TRUE SHAPE OF TRUNCATED SOLIDS

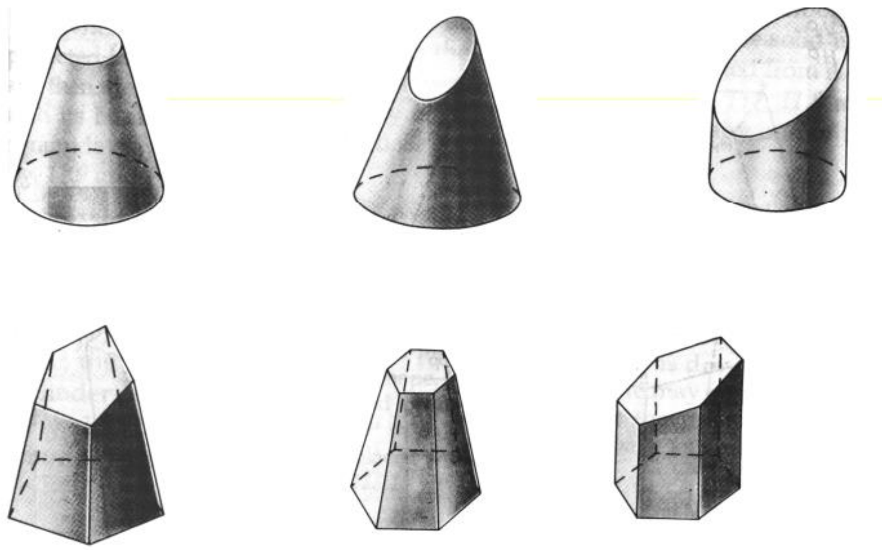
Definition:

In technical drawing, the true shape of truncated solid refers to the accurate representation of the solid's shape after a portion has been cut by a section plane, either parallel or inclined to the base. Types of truncated solids:

- truncated cone
- truncated pyramid
- truncated cylinder
- truncated prism

When prisms, pyramids, cylinders and cones are cut by cutting planes, the lower portion of the solids (without their top portions) are called, either **truncated** or **frustum** of these solids. The name frustum is used when the section plane cuts the solid at right angle to the axis.

Frustum vs. Truncated: If the cutting plane is *parallel* to the base, the remaining lower portion is a **frustum**. If the cutting plane is *inclined* to the base, the lower portion is a **truncated solid**.



Note: The true shape of sections of solids is usually drawn with sectional views, make it easier to visualise too many hidden details on solids. In addition to simple orthographic views, the sectional views could make a lot more sense in visualizing complex internal structures of objects.

- A sectional view, as the name suggests, is obtained by taking the section of the object along a particular plane. An imaginary cutting plane is used to obtain the section of the object.

Theory of Sectioning

- Whenever a section plane cuts a solid, it intersects (and or coincides with) the edges of the solids.
- The point at which the section plane intersects an edge of the solid is called the *point of intersection* (POI).
- In case of the solids having a curved surface, viz., cylinder, cone and sphere, POIs are located between the cutting plane and the lateral lines.

True Shape of sections

The Concept

When an inclined section plane cuts through a solid, looking straight down at the top view gives an **apparent shape** (a distorted foreshortened view). To see the **true shape**, the observer's line of sight must be **perpendicular (**90°**)** to the inclined cutting plane.

POINTS TO NOTE!

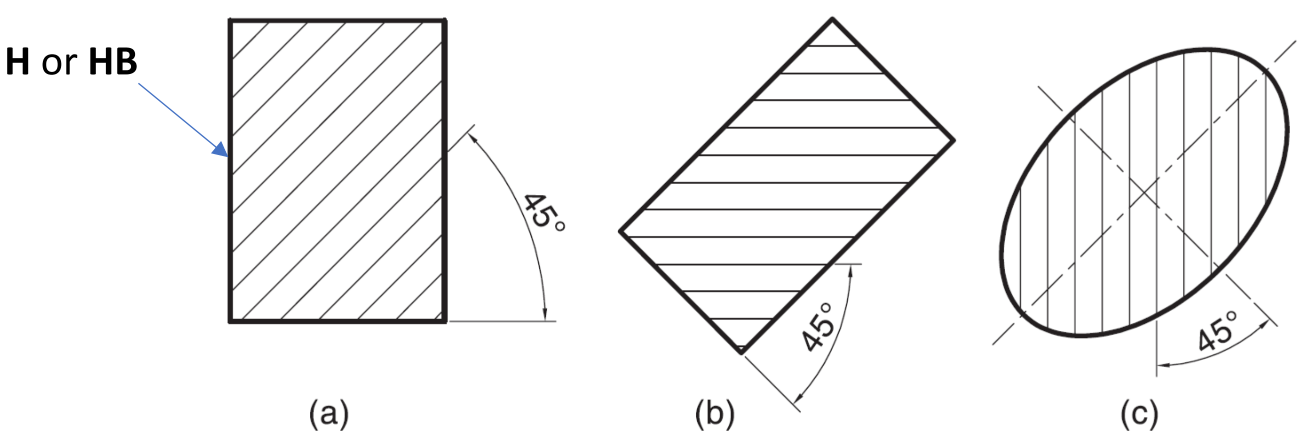
- A section will show its *true shape* when viewed in normal direction.
- To find the true shape of a section, ***it must be projected on a plane parallel to the section plane***.
- For polyhedral, the true shape of the section depends on the number of Points of Intersection. The shape of the section ***will be a polygon of the sides equal to the number*** of Points Of Intersections.
- The true shape of *the section of a sphere* is always a **circle**.
- The sections of prisms and pyramids *are straight line segmented curves*.
- The sections of cylinders and cones will *mostly have smooth curves.*

Types of True Shapes by Solid Geometry

Parent Solid	Section Plane Orientation	Resulting True Shape
Cylinder	Inclined to axis	Ellipse
Cone	Inclined to base (cuts all generators)	Ellipse
Cone	Parallel to one generator (slant height)	Parabola
Cone	Parallel to vertical axis	Hyperbola
Square Prism / Pyramid	Inclined to base	Rectangle or Trapezium / Polygon
Hexagonal Prism	Inclined to base	Elongated Hexagon

Hatching of the sections

- The surface created by cutting the object by a section plane is called a ***section***.
- The section is indicated by drawing the hatching lines (section lines) within the sectioned area.
- The hatching lines are drawn at 45° to the principal outlines or the lines of symmetry of the section
- The spacing between hatching lines should be uniform and in proportion to the size of the section.



Step-by-Step Construction Procedure

To project the True Shape of an **inclined truncated prism/cylinder**:

1.Draw Elevation and Plan: Set up basic views.

Draw the front elevation and plan of the given solid in first or third-angle orthographic projection using $2H$ pencil lines.

2.Position the Cutting Plane: Mark line X-Y.

Draw the cutting plane line ($S - S$ or $X - Y$) across the elevation at the specified angle (e.g., $45°$ or $60°$).

3.Project Perpendicular Generators:90 degrees to section plane.

Using a $30°/60°$ or $45°$ set-square aligned with the cutting line, draw projection lines **perpendicular (**$90°$**)** to the cutting plane from every point where it intersects the solid's edges.

4.Establish a Datum Line: Parallel reference line X1-Y1.

Draw a new reference line ($X_1 - Y_1$) parallel to the cutting plane at a convenient distance to construct the true shape clear of the elevation.

5.Transfer Plan Widths: Use dividers or compass.

Measure the perpendicular distances of corresponding points from the original $X - Y$ reference line on the plan view, and transfer these measurements onto the corresponding projection lines measuring from $X_1 - Y_1$.

6.Join Intersections and Hatch: Finalize with H pencil.

Join the plotted points sequentially with straight lines (for polygonal prisms/pyramids) or a smooth curve/French curve (for cylinders/cones). Hatch the interior cut surface using thin $45°$ parallel lines ($2H$).

WAEC PAST QUESTONS ON TRUE SHAPES OF TRUNCATED SOLIDS

Topic: True Shape of a Truncated Cone

1. The sketch in Fig. 2 shows the elevation of a truncated right cone.

Draw, full size, the:

(a) given views;

(b) plan;

(c) end view in the direction of arrow M;

(d) **true shape of the cut surface. {WAEC (SC) 2021}**

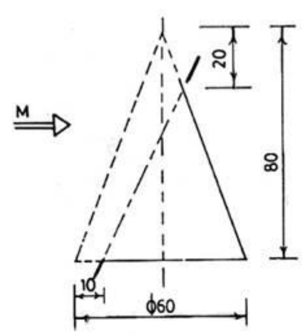
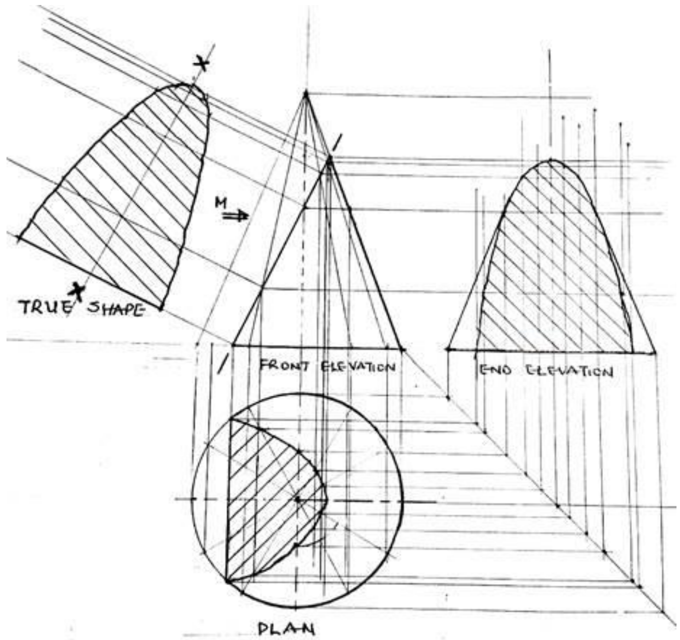


Fig. 2

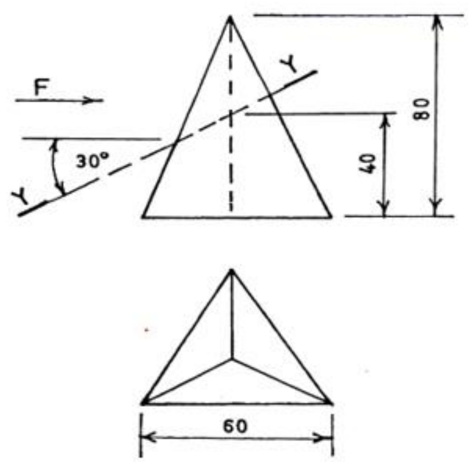
Video on True Shape of a Solid Cone: https://youtu.be/6TPc1-zE4ro

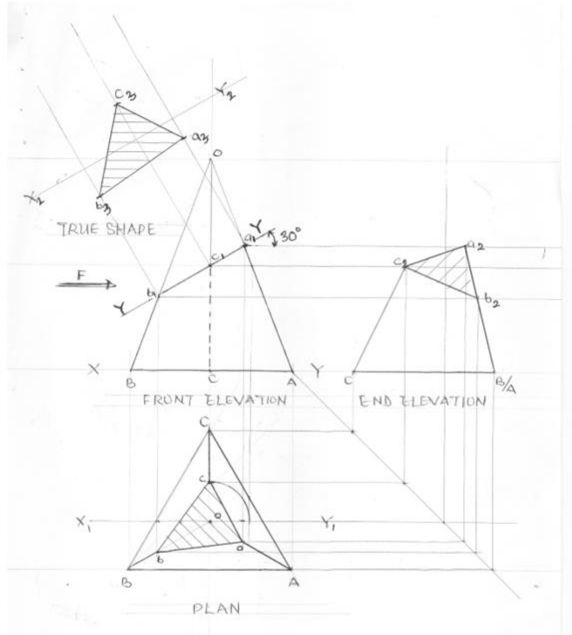
Solution



Topic: True Shape of a Truncated Triangular Pyramid

2. Figure 1 shows an equilateral triangular pyramid cut by plane Y–Y.
   a. Copy the given views.
   b. Draw the end view.
   c. Draw the complete plan.
   d. Draw the **true shape of the cut surface**
   {WAEC (PC) 2020}





Topic: True Shape and Development of a Square Prism

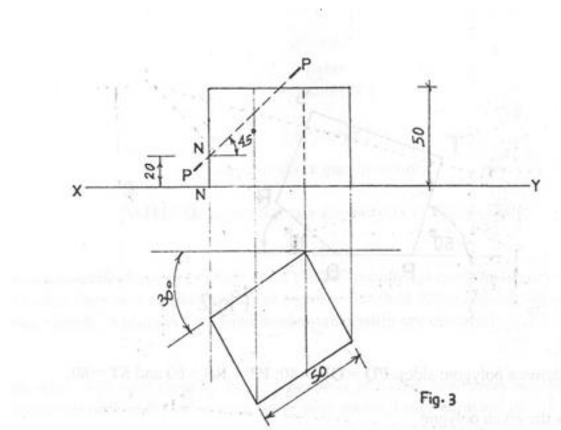


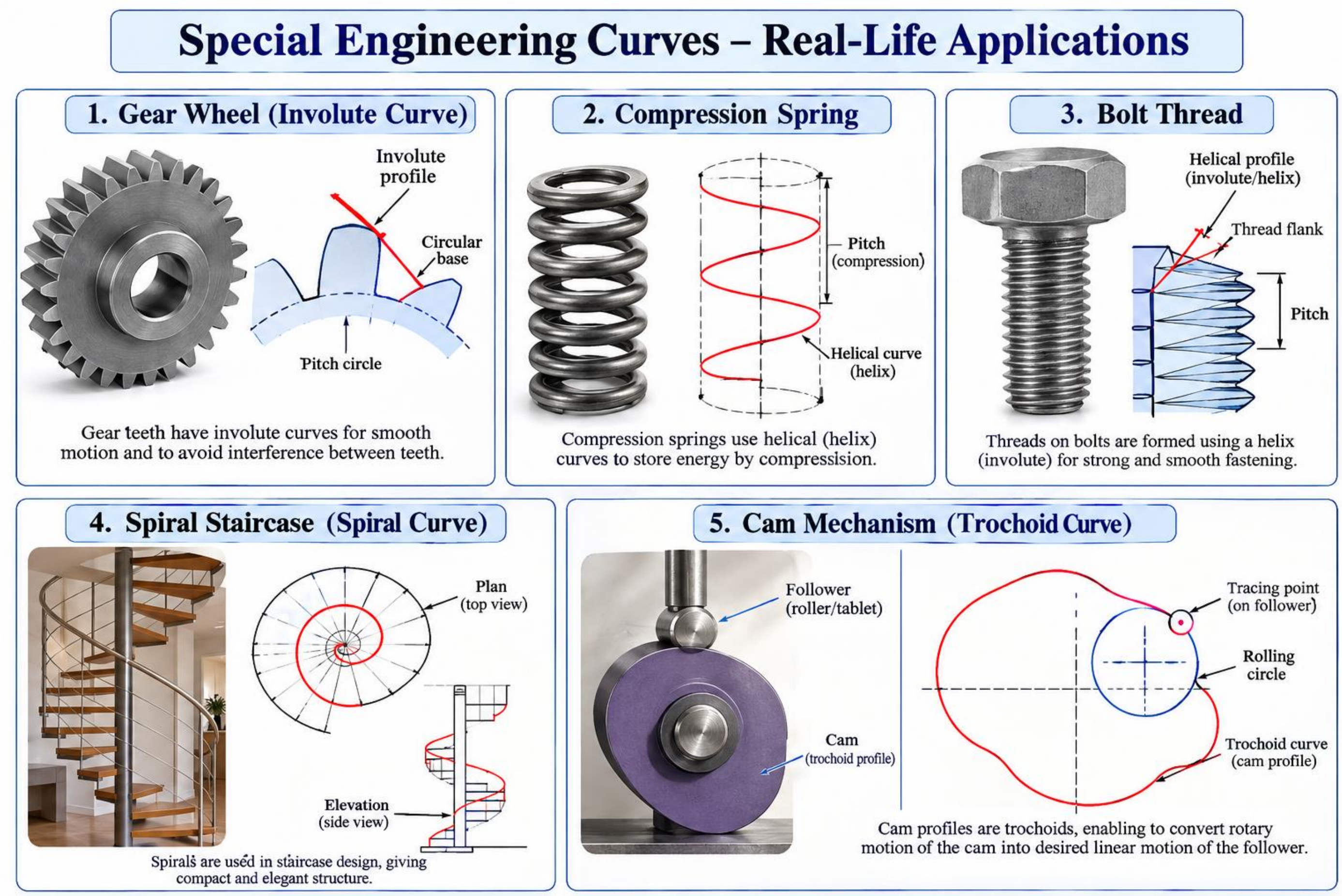
Fig. 3

3. Figure 3 shows the elevation and plan of a square prism cut by plane P-P.
    a. the given views;
    b. the **true shape of the section;**
    c. the complete plan;
    d. the surface development.

SPECIAL ENGINEERING CURVES II

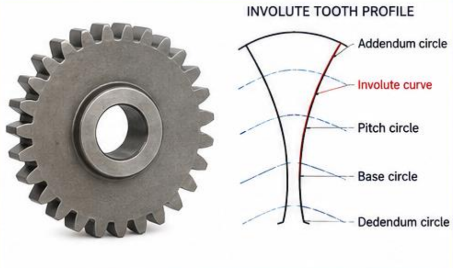
At the end of the lesson, learners should be able to:

1. Explain the basic terms involving the following special engineering curves:
    - Involute
    - Helix
    - Trochoid
    - Archimedean Spiral
2. Construct an involute of any plane figure.
3. Construct helices of both cylinders and cones.
4. Construct an Archimedean spiral.
5. Construct inferior and superior trochoids.


Special Engineering Curves – Real-Life Applications
1. Gear Wheel (Involute Curve)
Involute profile
Circular base
Pitch circle
Gear teeth have involute curves for smooth motion and to avoid interference between teeth.
2. Compression Spring
Pitch (compression)
Helical curve (helix)
Compression springs use helical (helix) curves to store energy by compression.
3. Bolt Thread
Helical profile (involute/helix)
Thread flank
Pitch
Threads on bolts are formed using a helix (involute) for strong and smooth fastening.
4. Spiral Staircase (Spiral Curve)
Plan (top view)
Elevation (side view)
Spirals are used in staircase design, giving compact and elegant structure.
5. Cam Mechanism (Trochoid Curve)
Follower (roller/tablet)
Cam (trochoid profile)
Tracing point (on follower)
Rolling circle
Trochoid curve (cam profile)
Cam profiles are trochoids, enabling to convert rotary motion of the cam into desired linear motion of the follower.

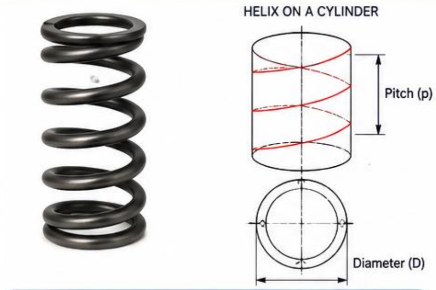
EXAMPLES OF SPECIAL ENGINEERING CURVES IN ENGINEERING OBJECTS

1. GEAR WHEEL (Involute)



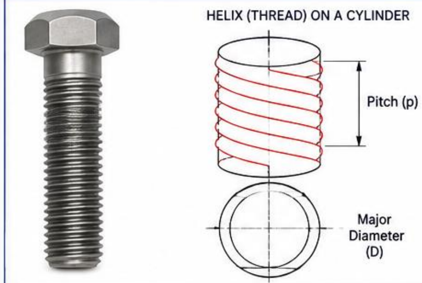
The sides of gear teeth are in the form of an involute curve. This shape ensures smooth and constant velocity ratio between meshing gears.

2. COMPRESSION SPRING (Helix)



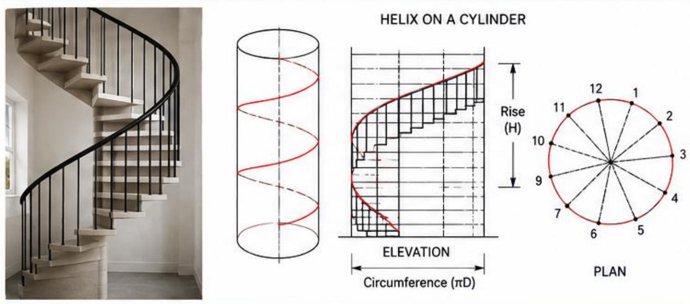
The coil of a spring is a helical curve wound round a cylinder. It stores energy when compressed.

3. BOLT THREAD (Helix)



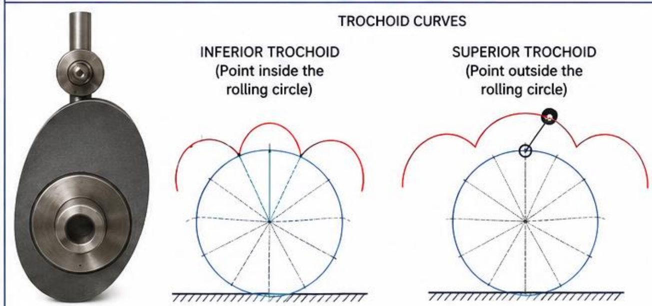
The thread of a bolt or screw is a helical curve. It converts rotational motion into linear motion for fastening.

4. SPIRAL STAIRCASE (Helix)



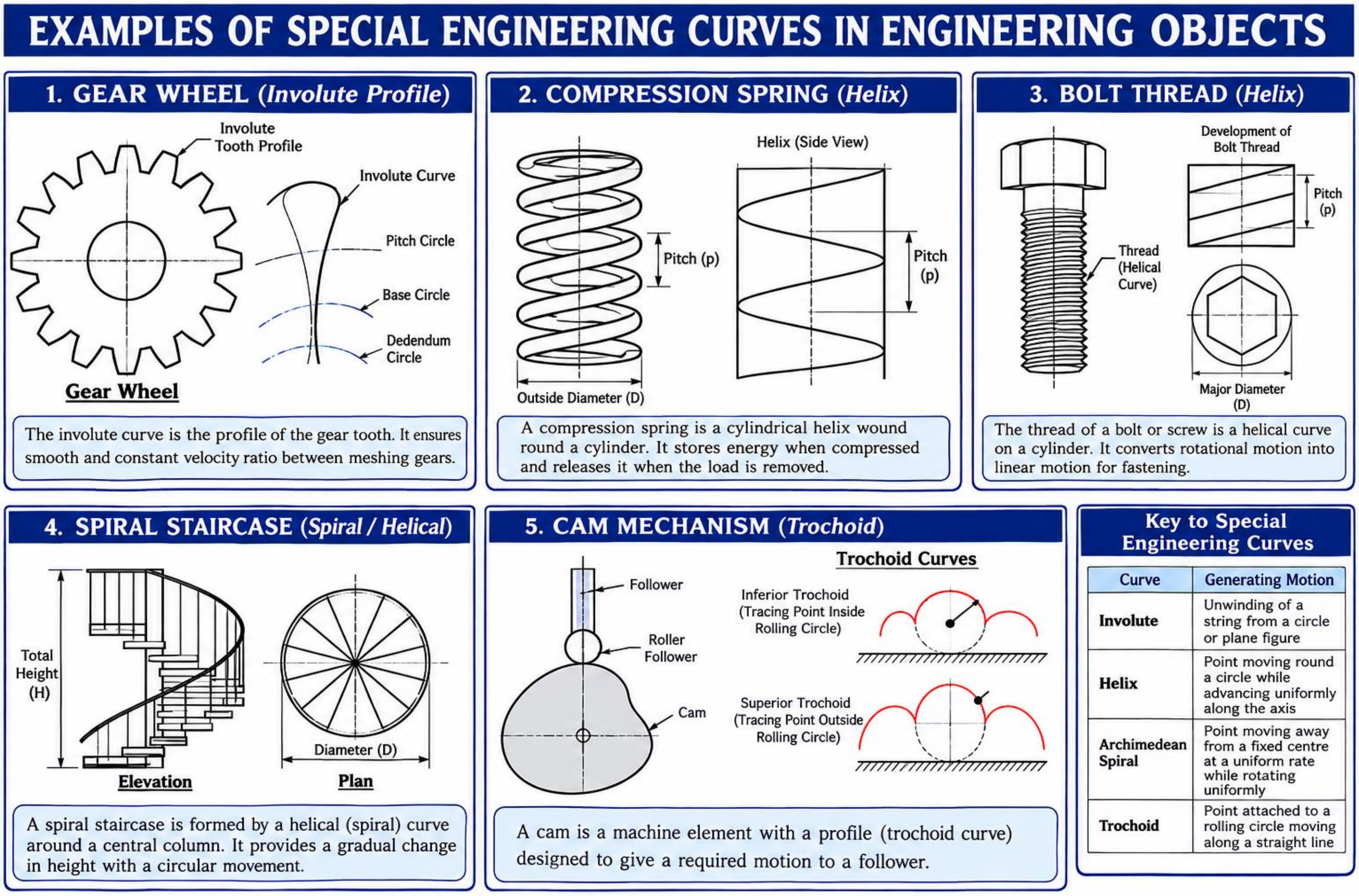
A spiral staircase follows a helical curve around a central column, allowing a continuous rise with uniform pitch.

5. CAM MECHANISM (Trochoid)



The profile of many cams is formed by trochoid curves.
These curves ensure smooth and controlled motion of the follower.

Special Engineering Curves are used in many engineering components to ensure smooth motion, efficiency and strength.



Definition:

Special engineering curves are curves generated by the movement of points under specified conditions.

1. Involute

An involute is the curve traced by the free end of a taut string or thread as it is unwound or unrolled from a circle or any regular plane figure.

Applications

a. Gear tooth profile
b. Rope winding
c. Cam mechanisms

2. Helix

A helix is the curve traced by a point moving uniformly around the circumference of **cylinder** or **cone** while simultaneously moving parallel to its axis.

Types:

- Cylindrical helix
- Conical helix

Applications

a. Screw threads
b. Springs
c. Drilling machines

Some terms associated with helix are:

- Axial Line: a straight line parallel to the longitudinal centre line of the cylinder.
- Pitch/lead/Coil: the axial movement of a point during one complete revolution.
- Left & Right-handed Helix: right-handed helix refers to when the point moves clockwise and away from the observer who looks axially at it, and left-handed helix is when the point moves anti-clockwise from the observer looking axially.

3. Archimedean Spiral

This is the locus of a point moving away from a fixed centre at a uniform rate while rotating uniformly around the centre.

Applications

- Spiral cams
- Gramophone records
- Scroll compressors
- Snail shell design

Some terms associated with helix are:

- Pole: the fixed point about which the line rotates.
- Radius Vector: the line joining any point on the curve within the pole.
- Vectorial Angle: the angle between the line, at any time, and its initial position.
- Convolution: the curve traced out by the moving point for one revolution. There could be any number of convolutions before reaching the final destination.

4. Trochoid

A curve traced by a point which does not lie on the surface of a circle rolling along a fixed straight line without slipping.

Types

- Inferior Trochoid (Point lies inside the rolling circle)
- Superior Trochoid (Point lies outside the rolling circle)

Applications

- Cam profiles
- Roller mechanisms
- Machine design

CONSTRUCTION OF SOME SPECIAL ENGINEERING CURVES

A. Construction of an Involute

E.g. 1 Involute of a Square

Construction Procedure

1. Draw a square ABCD.
2. Produce all sides in the direction of unwinding.
3. Choose point A as the starting point.
4. With centre B and radius BA, draw an arc.
5. With centre C and radius equal to CB + BA, draw another arc.
6. With centre D and radius equal to DC + CB + BA, draw another arc.
7. Continue similarly.
8. Join the successive arcs smoothly to obtain the involute.

E.g. 2 **Involute of a Circle**

Procedure:

- Draw the given circle.
- Divide it into 12 equal parts.
- Draw tangents at each division.
- Transfer successive arc lengths onto the tangents.
- Join the plotted points smoothly.

B. Construction of Helix

E.g. 1. Construction of *Cylindrical Helix* (15 Minutes)

Procedure

1. Draw the elevation of the cylinder.
2. Draw the top view.
3. Divide the top circle into 12 equal parts.
4. Divide the pitch in elevation into 12 equal parts.
5. Project corresponding points.
6. Join smoothly to obtain the helix.

E.g. 2. Construction of *Conical Helix* (10 Minutes)

Procedure

1. Draw the cone.
2. Divide the base circle into equal parts.
3. Divide the axis into equal divisions according to the pitch.

4. Project the corresponding points.
5. Join smoothly.

C. Construction of Archimedean Spiral

Procedure

1. Draw the required maximum radius.
2. Divide the circle into 12 equal sectors.
3. Divide the radius into 12 equal parts.
4. Number both divisions.
5. Plot corresponding points.
6. Join with a smooth continuous curve.

D. Construction of Trochoids

Inferior Trochoid

Construction

1. Draw the directing straight line.
2. Draw the rolling circle.
3. Select a tracing point inside the circle.
4. Divide the circle into 12 equal parts.
5. Roll the circle step by step.
6. Plot the tracing point successively.
7. Join smoothly.

Superior Trochoid

Construction

Repeat the same steps except that the tracing point lies outside the rolling circle.

PRACTICAL CONSTRUCTION OF SPECIAL CURVES

PAST WAEC QUESTIONS

1. SUPERIOR TROCHOID WASSCE (School Candidates) – 2017

A circle rolls along a straight line without slipping.
Plot the locus of the attached point after one complete revolution.
Name the curve obtained.

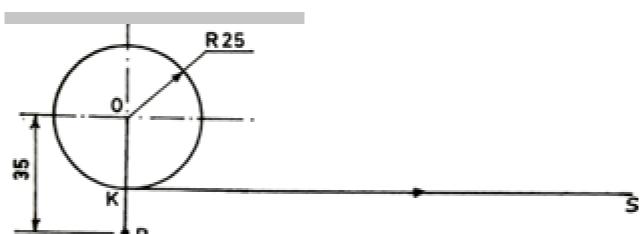
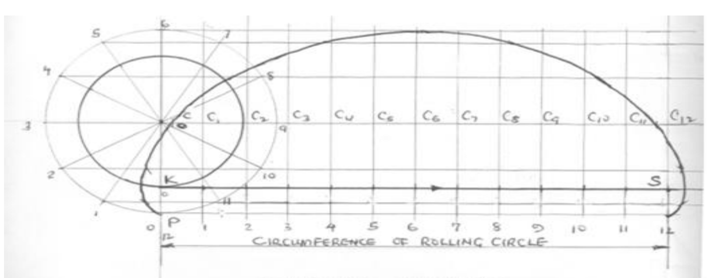


Fig. 2



SOLUTION

2. **WASSCE (School Candidates) – 2021 Q3.**

Construct an **involute of a circle** of radius **20 mm**, starting from the lowest point of the circle and proceeding clockwise.

Draw a tangent to the involute at point **P**, located at **70°** to the right of the vertical centre line.

WAEC Objective-Type Questions (Adapted from Past WAEC Themes)

These are representative questions in the style commonly used by WAEC.

Question 1

The curve traced by the free end of a string as it is unwound from a circle is called

A. Cycloid

B. Helix

C. **Involute**

D. Spiral

Answer: C

Question 2

Which engineering component commonly uses an involute curve?

A. Nut

B. Spring

C. **Gear teeth**

D. Washer

Answer: C

Question 3

The curve generated by a point moving uniformly round a cylinder while simultaneously moving parallel to its axis is

A. Spiral

B. Cycloid

C. Trochoid

D. **Helix**

Answer: D

Question 4

A point moving away from a fixed centre while rotating uniformly describes

A. Ellipse

B. **Archimedean Spiral**

C. Hyperbola

D. Cycloid

Answer: B

Question 5

If the tracing point lies **outside** the rolling circle, the curve formed is

A. Inferior Trochoid

B. Cycloid

C. **Superior Trochoid**

D. Helix

Answer: C

Summary

The teacher summarizes that:

Curve	**Generated By**	**Common Applications**
Involute	Unwinding of string	Gear teeth, cams
Cylindrical Helix	Rotation + axial movement	Springs, screws
Conical Helix	Rotation + movement on cone	Spiral conveyors
Archimedean Spiral	Uniform rotation + increasing radius	Scrolls, cams
Inferior Trochoid	Point inside rolling circle	Machine cams
Superior Trochoid	Point outside rolling circle	Mechanical linkages

Question 1

Construct a cylindrical helix on a cylinder of diameter **50 mm** and pitch **75 mm**.

Question 2

Construct a conical helix on a cone of base diameter **60 mm** and height **90 mm**.

Question 3

Construct an Archimedean spiral of three complete revolutions with a maximum radius of **75 mm**.

Question 4

Construct an inferior trochoid using a rolling circle of radius **30 mm,** whose point lies 10mm from the centre of the rolling circle.

Question 5

Construct a superior trochoid using a rolling circle of radius **25 mm**, whose point lies 15mm from the centre of the rolling

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Question 6

Construct an involute of a regular hexagon of side **20 mm**.

Assignment

1. Construct the involute of a regular hexagon of side **30 mm**.
2. Draw a cylindrical helix on a cylinder of **50 mm diameter** with **75 mm pitch**.
3. Construct an Archimedean spiral of **five revolutions** with a maximum radius of **75 mm**.
4. Draw both an inferior trochoid and a superior trochoid using a rolling circle of **40 mm diameter**, clearly indicating the location of the tracing point.
5. State **two engineering applications** each of the involute, helix, Archimedean spiral, and trochoid.

BULDING DESIGNS & WORKING DRAWINGS

<u>Concept of Building Design</u>

Definition

Building Design is the process of planning and arranging the various parts of a building so that it satisfies functional, aesthetic, structural and safety requirements.

It involves deciding:

- Size of rooms
- Location of doors and windows
- Position of bathrooms and kitchen
- Electrical installations
- Plumbing layout
- Structural arrangement

Importance of Building Design

- Ensures functionality
- Improves comfort
- Promotes safety
- Reduces construction errors
- Saves construction cost
- Enhances appearance

Working Drawing

Definition

A **Working Drawing** is a detailed drawing prepared for construction purposes. It gives complete information required by builders, engineers and artisans to construct a building.

Characteristics of Working Drawings

- Accurate
- Fully dimensioned
- Drawn to scale
- Easy to interpret
- Contains symbols
- Includes construction details

Types of Working Drawings

- Site plan
- Floor plan
- Foundation plan
- Roof plan
- Elevations

- Sections
- Electrical layout
- Plumbing layout
- Door and window schedule

Building Design Process

The building design process follows several stages.

1. Client's Brief

The owner explains:

- Purpose of the building
- Number of rooms
- Budget
- Special requirements

2. Site Investigation

Study of:

- Land size
- Soil condition
- Drainage
- Access road
- Orientation
- Climate

3. Preliminary Sketches

Architect prepares rough sketches showing possible room arrangement.

4. Design Development

Sketches are improved after discussions with the client.

5. Working Drawings

Detailed drawings are produced for construction.

6. Approval

Building plans are submitted to planning authorities.

7. Construction

Builders follow the approved working drawings.

Building Plan Sketches

Definition

A **Building Plan Sketch** is a rough drawing showing the arrangement of rooms before producing the final working drawing.

Purpose

- Visualize the building
- Arrange rooms properly
- Improve circulation
- Detect design errors early
- Discuss ideas with clients

Features of Good Plan Sketches

- Proper room arrangement
- Functional circulation
- Correct orientation
- Adequate lighting
- Ventilation
- Simplicity

Floor Plan

Definition

A **Floor Plan** is a horizontal section through a building drawn approximately 1 metre above the floor level.

It shows:

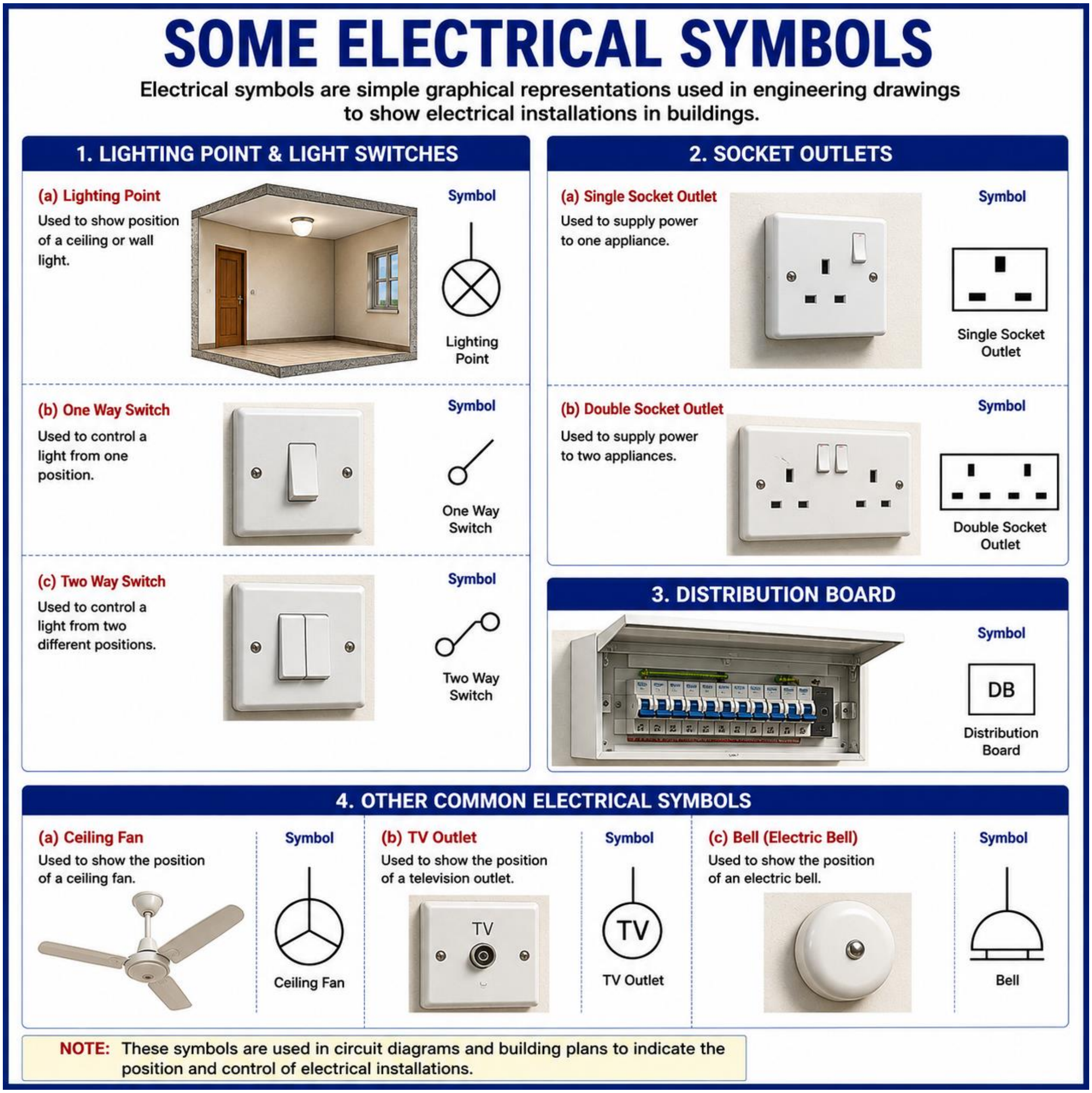
- Walls
- Doors
- Windows
- Rooms
- Dimensions
- Staircases
- Fixtures

Information Found on Floor Plans

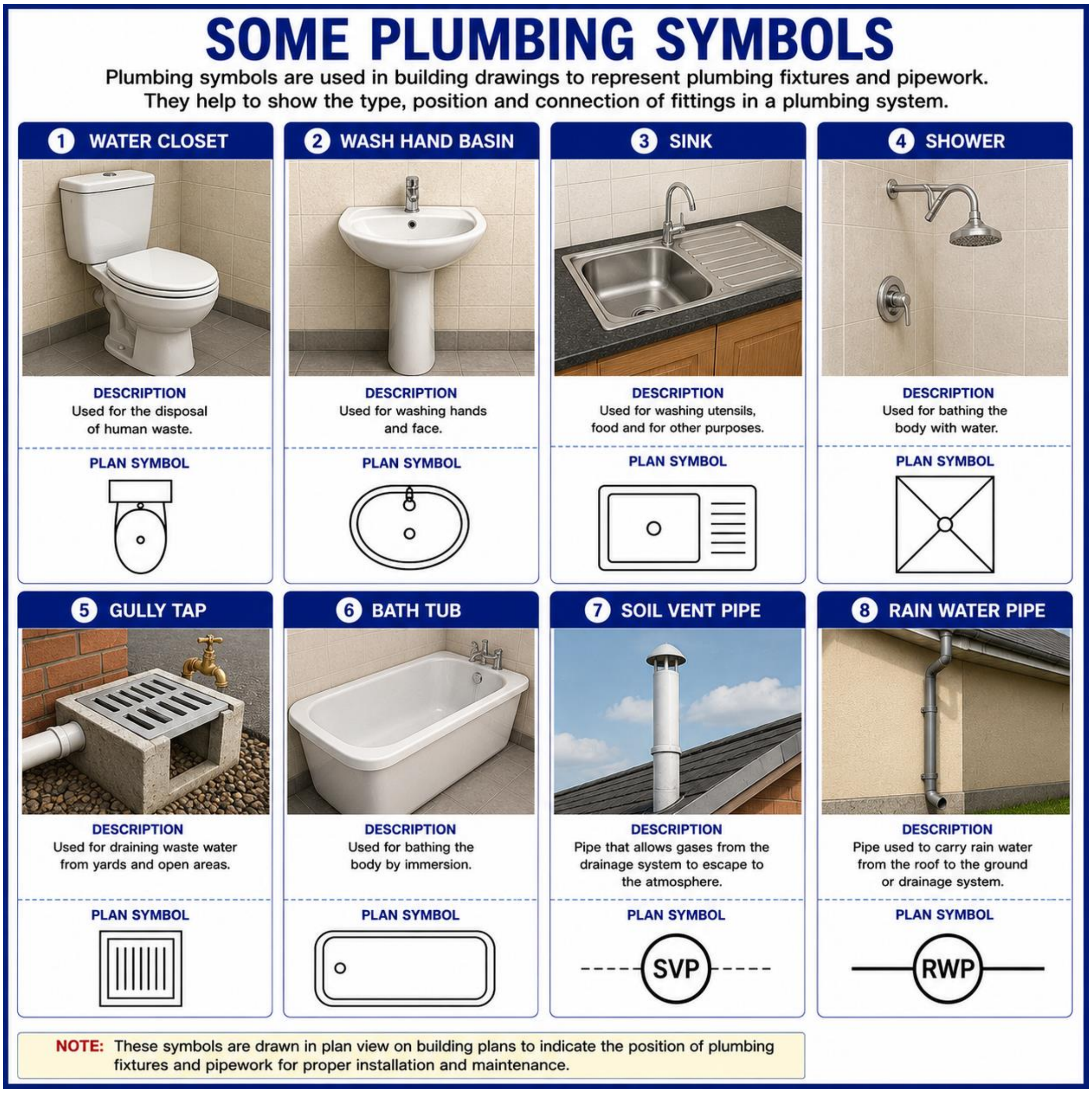
- Room names

- Wall thickness
- Door sizes
- Window sizes
- Dimensions
- Symbols

Common Electrical Symbols



Common Plumbing Symbols



Building Elevation

Definition

A **building elevation** is the orthographic projection showing the external appearance of one side of a building.

Elevations are drawn directly from the floor plan.

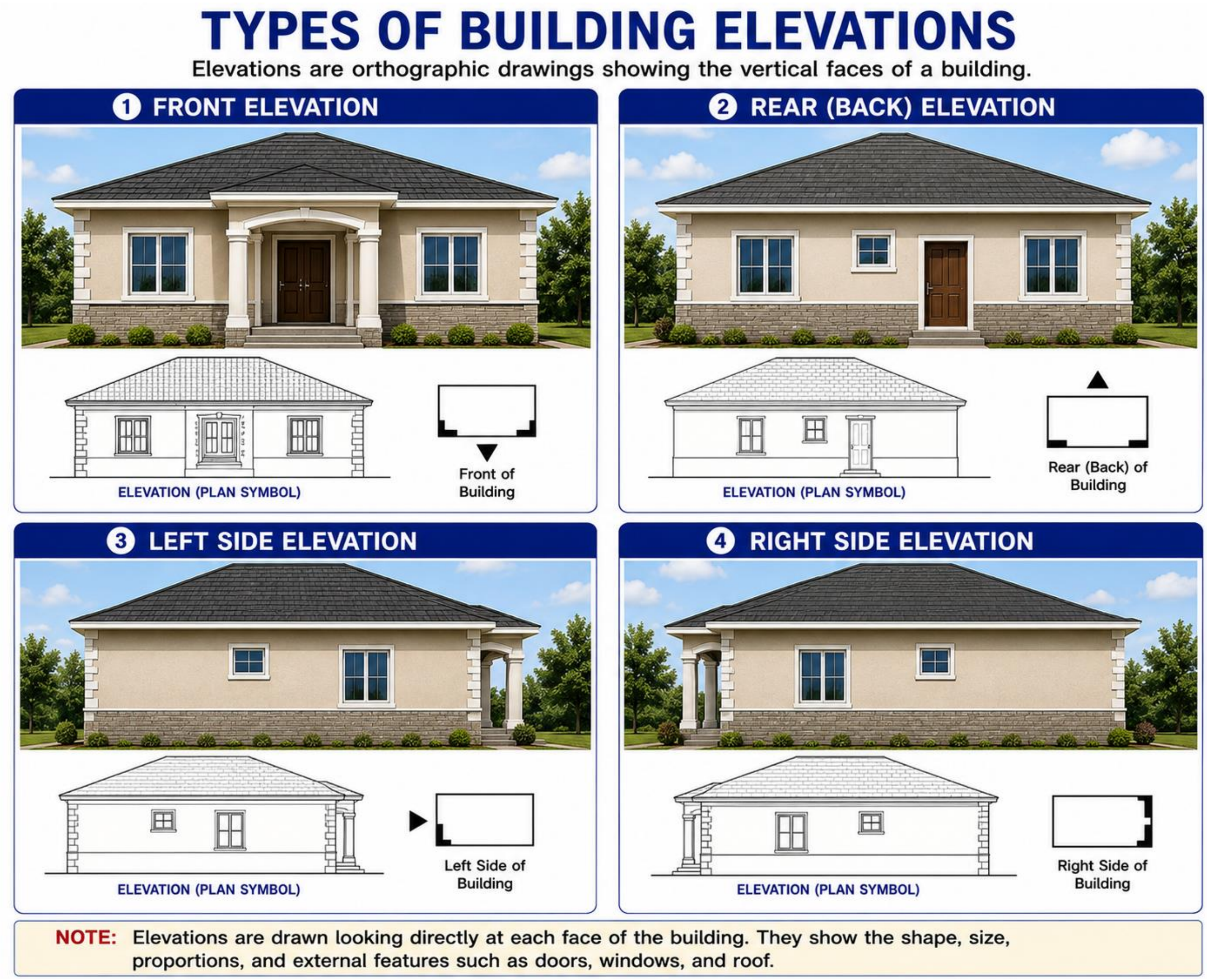
They show:

- Height
- Roof shape
- Doors

- Windows
- Verandas
- Columns
- External finishes
- Levels

Types of Building Elevations

1. Front Elevation
2. Rear (Back) Elevation
3. Left Side Elevation
4. Right Side Elevation



Importance of Elevations

- Show the appearance of the building.
- Indicate heights of doors and windows.
- Show roof details.
- Assist builders during construction.
- Aid approval by planning authorities

Rear Elevation

The rear elevation shows:

- Rear doors
- Kitchen exit
- Back windows
- Service areas
- Roof details

Left and Right-Side Elevations

Definition

Side elevations are the views obtained from either side of the building.

They show:

- Side windows
- Wall finishes
- Roof slopes
- Chimneys (if available)
- Side entrances
- External details

Procedure

- Project from floor plan.
- Transfer measurements.
- Draw roof profile.
- Draw doors and windows.
- Complete outlines.

- Add dimension

Sectional Building Drawings

Definition

A **sectional drawing** is a drawing obtained by imagining the building cut through by an imaginary cutting plane and removing one portion to expose the internal construction.

Purpose of Sectional Drawings

They reveal:

- Internal walls
- Floor construction
- Roof structure
- Ceiling
- Foundation
- Staircase
- Beams
- Columns

Types of Sections

1. Longitudinal Section

Cutting plane runs along the length of the building.

---

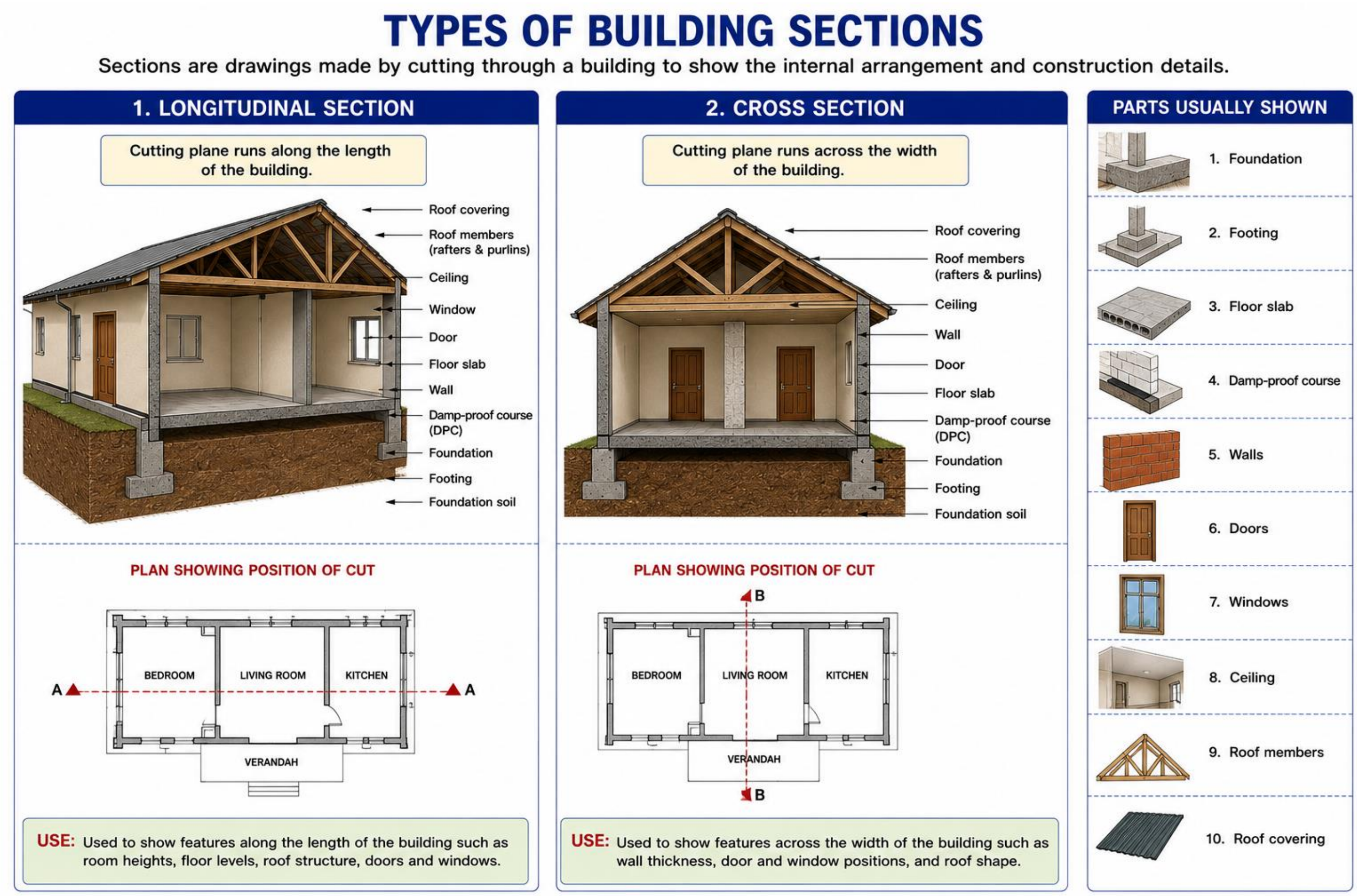
2. Cross Section

Cutting plane runs across the width of the building.

Parts Usually Shown

- Foundation
- Footing
- Floor slab
- Damp-proof course
- Walls
- Doors

- Windows
- Ceiling
- Roof members
- Roof covering



Section Lines

Cut surfaces are indicated using 45° hatch lines.

Question 1 (WASSCE 2016)

A sketch plan of a bungalow together with its specifications was provided.

Required:

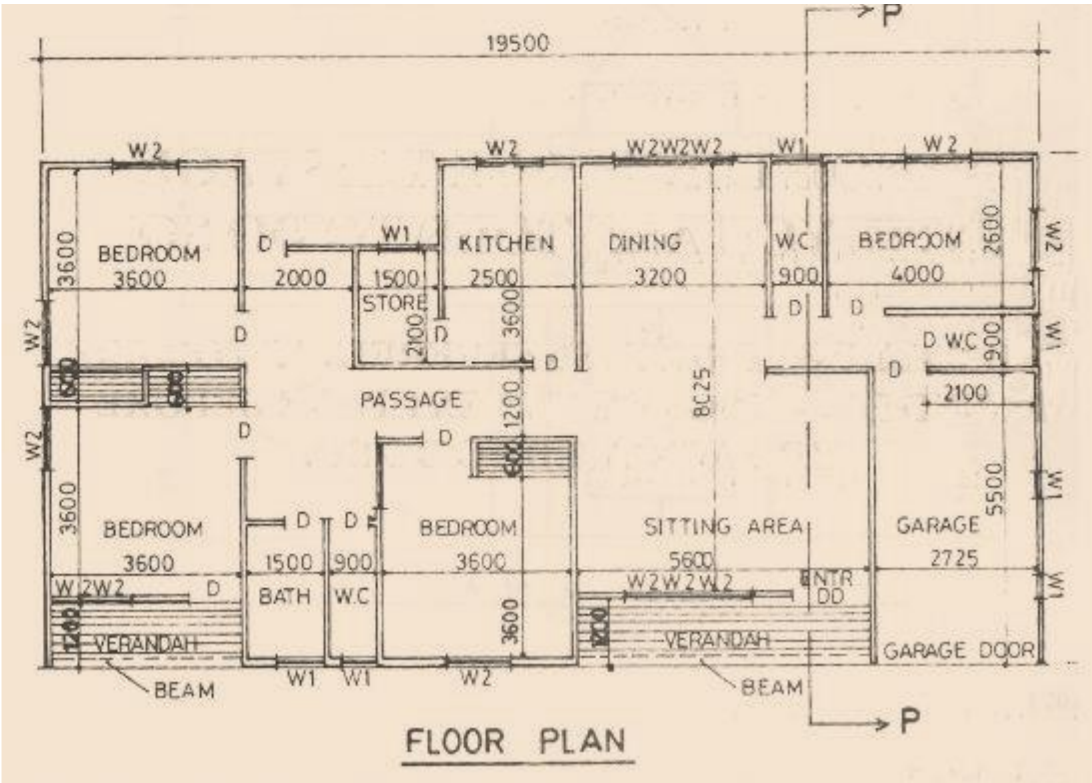
Using the given specifications:

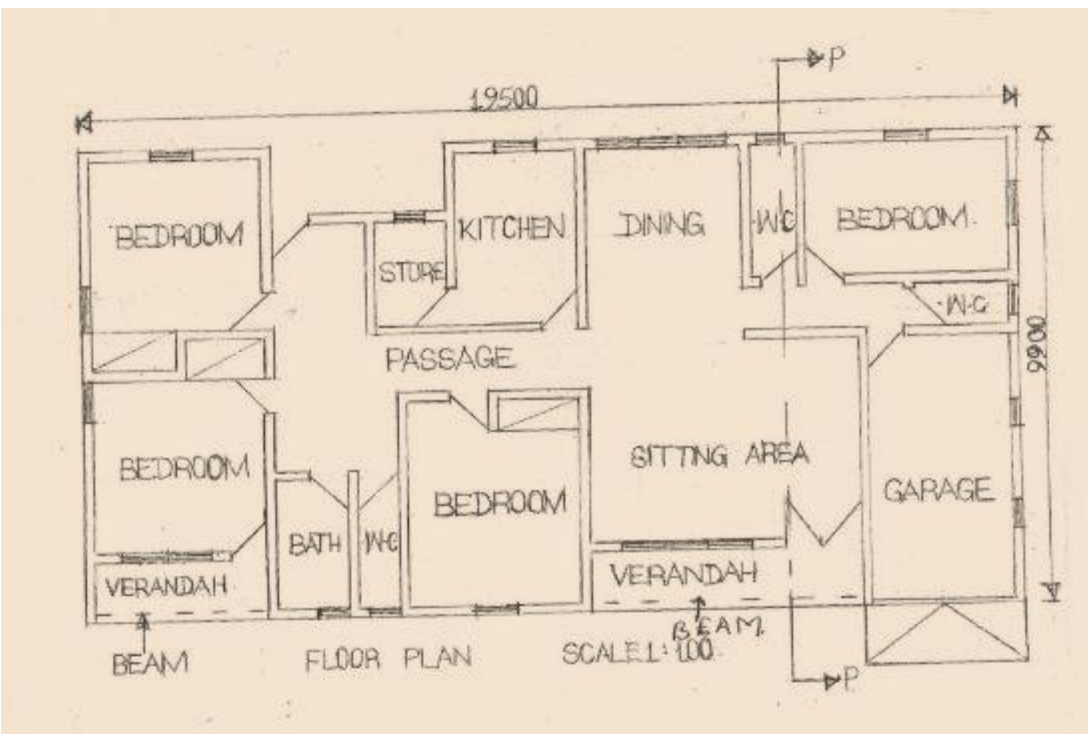
1. Draw, to a scale of **1:100**, the:

a. Floor Plan

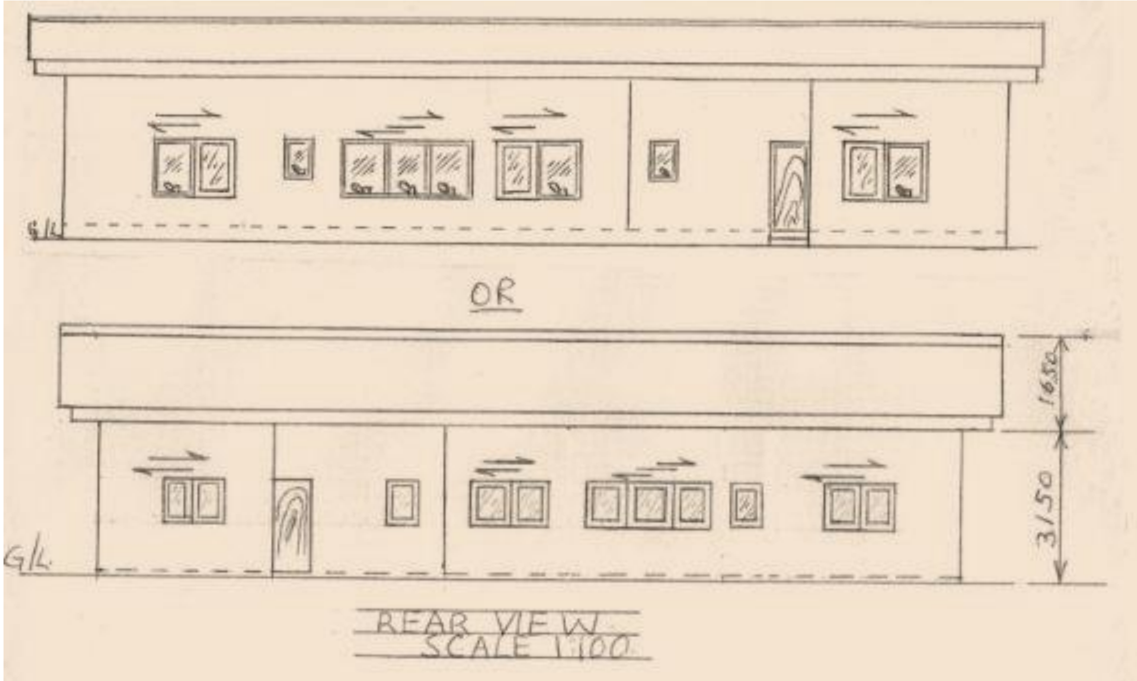
b. Rear Elevation

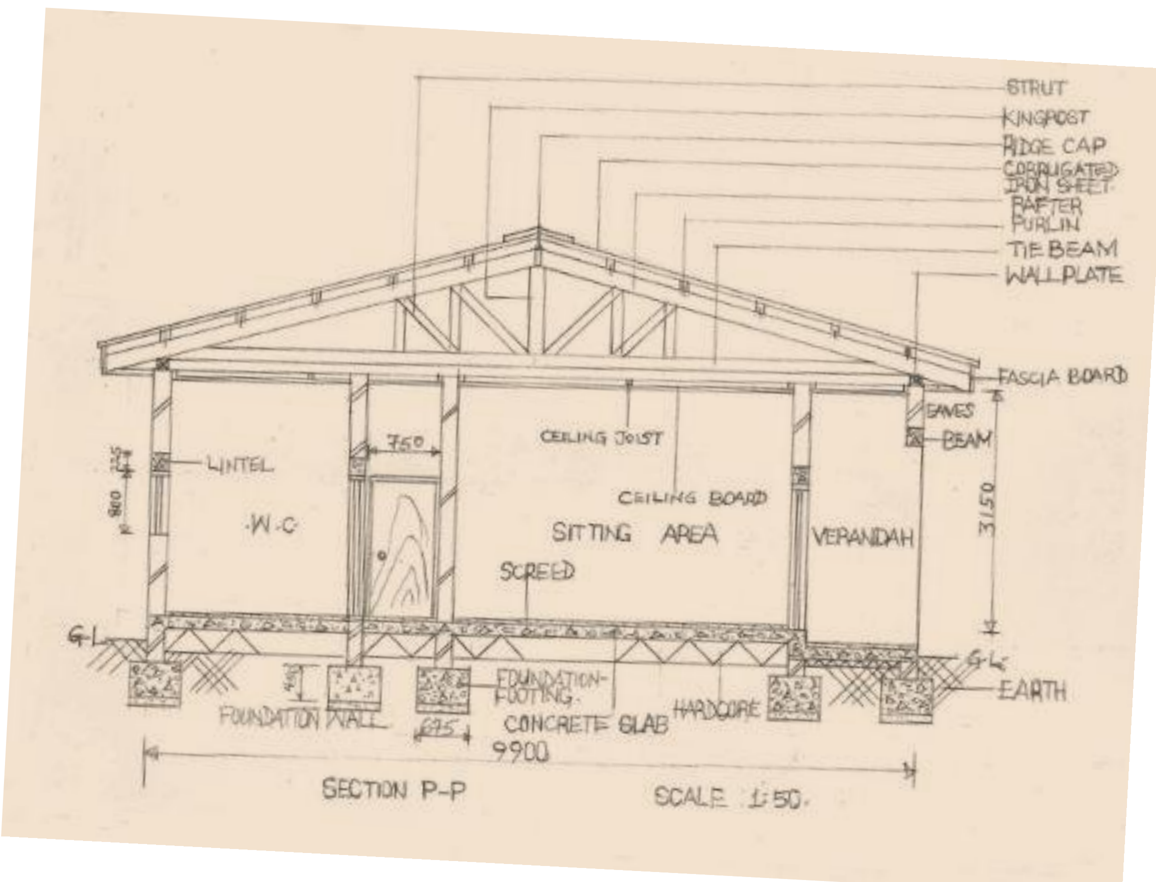
2. Draw, to a scale of **1:50**, the **Section on Plane P–P**.





FLOOR PLAN





Question 2 (WASSCE 2017)

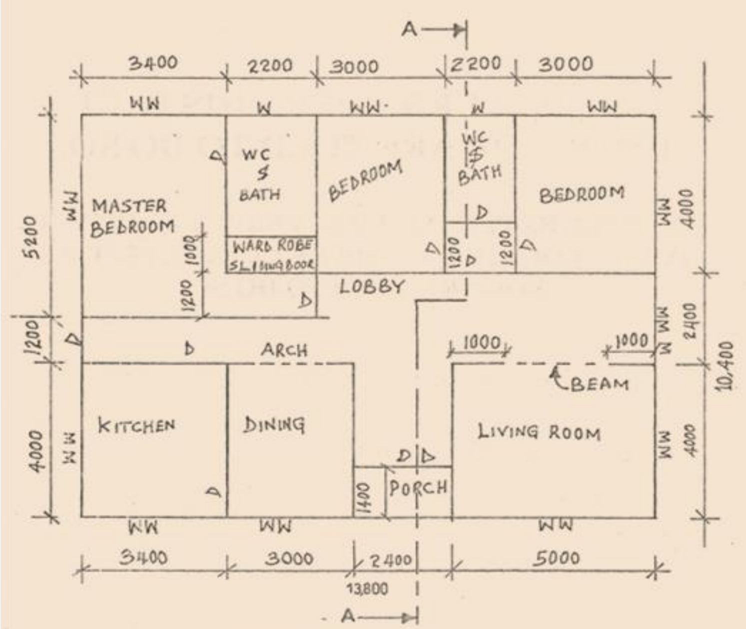
A bungalow plan with specifications was supplied.

Required

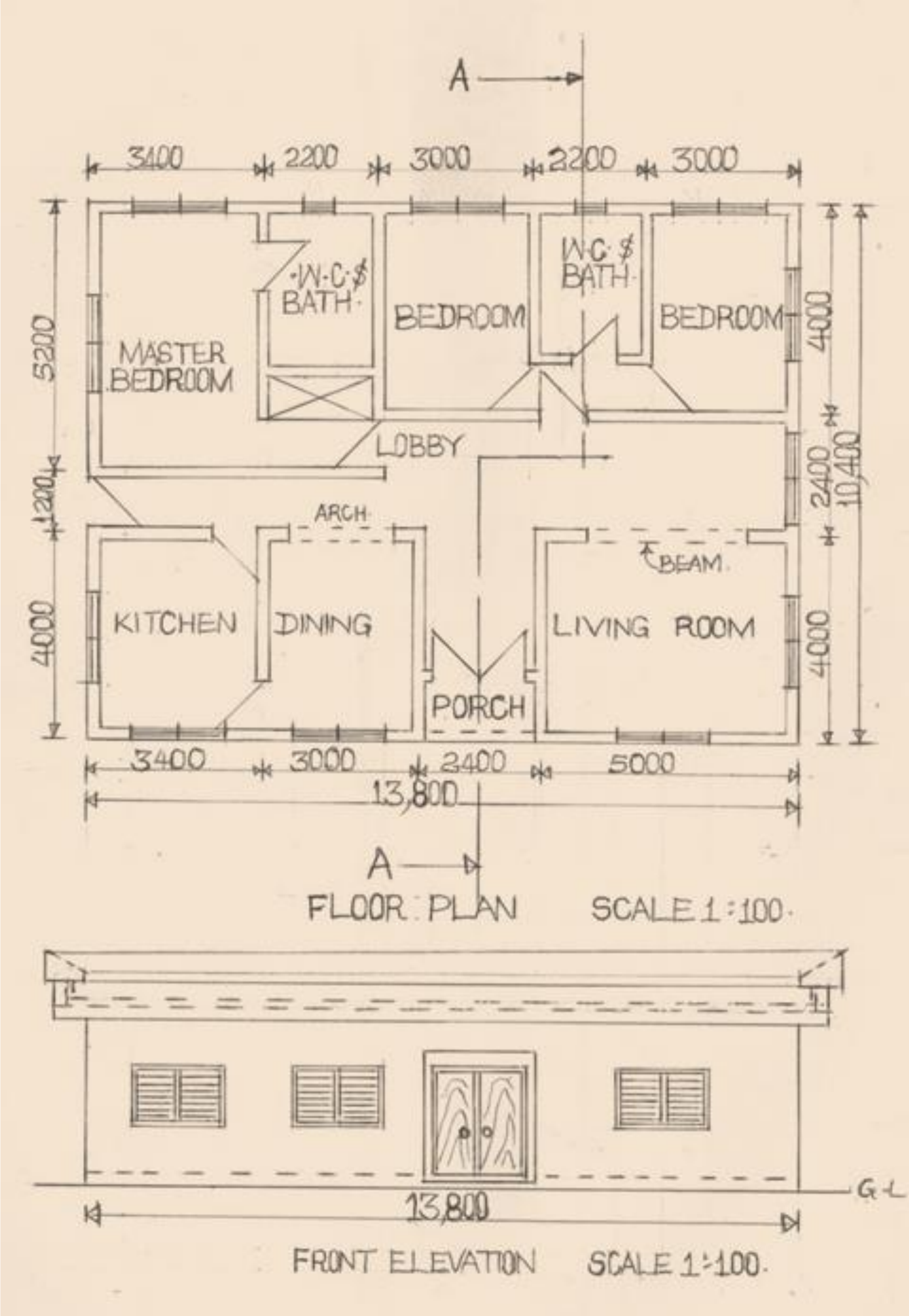
(a) Draw to a scale of **1:100**

- Floor Plan
- Front Elevation

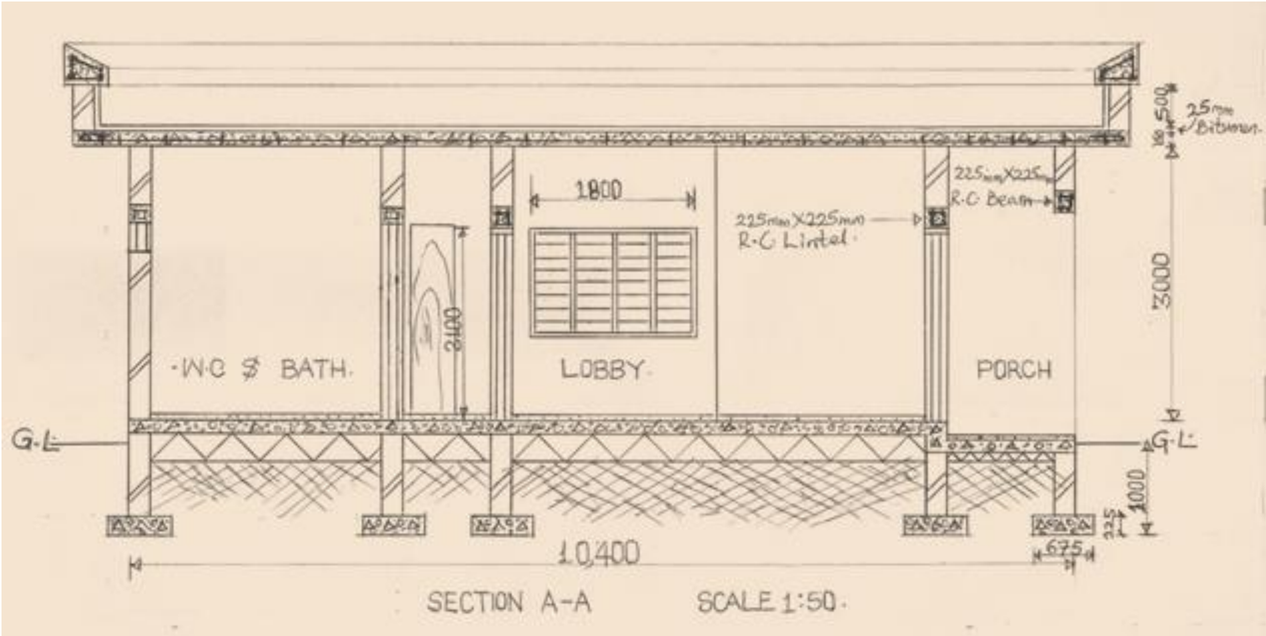
(b) Draw the **Section A–A** to a scale of **1:50**.



FLOOR PLAN
SCALE 1:100



A
3400
2200
3000
2200
3000
5200
1200
4000
W.C. $
BATH
MASTER
BEDROOM
BEDROOM
BEDROOM
4000
2400
10,400
LOBBY
ARCH
BEAM
KITCHEN
DINING
LIVING ROOM
PORCH
3400
3000
2400
5000
13,800
A
FLOOR PLAN SCALE 1:100
G-L
13,800
FRONT ELEVATION SCALE 1:100



Question 3 (WASSCE 2018)

A residential bungalow and specifications were supplied.

Required

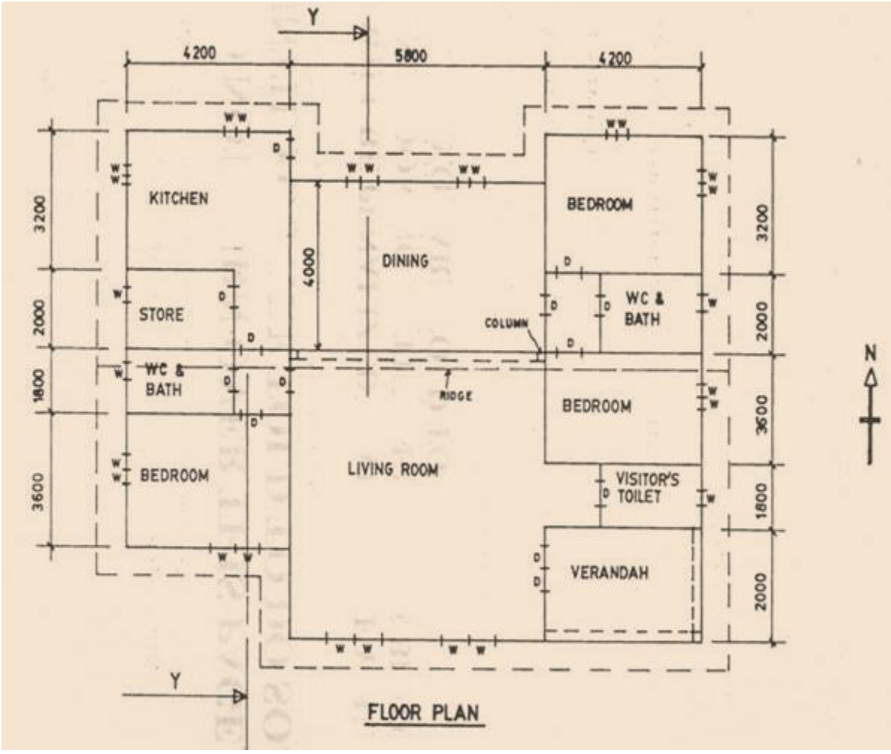
Using the given specifications:

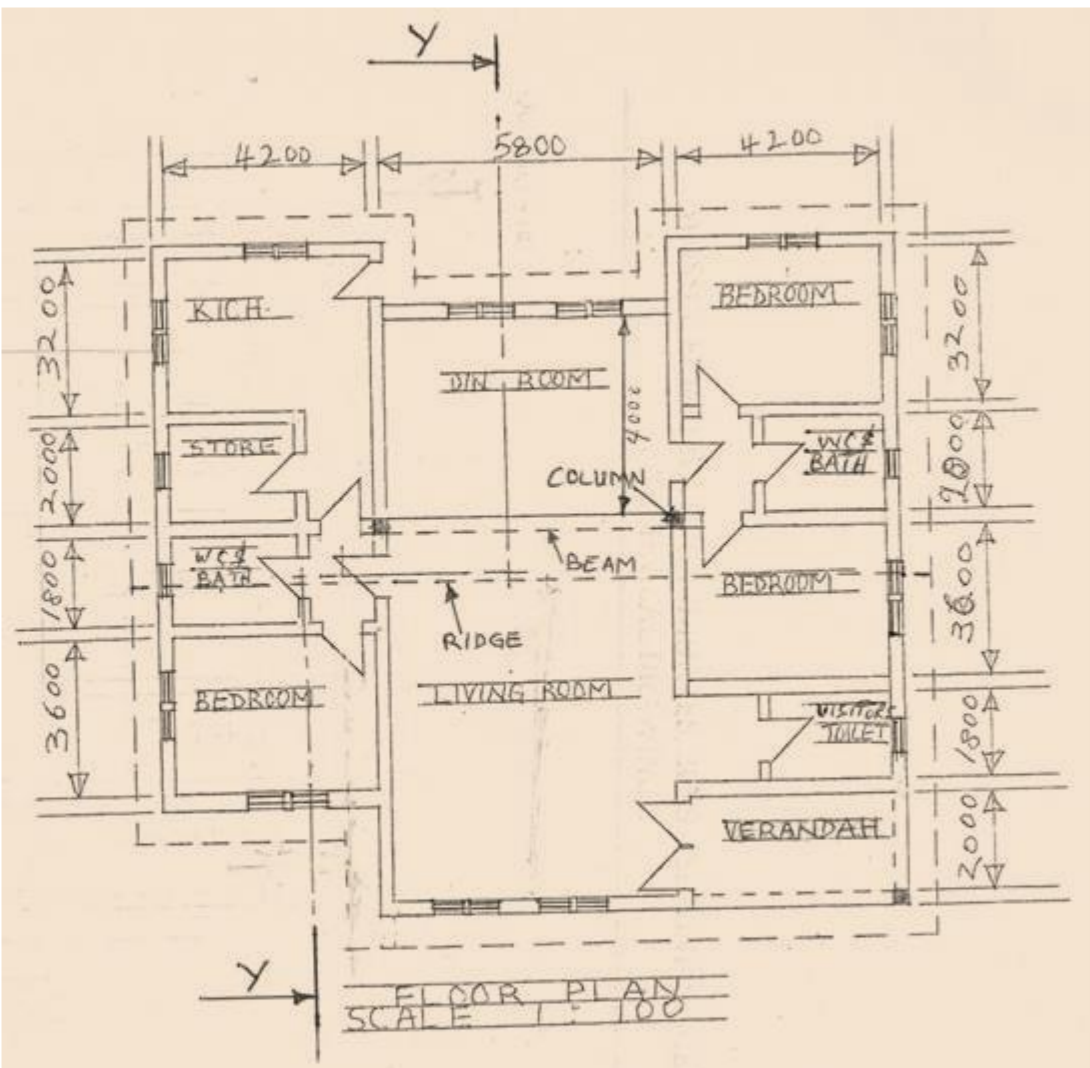
(a) Draw to a scale of **1:100**

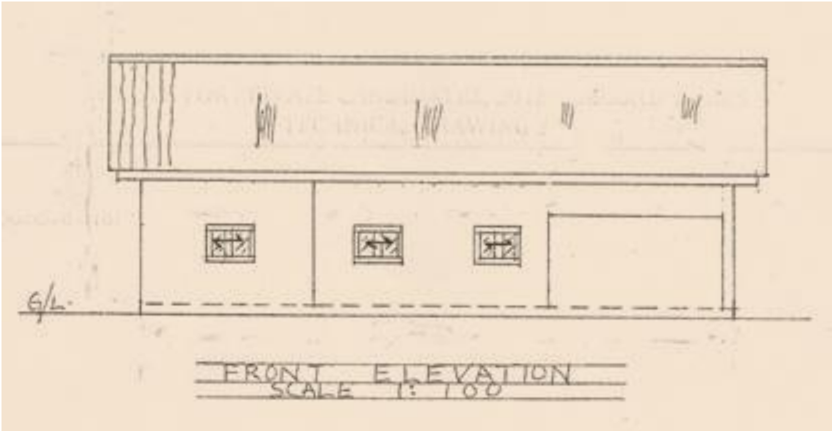
- Floor Plan
- Front Elevation

(b) Draw to a scale of **1:50**

- Sectional View on Plane Y–Y.


Y
4200
5800
4200
KITCHEN
DINING
BEDROOM
STORE
WC & BATH
COLUMN
RIDGE
BEDROOM
LIVING ROOM
VISITOR'S TOILET
VERANDAH
N
FLOOR PLAN


Y
4200
5800
4200
KITCH
DIN ROOM
BEDROOM
STORE
COLUMN
BEAM
RIDGE
BEDROOM
LIVING ROOM
VERANDAH
FLOOR PLAN
SCALE 1 : 100



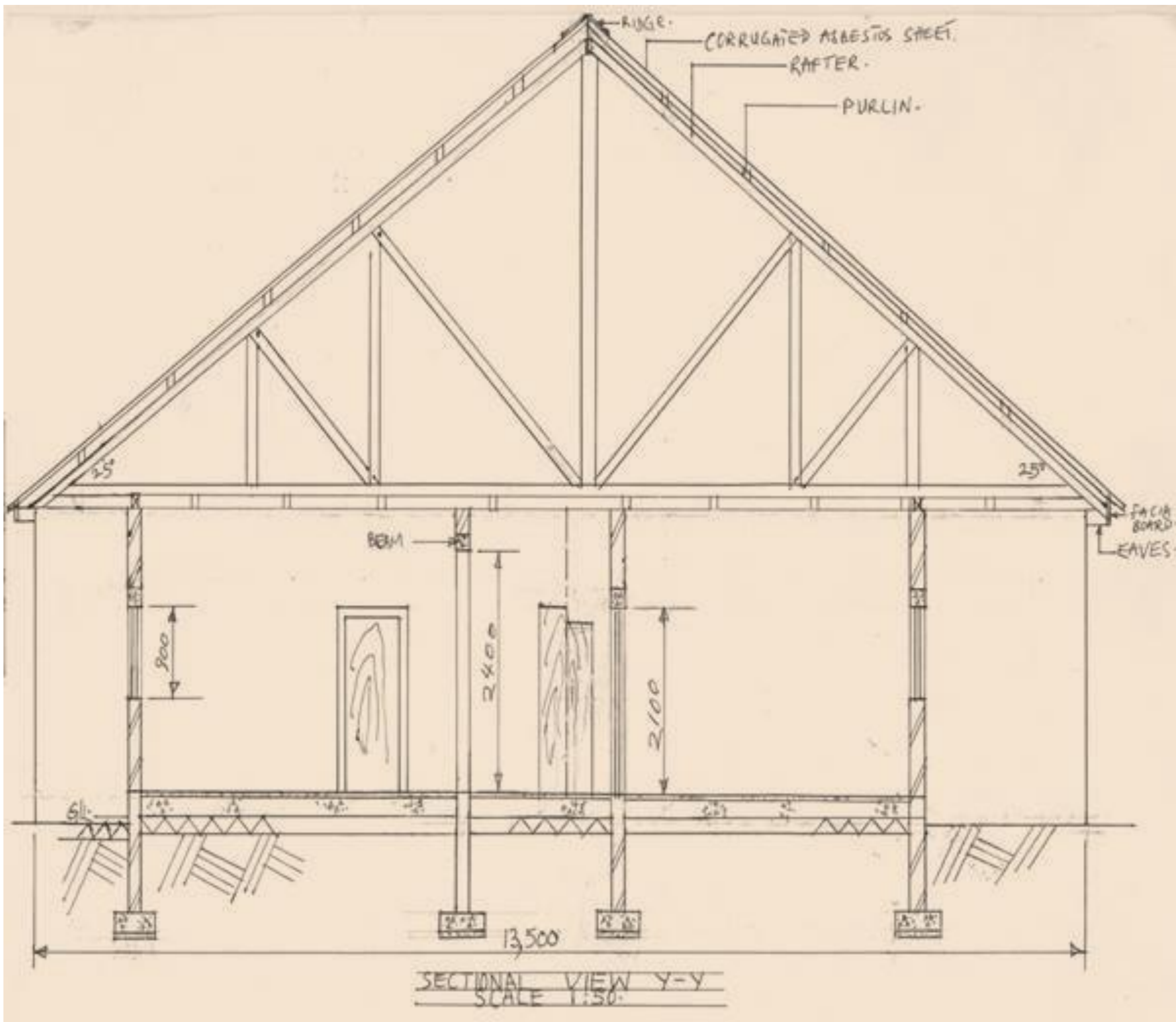
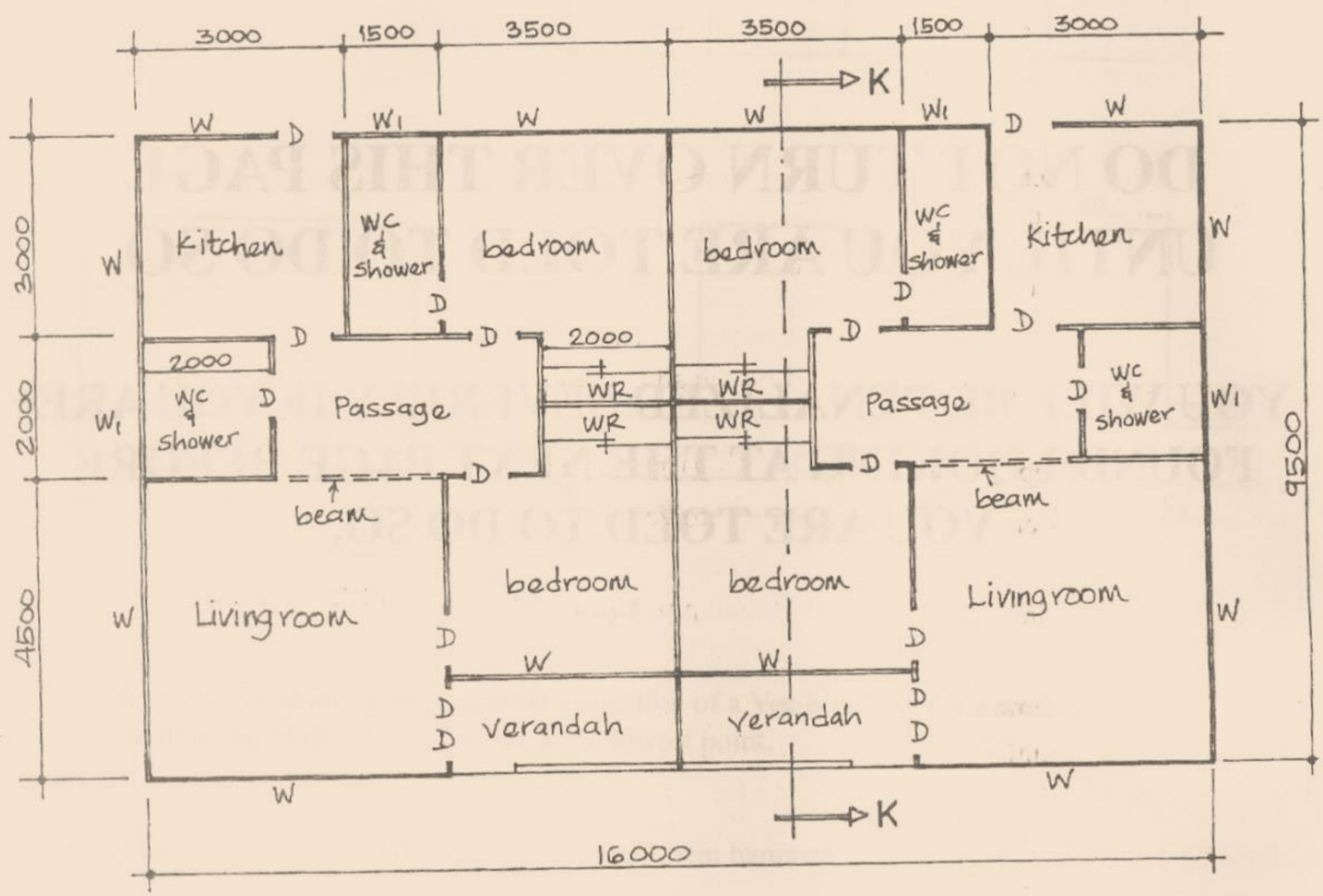


Figure showed the plan of a bungalow.

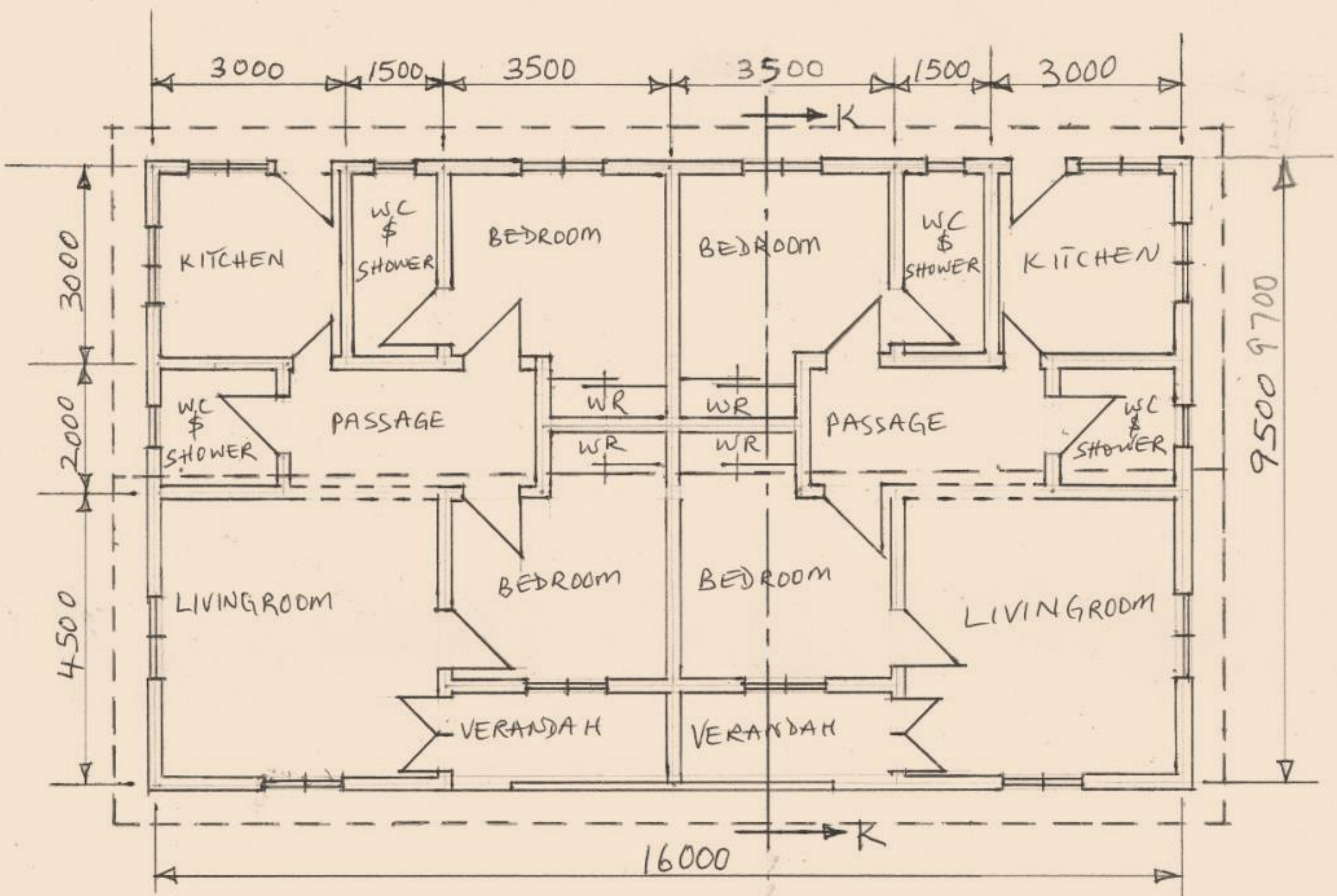
Required

1. Draw the **Floor Plan**.
2. Draw the **Front Elevation**.
3. Draw the **Sectional View K–K**.

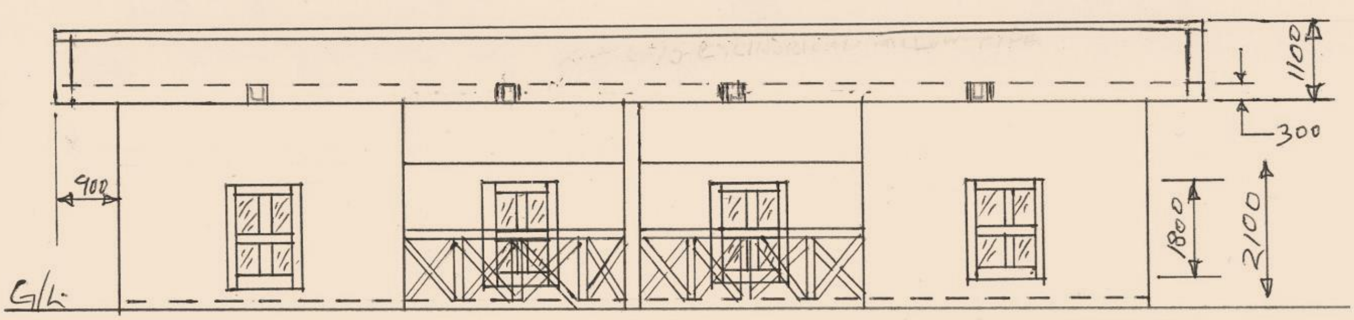


3000
1500
3500
3500
1500
3000
K
W
D
W1
W
W
W1
D
W
Kitchen
WC & Shower
bedroom
bedroom
WC & Shower
Kitchen
W
3000
D
D
D
D
D
2000
2000
WR
WR
WR
WR
WC & Shower
D
Passage
Passage
D
WC & Shower
W1
W1
2000
D
D
beam
beam
9500
bedroom
bedroom
Livingroom
Livingroom
W
W
4500
D
D
W
W
D
D
Verandah
Verandah
D
D
W
W
K
16000

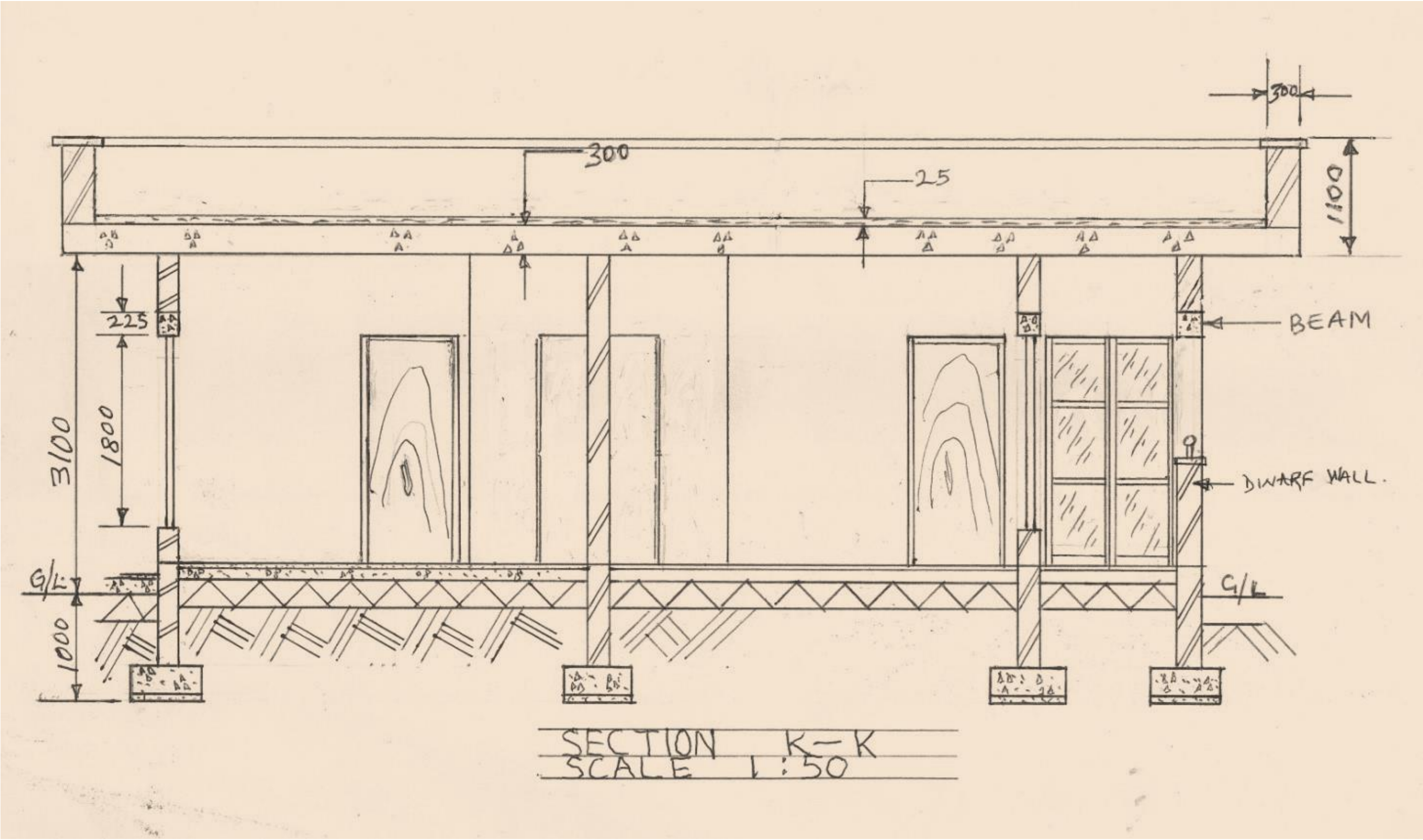
Fig. 2



FLOOR PLAN
SCALE 1:100



FRONT ELEVATION.
SCALE 1:100.



Question 5 (WASSCE 2020)

A sketch plan of a four-bedroom bungalow together with specifications was provided.

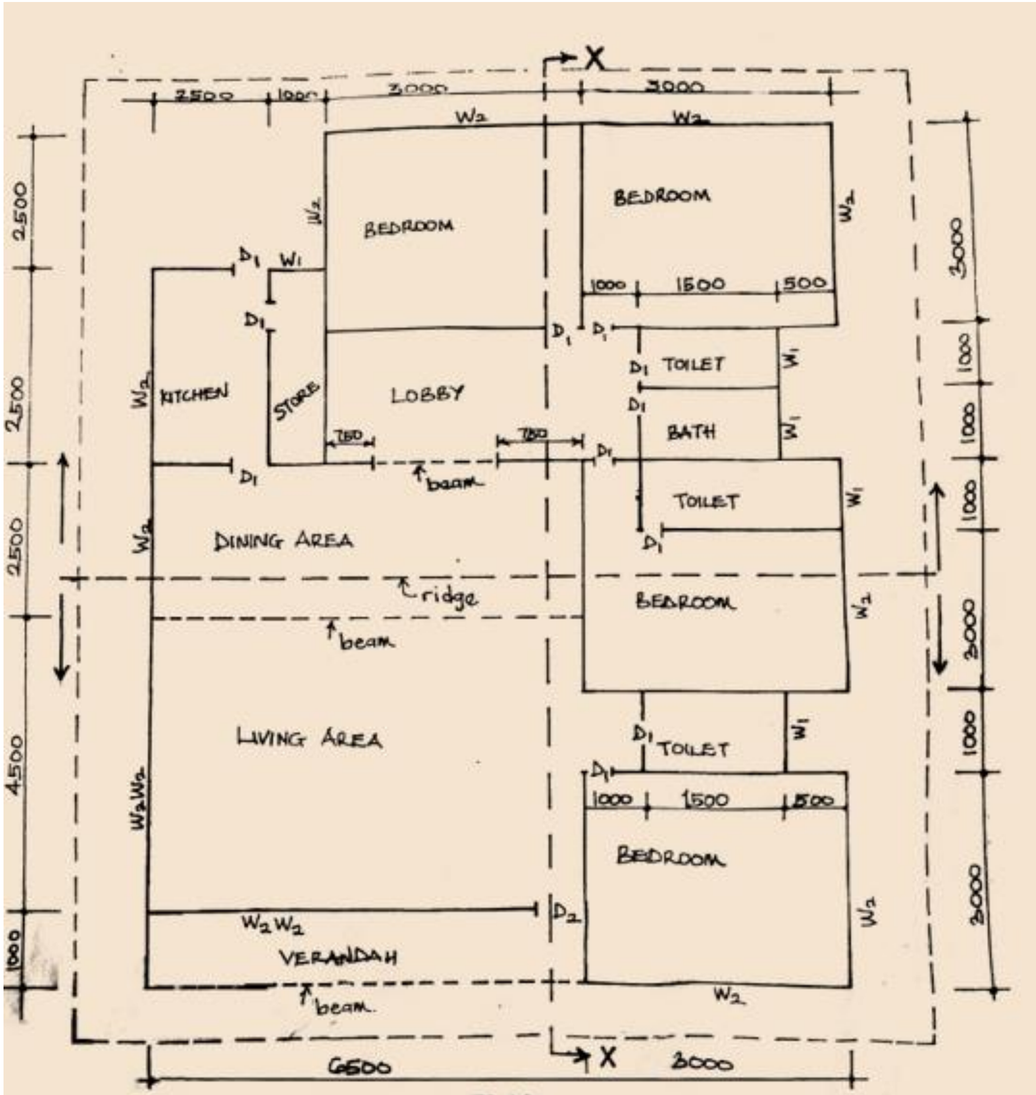
Required

(a) Draw:

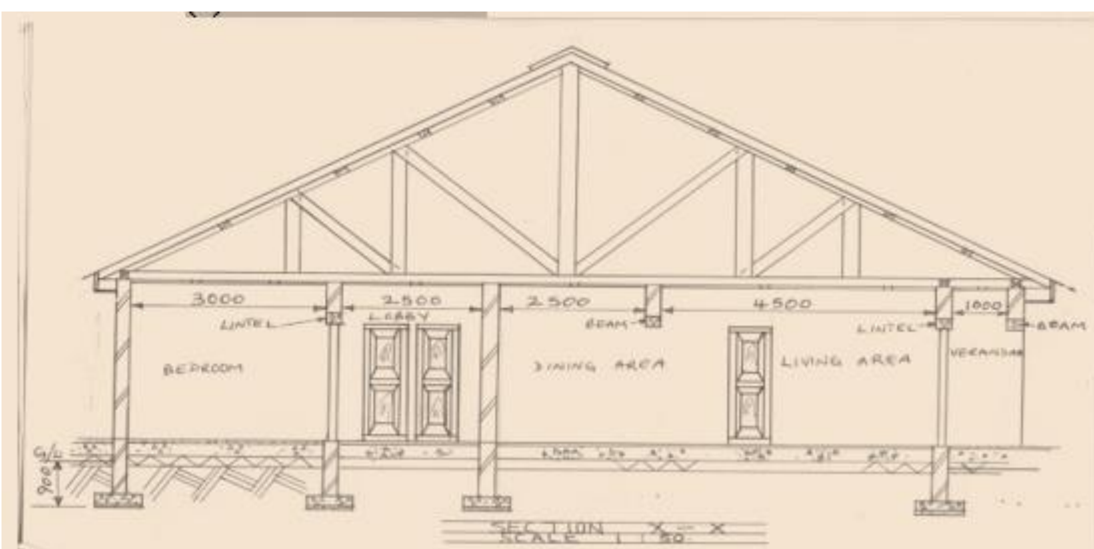
- Floor Plan

(b) Draw:

- Section X–X.



PLAN



DETAILED VIEW ON X-X

Question 6 (WASSCE 2020 Practical)

Using the given specifications of a bungalow:

(a) Draw to a scale of 1:100

- Floor Plan
- Front Elevation

(b) Draw to a scale of 1:50

- Section K–K.

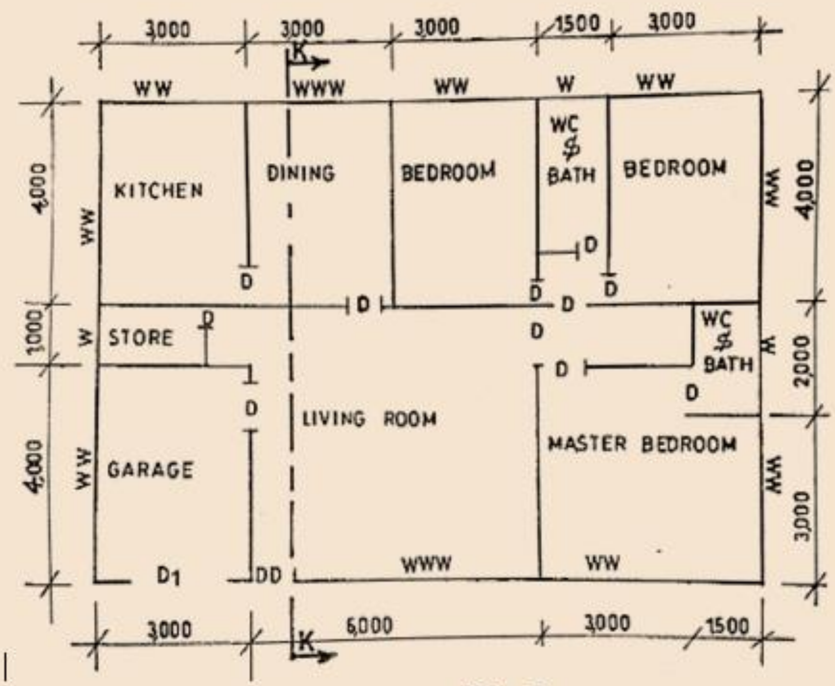
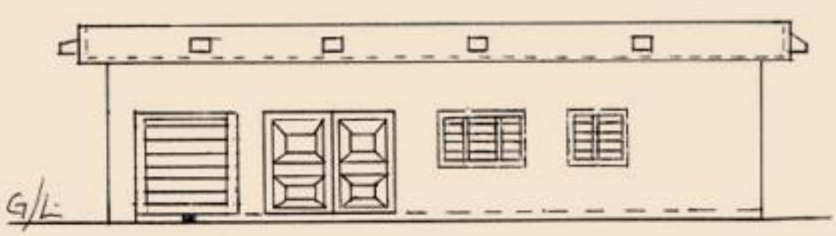
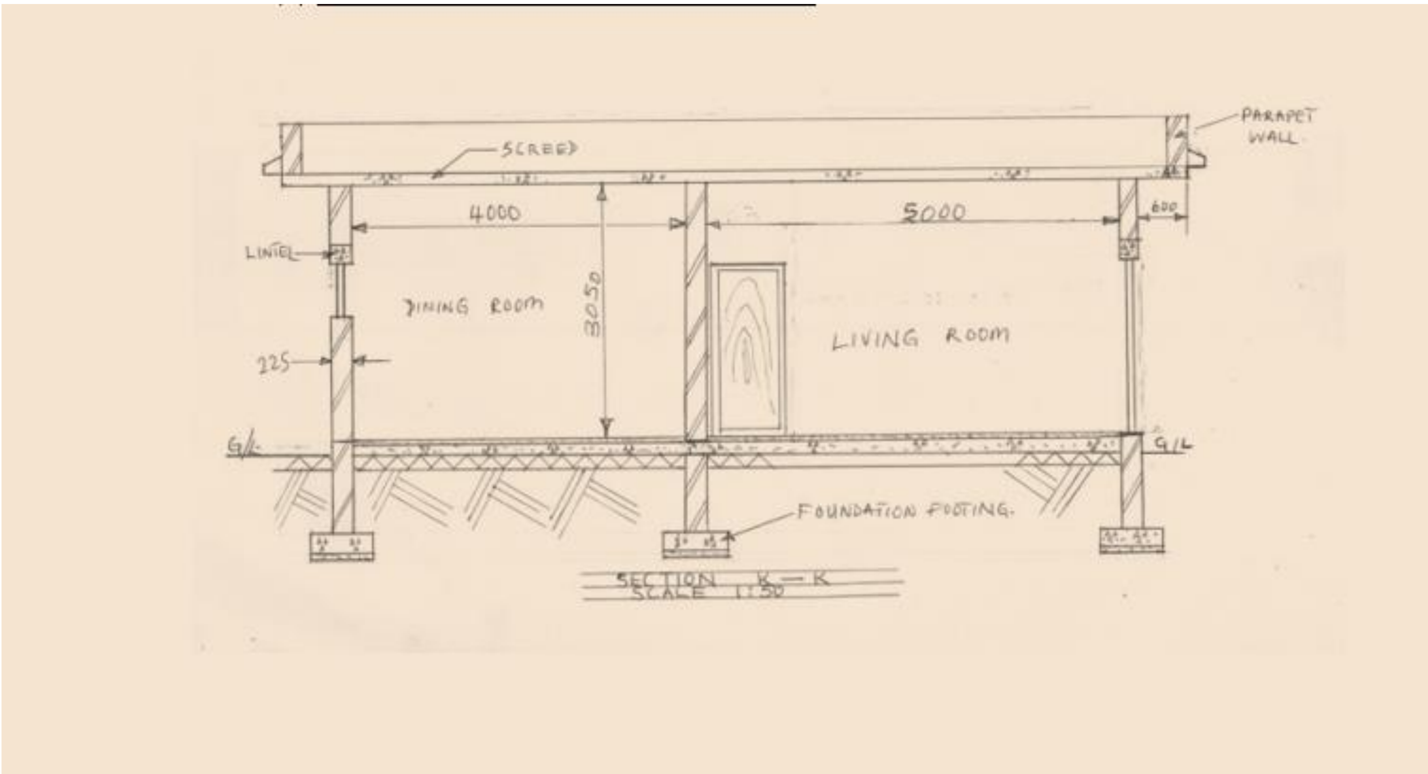


Fig. 2

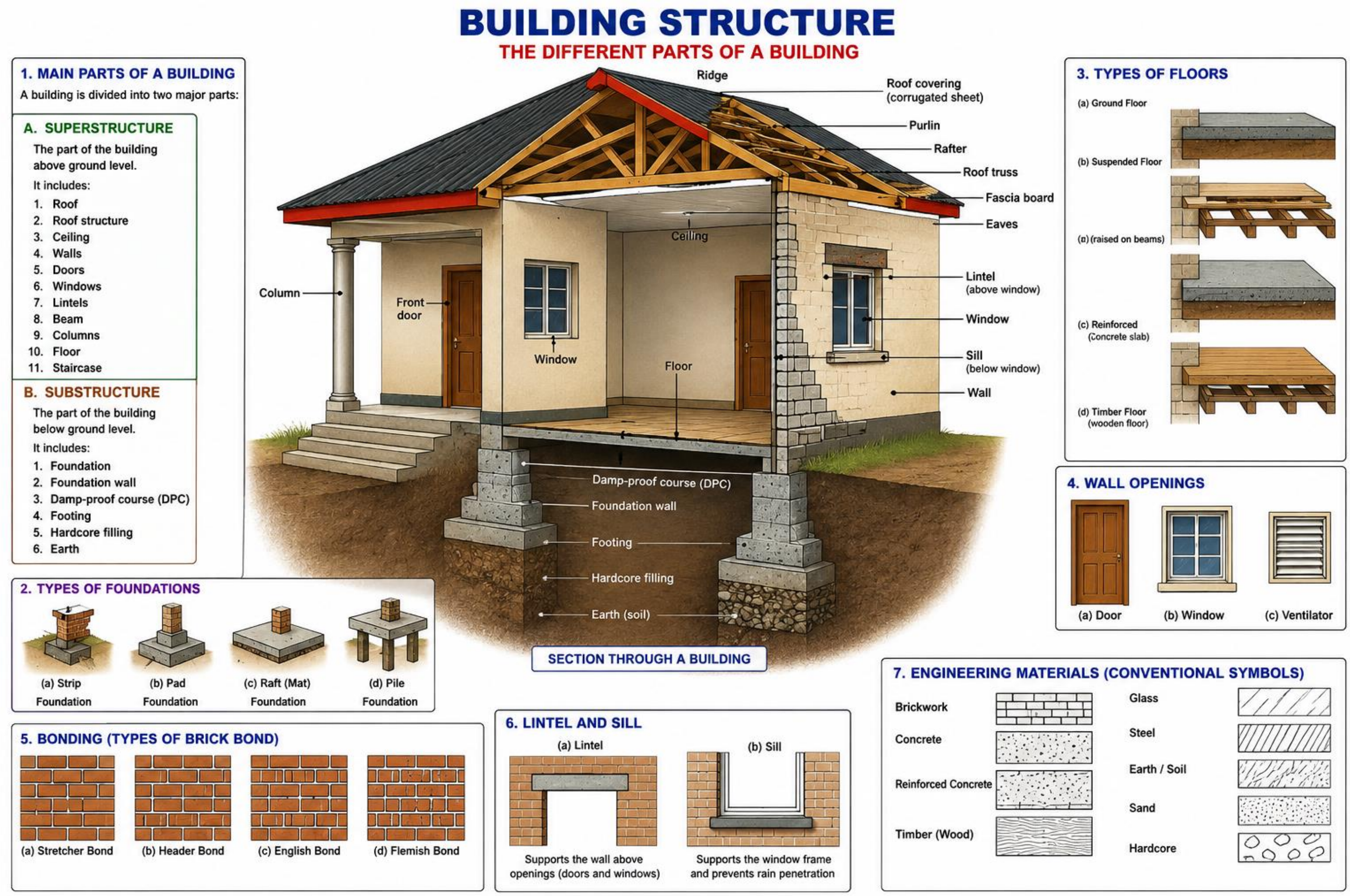




DETAILS OF PARTS OF BUILDING

At the end of the lesson, students should be able to:

1. Identify the parts of a building (Substructure and Superstructure).
2. Differentiate between the various building types.
3. Explain the foundation and floor types used in building construction.
4. Explain walls and wall openings.
5. Explain bonding, lintels, and sills.
6. Identify engineering/building materials represented by conventional symbols on building elevations and sectional drawings.



Parts of a Building

Definition

A building consists of two major parts:

A. Substructure

The substructure is the portion of the building below the ground level.

It supports the entire structure.

Components of the Substructure

- Foundation
- Footing
- Foundation wall
- Damp Proof Course (DPC)
- Oversite concrete
- Hardcore filling

Functions

- Transfers building load safely to the soil.
- Prevents settlement.
- Prevents moisture penetration.
- Provides stability.

B. Superstructure

The superstructure is the part of the building above ground level.

Components

- Walls
- Columns
- Doors
- Windows
- Lintels
- Beams
- Roof
- Ceiling
- Staircase

Functions

- Encloses spaces.
- Protects occupants.
- Supports roof.
- Provides appearance.

Building Types

Buildings may be classified according to their use.

Residential Buildings

Examples:

- Bungalow
- Duplex
- Flats
- Apartments

Commercial Buildings

Examples:

- Banks
- Offices
- Shopping complexes
- Hotels

Industrial Buildings

Examples:

- Factories
- Warehouses
- Workshops

Institutional Buildings

Examples:

- Schools
- Hospitals
- Churches
- Mosques

Agricultural Buildings

Examples:

- Poultry houses
- Barns
- Silos
- Farm sheds

Foundation and Floor Types (15 Minutes)

Foundation

A foundation is the lowest part of a building that safely transfers loads to the ground.

Functions

- Supports the building.
- Prevents uneven settlement.
- Increases stability.

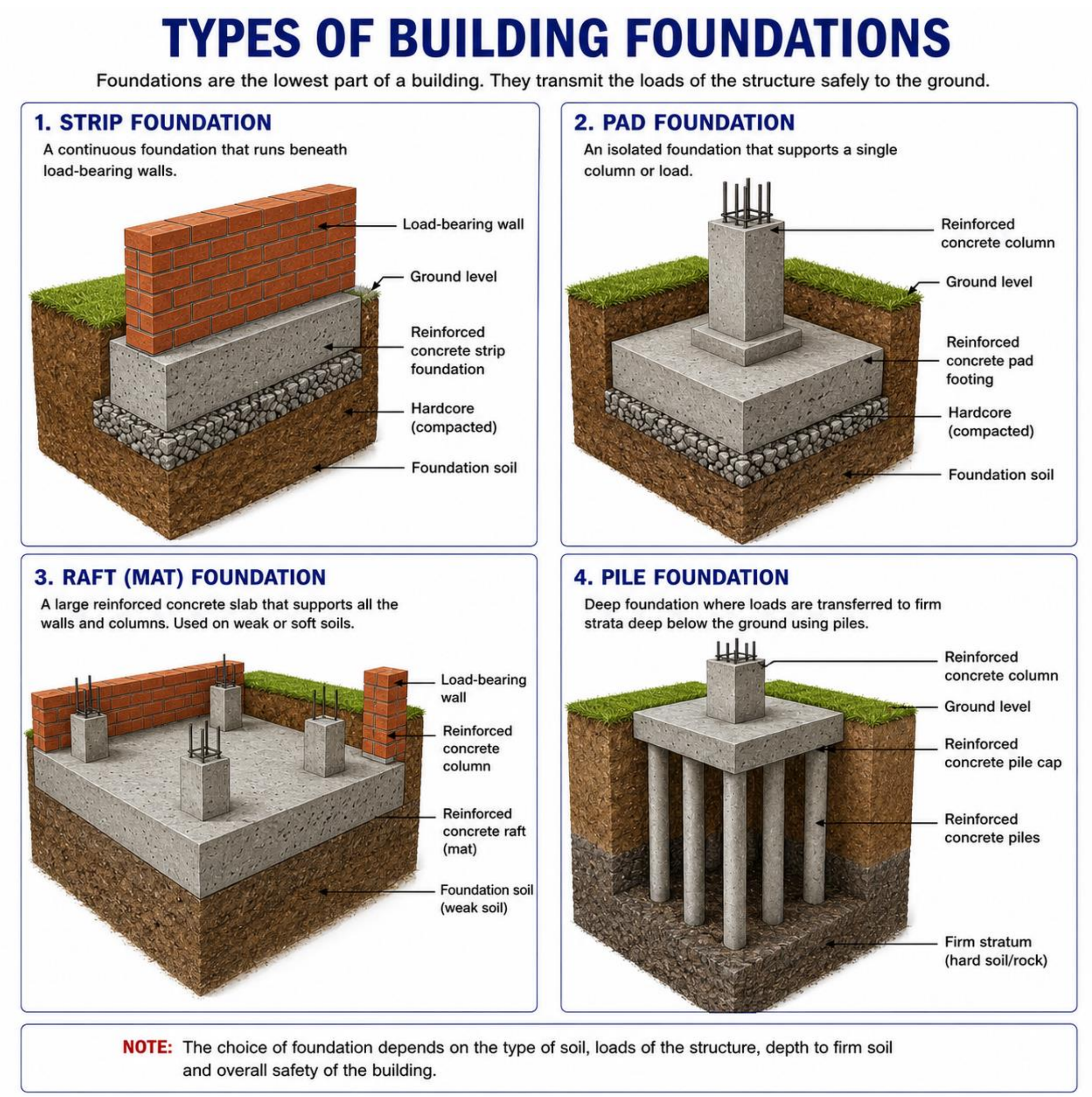
Types of Foundations

1. Strip Foundation: Used for load-bearing walls.

2. Pad Foundation: Used for isolated columns**.**

3. Raft Foundation: Suitable for weak soils.

4. Pile Foundation: Used where firm soil is deep below ground.



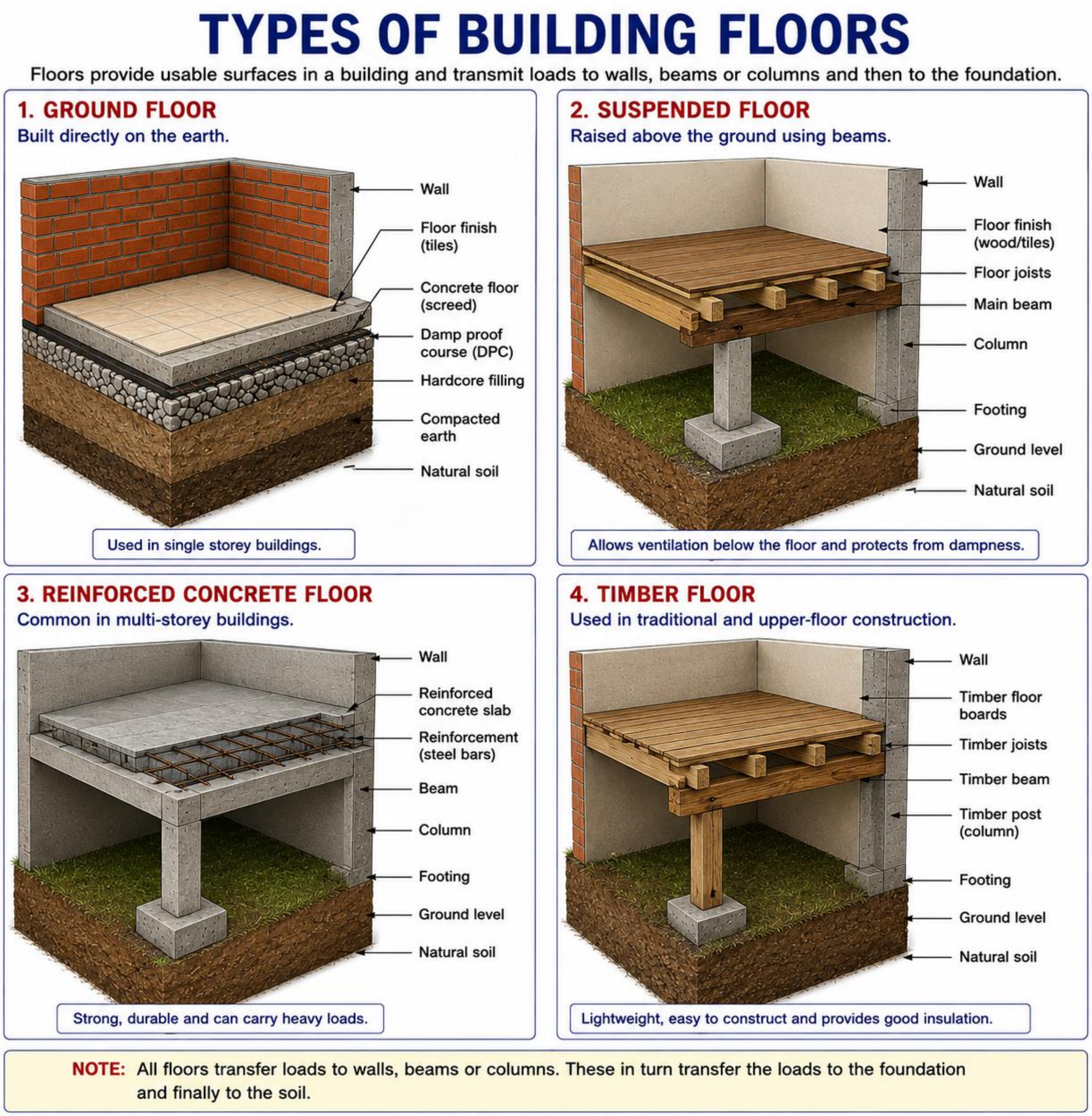
Floor Types

Ground Floor: Built directly on the earth.

Suspended Floor: Raised above the ground using beams.

Reinforced Concrete Floor: Common in multi-storey buildings.

Timber Floor: Used in traditional and upper-floor construction.



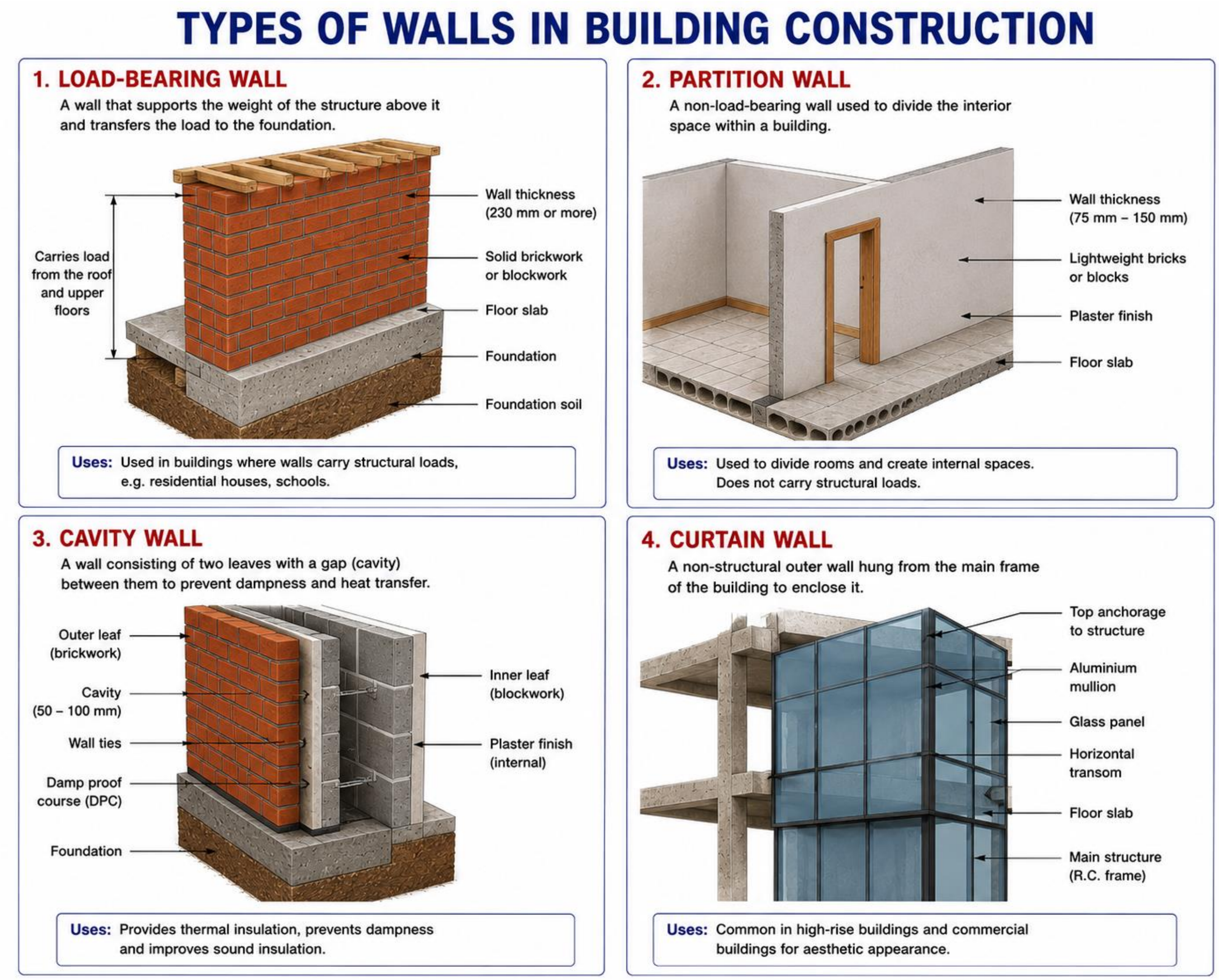
Walls and Wall Openings

Wall

A wall is a vertical structure that encloses or divides spaces.

Types of Walls

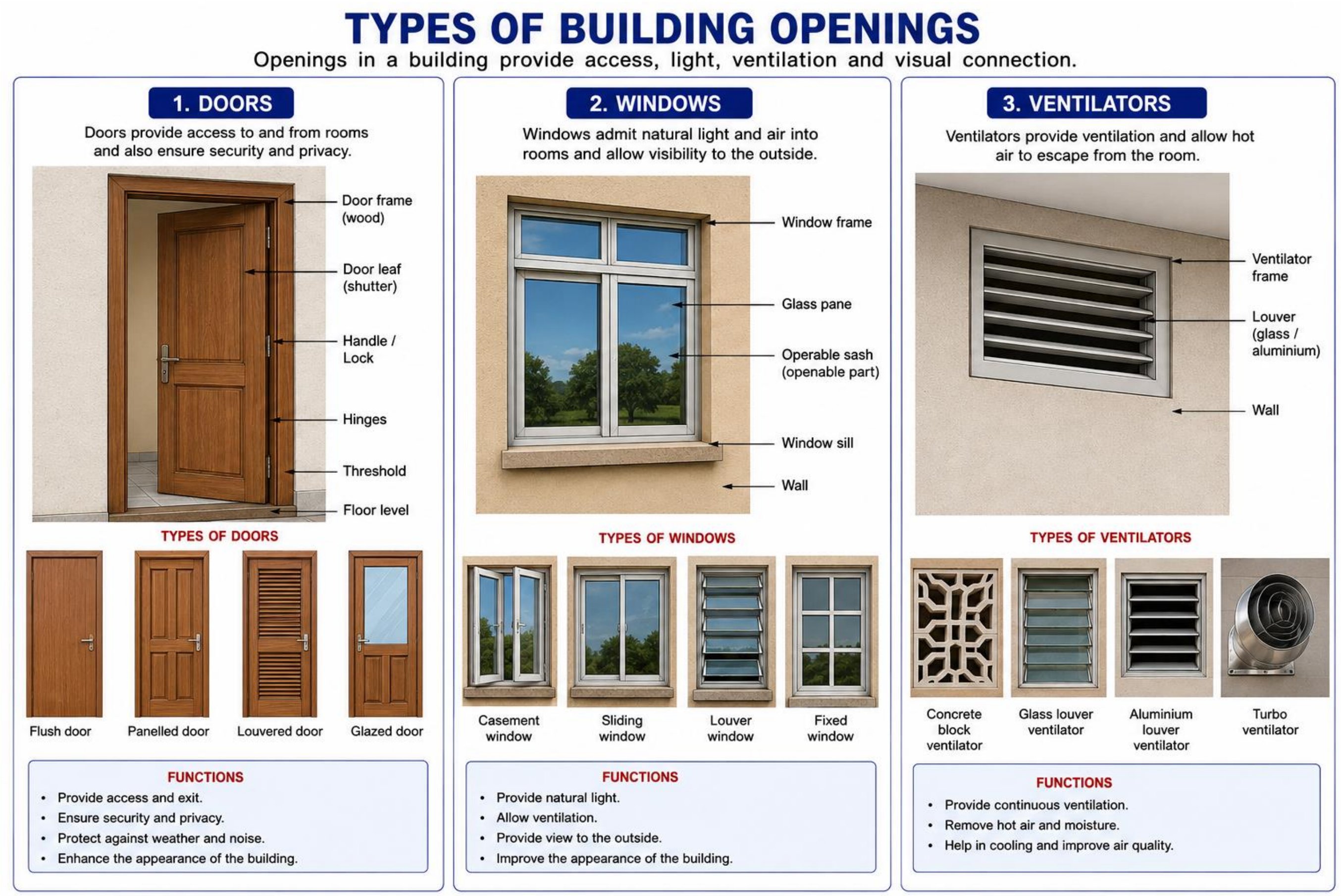
- **Load-bearing wall**
- **Partition wall**
- **Cavity wall**
- **Curtain wall**



Wall Openings

Wall openings include**:**

- **Doors**
- **Windows**
- **Ventilators**



Functions

- Access
- Ventilation
- Lighting
- Emergency escape

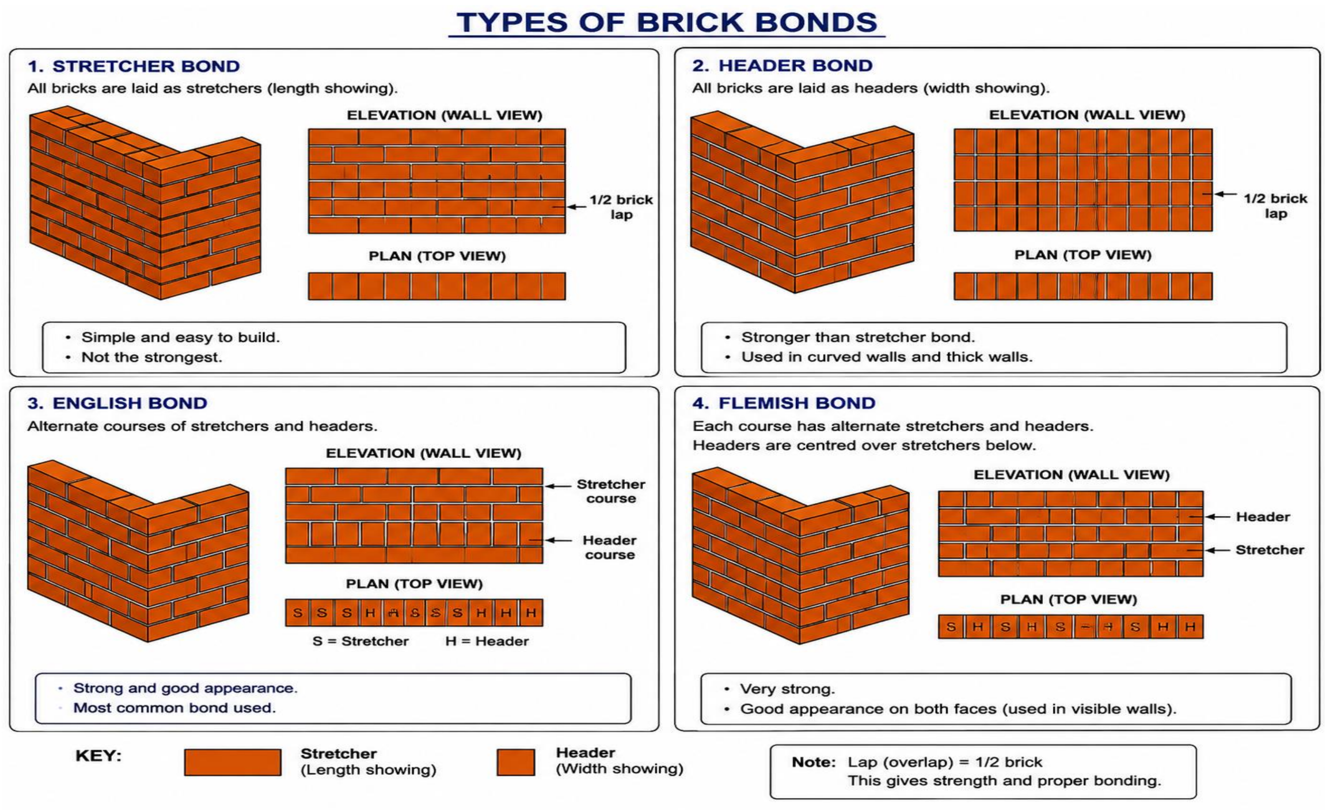
Bonding, Lintel and Sill

Bonding

Bonding is the arrangement of bricks or blocks to improve strength and stability.

Types of Bonds

- Stretcher Bond
- Header Bond
- English Bond
- Flemish Bond



Lintel

A lintel is a horizontal structural member placed above doors and windows to support the wall above them .

Functions

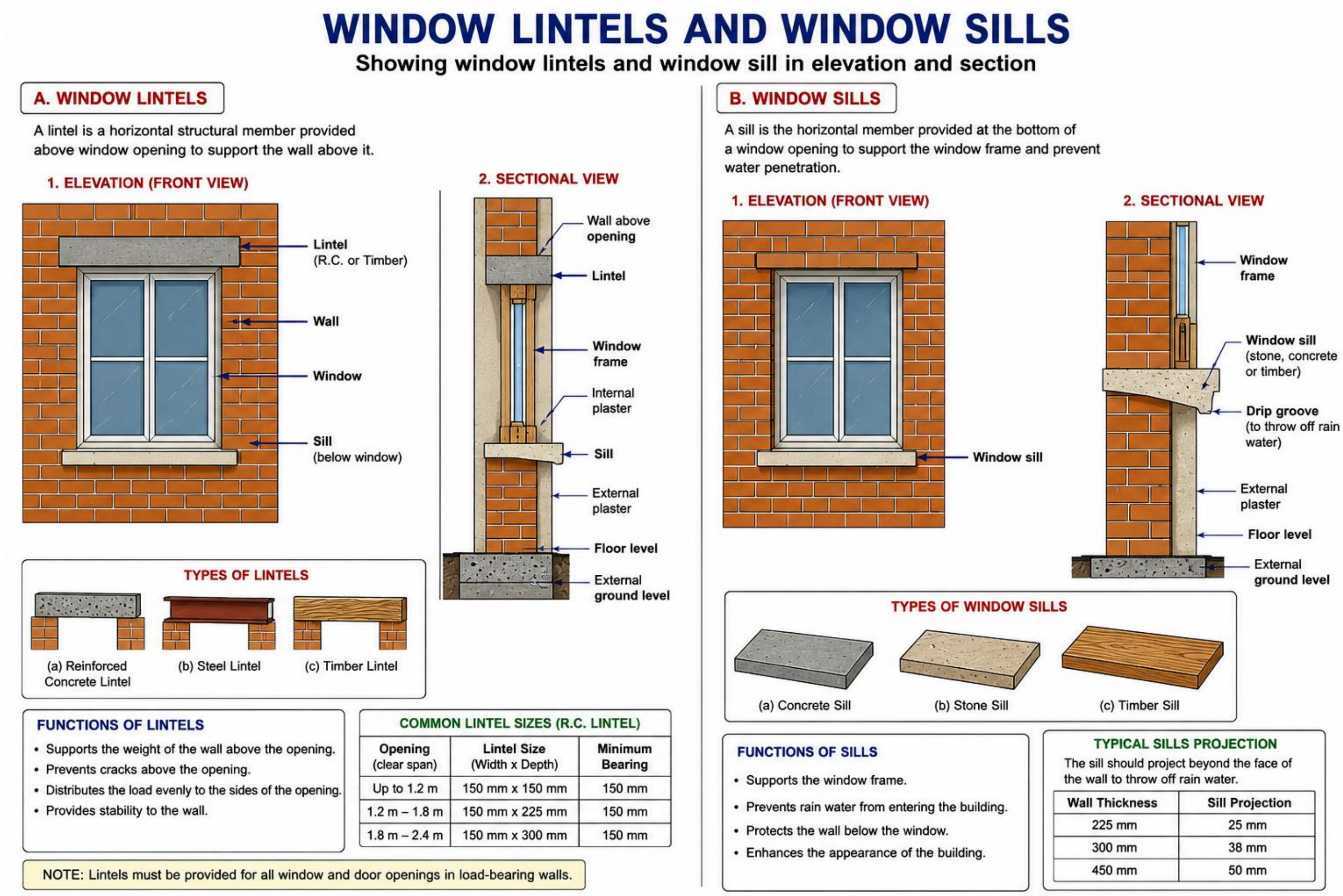
- Supports wall above openings.
- Distributes load.

Sill

A sill is the horizontal member at the bottom of a window opening to support the window frame and prevent water penetration.

Functions

- Supports the window frame.
- Prevents water penetration.
- Improves appearance.



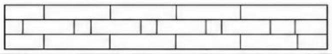
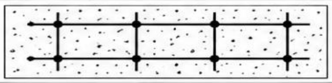
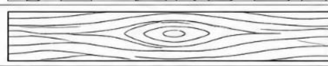
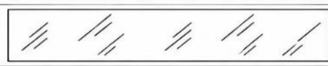
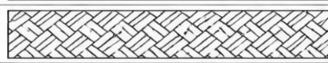
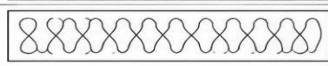
Engineering Materials and Symbols

In working drawings, building materials are represented using conventional symbols and hatching,

Importance of Symbols

- Ensure uniform interpretation.
- Simplify drawings.
- Save drawing time.
- Reduce written notes.
- Meet international drawing standards.

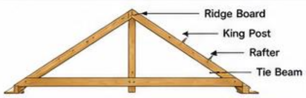
BUILDING MATERIALS – CONVENTIONAL REPRESENTATIONS

S/N	MATERIAL	CONVENTIONAL SYMBOL (AS USED IN DRAWINGS)	REAL LIFE IMAGE	DESCRIPTION / USE
1.	Brickwork			Used for walls and other masonry structures.
2.	Concrete			Used for floors, slabs, beams, columns and foundations.
3.	Reinforced Concrete			Concrete with steel bars to increase strength. Used in beams, slabs, columns, foundations, etc.
4.	Sand			Used in mortar, concrete, plastering and screeding.
5.	Hardcore			Used as sub-base for floors, paths and foundation filling.
6.	Timber (Wood)			Used for doors, windows, roof members, floor joists, formwork, etc.
7.	Steel			Used for steel frames, roof trusses, reinforcement and structural members.
8.	Glass			Used for windows, doors and other glazing works.
9.	Earth / Soil			Natural ground or backfill material.
10.	Insulation			Used to reduce heat, sound or electrical transfer.

ROOF TRUSS & ROOF MEMBERS

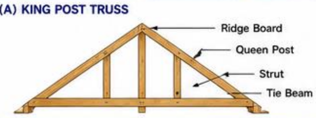
Roof trusses and members provide support for the roof covering and transfer loads safely to the walls.

TYPES OF ROOF TRUSSES



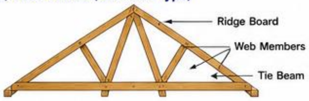
Has one vertical member (king post) at the centre to support the ridge.

(A) KING POST TRUSS



Has two vertical members (queen posts) with struts supporting the ridge board.

(C) FINK TRUSS (Common Type)

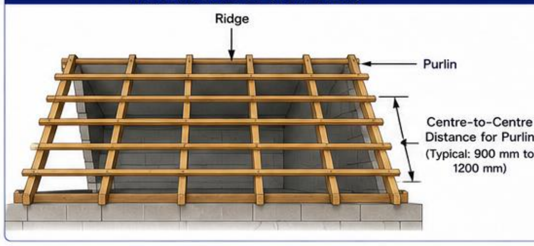


Uses web members instead of posts to support the structure.

KEY ROOF MEMBERS

Fascia Board	Board fixed vertically at the edge of the roof.
Soffit Board	Board fixed under the eaves.
Ridge Cap	Covering placed over the ridge for protection.
Ridge Board	Horizontal member at the highest point of the roof.
Purlin	Horizontal member that supports the roof covering and rests on the rafters.
Rafter	Sloping member that supports the purlins and gives shape to the roof.
Ceiling Joist	Horizontal members that support the ceiling.
King Post	Vertical member at the centre of the truss.
Queen Post	Vertical members placed symmetrically with struts.
Strut	Sloping member that supports the ridge board in a queen post truss.
Tie Beam	Horizontal member that ties the walls together and prevents spreading.
Wall Plate	Horizontal member fixed on top of the wall to support the roof.
Eaves Projection	Overhang of the roof beyond the wall line.

PURLIN LAYOUT (TOP VIEW)



IMPORTANT NOTES

- Roof trusses distribute the load of the roof covering to the walls.
- The span affects the size and spacing of the roof members.
- Proper fixing of all members ensures strength and stability.
- Use durable timber and treat against termites and decay.

NOTE: All dimensions and spacing may vary depending on the span, type of roof covering, and the design of the building.