Plumbing installation

Level-II

Learning Guide-19

Unit of Competence: Read and interprète plans and spécifications

Module Title: Reading and interpreting plans and spécifications

LG Code: EISPLI2 M06 LO1-LG-19

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LO1: Identify types of drawings and their functions

Instruction Sheet	**Identify types of drawings and their functions- LG -19**

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

- Identifying main types of Construction plans and drawings
- Identifying building drawings Key features and functions
- Adhering Construction company operations Quality requirements
- Identifying Environmental requirements and controls of building work Building job plans, building Specifications, environmental plan

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:

- Identify main types of Construction plans and drawings
- Identify building drawings Key features and functions
- Adhere Construction company operations Quality requirements
- Identify Environmental requirements and controls of building work Building job plans, building Specifications, environmental plan

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, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in page - 16, 42, 56 and 62 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 in page - 63.
6. Do the “LAP test” in page – 64 (if you are ready).

Information Sheet-1	Identifying main types of Construction plans and drawings

1.1 Types of drawings for building design

Drawing is a universal language which is important to world tread. Many different types of drawing can be used during the process of designing and constructing buildings. Some of the more commonly-used types of drawing are listed below, with links to articles providing further information.

1.1.1 Design drawings

Design drawings are used to develop and communicate ideas about a developing design. In the early stages they might simply demonstrate to the client the ability of a particular design team to undertake the design. They may then be used to develop and communicate the brief, investigate potential sites and assess options, develop the approved idea into a coherent and co-ordinate design, and so on.

1.1.2 Technical drawings

The term 'technical drawing' has a very broad meaning, referring to any drawing that conveys the way that something functions or how it is constructed. Technical drawings are intended to convey one specific meaning, as opposed to artistic drawings which are expressive and may be interpreted in a number of ways. Most drawings prepared during the design and construction of buildings might be considered to be technical drawings**.** It is concerned with the expression of technical ideas of practical nature & is the method used in all branches of technical industries & construction works of all nature.

1.1.3 Artistic drawing

It is mainly concerned with the expression of real or imagined ideas of cultural nature. Anyone can appreciate artistic drawing (even if each viewer has his own unique appreciation)

1.1.4 Perspective drawing

Perspective drawing is a technique for depicting three-dimensional volumes and spatial relationships based on the eye level and vanishing point (or points) of the viewer. It can give a realistic impression of what a volume or space will look like in reality. See figure 1.1

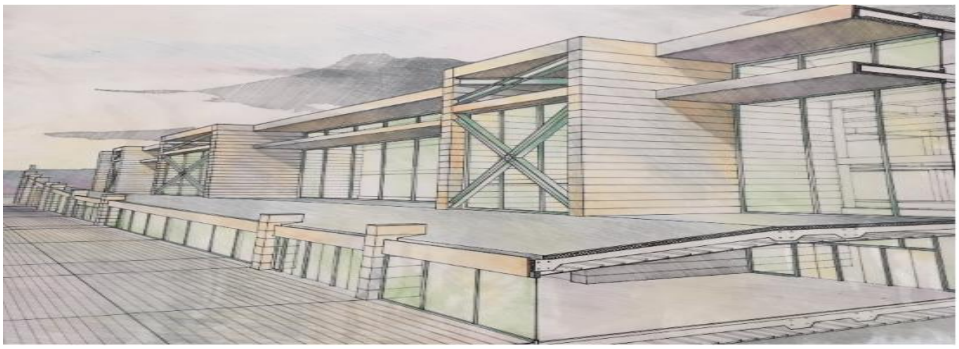


Figure 1.1 - Perspective view

1.1.5 Working drawings

Working drawings or construction working drawings provide dimensioned, graphical information that can be used; by a contractor to construct the works, or by suppliers to fabricate components of the works or to assemble or install components. Along with specifications and bills of quantities or schedules of work, they form a part of the 'production information' that is prepared by designers and passed to the construction team to enable a project to be constructed.

1.1.6 Detail drawings

Detail drawings provide a detailed description of the geometric form of a part of an object such as a building, bridge, tunnel, machine, plant, and so on. They tend to be large-scale drawings that show in detail parts that may be included in less detail on general arrangement drawings.

1.1.7 Engineering drawing

An engineering drawing is a type of technical drawing used to define the requirements for engineering products or components. Typically, the purpose of an engineering drawing is to clearly and accurately capture all geometric features of a product or component so that a manufacturer or engineer can produce the required item. Engineering drawing requires some training to understand (like any language).

1.1.8 Installation drawing

Installation drawings present the information needed by trades to install part of the works. This may be particularly important for complex installations such as plant rooms, data centers, ventilation systems, under floor heating, and so on.

1.1.9 Construction drawing

Construction drawing is the general term used for drawings that form part of the production information that is incorporated into tender documentation and then the contract documents for the construction works. This means they have legal significance and form part of the agreement between the employer and the contractor.

The main purpose of construction drawings is to provide a graphic representation of what is to be built. Construction drawings should be concise and coordinated to avoid, wherever possible, ambiguity and confusion. Delays and misunderstandings can be minimized by properly coordinating the drawings.

Construction drawings are generally drawn to scale, either in an elevation, plan or section view. They adopt a set of standard architectural hatchings and symbols that allow anyone familiar with them to decipher and interpret them. A complete set of construction drawings tends to plans comprise floor, elevations, sections and detail drawings, that together provide a complete representation of the building. On many projects, each major trade will have separate trade drawings, e.g. electrical, plumbing and so on.

1.1.10 Shop drawing

Shop drawings might be prepared by contractors, subcontractors, suppliers, manufacturers or fabricators. They generally relate to pre-fabricated components, showing how they should be manufactured or installed. They take design intent drawings and specifications prepared by the project design team and develop them to show in detail how the component will actually be manufactured, fabricated, assembled or installed.

1.2 Types of plans

Plans are drawn to accurately describe a particular object or building to all interested parties before it is constructed. If accurate plans are prepared then the proposed building will be fully understood by the Local Authority who approve the plans and the builder and trades persons who will build it.

Everyone has to work to some sort of plan, in order to meet the customer's requirements. On large construction jobs, very detailed plans are needed. In the off-site construction industry where you may be working to produce anything from:

- Shop fittings
- Pre-fabricated housing components
- Headstones
- Signs
- Plans may be less detailed.

The plans are not as detailed. They still give information such as:

- What you are making, including sizes and design
- The materials to use
- Where to install the product, if required
- How to install the product.

Plans will show:

- The location and size of the spaces in the building
- The materials that are to be used
- The location of the building on the site
- Special fittings and finishes
- In some cases the layout of services eg. Power and gas.

There are different types of construction plans with its function.

1.2.1 Floor plans

The most important architectural drawing is floor plan. It contains more information than all the other working drawings. The floor plan represents a tremendous amount of the project designer's time spent in analyzing and meeting the needs of the client. Basically the floor plan is a horizontal sectional view of the building taken about 150 cm above the floor line. It s purpose is to install the floor, to layout, cons tract walls & partitions. See figure 1.2

Floor plan specify

- Dimensions of overall brickwork, stud framing and room sizes to rough stud frames.
- Trim openings of all windows and doors.
- Space allowance for refrigerator and white goods.
- Wardrobe depths.
- Location and spacing of all columns and verandah posts.
- Roof and eave lines as dashed lines
- Doors and windows to describing the details of each
- Internal dimensions to establish positions of internal walls or fittings
- Thickness of walls
- Door swings
- Windows
- Location of fittings and fixtures
- Names on all rooms
- Floor finishes
- Position of stairs and number of stair treads

1.2.2 Foundation plan

It is a drawing showing the site & configuration of the floor plan. It is a drawing that shows the location of foundation wall concrete footings that shows the location of foundation wall concrete footings etc which are required to support a structure. See Figure 1.2

Its Purpose is used to shows the entire foundation system. At point just after the back filling is completed.

- To show all components such as the foundation wall footings, grade beams & any sub structure elements.
- It draws the same scale to the floor plan.
- Foundation plan should show;

  - Foundation wall thickness.
  - Grid lines.
  - Position at which detailed of foundation taken.
  - Level for excavation.
  - Position of wall relative to foundation.
  - Dimension.
  - Position of services to be installed below ground level.
  - Footing, grade beam

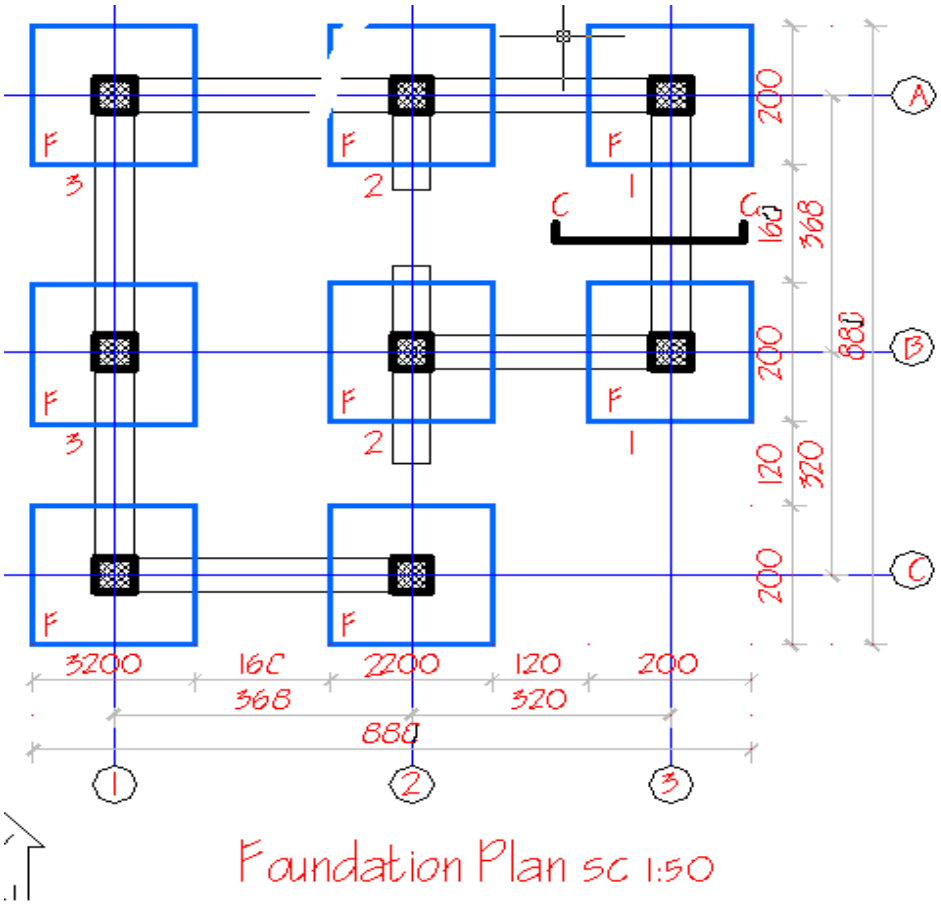


Figure 1.2 – Foundation plan

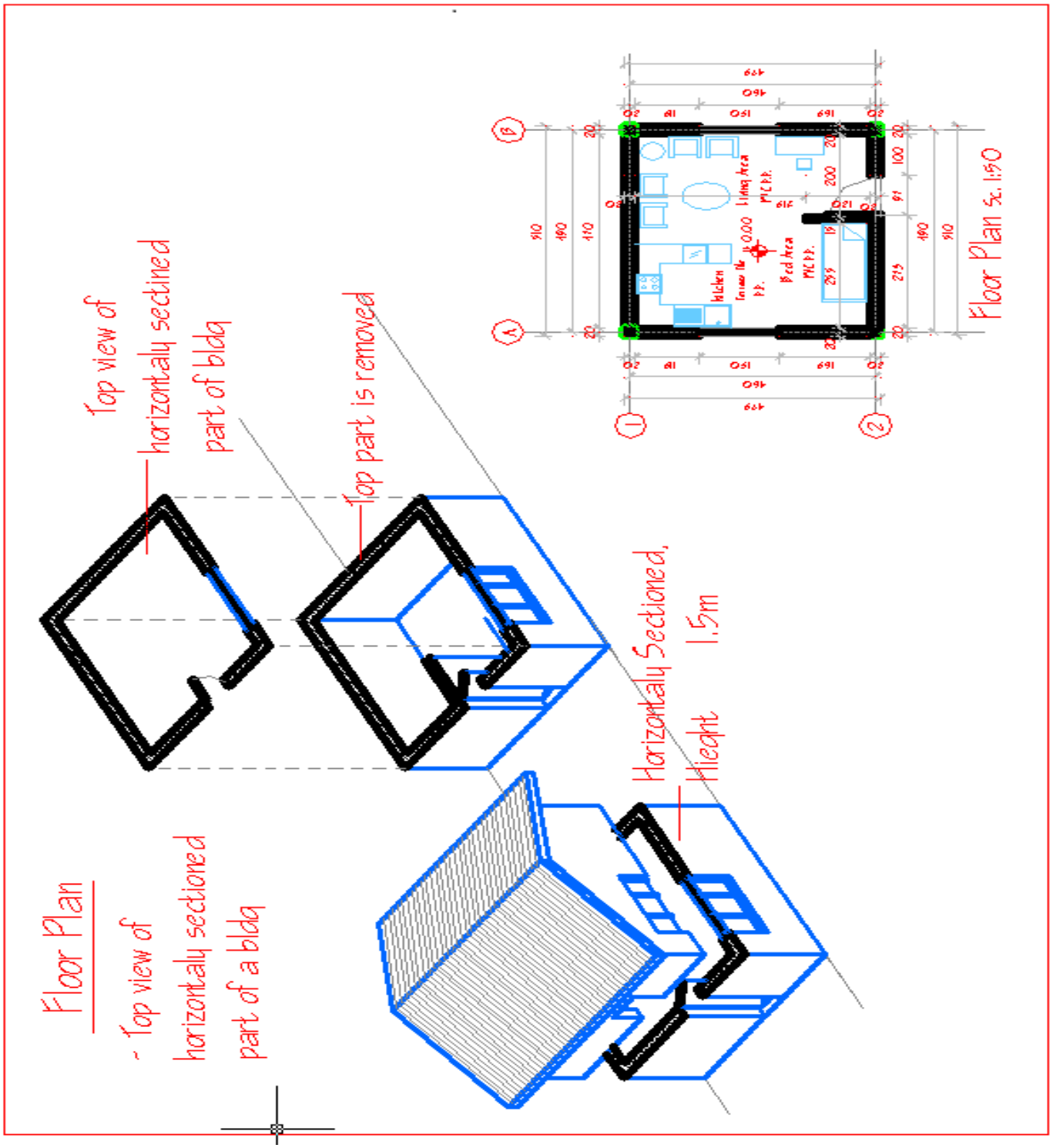


Figure 1.3 – Floor plan

1.2.3 Site plan

It is the top view of a building which shows the location of the house on the site together with information on terraces walks driveways, contours, elevation & utilities. See figure 1.4

Site plan should show;

- Streets, sidewalks, parking
- Sewerage, man hole, drainage lines
- Couture, trees
- Dimension
- Fences,
- North arrow
- Legend: - showing all symbols & materials used on the site.

Site Plan will specifies

- Outline of site boundaries showing location of proposed building
- Position of boundary setbacks.
- Depths, where they may occur.
- New roads and pathways
- Soil and surface water drains, complete with pipe sizes
- Service runs from the house to mains.
- Location of utility services (sewer, water, gas, electricity)
- The point of connection of those services to the house itself
- Indication of banking and cutting and areas for depositing and spreading surplus soil.
- New levels on the site in connection with the new house.
- Landscaping. Note, if the site is undulating or steep, section should be added to show principle areas of cutting and filling. They may also include:

  a. Real property description and lot number, etc.

B. North direction indicated

c. Street position and owners‟ name

d. Contours and levels

e. Driveway

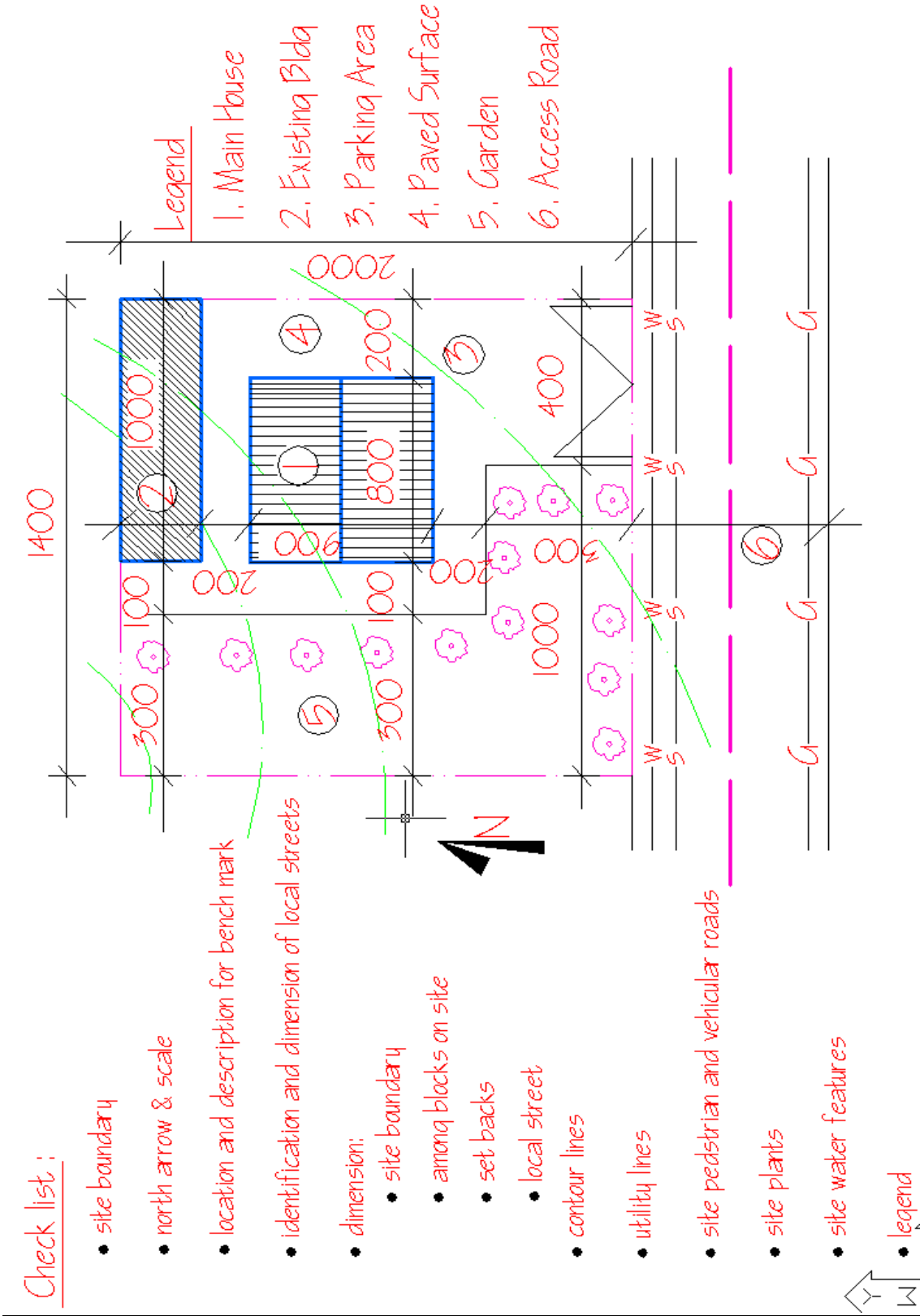


Figure 1.4 – Site plan

1.2.4 Survey Plan - Usually produced by a surveyor (See Figure 1.5)

- Existing site and surroundings.
- Position of major natural features, trees, ponds, rock out crops.
- Sufficient spot levels and contour lines related to a specified datum (height above sea level).
- Dimensions of boundaries.
- Position of roadways, easements; existing drains and possibly service mains.

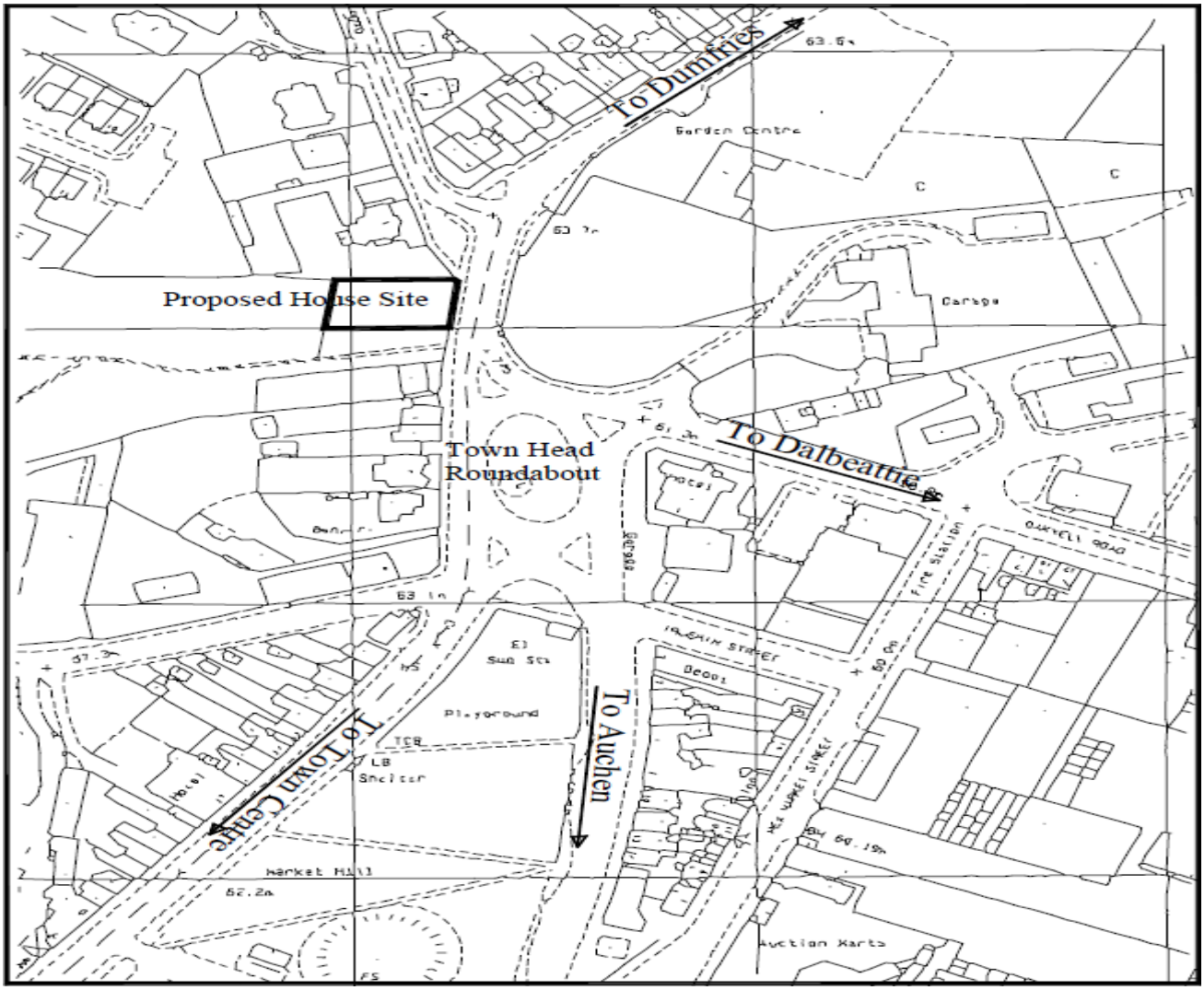


Figure 1.5 Survey plan

1.2.5 Footing plan

- Width and depth of all footings to wall, piers, and stanchions
- Location of footing system
- Position and levels of drains and gulley's close to footing
- Walls above footings with thickness noted.

1.2.6 Roof plan

- Shape of roofs
- Slopes of levels
- Types of coverings
- Falls to gutters and gutters
- Roof lights
- Possible type of construction.

Note, on simple houses the roof plan is super imposed over the floor plan See 1.6

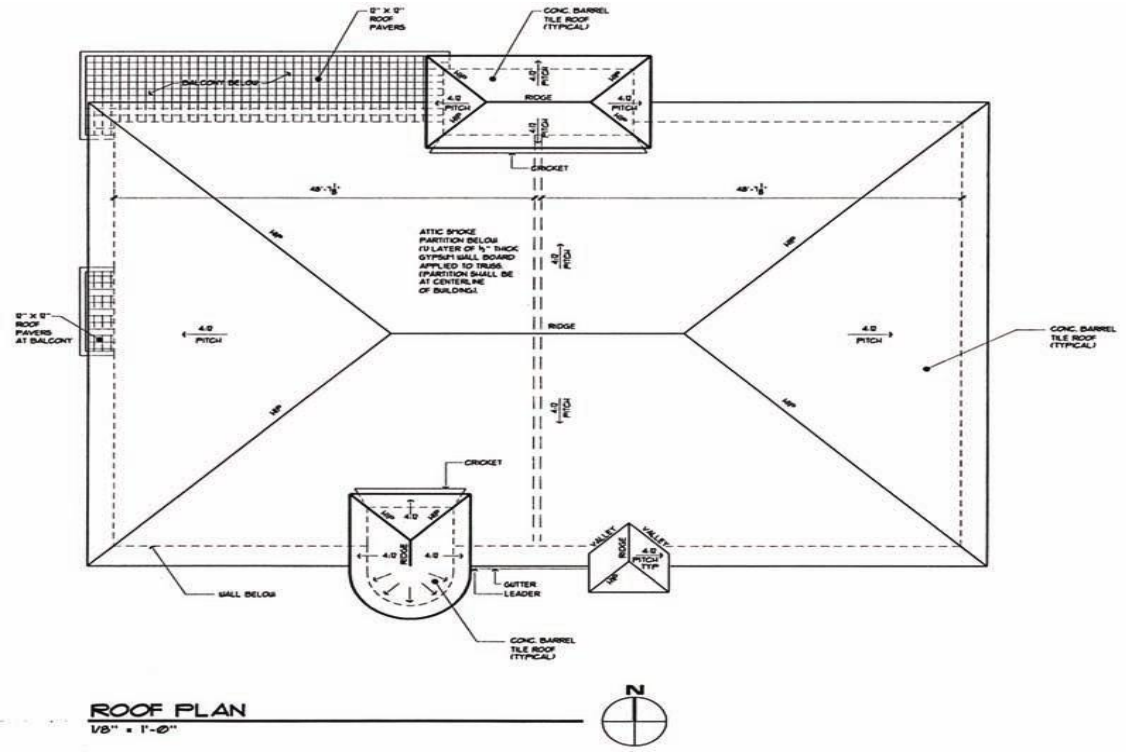


Figure 1.6 Roof plan

1.2.7 Services plan

Showing the arrangement of:

- Electrical layout
- Plumbing and internal drainage layouts.(See Figure 1.7)
- Air-conditioning or other mechanical services.

On simpler houses the electrical layout and plumbing layouts are superimposed on the floor plan.

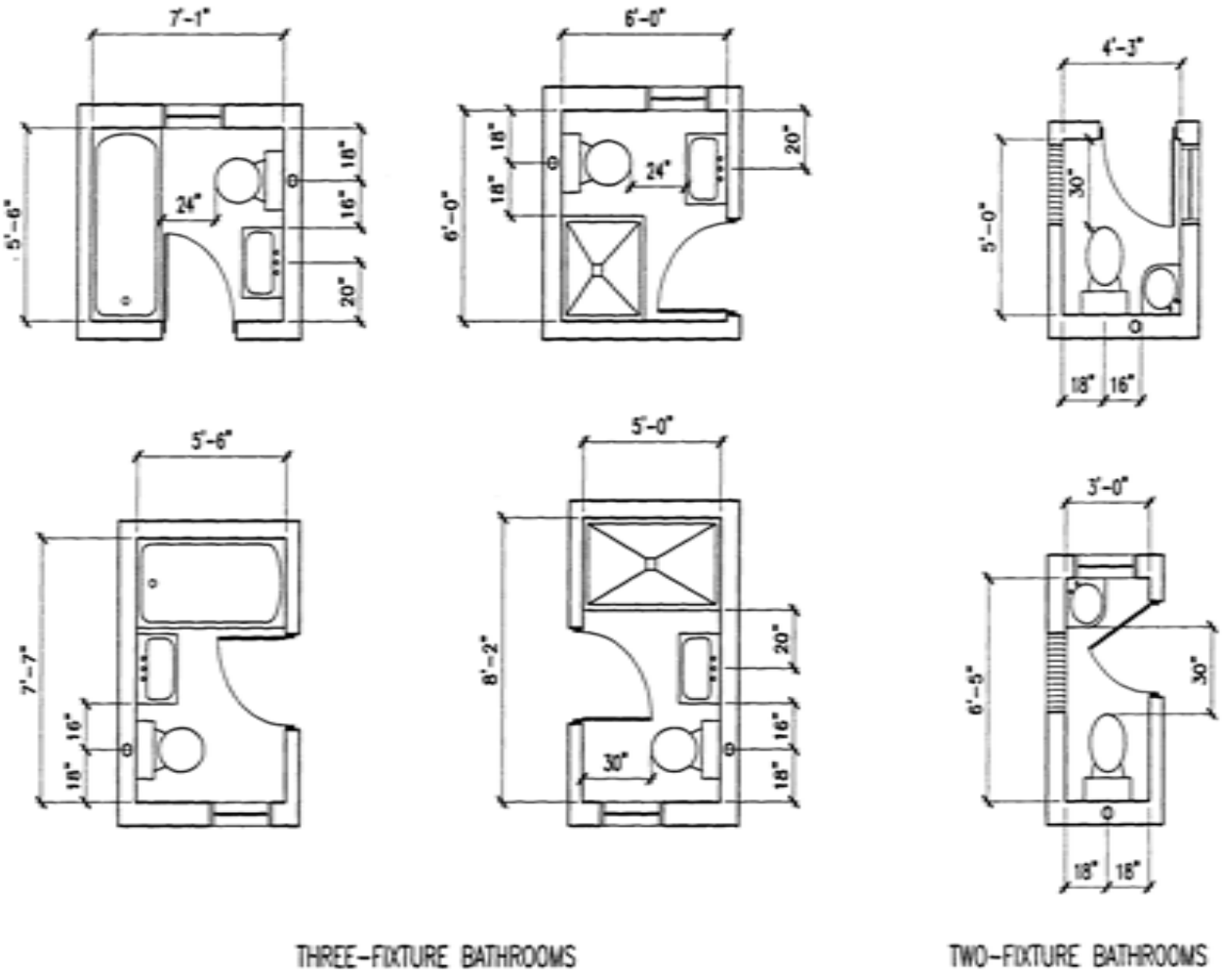


Figure 1.7 Plumbing plan

Self-Check -1	Written Test

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

1. Types of construction plan which shows the location of the house on the site together with information on terraces walks driveways, contours, elevation & utilities.

   A. Floor plan B. Foundation plan C. Site plan

2. The plans are not as detailed.

   A. True B. False

3. Drawings provide dimensioned, graphical information that can be used; by a contractor to construct the works, or by suppliers to fabricate components of the works or to assemble or install components.

   A. Construction working drawing B. Technical drawing C. Design drawing

4. As a requirement to construct building only accurately plans are drawn to describe a particular object or building.

   A. True B. False

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ **Date:** _____

Information Sheet-2	**Identifying building drawings** **Key features and functions**

2.1 Building working drawings

Working drawings enable estimators, builders and sub-contract trades persons to perform their respective tasks. Most working drawings have a standard layout of plans, elevations and detail sections. If you need to reach information from plans, this standard layout will help you find it. A set of drawings for the construction of a building consists of some or all of the following:

- Site Plan
- Foundation Plan
- Floor Plan
- Elevations (four)
- Sectional Elevation
- Section Details
- Tie Down/Fixings

Most of these relate to on-site construction plans, in off-site some plans will apply. The importance of job instructions in off-site construction workplace, such as a factory, will be discussed towards the end of this section. General requirements for working plans are that they be drawn to a scale of 1:100 except construction details, which are required to be drawn to a minimum scale of 1:20 and site plans to a scale of 1:500. However, 1:200 is preferred by many Local Authorities.

The scale may also depend on the area of the site. Off-site trades people, like construction workers, must be able to read and interpret plans without error. Often this could be the only method by which you will be able to calculate the size of the products you are going to produce and the materials you will need.

2.2 Key features and functions of working drawing

2.2.1. Site plan

The site plan is a vertical plan view of the building site or allotment. It identifies the location, shape, size and orientation of the construction site, and the position of the building or buildings on the site. It may also give other details such as:

- Real property description. (r.p.d.)
- Area of allotment
- Access roads
- Service points
- Contour lines
- Significant physical features
- Storm water drainage.

The North point is always shown on the site plan to show the orientation of the site and the building/s. Site plans are usually drawn to a scale of 1:200 with dimensions given in metres to two (2) decimal places. Refer to Figures 2.2 and Figure 2.3, and study the site plan and the information it conveys. Figure 2.*1* is a simple site plan used for orientation purposes only. The North point is indicated and from this you can determine the North, South, East and West boundaries likewise the North, South, East and West sides of the building. Example 1

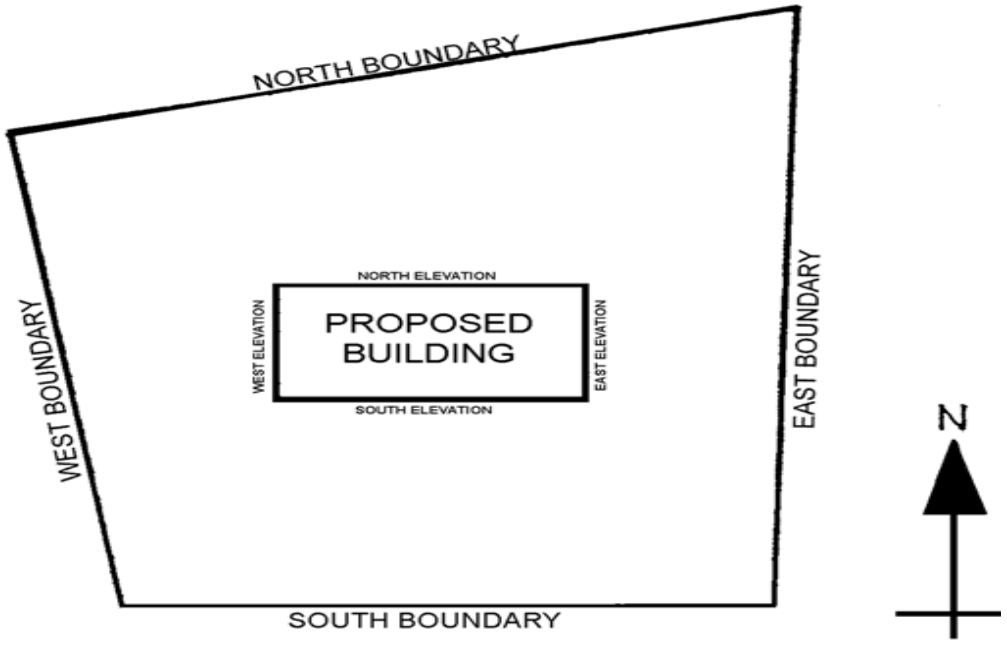


Figure 2.1 - A Simple Plan Showing Orientation Only

With reference to Figure 2.2 you will notice that it not only shows the distance the proposed office building is from the boundary lines but also the sewer main, sewer connection, underground power connection and the access drive to the adjacent street.

The position of a proposed future extension is shown in the North East corner. The example site plan shown in Figure 2.3, in addition to other information, indicates a datum set out point and contour lines. From the contour lines you can determine the fall of the allotment which in this case falls 2.1m, along the East boundary from North to South and 0.5m along the South boundary from West to East. You can also determine that the finished floor level (F.F.L.) is to be 1400 above the datum set out point.

Example 2

A site plan showing the access to the site from the adjacent street.

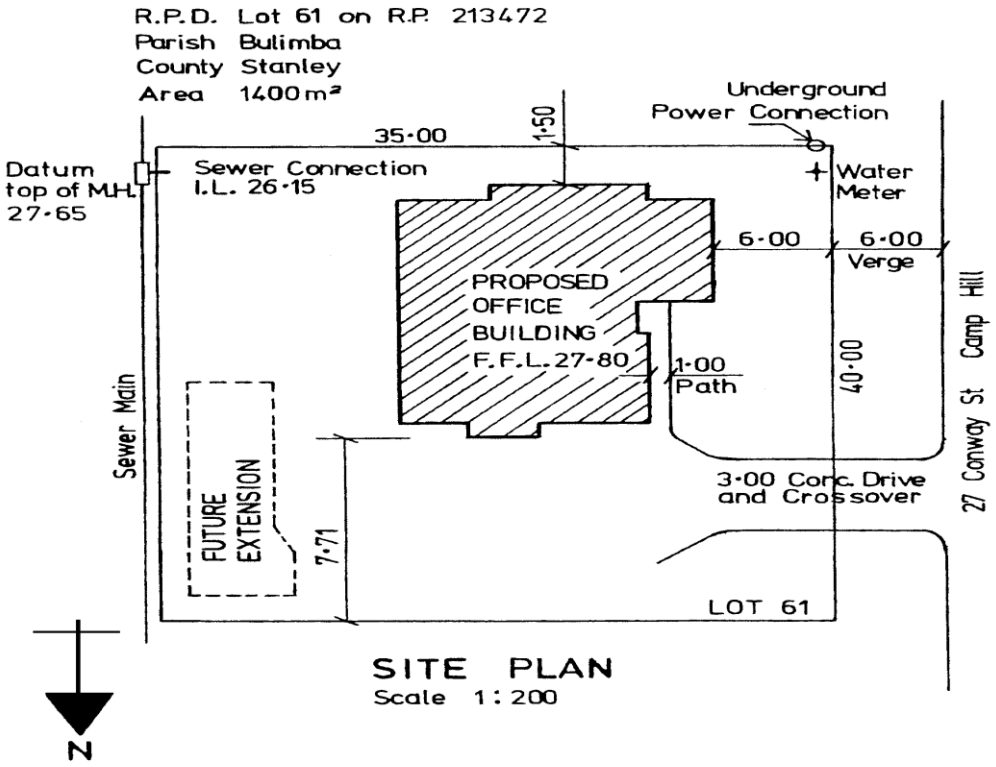


Figure 2.2 - Site Plan

Example 3

A site plan showing contours, concrete drive way and paths.

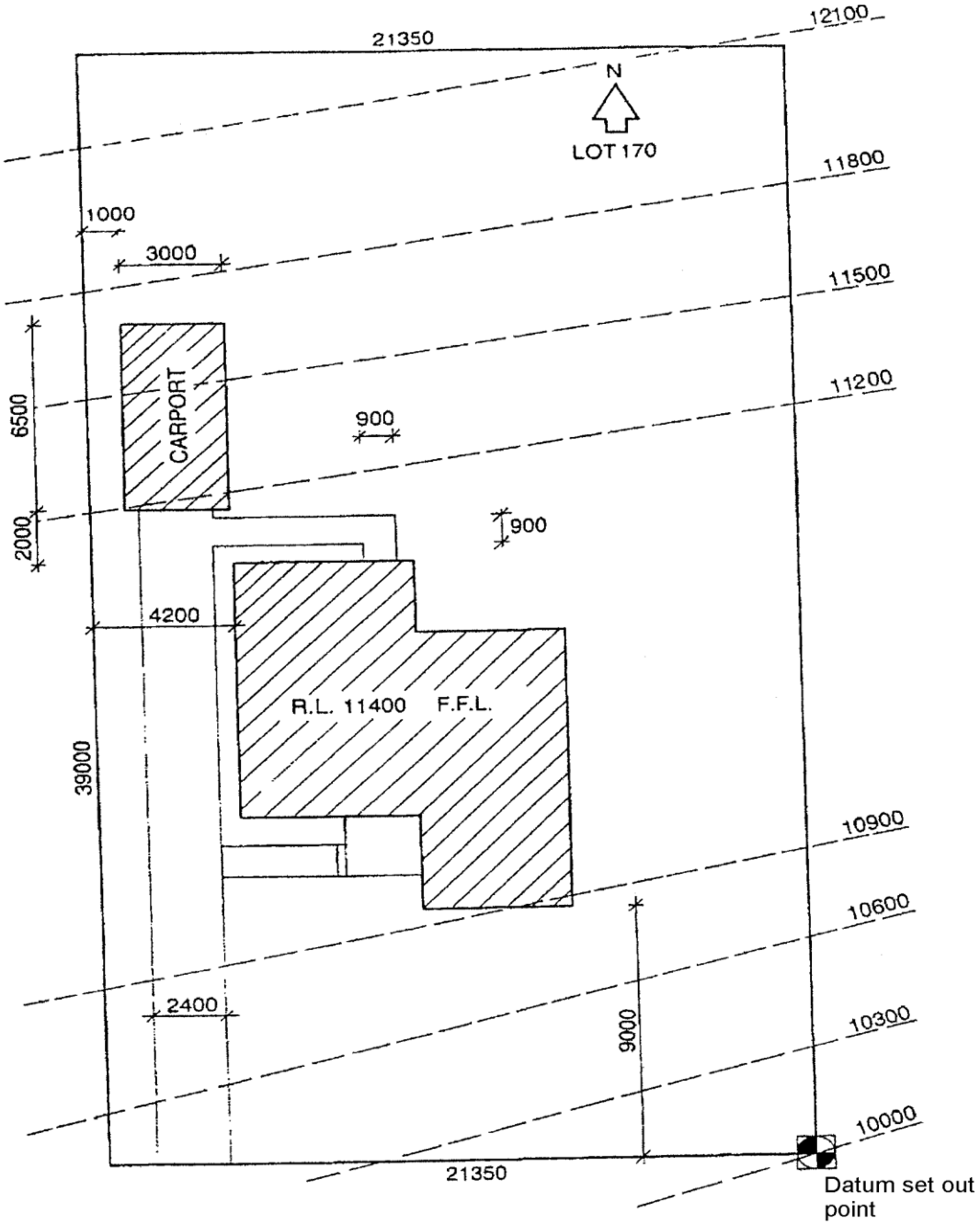
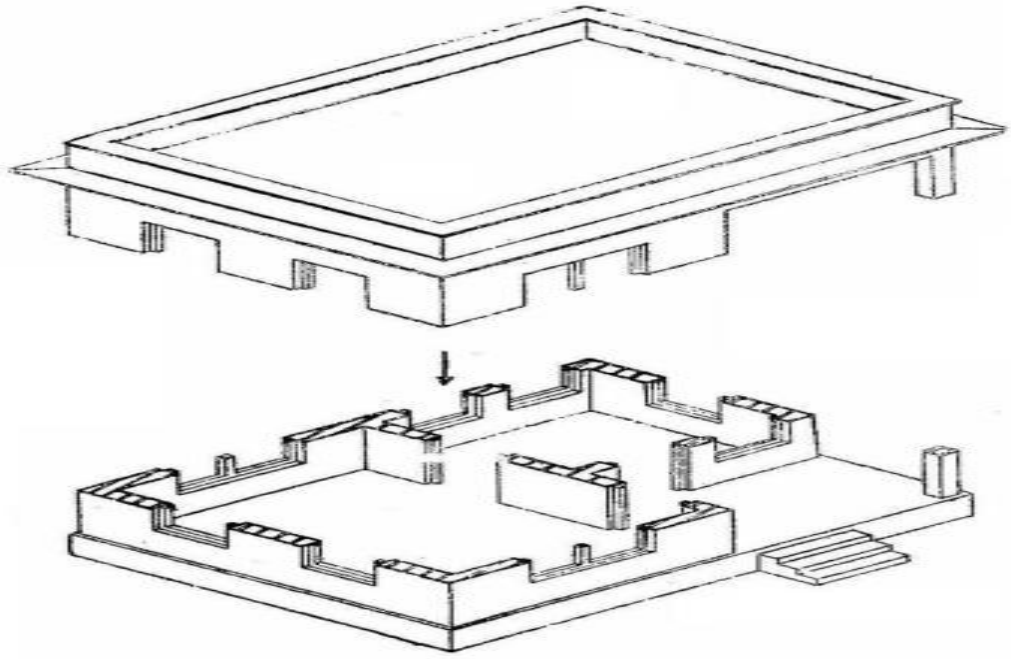


Figure 2.3 - Site Plan – Scale 1:200

2.2.2 Floor plans

This plan (refer Figure 2.4) usually gives more information than any other part of the working drawings and includes:

- Overall shape and size;
- Dimensions of individual rooms, patios, verandahs etc;
- Thickness of walls, external and internal;
- Position of openings, windows and doors;
- Roof outline; and
- Position of hanging and strutting beams if application
- Necessary dimension
- Interior dimension
- Floor label
- Opening dimension
- Door and window symbol
- Column centre to centre
- Symbols of plumbing fixture
- Change of direction
- Grid lines and column
- Over all dimensions
- Cutting planes
- Floor finish
- Pavements, drainage lines, ramps



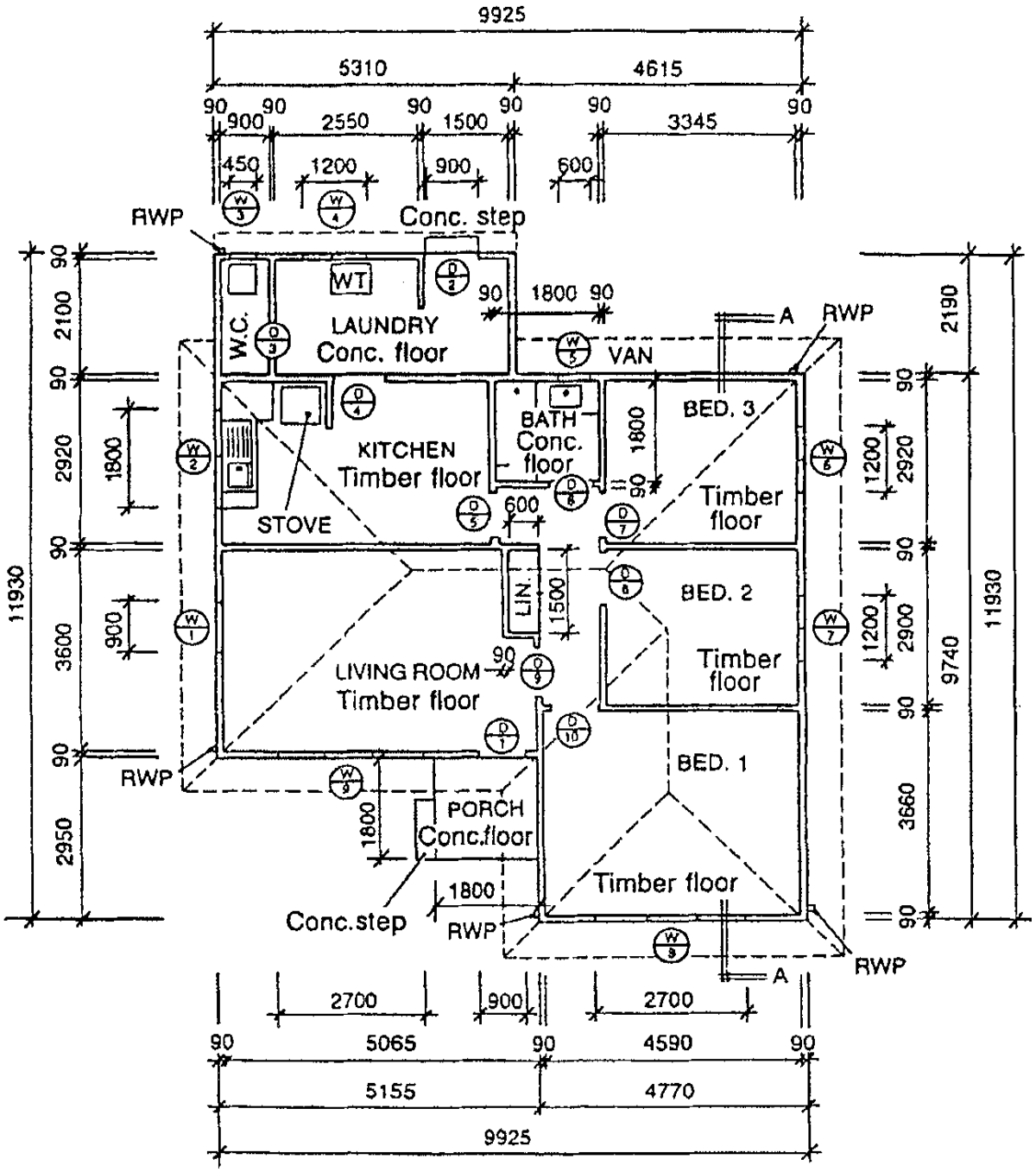


Figure 2.4 - Floor Plan

2.2.3 Foundation plan

Foundation plans are drawn to a scale of 1:100 and any dimensions are in millimetres. The size and type of reinforcement for concrete footings and slabs is often stated adjacent to the foundation plan. Figure 2.5 is an example of a typical foundation plan for a brick veneer dwelling. The foundation plan shows:

- Thickness and width of all footings whether strip or isolated
- Thickness of foundation walls
- Size of columns and concrete slab
- Thickness of concrete slab
- Thickness and width of slab thickening - when required to support load bearing walls.

2.2.4 Elevations

It is a view of a building containing a height dimension to show the height of the building & window & door. See Figure 2.6 (A and B)

Information shown on or adjacent to elevations is:

- Windows and doors to external walls
- External cladding for example, brick veneer, chamfer boards, fiber cement etc
- General roof shape and slope (pitch)
- Roof overhang
- Hand rail heights to verandahs if applicable.
- Dimension
- Notes indicating material (wall finish).

- Labeling views, two methods are used to label elevation views.

1. Related to the main gate to the house.
2. Related to Orientation of a building to north ward.

  - Front - North

- Rear - East
- Right - South
- Left - West

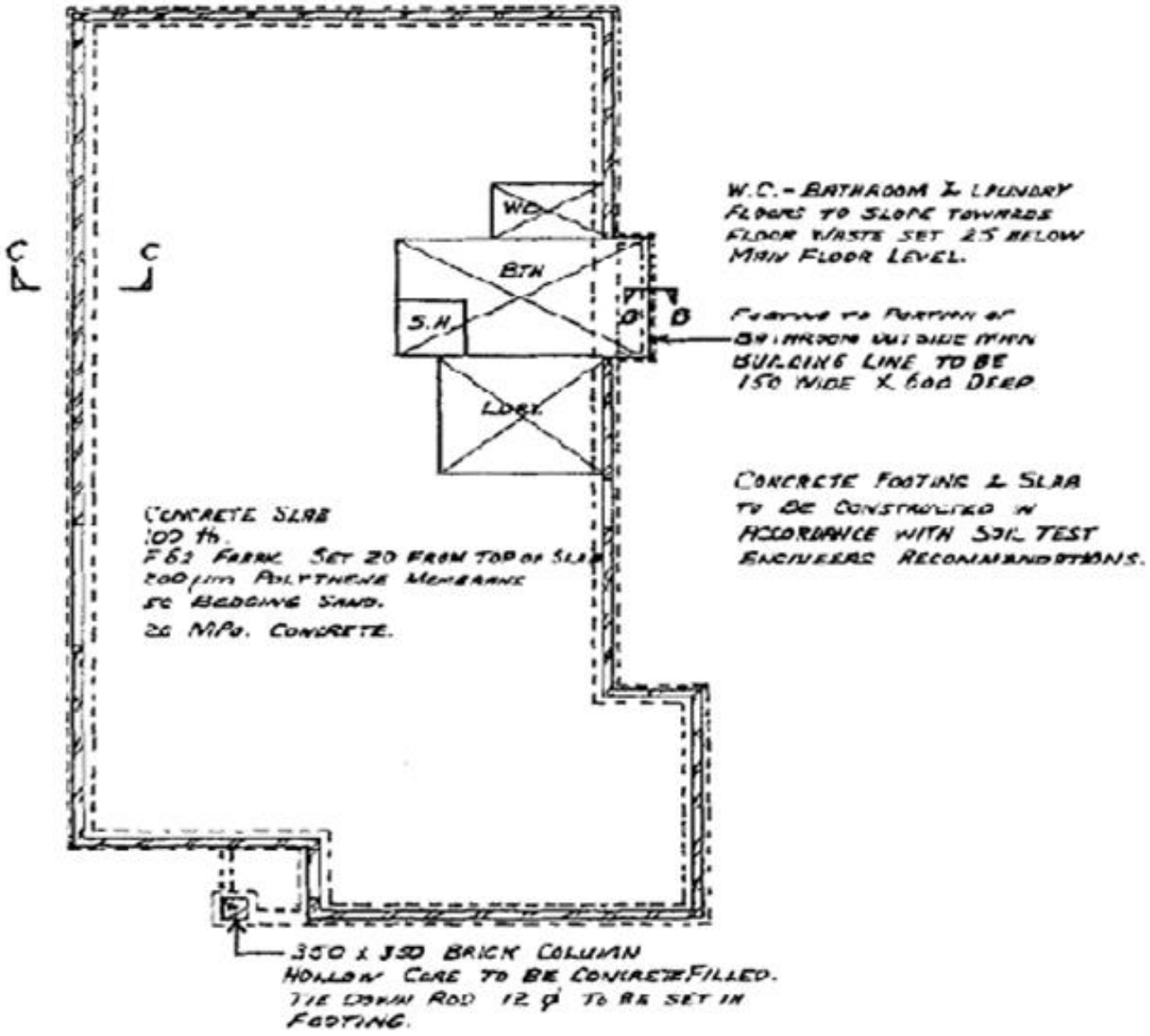


Figure 2.5 - Foundation Plan

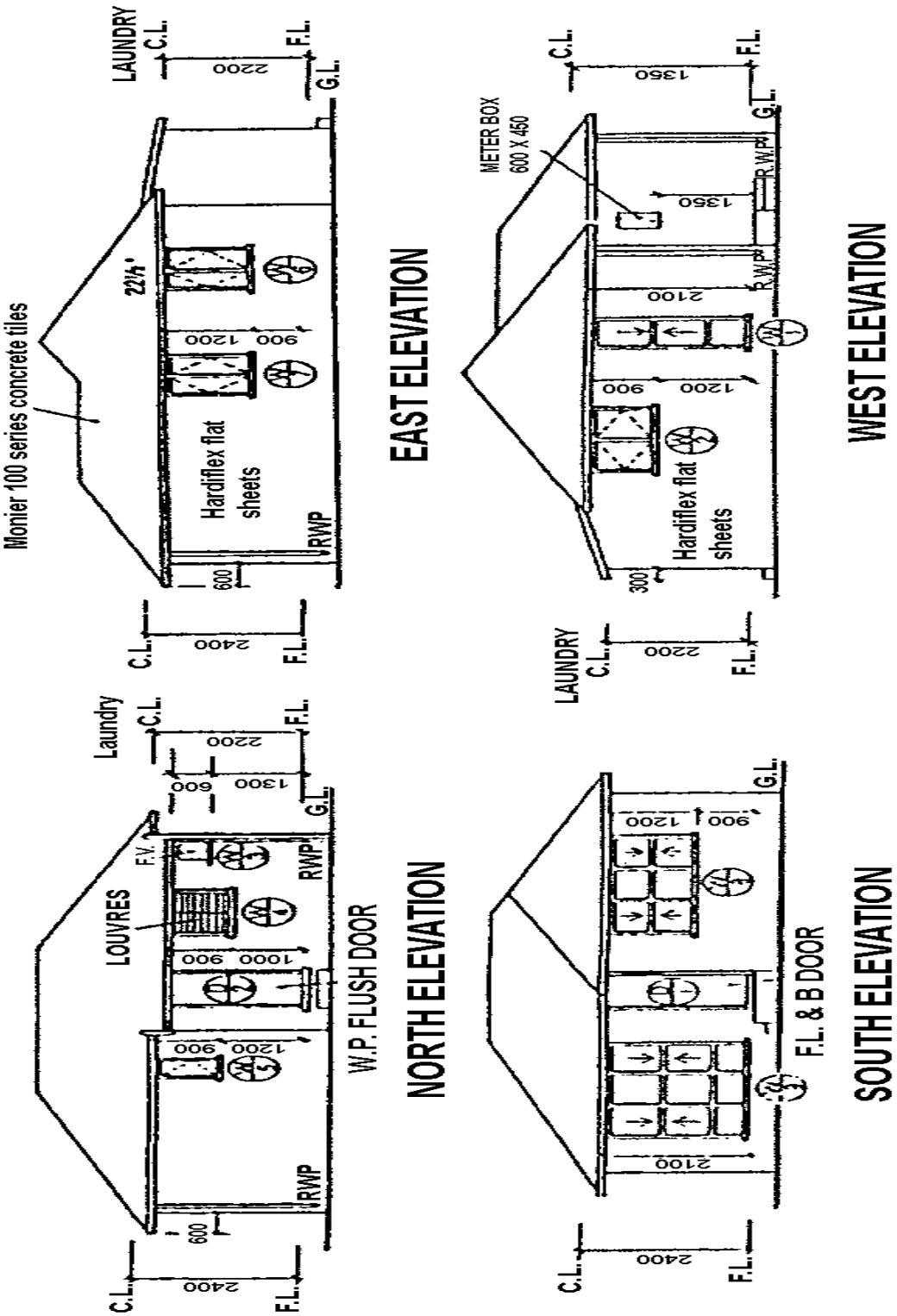
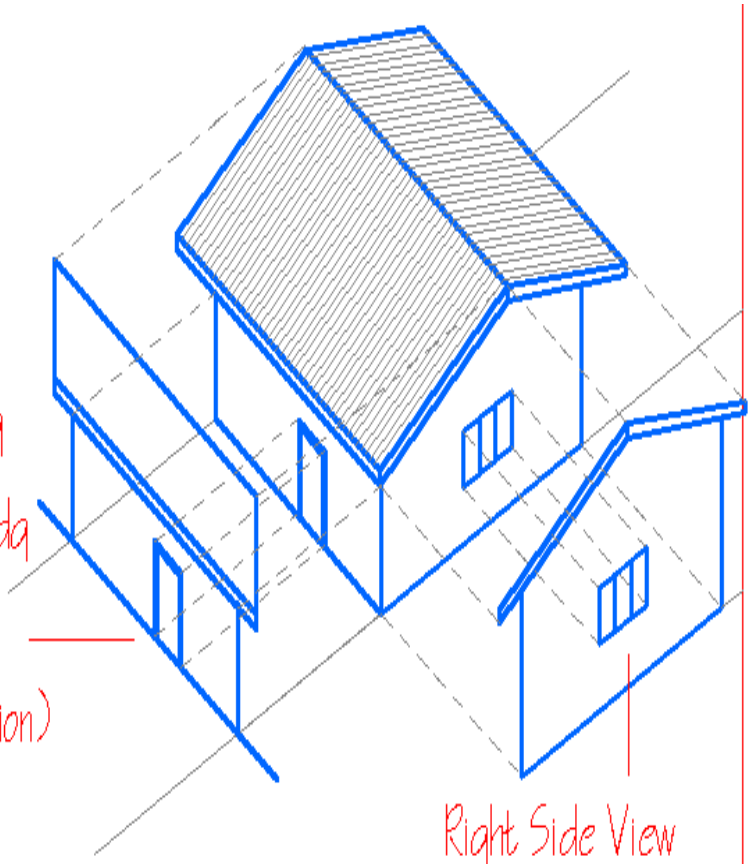


Figure 2.6A – Elevation

Elevations

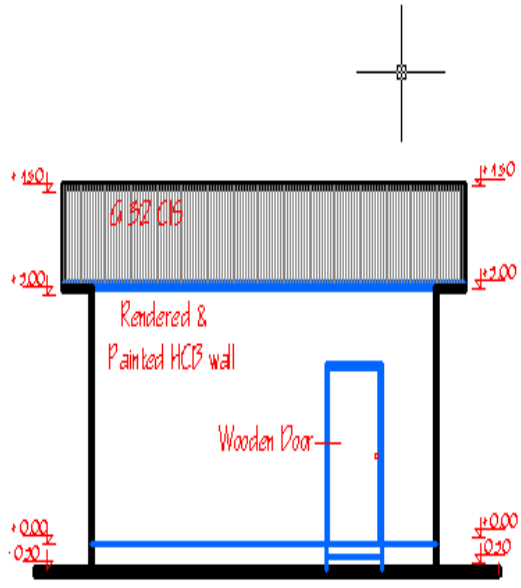
- side views of a bldg

- two types:
  - Exterior Elevation: exterior side views of a bldg
  - Interior Elevation: side views of interiors of a bldg

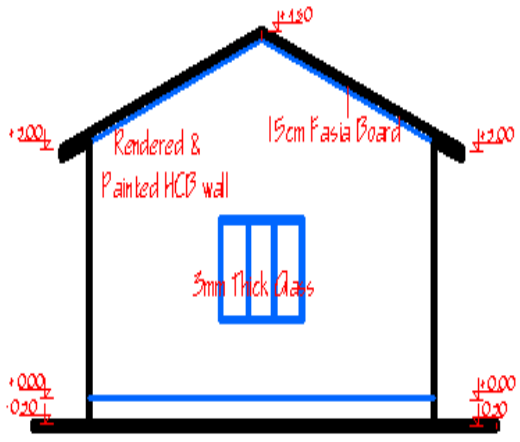


Front View
(Front Elevation)

Right Side View
(R. Side Elevation)



Front Elevation sc 1:50



Right Side Elevation sc 1:50

Figure 2.6B - Elevations

2.2.5 Sectional drawing

Sections are an orthographic projection that has been cut a part to show interior features or vertical views slicing the building. See Figure 2.7. Its Purpose Describe the construction materials of the structure. Sectional drawing is drawn in scale of 1:50 in common working drawing package.

a. Placement of cutting plane

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

b. Types of section

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.

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

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. That provides essential specific information.

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

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

C.Sections specify

- New and old ground levels showing cut and fill
- Position of floor level, ceiling level
- Positions of all windows and doors
- Heights of ceilings, doors and windows above the floor surface can be marked here.
- Dashed lines indicating positions of external wall bracing (optional on elevations but good practice).
- Dashed lines indicating natural ground lines (this will enable more accurate calculating of materials below floor level).
- Roof and wall claddings and finish.
- Types of glass selected for specific windows and doors
- Roof vents, air conditioning units, and solar locations

d. Sectional views

Sectional views are a means used by the designer or draftsperson to provide further information to the builder and/or trades person on construction details that do not show up clearly in the general working drawings. A section can be either an elevation or plan view. To draw a sectional elevation or sectional plan you imagine a vertical or horizontal plane cuts

through that portion of the structure that will best give the details required. An elevation or plan view is drawn where the imaginary cut is made.

The position of this imaginary cutting plane is identified on a full elevation or plan by a section line with an arrow at each. This indicates the direction in which the section is taken. These section lines are also identified by letters for example A-A or B-B. Refer to Figure 2.9 and note section lines A-A and B-B which indicate where the sectional elevations in Figure 2.8A and 2.10A are taken.

e. Sectional elevations

The sectional elevation shows such information as:

- Height of floor above ground level (G.L.);
- Ceiling height;
- Joinery line/height;
- Handrail height if applicable; and
- Depth of footings.

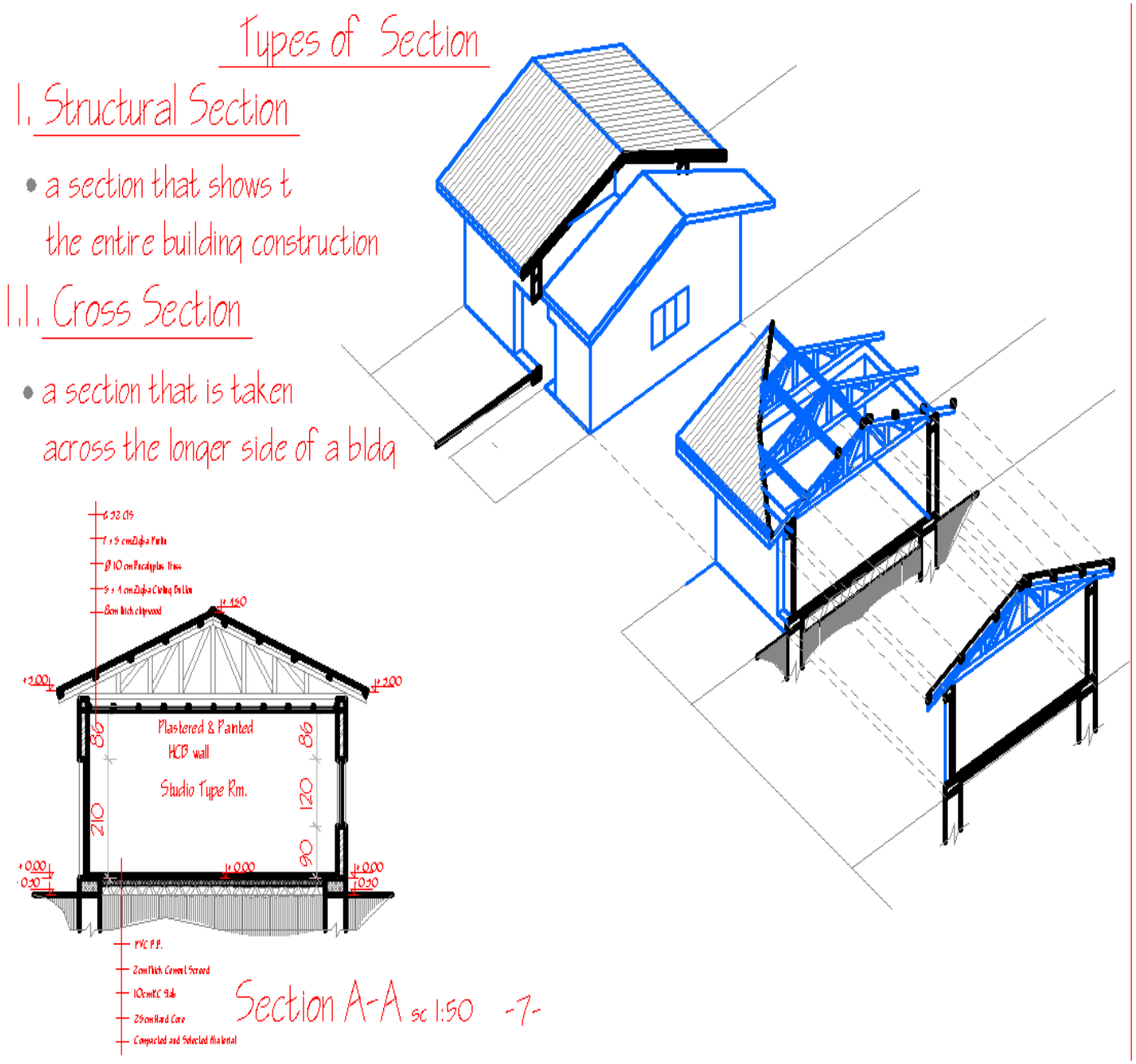


Figure 2.7A – Section

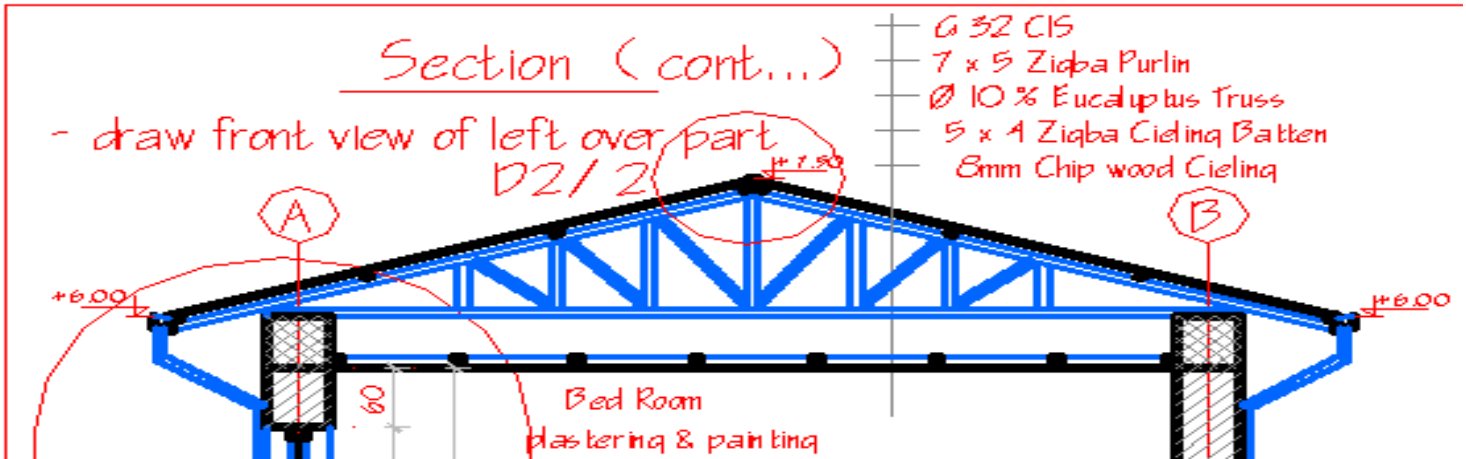


Figure 2.7B - Section

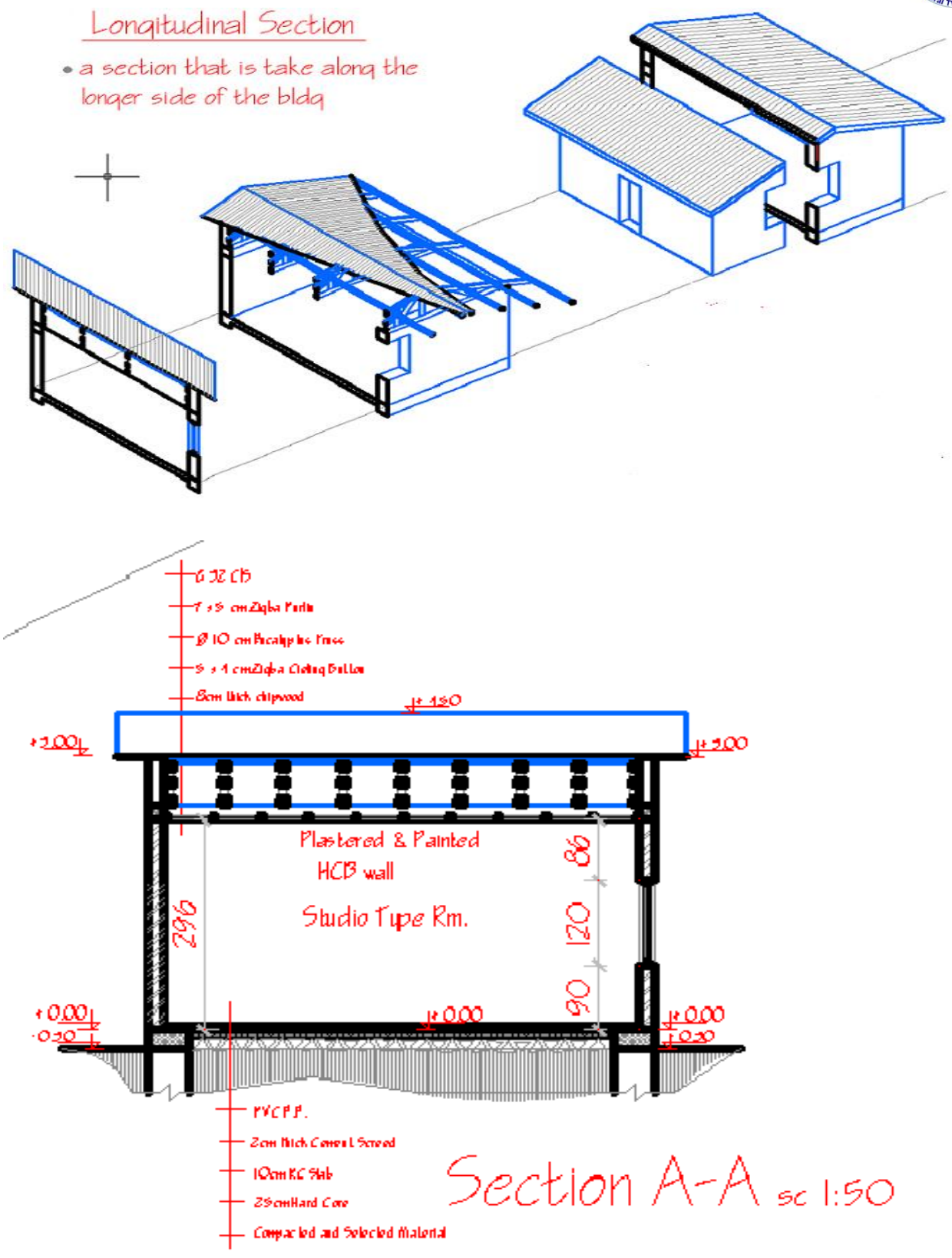
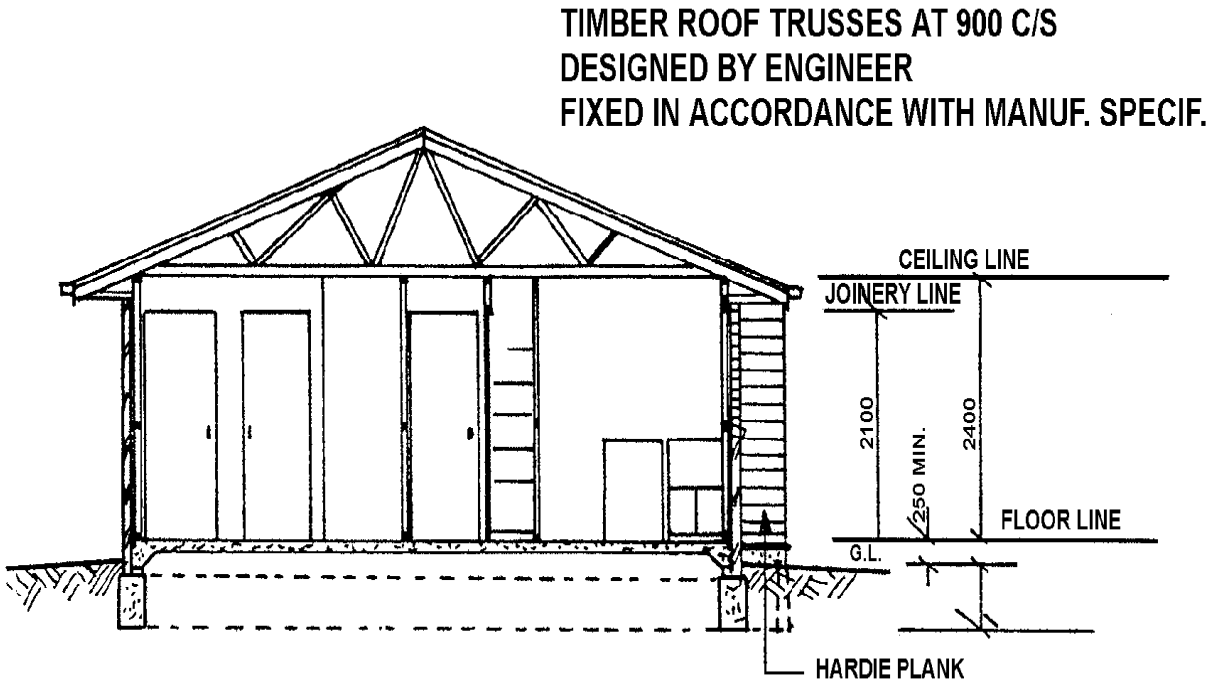


Figure 2.7C - Section

Figure below shows a typical sectional elevation for a brick veneer dwelling on a concrete slab.



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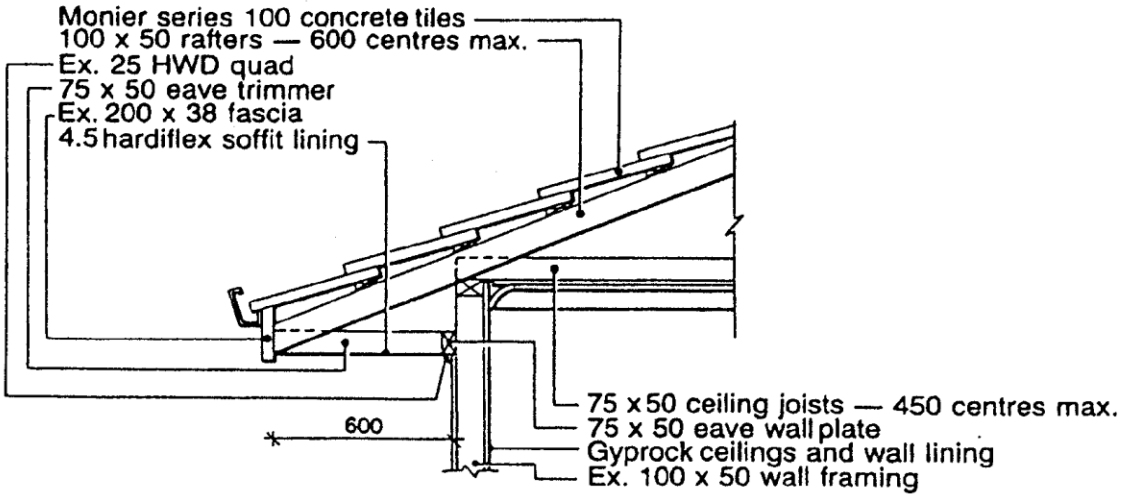
igure 2.8A - Section A – A Dwelling

2.2.6 Details

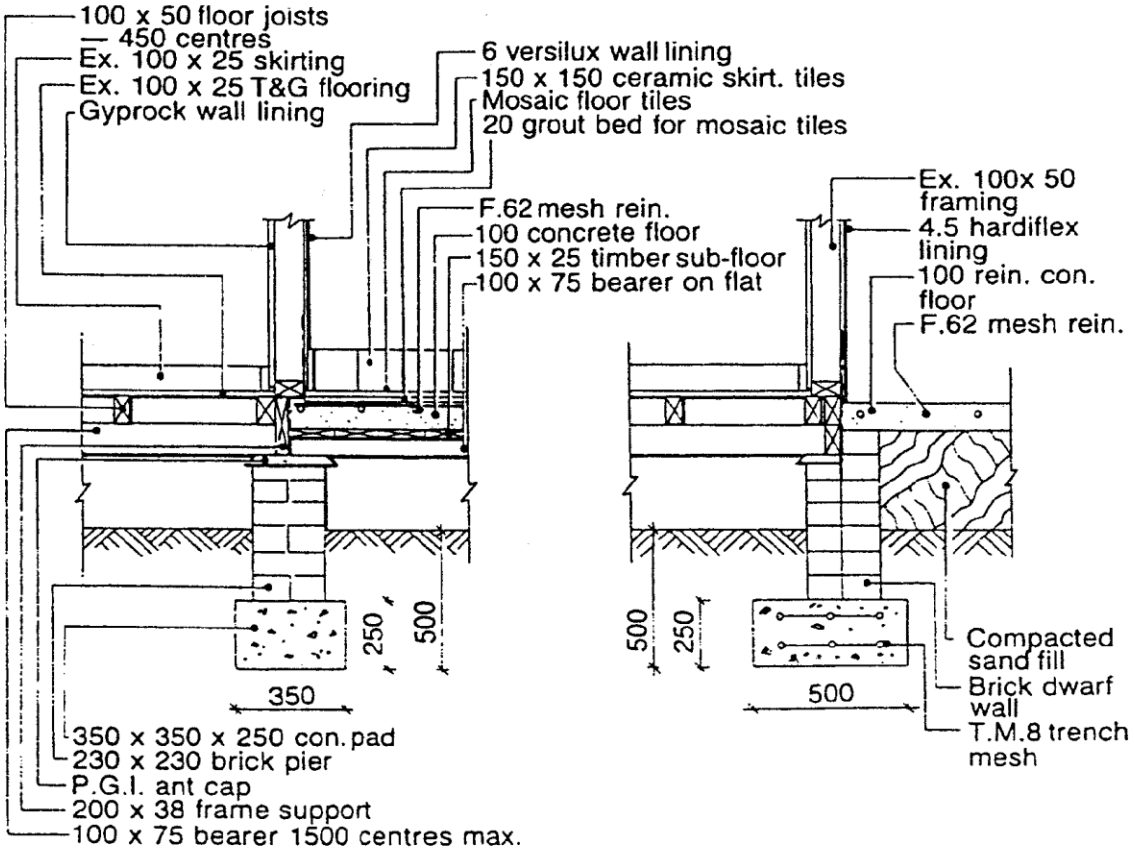
These views are used when it is not possible or practical to show specific constructional details on small scale drawings, for example: 1:100 or 1:50 details are usually drawn at scales of 1:20, 1:10 or 1:5 for more accurate drawings the scale maybe 1:1 or 1:2. See Figure 2.8A

The detail drawings delineated the actual connection between the various building elements in bigger scale. So that system of construction including materials would be easy to understand by everyone involved in the design and construction team.

- Details are enlarged drawings that provide essential specific information.
- A detail is often an enlarged segment of another section.



EAVE DETAIL SCALE 1:20



BATH. FLOOR DETAILS SCALE 1:20 LAUNDRY FLOOR DETAILS

DETAILS

Figure 2.8B – Section Details

It is used to describe and define area that requires additional emphasis. Provided for area that is too small on plan to describe fully and dimension accurately like parts toilet rooms, kitchen stair, chimney etc…

A good detailed drawing;

- Easy to supervision
- Reduced the participation of the designer in the construction phase.

Easy to understand assembly of parts by this the whole construction clear and reduce the construction phase. Most of the time the contractors questions the delay of construction time is because of poorly detailed drawings.

Before draw detail drawing a number of factors can be adjusted

- The number of details to be shows
- The scale of the details
- What details to show

Parts of Detail drawing of buildings are;

- Wall section
- Stairs
- Chimney
- Door and window
- Foundation details
- Roof details
- Ceiling details
- Building framing connection joints and walls
- Schedule

A. Footing and Slab Detail

The detail construction for a concrete footing and slab is usually drawn to a scale of 1:10. Refer to Figure 12 which shows a detail Section A-A of the thickening of the slab under a load bearing partition and section B-B which is a section through the concrete footing and adjacent construction. Refer figure 2.10A

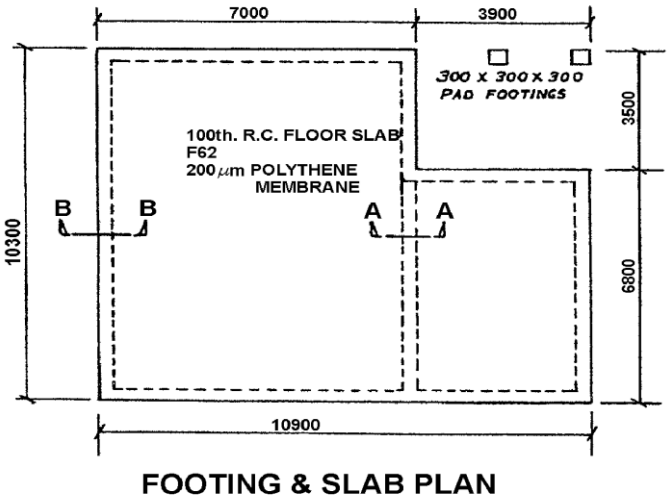


Figure 2.9 - Footing and Slab Section

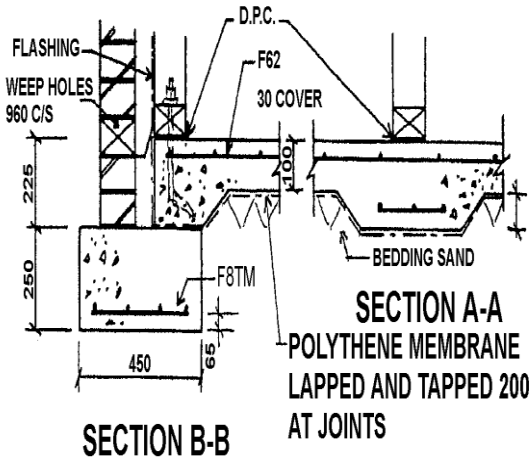


Figure 2.10A - Detail Footing – Slab Section

Section B-B shows the section sizes of the concrete footing, position and size of the reinforcement for both the concrete footing and floor slab, D.P.C. under wall framing, polythene membrane under the concrete slab, flashing in the wall cavity, weep holes and the relative positions of walls be they brick or timber.

This view also shows the thickness of the concrete floor slab and the shape of the edge thickening for the slab. Section A-A indicates the shape and extra reinforcement required for the thickening of the slab under load bearing partitions.

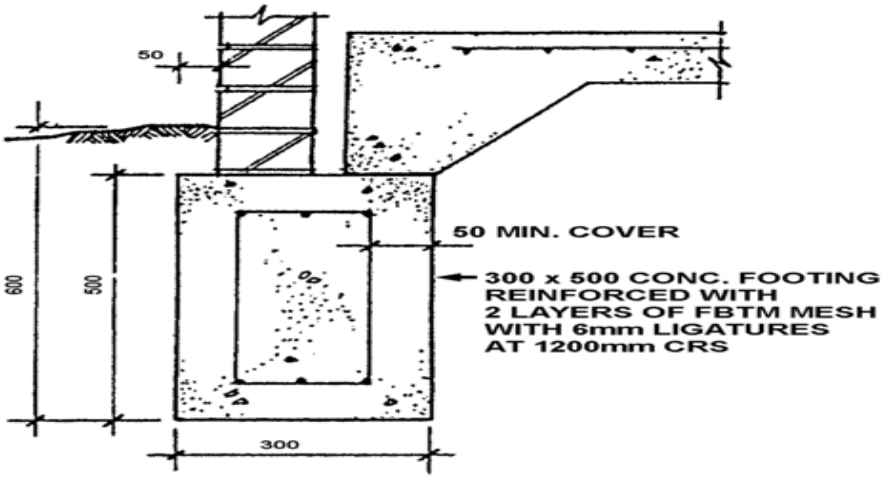


Figure 2.10B - Section B – B Footing

B. **Service Details**

- Plumbing
- Heating
- Air conditioning
- Electrical

Vary in scale and complexity depending upon requirements.

Plumbing drawing

1. Single Line Drawings

The single line format is most commonly used. Figure 2.11 is an example of a single line. The single line format represents all piping, regardless of size, as single line. All system equipment is represented by simple standard symbols (covered in later modules). By simplifying piping and equipment, single lines allow the system's equipment and instrumentation relationships to be clearly understood by the reader.

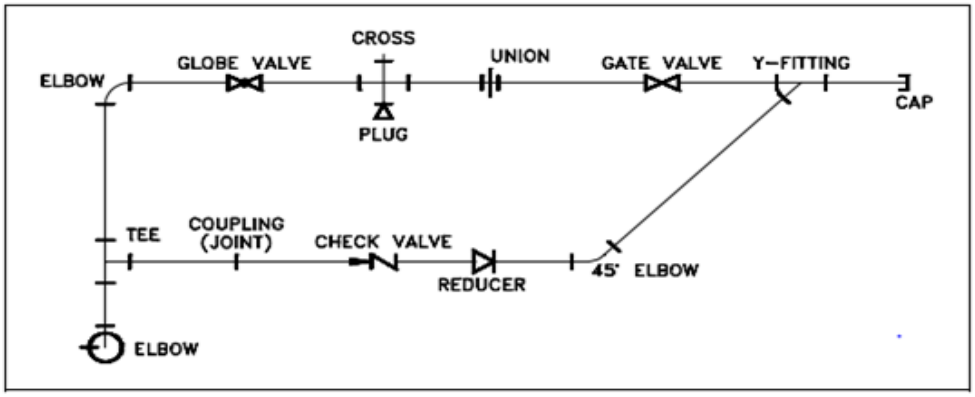


Figure 2.11 – Single line Drawing

2. Pictorial or Double Line Drawings

Figure Example of a Single Line Pictorial or double line drawings present the same type information as a single line, but the equipment is represented as if it had been photographed. Figure 2.12 provides an example illustration of a pictorial drawing. This format is rarely used since it requires much more effort to produce than a single line drawing and does not present any more information as to how the system functions. Compare the pictorial illustration,

Figure 2.12, to the single line of the same system shown in Figure 2.11. Pictorial or double line drawings are often used in advertising and training material.

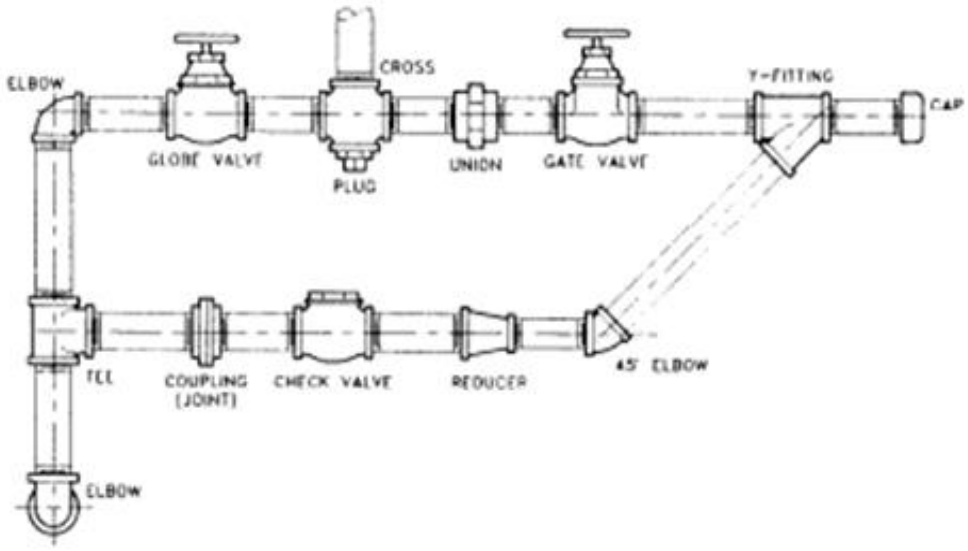


Figure 2.12 Double line drawings

3. **Isometric plumbing drawings**

All commercial building permit applications, in which the plumbing system has not been designed by a mechanical engineer, must include two sets of isometric plumbing drawings. See Figure 2.13 (A,B,C,D and E)

The isometric drawings should include the following information:

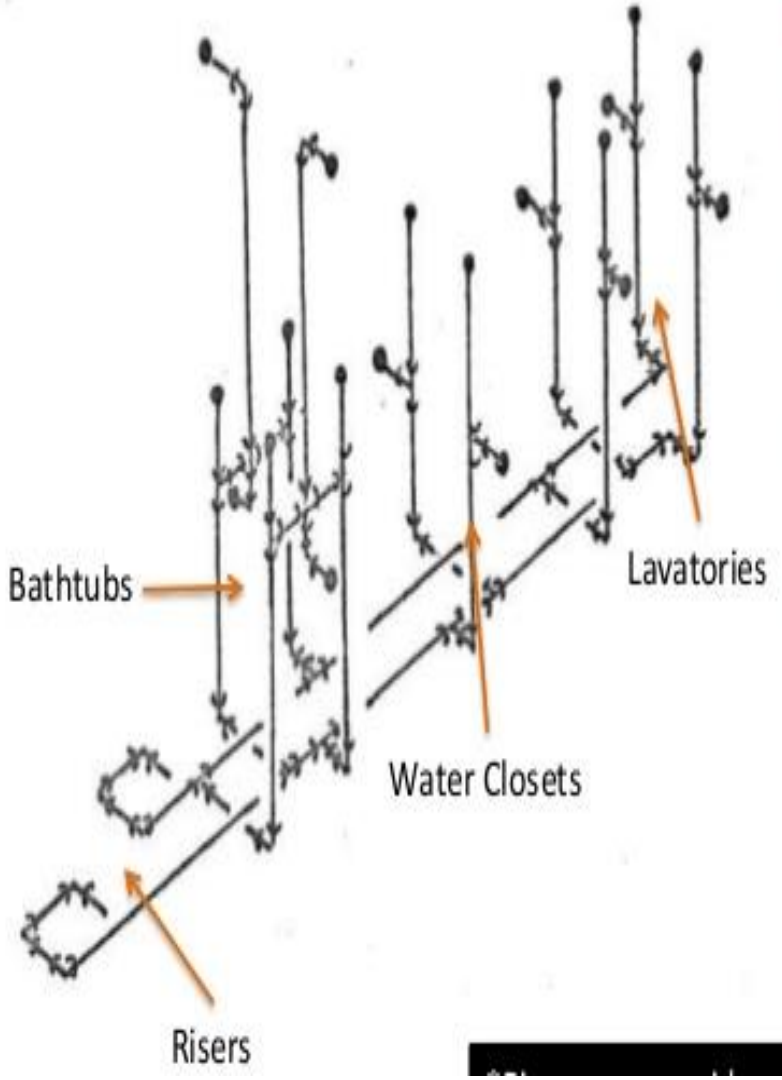
1. Isometric drawings of drain, waste and vent (D.W.V.) must include the size, location and type of pipe.

2. Isometric drawings of hot and cold water piping must include the type and size of pipe and method used for sizing pipe.

3. The isometric drawings are to specify whether combustible or non-combustible plumbing is to be used.

4. Grease traps must be installed in the plumbing system for restaurants and businesses that prepare food. The location and size of the grease interceptors must be included on the isometric drawing. For further information see the Building Inspections handout titled Grease Interceptors in Kitchens.

5. Isometric drawings to include the plumbing company name and contact phone number.



Qty.	Mat.	Unit Prince	Total
15ft	¾" cop. pipe		
20ft	½" cop. pipe		
6	¾" ells		
16	½" ells		
8	¾" tees		
10	½" tees		
14	½" adapter		
10	½" caps		

Figure 2.13A - Isometric Plumbing Drawings with BOQ

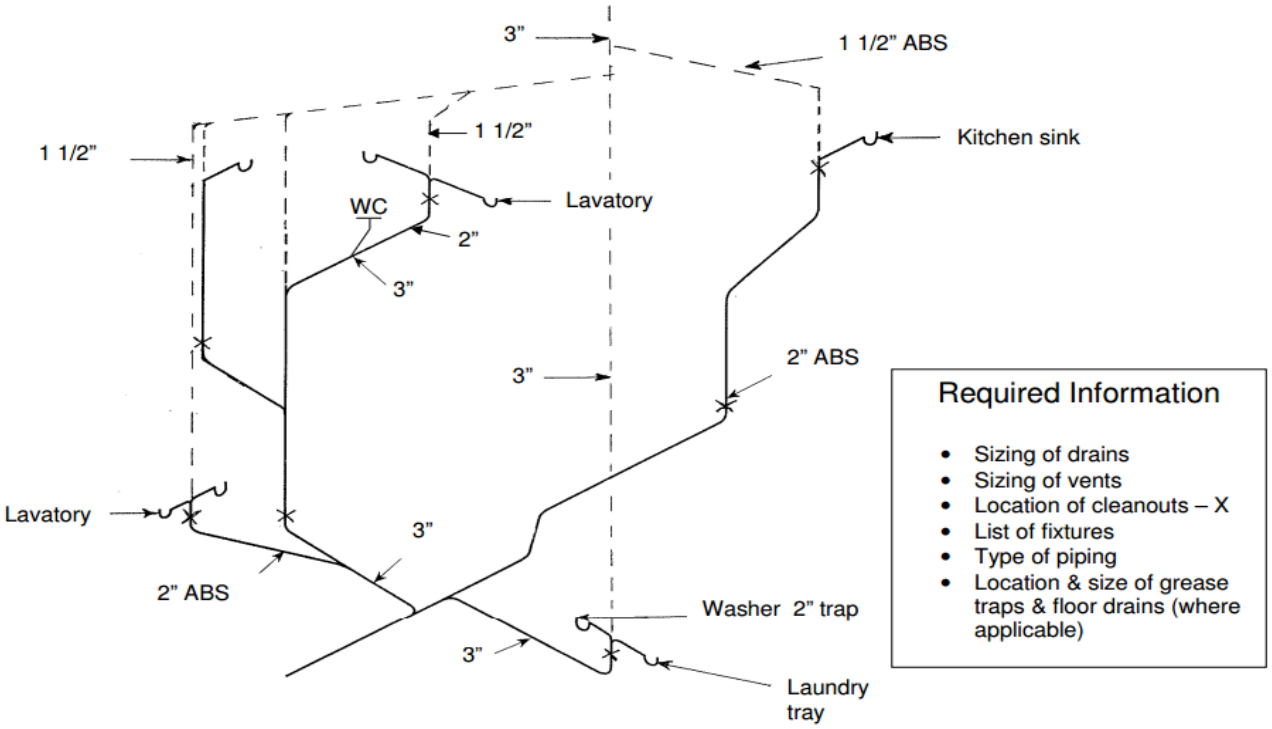


Figure 2.13B - Isometric Plumbing Drawings

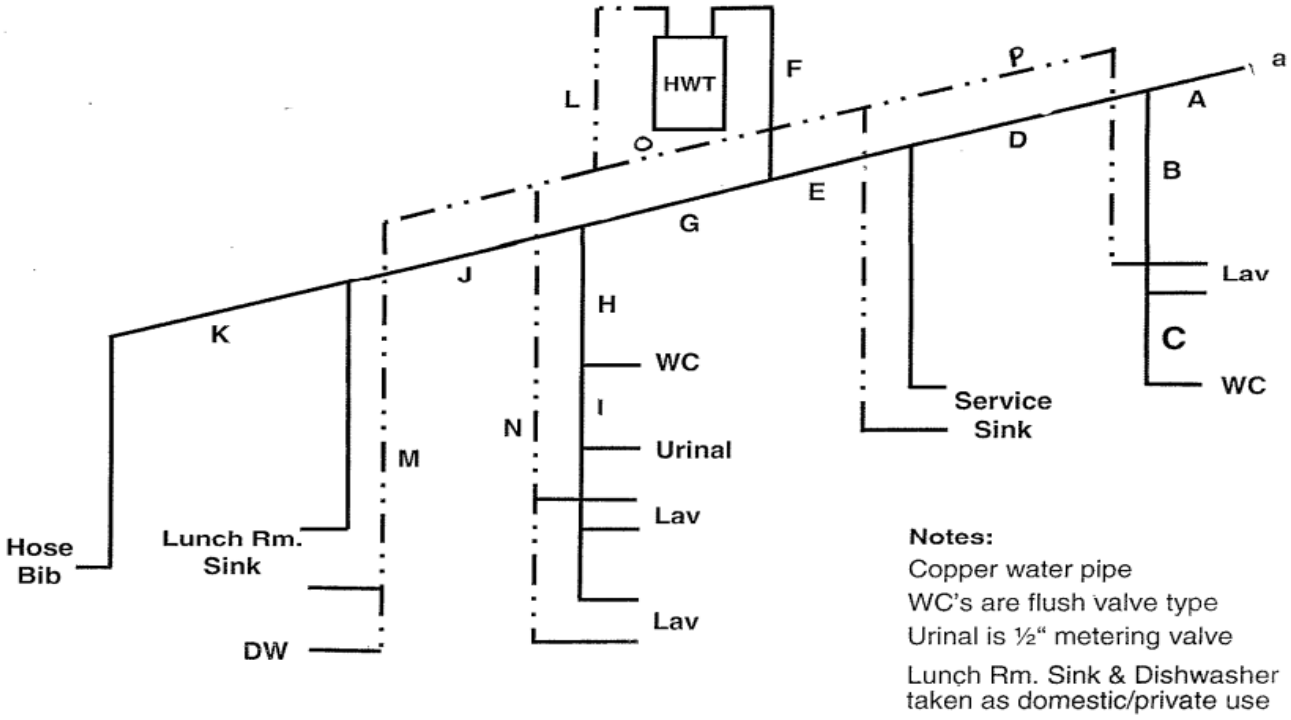


Figure 2.13C - Isometric Plumbing Drawings

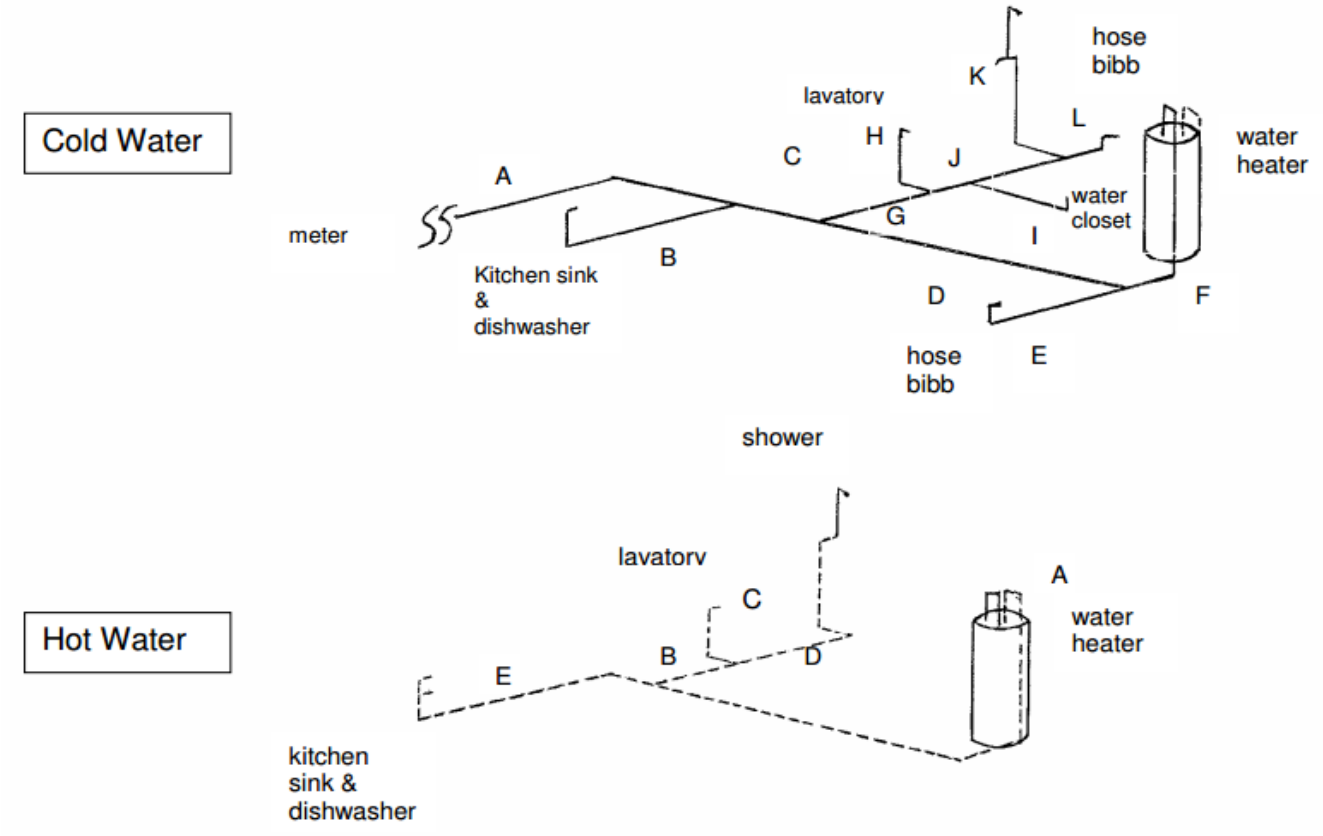


Figure 2.13D - Isometric Plumbing Drawings

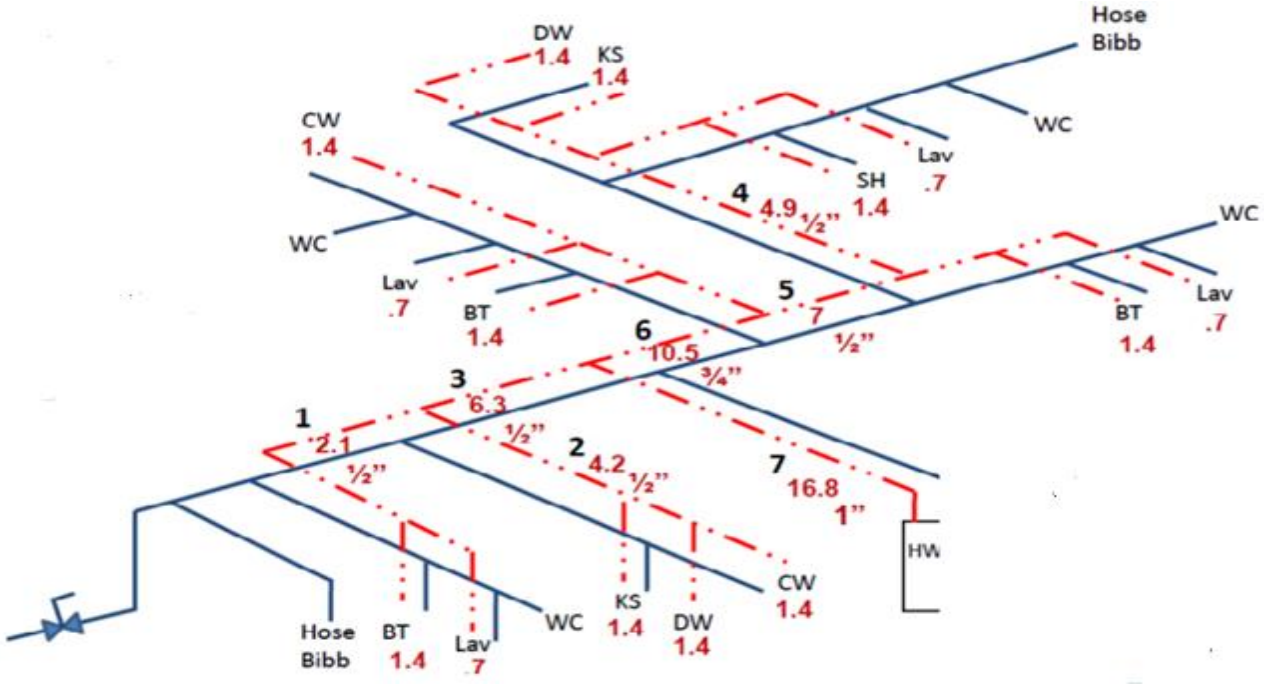


Figure 2.13E - Isometric Plumbing Drawings

2.2.7 Tie down

In a set of working drawings tie downs or special fixings are mostly shown in the form of a schedule or table that indicates how structural framing members are tied down or fixed to each other from the roof sheeting through to the footing. See Table 2.1.

Example:

- Roof sheeting to roof battens.
- Roof battens to rafters.
- Studs to bottom wall plates.
- Top wall plate to studs.
- Rafters to top wall plates.
- Bottom wall plates to concrete footing slab.

Tie Down	Table No.	Uplift Force	Figure No.	Allowable Load kN	Description/Type
Zincalume Roof Sheet to Battens					As per Manufacturing
Roof Battens to Trusses	8.11	2.1kN	8.11H	2.5kN	1/90 No 14 type 17 screw.
Trusses to Top Plates					As per Manufacturing. Specifications
Top Plate to Studs at 900 C/S. Adjacent to each Truss	8.8	6.1	8.8B	7.2	30 x 0.8mm Galvanised Iron Looped Strap 4/30 x 2.8 ⌶ Nails each end
Bottom Plate to Studs at 900 C/S	8.8	6.1	8.8B	7.2	as above
Bottom Plate to Concrete Slab	8.8	8.1	8.8A	19.0	1/M 12 bolt at 1200 C/S
Studs to sides of openings up to 1200 wide	8.10B	5.5	8.10B (1)	5.8	30 x 0.8mm G.I. Straps 6/30 x 2.8 ⌶ Nails to each end of strap
Studs to sides of openings over 1200 and up to 2400 wide	8.10B	10.9	8.10B (ii)	12.0	as above
Brickwork to Timber Frame					Cavity Brick ties at 600 x 600 C/S
Hardie Plank					As per Manufacturing Specifications
Plasterboard Ceiling and Walls					As per Manufacturing Specifications
Aluminium Joinery					As per Manufacturing Specifications

Table 2.1 – Tie down detail

Self-Check -2	Written Test

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

1. It is a view of a building containing a height dimension to show the height of the building & window & door.
   A. Elevation B. Detail C. Floor plan D. Foundation plan
2. Thickness of foundation walls, external and internal shown on floor plan.
   A. True B. False
3. Not it define a good detailed drawing
   A. Easy to supervision
   B. Reduced participation of designer in the construction phase.
   C. Simplify information
   D. Designer participation necessitated in each construction phase
4. Cross section drawing shows the entire building construction & also shows the interior spaces in elevation take on the long axis of the building
   A. True B. False

Note: **Satisfactory rating - 2 and 5 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-3	Adhering Construction company operations Quality requirements

3.1 Scales and the scale rule

A scale rule is essential for trade drawing. This rule provides scales in ratios 1:1; 1:5; 1:10 and 1:100 on the face side refer Figure 3.1. On the reverse side scales of 1:20; 1:200; 1:50 and 1:500 are calibrated. The scale rule should not be used as a guide for drawing lines.

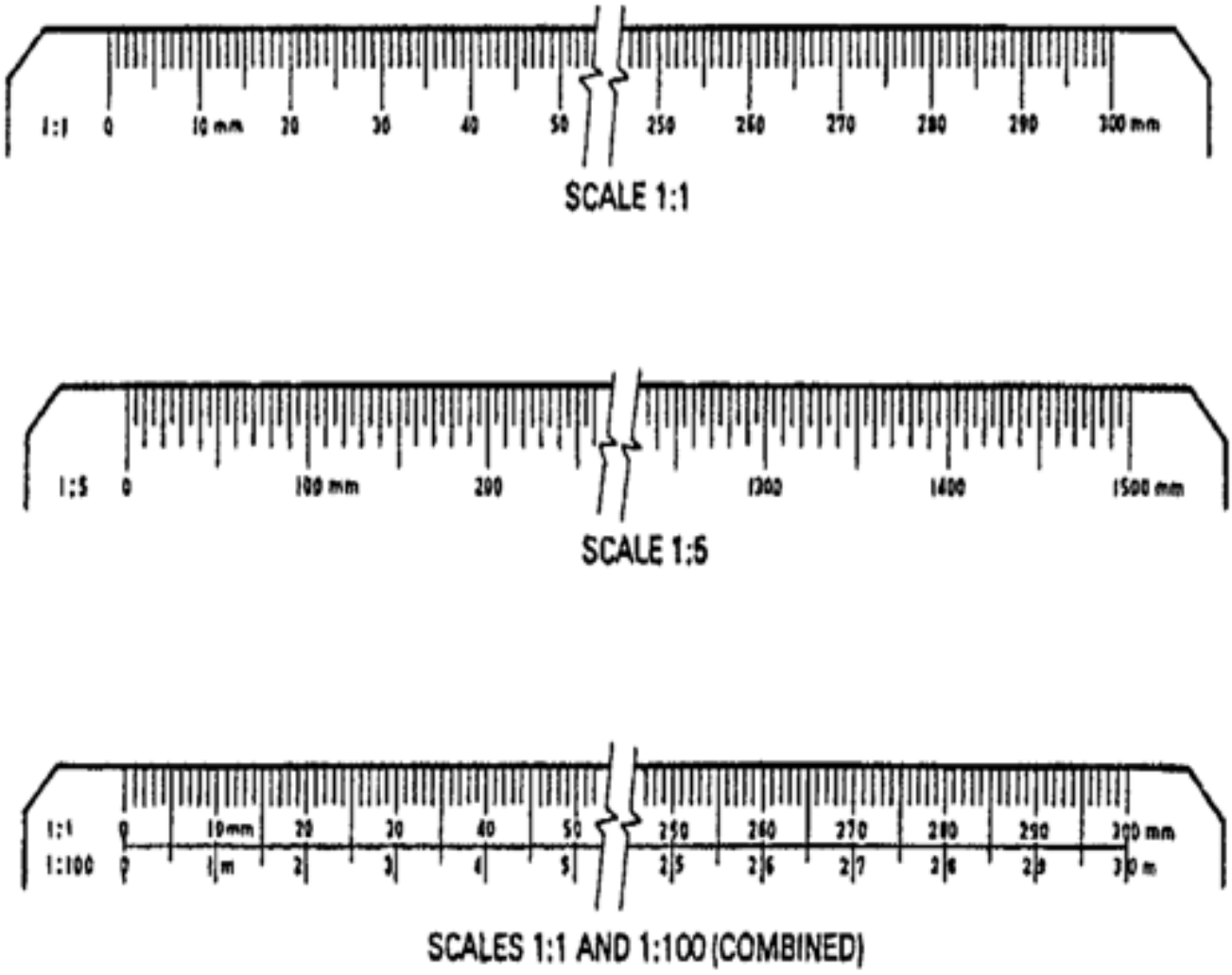


Figure 3.1 - Scale Rule Examples

3.1.1 Preferred Scales for construction Drawings

The scale selected for a particular drawing should be determined by consideration: refers Table 3.1:

- The type of information to be communicated
- The need for the drawing to adequately and accurately communicate the information necessary for the particular work to be carried out
- The need for economy of time and effort in drawing production
- Requirements of building or lending authorities
- Complexity of item being drawn
- Size of drawing sheet adopted.

DESIGN DRAWINGS		
Drawing	**Recommended Scales**	**Use**
Sketch Plans	1:200 1:100 1:50	To show the overall design of the building
PRODUCTION DRAWINGS		
Location Drawings		
Block Plan	1:2000 1:1000 1:500	To locate the site within the general district
Site Plan	1:500 1:200	To locate building work including services and site works - on the site.
General Location Drawings	1:200 1:100 1:50	To indicate the juxtaposition of rooms and spaces, and to locate the position of components and assemblies.
Special Area Location Drawings	1:50 1:20	To show the detailed location of components or assemblies in complex areas.
Construction Detail Drawings		
Construction Details	1:20 1:10 1:5 1:2 1:1	To show the interface of two or more components and assemblies for construction purposes
Component and Assembly Drawings		
Range Drawings	1:100 1:50 1:20	To show in schedule form, the range of specific components or assemblies to be used in the project.
Component and Assembly Details	1:10 1:5 1:2 1:1	To show precise information of components and assemblies for workshop manufacture.

Table 3.1 - Preferred Scales for Architectural Drawings

3.1.2 Reading the scale rule

Because buildings are large, scale drawings have to be used. When reading drawings or when preparing drawings to scale, you must be able to read the scale rule. A scale rule is similar to an ordinary rule in having graduation lines marked at one millimeter intervals, longer lines at the five millimeter marks and even longer lines at the ten millimeter marks. The ten millimeter marks also show the graduation number. However, on a scale rule the graduation number indicates the scaled up value rather than the true length.

For example, we have to mentally multiply the intermediate millimeters by the scale factor to obtain the exact measurement. For example, the 640 measurement read on the 1:20 scale shown in Figure 16, is 600mm plus (2mm x 20). If we were reading the 1:200 scale, the measurement would be 6m plus (2mm x 200) or 6.4m or 6400mm. Similarly the 7400 measurement read on the 1:200 scale is 6m + (7mm x 200) or 7400mm. Of course, on the 1:20 scale, the measurement would be 740 mm. See Figure 3.2

Examine your scale rule and notice that a number of scales are available depending on the type that you have. Notice that each set of graduations has two scales, one ten times the other. When you use the rule, select the scale to match the scale of the drawing.

Your instructor will assist you to understand the reading of the scale rule before you commence the scale drawing self-check exercise.

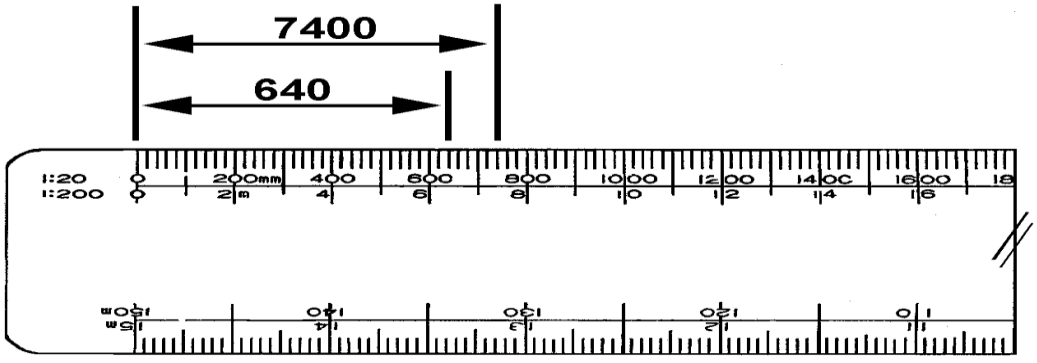
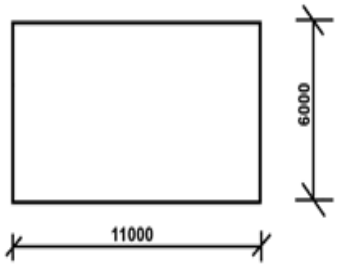


Figure 3.2 - Reading the Scale Rule

Figure 3.3 *is* the same building drawn to the scale of 1:200. At this scale 1 unit on the drawing represents 200 units on the building. Figure 3.4 is the plan of a rectangular building 11 000 by 6 000mm drawn to the scale of 1:100. This means 1 unit on the drawing represents 100 units on the building.



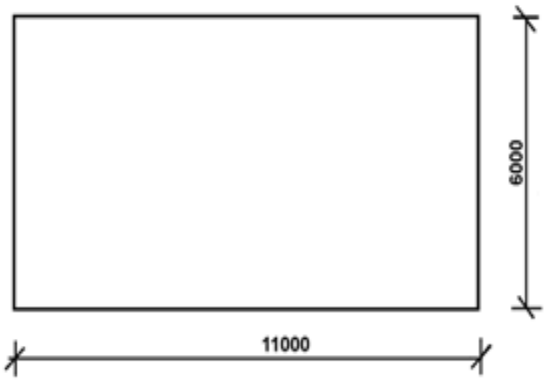


Figure 3.3 - Plan of a Rectangle – Scale 1:200

Figure 3.4 - Plan of a Rectangle – Scale 1:100

3.2 **Border and title block**

Border Line is a line drawn around the inside edge of the paper. Usually this is 10mm (20mm) from the edge of the paper (left side of the paper) and (from bottom, top and right side of the paper) 5mm. It is basically a rectangle drawn precisely and inside this rectangle is the design area. See Figure 3.5

A title block is normally drawn at the bottom of the paper. Inside the title block is printed important information such as Name, Title, drawing No, scale and Date. The measurements for the title block can be seen below (these can vary depending on the type of title block being used). All the lines are dark with the exception of the guidelines between which the printing is positioned. See Figure 3.5 and 3.6

The border line and title block ensures that the design sheet looks more professional and includes vital information

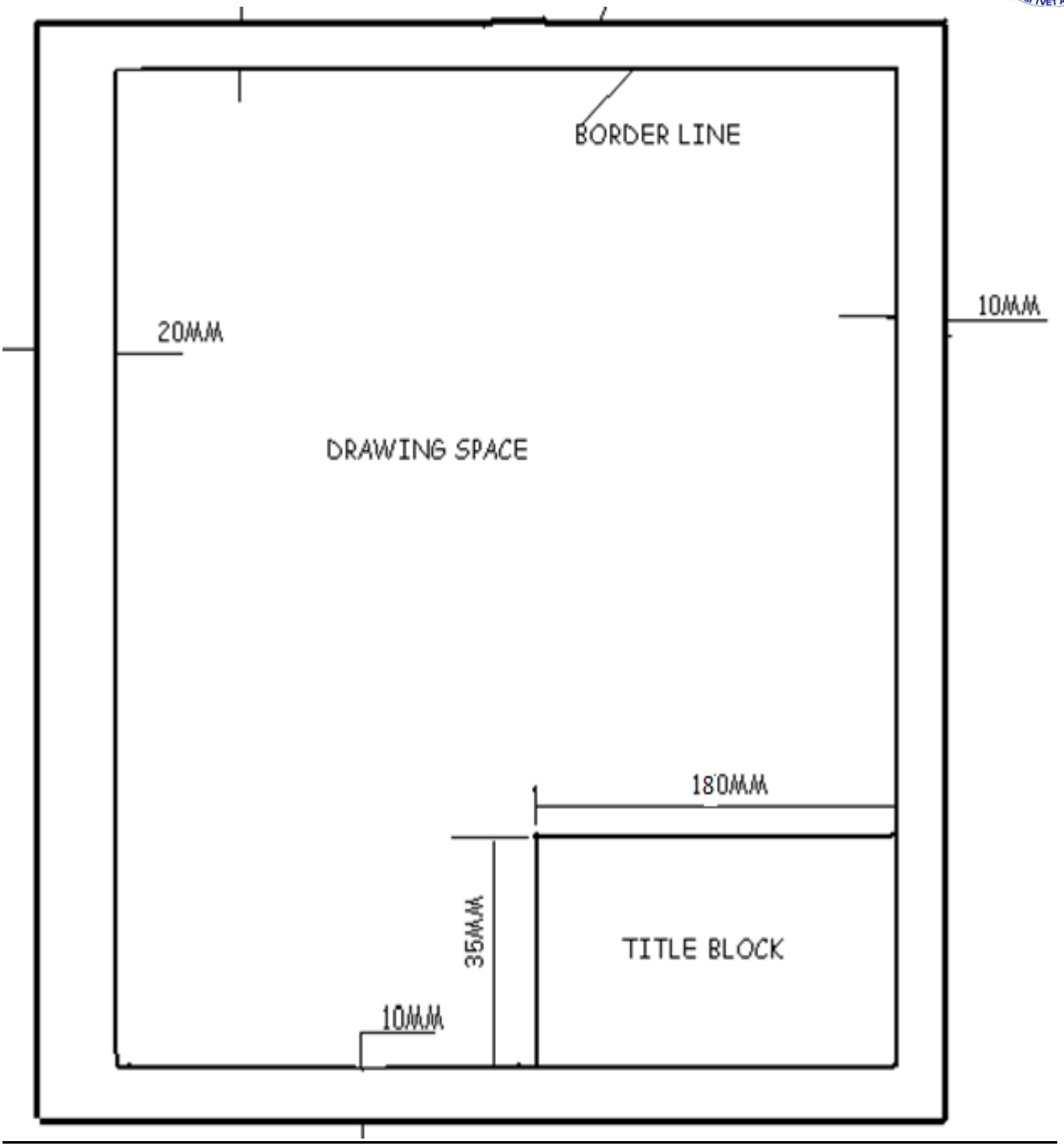


Figure 3.5 - laying drawing paper (sheet)

Title blocks are found usually in the bottom right hand corner of the plan, and can be vertical as shown here, or horizontal as shown below on Table 3.2 (A and B). The example of a title block shown on this page shows the relevant details found in the title block of most plans:

For example:

Client
• Project • Location • Consultant • Drawn by • Checked by • Issue or revision code • Scale • Date • Project Number • Drawing Number

Other information relevant to the preparation of the drawings can be recorded here.						
	CLIENT:	D.C. Green and Company				
	PROJECT:	Proposed Child Care Centre				
	LOCATION:	91 Fir Street Barcaldine QLD 4725				
	ARCHITECT:	B.J. Smyth				
	Drawn	**Checked:**	**Scale:**	**Project No:**	**Drawing No:**	**Date:**
	B.C.	J.G.	1:100	BCA-721	WD	10/96

Table 3.2A – Title Block

CLIENT: D. C. Green and Company		
PROJECT: Proposed Child Care Centre		
LOCATION 91 Fir Street BARCALDINE QLD 4725		
PROJECT CONSULTANTS Blake And Brown Consultants Floor 3 125 Black Road INDOOROOPILLY QLD 4068		
ARCHITECT B. J. Smyth 7 Denham Street INDOOROOPILLY QLD 4068		
THIS DRAWING Elevations And Sections **DRAWN:** B.C. **SCALE:** 1:100 **PROJECT NO**: BCA-721		
DRAWN: B.C.	**CHECKED**: J.G.	**ISSUE:** A
SCALE: 1:100	**DATE:** MAY 96	
PROJECT No: BCA-721	**DRAWING No:** WD - 04	

Table 3.2B – Title Block

3.2.1 Typical title block

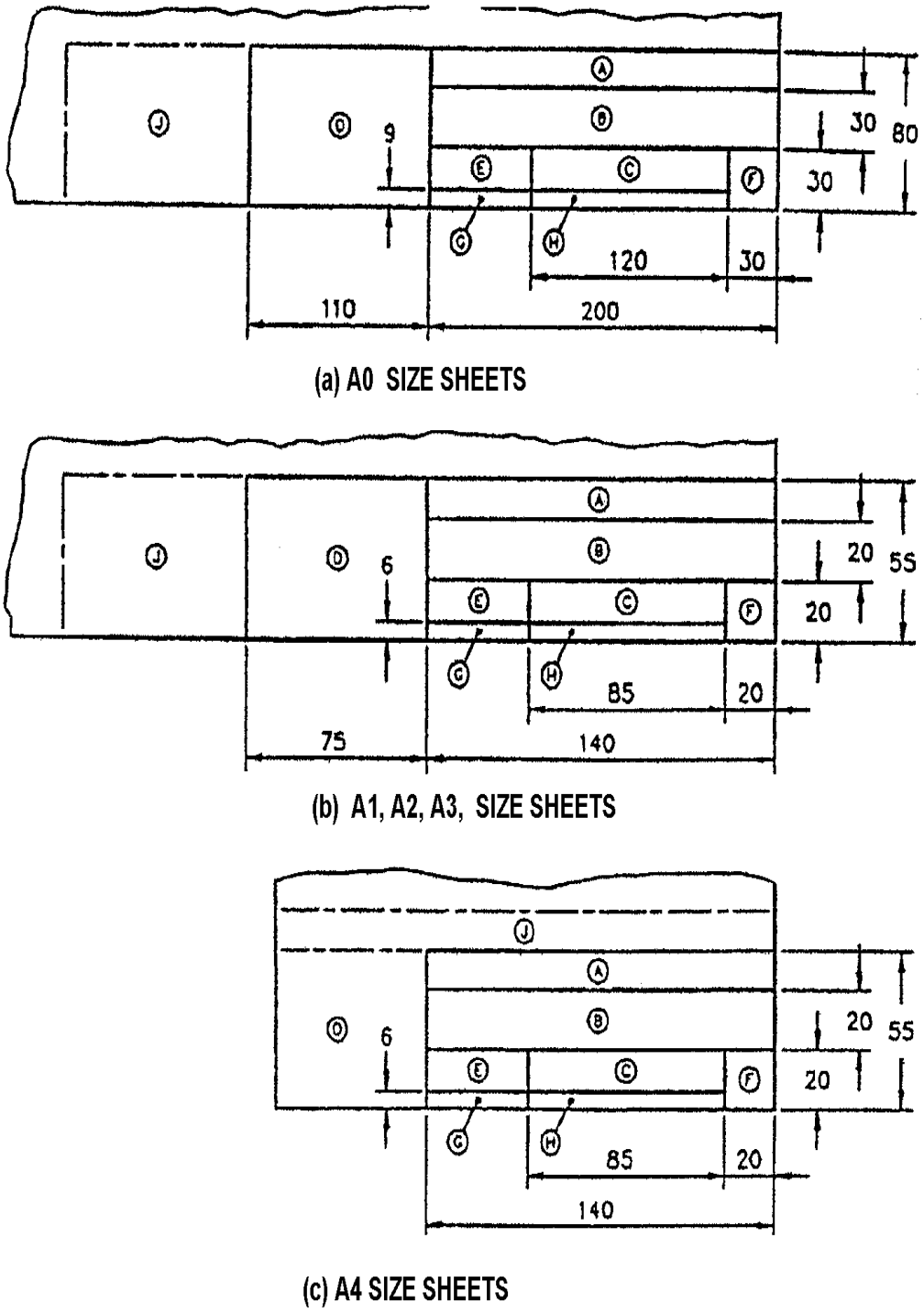


Figure3.6 - Suggested Size of a Title Block

3.3 Quality Requirement

Quality requirement is a common term in project management. It is defined as the condition used to assess the conformance of the project by validating the acceptability of an attribute or characteristic for the quality of a particular result.

The quality requirement defines the expectations of the customer for quality, the internal processes as well as the attributes of products that indicate whether the quality factors are satisfied or not. Quality requirements are specifications of the quality of products, services, processes or environments. Quality is any element, tangible or intangible, that gives things value beyond their functionality and features.

The following are illustrative examples of quality requirements.

3.3.1 Reliability

It is enduring and consistent performance in real world conditions. For example, a drum designed to maintain its sound for at least 150,000 strikes. Reliability Differentiation

The reliability required for the majority of structures shall be obtained by design and execution and appropriate quality assurance measures.

A different level of reliability may be generally adopted:

- For structural safety;
- For serviceability;

A different level of reliability may depend on:

- The cause and mode of failure;
- The possible consequences of failure in terms or risk to life, injury, potential economic losses and the level of social inconvenience;
- The expense and procedures necessary to reduce the risk of failure;

- Different degrees of reliability required at national, regional or local level.

Measures relating to quality assurance to reduce the risk of hazards in:

- Gross human errors;
- Design;
- Execution.

Within individual reliability levels, the procedures to reduce risks associated with various potential causes of failure may, in certain circumstances, be interchanged to a limited extent.

3.3.2 Consistency

The requirement of those units is the same or those units are internally consistent. For example, apples that is mostly the same size with similar appearance and taste.

3.3.3 Usability

Requirements related to ease of use such as a can of coffee that is easy for everyone to open and reseal.

3.3.4 Customer Experience

Requirements that make a product or service more pleasing to customers

3.4 Quality assurance vs. quality control

Quality Assurance and Quality Control are two very closely related concepts and because of that close relationship they are often confused and one is inappropriately used as a substitute for the other.

Quality Assurance is a process focused concept, where the processes are put in place to ensure the correct steps are done in the correct way. If the correct processes are in place there is some assurance that the actual results will turn out as expected. Quality Control is a product focused concept, where checking of the actual results are done to ensure that things are as expected. If the correct controls are in place you can know for certain that the actual results have been achieved because the actual results have been

checked.

Quality assurance processes are put in place to provide some comfort that the end product is what you want. Quality control is making sure the end product really is what you want. That can still be a bit confusing so this article will walk through some examples to clarify the difference between Quality Assurance vs. Quality Control.

All drawings should adhere to the following guidelines:

- **Dimension parts correctly**. Dimensioning shall be to primary or mating surfaces. Unwanted buildup of tolerances between mating surfaces should be avoided. Dimensions to insignificant theoretical center lines can result in mistakes by the machinist, as well as the inspectors, because of the multiple additions and subtractions required to locate the feature in relation to other features. Whenever possible, dimensions should be left to right and bottom to top (Quadrant I, all positive numbers) or from datums established by design requirements.
- Implied datums are no longer allowed. Whenever possible, select datums that are functional to the part. A datum should always be assigned to a physical surface or a feature of size. When using true position dimensioning (basic dimensions), the dimensions from the feature to other edges and its perpendicularity relationship to a surface must be identified with datum letters. The combined usage of positional tolerancing with plus and minus methods as related to basic dimensioned patterns is discontinued and replaced with the composite tolerancing method.
- Drawings for parts produced using templates must be properly dimensioned and toleranced. Lack of dimensioning may result in inadequate stress analysis, fit checking, and/or inspection. Engineering and tooling drawings should be dimensioned alike and related to one another.
- Use the list of material format correctly. The assembly number does not get an item number. While the material is properly an item on the List of Material, on end product drawings, there is no need to specify either the drawing number or an item number in the List of Material if there is only one part or material.
- Do not use “SK” (short for sketch) on any drawing that is used to manufacture a part.

- Specify the original manufacturer source of supply and complete address. List the original source and complete address in the General Notes, and flag them to the List of Material or Parts List.
- Specify radii and chamfers. Edge radii, in-plane corner radii, and protrusion chamfers must be specified to space flight standard size requirements.
- Specify as few reference dimensions as possible. Too many reference dimensions make checking, inspection, and cost estimating more difficult.
- Specify projected tolerance zone dimensions where applicable. Add a projected tolerance zone dimension to the true position tolerance when specifying threaded inserts, tapped holes, or dowel pins.

3.5 **Drawing record requirements**

a. Drawing of Record required to be submitted prior to request for final inspection.

b. Developer shall submit record drawing for all utilities and other improvements required.

c. Developer shall provide 3 sets of the drawing of record for review by government body.

d. Upon approval of submitted record drawing, developer shall provide:

    1. One corrected set of record drawings

    2. Electronic version as a scanned pdf or tif version.

    3. Electronic version as file.

    4. Text file of survey points collected for production of record drawing.

e. Drawing of Record shall be prepared by a licensed surveyor or professional engineer and shall be stamped and signed.

f. Shall include the following:

- Actual surveyed locations of the sewer mains and manholes (tied to acceptable positions) with their depths, grades, sizes and types. Also, the distance from the closest property line of each lot or parcel to the sewer lateral service shall be shown.

- Actual surveyed locations with ties to all valves for the culinary water, secondary water and irrigation company water shall be shown. An approximation of the water mains, with their sizes and the type of water main, shall also be shown.

- Actual surveyed location of the storm drain and sub-drain manholes, catch basins, inlet boxes and pipes with their depths, grades, sizes and types.

- Actual surveyed location of above ground dry utility appurtenances and approximation of buried dry utility lines.

- Benchmarks (at least 2) established and shown on the drawing of record that shall be located on or near the development.

- The drawing of record shall reflect all field changes or any aspect of the original construction plans.

- An elevation shall be established at the ends of all new curb and gutter, waterways and sidewalks, which are stubbed at the ends of the development.

- Actual surveyed building pad elevations shall be shown and shall not vary from the construction plans by more than 0.5 feet

- Detailed landscaping plans for landscape areas to be maintained by the City

- Actual surveyed top and bottom elevations of walls adjacent to city streets at least every 100 feet with elevation of nearest curb.

g. Drawing of record must be approved prior to final acceptance and start of warranty period.

Operation Sheet 1	Adhering Construction company operations Quality requirements

The techniques for identifying types of drawings and their functions first operate the following.

On a sheet of A3 drawing paper you are required to draw equal 4 spaces to the larger part of the paper and into 3 other part of a paper that mean 12 spaces on your scale rule to an accuracy of ± 0.4mm. Ask your instructor an example of what you are required to do.

Procedure:

Step 1. Draw borderline

Step 2. Draw title block

Step 3. Divide the sheet into 12 equal rectangles

Step 4. At the top left hand corner of each rectangle nominate the scale used.

Step 5. Draw a vertical line 10mm from the left hand side of each rectangle

Step 6. From the vertical line drawn in step (5) draw horizontal lines to the lengths 70, 740, 850 and 865 millimeters with 20mm gap between lines in each rectangle.

Self-Check -3	Written Test

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

Part A	**Part B**
1. A process focused concept	A. Quality Assurance
2. A product focused concept	B. Consistency
3. 1:100	C. Quality control
4. Same size with similar appearance and taste 1:50	D. 2 times greater than
	E. 2 times greater than 1:100

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ **Date:** _____

Information Sheet-4	**Identifying** Environmental requirements **and controls of building work Building job plans, building Specifications, environmental plan**

4.1 Fundamental Requirements

Drawings required for Subdivisions and Site Developments that include Grading more than one acre, Installation of improvements required government body, Installation of any improvements intended to become public and when determined to be necessary by the Engineer.

A structure shall be designed and executed in such a way that it will, during its intended life with appropriate degrees of reliability and in an economic way:

- ✓ Remain fit for the use for which it is required; and
- ✓ Sustain all actions and influences likely to occur during execution and use.

Design according to above implies that due regard is given to structural safety and serviceability, including durability, in both cases.

A structure shall also be designed and executed in such a way that it will not be damaged by events like fire, explosion, impact or consequences of human errors, to an extent disproportionate to the original cause.

The potential damage shall be avoided or limited by appropriate choice of one or more of the following:

- Avoiding, eliminating or reducing the hazards which the structure may sustain;
- Selecting a structural form which has low sensitivity to the hazards considered;

- Selecting structural form and design that can survive adequately the accidental removal of an individual element or a limited part of the structure, or the occurrence of acceptable localized damage;
- Avoiding as far as possible structural systems which may collapse without warning;
- Tying the structure together.

The above requirements shall be met by the choice of suitable materials, by appropriate design and detailing, and by specifying control procedures for design, production, execution and use relevant to the 'particular project.

4.2 Durability

In design that the durability of a structure or part of it in its environment is such that it remains fit for use during the design working life given appropriate maintenance. The structure should be designed in such a way that deterioration should not impair the durability and performance of the structure having due regard to the anticipated level of maintenance.

The following interrelated factors shall be considered to ensure an adequately durable structure:

- The intended and possible future use of the structure;
- The required performance criteria;
- The expected environmental influences;
- The composition, properties and performance of the materials;
- The choice of the structural system;
- The shape of members and the structural detailing;
- The quality of workmanship, and level of control;
- The particular protective measures;
- The maintenance during the intended life.

4.3 **Specification**

The specification forms part of the Tender Documents and ultimately part of the Contract Documents. These specification documents contain a general building specification, along with an accompanying Schedule or Supplement compiled to cater for the needs and requirements of the individual proprietors for their specific house. Items such as the following are spelt out in detail:

- Disposal of excavated materials
- Trees and other items to be protected
- Extent of drainage work
- Extent and finish to concrete
- Type and colour of bricks
- Type of floor sheeting, internal linings and ceilings
- Manufacture and type of door and window frames and sashes
- External and internal joinery designs, door hardware and furniture
- Sizes and details of internal fixing timbers
- Glazing types
- Extent of cupboards and wardrobes etc
- Roof sheeting material and sarking/ sisalation
- Make and type of plumbing fixtures and fittings
- Extent of electrical work and type of switches and fittings throughout
- Extent of, type and quality of wall and floor tiling
- Other floor covering and finishes
- Painting and colour selection
- Prime cost items (p.c.i.s)
- Items to be supplied by the proprietor
- Details of other miscellaneous items to be supplied by the builder or the proprietor.

4.4 Environmental protection

It is the practice of protecting the natural environment by individuals, organizations and governments. Its objectives are to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends.

Environmental protection requirements are identified for the project in accordance with environmental plans and regulatory obligations and applied tools and equipment selected to carry out tasks are consistent with the requirements of the job.

Material quantity requirements are calculated in accordance with plans and specifications for materials appropriate to the work application are identified. The work man site preparation begins before you starting any work,

Due to the pressures of overconsumption, population growth and technology, the biophysical environment is being degraded, sometimes permanently. There is disagreement on the extent of the environmental impact of human activity and even scientific dishonesty occurs, so protection measures are occasionally debated.

4.4.1 Environmental Management plan

Environmental Management plan consists of the following activities:

- Specific action plan for implementing mitigation measures
- Statutory requirements and Implementation
- Monitoring of Environmental Quality
- Documentation
- Rainwater Harvesting
- Green Belt Plantation
- Training
- Social Responsibility

4.4.2 Waste management

Waste is solid substances generated as a result of human activities, and, being no longer of value for the respective economic, physiological or technological process, are removed from it.

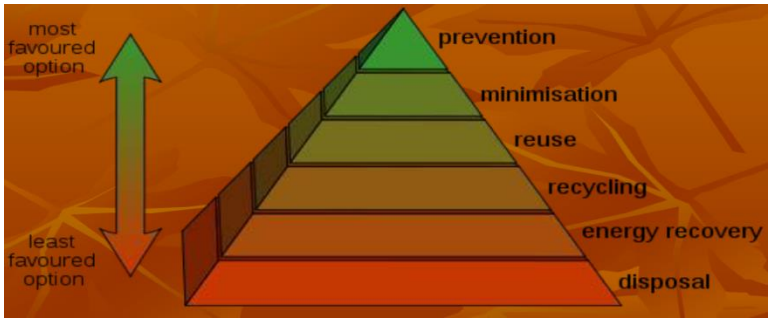
Construction waste consists of unwanted material produced directly or incidentally by the construction or industries. This includes building materials such as insulation, nails, electrical wiring, as well as waste originating from site preparation such as dredging materials, tree stumps, and rubble. Construction waste may contain lead, asbestos, or other hazardous substances. Much building waste is made up of materials such as bricks, concrete and wood damaged or unused for various reasons during construction.

Observational research has shown that this can be as high as 10 to 15 % of the materials that go into a building, a much higher percentage than the 2.5-5 % usually assumed by quantity surveyors and the construction industry. Since considerable variability exists between construction sites, there is much opportunity for reducing this waste.

The waste management is to reduce waste formation and to use resources more efficiently and rationally, ensuring that the waste of one sector is used as a raw material in another sector. To desirable waste management waste management hierarchy used.

Waste management hierarchy

The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste.



Reducing Waste and other materials are by modifying industrial production. Source reduction methods involve changes in manufacturing technology, raw material inputs, and product formulation. At times, the term "pollution prevention" may refer to source reduction.

- waste minimisation is the process and the policy of reducing the amount of waste produced by a person or a society. Waste minimisation involves efforts to minimise resource and energy use during manufacture. For the same commercial output, usually the fewer materials are used, the less waste is produced. In the waste hierarchy, the most effective approaches to managing waste are at the top. In contrast to waste minimisation, waste management focuses on processing waste after it is created, concentrating on re-use, recycling, and waste-to-energy conversion.

- Resource optimisation is Minimising the amount of waste produced by organisations or individuals goes hand-in-hand with optimising their use of raw materials. For example, a dressmaker may arrange pattern pieces on a length of fabric in a particular way to enable the garment to be cut out from the smallest area of fabric.

- Reuse of scraps material - Scraps can be immediately re-incorporated at the beginning of the manufacturing line so that they do not become a waste product. Many industries routinely do this; for example, paper mills return any damaged

rolls to the beginning of the production line, and in the manufacture of plastic items, off-cuts and scrap are re-incorporated into new products.

- Improved quality control and process monitoring - Steps can be taken to ensure that the number of reject batches is kept to a minimum. This is achieved by increasing the frequency of inspection and the number of points of inspection. For example, installing automated continuous monitoring equipment can help to identify production problems at an early stage.

- Waste exchanges - This is where the waste product of one process becomes the raw material for a second process. Waste exchanges represent another way of reducing waste disposal volumes for waste that cannot be eliminated.

- Ship to point of use - This involves making deliveries of incoming raw materials or components direct to the point where they are assembled or used in the manufacturing process to minimise handling and the use of protective wrappings or enclosures.

4.4.3 Clean up

Cleaning is the removal of all visible soil in an approved way with the use of mechanical and chemical action or both, so that all areas are cleaned and sanitised to a high standard. Cleaning is an investment in the assets of a building

Shine the workplace by eliminating dirt, dust, fluids, and other debris. Adequate cleaning supplies that have been tested to make sure the solution will not harm any equipment or work areas. Clean things such as equipment, tools, work surfaces, desks, storage areas, floors, lighting, and anything else that affects overall cleanliness.

Once the work area, tools, and equipment are clean, they need to be kept that way. Continued housekeeping is one way to keep the work area clean, but the better method

is to prevent things from getting dirty in the first place. Find ways to keep the workplace clean by eliminating sources of contamination. Root cause analysis, mistake-proofing, and the use of preventative measures are important to keep the workplace clean and orderly.

Equipment that is kept clean performs more efficiently, has less unscheduled downtime, and reduces costs to the company. Many organizations find that safety and productivity improve as regular maintenance and housekeeping become the norm.

Follow these action steps to success clean up.

- Define “clean” – you may face conflicting definitions for clean within your work area.
- Find a definition that everyone supports.
- Get cleaning supplies – be sure to identify appropriate cleaning supplies for your work area. Some cleaning solutions may harm equipment while other cleaning instruments may harm metals, photo cells, or tooling. Consult sanitation specialists for guidance.
- Take “before” pictures – a record of your current state often generates the motivation to keep things clean.
- Clean the work area – share the work load among the group.
- Eliminate small imperfections through cleaning and inspecting activity.
- Take “after” pictures – use photographs to demonstrate your results.

Self-Check -4	Written Test

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

1. Which of the following design drawings and technical specifications should include

A. Bill of Quantities
C. Requirements for Material Testing

B. Material specifications
D. All

2. Due to the pressures of overconsumption, population growth and technology, the biophysical environment is being degraded, sometimes permanently.

A. True B. False

3. Remains fit for use during the design working life

A. Safety B. Durability
C. Suitability D. Usability

4. The specification forms are part of the Tender Documents and ultimately part of the Contract Documents.

A. True B. False

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ Date: _____

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

Given necessary drawings tools and materials you are required to perform the following tasks within 2 hours.

Task 1. Identify main types of Construction plans and drawings

Task 2. Identify at least 10 information in building working drawings with its key features and functions

Task 3. Identify at least 4 adherences of a Construction company operations Quality requirements within a drawing

Task 4. Identify at least 4 concern in identify environmental requirements and controls of building work Building job plans, building Specifications and environmental plan in drawing.

List of Reference Materials

1. Support materials, General construction training package BCG98 , Learning materials,BCG1003A: Read and interprete plans, Australian National Training Authority 2000, Website: www.atpl.net.au

2. EIA Report for 1000 MW Coal Based Thermal Power Plant at Naraj Marthapur, Cuttack, Orissa, The Tata Power Company Ltd. https://elaw.org/system/files/Chapter%206.pdf

3. Prepare a plumbing takeoff List (plumbing I), Sub course en 5110, Plumber, Edition A

Plumbing installation

Level-II

Learning Guide-20

Unit of Competence: Read and interprète plans and spécifications

Module Title: Reading and interpreting plans and spécifications

LG Code: EISPLI2 M06 LO2-LG-20

TTLM Code:EISPLI2 M06 TTLM 0919v1

LO2: Recognize amendments

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

- Checking construction ***project documents***
- Checking Amendments to project ***specifications***
  - ✓ Define current ***information*** in specification
  - ✓ Convey information in specification to others

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:

- Check construction ***project documents***
- Check Amendments to project ***specifications***
  - ✓ Define current ***information i***n specification
  - ✓ Convey information in specification to others

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, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in page -6, 9, 12 and 14 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” in page -15.
6. Do the “LAP test” in page – 16 (if you are ready).

Information Sheet-1	Checking construction *project documents*

1.1 Project work

A project is made up of a group of interrelated work activities constrained by a specific scope, budget, and schedule to deliver capital assets needed to achieve goals of work.

Projects are efforts to achieve objectives and Projects have a start, a middle and an end making them different from operational activities which are performed regularly over time e.g. payroll operation. There are core skills involved in project management including identifying and agreeing on project objectives, scheduling and estimating. In addition other issues such as managing risk, communication and dealing with other people are key areas of importance. In project there are three core issues which need to be addressed quality, cost and time.

1.2 Project documents

Construction documents relate to the design, construction and commissioning of the project works. Typically, the documents should include design drawings and Construction specifications

All work performed pursuant to specifications shall comply with the requirements of the relevant local Acts, Regulations, Standards and Codes of Practice of all authorities having jurisdiction over the work.

Technical data should include;-

- **Design drawings**: – these set out design information and Procedures which are required to be used on the works.
- **Bill of Quantities**: – this itemizes the quantity of materials to enable a tenderer to accurately cost the work for which they are bidding.
- **Material specifications;** – such as diameter, type and grade of Material for pipes (E.g. polyethylene pipes or UPVC), joining Methods (e.g. electro-fused or compression fittings etc.), or 28-Day compressive strength of concrete.
- **Requirements for Material Testing**;- e.g. testing required for Earthworks (i.e. minimum required compaction and moisture range To be achieved), frequency of testing (e.g. one soil density test per1,000 m3of bulk earthworks) or the number of tests per 1,000 m2 of area for hydraulic conductivity tests in sedimentation ponds.
- **Construction and installation methods.**

1.3 Plumbing standard document

Check plumbing standard document as plumbing work project for example refer BaTCoDA

1.3.1 Water well

- The water well is dug according to the specifications and drawings, if possible dug during the dry season.

- If septic tanks, soak away pits and dry latrines are situated nearby and inform the designer to change the position of the well.

1.3.2 Water supply lines

- The dimensions and types, tubes valves and water tower are according to the specifications and drawings.

- All valves, unless otherwise specified is buried in the ground to a minimum depth of 30cm.

1.3.3 Sanitary installations

- Dimensions and types of pipes, tubes, valves and sanitary ware is according to the specification and drawings.

- Pipes and tubes are placed in the board core with minimum 10cm covering layer of sand or in channels of floors as indicated on the drawings.

- All connection between sanitary ware and sewer system is done with the prescribed siphon.

- All exposed pipes and tubes are well cleaned and painted as specified.

- All sanitary work complies with the standard technical specification.

1.3.4 Sewer system

- Dimensions and types of pipes and inspection pits is according to the specifications and the drawings.

- The excavation measurements of the sewer lines are according to the drawings.
- The excavation is done in straight lines between the manholes.
- Unless otherwise specified, the pipes are laid on a sand bed with a minimum thickness of 10cm and in an absolutely straight line with an even slope of minimum 1**:**100 and covering soil layer is minimum 50cm.
- The joining of concrete to pipes is always done with cement mortar, the joint completely filled all around.
- All pipes connected to the inspection pit come approximately on the same level and check channel formed in concrete at the bottom of the pit.
- Back filling is in layers of minimum 20cm, if vibrating or roller machine is used the thickness of the layer can be 40cm unless otherwise specified.

1.3.5 Septic tank and soak away pit

- Dimension and type of septic tank and soak away pit is according to the specifications and drawings.
- The position of septic tank and soak away pit if situated nearby water wells, and inform the designer for the change of the positions.
- Level of overflow pipes between different chambers and inlet and outlet pipes are according to the drawings.
- All plastering in and out, is with cement plaster with thickness and mixture according to specifications and drawings.

Self-Check - 1	Written Test

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

1. Core issues of project

   A. Quality B. Cost C. Time D. All E. None

2. Not a requirement of material testing.

   A. Type of test B. None C. Frequency of test D. Number of test

3. It is a material specification of pipe

   A. Diameter B. Thickness C. joining Methods D. compressive strength

3. Identify type of document which itemizes the quantity of materials.

A. Bill of quantity B. Design C. Specification D. Testing

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

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

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Checking Amendments to project ***specifications***

2.1 Define current *information* in specification

2.1.1 Plumbing project *specifications*

This specification is intended to cover design, engineering, manufacture, test and inspection of works, delivery to site, properly packed for transportation, erection, testing, commissioning, performance demonstration at site and handing over to client/consultant/ purchaser of Plumbing System as indicated in the schedule of Requirement and scope of work as required for reliable and effective plumbing for project. Plumbing system specification deals with:

- Complete earthwork i.e., excavation and back filling for the entire buried piping for plumbing & sewerage system.

- The supply, erection and commissioning of spares as specified with tools and tackles as required.

- Makes it obligatory for the contractor for arranging and obtaining necessary clearance / approval from all Local / statutory authorities.

- It is not the intent to completely specify all the details of design and construction herein. Never the less the equipment and installation shall confirm to high standard of engineering, design and workmanship in all respect and shall be capable of performing continuous satisfactory operation acceptable to the client/ consultant/ purchaser as well as to the various statutory authorities. In case of any violation of the above contract, the client/ consultant/ purchaser reserves the right to change/ reject/ modify the equipment/ system during detail engineering.

- Wherever material or article is specified or described by the name of particular brand, manufacturer or vendor, the specific item mentioned shall be understood as established type function and quality desired. Other manufacturer‟s product will be considered provided sufficient information is furnished to allow the client/ purchaser to determine that the product proposed is equivalent to that brand.

- The entire system shall be designed and engineered by the Bidder based on the guidelines furnished in the specification, various codes / standards, Bidder's experience and also good engineering practice. Items and quantities, which have been furnished in this specification, are tentative and indicative only. Bidder to go through the layouts & schematic diagrams given along with the tender & any discrepancy in the quantities/ specifications/ model nos./ etc to be identified, discussed & agreed upon mutually at the pre bid stage itself & concluded. Any deviation at a later date is not accepted without proper justification for the same.

- Supplies and services to be covered under this tender specification and the conditions thereof are detailed in the subsequent sections of the specifications. In case of conflict among various sections, subsections, documents, drawings the same shall be referred to clients/consultant/purchaser whose decision shall be final and binding to the Bidder. In all cases, the best advantages will go to the purchaser.

2.1.2 Amendments of drawings

Amendments of drawings are documents revisions which may affect one or all drawings Identified by revision block or number and triangle points to revision. Revisions in the field of drawings are made by deletion, either by erasure or crossing out a series of parallel lines placed on the face of drawing over the deleted portions of drawing, by addition, or by redrawing all delineations shall be made to scale. Revisions shall be identified by symbols in the field of the drawing cross-referenced to the revision description. Revision symbols shall be entered in the revision block. Revisions shall be by alphabetical letter and order, except that letters I, O, Q, S, X, and Z shall not be used as revision symbols. Following letter Y, use AA, AB, etc.; after AY, use BA, BB, etc.

Revision recorded in a symbol (e.g., “A3”) enclosed in a circle shall appear in the field of drawing at the point of revision. The letter “A” refers to any revisions completed at a given time. The number following refers to the number of the revision made.

When changes are made to a drawing through a direct incorporation, revision symbols are required on the field of the drawing, and abbreviated descriptions of the changes must be recorded in the revision block. When changes are made to a drawing through an EO or Revision Notice system, revision symbols are not required on the field of the drawing, but the Revision Block must state “See EO number for changes” or “See Revision Notice number” in the revision description column.

For either method of incorporation, the person incorporating the revision, the person assigned to check the incorporation, and the engineer responsible for the revision all shall date and initial the revision block in the approved column.

When a drawing is redrawn without changes, the phrase “Replaces Revision (old revision letter) Without Change” shall be added to revision block and revision letter shall remain unchanged. See Figure Original names and dates from the old title block shall be typed in on the replacement drawing.

REVISION			
SYM	DESCRIPTION	DATE	APPROVAL
A3	(1) R.188 WAS R.250 (2) ADDED .500, 1.500 AND 2.000 DIMS (3) REM'D .750 AND 7.000 DIMS	1-2-84	(SIGNATURE)
B4	(1) WAS 1.500; (2) WAS .635; (3) WAS 1.000+.005; (4) WAS "NOTE 4" -.000	2-3-84	(SIGNATURE)

Self-Check -2	Written Test

2.2 Convey information in specification to others

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

1. Reliability and effectiveness of plumbing for project depend on current information of its specification.

   A. False B. True C. Not both

2. Specification not completely specifies all the details of design and construction.

A. True B. False C. Not both

3. Testing and inspection of works are not encompass in specification document

A. False B. True C. Not both

4. False about Amendments of drawings

A. Documents revisions B. Identified by revision block or number

C. Redrawing all delineations made to different scale D. Made by deletion

Note: Satisfactory rating - 2 and 4 points Unsatisfactory - below 2 and 4 points

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

Score = _____

Rating: _____

Name: _____ Date: _____

List of Reference Materials

4. Support materials, General construction training package BCG98 , Learning materials,BCG1003A: Read and interprete plans, Australian National Training Authority 2000, Website: www.atpl.net.au
5. EIA Report for 1000 MW Coal Based Thermal Power Plant at Naraj Marthapur, Cuttack, Orissa, The Tata Power Company Ltd. https://elaw.org/system/files/Chapter%206.pdf

6. Prepare a plumbing takeoff List (plumbing I), Sub course en 5110, Plumber, Edition A

Plumbing installation

Level-II

Learning Guide-21

Unit of Competence: Read and interpret plans and spécifications

Module Title: Reading and interpreting plans and spécifications

LG Code: EISPLI2 M06 LO3-LG-21

TTLM Code: EISPLI2 M06 TTLM 0919v1

LO3: Recognize commonly used symbols and abbreviations

Instruction Sheet	Recognize commonly used symbols and abbreviations

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

- Recognising Construction symbols and abbreviations
- Interpreting construction drawing legend

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:

- Recognise Construction symbols and abbreviations
- Interpret construction drawing legend

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 and Sheet 2.
4. Accomplish the “Self-check 1 and Self-check t 2, Self-check 3 and Self-check 4” in page 25 and 28 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” in page -15.
6. Do the “LAP test” in page – 30 (if you are ready).

Information Sheet-1	Recognising Construction symbols and abbreviations

1.1 Construction symbols

An important part of building construction is the ability to read and understand the information shown on a construction drawing or a set of construction drawings. The drawings show what plumbing facilities are required by using symbols and abbreviations to identify the real material items. The symbols and abbreviations on the construction drawing tell the plumber the location of water and waste pipelines, the type and size of pipe, the type of fittings for pipeline connections, and the location of all the fixtures required.

Once you can read and understand the information on a construction drawing, you can determine the lengths of pipe required by type and size, the number of different types of fittings by size, and the number of different types of fixtures. You will be able to make a list of plumbing materials needed to install any part of or all of the plumbing system.

Technical standards exist to provide glossaries of abbreviation, acronyms, and symbols that may be found on engineering drawings. Many corporations have such standards, which define some terms and symbols specific to them for example construction drawing includes:

1.1.1 Material symbols

Symbols are the representation of actual object by some notation which convey the necessary information. Shown below are a series of symbols relating to the construction industry. Figure :

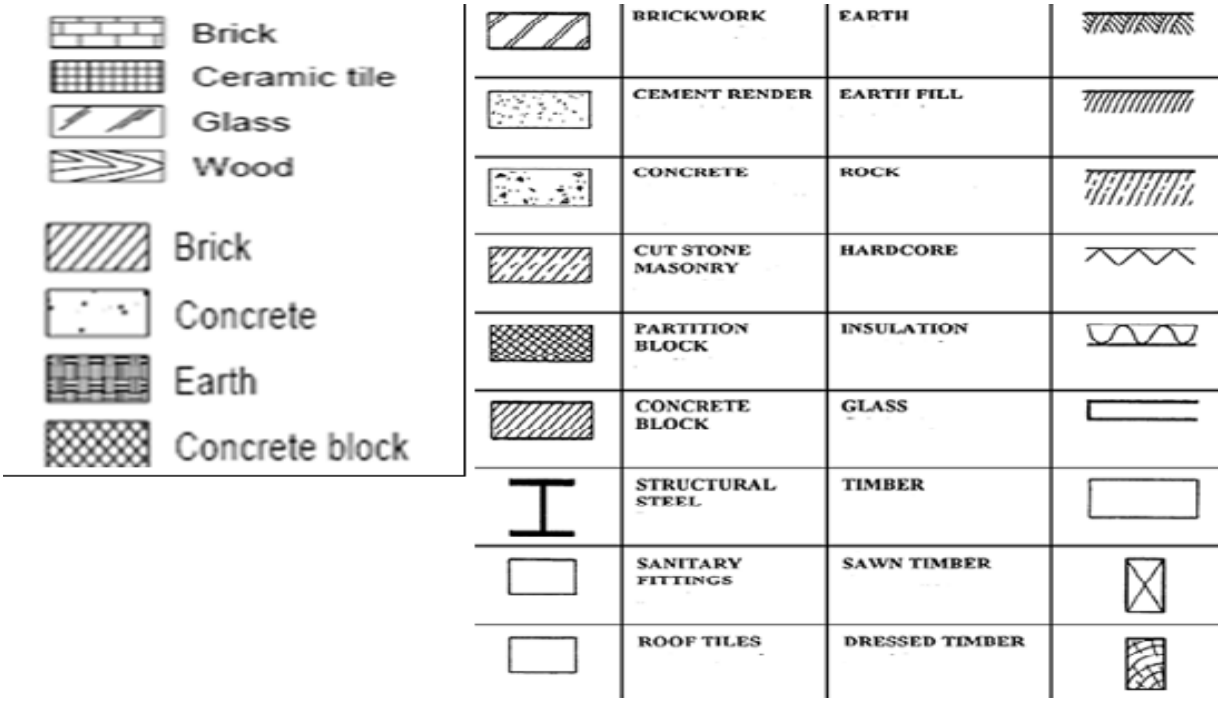


Figure 1.1 : Materials Symbols

1.1.2 Door and window symbols see Figure 1.2 and Figure 1.3

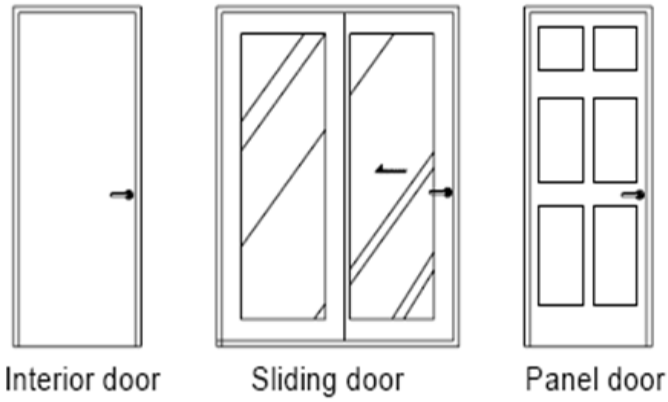


Figure 1.2 Doors symbol

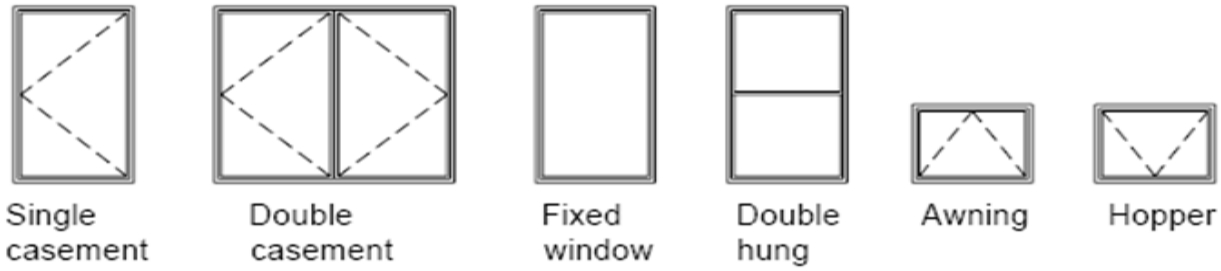


Figure 1.3 Windows symbol

1.1.3 Structural symbol see Figure 1.4

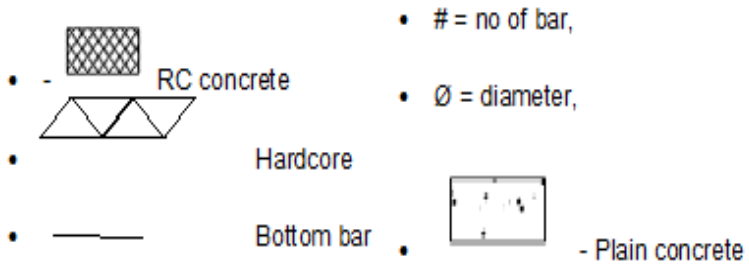


Figure 1.4 Structural symbol

1.1.4 Surveying symbol, see Figure 1.5

Figure 1.5 Structural symbol

1.1.5 Plumbing symbols See Figure 1.6, Figure 1.7 (A,B,and C)

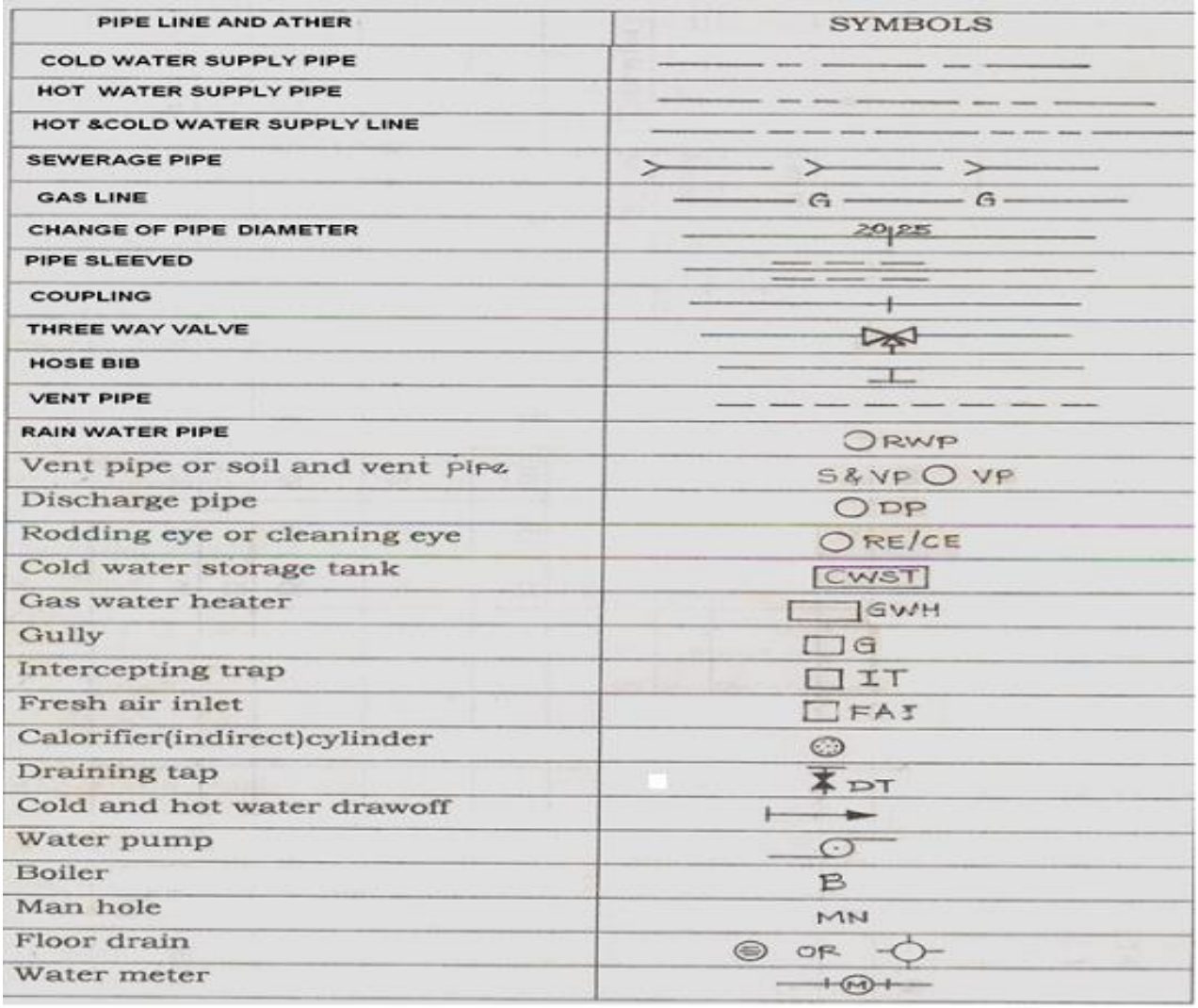


Figure 1.6 Structural symbol

1.1.6 Fitting symbols, See Figure 1.7 (A, B and C)

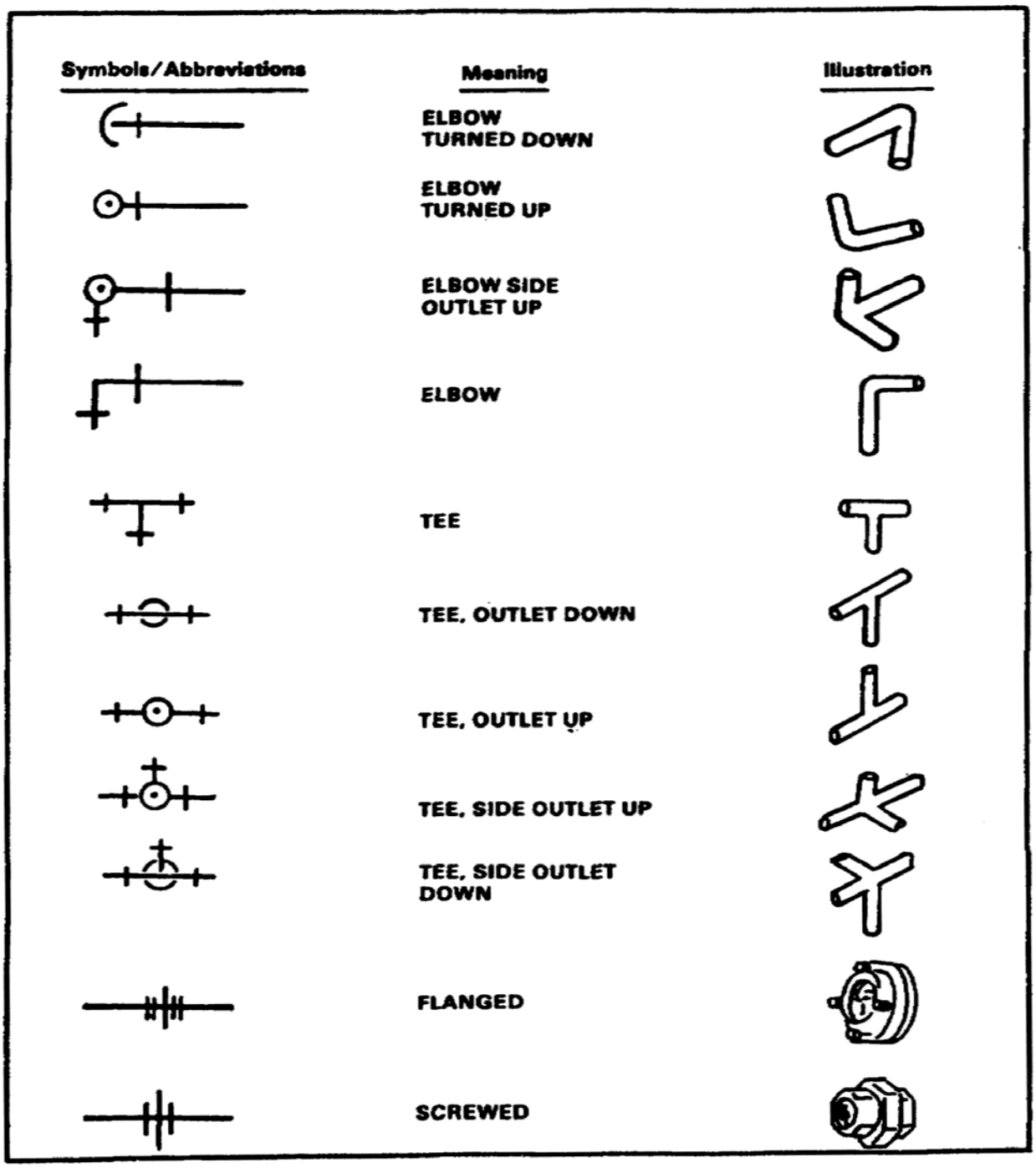


Figure 1.7A Fitting symbol

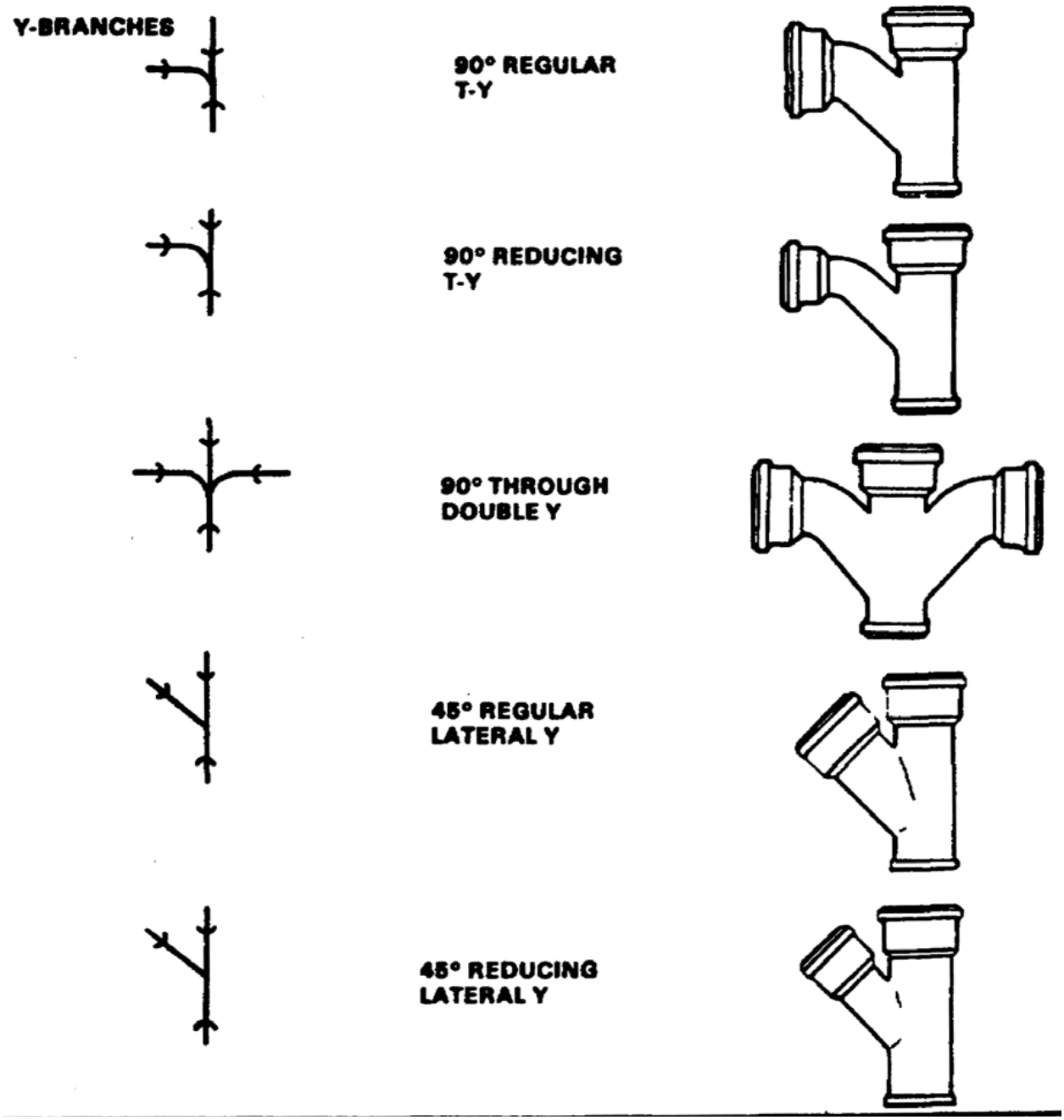


Figure 1.7B Fitting

symbol

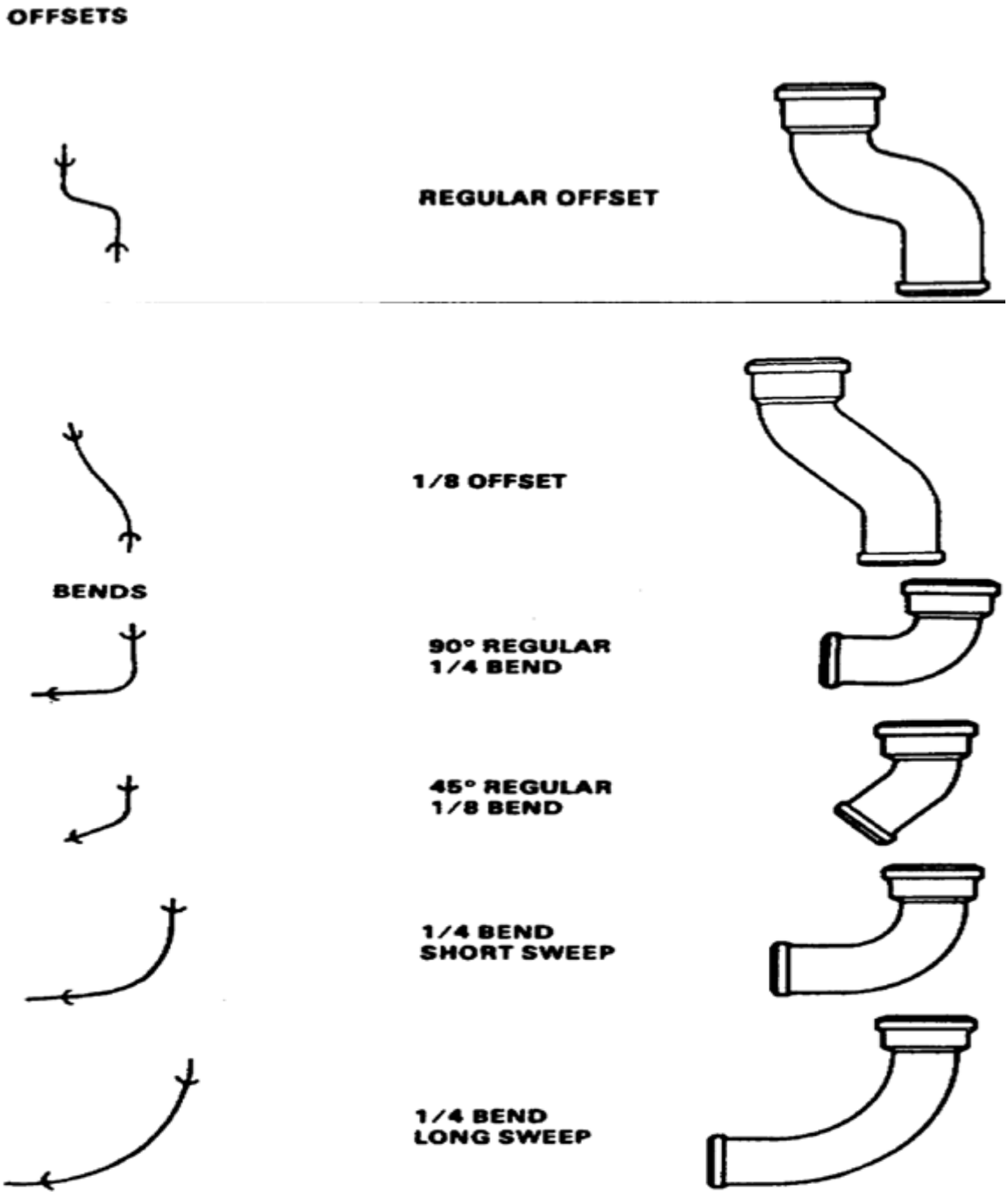

OFFSETS
REGULAR OFFSET
1/8 OFFSET
BENDS
90° REGULAR
1/4 BEND
45° REGULAR
1/8 BEND
1/4 BEND
SHORT SWEEP
1/4 BEND
LONG SWEEP

Figure 1.7C Fitting symbol

1.1.7 Devices symbol, See Figure 1.8

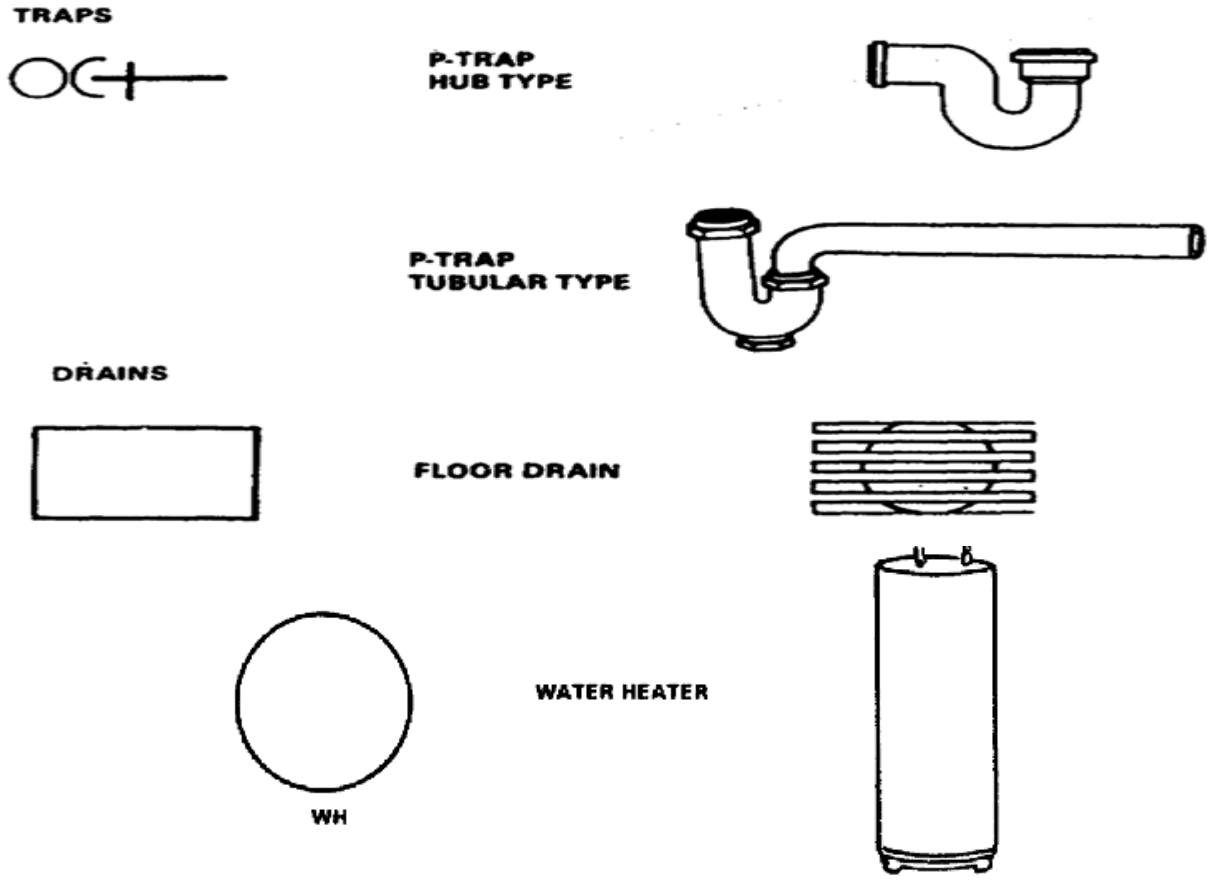


Figure 1.8 Device symbol

1.1.8 Taps and Valves symbols, See Figure 1.9

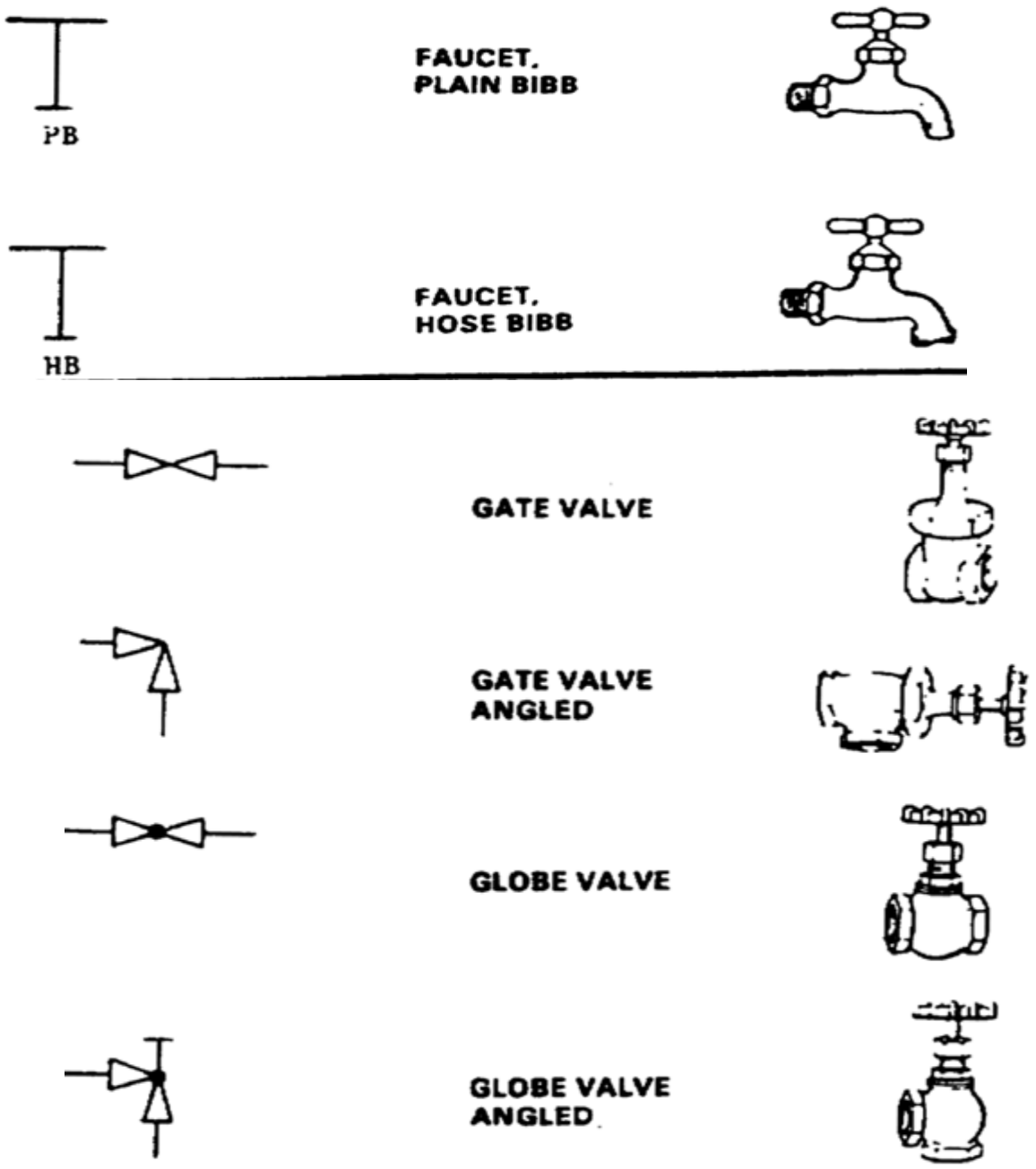
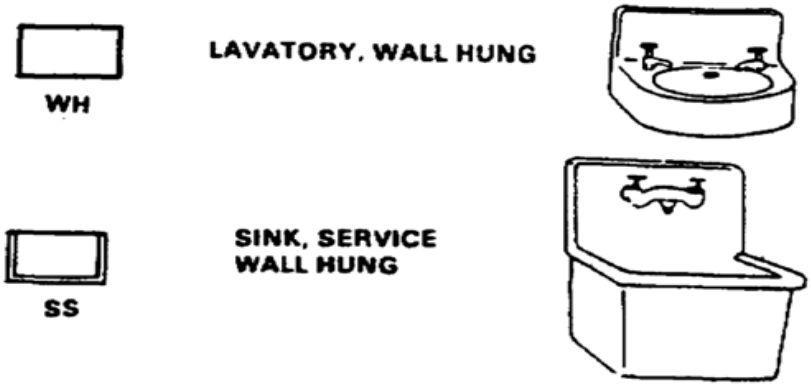


Figure 1.9 Taps and Valves symbol

1.1.9 Fixture symbols

Some symbols Shown below are currently found on water supply and/or sanitary plans. Common abbreviations are listed in Figure 1.10(A and B).



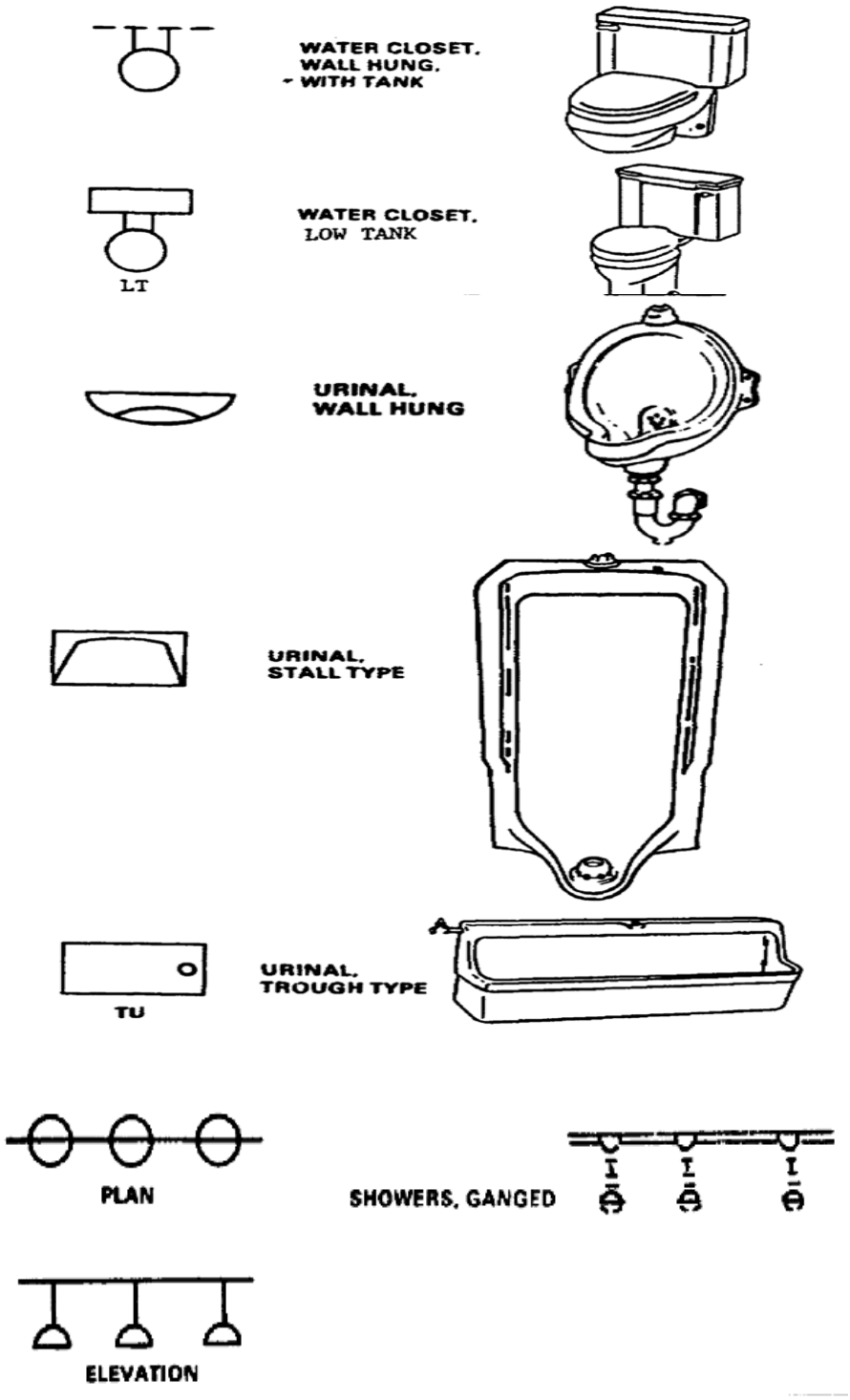


Figure 1.10A Fixtures symbol

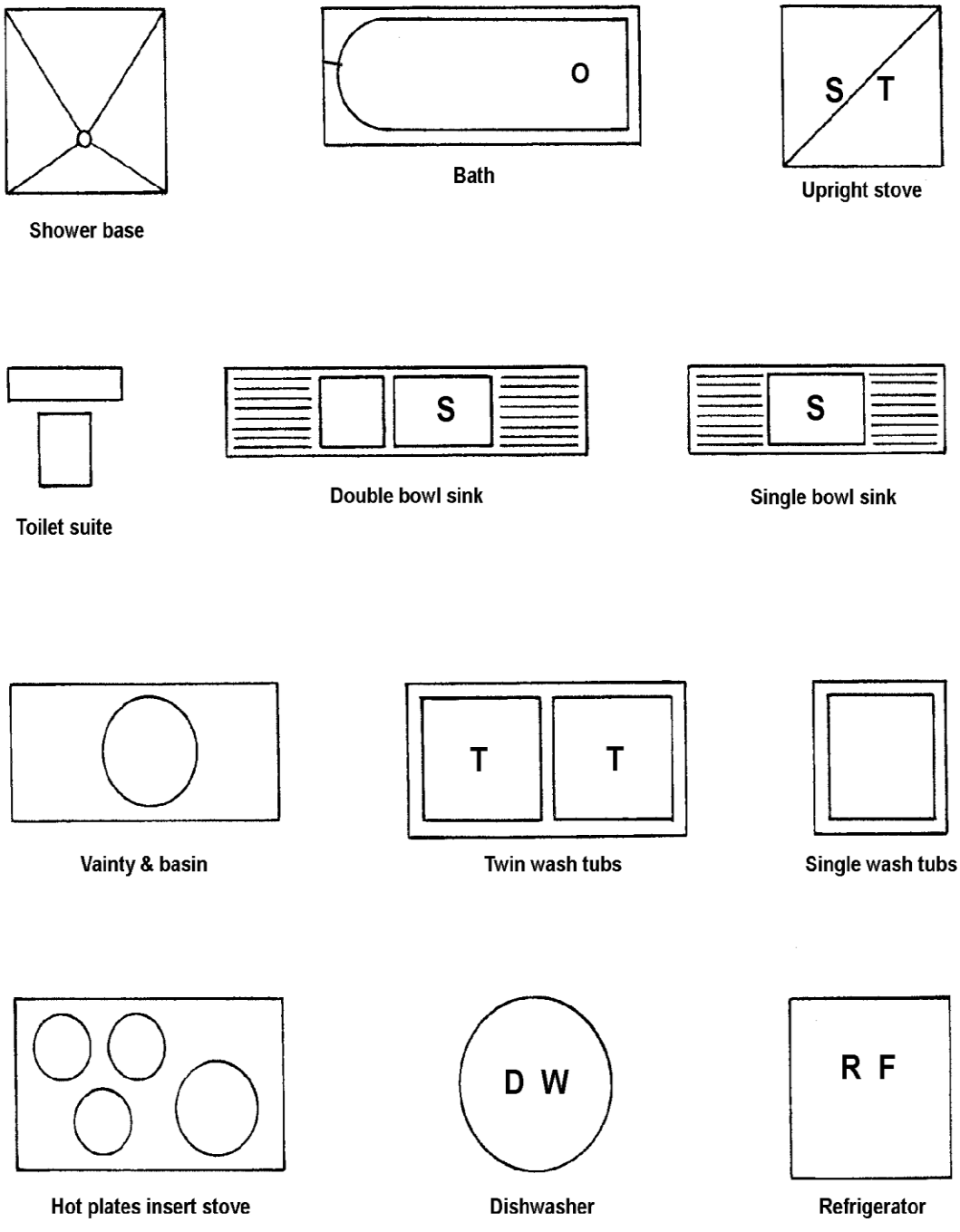


Figure 1.10B Fixtures symbol

1.1.10 Electrical symbols, See Figure 1.11

Shown below are some symbols currently found on wiring diagram or electrical plans. Common abbreviations are listed in Figure 1.11.

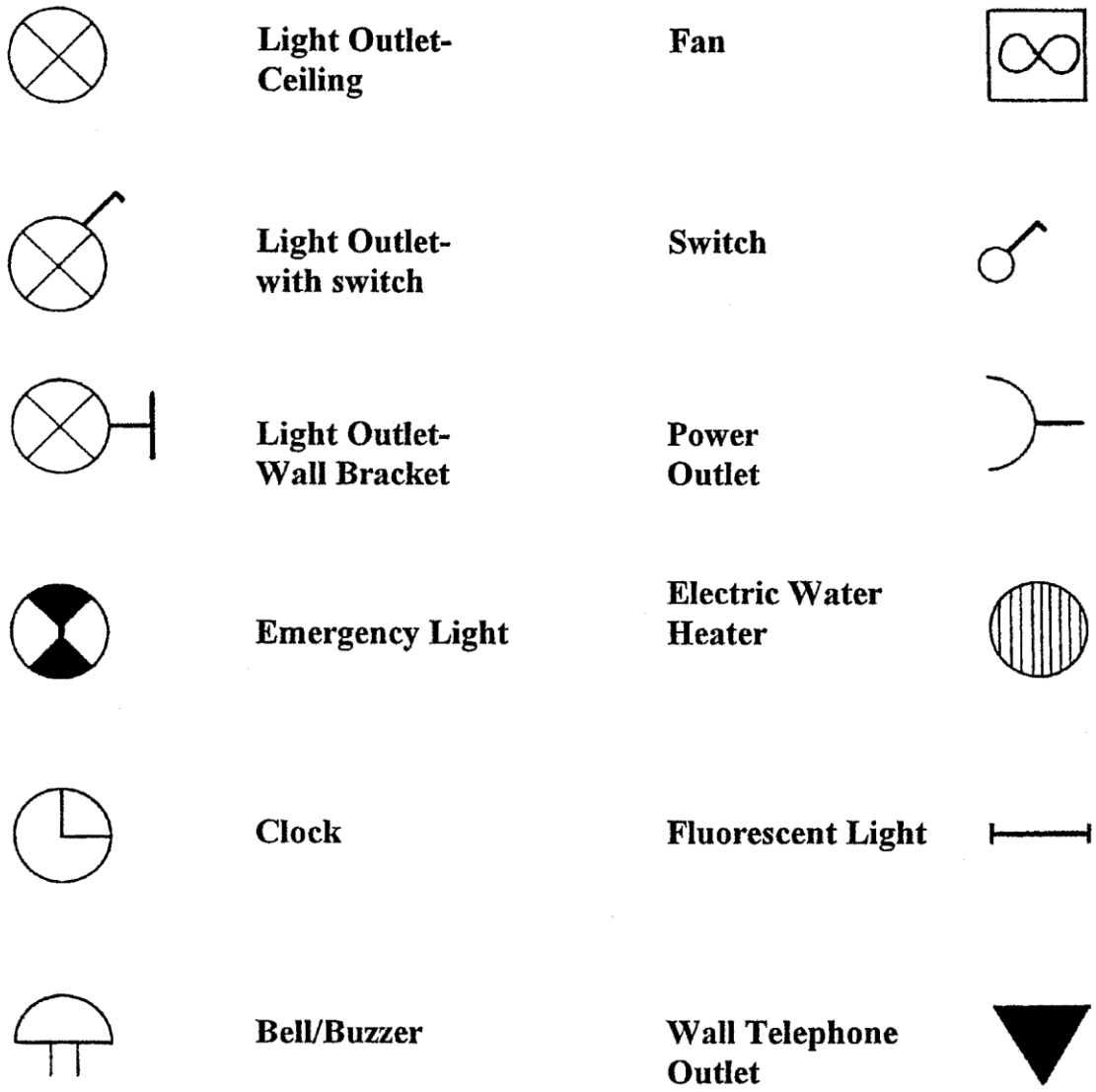
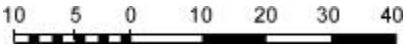


Figure 1.11: Electrical Symbols

1.1.11 Architectural Symbols See Figure 1.12

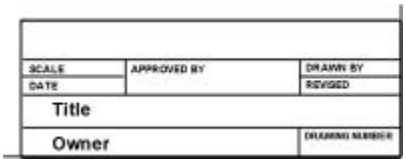
Job datum level - indicates the altitude at a specific point, relative to a universal reference point known as a 'datum'.

Window and door references - a reference to specific window and door diagrams (numbers indicate which diagrams



Graduated scale - used to indicate the size and scale of objects and structures in the diagram

Compass - shows the orientation of the plan diagram and the structures it depicts

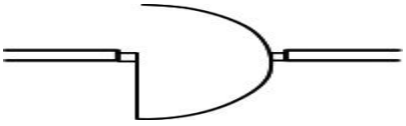


Title block - provides details about the project, the specific plan revision you're looking at, the architect or designer, the date etc.

Window

Single-swing door (180 degrees)

Single-swing door (90 degrees)



Single double-acting door

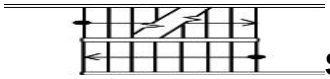
Pocket / cavity door - a sliding door that slides into the wall cavity

Exposed sliding door

Bifold / concertina doors centered on a track

Bifold / concertina doors fixed to one side on a track

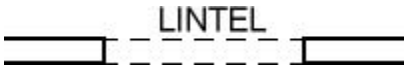
Ramp - arrow points upwards



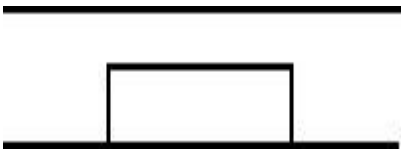
Stairs - arrow points upwards

Fall / drainage - arrow points downwards, towards floor waste / drain.

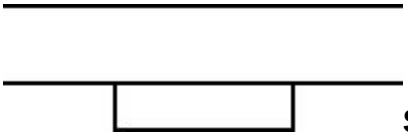
Archway



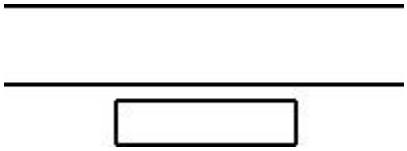
Lintel



Recessed object - an object recessed into a particular wall or surface.



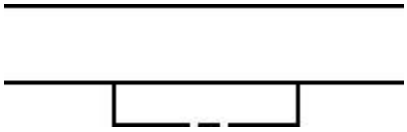
Surface-mounted object - an object mounted directly on a wall or surface.



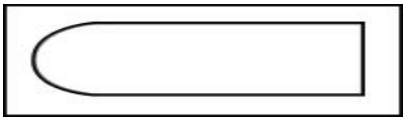
Free-standing object - an object not connected to the adjacent wall or surface.

Object mounted over - an object

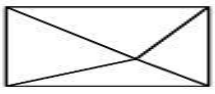
mounted over the area shown.



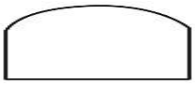
Object sitting above the plane of the depicted section - a surface mounted object sitting higher than the plane of the diagram.



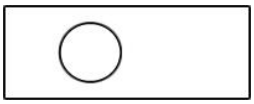
Bathtub



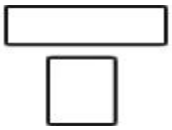
Shower stall - lines in the center of this diagram indicate drop for drainage



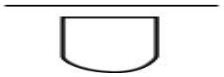
Basin



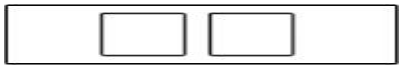
Vanity with basin



Toilet

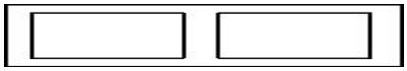


Bidet

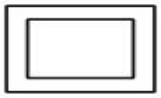


Sink with two bowls

Sink with one bowl

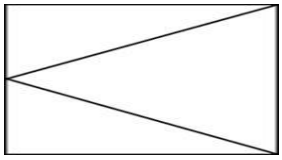


Double tub or trough

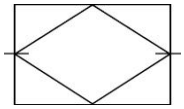


Single tub or trough

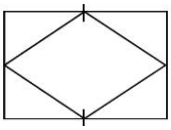
Hotplates



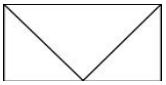
Right-side hinged window



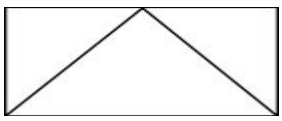
Side pivoted window



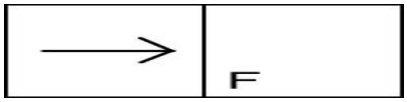
Top and bottom pivoted window



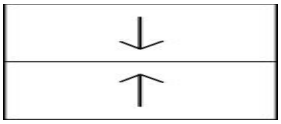
Top hinged window



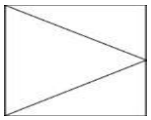
Bottom hinged window



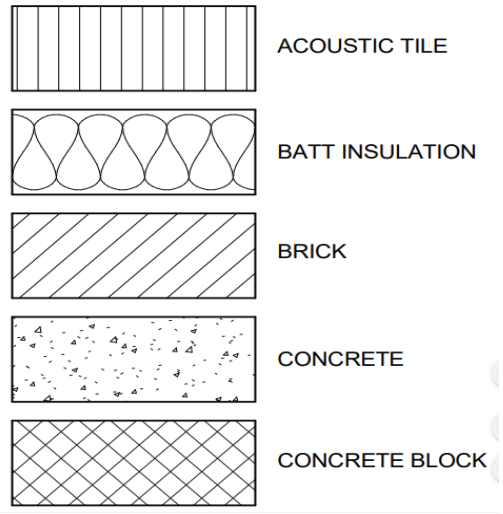
Horizontal sliding window with fixed sash



Vertical sliding sash window



Left hinged door



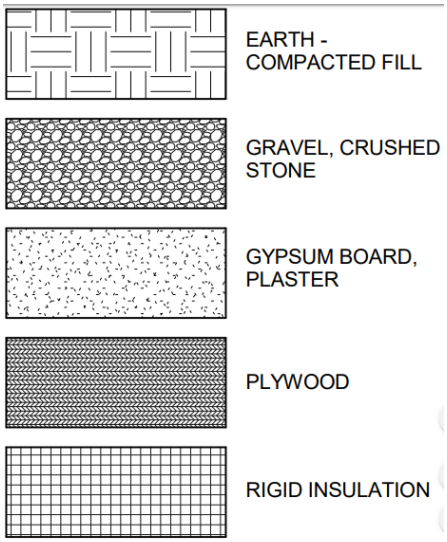


Figure 1.12 Architectural symbols

1. 2 Construction abbreviations

Abbreviations are a quick method of writing on a plan without taking up too much space. They are also easy to read when used correctly. Have a close look at each abbreviation and you will see how the abbreviated letters are taken from their meanings.

The purpose of Construction abbreviations is to provide a list of authorized abbreviations for use on drawings and associated documents.

- Uppercase Gothic letters shall be used.
- Abbreviations for word combinations (e.g., MMC—Maximum Material Condition) shall be used as such and shall not be separated for use singly. Single abbreviations may be combined when necessary.
- The same abbreviation shall be used for all tenses, the possessive case and the singular and plural forms of a given word.

- Abbreviations should be used only to save space or time, but never at the expense of clarity.
- Periods shall be used with abbreviations that spell entire words to provide clarity and to avoid misinterpretation.

Construction abbreviations are categorized in to the following in its purpose.

1.2.1 Level Abbreviations

- FCL: Finished Ceiling Level
- NGL: Natural Ground Level
- FFL: Finished Floor Level
- RL: Reduced Level
- FGL: Finished Ground Level

1.2.2 Common abbreviations

Listed below are some common abbreviations used in the construction industry.See Figure 1.13.

RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REF	REFERENCE, REFRIGERATOR
REINF	REINFORCING
REQD	REQUIRED
REV	REVERSE, REVISED, REVISION
RHR	RIGHT HAND REVERSE
RL	ROOF LADDER
RM	ROOM
RO	ROUGH OPENING
RTU	ROOF TOP UNIT
RWC	RAIN WATER CONDUCTOR
RWL	RAIN WATER LEADER
SCHED	SCHEDULE
SECT	SECTION
SF	SQUARE FOOT / FEET
SGL	SINGLE
SHT	SHEET

Abbr'	Meaning	Abbr''	Meaning	Abbr''	Meaning
AL	Aluminium	CONC	Concrete	R	Roof
AS	Australian Standard	CC	Concrete Ceiling	SD	Service Duct
AUX	Auxiliary	CF	Concrete Floor	SEW	Sewer
B	Basin	CTR	Contour	SD	Sewer Drain
B	Beam	CORR	Corrugated	SHR	shower
BRR	Bearer	DW	Dish Washer	S	Sink
BLK	Block	D	Door	SQ	Square Tube
BDYL	Boundary Line	DP	Down Pipe	SPR	Sprinkler
BT	Boundary Trap	DGE	Drainage	SF	Strip Footing
BRKT	Bracket	FHT	Floor Height	SWD	Storm Water Drain
BK	Brick	FW	Floor Waste	SWBD	Switchboard
BV	Brick Veneer	G	Gas	TC	Terra Cotta
BWK	Brick Work	HW	Hot Water Unit	TR	Trench
BLDG	Building	MH	Man Hole	TM	Trench Mesh
BL	Building Line	OUT	Outlet	TRH	Trough
CBL	Cable	OA	Overall	T	Truss
CAB	Cabinet	OH	Overhead	U/C	Under Construction
CAN	Canopy	PF	Pad Footing	U/G	Underground
CI	Cast Iron	PTN	Partition	UB	Universal Beam
CW	Cavity Wall	P	Pier	UR	Urinal
CEM	Cement	P/F	Plan of Sub-division	V	Vent
CM	Cement Mortar	PBD	Plasterboard	VER	Verandah
CR	Cement Render	PG	Plate Glass	VERT	Vertical
CRS	Centres	PF	Portal Frame	WBD	Wallboard
CL	Centre line	PCC	Precast Concrete	WP	Waste Pipe
CHY	Chimney	RAD	Radius	WC	Water Closet
CCT	Circuit	RF	Raft Footing	WPM	Waterproof M'brane
CD	Clothes Drier	RHT	Rail Height	WM	Water Meter
CW	Cold Water	RWH	Rain Water Head	WR	Weather Resistant
COL	Column	RSC	Rolled Steel Channel	WRC	Western Red Cedar
C	Cooker	RSJ	Rolled Steel Joist	W	Window

Figure1.13 Abbreviations used by the construction industry

1.2.3 Architectural Abbreviation

HCB – Hollow concert block

GIS – Galvanized iron sheet

T—Double shutter

S—Single shutter

W—Window

D—Door

CB—Concert Block

FF—Floor Finishing

CIS-- Corrugated iron sheet

Ar= architectural

1.2.4 Structural abbreviation

F=footing	GB= grade beam	J= joists
C=column	S=slab	C/C= center to center
IB= intermediate beam	L=lintel	RCC-—reinforcement cemented concert
UB=upper tie beam	FC= footing column	

1.2.5 Sanitary abbreviation

Sn=sanitary	BT - Bath Tub	UR - Urinal
PVC—Poly Vinyl Chloride	D- Dryer	S- Sink
V—ventilation	BD- Bidet	KS- Kitchen Sink
WC- Water Close	AV- Air Vent	SH- Shower
RCP- Reinforced Concrete Pipe	FD- Floor Drain B- Boiler	
HWB- Hand Wash Basin	WH- Water Heater	W – Washer
CW- Cold Water	MH- Man Hole	
HW- Hot Water	ST - Septic Tank	

1.2.6 Technical abbreviations

BoM or BOM = bill of materials Also called a list of materials (LM or L/M)	C-C or C-TO-C = center-to-center; on centers Defines center-to-center distance of two features,	DWG, dwg = drawing R = radius THK or thk= thickness

QTY or qty = quantity

QMS = quality management system

Pc, pcs = piece, pieces

BOQ = Bill of Quantities

MC= Moisture Content

OPC = Ordinary Portland cement

CR= Crushing Ratio

MDD -Maximum Dry Density

Dia = Diameter

OMC- Optimum Moisture Content

Hr = Hour

LS = Linear Shrinkage

1.2.7 Vent abbreviation and symbols

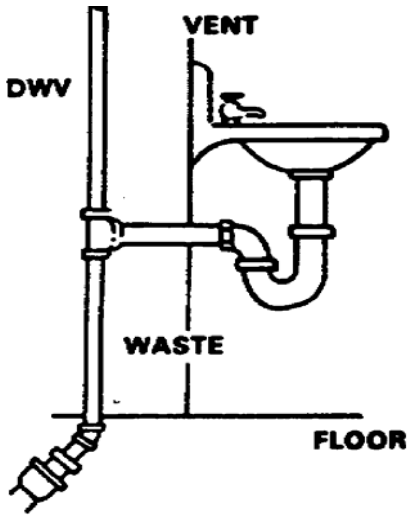
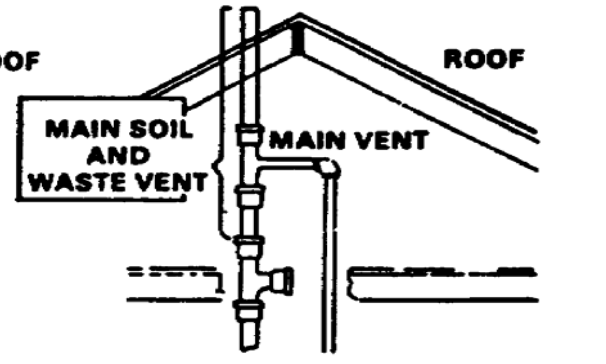
DWV	DRAIN WASTE VENT	
○ VTR	VENT TO ROOF	

Figure 14 – Vent abbrevation

1.2.8 Vertical waste pipe

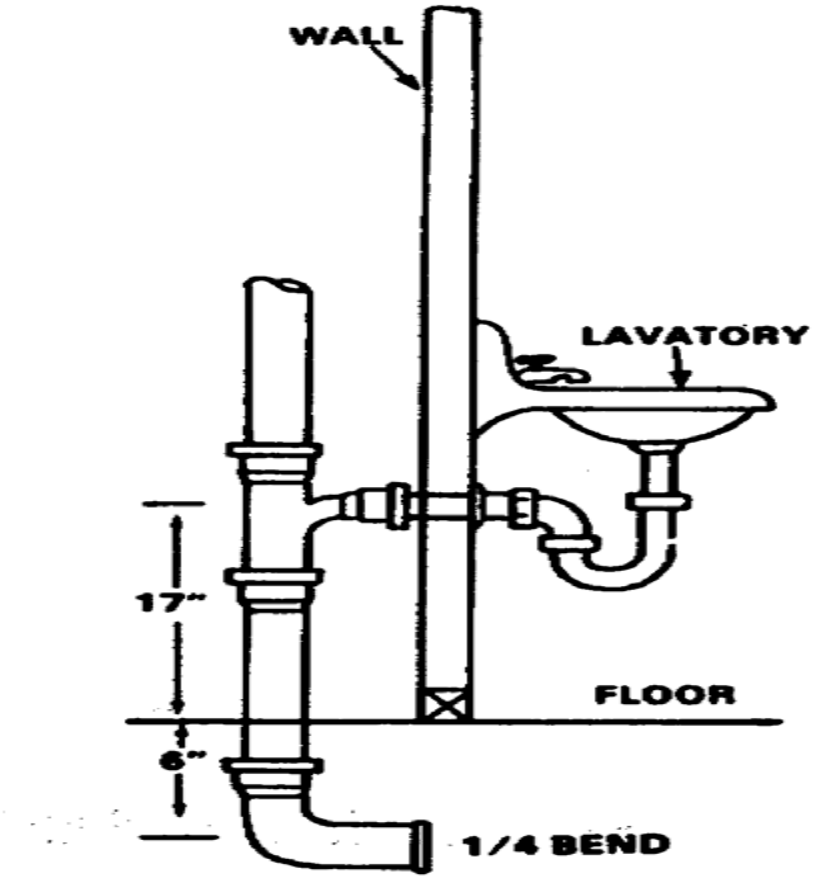


Figure 1.15 – Vertical Waste pipe

Self-Check - 1	Written Test

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

Matching (6 points)

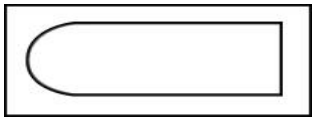
1. Ordinary Portland cement

A. 

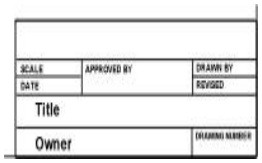
2. Quantity

B. DWG, dwg

3. Titles block

C. 

4. Drawing D. QTY or qty

5. Exposed sliding door G, 

6. Bath tub F. OPC

Note: Satisfactory rating - 3 and 6 points Unsatisfactory - below 3 and 6 points

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

Score = _____

Rating: _____

Name: _____ Date: _____

1.

Information Sheet-2	Interpreting construction drawing legend

2.1 Construction drawing legend

Construction drawings provide all the necessary information required by the builder to tender for and complete a construction project by using symbols, abbreviations, notes, scales, dimensions and legends. They will also provide information for offsite trades for the manufacture and fixing of internal fittings.

Specifically legend provides the following parts of information to interpret construction drawings.

- The name of the company, organization or design authority from which the drawing originates.
- The title or name of the drawing.
- The drawing number.
- A record of the information relative to the preparation of the drawing. This information could include the names of the draftsperson, checker and approving authority. It might also include a contractor's name and reference number.
- A code number identifying the particular division or department within the design authority responsible for the drawing.
- The drawing sheet size.
- The predominant scale of the drawing.

- Miscellaneous information such as modification number, the sheet number for multi sheet drawings, or the estimated mass of the item.

- Additional blocks for other general information such as dimensions and tolerances notes, material notes, or surface finish requirements, should be placed in this area.

For clear understanding of legend you have to refer parts of construction drawing information which deals with title block, drawing symbols, plumbing symbols, electrical symbols, abbreviations and specifications.

Self-Check - 2	Written Test

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

1. Legend provides information only for offsite trades for the manufacture and fixing of internal fittings used for plumbing work.
2. Method of construction is written in legend.
3. Legend not provides one of the following information.

   A. Tolerances notes B. material notes C. surface finish requirements D. None

Note: **Satisfactory rating – 1.5 and 3 points** **Unsatisfactory - below 1.5 and 3 points**

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

Score = _____

Rating: _____

Name: _____ **Date:** _____

Operation Sheet 1	Recognize Construction symbols and abbreviations

The techniques for Recognising Construction symbols and abbreviations are;

Steps1- First open next page

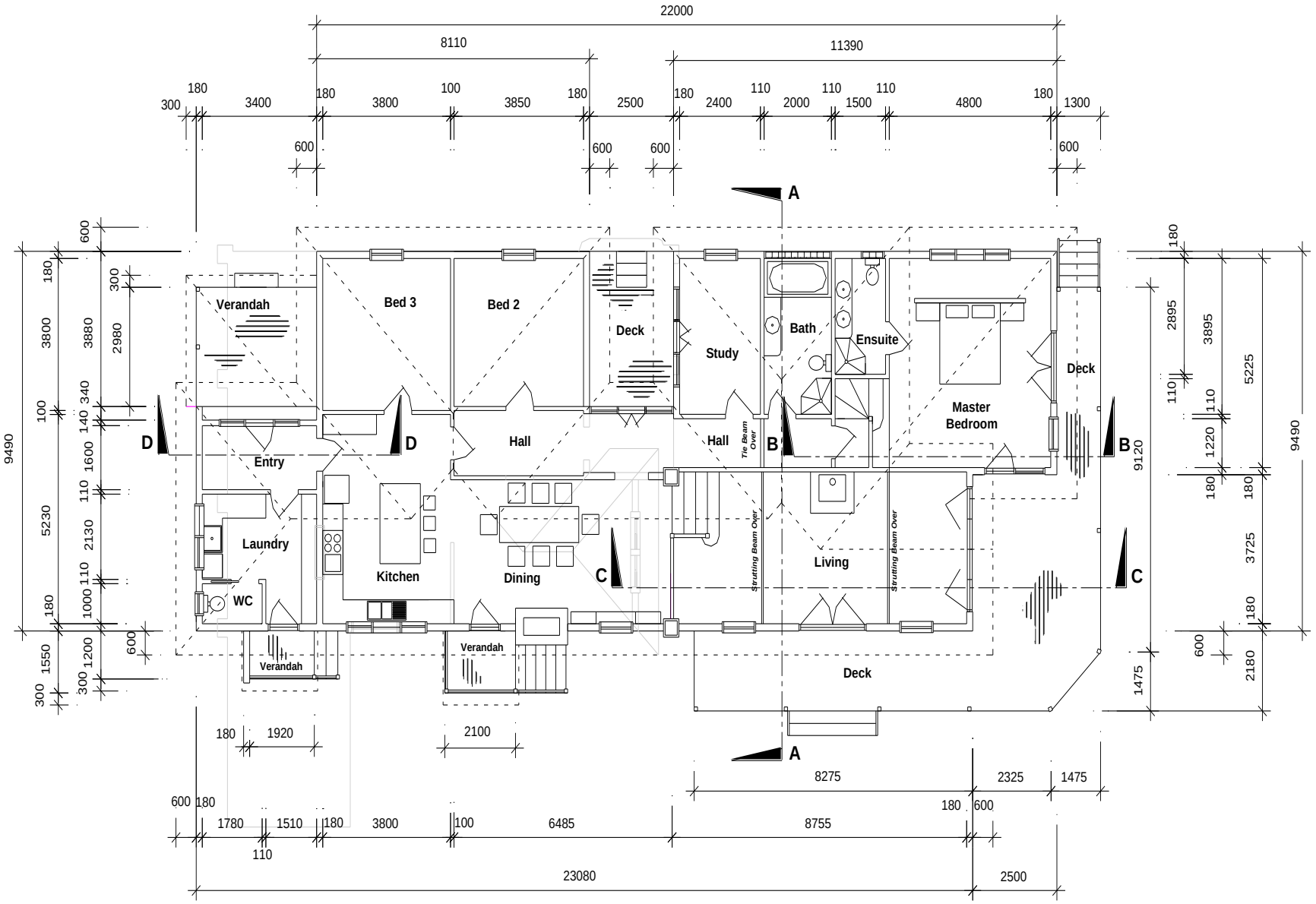
Step 2- Understand a type of construction working drawings given below.

Step 3- Collect at least 12 construction symbols

Step 4- Show to your classmate and your instructor

Step 5- Collect at least 14 construction abbreviations

Step 6- Show to your classmate and your instructor


22000
8110
11390
Verandah
Bed 3
Bed 2
Deck
Study
Bath
Ensuite
Deck
Master Bedroom
Entry
Hall
Hall
Tie Beam Over
Laundry
Kitchen
Dining
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Living
WC
Verandah
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A
B
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9490
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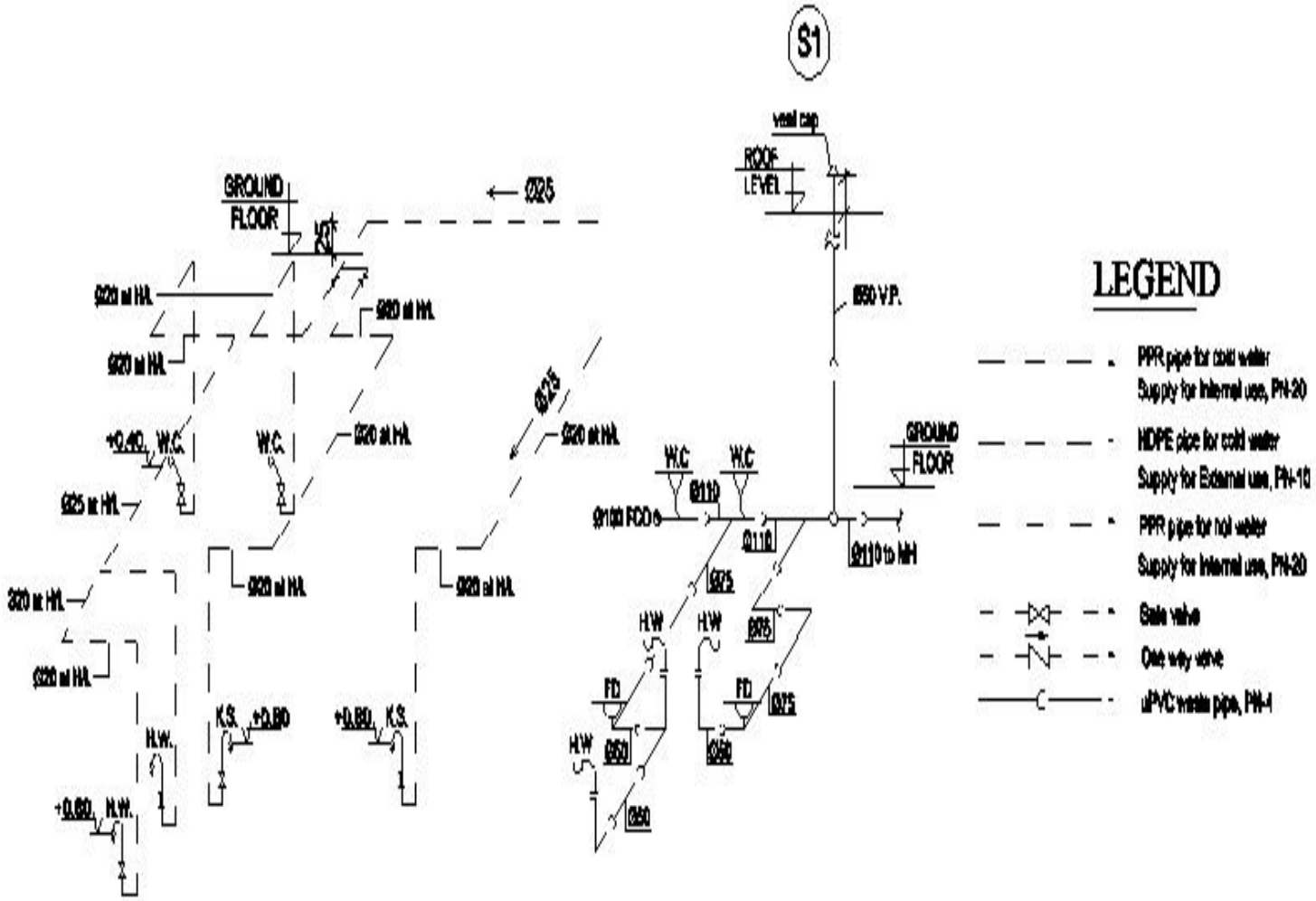


Water Supply & Waste Water Riser Diagram

Operation Sheet 2	Interpret construction drawing legend

Techniques for interpreting construction drawing legend:

Step 1- Understand the above drawing.

Step 2- Make sure type of construction working drawing above.

Step 3- Collect at least 4 information drawing given above in legend.

Step 4- List types of information.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 4.30 hours.

Task 1. Select one building in your campus.

Task 2. List materials and construction parts used to build and in a building.

Task 3. Measure and Sketch a building using construction symbols and abbreviations in building.

Task 4. Write legend for a building.

List of Reference Materials

- Support materials, General construction training package BCG98 , Learning materials,BCG1003A: Read and interprete plans, Australian National Training Authority 2000, Website: www.atpl.net.au
- EIA Report for 1000 MW Coal Based Thermal Power Plant at Naraj Marthapur, Cuttack, Orissa, The Tata Power Company Ltd. https://elaw.org/system/files/Chapter%206.pdf
- Prepare a plumbing takeoff List (plumbing I), Sub course en 5110, Plumber, Edition A
- ASME (2007), Y14.38–2007: Abbreviations and acronyms for use on drawings and related documents, ASME.
- French, Thomas E.; Vierck, Charles J.; et al. (1953), A manual of engineering drawing for students and draftsmen (8th ed.), New York, New York, USA: McGraw-Hill
- Building Construction Handbook' (6th ed.), CHUDLEY, R. and GREENO, R., Butterworth-Heinemann (2007

Plumbing installation

Level-II

Learning Guide-22

Unit of Competence: Read and interpret plans and spécifications

Module Title: Reading and interpreting plans and spécifications

LG Code: EISPLI2 M06 LO4-LG-22

TTLM Code: EISPLI2 M06 TTLM 0919

LO4: Locate and identify key features

on a site plan.

Instruction Sheet	Locate and identify key features on a site plan.

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

- Achieving the construction plan orientation
- Identifying key features of the construction site
- locating construction site
- Identifying access to construction site like services ;main features, contours and datum

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:

- Achieve the construction plan orientation
- Identify key features of the construction site
- locate construction site
- Identify access to construction site like services ;main features, contours and datum

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, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in page -6, 9, 12 and 14 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” in page -15.
6. Do the “LAP test” in page – 16 (if you are ready).

Information Sheet-1	Achieving the construction plan orientation

1.1 Building Orientation

Building orientation refers to the way a building is situated on a site and the positioning of windows, rooflines, and other features. A building oriented for solar design takes advantage of passive and active solar strategies.

Passive solar strategies use energy from the sun to heat and illuminate buildings. Building orientation and building materials also facilitate temperature moderation and natural day lighting.

Active solar systems use solar collectors and additional electricity to power pumps or fans to distribute the sun's energy. Heat is absorbed and transferred to another location for immediate heating or for storage for use later. Water, antifreeze or sometimes air circulates to transfer heat.

To optimize building orientation it is best to incorporate passive solar systems into a building during the initial design. Passive solar systems utilize basic concepts incorporated into the architectural design of the building. They usually consist of:

- Rectangular floor plans elongated on an east-west axis
- Glazed south-facing wall of Thermal storage medium exposed to the solar radiation

- Light shelves/overhangs or other shading devices which sufficiently shade the south-facing elevation from the summer sun; south elevation overhangs should be horizontal while east and west elevations usually require both horizontal and vertical over hangs

- Windows on the east and west walls, and preferably none on the north walls In addition to passive solar and energy-conserving strategies, active solar systems can be integrated into a building's design and systems.

- Buildings designed to serve as active solar collectors should not be shaded by nearby trees or buildings and should have solar arrays or roof area facing south.

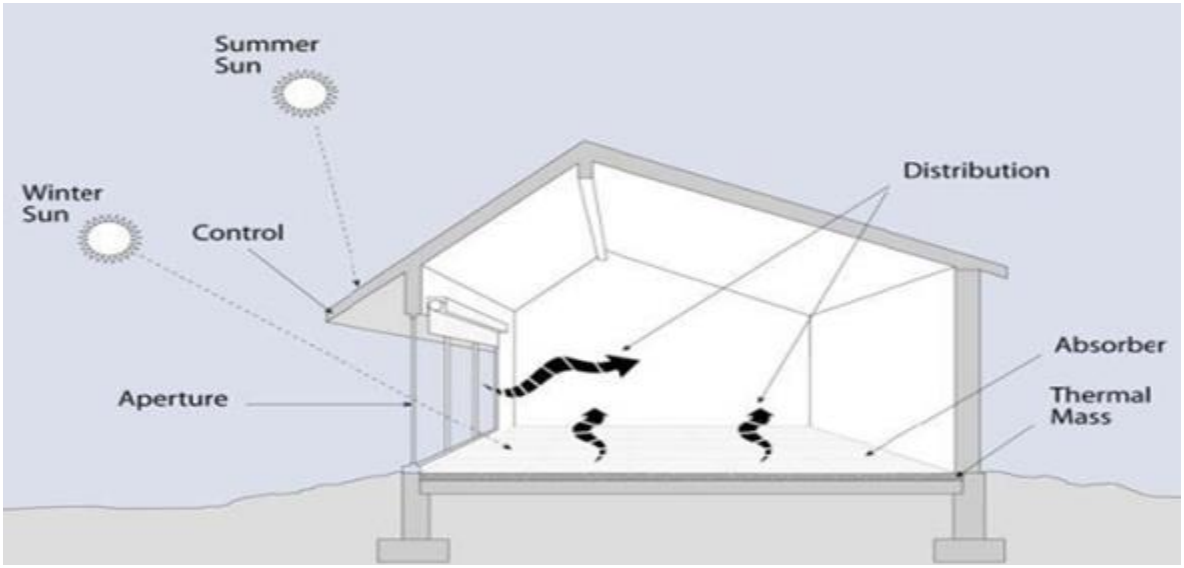


Figure Elements of passive solar design

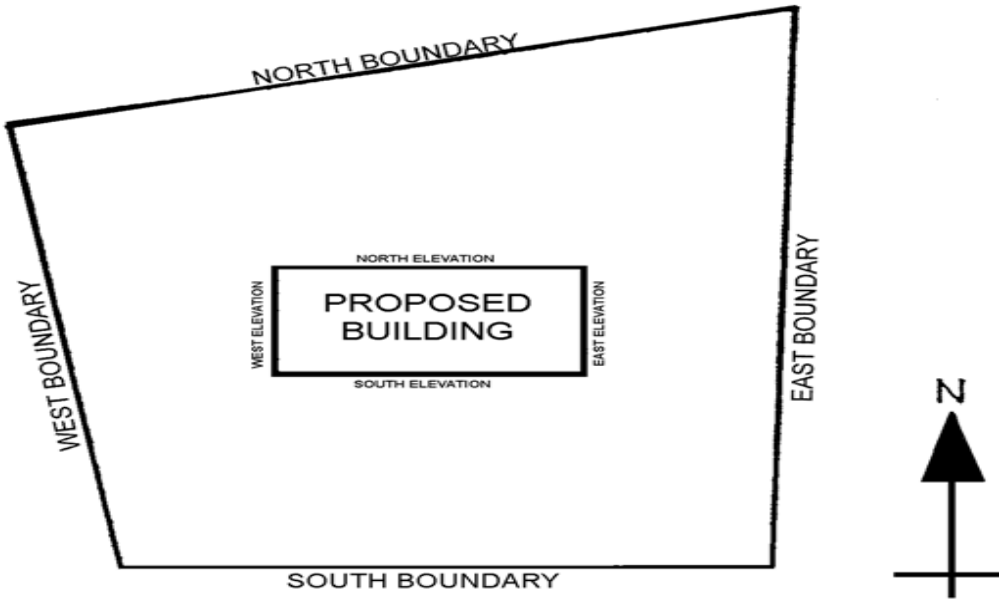


Figure - A Simple Plan Showing Orientation Only

Orientation; when the site and requirements of a house have been finalized The next step is orientation of the house which means fixing the direction of the building in such a way that is derives maximum benefit from the sun, air and nature. We know that means health and happiness are influenced directly by this environment. Figure 2.1 is a simple site plan used for orientation purposes only. The North point is indicated and from this you can determine the North, South, East and West boundaries likewise the North, South, East and West sides of the building.

Self-Check - 1	Written Test

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

Part 1	Part 2
1.	Temperature moderation and natural day lighting
A. Building orientation	
2.	Use solar collectors and electricity
B. Passive solar orientation	
3.	Positioning building features
C. Active solar strategies	
4.	Use energy from the sun.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Information Sheet-2	**Identifying key features of the construction site**

2.1 Building site

Site are the lands and other places, on, under or through which the works are to be executed or carried out, and any other lands or places provided by the 'Company' for the purposes of the 'Contract' together with such other place as may be specially designated in the 'Contract' as forming part of the site.

Site plan must be should show:-

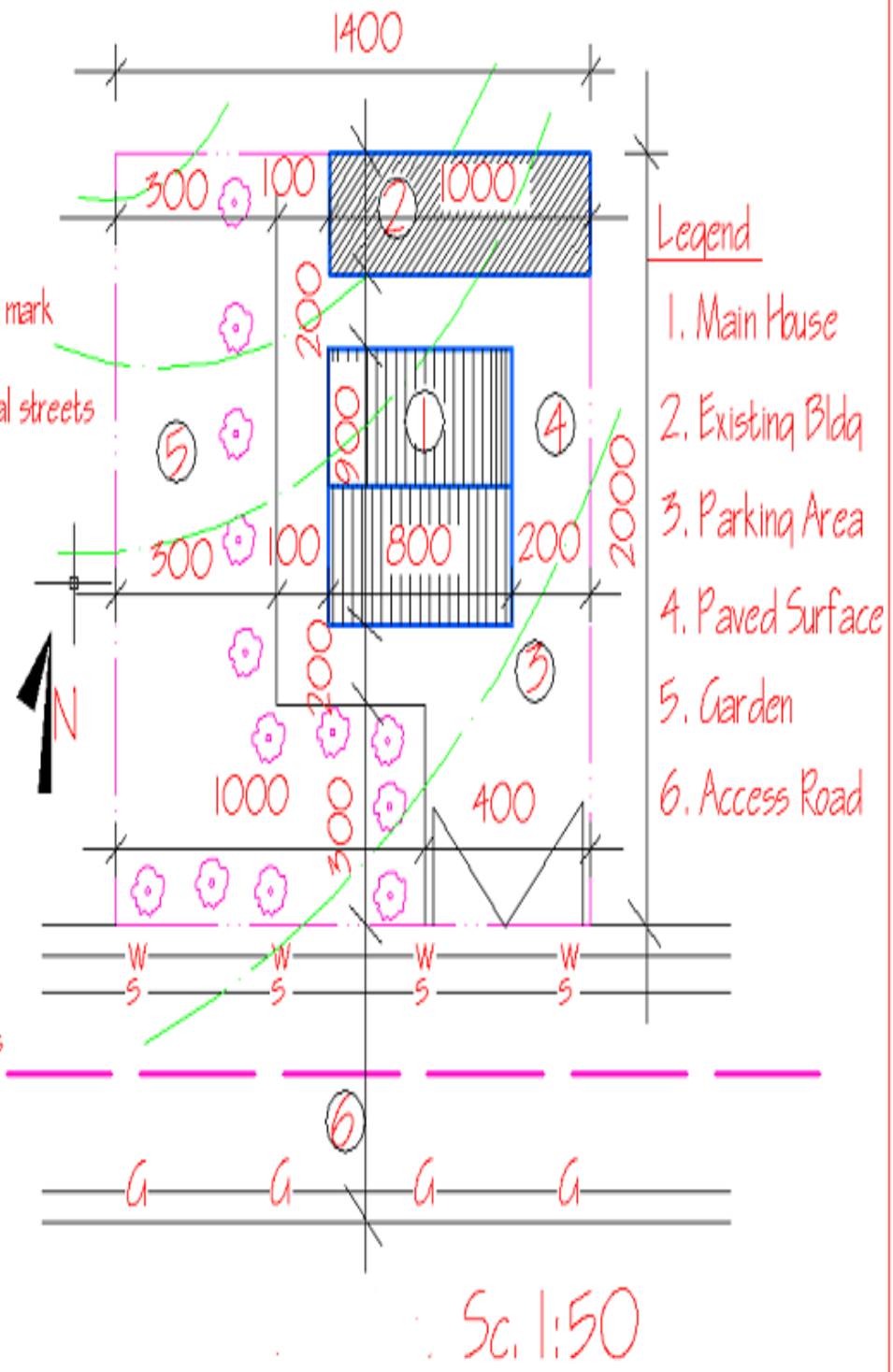
- Property lines length side direction.
- Adjoining building streets sidewalks parking curbs parkways
- Existing structure & proposed structure
- All utility lines (sewer, Electric Telephone)
- Contours existing & new contour elevations
- Dimension
- Fences structural retaining walls, area ways to property line
- North arrow or North star
- All Existing paved ground whether to remain or be removed, new paving, parking lots, platforms, play fields, fountains, etc…
- Trees, shrubs if exist.
- Legend showing all symbols & material used on the site.
- Sewerage, man hole, drainage lines

Site plan is the top view of a building which show the location of the house on the site together with information on terraces walks driveways, contours, elevation & utilities.


Federal TVET Agency

Check list :

- site boundary
- north arrow & scale
- location and description for bench mark
- identification and dimension of local streets
- dimension:
  - site boundary
  - among blocks on site
  - set backs
  - local street
- contour lines
- utility lines
- site pedstrian and vehicular roads
- site plants
- site water features
- legend



Self-Check 3	Written Test

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

1. Contour lines are a line that connects points of equal level on the surface of the earth.

2. Orientation means fixing the direction of the building in such a way that is derives maximum benefit from the sun and air

3. Not features of the site plan.

   A. Location & Orientation B. Geographical & Topographical

   C. Access & Egress D. Size in height

4. Orientation is a reference surface of constant potential, called as a level surface of the earth's gravity field, for measuring the elevations of the points.

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.

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-3	Locating construction site

3.1 Locating construction site

- Dimensions shall be chosen and placed on drawings based on the parts interrelationships with mating parts, not to insignificant theoretical center lines.
- Primary, secondary, and tertiary datum features shall be labeled in alphabetical order when creating a new drawing.
- Drawings of parts requiring templates in the fabrication process and their template drawings must be dimensioned alike.
- Refer to tooling required notes in “Dimension Notes”.
- Use a minimum of reference dimensions on drawings.
- When using true position dimensioning, the dimension from the feature to other edges and its perpendicularity relationship to a surface must be identified with datum letters. Implied datums (when no datum letter(s) are specified) are no longer acceptable.

Self-Check - 3	Written Test

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

1. Datum is a reference surface of constant potential

   A. True B. False C. Not both

2. When locate implied datums when no datum letter(s) specified are acceptable.

   A. True B. False C. Not both

3. A standard datum also an arbitrary surface may be adopted as a datum.

   A. True B. False C. Not both

4. Dimensions shall be chosen and placed on drawings based on center lines.

B. A. True B. False C. Not both

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

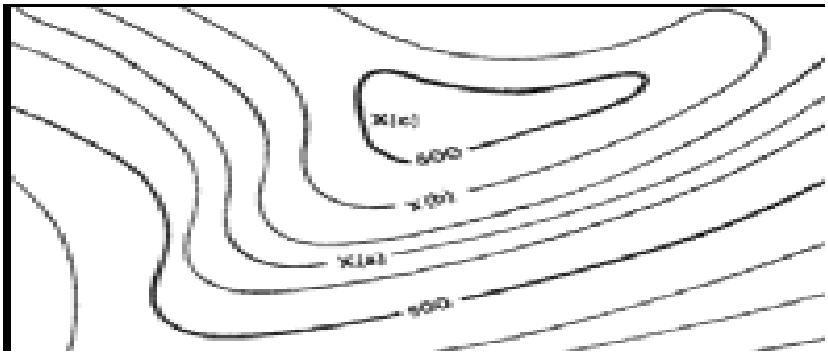
Rating: _____

Name: _____ Date: _____

Self-Check -4	Written Test

Information Sheet-4	**Identifying access to construction site like services ;main features, contours and datum**

Contour lines: It is a line that connects points of equal level on the surface of the earth.



Datum; is a reference surface of constant potential, called as a level surface of the earth's gravity field, for measuring the elevations of the points. One of such surfaces is the mean sea level surface and is considered as a standard datum. Also an arbitrary surface may be adopted as a datum.

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

Part 1	**Part 2**
1. Equal level on the surface of the earth	A. Datum
2. Electricity	B. Contour lines
3. Level surface of the earth's	C. Utility
4. Sewerage	

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.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Operation Sheet 1	Techniques of Identifying key information about local resources including in government and non-governmental organizations

The techniques for identifying key information about resource providers are;

Steps 1- Review preliminary activities: check questionnaires, type of data needed, chosen

Methods, resources (finance, material and time), etc.

Step 2- List out orderly all resource providers including governmental and non-governmental

Step 3- Implement the collection of information

Step 4- Define resource providers who are available to do the work from the list

Step 5- Send the completed documents to supervisor/ concerned body

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 8-12 hours.

Task 1: Identify key information about local resources including in government and non-Governmental organizations

Task 2: List information as part of directory/community asset map

Task 3: Renew and update gathering information in regular base

List of Reference Materials

1. Support materials, General construction training package BCG98 , Learning materials,BCG1003A: Read and interprete plans, Australian National Training Authority 2000, Website: www.atpl.net.au
2. EIA Report for 1000 MW Coal Based Thermal Power Plant at Naraj Marthapur, Cuttack, Orissa, The Tata Power Company Ltd. https://elaw.org/system/files/Chapter%206.pdf

3. Prepare a plumbing takeoff List (plumbing I), Sub course en 5110, Plumber, Edition A

Plumbing installation

Level-II

Learning Guide-23

Unit of Competence: Read and interpret plans and spécifications

Module Title: Reading and interpreting plans and spécifications

LG Code: EISPLI2 M06 LO5-LG-23

TTLM Code: EISPLI2 M06 TTLM 0919v1

LO5: Identify project requirements

Instruction Sheet	Identify project requirements – LG-23

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

- Identifying project dimensions
- Identifying Construction types and dimensions
- Identifying environmental controls and location
- Identifying location dimensions and tolerances for ancillary works

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:

- Identify project dimensions
- Identify Construction types and dimensions
- Identify environmental controls and Location
- Identify Location dimensions and tolerances for ancillary works

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, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in page -6, 9, 12 and 14 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” in page -15.
6. Do the “LAP test” in page – 16 (if you are ready).

Information Sheet-1	Identifying project Dimensions

1.1 Drawing Dimensions

Architects aim to show only the dimensions required by each particular drawing and to avoid duplication of information in a set of construction drawings. Firms often establish an in-house set of guidelines for dimensioning drawings. One example is from one of the Architect's Handbook of Professional Practice.

- Dimension only from a fixed reference point, such as a column centerline or foundation wall.
- Dimension only those things that really matter
- Do not repeat dimensions, either within a drawing or on more than one drawing
- In general, do not close dimension strings. In a string of dimensions, leave tolerance by omitting the dimension for a non-critical space or assembly. When a dimension is omitted, delete the dimension line as well. Final decision concerning the method of dimensioning resides with the project architect.
- The thicknesses of tile, wood base, wainscoting, trim, and similar applied finishes are not included in room dimensions.
- Vertical dimensioning appears on elevations or wall sections.

- Dimensions should be to the top of significant structural elements and to window and door heads (rather than sills).
- They should be from the top of the foundation, finish floor level, or similar fixed reference.
- Masonry is dimensioned to the top of the masonry unit, not to the joint centerline.
- Ends of dimensions are indicated by short, bold, diagonal slashes. No dots, arrows, or crosses.
- Dimensioning and checking dimensions are the responsibility of the job captain alone. The work should not be delegated.
- All dimensions are to be double-checked by an architect not directly involved with the project.

1.2 Dimensioning

Proper dimensioning is vital to achieving an accurate representation of the project in the drawings and to avoiding discrepancies and conflicts between drawings. Many professionals consider dimensioning an art form.

The basic concept of dimensioning is accomplished by adding size and location information necessary to manufacture the object. This project information has to be clear and complete. Dimensioning is the process of specifying parts information by using of figures, symbols and notes. This information is such as:

- Sizes and locations of features
- Material's type
- Number required
- Kind of surface finish
- Manufacturing process

- Size and geometric tolerances

Self-Check - 1	Written Test

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

1. Dimension only those things that really matter a project.

   A. False B. True C. Not both

2. Dimensioning is specifying parts of information only by using of figures or numbers.

   A. True B. False C. Not both

3. All dimensions are to be double-checked by an architect not directly involved with the project.

   A. False B. True C. Not both

4. Accurate representations of the project in the drawings are creating discrepancies and conflicts between drawings.

   A. True B. False C. Not both

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ **Date:** _____

Information Sheet- 2	Identifying Construction types and Dimensions

2.1 Classification of building construction

Based on occupancy and categories type of building construction are:

- Residential
- Educational
- Institutional
- Assembly
- Business
- Mercantile
- Industrial
- Storage
- Hazardous

For each category of drawing different types of construction working drawing produced.

2.2 Types of construction drawing

Elements of Construction Drawings most two-dimensional construction drawings contain elements with which you are very familiar:

- Plan, section, elevation, and detail drawings produced at different scales
- Dimensions
- Symbols and targets (or “keys”)
- Drawing annotations and abbreviations

They may also contain:

- Schedules
- Site or contextual photographs and reference drawings (documentation of existing structures, site surveys)

Dimensions taken from different types of working drawings are:

A. Site plan

All necessary dimensions are:

- Property lines
- Side yards, pears, front yard
- Street center line
- Length of walks and walls
- Fences, structural retaining walls, area ways and pools
- Drainage lines

B. Floor plan

All necessary dimensions are:

- Inside and outside walls
- Floor size
- Window and door opening
- Edges and thickness of materials
- Interior partitions
- Sizes and locations of terraces , walks
- Special construction items
- Roof cover area
- Water supply lines
- Drainage supply line
- External drainage lines, pavements, ramps, steps trees, gardens etc.

C. Elevation drawing

All necessary Dimensions are:

- Height of roof
- Depth of footing
- Height of masonry wall and chimney
- Height of windows
- Roof slope indication
- Window schedules
- Ground levels
- Floor levels
- Window and door division
- Sun protection, window shutters
- Roof fascia
- Roof beam
- Chimney, flashing, skylights
- Rain water gutter pipes
- Ventilation for the roof

D. Section

All necessary dimensions are:

- Openings
- Stair
- Ducts built in furniture
- Guard rails
- Room height /floor to floor
- Floor to ceiling
- Floor to top of a wall
- Floor to top of beam, column etc
- Foundation
- Foundation thickness
- Back filling

- DPC
- Holes for drainage
- Fill and hard core materials
- Thickness and layering
- Floor in section
- Thickness
- Stair cases
- Threads (and number)
- Flight width
- Hand rails
- Balconies
- Landings
- Fire places
- Room / space
- Lintel size

E. Roof plan

All necessary Dimensions are:

- Over hangs
- Canopies
- Roof surfaces
- Walls
- Column centre lines
- Roof finishes
- Gutters & down pipes
- Parapet walls
- Coping on walls and roofs
- Roof eaves, ridges, up stands, valleys
- Mechanical equipment,
- Smoke vent,
- Access, panels and doors
- Paved areas
- Fences
- Railings
- Chimneys
- Flag poles, radio and tv antenna etc
- Over hang in solid line
- Roof framing.

Self-Check - 2	Written Test

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

1. An accurate representation of the project in the drawings means that avoiding discrepancies and create conflicts between drawings

   A. True B. False C. Not both

2. Dimension of ground floor is taken from elevation drawing.

   A. False B. True C. Not both

3. Floor to top of a wall dimension is taken from sections, elevations and wall detail.

   A. True B. False C. Not both

4. Schedules and Site or contextual photographs are parts of construction drawing used to take dimensions.

   A. True B. False C. Not both

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ **Date:** _____

Information Sheet- 3	**Identifying environmental controls and Location**

3.1 Environmental controls and Location

The environment has been defined to mean surrounding area including human and natural resources to be affected by execution and after completion of works.

The environmental values to be protected and enhanced are:

- Life, health and wellbeing of people.
- Diversity of ecological processes and associated ecosystems.

The Contractor shall take all precautions for safeguarding the environment during the course of the construction of the works. He shall abide by all prevalent laws, rules and regulations governing pollution and environmental protection. The Contractor is expected to arrange and execute the works in such a way that existing environmental conditions are not deteriorated.

3.2 Environmental Impact controls and Location

3.2.1 Waste Management

A detailed waste management plan has been prepared for the construction of the project facility. Plans waste management plan which outlined and developed for

monitoring of waste management summarized within the section of the Construction environment management plan.

A number of wastes have been identified which are likely to be generated from general construction activities. These include:

- Vegetation cleared during site preparation works.
- Oils and oily wastes
- Waste paints and solvent.
- Waste adhesives.
- Aerosol cans.
- Waste antifreeze/radiator coolant.
- Domestic waste and recyclables from construction workers.
- Paper, cardboard, plastics and timber from packaging.
- Scrap metals (ferrous and non-ferrous).
- Surplus concrete.
- Used welding rods.
- General inert construction waste.
- Grey water and sewage.
- Medical and first-aid station waste.
- Office wastes.

Additional waste streams will be generated from operating:

- Office wastes.
- General domestic waste, including recyclable wastes.
- Food waste.
- Grey water and sewage.
- Medical and first-aid station waste

Wastewater from construction phase activities will include hydro test water, flushing water, vehicle and equipment wash down water, brine from the desalination plant, storm water and sewage treatment plant effluent The potential impacts include the following:

- Land and water contamination from inappropriate storage, handling and disposal of solid and liquid wastes.
- Land and water contamination from spills and releases during handling and transportation.
- Increased populations of vermin from inappropriate storage and handling of waste.
- Odors due to inappropriate storage and handling of waste.
- Water contamination from discharges of contaminated storm water, sewage treatment effluent, and brine.
- Inefficient use of resources.
- Adverse effects to marine, aquatic and terrestrial flora and fauna

3.2.2 Noise and Vibration

The environmental values to be enhanced or protected for noise are:

- The health and biodiversity of ecosystems.
- Human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn, be involved in recreation, relax and converse.
- The amenity of the community.

The environmental value in relation to noise to be protected is to ensure that no significant behavioral disturbance occurs for life. Environmental protection objective is Minimize excessive noise and vibration emissions during construction of the project facility. Performance criteria are:

- Zero noise/vibration complaints from the local community as a result of the works

- Zero non-compliance with project specific noise criteria at noise sensitive receptors
- Zero non-compliance with project specific vibration criteria at sensitive receptors
- Zero non-compliance with EPP (Noise)
- Zero harm to fauna from noise and vibration

Monitoring will be undertaken in accordance with the latest edition of Noise Management Manual. Monitoring will record:

- The statistical levels and minutes
- Background noise
- The level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels
- Atmospheric conditions including temperature, relative humidity and wind speed and directions
- Effects due to any extraneous factors such as traffic noise location, date and time of monitoring
- If the complaint concerns low frequency noise,
- If the complaint concerns low frequency noise, one third octave banc measurements in db(lin) for centre frequencies in the 10 – 200 hz range

3.2.3 Workplace environmental impact

The risks associated with the construction of the plant will be taken into consideration during detailed design and as part of commissioning planning.

The potential workplace risks and associated mitigation measures directly related to the construction phase of the project are discussed below. Potential risk mitigation measures during construction phase are:

- Injuries from moving plant and vehicles: Measures to be adopted include: appropriate signage, reduced vehicle speed limits, designated roadways and walkways
- Falls, slips and trips: Measures to be adopted include: appropriate signage and designated walkways
- Working at heights - falls, slips and trips and/or equipment falling: Measures to be adopted include: Fall arrest and restraint equipment will be worn when working above two meters.
- Working in confined spaces: implement a safety management plan with confined space procedures complying with Standards.
- Continual working with airborne contaminants (dust): Measures to be adopted include: dust suppression, road watering, and appropriate vehicle and machine maintenance
- Hearing impacts from prolonged noise exposure: Measures to be adopted include signage and PPE and specification of equipment that meets noise level requirements
- Injuries from hazardous substances/chemicals: Measures to be adopted include signage, Material Safety Data Sheets (MSDS) required for all chemicals, and PPE.
- Working with electricity: implement with procedures complying with Standards.
- Heat exhaustion, dehydration and/or sunburn from continual working in the sun: implement including measures to identify signs of heat stress and actions to avoid and treat

3.3 Environmental management plan

The Construction environmental management plan (EMP) documents the following for the construction phase:

- Description of construction activities.
- Environmental values to be preserved.
- Potential environmental impacts on environmental values.
- Environmental protection commitments, targets and objectives.

- Control strategies.
- Roles and responsibilities.
- Monitoring, reporting and response to ensure targets are achieved.

Self-Check - 3	Written Test

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

1. Roles and responsibilities of the plumber are included in environmental management plan.

   A. True B. False C. Not both

2. Measures to be adopted include signage and PPE and specification of equipment that meets noise level requirements.

   A. Prolonged noise exposure B. Falls, slips and trips

   C. Working at heights D. Working in confined spaces

3. The owner is expected to arrange and execute the Works in such a way that existing environmental conditions are not deteriorated.

   A. True B. False C. Not both

4. Environmental protection objective is minimizing damage due to environment impact during design and construction phase of the project facility.

   A. False B. True C. Not both

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.

Score = _____

Rating: _____

Name: _____ **Date:** _____

Information Sheet-4	**Identifying location dimensions and tolerances for ancillary works**

4. Ancillary location dimensions and tolerances in plumbing work

4.1. Earthwork, Concrete, Masonry, Finishing and other related works

In this specification as the work is related.

- Site preparation, for service trenches.
- Roofing, for roof plumbing.
- Tiling, for waterproofing of wet areas.
- Painting, for priming steel or iron before Installation and exposed piping required to be painted.

Ancillary works for plumbing according to Ethiopian Building code of standards are:

4.2 Protection:

- Use all means necessary to protect piping and other sanitary material during transport and before, during and after installation to ensure that no damage occurs to the materials, and
- Coatings. In the event of damage to material or surface make all repairs or if unacceptable replace as required by the engineer.

- Sanitary ware shall be supplied in their original packing.

4.3 Storage:

- Pipes shall be stacked on level ground to ensure that no pipes rest on sockets or other Joints.
- End of pipes in bottom rows shall be securely chocked to prevent collapse of stock.
- Pipes shall to the extent possible, be stacked in pyramid form and to a maximum height of 2000mm above ground.
- Sanitary ware shall be stored in a locked room and in their original packing. No fixture shall be laid over
- The other unless there is proof that the packing material is capable of sustaining the load.

4.4 Protection and sterilization:

- Installed pipes shall be adequately protected against damage And deterioration.
- When handed over the installation shall be clean and in sound condition.
- Water supply main and distribution pipes to be used for potable supplies shall be sterilized before using.

4.5 Setting out:

- Services and drains shall be set out in accordance with the drawings and instructions by the engineer.
- Temporary benchmark shall be maintained for as long as necessary.

4.6 Trench excavation & cutting:

- Excavation for pipe laying shall be carried out only after a full Supply of pipes has been made readily available for that section.

- The bottoms of excavations shall be trimmed and consolidated to the correct levels. Any excavation in excess of the required depth shall be Material of the same composition as pipe beds.

- If the bottom of excavations is not firm, excavation shall be carried to firm level and to approval by the engineer and filled with material of the same composition as pipe bed.

- Rock projections, boulders and any hard spots shall be removed and excavations made to true level.

- The minimum width of excavations for pipes shall be 600mm for pipes up to 200mm diameter and not Less than 600mm greater than the external diameter of the pipe for pipe sizes over 200mm.

- The bottom of excavations shall be approved prior to bedding.

4.7 Pipe covers and supports

4.7.1 Concrete beds and surrounds

- Concrete beds and surround shall be in c-15 plain concrete minimum 50mm below pipe, 150mm wider than the diameter of the pipe and 150mm thick above crown of pipe or as detailed on drawings.

- Concrete surrounds to internal installation shall be in the quality and thickness of concrete use for the structure.

- Where pipes are buried in walls cement sand mortar mix 1:3 shall be used to cover up the pipes.

4.7.2 Granular beds and surround

Granular beds and surround shall be graded gravel approved by the engineer with a maximum size of 20mm free from dust and organic material. The bed shall be placed to the width of the trench, 50mm below pipe and up to 150mm above the crown of pipe or as indicated in drawings.

4.7.3 Backfill to pipe excavation for service pipes

- Where granular fill is not used, pipe surrounds and the fill 300mm above the pipe shall be in selected
- Excavated material free from stones retained on 20mm sieve. The backfill above granular or selected
- Excavated material fill and concrete surrounds shall be in excavated materials in layers not exceeding 200mm before compaction. No mechanical compactors shall be used before there is 1000mm of fill Material on the pipes or there is 600mm of fill material if the pipe has concrete surrounding thrust blocks at branches and changes of directions where shown, shall be in c-15 concrete.
- Where pipes in buildings run exposed, supports and anchors shall be provided as detailed in drawings, ensuring that adequate precaution is taken to allow sufficient freedom for movement of pipes due to thermal variation.

4.8 Manholes & catch pits

- Manholes shall be in precast concrete C-20 quality, brick or class a hollow block work as indicated and detailed in the drawings. The manholes shall be laid on a minimum concrete bed of 150mm, C-20 Concrete.
- Manholes other than precast concrete shall be plastered internally and externally where there is no Underground infiltration with two coats of cement plaster. Joints of precast concrete manhole shall be flush pointed.

- The base of manholes shall be benched using half pipes or C-20 concrete to form smooth transition between inlet and outlet. Benched and other surfaces shall be smoothened in cement screwed.

- Manhole covers shall be in cast iron cover and frames or C-25 precast concrete as detailed in drawings. .

4.9 Septic tanks soak pits & percolation field

- The relevant sections of the technical specification shall be applied to the construction of the above.

- The measurement shall be done in accordance with the stated method of measurement for each item in the works.

Self-Check -4	Written Test

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

1. Excavated material fill and concrete surrounds shall be in excavated materials in layers not exceeding 200mm before compaction.

   A. True B. False C. Not both

2. The minimum width of excavations for pipes shall be 600mm for pipes up to 200mm diameter and not Less than 600mm greater than the external diameter of the pipe for pipe sizes over 200mm.

   A. True B. False C. Not both

3. The manholes shall be laid on a minimum concrete bed of 150mm, C-20 Concrete.

   A. True B. False C. Not both

4. Concrete beds and surround shall be in c-15 plain concrete minimum 50mm below pipe, 150mm wider than the diameter of the pipe and 150mm thick above crown of pipe or as detailed on drawings.

   A. True B. False C. Not both

Note: **Satisfactory rating - 2 and 5 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating _____

Name: _____ **Date:** _____

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary drawings, templates, tools and materials you are required to perform the following tasks within 8-12 hours.

Task 1: Identifying project dimensions

Task 2: Identifying Construction working drawing types and dimensions

Task 3. Identifying environmental impacts, controls and location

Task 4: Identifying location dimensions and tolerances for ancillary works

List of Reference Materials

4. Support materials, General construction training package BCG98 , Learning materials,BCG1003A: Read and interprete plans, Australian National Training Authority 2000, Website: www.atpl.net.au
5. EIA Report for 1000 MW Coal Based Thermal Power Plant at Naraj Marthapur, Cuttack, Orissa, The Tata Power Company Ltd. https://elaw.org/system/files/Chapter%206.pdf

6. Prepare a plumbing takeoff List (plumbing I), Sub course en 5110, Plumber, Edition A

7. EEPCO Ethiopian Electric Power Corporation,Jan 2008,Gibe III - Environmental and Social Management Plan,Ethiopia

8. Samaneh ZOLFAGHARIAN and et.el,Environmental Impacts Assessment on Construction Sites

Plumbing installation

Level-II

Learning Guide-24

Unit of Competence: Read and interpret plans and spécifications

Module Title: Reading and interpreting plans and spécifications

LG Code: EISPLI2 M06 LO6-LG-24

TTLM Code: EISPLI2 M06 TTLM 0919v1

LO6: Read and interpret job specifications

Instruction Sheet	**Read and interpret job specifications - LG-24**

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

- Identifying Construction Job specifications drawings ,notes and descriptions
- Identifying Standards of construction project work , Finishes and tolerances
- Identifying Material attributes of construction specifications

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:

- Identify Construction Job specifications drawings ,notes and descriptions
- Identify Standards of construction project work , Finishes and tolerances
- Identify Material attributes of construction specifications

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, Sheet 3 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in page -6, 9, 12 and 14 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” in page -15.
6. Do the “LAP test” in page – 16 (if you are ready).

Information Sheet-1	**dentify Construction Job specifications drawings ,notes and descriptions**

1.1 Specifications for construction

The construction drawings show the location, size, and particulars of a structure to be built. The specifications set the standards of the workmanship and materials in writing. The drawings and specifications complement one another and are used together. For example, the drawings show the color and location of paint to be applied to a wall surface, but do not tell how it is to be applied (sprayed, rolled, or brushed) and the resulting quality of workmanship required. In this case, the subsurface must first be prepared to receive the paint, adjacent areas need to be protected from the painting, the minimum skills of the painter must be specified, and the cleanup needed must be called out. These particulars are all detailed in written specifications for the painting, and similar instructions are prepared for all the other work to be carried out on the project.

Specifications are written documents that clearly describe the required materials, requirements for the execution of the work, and workmanship expected. Generally, for small, simple projects the written specifications may be placed directly in the drawings, either typed on transparent adhesive film or in text form on a separate drawing sheet. However, for most projects, the specifications are included in a “job book” or “project manual” and issued with the contract agreements and construction drawings as the complete set of contract documents.

The specifications for construction should clearly specify: -

- Type and quality of materials, equipments, labor or workmanship
- Methods of fabrication, installation and erection
- Standards, codes and tests
- Allowance, submittals and substitutions
- Cost included, insurance and bonds
- Project records and site facilities

1.1.1 Job Specification

Also known as employee specifications, a job specification is a written statement of educational qualifications, specific qualities, level of experience, physical, emotional, technical and communication skills required to perform a job, responsibilities involved in a job and other unusual sensory demands. It also includes general health, mental

health, intelligence, aptitude, memory, judgment, leadership skills, emotional ability, adaptability, flexibility, values and ethics, manners and creativity, etc. Job specification helps candidates analyze whether are eligible to apply for a particular job vacancy or not. It helps recruiting team of an organization understand what level of qualifications, qualities and set of characteristics should be present in a candidate to make him or her eligible for the job opening. Job Specification gives detailed information about any job including job responsibilities, desired technical and physical skills, conversational ability and much more. It helps in selecting the most appropriate candidate for a particular job.

1.1.2 Construction job specifications

Contents or elements of construction on job specifications:

A. Survey Plan - Usually produced by a surveyor

a. Existing site and surroundings.
b. Position of major natural features, trees, ponds, rock out crops.
c. Sufficient spot levels and contour lines related to a specified datum (height above sea level).
d. Dimensions of boundaries.
e. Position of roadways, easements; existing drains and possibly service mains.

B. Site Plan: usually produced by drafts man and architect

a. Outline of site boundaries showing location of proposed building
b. Position of boundary setbacks.
c. Depths, where they may occur.
d. New roads and pathways
e. Soil and surface water drains, complete with pipe sizes
f. Service runs from the house to mains.
g. Location of utility services (sewer, water, gas, electricity)
h. Landscaping. Note
i. The point of connection of those services to the house itself
j. Indication of banking and cutting and areas for depositing and spreading surplus soil.
k. New levels on the site in connection with the new house.

If the site is undulating or steep, section should be added to show principle areas of cutting and filling. They may also include:

a. real property description and lot number, etc.
b. north direction indicated
c. Drive way.
d. street position and owners‟ name
e. contours and level

C. Floor plan: usually produced by drafts man and architect

a. Dimensions of overall brickwork, stud framing and room sizes to rough stud frames. Trim openings of all windows and doors. Space

allowance for refrigerator and white goods. Wardrobe depths. Location and spacing of all columns and verandah posts.

b. roof and eave lines as dashed lines
c. Doors and windows to have a legend reference describing the details of each.
d. internal dimensions so far as necessary to establish positions of internal walls or fittings
e. thickness of walls
f. door swings
g. windows
h. location of fittings and fixtures
i. names on all rooms
j. floor finishes
k. position of stairs and number of stair tread

D. Sections and elevations: usually produced by drafts man and architect

- Elevations of all parts of the building.
- Size and shape of openings.
- External finishes.
- New and old ground levels showing cut and fill
- Position of floor level, ceiling level
- Positions of all windows and doors
- Heights of ceilings, doors and windows above the floor surface can be marked here.
- Dashed lines indicating positions of external wall bracing (optional on elevations but good practice).
- Dashed lines indicating natural ground lines (this will enable more accurate calculating of materials below floor level).
- Roof and wall claddings and finish.
- Types of glass selected for specific windows and doors.
- Roof vents, air conditioning units, and solar locations

E. Other plans used either where requested or for more complex houses usually produced by drafts man and architect.

E-1 Footing plan

- Width and depth of all footings to wall, piers, and stanchions.
- Location of footing system
- Walls above footings with thickness noted.
- position and levels of drains and gulley's close to footings

E-2 Roof plan

- Shape of roof
- Slopes of levels
- Types of coverings
- Falls to gutters and gutter
- Roof lights
- Possible type of construction. Note, on simple houses the roof plan is super imposed over the floor plan

E-3 Services plan supported by electrical, sanitary and mechanical engineers that show the arrangement of:

- Electrical layout
- Plumbing and internal drainage layouts.
- Air-conditioning or other mechanical service

Note – on simpler houses the electrical layout and plumbing layouts are superimposed on the floor plan.

1.1.3 Job Description

Job description includes basic job-related data that is useful to advertise a specific job and attract a pool of talent. It includes information such as job title, job location, reporting to and of employees, job summary, nature and objectives of a job, tasks and duties to be performed, working conditions, machines, tools and equipment to be used by a prospective worker and hazards involved in it.

The main purpose of job description is to collect job-related data in order to advertise for a particular job. It helps in attracting, targeting, recruiting and selecting the right candidate for the right job.

- It is done to determine what needs to be delivered in a particular job.
- It clarifies what employees are supposed to do if selected for that particular job opening.
- It gives recruiting staff a clear view what kind of candidate is required by a particular department or division to perform a specific task or job.
- It also clarifies who will report to whom.

1.1.4 Job descriptions of Construction

- Demolition and site preparation
- Substructure
- Structure
- Architectural works | non-structural works
- Services and equipment
- Underground drainage
- External works

1.1.5 Buildings job description

A. **Substructure:**

A-1 Excavation work

A-2 Foundations, including:

- Piling, up to and including lowest floor slabs
- Basement sides and related excavation
- Lateral supports
- Waterproof tanking
- Drainage blanket and
- Insulation.

A-2 Concrete work

A-3 Masonry work

B. **Super Structure:**

- Structural frames
- Upper floors
- Stairs and roof slabs including the basement suspended floors and fireproofing to steel structure
- Prefabricated buildings
- External and internal walls
- Works to existing buildings structure.

1.**1.6 Plumbing job description**

A. Underground drainage

- Civil piping: surface water
- Civil piping: foul
- Manholes
- Pumping systems
- Connections

B. Water supply and above-ground drainage

- Cold water supply
- Hot water supply
- Flushing water supply
- Grey water supply
- Cleansing water supply
- Irrigation water supply
- Rainwater disposal
- Soil and waste disposal
- Planter drainage disposal
- Kitchen drainage disposal
- Related electrical and control systems.

C. Supply of sanitary fittings

. D. Disposal systems:

- Refuse
- Laboratory waste
- Industrial waste
- Incinerator.

E. Fire services:

- Fire hydrant and hose reel system
- Wet risers
- Sprinkler system
- Deluge system
- Fire hydrant
- Gaseous extinguishing system
- Foam extinguishing system
- Audio/visual advisory system
- Automatic fire alarm and detection system
- Portable hand-operated appliances
- Related electrical and control system

Both Job specification and job description are essential parts of job analysis information. Writing them clearly and accurately helps organization and workers cope with many challenges while on board.

Job description and job specification are two integral parts of job analysis. They define a job fully and guide both employer and employee on how to go about the whole process of recruitment and selection. Both data sets are extremely relevant for

creating a right fit between job and talent, evaluate performance and analyze training needs and measuring the worth of a particular job.

1.1.7 **Scope of work**

The general character and the scope of work to be carried out are illustrated in the drawings and specifications. The scope of work shall furnish all labour, supply and install all materials, appliances, tools, equipments etc, necessary for the complete provision and testing of the whole plumbing services installation. This also includes any material, appliances, equipment not specifically mentioned herein or noted on the drawings as being furnished or installed but which are necessary and customary to make a complete installation as shown on the drawings or described herein, properly connected and in working order.

Following are the different items of work, which have to be designed, supplied, erected, tested, commissioned, & obtain necessary approvals from Local statutory bodies wherever applicable.

- **Internal Sanitary works,** consist of supply, fixing, testing and commissioning of sanitary fixtures like WC, urinals, wash basins, Towel rods, Towel rings, driers, Grab bars, etc., complete with accessories as specified in the BOQ.
- **Internal Potable / Domestic water** piping work comprising of CPVC and like piping with fittings, isolation valves, gauges etc. complete as specified in the BOQ.
- **Internal Sewerage piping** work comprising of PVC and like piping with fittings etc. complete as specified in the BOQ.
- **External Potable / Domestic water** piping work comprising of GSP and like (with wrapping and coating) piping with fittings, isolation valves, gauges etc. Complete as specified in the BOQ.
- **External Sewerage piping** work comprising of PVC piping and like with fittings etc. complete as specified in the BOQ.
- **Pumps comprising of submersible/mono block pumps,** etc. complete as specified in the BOQ.

In general the work to be performed comprise of the following:

- All incidental works connected with plumbing services installation such as
- excavation of trenches and back filling, cutting & chasing in concrete and brick and making good, cutting / drilling holes through walls, floors, and grouting for fixing of fixtures/equipment, etc.
- Furnish and install a complete workable plumbing services installation as shown on the drawings and described in this specification and as per the latest Standards and specifications including all that which is reasonably inferred.
- Complete installation of internal and external water supply system.

- Complete installation of the sewerage and sewerage appurtenances internally as well as around the building.
- Complete installation of all sanitary and plumbing fixtures.
- Co-operation with other crafts in putting the installation in place.
- Repair all damage done to the premises as a result of this installation and remove all debris left by those engaged for this installation to the satisfaction of Client.
- Cleaning of all plumbing and sanitary fixtures, testing and proving the satisfactory performance of all fixtures at the time the building is handed over to the Client.
- Painting of all exposed pipes as specified in relevant code.
- Assume full responsibility of all required applications and costs to connect to Corporation water mains, sewers and storm water drains, to the extent applicable to this installation.

Self-Check - 1	Written Test

Directions: Match the construction element with its related job description for all the questions listed below. Use the Answer sheet provided in this page.

Group 1	**Group 2**
1. Position of major natural features	A. Sub structure
2. Excavation work system	B. Fire hydrant and Hose reel
3. Fire services	C. Water supply system
4. Flushing water	D. Survey plan

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet- 2	I Identify Standards of construction project work , Finishes and tolerances

2.1 Standards of construction project work

A building or construction project requires a complete set of specialised drawings. These drawings, called a project set, are used by the local planning department and building control, as well as by builders, joiners, plumbers, electricians and water, gas and telephone engineers.

Drawings for new buildings require approval from the building control department and the planning department before construction work can begin. The building control department checks that the quality of design and construction meet standards. The planning department assesses whether or not the style and proportions of the proposed building are appropriate for the location.

The plumbing drawings indicate the points of supply and termination of work shall be installed as indicated in the drawings. The drawings and specifications are meant for the assistance and guidance of the Plumbing and Sanitary Nominated Contractor, and exact location, distance and levels will be governed by the individual building and site conditions. Therefore, approval of the Client/Architects/ Consultants shall be obtained before commencement of work on the following.

- Exact run and sizes of all piping on all floors and vertical stacks.
- Location of all mechanical equipment with layout and piping connections.
- Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.
- Run of all water supply lines with diameters, location of control valves, access panels.
- Location of all mechanical equipment with layout and piping connections.

2.2 Finishes

Finish exposed piping, including fittings and supports as follows:

- Internal locations such as toilet and kitchen areas: Chrome plate copper piping to Service condition, bright.
- Externally: Paint.
- Concealed but accessible spaces (including cupboards and non-habitable enclosed spaces): Leave unpainted except for required identification marking. Prime steel piping and iron fittings.
- Valves: Finish valves to match connected piping.

2.3 Tolerance

It is the range between the limits within which a size or position must lie. In similar term deviation is the difference between the actual (i.e., measured) size or position and the specified size or position. Other form of tolerance is permissible deviation, the specified limit(s) of deviation.

Deviate from the provisions of the specifications and drawings either on account of manufacturing practice or from any other reasons list points of changes and submit complete information on drawings and specifications which will enable to evaluate the same on merits of the deviations & come to a common conclusion. All any deviations or departures not brought out to the notice shall be disregarded.

Tolerances are used to the boundaries set for behavior on the project. Project tolerance is the permitted deviation from planned parameters. Usually this will be increase or decrease from planned cost or time. For example, tolerance of work is 4% above or below the budget. Types of project tolerance are: Budget tolerance. Schedule tolerance and risk tolerance.

- **Budget tolerance**

Measured as a percent or fixed amount. Example: +/- 10%. This means that as long as within10% of forecasted budget at completion can carry on.

- **Schedule tolerance**

Measured as a percent or fixed amount. Example: +/- 10 days. This means that as long as forecasting to complete the project within 10 days of the scheduled end date can continue without seeking further input. If the forecasted project completion date stretches to more than 10 days after the current base lined schedule date, that need to seek approval from project sponsor.

- **Risk tolerance**

It is measured as a number of risks with a certain status. Example: no risks requiring involvement and/or fewer than four risks with ‘major’ status. This means that as long as there are no risk management actions that need involvement, or fewer than four risks with the status of ‘major’. Then have the freedom to continue to manage these within the project as long as reported in the monthly project reporting.

Self-Check - 2	Written Test

Directions: Match the construction element with its related job description for all the questions listed below. Use the Answer sheet provided on this page.

1. Tolerance measured as a number of hazard or unsafe practice with a certain status

   A. Risk Tolerance B. Budget Tolerance

   C. Schedule Tolerance D. Quality Tolerance

2. Drawings for new buildings require approval before construction work can begin.

   A. False B. True

3. Select irrelevant relation of finishes with place and types of work.

   A. Internal locations - Chrome plate B. Externally -- Paint.

   C. Identification marking - unpainted D. Valves - unmatched with piping.

4. Drawing and specification are support each other.

   A. False B. True

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.

Score = _____

Rating: _____

Name: _____ Date: _____

Operation Sheet 2.1	Identify Standards of construction project work , Finishes and tolerances

The techniques for Identify Material attributes of construction specifications are;

Step 1 - Identify a project work of construction with plumbing working drawing

Step 2 – Identify recommended specification for a project work above.

Step 2 – Identify standards used for this project work.

Step 3 – Identify finishes used in this construction project work.

Step 4 - Identify materials used in drawing selected above.

Step 5 - Identify attributes of construction materials used for above drawing.

Information Sheet- 3	Identify Material attributes of construction specifications

3.1 Properties of construction materials

Building materials or construction materials are the major requirement in this modern age of technology. There are many types of building materials used for different construction works.

The properties of materials relate to things such as how strong they are, how well they conduct heat or electricity or how flexible they are common to plumbing materials.

For a material to be considered as building material, it should have required engineering properties suitable for construction works. These properties of building materials are responsible for quality and capacity and help to decide applications of these materials. Such properties of building materials are categorized as follows.

- Physical properties
- Mechanical properties
- Chemical properties
- Electrical properties
- Magnetic properties
- Thermal properties

These are the properties required to estimate the quality and condition of the material without any external force.

3.1.1 The physical properties of engineering materials are as follows.

- Bulk density
- Porosity
- Durability

- Density
- Density index
- Specific gravity
- Fire resistance
- Frost resistance
- Weathering resistance
- Spalling resistance
- Water absorption
- Water permeability
- Hygroscopicity
- Coefficient of softening
- Refractoriness

A. Bulk Density of Building Materials

Bulk density is the ratio of mass to the volume of the material in its natural state that is including voids and pores. It is expressed in kg/m^3. Bulk density influences the mechanical properties of materials like strength, heat and conductivity etc. bulk density values of some of the engineering materials are given below.

B. Porosity of Building Materials

Porosity gives the volume of the material occupied by pores. It is the ratio of volume of pores to the volume of material. Porosity influences many properties like thermal conductivity, strength, bulk density, durability etc.

C. Durability of Building Materials

The property of a material to withstand against the combined action of atmospheric and other factors is known as durability of material. If the material is more durable, it will be useful for longer life. Maintenance cost of material is dependent of durability.

Building material	**Bulk density (kg/m^3)**
Brick	1600 – 1800
Sand	1450 – 1650

Material	Density (kg/m^3)
Steel	7800 – 7900
Brick	2500 -2800
Granite	2600 – 2900

Steel	7850
Heavy concrete Light concrete	1800 – 2500 500 – 1800
Granite	2500 – 2700

D. Density of Building Materials

Density is the ratio of mass of the material to its volume in homogeneous state. Almost all the physical properties of materials are influenced by its density values. Density values of some building materials are given above.

E. Density Index

Ratio of bulk density of material to its density is termed as density index. Hence it gives the volume of solid matter in the material. In nature, fully dense material is not available so, density index is always less than 1 for any building material.

F. **Specific Gravity of Building Materials**

Specific gravity is the ratio of mass of given substance to the mass of water at 4^{o}C for the equal volumes. Specific gravity of some materials is listed below.

Material	Specific gravity
Steel	7.82
Cast iron	7.20
Aluminum	2.72

Material	Specific heat J/N ^{o}C
Steel	0.046 x 10^3
Wood	0.239 to 0.27 x 10^3
Stone	0.075 to 0.09 X 10^3

G. Fire Resistance of Building Materials

It is the ability to withstand against fire without changing its shape and other properties. Fire resistance of a material is tested by the combined actions of water and fire. Fireproof materials should provide more safety in case of fire.

H. **Frost Resistance**

The ability of a material to resist freezing or thawing is called frost resistance. It is depends upon the density and bulk density of material. Denser materials will have more frost resistance. Moist material have low frost resistance and they lose their strength in freezing and become brittle.

I. **Weathering Resistance**

It is the property of a material to withstand against all atmospheric actions without losing its strength and shape. Weathering affects the durability of material. For example corrosion occurs in iron due to weathering. To resist this paint layer is provided.

J. Spalling Resistance

The ability of a material to undergo certain number of cycles of sharp temperature variations without failing is known as spalling resistance. It is the dependent of coefficient of linear expansion.

K. Water Absorption

The capacity of a material to absorb and retain water in it is known as water absorption. It is expressed in % of weight of dry material. It depends up on the size, shape and number of pores of material.

L. **Water Permeability**

The ability of a material to permit water through it is called water permeability. Dense materials like glass metals etc. are called impervious materials which cannot allow water through it.

M. **Hygroscopicity**

Hygroscopicity is the property of a material to absorb water vapor from the air. It depends on the relative humidity, porosity, air temperature etc.

N. Coefficient of Softening

Coefficient of softening of a material is the ration of compressive strength of a saturated material to its compressive strength in dry state. It affects the strength of water absorbent materials like soil.

O. Refractoriness

The properties of a material which cannot melts or lose its shape at prolonged high temperatures (1580^{o}C or more). Example: fire clay is high refractory material.

3.1.2 Mechanical Properties of Building construction Materials

Mechanical properties of the materials are finding out by applying external forces on them. These are very important properties which are responsible for behavior of a material in its job. The mechanical properties are,

- Strength
- Plasticity
- Impact strength
- Hardness
- Brittleness
- Abrasion resistance
- Elasticity
- Fatigue
- Creep

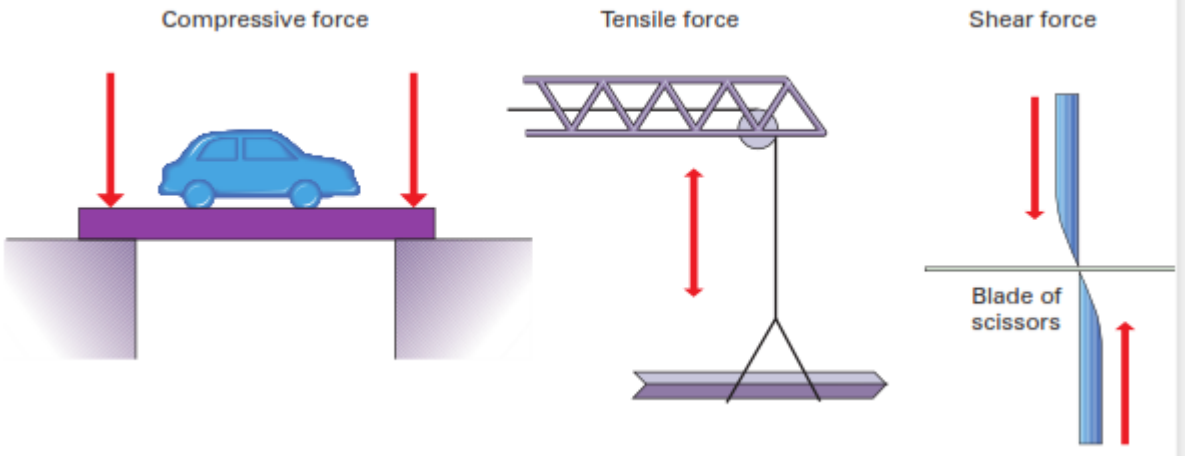
A. Strength of Building Materials

The capacity of a material to resist failure caused by loads acting on it is called as strength. The load may be compressive, tensile or bending. It is determined by dividing the ultimate load taken by the material with its cross sectional area. Strength is an important property for any construction materials. So, to provide maximum safety in strength, factor of safety is provided for materials and it is selected depending on nature of work, quality of material, economic conditions etc.

The strength of a material is the extent to which it can withstand an applied force or load (stress) without breaking. The load is expressed in terms of force per unit area (newtons per square metre,N/m2), and can be in the form of a:

- compression force, as applied to the piers of a bridge or a roof support
- tensile or stretching force, as applied to a guitar string, tow rope or crane cable
- shear force as applied by scissors or when materials are torn (see figure 4.5).

Materials are therefore described as having compressive, tensile or shear strength.



Materials that can withstand a high compression loading include cast iron, stone and brick, hence the common use of these materials for building purposes. However, they are brittle and will break if subjected to high tension. If a building is to be designed to resist tensile strain – in an earthquake-prone area, for example – steel, which has high tensile strength, would be a more suitable building material.

B. Hardness of Building Materials

The property of materials used to resist scratching by a herder body. Hardness is most important to decide the usage of particular aggregate. It also influences the workability. Hardness is a measure of a material's resistance to permanent or plastic deformation by scratching or indentation. It is an important property in materials that have to resist wear or abrasion – moving parts in machinery, for example – and frequently needs to be considered along with the strength of materials.

C. Elasticity of Building Materials

The capacity of a material to regain its initial shape and size after removal of load is known as elasticity and the material is called as elastic material. Higher values of modulus of elasticity lower the deformations. Almost all materials will stretch to some extent when a tensile force is applied to them. The increase in length on loading, compared to the original length of the material, is known as strain. As loading continues, a point is reached when the material will no longer return to its original

shape and size on removal of the load, and permanent **deformation** occurs; the material is said to have exceeded its elastic limit or yield stress, and is suffering plastic deformation – it has been stretched irreversibly. Eventually, at maximum stress, the material reaches its breaking point – its ultimate tensile strength – and failure or fracture rapidly follows. This sequence is illustrated for a variety of materials below.

- Mild steel has little elasticity but has the highest yield stress of all the samples; it is fairly ductile, i.e. it has a large range over which it can sustain plastic deformation, and it has the highest ultimate tensile strength.
- Cast iron is brittle – it has the least elasticity of the four samples, and no ability to sustain plastic deformation, although its tensile strength is higher than that of concrete.
- Copper has little elasticity but is the most ductile of the four samples. It has an ultimate tensile strength less than half that of mild steel.
- Concrete has little elasticity, and the lowest tensile strength of the four samples.

D. Plasticity

When the load is applied on the material, if it will undergo permanent deformation without cracking and retain this shape after the removal of load then it is said to be plastic material and this property is called as plasticity. They give resistance against bending, impact etc. Examples: steel, hot bitumen etc.

E. Brittleness

When the material is subjected to load, if it fails suddenly without causing any deformation then it is called brittle material and this property is called as brittleness. Examples: concrete, cast-iron etc.

F. Fatigue

If a material is subjected to repeated loads, then the failure occurs at some point which is lower than the failure point caused by steady loads. This behavior is known as fatigue.

G. Impact Strength

If a material is subjected to sudden loads and it will undergo some deformation without causing rupture is known as its impact strength. It designates the toughness of material.

H. Abrasion Resistance

The loss of material due to rubbing of particles while working is called abrasion. The abrasion resistance for a material makes it durable and provided long life.

I. Creep

Creep the deformation caused by constant loads for long periods. It is time dependent and occurs at very slow rate. It is almost negligible in normal conditions. But at high temperature conditions creep occur rapidly.

3.1.3 Chemical Properties of Building Materials

The properties of materials against the chemical actions or chemical combinations are termed as chemical properties. And they are

- Chemical resistance
- Corrosion resistance

A. Chemical Resistance of Building Materials

The ability of construction materials to resist the effects by chemicals like acids, salts and alkalis is known as chemical resistance. Underground installations, constructions near sea etc. should be built with great chemical resistance.

B. Corrosion Resistance

Formation of rust (iron oxide) in metals, when they are subjected to atmosphere is called as corrosion. So, the metals should be corrosive resistant. To increase the corrosion resistance proper measures should be considered. Otherwise it will damage the whole structure.

3.1.4 Electrical Properties of Building Materials

The properties of a material to conduct or to resist electricity through them are electrical properties of material. For example, wood have great electric resistance and stainless steel is a good conductor of electricity.

3.1.5 Magnetic Properties of Building Materials

The magnetic properties of materials like permeability, hystereses etc. are required in the case of generators etc. iron is magnetic material and aluminum is non-magnetic material.

3.1.6 Thermal Properties of Building Materials

- Thermal capacity
- Thermal conductivity
- Thermal resistivity
- Specific heat

A. Thermal Capacity of Building Materials

Thermal capacity is the property of a material to absorb heat and it is required to design proper ventilation. It influences the thermal stability of walls.

B. Thermal Conductivity

The amount of heat transferred through unit area of specimen with unit thickness in unit time is termed as thermal conductivity. It depends on material structure, porosity, density and moisture content. High porous materials, moist materials have more thermal conductivity.

C. Thermal Resistivity

It is the ability to resist heat conduction. And it is the reciprocal of thermal conductivity. When it is multiplied by thickness of material it gives thermal resistance.

D. Specific Heat

Specific heat is the quantity of heat required to heat 1 N of material by $1^{o}C$. Specific heat is useful when we use the material in high temperature areas. Specific heat values of some engineering materials are given below.

3.2 List of Material

A List of Material (LM) shall be prepared and included on each assembly drawing to provide the individual part or sub assembly item number, quantity required, part number, description, material, and material specification.

Requirements on the body of the drawing

- The List of Material shall be placed above the drawing title block.
- Entries shall be made in the blocks and columns.
- Each part listed in the list of material (parts List) must be identified at least once by an Item (find) Number on the body of the drawing (except single item drawings).
- Parts note shall be bracketed, indicating reference, when they are identified by number and are not noted in the list of material.
- Repeated item numbers shall be indicated as reference either within brackets or by the word “REF.”

Requirements in the List of Material

Self-Check - 3	Written Test

- The List of Material is a list of all parts and materials called out on the drawing.
- The quantity of parts noted in the List of Material is the number required to complete the noted assembly.
- When a new drawing is made, all parts in the List of Material should be grouped as to type, such as dash number (for shown and opposite assemblies), drawings for detailed parts1, parts2, parts3, etc., and listed in this sequence.

DETAIL DRAWING

—	—	———	WIRE	BE CU	QQ-C-530, COND 1/2 HT
ITEM NO.	REQD	PART NO.	DESCRIPTION	MATERIAL	MATERIAL SPEC & NO.

DETAIL SHOWN & OPPOSITE DRAWING

—	—	-2	BAR OPPOSITE	AL ALY	QQ-A-225/6 6061-T6
—	—	-1	BAR SHOWN	AL ALY	QQ-A-225/6 6061-T6
ITEM NO.	REQD	PART NO.	DESCRIPTION	MATERIAL	MATERIAL SPEC & NO.

INSEPARABLE ASSEMBLY DRAWING

2	2	MS21209C0415	INSERT (4-40 UNC x .165 LG)		SEE NOTE 1
1	1	———	PLATE	AL ALY	QQ-A-250/11 6061-T6
ITEM NO.	REQD	PART NO.	DESCRIPTION	MATERIAL	MATERIAL SPEC & NO.

INSEPARABLE ASSEMBLY DRAWING

2	3	MS21209C0415	INSERT (4-40 UNC x .165 LG)		SEE NOTE 1
1	A/R	———	PLATE	AL ALY	QQ-A-250/11 6061-T6
—	X	GD1000001	PLATE ASSY		
ITEM NO.	REQD	PART NO.	DESCRIPTION	MATERIAL	MATERIAL SPEC & NO.

Directions: Match the construction element with its related job description for all the questions listed below. Use the Answer sheet provided in this page.

1. The List of Material is a list of all parts and materials called out on the drawing.

   A. True B. False

2. prepared List of Material (LM) shall not be include:

A. Drawing B. quantity required C. Description of material D. Cost

3. Each part listed in the List of Material (Parts List) must be identified at least once by an Item (Find) Number on the body of the drawing including single item drawings.

A. False B. True

4. It is the property of a material to absorb water vapor from the air. It depends on the relative humidity, porosity, air temperature etc.

A. Hygroscopicity B. Corrosion Resistance

C.Refractoriness D. Water Absorption

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.

Score = _____

Rating: _____

Name: _____ **Date:** _____

Operation Sheet 3.1	Identify Material attributes of construction specifications

The techniques for Identify Material attributes of construction specifications are;

Step 1- Select one of specification used in Ethiopia.

Step 2 - Select a construction with plumbing working drawing.

Step 3 - Identify materials used in drawing selected above.

Step 4 - Identify attributes of construction materials used for above drawing.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary drawings, specifications, templates, tools and materials you are required to perform the following tasks within 4 hours.

Task 1. Identify appropriate single set construction with plumbing working drawing and specification.

Task 2. Identify notes and description shown in drawing and specification.

Task 3. Identify job specified in drawing for this construction project work.

Task 4. Identify standards of this construction project work.

Task 5. Identify standards concerning finishes of this construction work.

Task 6. Identify tolerances used for this construction work.

Task 7. Identifying construction Materials attributes from specifications and drawings.

List of Reference Materials

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- *French, Thomas E.; Vierck, Charles J.; et al. (1953),* A manual of engineering drawing for students and draftsmen *(8th ed.), New York, New York, USA: McGraw-Hill*
- Building Construction Handbook' (6th ed.), CHUDLEY, R. and GREENO, R., Butterworth-Heinemann (2007
- Support materials, General construction training package BCG98 , Learning materials,BCG1003A: Read and interprete plans, Australian National Training Authority 2000, Website: www.atpl.net.au
- EIA Report for 1000 MW Coal Based Thermal Power Plant at Naraj Marthapur, Cuttack, Orissa, The Tata Power Company Ltd. https://elaw.org/system/files/Chapter%206.pdf
- Prepare a plumbing takeoff List (plumbing I), Sub course en 5110, Plumber, Edition A
- https://www.stakeholdermap.com/projectmanagement/project-tolerance.html

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1.

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