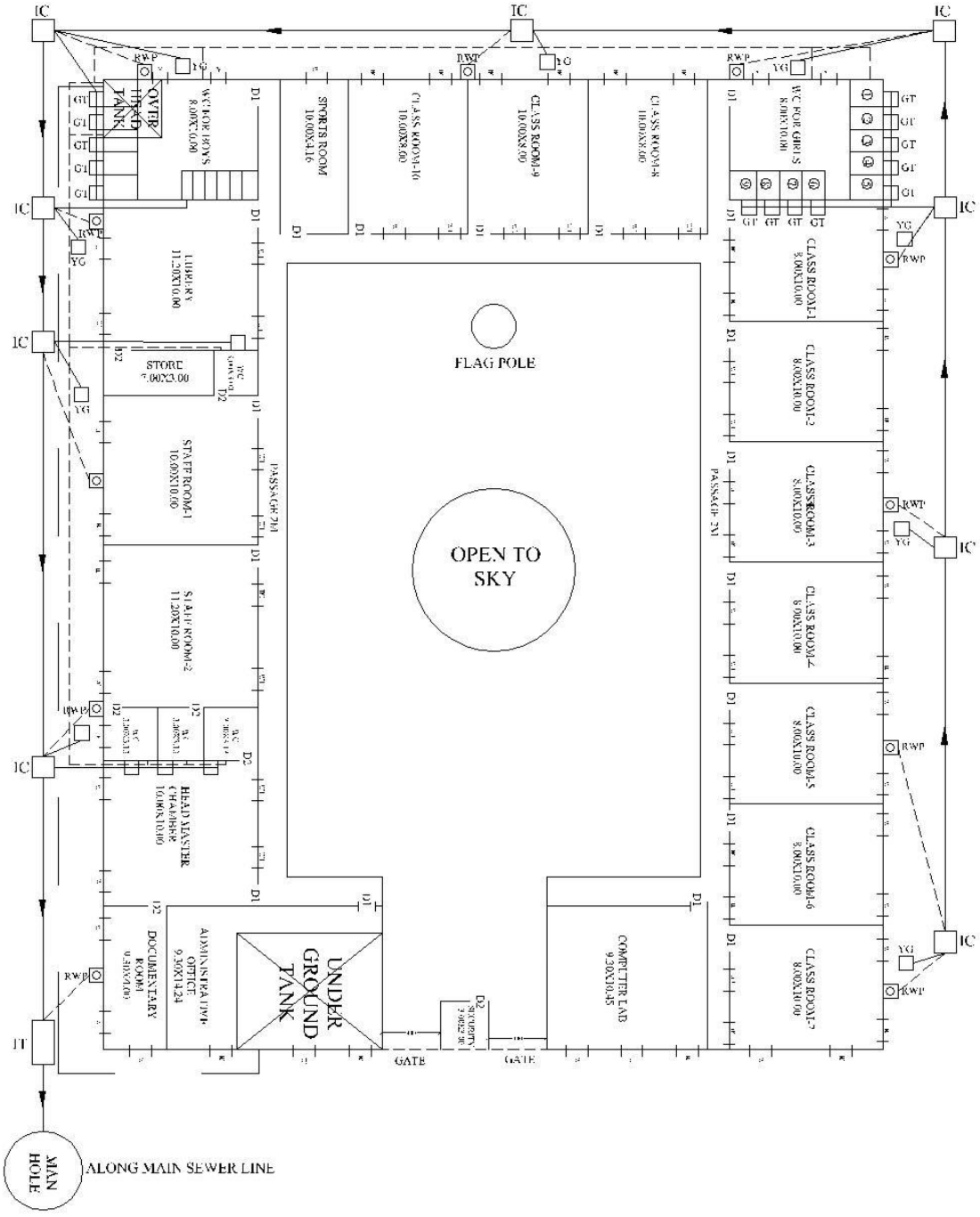


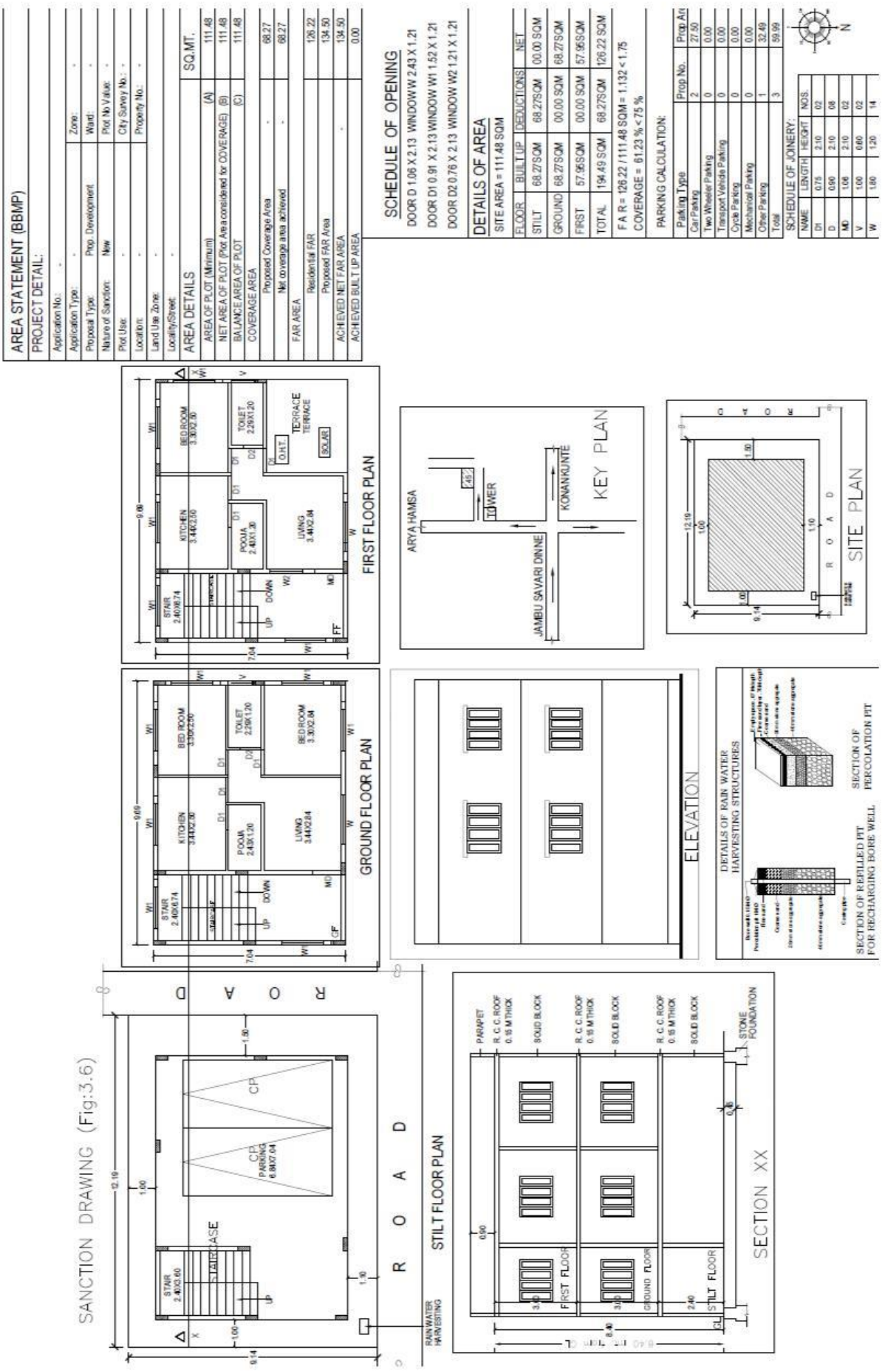
CROSS SECTION OF SCHOOL BUILDING

ELECTRICAL SUPPLY FOR SCHOOL BUILDING



SANITARY AND WATER SUPPLY CONNECTION FOR HOSPITAL BUILDING




AREA STATEMENT (BBMP)
PROJECT DETAIL:
Application No: -
Application Type: - Zone: -
Proposal Type: Prop. Development Ward: -
Nature of Sanction: New Plot No/ Vatub: -
Plot Use: - City Survey No.: -
Location: - Property No.: -
Land Use Zone: -
Locality/Street: -
AREA DETAILS SQ.MT.
AREA OF PLOT (Minimum) (A) 111.48
NET AREA OF PLOT (Plot Area considered for COVERAGE) (B) 111.48
BALANCE AREA OF PLOT (C) 111.48
COVERAGE AREA
Proposed Coverage Area - 68.27
Net coverage area achieved - 68.27
FAR AREA
Residential FAR 126.22
Proposed FAR Area - 134.50
ACHEVED NET FAR AREA - 134.50
ACHEVED BUILT UP AREA 0.00
SCHEDULE OF OPENING
DOOR D 1.06 X 2.13 WINDOW W 2.43 X 1.21
DOOR D1 0.91 X 2.13 WINDOW W1 1.52 X 1.21
DOOR D2 0.76 X 2.13 WINDOW W2 1.21 X 1.21
DETAILS OF AREA
SITE AREA = 111.48 SQM
FLOOR BUILT UP DEDUCTIONS NET
STILT 68.27SQM 68.27SQM 00.00 SQM
GROUND 68.27SQM 00.00 SQM 68.27SQM
FIRST 57.95SQM 00.00 SQM 57.95SQM
TOTAL 194.49 SQM 68.27SQM 126.22 SQM
F A R = 126.22 / 111.48 SQM = 1.132 < 1.75
COVERAGE = 61.23 % < 75 %
PARKING CALCULATION:
Parking Type Prop No. Prop Ar
Car Parking 2 27.50
Two Wheeler Parking 0 0.00
Transport Vehicle Parking 0 0.00
Cycle Parking 0 0.00
Mechanical Parking 0 0.00
Other Parking 1 32.49
Total 3 59.99
SCHEDULE OF JOINERY:
NAME LENGTH HEIGHT NOS
D1 0.75 2.10 02
D 0.90 2.10 08
MD 1.06 2.10 02
V 1.00 0.60 02
W 1.80 1.20 14
FIRST FLOOR PLAN
GROUND FLOOR PLAN
KEY PLAN
ARYA HAMSA
TOWER
JAMEU SAVARI DIN.NE
KONANKUNTE
SITE PLAN
ROAD
ELEVATION
DETAILS OF RAIN WATER HARVESTING STRUCTURES
SECTION OF PERCOLATION PIT
SECTION OF REFILLED PIT FOR RECHARGING BORE WELL
SANCTION DRAWING (Fig:3.6)
STILT FLOOR PLAN
SECTION XX
RAIN WATER HARVESTING
PARAPET
R.C.C. ROOF 0.15 M THICK
SOLID BLOCK
STONE FOUNDATION
FIRST FLOOR
GROUND FLOOR
STILT FLOOR

LEARNING OUTCOMES

- After learning, student will be able to develop the double line diagram, cross-section, front elevation of the single line residential, school, hostel ,hospital buildings.

- In the preparation of drawings of residential, public and industrial buildings.