Bar Bending & Concreting

Level-II

Learning Guide-#17

Unit of Competence: Read and Interpret Plans and Working Drawings

Module Title: Reading and Interpreting Plans and Working Drawings

LG Code: EIS BBC2 M05 1019 LO1-LG-17

TTLM Code: EIS BBC2 M05 TTLM 0919v1

LO4. Identify and locate key features on drawings.

Instruction Sheet	Learning Guide #17

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Identifying key features of plans
- Identifying elevations and sections

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- The key features of plans, elevations and sections are identified.
- Client requested variations to standard plans are identified on drawings.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, and Sheet 3”.
4. Accomplish the “Self-check 1, Self-check t 2, and Self-check 3”
5. Check the answers for your achievement from the answer key

Information Sheet-1	Identifying key features of plans

1.1. Introduction

Plans are often for technical purposes such as architecture, engineering, or planning. Their purpose in these disciplines is to accurately and unambiguously capture all the geometric features of a site, building, product or component. Plans can also be for presentation or orientation purposes, and as such are often less detailed versions of the former. The end goal of plans is either to portray an existing place or object, or to convey enough information to allow a builder or manufacturer to realize a design.

The term "plan" may casually be used to refer to a single view, sheet, or drawing in a set of plans. More specifically a plan_view is an orthographic_projection looking down on the object, such as in a floor plan.

The process of producing plans, and the skill of producing them, is often referred to as technical_drawing. A working drawing is a type of technical drawing, which is part of the documentation needed to build an engineering product or architecture. Typically, in architecture these could include civil drawings, architectural drawings, structural drawings, mechanical drawings, electrical drawings, and plumbing drawings. In engineering, these drawings show all necessary data to manufacture a given object, such as dimensions and angles.

1.2. Drawing Plan Components

- **Index**

An index of drawings located on the first sheet which must include all occupancy classifications, types of construction, the area in gross square feet for each level, the maximum occupant load and the structural design loads.

- **Site Plan**

A site plan showing to scale the size and location of new construction and all existing structures on the site, including:

  - ✓ Setback and side yard dimensions

- ✓ All property and interior lot lines
- ✓ Distances from lot lines and other buildings on the same lot
- ✓ Street names and locations
- ✓ Established street grades
- ✓ Types and sizes of all utility lines
- ✓ Elevations of all proposed finished grades

The site plan must be drawn in accordance with an accurate boundary line survey. In the case of demolitions, the site plan must show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The building official is authorized to waive or modify requirements for a site plan when the application for approval is for alteration or repair or when otherwise warranted.

- **Utility Information**

The following utility information shall be supplied on the site plan in order to process through the Utility Departments:

- ✓ Electric service, location, voltage, wire and conduit size
- ✓ Total electric loads in KW
- ✓ Total gas loads in BTU
- ✓ Size and location of gas and water service lines and meters
- ✓ Size and location of storm and sanitary lines

- **Floor Plans**

Complete floor plans, including plans of full or partial basements and full or partial attics and penthouses. Floor plans must show all relevant information such as door swings, stairs and ramps, windows, shafts, all portions of the means of egress, etc. and shall be sufficiently dimensioned to describe all relevant space sizes. Wall materials must be described by cross-hatching with explanatory key, by notation or by other clearly understandable method. Spaces must be identified by code appellation. The construction documents must designate the number of occupants to be accommodated on every floor, and in all rooms and spaces.

- **Sections**

Cross sections, wall sections, details including typical connections as required to fully describe the building construction showing wall, ceiling, floor and roof materials. Construction documents must describe the exterior wall envelope in sufficient detail to determine compliance with the code. An energy-efficiency analysis of the total building envelope may also be required.

- **General Building Code Information**

The fire resistance ratings of all structural elements as required by the code, data substantiating all required fire resistance ratings including details showing how penetrations will be made for electrical, mechanical, plumbing and communication conduits, pipes and systems and the materials and methods for maintaining the required structural integrity, fire resistance rating and fire stopping.

- **System Plans & Descriptions**

Complete description of the plumbing, HVAC, gas and electrical systems. This includes the location, materials and sizes of all:

- ✓ Piping
- ✓ Fixtures
- ✓ Equipment
- ✓ Schematics
- ✓ Duct work
- ✓ Lighting and power

- **Fire Alarm & Sprinkler Systems**

These drawings are required to be prepared by individuals certified in the state of Ohio to design these systems. The drawings for these will need to be submitted under separate permits.

- **Statement of Special Inspections**

Where structural tests and special inspections are required by the Ohio Building Code, the applicant must submit a statement of special inspections prepared by the registered

design professional as a condition for the issuance of the plan approval. This statement will include a complete list of materials and work requiring special inspections; the inspections to be performed; and a list of individuals, approved agencies, or firms intended to be retained for conducting such inspections. Additional drawings or information may be required in order to determine compliance with the applicable state codes.

1.3. Features of Plans

- **Format**

Plans are often prepared in a "set". The set includes all the information required for the purpose of the set, and may exclude views or projections which are unnecessary. A set of plans can be on standard office-sized paper or on large sheets. It can be stapled, folded or rolled as required. A set of plans can also take the form of a digital file in a proprietary format such as DWG or an exchange file format such as DXF or PDF.

Plans are often referred to as "blueprints" or "bluelines". However, the terms are rapidly becoming an anachronism, since these copying methods have mostly been superseded by reproduction processes that yield black or multicolor lines on white paper, or by electronic representations of information.

- **Paper sizes**

It’s obviously not practical to draw a building at full size, so a suitable scale and paper size must be chosen.

We use the metric system of paper sizes. It’s a logical system (except that the bigger the number, the smaller the paper!).

- **Scale**

Plans are usually "scale drawings", meaning that the plans are drawn at a specific ratio relative to the actual size of the place or object. Various scales may be used for different drawings in a set. For example, a floor plan may be drawn at 1:48 (or 1/4"=1'-0") whereas a detailed view may be drawn at 1:24 (or 1/2"=1'-0"). Site plans are often drawn at 1" = 20' (1:240) or 1" = 30' (1:360). In the metric system the ratios commonly are 1:5, 1:10, 1:20, 1:50, 1:100, 1:200, 1:500, 1:1000, 1:2000 and 1:5000

1.4. Views and projections

Because plans represent three-dimensional objects on a two-dimensional plane, the use of views or projections is crucial to the legibility of plans. Each projection is achieved by assuming a vantage point from which to see the place or object, and a type of projection. These projection types are:

1.4.1. Parallel projection

- Orthographic projection
  - ✓ Multiview projection, including:
    - Plan view or floor plan view
    - Elevation, usually a side view of an exterior
    - Section, a view of the interior at a particular cutting plane
  - ✓ Axonometric projection, including:
    - Isometric projection
    - Dimetric projection
    - Trimetric projection
- Oblique projection, and

1.4.2. Perspective projection, including:

- One-point perspective
- Two-point perspective
- Three-point perspective

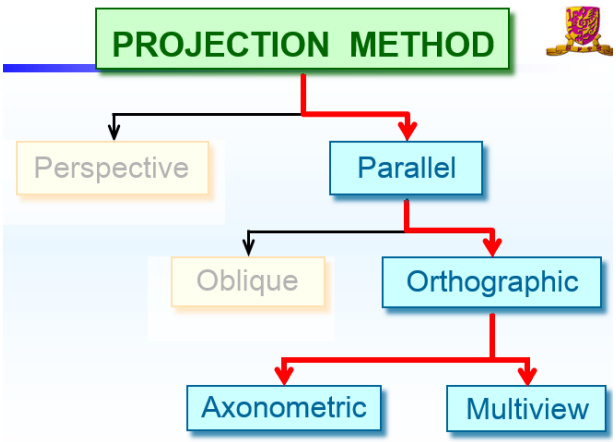


Fig. 1.1: projection method

Projection Theory

The projection theory is used to graphically represent 3-D objects on 2-D media (paper, computer screen). The projection theory is based on two variables: Line of sight and Plane of projection (image plane or picture plane)

Line of sight (LOS): (LOS)is an imaginary ray of light between an observer's eye and an object. There are 2 types of LOS: parallel and converge

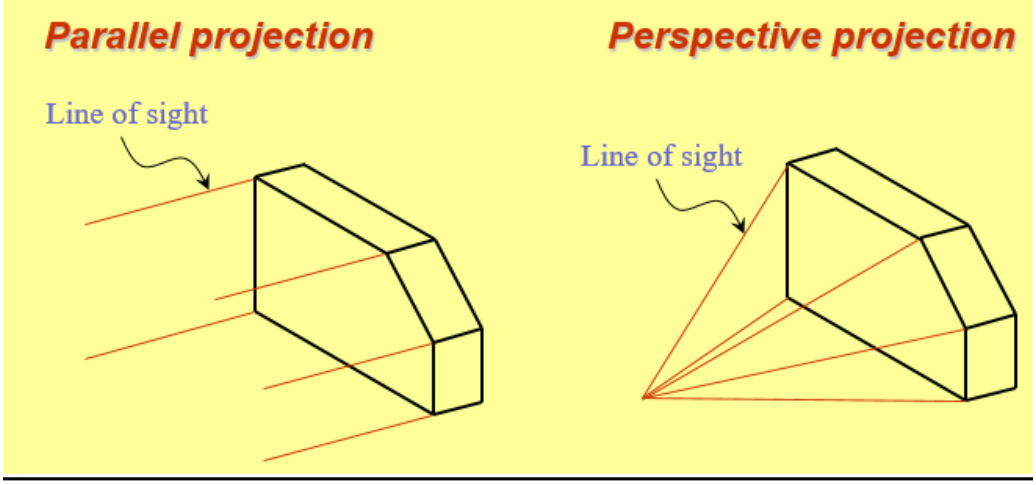


Fig. 1.2: Line of Sight (LOS)

Plane of projection (POP): is an imaginary flat plane which the image is created. The image is produced by connecting the points where the LOS pierce the projection plane.

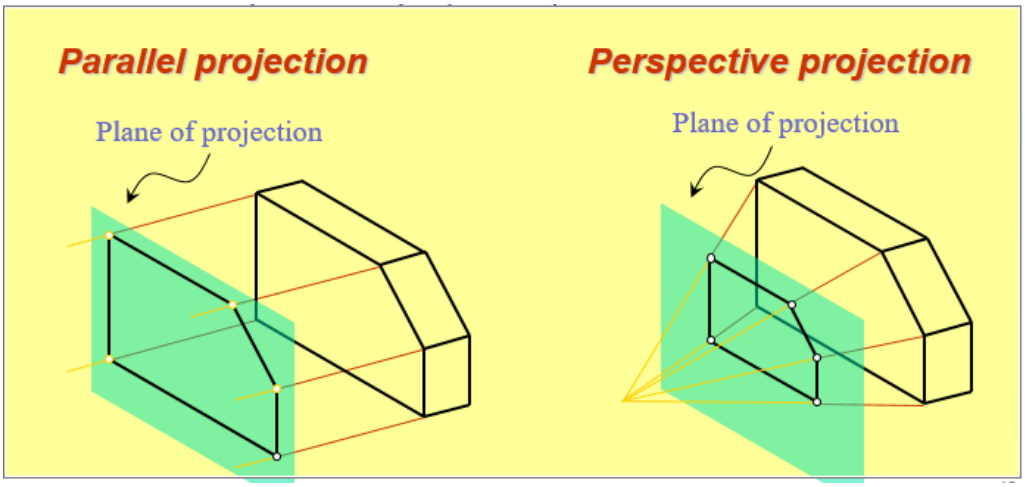


Fig.1.3: plane of projection

Orthographic projection is a parallel projection technique in which the parallel lines of sight are perpendicular to the projection plane.

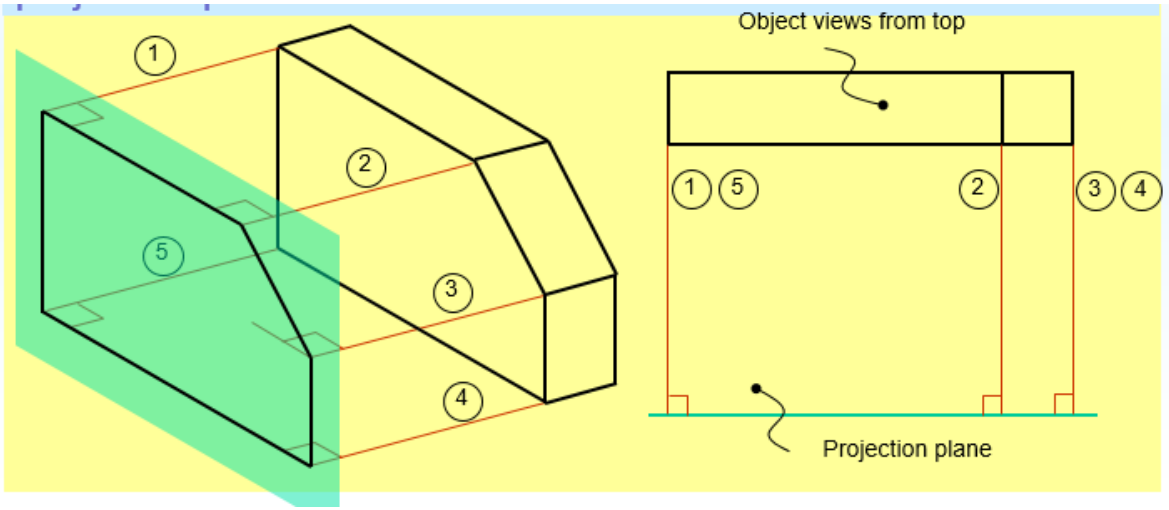


Fig. 1.4: Orthographic projection

Orthographic view depends on relative position of the object to the line of sight. Two dimensions of an object is shown. More than one view is needed to represent the object. That is Multiview drawing.

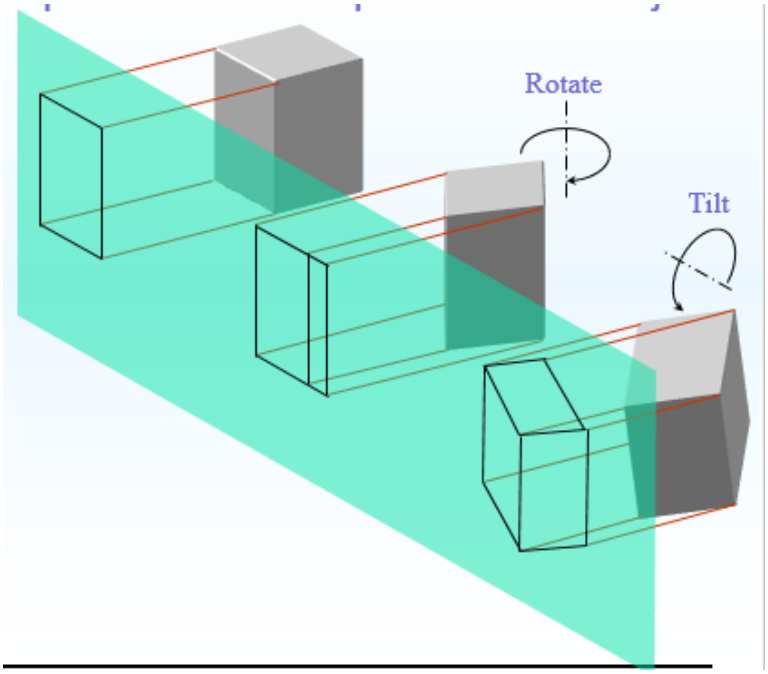


Fig. 1.5: Orthographic view

Multiview drawing: Three dimensions of an object is shown.

Multiview Projections: Project an object from six principal directions (front, back, top, bottom, right, left)

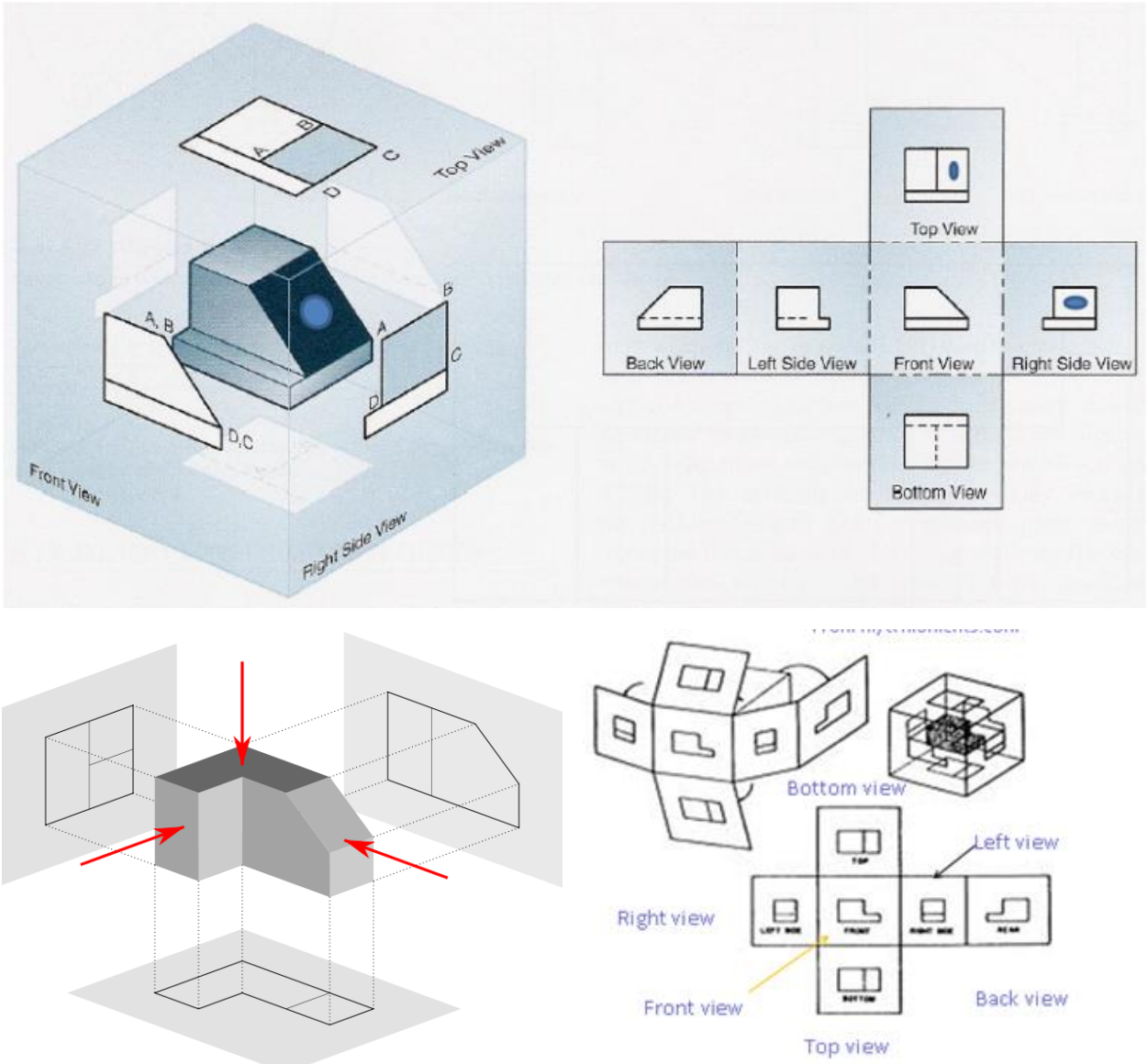


Fig. 1.6: Multiview Projections

Axonometric drawing:

Auxiliary Views: Used to show true dimensions of an inclined plane.

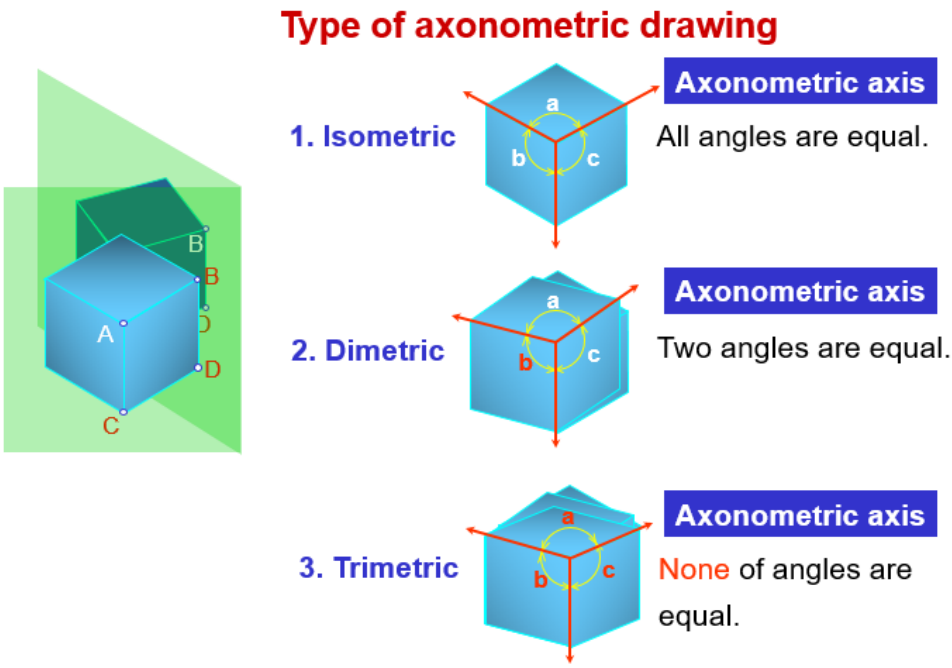


Fig. 1.7: a) types of isometric drawing

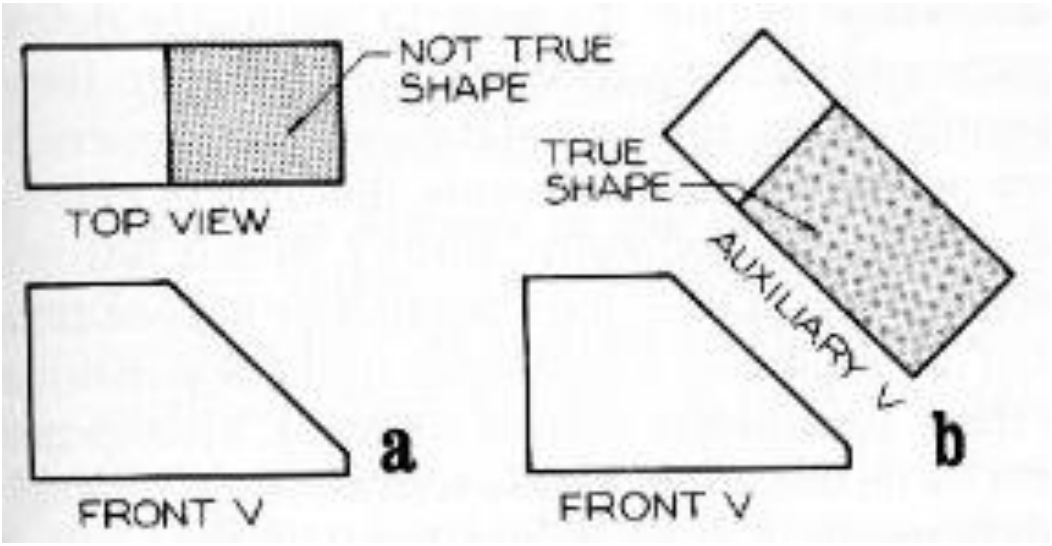


Fig. 1.7: Auxiliary Views

Isometric Drawing: Represent 3-D objects by a 2D view in the projection in which the coordinate axes appear equally foreshortened. It is easy to understand the 3-D shape However, the projection causes shape and angle distortions.

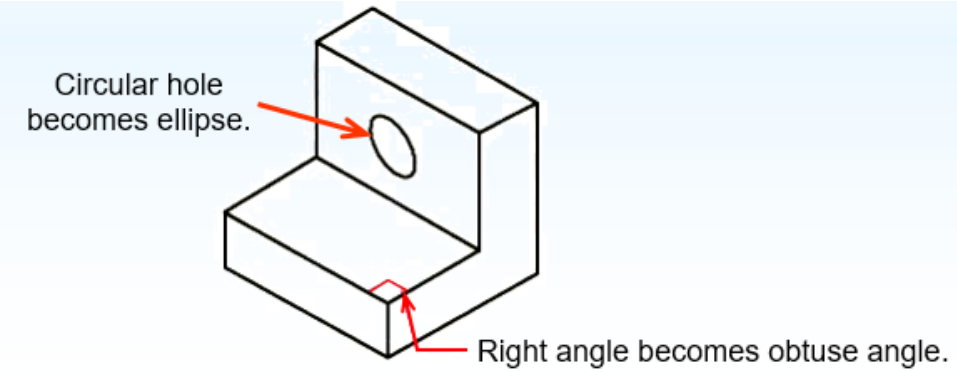


Fig. 1.8: Isometric Drawing

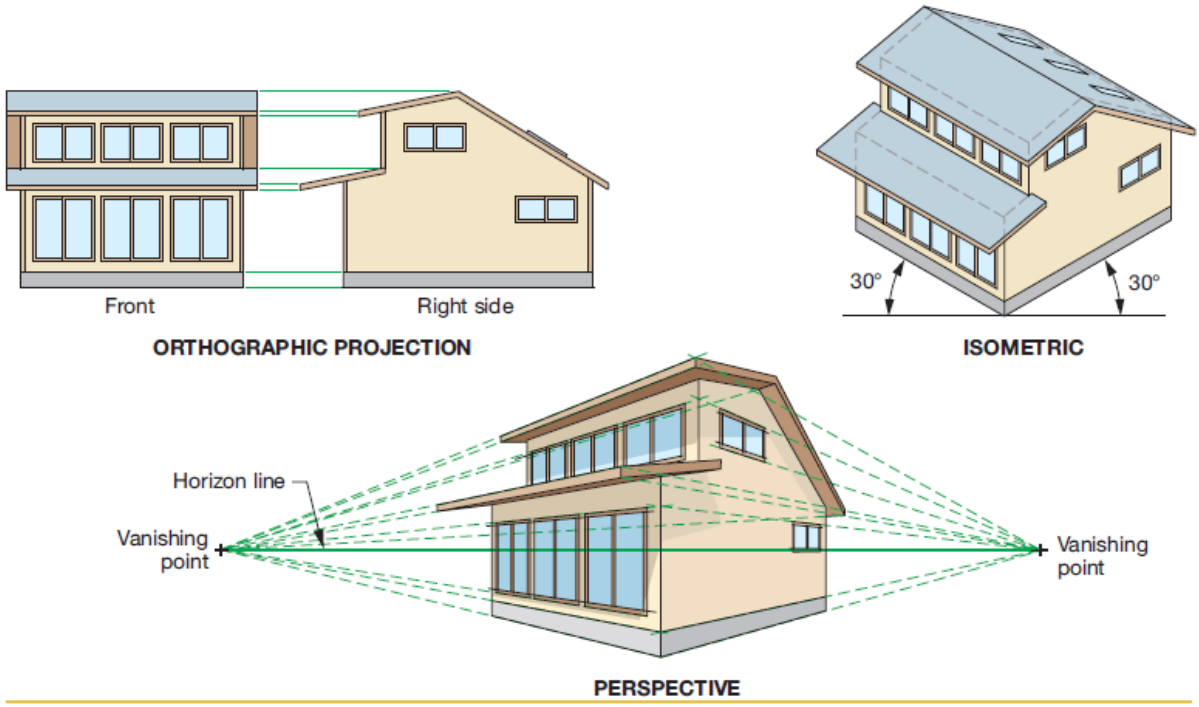


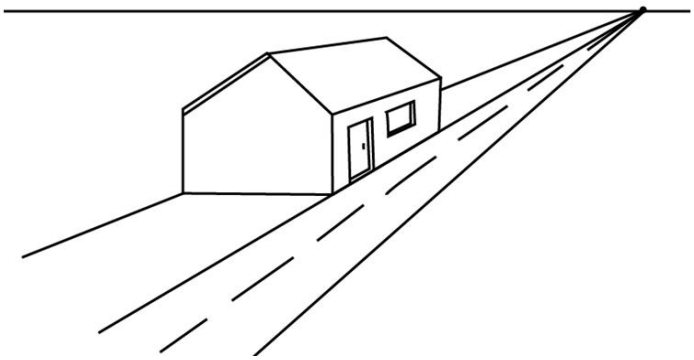
Fig. 1.9: A full set of building plans will use many drawing types to relate information using 2D & 3D techniques.

Perspective projection

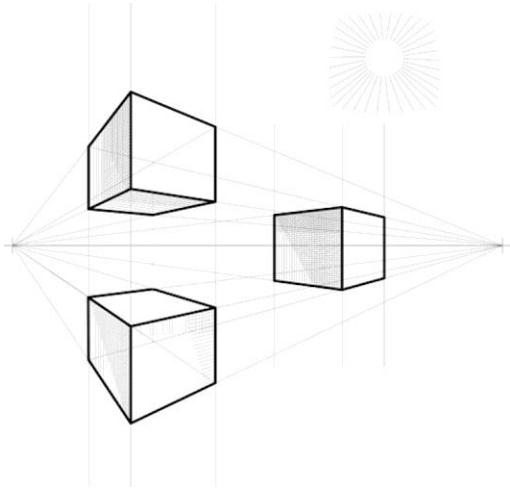
Perspective drawing gives objects on a 2D surface a sense of three-dimensionality. There are two types of perspective: linear perspective and atmospheric perspective.

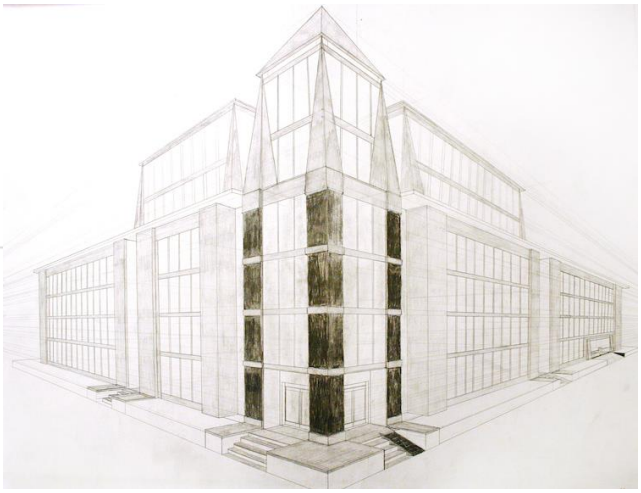
One-Point Perspective

One of the best illustrations of single-point perspective is to imagine that you're looking at a straight road. All of the elements of the composition—particularly the road itself—will converge at a single point on the horizon line.

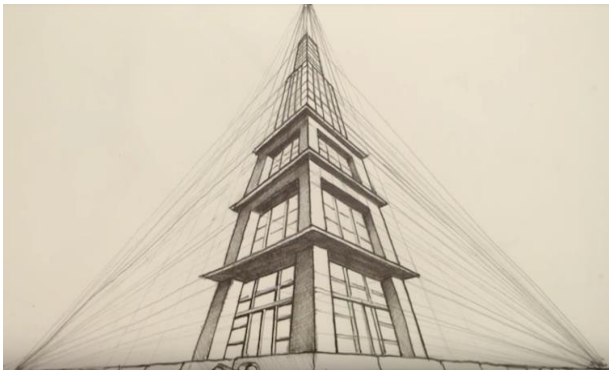


TWO-POINT PERSPECTIVE





THREE-POINT PERSPECTIVE



- **Planning approach**

There is no universal standard for sheet order, however the following describes a common approach:

- ✓ **General Information:** The first sheets in a set may include notes, assembly descriptions, a rendering of the project, or simply the project title.
- ✓ **Site**: Site plans, including a key plan, appear before other plans and on smaller projects may be on the first sheet. A project could require a landscape plan, although this can be integrated with the site plan if the drawing remains clear.
- ✓ **Specific plans :** Floor plans, starting with the lowest floor and ending with the roof plan usually appear near the beginning of the set. Further, for example, reflected Ceiling Plans (RCP)s showing ceiling layouts appear after the floor plans.
- ✓ **Elevations**: Starting with the principal, or front elevation, all the building elevations appear after the plans. Smaller residential projects may display the elevations before the plans. Elevation details may appear on the same sheets as the building elevations.
- ✓ **Sections**: Building sections that describe views cut through the entire building appear next, followed by wall sections, then detail sections.
- ✓ **Details**: Details may appear on any of the previous sheets, or may be collected to appear on detail sheets. These details may include construction details that show how the components of the building fit together. These details may also include millwork drawings or other interior details.
- ✓ **Schedules**: Many aspects of a building must be listed as schedules on larger projects. These include schedules for windows, doors, wall or floor finishes, hardware, landscaping elements, rooms, and areas.

Where additional systems are complex and require many details for installation, specialized additional plan drawings may be used, such as:

- ✓ **Structural**: While smaller projects may only show structural information on the plans and sections, larger projects have separate sheets describing the structure of the building.

- ✓ **Mechanical**: Mechanical drawings show plumbing, heating ventilation and air conditioning systems, or fire protection systems.
- ✓ **Electrical**: Electrical plan drawings may include equipment and cable tray layout, lighting and power, grounding, telephone, local area network, special communications or signal systems, or a reflected lighting plan.

1.5. Interpreting scaled drawings

You should always use the written dimensions when getting sizes from drawings, unless there's a very good reason not to.

On a well-drawn set of drawings, all the sizes the builder needs will be written somewhere on the drawings. Occasionally, however, if a required dimension is not written, the tradesperson will need to 'scale' from the drawing. This means that a scale rule is used to measure directly from the drawings.

1.5.1. Using a scale rule

Scale rules are usually white and made of plastic. They have a different scale printed along each edge. Some have a single scale per edge, and others have two scales combined on one edge. Different brands may vary in the way the scales are grouped. A scale rule can be triangular shaped or flat, like a standard ruler.

On the top edge of the rule below, the scales are 1:1 and 1:100, so the dimensions they show differ by a factor of 100.

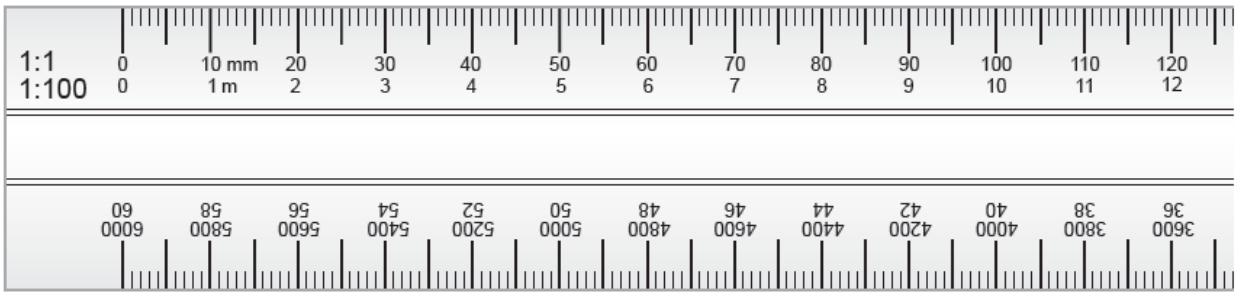


Fig. 1.10: a) Scale ruler

Another scale rule edge is shown below. In this case, the dimensions differ by a factor of 10 (1:50 is 10 times larger than 1:500).

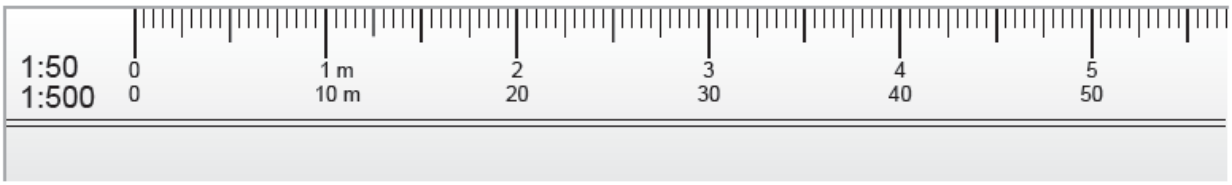


Fig. 1.10: b) Scale Rule age

To measure something to scale, put the zero mark on the left-hand edge of what you are measuring, and read the length at the right-hand edge, as shown below.

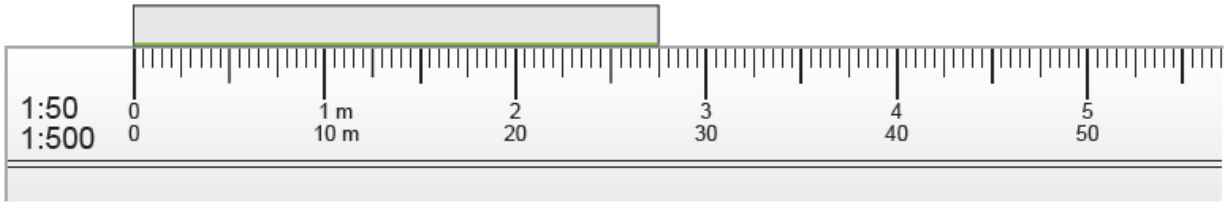


Fig. 1.10: c) Scale reading

Occasionally you may need to draw something yourself in order to explain part of the construction to an employee or subcontractor. Knowing how to use a scale rule will enable you to do it accurately.

1.5.2. Types of Basic Line

Types of Lines	Appearance	Name according to application
Continuous thick line	———	Visible line
Continuous thin line	———	Dimension line Extension line Leader line
Dash thick line	— — — —	Hidden line
Chain thin line	—— - —— - ——	Center line

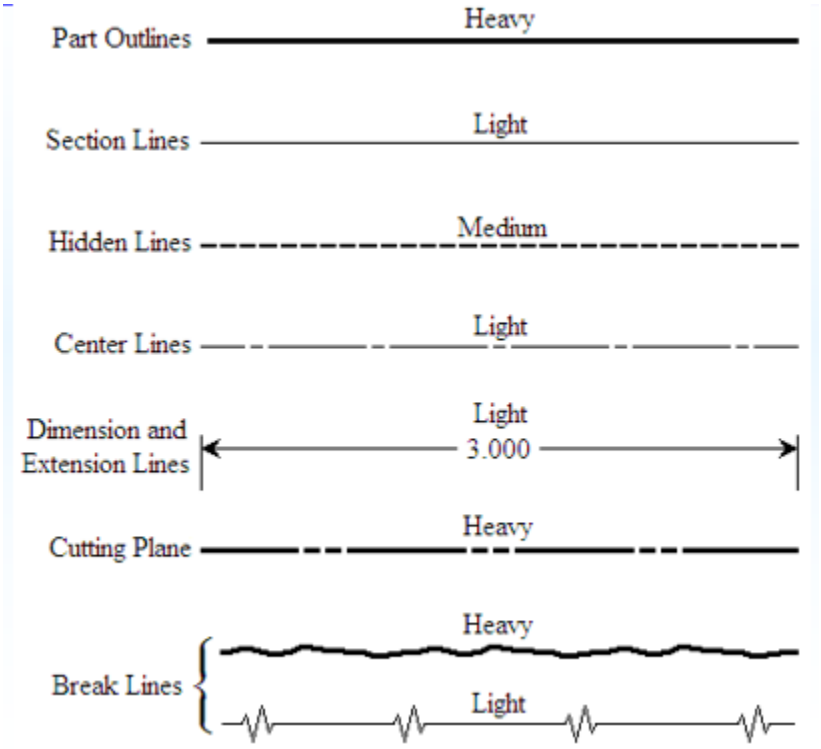


Fig. 11: a) types of line used in drawing

-Visible lines
-Hidden lines
-Center line
-Break line
-Dimension & extension lines
-Section lines
-Cutting plane lines
-Phantom lines

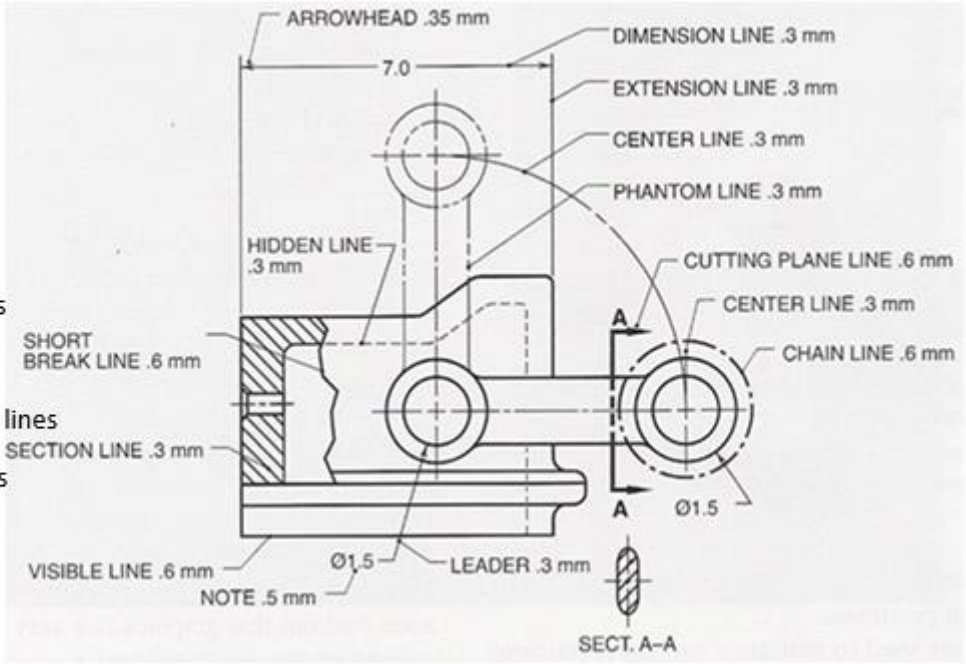


Fig.

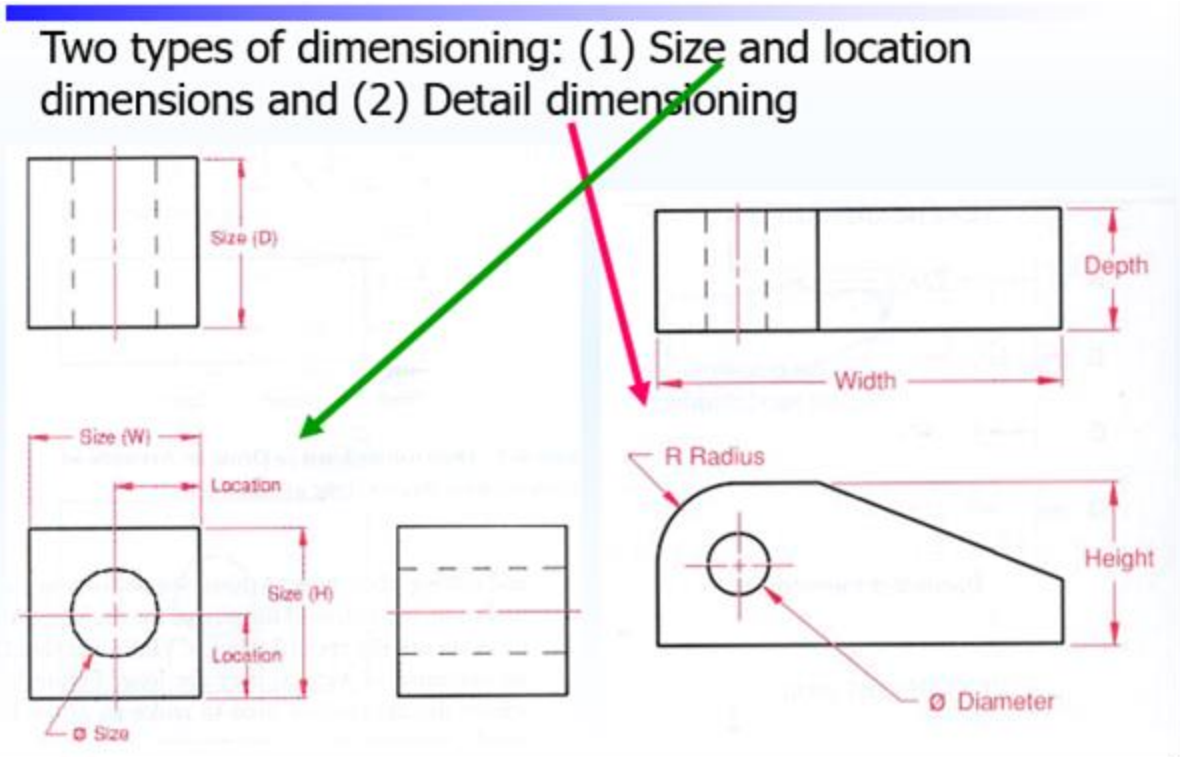
Line Conventions:

- Visible Lines – solid thick lines that represent visible edges or contours

- Hidden Lines – short evenly spaced dashes that depict hidden features
- Section Lines – solid thin lines that indicate cut surfaces
- Center Lines – alternating long and short dashes
- Dimensioning
  - ✓ Dimension Lines - solid thin lines showing dimension extent/direction
  - ✓ Extension Lines - solid thin lines showing point or line to which dimension applies
  - ✓ Leaders – direct notes, dimensions, symbols, part numbers, etc. to features on drawing
- Cutting-Plane and Viewing-Plane Lines – indicate location of cutting planes for sectional views and the viewing position for removed partial views
- Break Lines – indicate only portion of object is drawn. May be random “squiggled” line or thin dashes joined by zigzags.
- Phantom Lines – long thin dashes separated by pairs of short dashes indicate alternate positions of moving parts, adjacent position of related parts and repeated detail
- Chain Line – Lines or surfaces with special requirements

Dimensioning: Two types of dimensioning:
(1) Size and location dimensions and

(2) Detail dimensioning

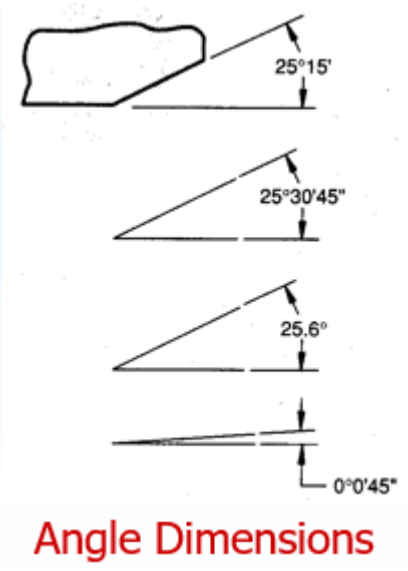


Units of Dimensions

Length: English - Inches, unless otherwise stated

SI – millimeter, mm

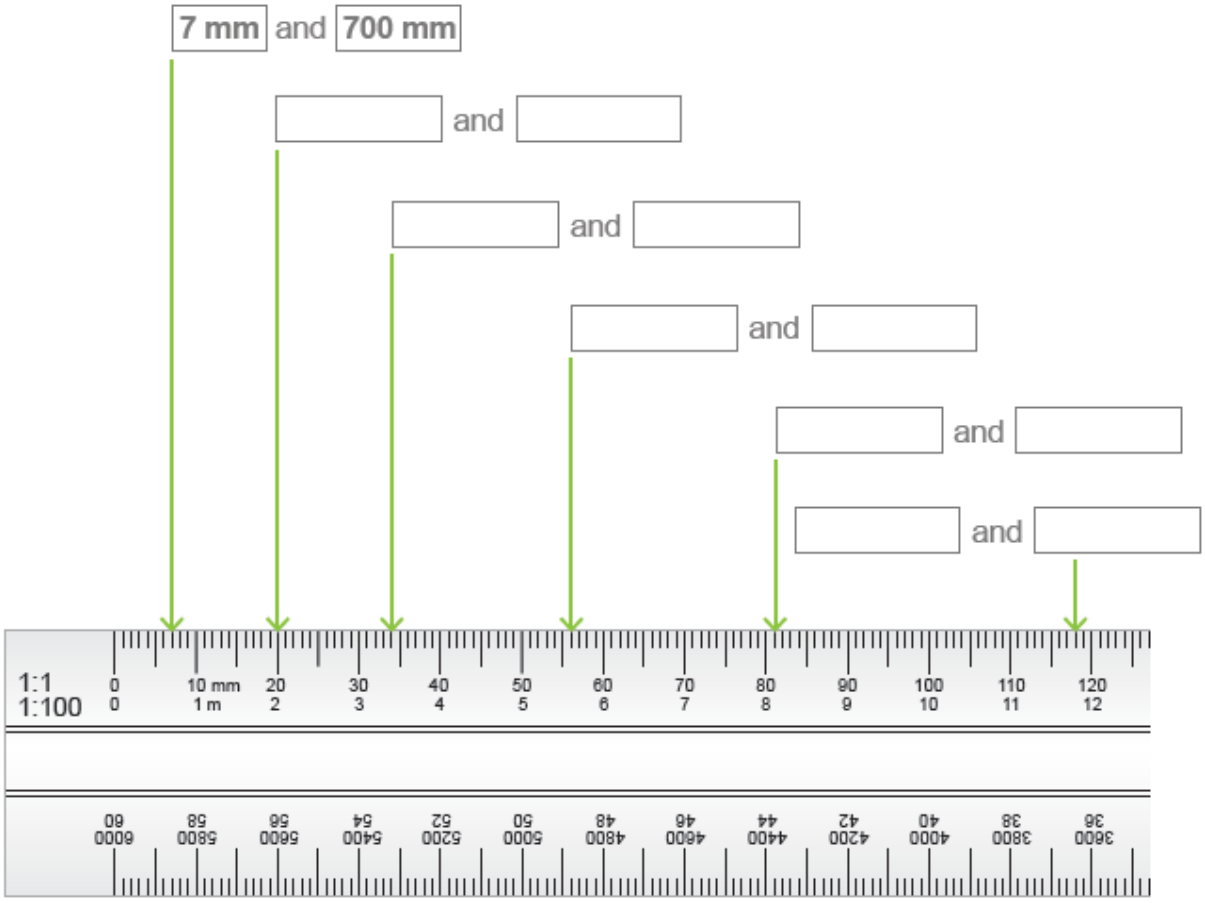
Angle: degrees, minutes, seconds



Self-Check -1	Written Test

Directions: Answer all the questions listed below.

1. What are drawing plan components? List them. (3 points)
2. What are Features of Plans? list them. (5 points)
3. Below is a section of a scale rule. Write the sizes indicated by each of the arrows. An example has been provided.



Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 2	Identifying elevations and sections

2.1. Elevation Plan

An elevation drawing is an orthographic projection drawing that shows one side of the house. The purpose of an elevation drawing is to show the finished appearance of a given side of the house and furnish vertical height dimensions. Four elevations are customarily drawn, one for each side of the house.

An elevation plan ordinarily includes the following:

- Finished floor and ceiling levels
- Porches, decks and patios
- **Grade Line, Floors & Ceilings**
  - ✓ The reference point for most elevations is the grade line.
  - ✓ All features, which are below the grade line, should be drawn with hidden lines.
  - ✓ Examples are: foundation walls, footers & window wells
- **Wall, Windows & Doors**
  - ✓ All visible wall corners are shown on the elevation using object lines.
  - ✓ Windows and doors located on the exterior wall must be included on the elevation.
  - ✓ It is customary to place tops of windows the same height as the tops of doors.
- **Roof Features**
  - ✓ The elevation drawing is where the roof style and pitch are shown, as well as chimney height and size. The roof pitch symbol is preferred when indicated the roof pitch.
  - ✓ If more than one roof height is anticipated, the highest section should be drawn first.
- **Dimensions, Notes & Symbols**

Dimensions on the elevation are mainly vertical height dimensions. Features that must be dimensioned are:

- ✓ Thickness of the footer
- ✓ Distance from the footer to the grade
- ✓ Finished floor-to-finished ceiling distance
- ✓ Overhang width
- ✓ Height of the top of windows and doors
- ✓ Height of the chimney above the roof

- Notes should be included where additional information is needed like:
  - ✓ Grade info.
  - ✓ Exterior wall material notation
  - ✓ Roof covering material identification
  - ✓ Fascia material
  - ✓ Flashing material
- Many symbols may be used to further indicate specifics on the house.

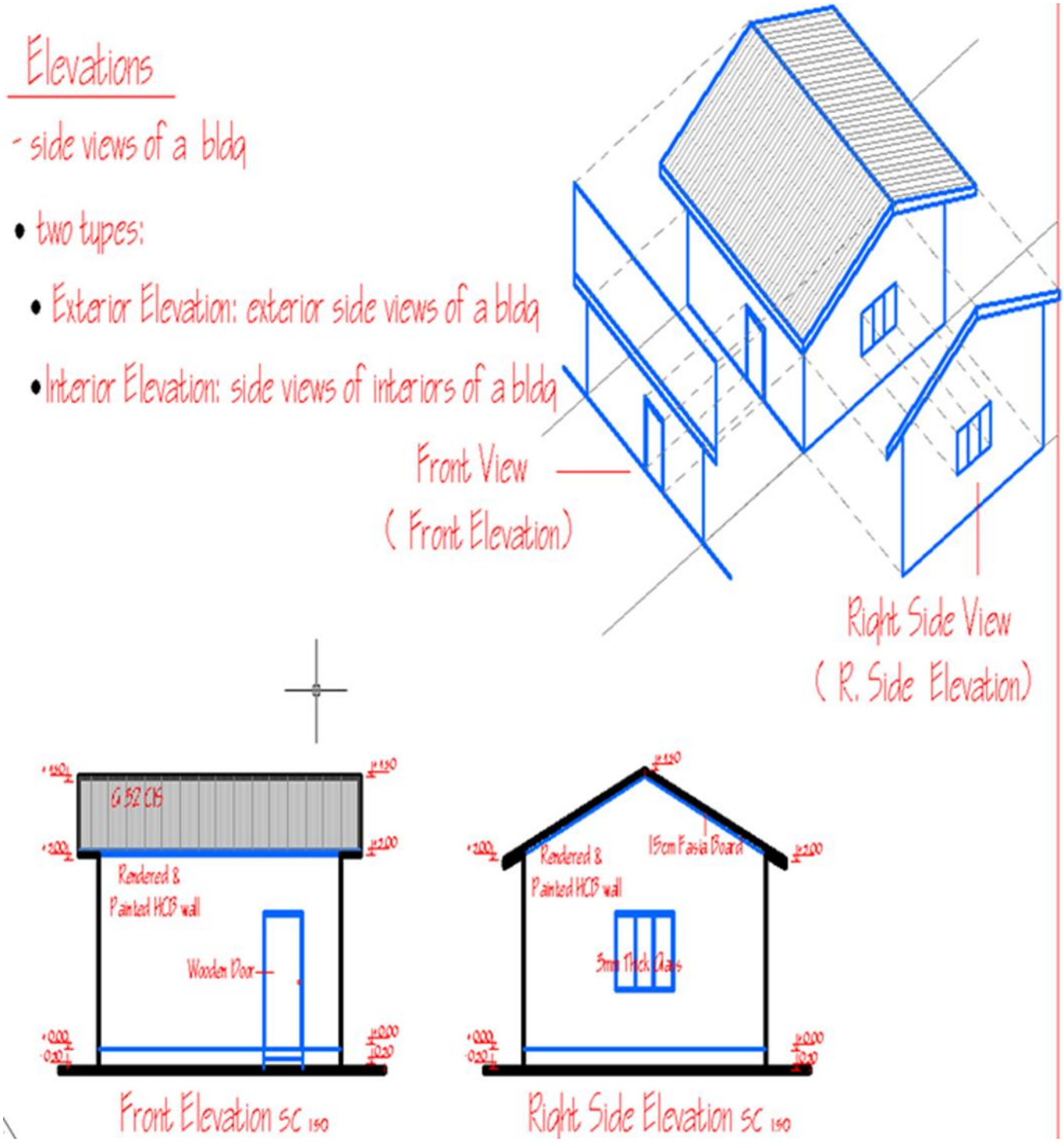


Fig. 2.1: Front and Right-Side Elevation view of the building

Fig. 2.2: Rendered Elevation Drawing

2.2. Section Drawing

In reference to architectural drawing, the term section typically describes a cut through the body of a building, perpendicular to the horizon line. A section drawing is one that shows a vertical cut transecting, typically along a primary axis, an object or building.

The section reveals simultaneously its interior and exterior profiles, the interior space and the material, membrane or wall that separates interior from exterior, providing a view of the object that is not usually seen.

Types of section drawing: -

1. **Full section**: -show the entire building construction & also show the interior spaces in elevation.
   a) **Longitudinal section: -** take on the long axis of the building.

Fig. 2.4: Longitudinal section

b) **Cross section; -** Taken a cross its narrow (short) axis of the building.

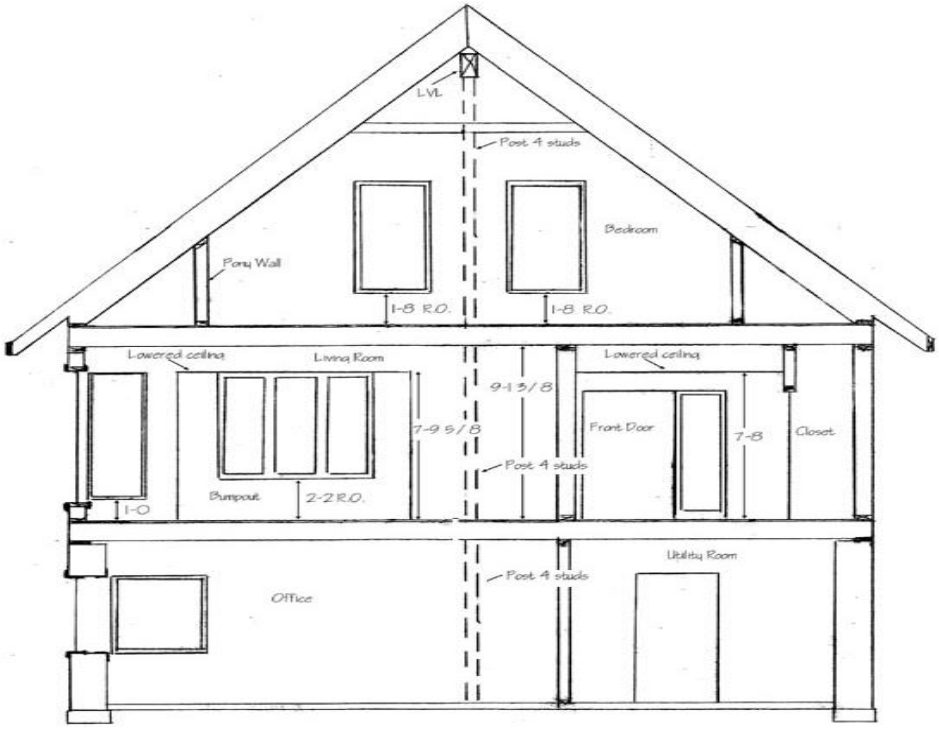


Fig. 2.5: Cross section view

2. **Wall section; -** shows the construction of a typical wall to a large scale.

3. **Detail section: -**sections views cut through a small segment of a building & drawn with enlarge scale.

Detail section provides essential specific information like: -

- Window & door section.
- Stair section
- Structural Detail section.
- Chimney detail.

Sectional drawing is drawn in scale of 1:50 in common working drawing package.

Placement of cutting plane is best to be passé through: -

a) **Stairs**: - to show vertical movement.
b) **Window & door**: - to show details in opening.
c) Important interior spaces to show the interior spaces well.

Generally, it depends on the need to convey the greatest amount of information & clarity for those building the structure.

Number of sections taken is various according to the structural complexity of the particular building.

Section should show: -

- Height dimension
- Description (necessary notes)
- Floor level & there material.
- Foundation construction material.
- Door &window Frames.
- Roof construction.
- Symbols.

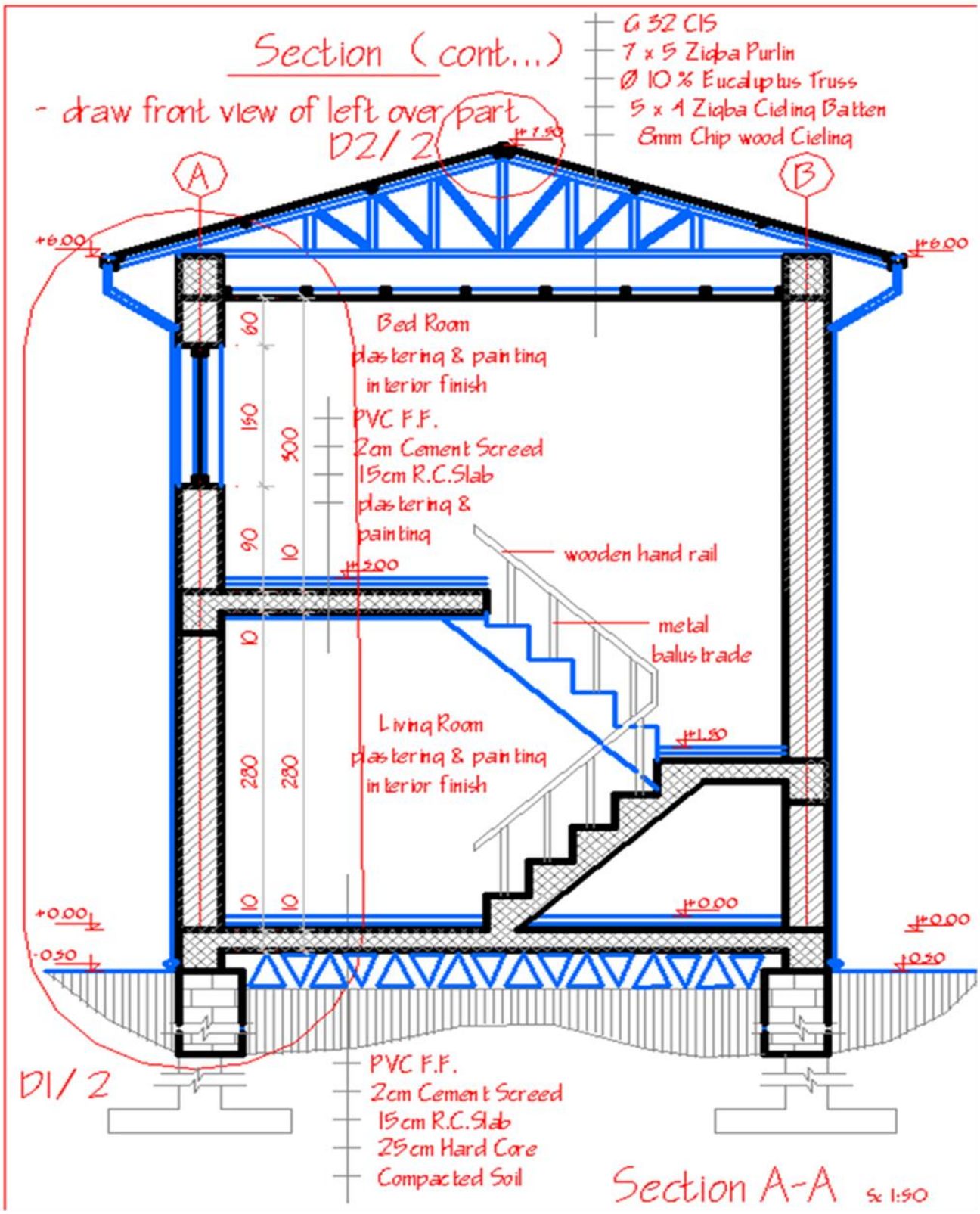


Fig. 2.6: Detail Section

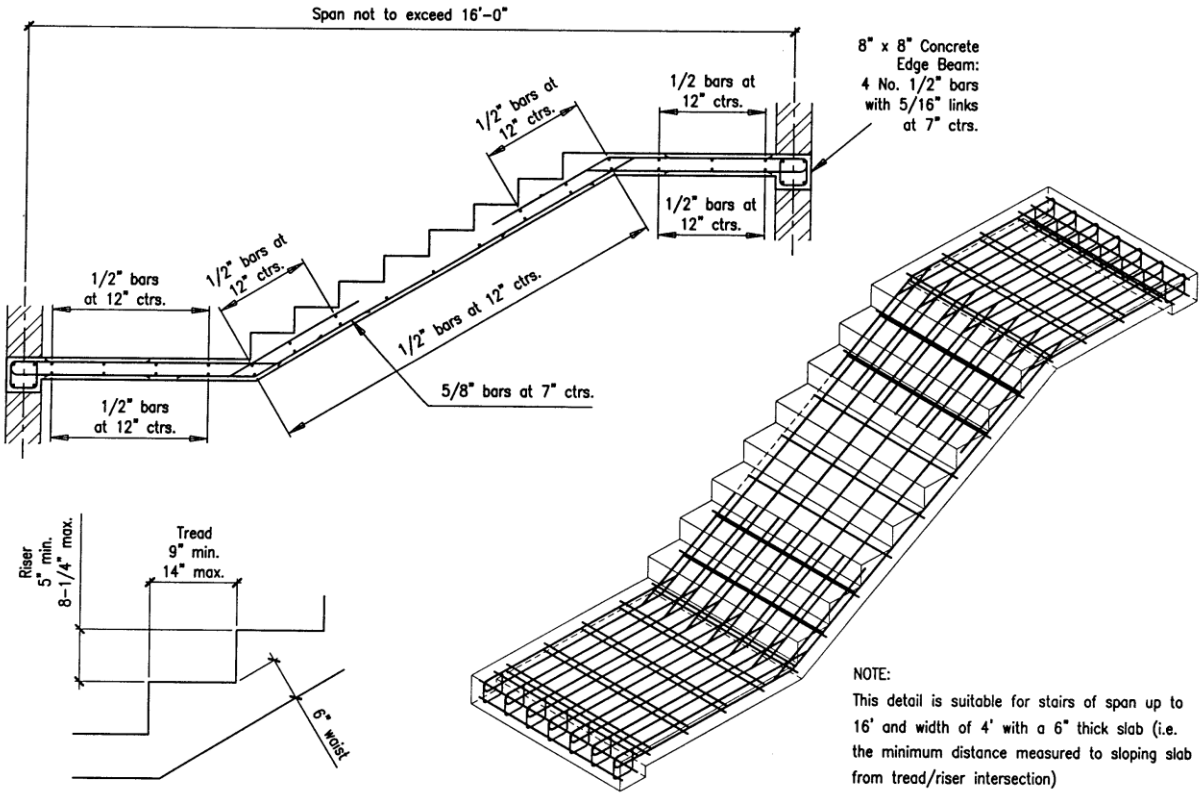


Fig. 2.7: detail drawing of stair

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

3. List components of elevation plan. (5 points)

B. Air spaces

C. Local resources

C. Local maps

D. Services

4. List components of section plan. (5 points)

Note: **Satisfactory rating - 5 and 5 points** **Unsatisfactory - below 5 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Answer key

Self-Check -1

Question #:

1. **drawing plan components** Index
   - Site Plan
   - Utility Information
   - Floor Plans
   - Sections
   - General Building Code Information
   - System Plans & Descriptions
   - Fire Alarm & Sprinkler Systems
   - Statement of Special Inspections
2. Features plan
   - Format
   - Paper sizes
   - Scale
3. (20 and 2000), (35 and 3500), (55 and 5500), (81 and 8100) and (118 and 11800)

Self-Check -2

Question #:

1. Components of Elevation Plan
   - Finished floor and ceiling levels
   - Porches, decks and patios
   - Grade Line, Floors & Ceilings
   - Wall, Windows & Doors
   - Roof Features
   - Dimensions, Notes & Symbols
2. Components of Section Plan
   - Height dimension
   - Description (necessary notes)
   - Floor level & there material.
   - Foundation construction material.
   - Door &window Frames.
   - Roof construction.
   - Symbols.

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