LEARNER'S BOOK

CIVIL TECHNOLOGY

GRADE 8

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

KAGISO TRUST
Overcoming poverty

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Civil Technology Grade 8 Learner's Book

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INTRODUCTION, CONTENT OVERVIEW

Civil Technology focuses on the concepts and principles in the built environment and on the technological process. It includes the practical skills and application of scientific ideas. The subject aims at the improvement of skills in the building environment. Consideration is given to environmentally friendly (green energy) technologies.

Civil technology focuses on three main areas, namely:

- Plumbing (Civil Services)
- Bricklaying and Plastering (Construction)
- Woodworking and Timber (Woodworking)

Plumbing (Civil services) deals with supply of cold and hot water to buildings, installation of sewerage systems and control of storm (rain) water. Plumbing also focuses on materials and the way they are used to provide water and sanitation on a site.

Bricklaying and plastering (Construction) deals with concrete and brick structures in the building environment. E.g., Building of houses, malls and shopping complexes. It focuses on materials and the way they are used to provide infrastructures in the development of sites.

Woodworking and timber deals with wood structures such as roof trusses, doors, windows and any part of a building that is made of timber. Woodworking works hand in hand with construction. It also focuses on providing temporary supporting to construct permanent structures such as suspended floors, stairs, arches and roofs.

Civil Technology prepares a person for the following career paths/choices:

- Plumber
- Drainlayer
- Carpenter and joiner
- Builder
- Teacher
- Building inspector
- Quantity surveyor
- Architect
- Draftsperson
- Building surveyor
- Engineering technician
- Engineering technologist
- Civil engineer
- Handyman

Occupational Health and Safety

CHAPTER

7

LEARNING OUTCOMES

By the end of this chapter, learners should be able to use the civil technology workshop safely and follow all measures identified in the Occupational Health and Safety Act (OHSA), Act No. 85 of 1993. The following will be covered in this chapter:

- Learning about workshop rules and procedures
- Learning about a safe workshop layout
- Defining occupational health and safety
- Learning about good housekeeping
- Defining what an accident is
- Learning about the different causes of accidents
- Identifying unsafe acts and unsafe conditions
- Learning about different personal protective equipment (PPE)
  - Eye and ear protection
  - Head protection
  - Footwear
  - Protective clothing
- Identifying and learning about different safety signs
  - Information signs
  - Prohibitions
- Exploring basic first aid

INTRODUCTION

Annually, hundreds of accidents occur on our roads, in mines, in the workplace and on construction sites, not only because of unsafe working conditions, but also because people become complacent, act negligently, lose concentration, or are tired or in too great a hurry.

Remember, safety is the responsibility of every individual, not just that of the employer of factory owner. Every single person must be always aware of potential dangers in order to ensure safety in the workplace.

All learners must acquire the necessary knowledge and skill to enable them to prevent accidents from occurring.

Workshop orientation:

Workshop rules and procedures

It is important that all learners keep to the following rules in the workshop:

- Never enter or leave the workshop without the teacher's permission.
- Work only in the area allocated to you.
- Never run in the workshop.
- Always clean your workshop before you leave.
- Always carry sharp tools with its sharp part facing the ground.
- Never throw objects at other learners.
- Do not eat, drink and play in the workshop.
- Do not leave tools and materials laying in the workshop.
- Always wear full **Personal Protective Equipment (PPE)** in the workshop.
- Always use a **guard** when working on a machine.
- Keep your hands away from moving or rotating parts of the machinery.
- Use hand tools carefully, keeping both hands behind the cutting edge.
- Report any damage to machines or equipment as this could cause an accident.

New words

Personal Protective Equipment (PPE) - protective clothing to protect the wearer's body from injury and infection.

guard - used to protect a machine operator from dangers or hazards during the normal operation of a machine.

Workshop Safety

Workshop safety is a number of various risk assessments of working practices which must be observed and adhered to and enforced by the person using the workshop. Different workshops have different safety rule requirements. A safe working environment can be maintained by following the safety rules that apply to that workshop. An employer will draft their final safety rules for their workshops, and their employees need to follow those rules to ensure their and their fellow workers' safety.

The basic regulations for safety rules are included in the OHSA (No. 85 of 1993).

Good housekeeping

Good housekeeping is putting everything in its intended place by making it easier to find and to avoid any accidents.

Figure 1 Examples of work areas before and after housekeeping

Aims of housekeeping

"A clean, orderly workshop is a safe workshop". Good housekeeping means working in an orderly way, and always returning tools and materials to their correct places.

Good housekeeping is explained by the phrase "A place for everything and everything in its place". This practice ensures that the workshop is always kept clean and tidy, making it a better and safe place to work. Housekeeping is a crucial aspect of workplace safety as good housekeeping helps prevent accidents and reduces the severity or consequences of accidents.

Proper housekeeping:

- saves time
- eliminates potential accidents
- saves space
- can prevent fire hazards
- ensures that the workplace is safe.

Definition of accident

What is an accident?

An accident is an unplanned and uncontrolled event that occurs as a result of unsafe actions or conditions. The Occupational Health and Safety Act (OHS Act) is important to everyone who works in an environment where machinery is operated or where materials are manufactured and transported. A copy of the Act should be displayed in a prominent place in the factory or workplace to ensure that every employee has access to it. The Act ensures the right of every employee to work in a safe, healthy environment. Make sure you know and understand your rights. Prevention of accidents goes hand-in-hand with following safety rules that are in place in the workshops.

Causes of accidents

Workshop	Workplace
• Not wearing personal protective equipment (PPE) in the workshop. • Loose clothing • By not displaying safety rules and regulations in the workplace • Working without the permission of the teacher/supervisor. • Do not play or fool around in the workshop. • Placing of tools, materials, etc. on the walkways in the workshop. • Using the tools or machines for the wrong purpose. • Adjusting or touching moving machinery. • Working at a dangerous speed. • Oil spills or other liquids that may cause slipping	• Not wearing personal protective equipment (PPE). • By not displaying safety rules and regulations in the workplace. • Working with and operating faulty or malfunctioning machinery. • Oil spills or other liquids that may cause slipping. • Working at unsafe speed

Unsafe acts or operations

- Unsafe speed
- No authority
- Safety devices not operative
- Arranging and placing objects unsafely
- Fooling around, teasing, and abusing workmates

- Equipment used in an unsafe manner
- Adjusting moving equipment
- Taking risks
- Taking up unsafe position
- Not wearing safety gear

Unsafe circumstances or conditions

- Construction site unsafe
- Overcrowding
- No personal protective equipment
- Disorderly and haphazard planning
- Inadequate illumination
- Toxic or dangerous substances are not stored safely
- Inadequate ventilation
- Equipment and tools in bad condition
- No guards on machines
- Slippery, rough or sharp surfaces

Personal Protective Equipment (PPE)

New words

biohazards - organic substances that can be dangerous to a person's health

airborne particulate matter - very small solid or liquid droplets that can be inhaled and cause serious health risks.

PPE is a collective name for all items worn or used to prevent or minimise injury when performing a task. There is a variety of PPE designed to offer specific protection. These should always be worn or used when working. Firefighters' gear, for example, is suited for an environment of extreme heat with open flames and smoke. Likewise in the workshop, the appropriate PPE is to be used. You will learn about the different PPE and their appropriate use.

PPE refers to protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, **biohazards**, and **airborne particulate matter.**

To provide safety for yourself is to always wear your proper PPE. There are hazardous situations, toxic fumes and objects that may cause an unplanned event that may lead to a person getting injured or even killed.

Personal Protective Equipment (PPE)		
		
Apron: Protects clothing from staining, hazards, etc.	Overall: Protects clothing from work hazards, exposure of the body or skin from too much heat, chemicals and other risks.	Safety shield: They protect the eyes and face. Safety shields allow air in and around the eye.
		
Dust mask: Worn over the nose to protect against inhaling dust particles, etc.	Safety boots/Safety footwear: Protects the foot from falling objects or compression, and against punctures from below.	Safety gloves: Safety gloves protect the hands from various types of hazards, electric shocks, infection and contamination, as well as a range of injuries – from minor cuts and bruises to deep wounds and severe hand burns.
		
Hard hat: Protects the user's head from injury due to falling objects.	Safety goggles: Protective eyewear usually encloses or protects the area surrounding the eye to prevent particles, water or chemicals from striking the eyes.	Earmuffs: Covers the ears to blackout background noise and sound impulses.

Figure 1 Examples of PPE

Safety signs

New words

safety regulations rules that must be taken seriously

non-verbal does not involve the use of speech or words.

A safety sign provides information about safety or health and can be a signboard, colour, acoustic signal, verbal communication, or a hand signal. Safety signs indicate **safety regulations** that must be adhered to. They are generally used to convey a message (without using words). This **non-verbal** way of communication is effective and has no limitations. For example, the message conveyed by a "no entry" sign will be understood correctly by people who do not even speak the same language or someone who may be illiterate.

Safety signs are categorised under the following categories:

- Information signs
- Prohibitions

	MEANING	SHAPE	COLOUR	SYMBOLS		
Information	MANDATORY	ROUND	BLUE 	 Keep clear	 Wear gloves	
	WARNING	TRIANGLE	YELLOW 	 Danger high voltage	 Danger forklifts in operation	 Danger mind your head
	SAFE CONDITIONS	SQUARE	GREEN 	 First aid	 Emergency exit	
Prohibitions		ROUND	RED 	 No smoking	 No learners	

Figure 1 Different safety signs

Basic First Aid

First aid is defined as the first and immediate assistance given to any person suffering from either a minor or serious illness or injury.

It includes initial intervention in a serious condition prior to professional medical help being available, such as performing cardiopulmonary resuscitation (CPR) while waiting for an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut. First aid is generally performed by someone with basic medical training.

First-aid kit

A basic first aid kit may contain:

- plasters in a variety of different sizes and shapes.
- small, medium and large sterile gauze dressings.
- at least 2 sterile eye dressings.
- triangular bandages.
- cr pe rolled bandages.
- safety pins.
- disposable sterile gloves.
- antiseptic wipes.
- tweezers.

Figure 1 First-aid kit checklist

Activity 1.1 Safety

1.1 Write down five unsafe circumstances in the workshop.

1.2 Write down five unsafe acts in the workshop.

1.3 Label parts A - F of the PPE items.

		
A	B	C
		
D	E	F

1.4 Identify the safety signs A – D below:

A 	B 
C 	D 

Graphics as Means of Communication

CHAPTER

2

LEARNING OUTCOMES

By the end of this chapter, learners should be able to use graphic communication and symbols such as images and drawings.

The following will be covered in this chapter:

- The purpose of graphic communication
- General drawing principles
- Correct use and care of drawing instruments
- Lines and types of lines (SANS 0111 Guidelines)
- Freehand drawing
- Pictorial drawing (using drawing instruments)
- Orthographic projection)

INTRODUCTION
What is graphic communication

Graphic communication is communication using visual graphic symbols such as images, drawings and photographs.

There are two kinds of drawings – artistic drawing and engineering drawings (drafting). Artistic drawing can be seen as a representation of something either imaginary or real, while drafting is aimed at creating a plan representing the construction of an object, so that it can be practically, technically, and very precisely realised.

The purpose of Graphics Communication

- To enable the understanding of graphical drawings as a communication method.
- To enable the reading and interpretation of building plans.
- To enable people to draw free hand drawings in order to communicate graphically on site.
- Drawings are used to capture reality, ideas and designs on paper.

General drawing principles and the correct use and care of drawing instruments

Uses of drawing instruments

The drawing instruments for Engineering Graphics and Design (EGD) consists of the following basic requirements:

Drawing paper/sheet

Drawing papers/sheets can be obtained in sheets of various sizes.
Sizes are: A0 - 841mm x 1189mm
A1 - 598mm x 841mm
A2 - 420mm x 594mm
A3 - 297mm x 420mm
A4 - 210mm x 297mm

Drawing board

- The drawing board provides a flat and smooth surface for the drawing sheet. Drawing boards are available in various sizes and must always be larger than a drawing sheet. Try to keep your drawing boards clean and unscratched.

Figure 1 Drawing board

Clutch pencil

The drawing pencil is probably the most important tool that a draughtsman possesses. No drawing will be visible without a pencil. Pencil lead is made from graphite and is available in various grades (B, H, HB, HHB, etc.) Always take care of your pencil and keep the tip sharp.

Figure 1 Clutch pencil

Set square

A right-angled triangular plate for drawing lines, especially at 90¡, 45¡, 60¡, or 30¡.

Figure 1 Examples of set squares

T-square

The T-square is used primarily as a guide to draw horizontal lines. This instrument gets its name from its resemblance to the letter 'T'. A T-square can also be used in conjunction with a set square to draw vertical and angled lines.

Figure 1 T-square

Scale ruler

The scale ruler is used to determine the dimensions of scale drawings. It is used for measuring lengths and transferring measurements at a fixed ratio.

- The most popular scale ruler is triangular and has six scales: 1:1, 1:2, 1:5, 1:10, 1:20 and 1:200.
- It is usually 300 mm long and is made of plastic or metal.
- The measurements are in millimetres on one side and centimetres on the other side.

Figure 1 Scale ruler

Protractor

- This semi-circular instrument is made of transparent plastic. It is used to measure angles up to 360 degrees.

Figure 1 Protractor

Compass

- The compass is used for drawing circles and semi-circles.
- The sharp end is positioned firmly on the paper and the leg containing the pencil is gently turned around on the paper.
- Always draw the circles in a clockwise direction.

Figure 1 Compass

Divider

- The divider is used to measure distances between two points.
- Each leg is placed on the point that you want to measure, and the distances is then measured by transferring the divider to a ruler.

Figure 1 Divider

Taking care of your drawing equipment:

Drawing instruments will last longer if you take care of them.

- The drawing board should be stored in a box after use.
- The instruments can be wiped clean with a small piece of damp chamois kept for this purpose.
- Pay particular attention to the pencils. Sharpen them regularly.
- Wipe the ruler, pens, pencils, compasses and set squares before and after use.
- The best wipes are pieces of old sheets or shirts that have been discarded.
- Store drawing instruments in a box or bag.

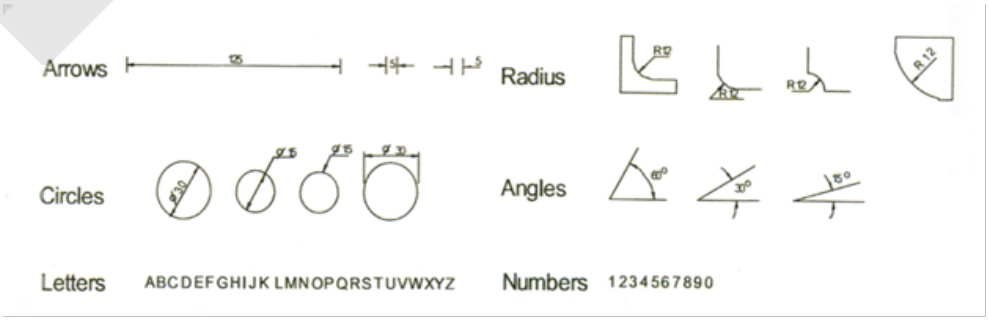
Lines (SANS110 guidelines) /Types of lines

Line work

Line type	Description	General application
A	Continuous line dark.	Visible outlines and edges.
B	Continuous line light.	Dimension lines. Extension lines. Hatching lines. Leader lines.
C	Continuous line very light.	Construction lines. Projection lines. Guidelines for printing.
D	Dashed line light.	Hidden lines.
E	Chain line light.	Centre lines. Pitch lines and circles. Lines indicating symmetry.
F	Chain line light – dark ends.	Cutting planes.
G	Short break line light.	Irregular boundaries.
H	Long break line light.	Limits of views and sections, if the line is not an axis.

Line types and line work

- Lettering and Dimensioning Techniques Examples



Freehand drawing

- This is a simple drawing done by hand without the aid of tools such as templates, stencils or tracing copies.

- Only pencils and erasers are used for free hand drawing.
- The technique can be mastered by practicing and drawing regularly,

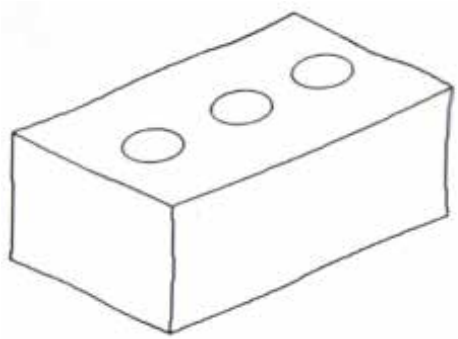


Figure 1 FREE HAND DRAWING OF A BRICK

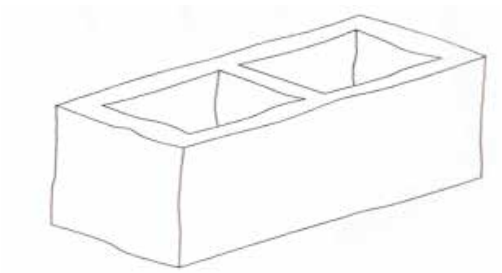


Figure 1 FREE HAND DRAWING OF A BRICK BLOCK

Scale drawing 1:1 and 1:2

SCALE

All drawings are drawn to scale. The scale refers to the proportion or ratio between the dimensions adopted for the drawings and the corresponding dimensions of the object.

The following scales will be used in this regard:

Full Scale:1: 1

Reducing Scales:

1: 2
1: 5
1: 10
1: 50
1: 100

Enlarging Scale:

2:1
5:1

Pictorial Drawings/Orthographic projection

Civil drawing

- Civil drawings are the drawings which are construction focused.
- They are mostly about brickwork and other features of construction, like doors and window frames and all drawings relevant to Civil technology.

First angle orthographic drawing

- Scale, objects and Plane figures (Brick)
- The first angle orthographic simplifies every side of the object, example it gives the viewer the opportunity to individual Top View, Side View and Front View.

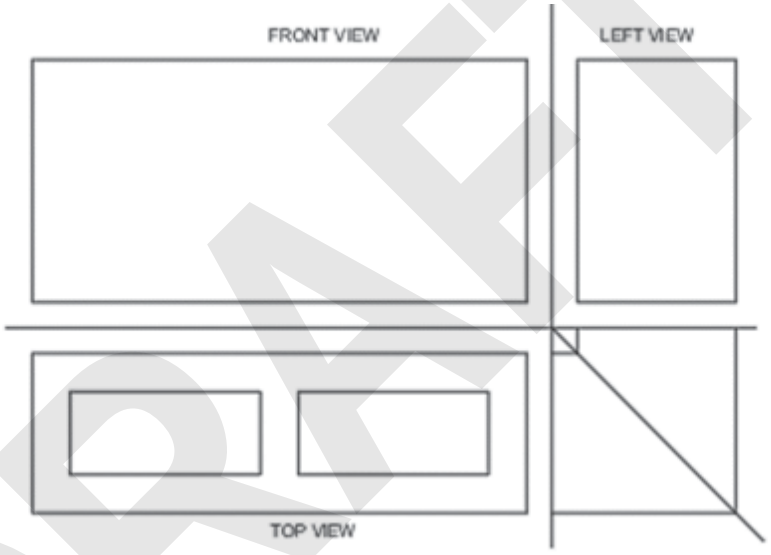


Figure 1 Drawing of a building block

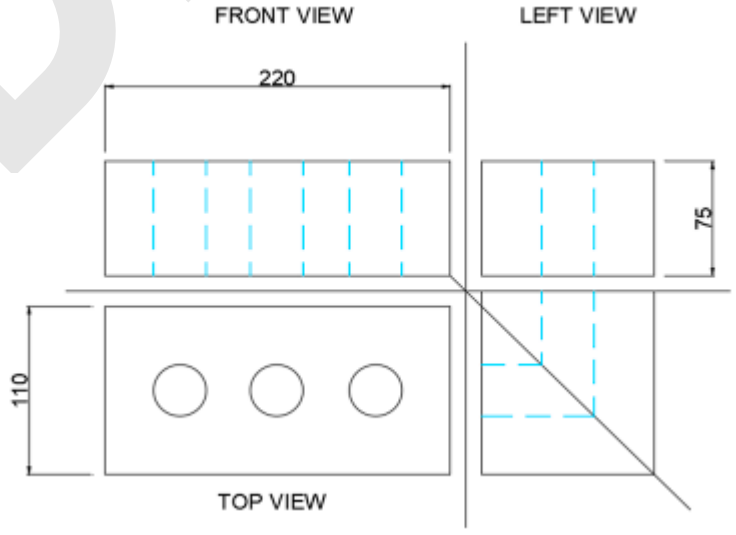
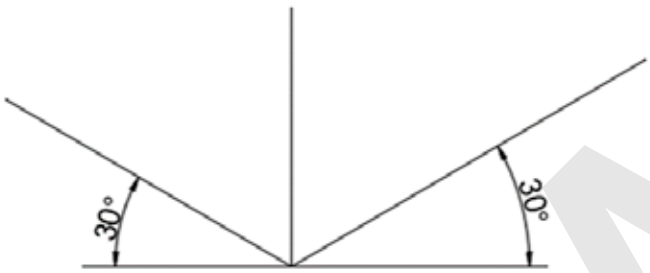


Figure 1 Drawing of a brick

Isometric drawing

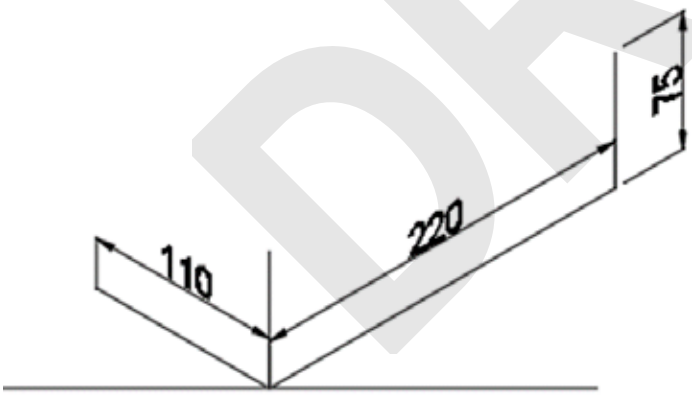
STEP 1

Step 1: start your isometric drawing by drawing a vertical line to meet the horizontal



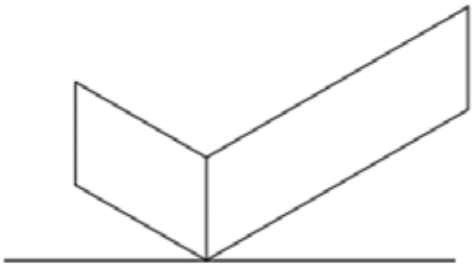
STEP 2

Step 2: Use a 30 °Set square to draw two lines as shown above.

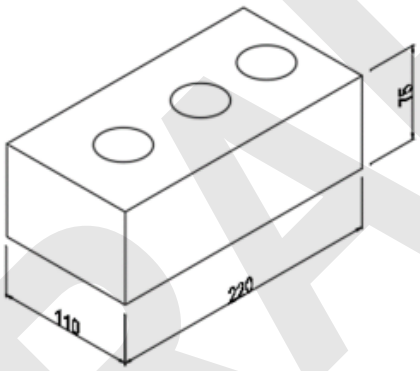


STEP 3

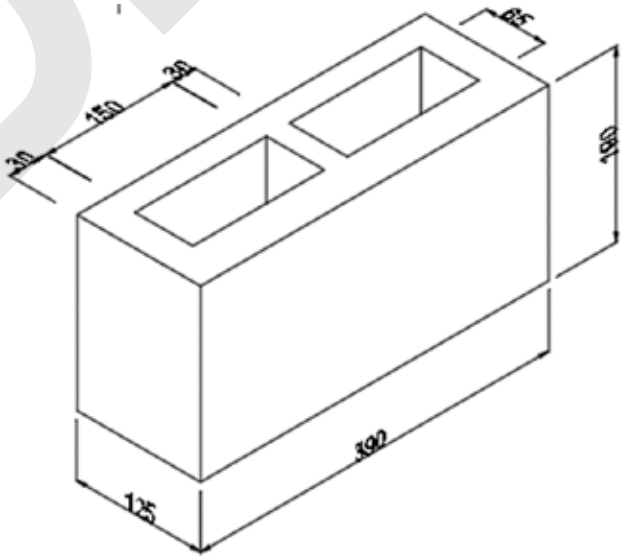
Step 3: Measure the horizontal dimensions of the brick along the two lines of the 30
Length=220 mm
Breadth = 110 m
Height = 75 mm



Step 4: Draw the line parallel to the previously drawn lines as shown below.



Step 5: Complete the Isometric drawing by joining the lines to form a brick as shown above.



GRAPHIC COMMUNICATION

DRAWING EXCERCISE:

2.1 Setting up drawing sheets.

- Schools will design their own layout of the title block.
- The layout should meet the specific school's requirements.
- The title blocks are drawn on the inside of the border line, at the bottom of the drawing sheet.

2.2 Drawing sheet with general name/ title block

- Name block refers to the specific block where the name of the learner and surname, grade, date, title of the drawing, e.g. (scale 1:100)

2.3 Geometrical construction

To draw a shape, line, angle, or an arch accurately using a ruler, compass and set square

2.4 Simple Isometric drawing

- A three-dimensional representation of an object on a 2-dimensional surface in which all three dimensions are equally emphasised.
- In an Isometric drawing, all the lines are parallel to the major axes

Tools

CHAPTER

3

LEARNING OUTCOMES

By the end of this chapter, learners should be able to identify the parts, functions and care of tools and equipment. The following will be covered in this chapter:

- Use of tools and equipment
- Handling of tools
- Maintenance of tools
- Identification and proper use of:
  - Basic site equipment
  - Plastering tools
  - Setting out tools
  - Bricklaying tools
  - Brick cutting tools
  - Jointing tools
  - Woodworking tools
  - Plumbing tools

Identification, proper use and maintenance of tools

Tools which are used in the Civil Technology fields can be broadly categorised into basic site equipment, plastering tools, setting out tools, bricklaying tools, jointing tools, woodworking tools and plumbing tools.

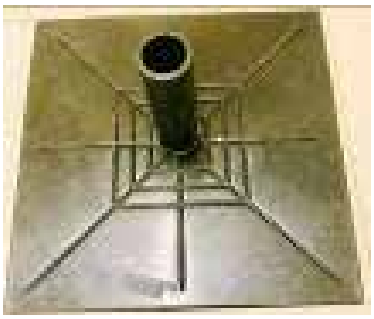
Basic site equipment:

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Round shovel	• To mix concrete and mortar	• Clean with water after every use. • Keep in the storeroom
 Square shovel	• To clear loose material and rubble at building sites	• Clean with water after every use. • Keep in the storeroom

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Steel shaft digging spade	• Used for digging trenches	• Clean with water after every use. • Keep in the storeroom
 Pickaxe	• To break up hard ground	• Clean with water after every use. • Keep in the storeroom
 Wheelbarrow	• To transport mortar, concrete, filling and bricks	• Clean with water after every use. • Turn it upright to dry • Keep in the storeroom

Plastering tools:

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
  Wooden/plastic float	• Used to finish off plaster or concrete surfaces to achieve a finely textured surface	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Plastering trowel	• To apply plaster to the wall • Also used for smoothing concrete and plaster	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom
 Hand hawk	• Used to carry manageable quantities of plaster	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom
 Straight edge	• Used to guide a plasterer for levelling of foundations, floors and plastering	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom
 Block brush	• Used for wetting down walls before plastering and during the floating process	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom in the storeroom
 Gauging Nose trowel	• Used for mixing small quantities of mortar for patching and laying on mouldings	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom

Setting out tools:

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Steel square	• To check the squareness of buildings • Setting out of brickwork	• Wash off the excess mortar with clean water • Keep in dry place
 Measuring tape	• Used for fine and accurate measuring	• Wipe the excess mortar with a cloth • Keep in a storeroom
 30m Steel tape	• Used for setting out of large buildings	• Wipe the excess mortar with a cloth • Keep in a store place
 Metal pegs/Wooden pegs	• Used to indicate the foundation trenches and to what level concrete should be poured	• Wash or rinse with water • Keep it in a storeroom
 Building line	• Setting out foundations and brickwork and to guide the straight and level laying of bricks • Lining up doors and window frames; lining up columns and beams	• Wipe the line clean after use • Roll up carefully after wiping to avoid knots

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Spirit level	• Used for checking the horizontal and vertical levels of brickwork	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom

Bricklaying tools:

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Brick trowel	• Used for picking up and spreading mortar in the building process	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom
 Corner blocks	• Used with the building which indicates a straight line to build against	• Remove excess mortar with wet cloth. • The line should be rolled back on the block to avoid it to be tangled. • Keep all in the storeroom.
 Gauge rod/brick gauge	• Used for checking and aligning the accurate height of the courses of the brickwork	• Remove excess mortar and rinse with water and wipe with wet cloth. • Put safely in the storeroom

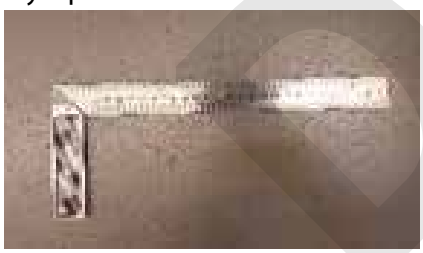
Brick cutting tools:

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Brick hammer	• Dressing bricks and blocks • Roughening smooth surfaces	• Keep hammer face clean and ensure that the handle is firmly attached to the head • Sharpen the chisel end regularly
 Bolster	• Used with a club hammer to cut bricks or blocks accurately	• Sharpen the edge regularly • Grind down any mushrooming from the head.
 Club hammer	• Used where heavy hammering is necessary • driving pegs into the ground	• Keep the hammer face clean and ensure that the handle is firmly attached to the head • Replace hammer heads when the edge of the head is rounded or worn
 Cold chisel	• cutting concrete and brickwork • cutting metal	• Sharpen it regularly • Grind down the mushroom hear on the hammer end regularly

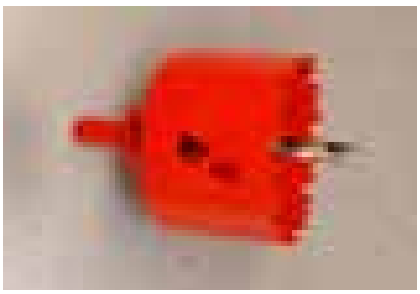
Jointing Tools:

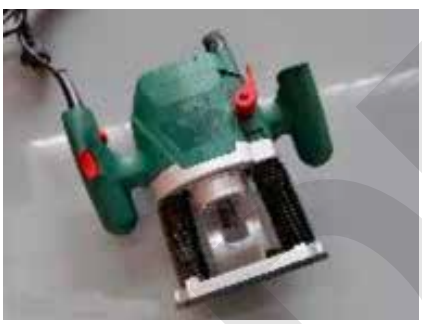
Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Long Jointer	• Used to smoothen the joints between courses of the brickwork • To ensure a good and consistent finish	• Wash off the excess mortar with clean water and cloth. • Keep in a storeroom
 Short Jointer	• Used with a club hammer to cut bricks or blocks accurately	• Sharpen the edge regularly • Grind down any mushrooming from the head

Woodworking tools:

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
Try square 	• To draw lines at 90^0 on timber. • To check for squareness	• Do not drop the try square • Wipe it after use
Short Jointer 	• To mark lines parallel to a surface	• Oil wooden parts regularly • Wipe the gauge with an oil cloth

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Tenon saw	• Fine cutting along and across the grain. • Cutting out joints	• Wipe off and store in a dry place after use • Cover the teeth when the saw is stored .
 Planer	• To remove rough surfaces on timber fast	• Store the plane on its side when it is not used • Do not drop
 Mortice chisel	• Remove unwanted wood when forming joints	• Sharpen the edge regularly • Grind down any mushrooming from the head
 Wooden mallet	• To drive chisels into wood. • To knock wood joints together	• Do not hit nails or screws with a wooden mullet • Ensure that the handle is firmly attached to the head
 Pincers	• To remove bent nails	• Clean with a cloth or a stiff brush • Lubricate the jaws and hinges of the pincers with a drop of light oil
 Claw hammer	• To drive in nails and to remove nails	• Keep the hammer face clean and ensure that the handle is firmly attached to the head • Replace hammer heads when the edge of the head is rounded or worn

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Wood rasps	• Shaping and finishing wood and plastic • Removing excess or projecting timber to obtain a flat surface	• Store in a dry place • Do not use a rasp to file metal
 Boring, Drilling tools and Bits	• For drilling or shaping holes of different sizes in wood	• Place boring and drill bits back into the plastic sleeve or case you bought them in • Use the correct boring tool or drill bit for material it was designed for
 Electric/cordless hand drill	• For drilling holes through materials of different thicknesses • Can sometimes be used as a screwdriver	• Keep the hammer face clean and ensure that the handle is firmly attached to the head • Replace hammer heads when the edge of the head is rounded or worn
 Jig saw	• For cutting curves and complex shapes in wood • For finishing inside corner cuts	• Keep the ventilation slots free from dust and debris • Make sure the handle is clean, dry and free of oil or grease

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Portable circular/skill saw	• Can be used to cut wood, metals, plastic, fiberglass, cement blocks, slate and brick if the correct blade is fitted	• Use the right circular saw blade for the material you want to cut • Clean the skill saw after each use
 Orbital sender	• For quick sanding of flat surfaces • For smoothing out wood surfaces	• Ensure that the electrical cable is in a good condition • Do not overload (put too much pressure on) the machine
 Router	• For making cut-outs, duplicates from a pattern, edging, cut joints, and decorative surface cuts	• Properly store the router bits • Router bits should be replaced as soon as they become blunt • Keep the ventilation slots

Plumbing tools:

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Tin snips	• Cutting straight cuts and curves in sheet metal	• Keep clean and dry • Wipe the blade with an oiled cloth after use
 Hack saw	• To cut metal • To cut plastics	• You should regularly inspect hacksaw blades for signs of damage including warping or blunting • Replace blades if they show signs of wear and tear
  Pop rivet gun	• To secure pop rivets	• Use a cloth to wipe the riveter clean after each use • Store the riveter in a toolbox when not in use
 Ball pein hammer	• Used to shape metal • To snap head rivets	• Keep the hammer face clean and ensure that the handle is firmly attached to the head • Replace hammer head when the edge of the head is rounded or worn

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Anvil	• Used as workplace to forge or shape metal objects	• Cover the anvil with a cotton cloth when not using it • Add oil to the surface of the anvil after cleaning it with a damp cloth
 Scriber	• To mark off lines on metal	• Clean the scribe after use • Store in a dry place
 Pipe cutter	• To cut copper and galvanised pipes	• Oil the moving parts regularly
 Gas torch	• To heat copper pipes when bending or soldering	• Purge torch of all butane before filling and refilling • Clean the jets regularly

Name of tool	Uses	Storage/ Maintenance and handling (Good housekeeping)
 Reamer	• To remove burr on the inside of pipes after cutting	• Remove build-up along the reamer cutting edges • Store the reamer in a manner that will not dull the cutting edges
 Centre punch	• To punch a dent or hole in sheet metal to mark points prior to drilling	• Sharpen the tip of the punch regularly
 Spring divider	• To mark metal surfaces before cutting	• Keep the dividers clean and dry • Protect the points against damage
 Plunger	• Used for clearing blockages in drains and pipes	• Clean and disinfect the plunger after use
 Grooving tool	• Used for cutting threads and recesses for joining pipes and fittings	• Inspect the jaw and die bits for excessive wear • Clean tool of all metal cuttings

Activity 3

3.1 Explain the use of the following tools.

- **3.1.1** Measuring tape
- **3.1.2** Marking gauge
- **3.1.3** Firmer chisel

Activity 3.2

3.2 Explain the use of the following tools:

- **3.2.1** Electric drill
- **3.2.2** Orbital sander

Activity 3.3

Identify and state the use of the following tools:

Equipment	Identification	Use
A 		
B 		
C 		

Activity 3.4

3.4.1 The pictures below are of hand tools used on sites and in workshops. Write down the correct name for each tool.

A 	B 
C 	D 
E 	

Activity 3.5

3.5.1 The pictures below are of tools used on sites and in workshops. Write down the correct name and use for each tool.

Equipment	Identification	Use
A 		

Equipment	Identification	Use
B 		
C 		
D 		

Materials

CHAPTER

4

LEARNING OUTCOMES

By the end of this chapter, learners should be able to identify and classify ferrous and non-ferrous metals, woodworking materials and building materials.

The following will be covered in this chapter:

- Learning about ferrous metals
- Learning about non-ferrous metals
- Woodworking materials
- Building materials

Identify and differentiate between ferrous and non-ferrous metals

Did you know
The word 'ferrous' is derived from the Latin word ferrum which means 'iron'

The main ingredient of a ferrous metal is iron which means that ferrous metals contain iron and non-ferrous metals do not. Non-ferrous metals contain little or no iron. When carbon is added to iron the material becomes steel. Ferrous metals have a high carbon content which generally makes them vulnerable to rust when exposed to moisture.

Ferrous metals and non-ferrous metals each have their own distinctive properties. These properties determine the applications they are most suited for.

New words

tensile strength - the maximum stress that a material can withstand while being stretched or pulled before breaking.
malleability - a material's ability to form thin sheets under pressure by hammering or rolling. Examples of malleable metals are gold, iron, aluminium, copper, silver and lead.

Some common ferrous metals include alloy steel, carbon steel, cast iron and wrought iron. Ferrous metals have a high **tensile strength** and durability. Carbon steel is used in the construction industry and is used in skyscrapers and bridges. Ferrous metals are also used in shipping containers, industrial pipes, motor vehicles, railroad tracks, and many commercial and domestic tools.

Most ferrous metals are magnetic which makes them very useful for motor and electrical applications. The use of ferrous metals in your refrigerator door allows you to pin your shopping list on it with a magnet.

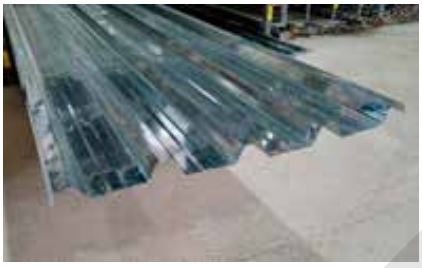
Non-ferrous metals include aluminium, copper, lead, zinc and tin, as well as precious metals like gold and silver. Their main advantage of non-ferrous metals over ferrous materials is their **malleability**. They also have no iron content, giving them a higher resistance to rust and corrosion, and making them ideal for gutters, liquid pipes, roofing and outdoor signs. Non-ferrous metals are non-magnetic, which is important for many electronic and wiring applications.

Examples of ferrous metals:

Material	Properties	Uses
Cast iron	• Easy to cut • Very hard, but breaks easily	• Gates, • benches, • doorknobs, • water pipes.
Mild steel	• fine and smooth appearance • easy to bend	• Galvanised water pipes, • corrugated roofs, • post boxes
Stainless steel	• easy to clean • corrosion-proof	• taps, • kitchen sinks, • toilet pans, • pipes

Examples of non-ferrous metals:

Material	Properties	Uses
 Aluminium	• very light • corrosion-proof	• window and door frames, • balustrades
  Brass	• malleable • easily machined	• compression fittings, • doorknobs, • door locks, • light fittings

Material	Properties	Uses
 Copper	• durable • good conductor of heat and electricity	• cold and hot water pipes, • pipe fittings, • doorknobs
 Zinc	• fairly hard • rustproof/rust-resistant	• bolts and nuts, • coating of mild steel (to prevent corrosion), • electrical equipment

Woodworking materials

Timber:

Material	Properties	Uses
 South African Pine	• Tough • Resinous	• Floorboards • Ceilings • Furniture

Material	Properties	Uses
 Meranti	• Fairly open, straight grain • Inclined to warp	• Durable furniture • Skirtings • Mouldings

Board products:

Material	Properties	Uses
 SupaWood (MDF)	• Easy to machine and work • Manufactured by compressing wood fibres	• Cupboard panels • Counter tops • Door panels
 Plywood	• Workable without difficulties • Equally strong across the length and width	• Bottom of drawers • Door panels • Cupboard panels

Building Materials:

Material	Properties	Uses
Sand	• Should not contain too much clay • Should contain fine particles	• Building • Plastering • Paving.
Water	• Tasteless and odourless • Should be clean and free from chemicals	• For mixing mortar • Increase workability of concrete
Cement/Lime	• Provides strength to masonry • Improves the workability of mortar and plaster mixes	• Binding ingredient in concrete, mortar and screed
Fine/Coarse aggregate	• Must be clean, hard, coarse and durable • It binds the various aggregates in a concrete mixture	• Roadway base course • Adding volume to concrete • Backfill
Bricks	• Available in a variety of colours • Cavities in bricks allow bricks to dry faster	• Building walls • Paving • Landscaping
Building blocks	• Strong and durable • Can have one or more cavities	• Building walls • Boundary walls

Activity 4.1

4.1.1 Differentiate between ferrous and non-ferrous metals?

4.1.2 Identify ferrous and non-ferrous metals by completing the table.

Metal	Ferrous or non-ferrous
1.2.1 Copper	
1.2.2 Cast iron	
1.2.3 Mild steel	
1.2.4 Aluminium	

4.1.3 List one example from school or home where the following materials are used:

- 4.1.3.1 Aluminium
- 4.1.3.2 Brass
- 4.1.3.3 Stainless steel

Activity 4.2 – WOODWORKING MATERIALS

4.2.1 Differentiate between board products and solid timber.

4.2.2 List ONE specific use of the following:

- 4.2.2.1 Saligna
- 4.2.2.2 S.A. Pine
- 4.2.2.3 Shutter board
- 4.2.2.4 Chip board

Activity 4.3 – BUILDING MATERIALS

4.3.1 |Work in groups and collect different types of building material used for building

- » Cement
- » Coarse aggregate
- » Fine aggregate
- » Bricks

4.3.2. Explain the purpose of cement in the concrete mix.

4.3.3. Define the term 'Hydration'.

Joining

CHAPTER 5

LEARNING OUTCOMES

By the end of this chapter, learners should be able to understand and practically be able to join sheet metal, wood and bricks.

The following will be covered in this chapter:

- Joining of sheet metal
  - » Joining of sheet metal by means of a lap joint using rivets
  - » Grooved seam joint
- Joining of wood
  - » Butt joint
  - » Half lapped joint
- Joining of bricks
  - » Joining brick
  - » Dry packing of Half brick wall showing the toothing and raking back

Introduction to Joining:

Joining is the process that involves joining together materials, to produce more complex items. Materials can be joined by means of nails, screws, adhesives, mortar, screed, pipe joints, etc.

Joining of sheet metal (lap joint)

Joining of sheet metal by using rivets:

Joining of sheet metal by means of pop rivets are used in different applications to secure two or more components, such as plastic or sheet metal via pre-drilled holes.



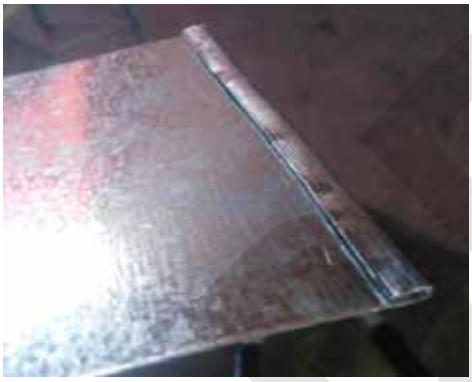



Grooved seam joint

A grooved seam joint is one of the most widely used methods for joining light- and medium-gauge sheet metal. A folded seam is made by folding the edges of both ends of the metal and hooking the folds together before pounding flat with a mallet and soldering. The folded seams are simple, but not as long-lasting or water-tight as some newer, machine-made seams.

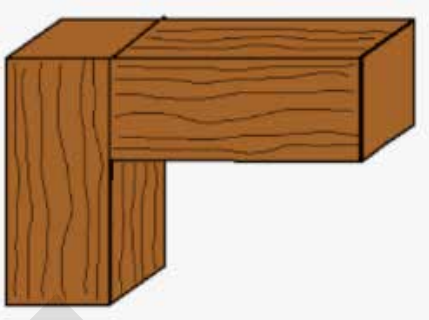






Joining of wood

Butt joint



A butt joint is the most basic of woodworking joints and it joins two pieces of wood by merely butting them together. Butt joints is an easy woodworking joint but it is also the weakest type of joint. Butt joints rely on screws or nails and glue for reinforcement. Biscuits or dowels can also be used for reinforcement of a butt joint.

Half Lapped joint

A half-lap joint is a carpentry and woodworking joint made between two pieces of wood. This joint involves removing half the thickness of both pieces of wood and then mating them together to create a thickness that is uniform with the rest of the wood pieces. The halved joints are fitted into one another to create a locked joint.

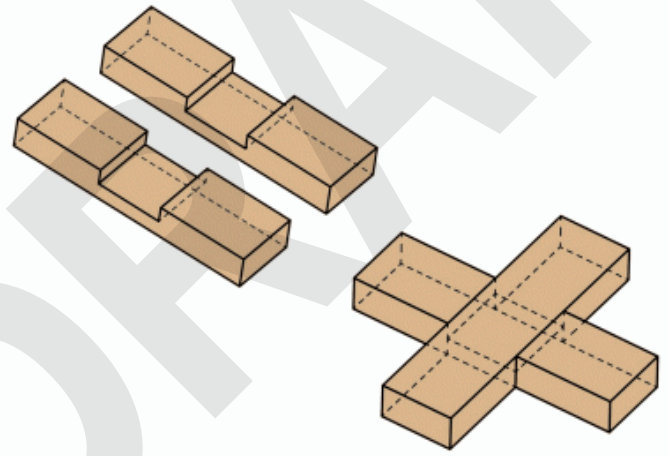
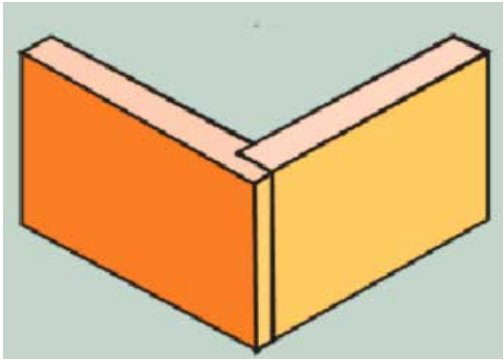


Figure 1 Example of a half lapped joint

Rebate joint



The rebate joint is a very similar to the butt joint but the big difference between the two is that one of the ends of the timber has a groove cut out of it to create much better holding strength. This type of joint is usually used as a corner joint. Rebating refers to cutting a 90° rectangular block out of a piece of wood to create an 'L' shape. A rebate joint can be reinforced with glue and screws, nails or dowels.

Joining of bricks

Joining brick

Brick joining means to place bricks together in a particular way in order to obtain the best bond. The pattern in which bricks are laid is called the brick bond. It applies to both brick walls and brick paving for patios and paths, as well as to concrete block and other types of masonry construction

Bricks can be placed in different bonds.

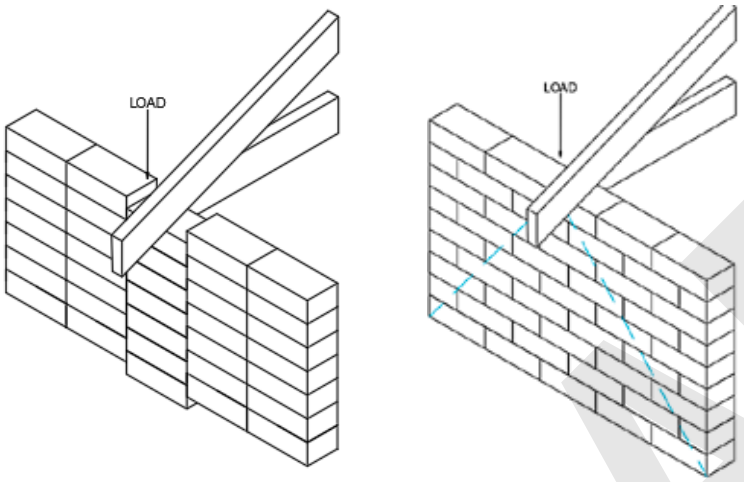


Figure 1 Examples of brick bonds

The primary purpose of a bond is to ensure the brickwork is strong and stable.

JOINING

Activity 5.1

5.1 Make a neat drawing of the following joints

- **5.1.1** Rebate joint
- **5.1.2** Butt joint
- **5.1.3** Half lap joint

Mortar and Concrete

CHAPTER

6

LEARNING OUTCOMES

By the end of this chapter, learners should be able to understand the concepts and definition of mortar and concrete. They should be able to practically prepare, mix proportions and place mortar and concrete.

The following will be covered in this chapter:

- Defining mortar / dagha
- Defining concrete
- Preparation, mixing proportions of mortar and placing of mortar
- Preparation, mixing proportions of concrete and placing of concrete

Mortar:

Mortar (dagha) is a proportional mixture of cement, sand and water. Lime can be added to make it more workable. Mortar is used as a binding material when building with brick, block, and stone. Mortar is also used for plastering.

Preparation, mixing proportions of mortar and placing of mortar.

Concrete:

Two methods of mixing concrete:

- Hand mixing
- Machine mixing

Hand mixing of concrete

Figure 1 Hand mixing of concrete

Concrete Mixer (Machine)

Figure 1 Concrete mixer

Concrete:

Concrete is a mixture of cement, sand (fine aggregates), stones (coarse aggregates) and water. Concrete is stronger and more durable so it can be used for structural projects such as setting posts, foundations, slabs and masonry. The ratio of cement, sand and stone used in the mixing of the concrete, determines the strength of the concrete.

	Cement	River Sand	Stone
Low-strength concrete 15 Mpa	1	$3\frac{1}{2}$	$3\frac{1}{2}$
Medium-strength concrete 25 Mpa	1	$2\frac{1}{2}$	$2\frac{1}{2}$
High-strength concrete 30 Mpa	1	$1\frac{3}{4}$	$1\frac{3}{4}$

MORTAR AND CONCRETE

Activity 6.1

6.1 In groups, write the difference between mortar and concrete. Redraw the table below to answer.

Mortar	Concrete

6.2 List two uses each of concrete and mortar.

Mortar	Concrete

6.3 Name two ways that is used to mix concrete.

6.4 Complete the table by filling in the ingredients of mortar and concrete.

Mortar	Concrete

Practical tasks

Activity 6.2

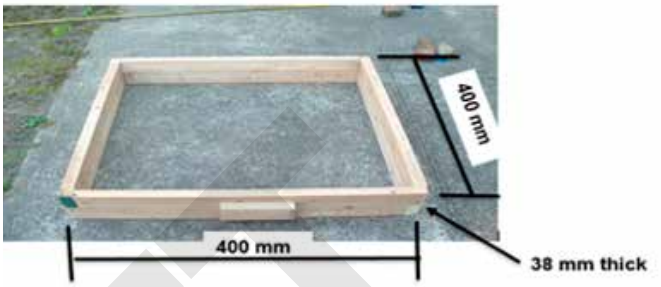
Figure 1 Concrete used for paving

In groups, make use of materials to mix a medium strength concrete to be used for paving around your school. Use the table below to indicate the correct mixing ratio to achieve the medium strength. After completion, cover with plastic and leave it to set for 21 days.

Instructions

The teacher should supply the learners with the following:

- Formwork to all the groups
- Tools and equipment
- Materials needed



Foundations and Trenches

CHAPTER

7

LEARNING OUTCOMES

By the end of this chapter, learners should be able to define and identify types of foundations.

The following will be covered in this chapter:

- Learning about foundations and trenches
- Strip foundation
- Stepped foundation

Trenches

Trenches are excavated manually or by machinery. Excavation simply means the removal of soil. The trenches are filled with concrete to be used as foundation for building or construction.

Manually excavated trenches are done using:

- Picks
- Shovels and spades
- Wheelbarrows

Excavating trenches using a machine:

- Excavator
- Jack hammer

Machine Excavation

Manual Excavation

Safety – Trenches

- Must be inspected daily for signs of collapse.
- If trench is to deep, use a ladder to enter and exit.
- Do not leave unnecessary tools and equipment in the trench.
- Ensure the walls of the trench are secure.

Foundations

Foundation – is the lowest load-bearing part of a building, typically below ground level.

Strip foundation

Strip foundations are types of shallow foundations that provides a continuous longitudinal bearing to a linear structure such as a wall or closely spaced rows of columns.

Figure 1 Example of strip foundation

Stepped foundation

Stepped foundations are foundations that provide support to structures, transferring their loads to layers of soil or rock that have sufficient bearing capacity and suitable settlement characteristics.

Figure 1 Example of stepped foundation

Activity 7

7.1 Discuss two ways that are used to excavate trenches

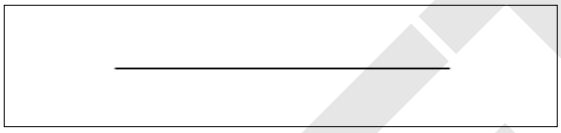
7.2 Explain two safety precautions that must be observed when working in trenches.

7.3 Setting out a right angle for a site.

The 3-4-5 triangle method is used to commence with the setting out of a small building that needs to be constructed.

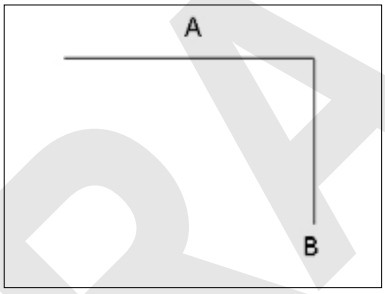
Step 1

Mark out 4m on one side using pegs and string.



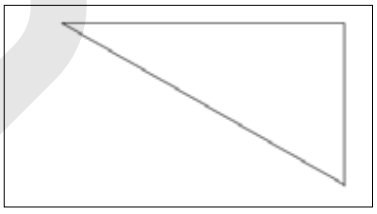
Step 2

From one of the pegs, mark off 3m at approximately 90^0.



Step 3

From A measuring 5m on string, move peg B so that the peg meets the string from A. The resultant corner between the 3 m and 4 m strings will be 90^0.



Brickbonding

CHAPTER

8

LEARNING OUTCOMES

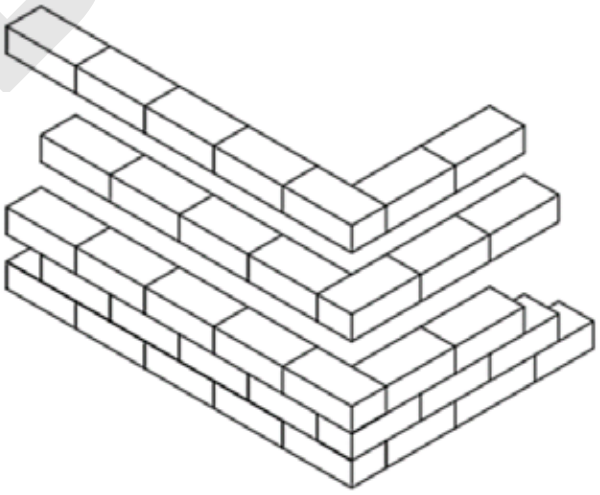
By the end of this chapter, learners should be able to identify and draw different types of brick bonds and walls. They should also be able to dry pack straight walls with toothing and raking ends, as well as corner junctions.

The following will be covered in this chapter:

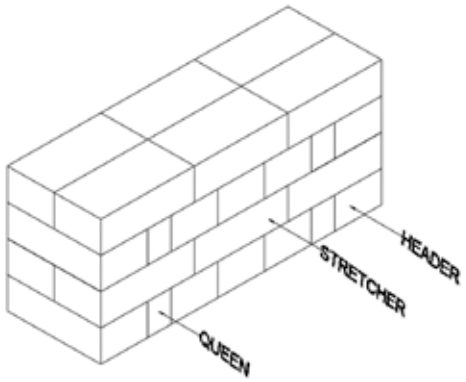
- Learning about brick bonds
  - » Stretcher bond
  - » English bond
- Learning about types of walls
  - » Straight wall
  - » Corner junction
- Draw a plan view of alternate courses of brick work
- Dry packing of:
  - » Straight wall with toothing and raking ends
  - » Corner junction

Identification of brick bonds:

Stretcher bond

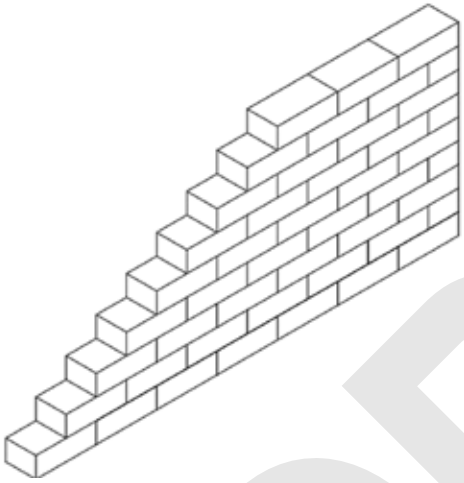


English Bond

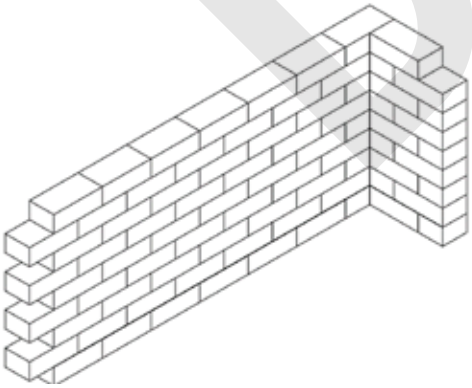


Types of walls:

Straight wall

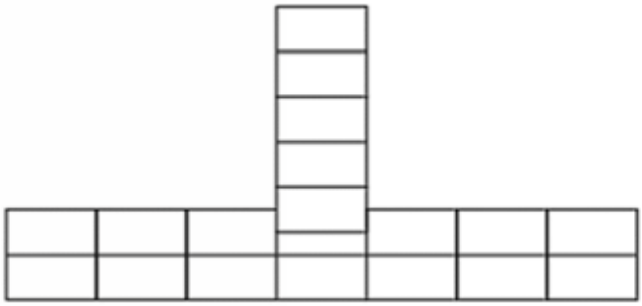


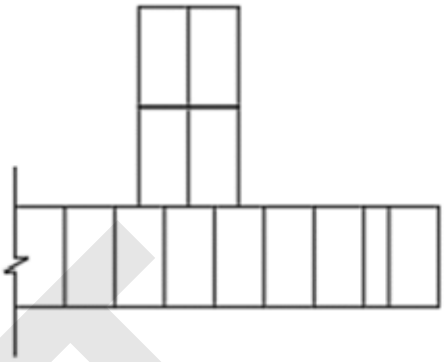
Corner junction



Drawing

Alternate courses of brick work - plan view

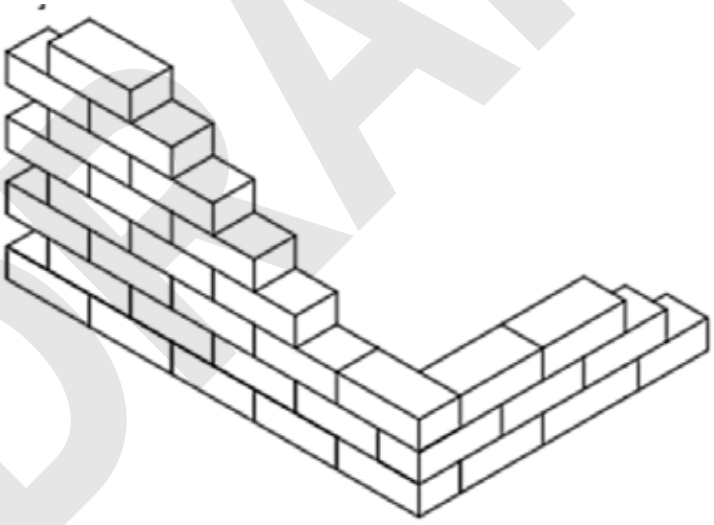




Dry packing

Straight wall with toothing and raking ends

Corner junction



BRICKBONDING

Activity 8.1

Dry packing of ½ brick wall in stretcher bond.

Instructions:

The figure below shows a front elevation of a Half Brick Wall build in stretcher bond

In groups dry, pack bricks showing a ½ Brick wall built in stretcher bond.

- 6 bricks long (1320 mm)
- 5 courses high (375 mm)
- Place D.P.C after two courses

Materials needed:

- Bricks
- DPC
- Straight edge
- Measuring tape
- Chalk/Chalk line

Simulation:

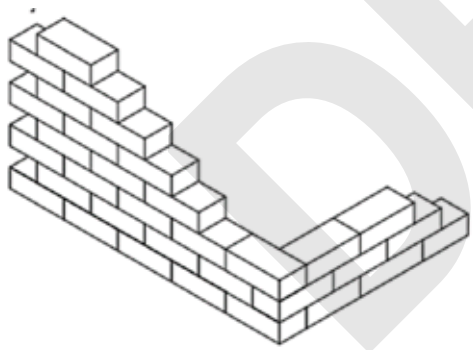


Figure 1 Example brick wall

Water Cycle/Supply

CHAPTER

9

LEARNING OUTCOMES

By the end of this chapter, learners should be able to understand the water cycle and to identify different items on a model/picture/drawing/on-site plan.

The following will be covered in this chapter:

- Learning about the water cycle
- Illustrate the cycle of water by means of a diagram
- Learning about water catchment areas, dams and reservoirs
- Identification of a water meter, stop cock, taps and mixers on a model/ picture/drawing/on-site plan

Understand the water cycle.

In this chapter we are going to talk about the water cycle - how water evaporates from the surface of the earth, rises into the atmosphere, condenses into rain or snow in clouds and falls again to the surface as precipitation.

Illustrate the cycle of water by means of a diagram

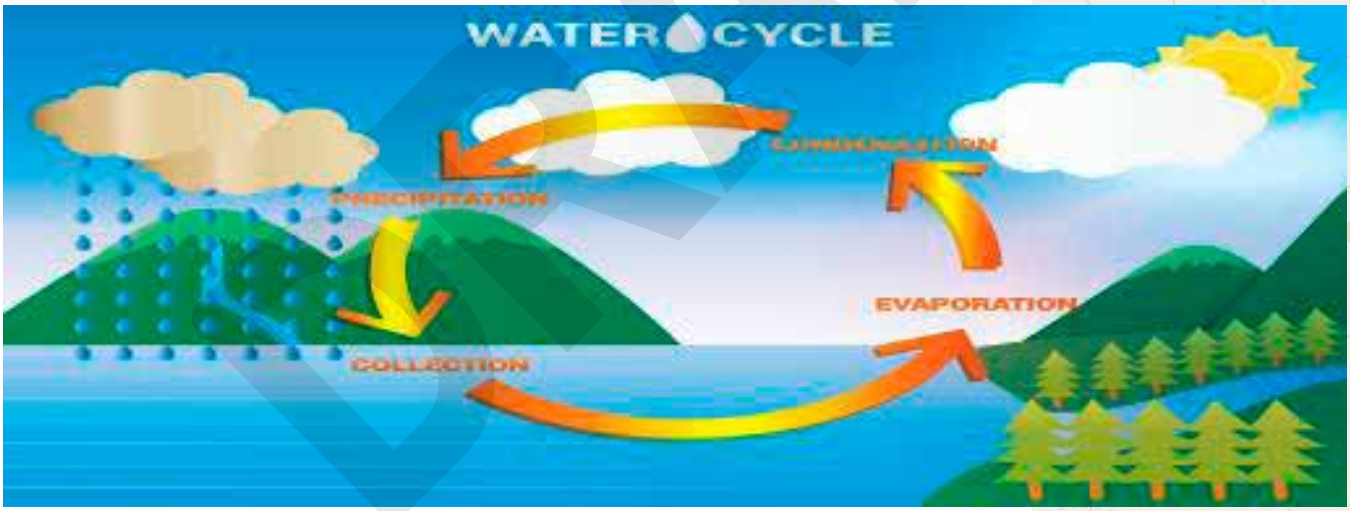


Figure 1 The water cycle

Four main process of water cycle.

There are four main stages in the water cycle.

1. Evaporation
2. Condensation (clouds)
3. Precipitation(rain)
4. Collection.

1. Evaporation

Evaporation is the process by which liquid or water changes from a liquid state to a state of gas. Water enters the atmosphere as water vapour. Energy from the sun heats up water in the ocean, dams, rivers and lakes. For example: In the household when water is heated, it releases steam that goes up to the atmosphere. This is what we call evaporation.

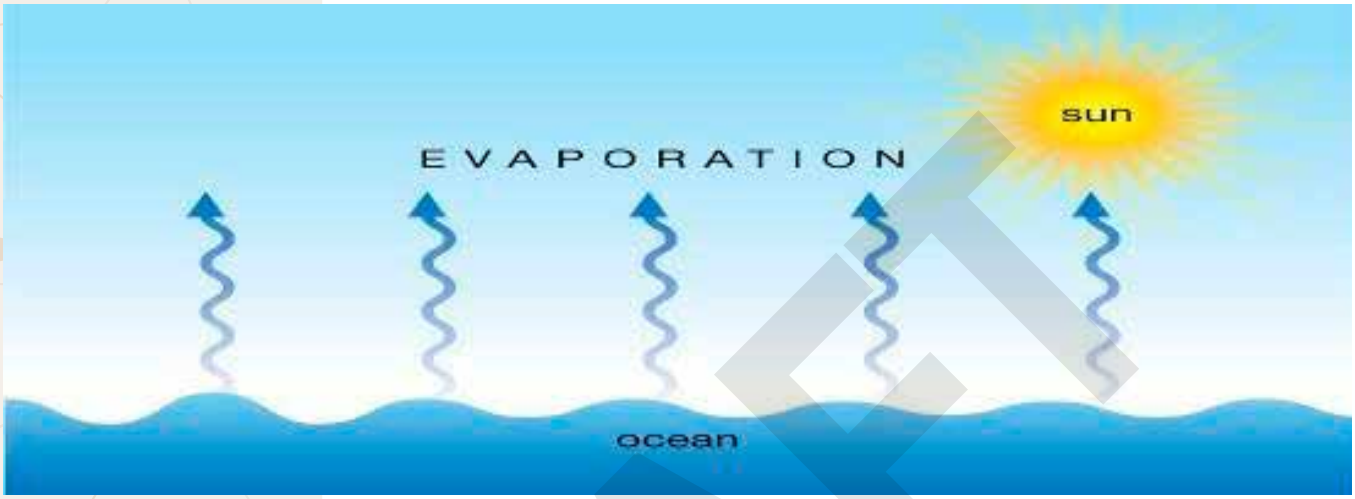


Figure 1 Evaporation

2. Condensation.

Condensation is the process that follows evaporation, when water vapour changes to liquid. This process is the opposite of evaporation. Water changes from a state of gas into a liquid state. When water vapor comes into contact with solid objects like clouds it cools down and water is formed. For example: When the steam from heated water comes into contact with a hard object, water will be formed. That is what we call condensation.

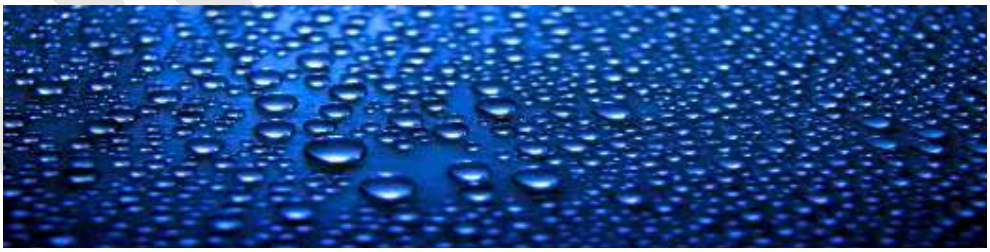


Figure 1 Condensation

3. Precipitation.

Precipitation is any form of water that is formed in the atmosphere and falls back to the earth. This water will come down in the form of rain, snow and hail. In our case precipitation is formed in the clouds and that is where we get rain drops, snow and hail.

Figure 1 Precipitation

4. Collection.

This is when water that falls from the clouds as rain, snow, hail or sleet, collects in the oceans, rivers, lakes, streams. Most will infiltrate (soak into) the ground and will collect as underground water.

Water catchment areas

A catchment is an area where water is collected by the natural landscape. We use the water collected by the natural landscape to help supply water for our needs, by building dams and weirs, or tapping into groundwater. This is called the water supply system.

Dams

Figure 1 Dam

Reservoirs

A reservoir is most commonly as an enlargement or artificial lake, pond or impoundment created using a dam or lock to store water.

Figure 1 Water reservoir

Identification of the following in a form of a model/ picture/drawing/on site plan:

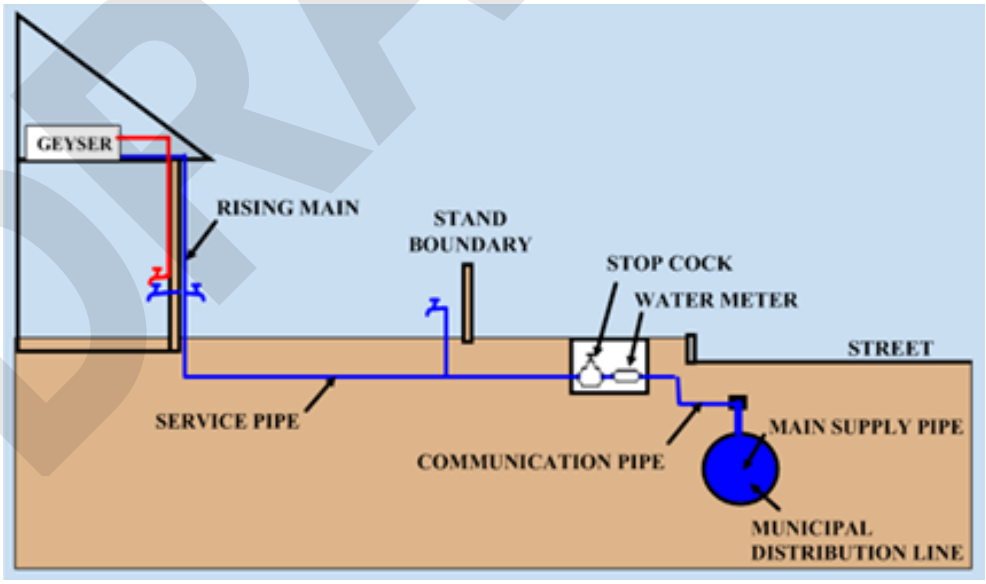


Figure 1 Water supply diagram

Water meter

A water meter is measuring the quantity (volume) of water that passes through a pipe or other outlet. Typically, water meters use a standard unit of measure for volume, such as litres or kilolitres.

Stopcock

A stop tap, sometimes called a stopcock, is a small tap located on a water pipe. There are two types of stop taps: internal and external. They are easy to use and turn the flow of water on and off.

Taps

Tap water (also known as faucet water, running water, or municipal water) is water supplied through a tap or a water dispenser valve.

Mixers

A mixer tap combines hot and cold water together through one spout, and the user alters the temperature by either one or two controls. This is different to other taps where you may have two separate taps each with their own spout for separate hot and cold water.

THE WATER CYCLE

Activity 9.1

9.1.1 Name any two stages of the water cycle.

9.1.2 Describe one stage of the water cycle.

Activity 9.2

9.2.1 Name three types of pipes that are used for cold water installation in a dwelling.

9.2.2 Describe the following:

- **a.** Rising main
- **b.** Main supply
- **c.** Service pipe

Sanitary Fitments

CHAPTER

10

LEARNING OUTCOMES

By the end of this chapter, learners should be able to identify sanitary fitments on a model/picture/drawing/on-site plan.

The following will be covered in this chapter:

- Learning about sanitary fitments
  - Water closet
  - Wash basin
  - Bath
  - Shower
  - Sink

INTRODUCTION

In Civil Technology the word 'sanitary' refers to conditions that affect hygiene and health, and in particular, sewage facilities and clean drinking water. It can also refer to a state of cleanliness or hygiene. Sanitation refers to the provision of sewage facilities and clean drinking water.

Sanitary fittings connect sections of piping systems to regulate the flow of fluid, but sanitary fittings are specially designed and made to prevent the entrapment, formation, and spread of bacteria in the piping system.

Sanitary fitments can be divided into to two categories:

- Soil water appliances:
  To remove solid waste material. Examples of soil water appliances include toilets, bidets, urinals and bed pan sinks.
- Wastewater appliances:
  To collect and remove water once it has been used. Examples of wastewater appliances include bathtubs, sinks, showers and wash basins.

Identification of sanitary fitments on a model/picture/drawing/on site plan:

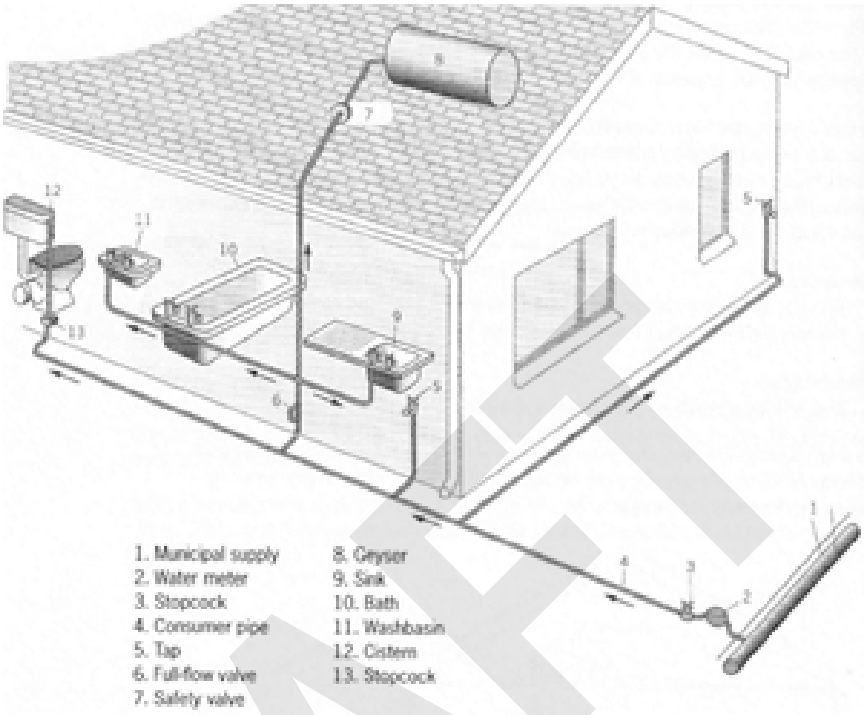


Figure 1 Sanitary fittings in a house

Water closet

Closed couple cistern system

Side flush

Dual flush system

Wash basin

Wall mounted hand wash basin, manufactured with 8 mm thick ceramic.

Figure 1 Wash basin

Bath

A bathtub or bath is a container for holding water in which a person or animal can wash. Most modern bathtubs are made of thermoformed acrylic, porcelain enamelled steel, fiberglass-reinforced polyester, or porcelain enamelled cast iron.

Figure 1 Bath

Figure 1 Shower

Shower

A shower is a cubicle or bath in which a person stands to wash. Water is sprayed on the body, usually from an overhead perforated nozzle (showerhead).

Sink

A sink is a bowl-shaped plumbing device that is used in the kitchen for washing dishes and preparing food. In a bathroom the sink can be used to wash your hands or face. Stainless steel is an obvious choice for a kitchen sink because it cleans up quickly and looks good. Porcelain is normally used for bathroom sinks.

Single bowl sink

Double bowl sink

Sanitary fitments:

Activity 10

10.1 Sanitary fitments are divided into two categories. Name two of them.

10.2 Name three wastewater appliances used at home.

10.3 Give an example of soil water appliance

Timber

CHAPTER

11

LEARNING OUTCOMES

By the end of this chapter, learners should be able to understand and identify various characteristics of timber.

The following will be covered in this chapter:

- Learning about timber
- Sketch and label the cross-section of a tree trunk
- Learn about the conversion methods of timber
- Learn about the characteristics of softwood
- Learn about the characteristics of hardwood
- Learn about the characteristics of manufactured boards

INTRODUCTION

Timber is wood that is used for building material and making furniture. Timber can be classified as either softwood or hardwood, depending on the type of tree the timber comes from. Timber from hardwoods is normally more dense than softwoods.

There are a number of benefits of using timber in construction:

- It is readily available. Timber is a natural material used in many forms for building and construction.
- It is safe.
- It is easy to work with.
- It is cost effective.
- It is versatile and visually appealing.
- It is naturally anti-corrosive.

Identify and describe the following:

Sketch and labels of the cross-section of a tree trunk

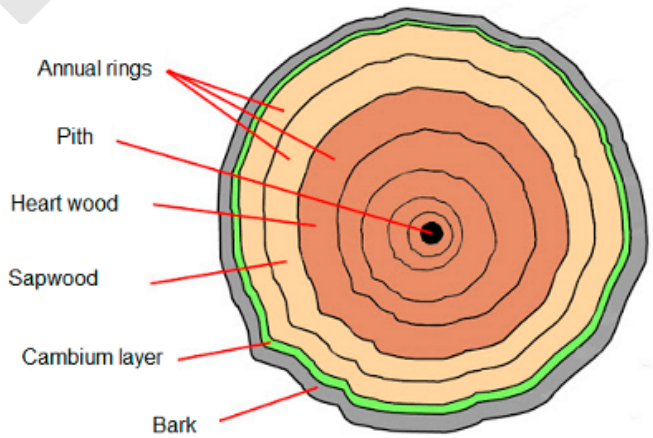


Figure 1 Cross-section of a tree trunk

Conversion methods of timber

(Through and through, square and quarter methods)

As soon as possible after felling the tree should be converted into usable timber.

Timber conversion is the process of turning a log into a pile of usable planks or boards. This involves the cutting of logs into slab sizes of timber suitable for use in the marketplace. The method of cutting depends on the following:

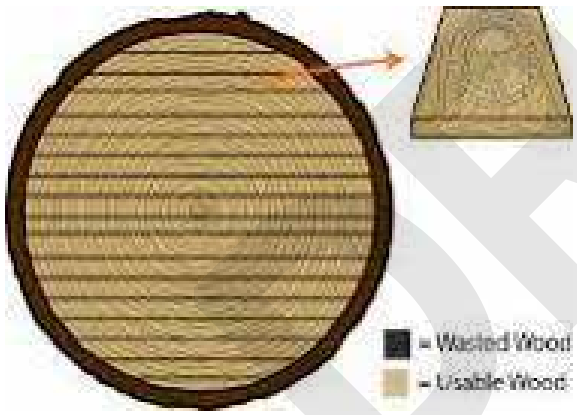
- Size required
- Quality of the logs.
- The kind of timber,
- Purpose for which the wood is to be used.

There are three main methods of converting timber:

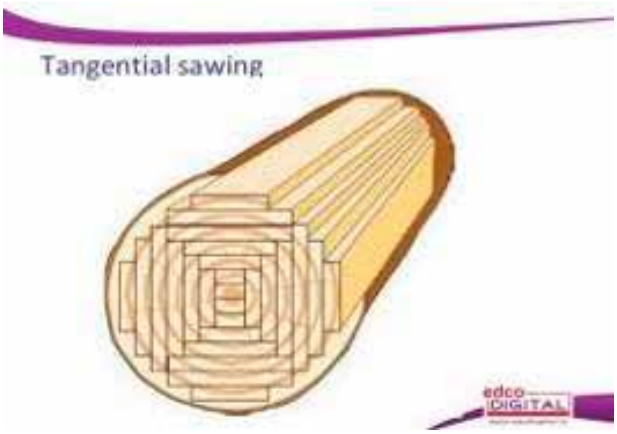
- Through and through (or Plain),
- Square method, and
- Quarter method also referred to as rift sawn.

Methods of conversion

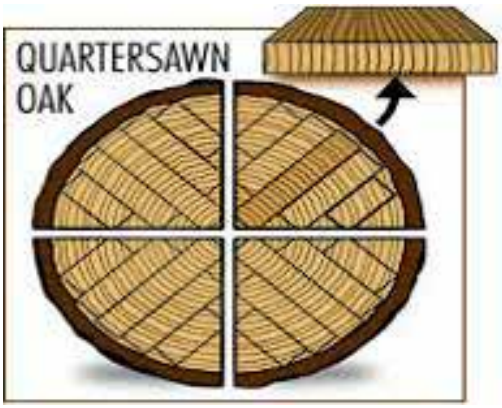
Through and through/Economical or plain method



Square method



Quarter sawing method



Solid wood (Soft and Hardwood) is available in the following standard sizes:

Size	Pictures	Lengths
38x38 (mm)		From 0.9 m - 6.6 m
76x50 (mm)		From 0.9 m - 6.6 m
114x38 (mm)		From 0.9 m - 6.6 m
228x38 (mm)		From 0.9 m - 6.6 m

Characteristics of softwood

Pine

Wood	Characteristic
	• Light to dark yellow in colour • Straight grain • Easy to work, using hand and power tools • Easy to finish using varnish and paint

Characteristics of hardwoods

Meranti

Wood	Characteristic
	• It is yellowish to reddish brown in colour. • Medium coarse but even. • Easy to work, using both power tools and hand tools. • Easy to finish using varnish

Manufactured boards

Manufactured boards are manmade. They are manufactured by processing wood, usually from wood that could not be used as higher grade, during conversion on timber.

Characteristics of Manufactured boards

Board product	Characteristic
Plywood	• It consists of odd number of layers, starting from 3 to seven and more. (3 to 7 is a ply and more is called a multi-ply) • It can be used internally and externally. • The layers alternate at an angle of 90 degrees • Very strong
 Hardboard	• It is made from wood fibre, fine chips or pulped wood waste. • It cannot be used outside because it absorbs water. • The fibres are rearranged and compressed together to form a hard panel. • It is stronger than wood

Board product	Characteristic
 Chip board	• Is a rigid board with a relatively smooth surface • It is difficult to burn • It is resistant to warping and will not splinter
 SupaWood	• Made by bonding fine wood fibres • Easy to work with when using machine • It can be shaped without chipping
 Soft board	• For insulation in the ceiling, and under floorboards • Good insulator for sound and heat • Used for notice boards and pin boards

TIMBER

Activity 11

11.1 Sketch the cross-section of a tree trunk and label its parts.

11.2 Name one softwood and one hardwood.

11.3 Name two characteristics of the softwood and hardwood you have named in the above question.

Finishing

CHAPTER

12

LEARNING OUTCOMES

By the end of this chapter, learners should be able to identify and use a variety of finishing products and processes.

The following will be covered in this chapter:

- Sandpaper with attention to the different grits
- Sanding sealer
- Raw linseed oil or any other type of oil
- Varnish or Stain
- Painting
- Plastering
- Galvanizing
- Powder coating

What is wood finishing?

Wood finishing refers to the process of refining or protecting a wooden surface, especially in the production of furniture. Finishing can also make wood easier to clean and keep it sanitised, sealing pores that can be breeding grounds for bacteria.

Identify and use of the following finishing products/ processes:

Sandpaper with attention to the different grits

The following grits of sandpaper must be used to prepare the model for finishing – 180 grit (or finer), 80 grit and 60 grit. Sandpaper removes the scratches, pencil marks and dents.

Sanding sealer

Sanding sealer seals the timber so that a finish can be applied.

Remove wood dust and wipe the project clean. Apply the first coat of sanding sealer and allow the sealer to dry. Lightly rub the surface with an extra fine sandpaper. Remove dust and finish with preferred woof finish

Raw linseed oil or any other type of oil

Is applied to timber with mutton cloth. This type of finish ensures that the timber becomes durable and tough. Provides a waterproof exterior.

Varnish or Stain

Varnishes

Varnish is obtained in various finishes – matt, glossy and sheen.

There are different colours of varnishes used by woodworkers. These include the following:

- Clear
- Deep mahogany
- Dark Rosewood
- Natural Cedar
- English Oak
- Rich Teak. etc

Stains

Stains are used to alter the shade of the timber. There are various stains as shown below.

Clear Stain

After you have stained the wood, you will need to apply a clear-coat finish. It is best to allow the stain to dry overnight before applying the clear coat. Using clear coat will seal and protect your wood from the possibility of water damage.

Solid Stain

Solid stains are applied in the same manner as clear stains and must be clear coated when used on furniture or interior trim. People often choose solid stains for use on exterior cedar trim and siding.

Painting

Paints are also used to finish timber as some types of may not have an attractive grain.
Two basic types of paint used to finish wood are latex and oil. Latex paints are water-based and will clean up with water and oil paints are oil-based and will clean up with paint thinner or mineral spirits.

Plastering

Plastering Trowel

Is a small hand tool with a handle and a flat metal blade.

Figure 1 Plastering trowel

Wooden Float

Is a hand tool with a flat face used for smoothing and finishing the surface of plaster or cement?

Figure 1 Wooden float

Hand Hawk or Hand Board

Is a mall, square, hand-held surface on which a load of plaster or mortar is carried.

Figure 1 Hand hawk

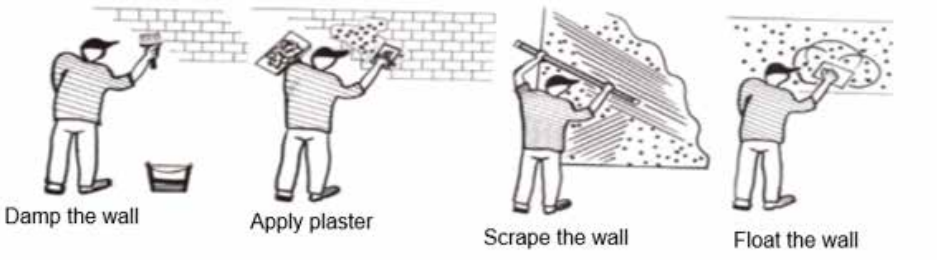
Block Brush

Is a mall wooden block approximately 215 mm in size with bristles fixed into the flat side and a wooden handle fixed to the top?

Is used for wetting down walls before plastering and during the floating operation

Figure 1 Block brush

Steps to be followed when plastering



Galvanising

Galvanisation (or galvanising as it is most commonly called) is the process of applying a protective zinc coating to iron or steel, to prevent rusting. The most common method is hot dip galvanising, in which steel sections are submerged in a bath of molten zinc.

Powder coating

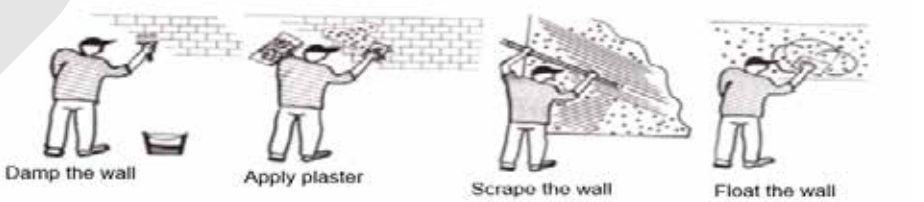
Powder coating is a method of painting metal parts that's much different from traditional painting methods. A dry powder of a certain colour is sprayed onto the metal surface, which holds an electrical charge. The electrical charge causes the powder to fuse to the surface of the metal. Once the spraying is done, the item is baked in a curing oven to achieve a smooth coating. The baking creates a hard finish that is tougher than conventional paint.

FINISHING

Activity 12

12.1 Define the term plastering.

12.2 The figure below shows a worker plastering a wall. List the steps from A -D to be followed when plastering.



A **B** **C** **D**

12.3 What type of tool is used at step C?

12.4 Explain the following terms:

- **Stain**
- **Varnish**

Quantities

CHAPTER

13

LEARNING OUTCOMES

By the end of this chapter, learners should be able to differentiate between units used for measurement. Learners should be able to do simple calculations and calculate the number of bricks needed for a small building.

The following will be covered in this chapter:

- Learning about units used for measurement
  - metre (m)
  - millimetre (mm)
  - square metre (m^2)
  - cubic metre (m^3)
- Do simple calculations on the following:
  - Volume of concrete for a straight trench
  - Square meter of materials such as brick walls
  - Dimensions of different materials
  - Calculation of bricks in a square building
- Calculate the number of bricks needed for a small building:
  - If a brick is 220 x 110 x 75mm and the centre line is provided for a half-brick wall

Units used for measurement

In the Civil technology industry, there is a lot of different objects and sites that must be measured to make calculations. The main units of measurement that is used, is the following:

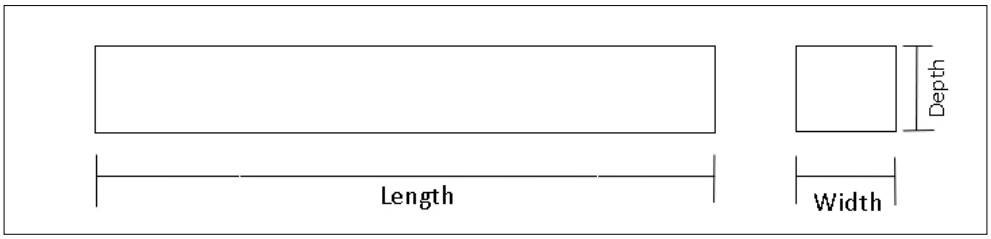
- metre (m)
- centimetre (cm)
- millimetre (mm)
- square metre (m^2)
- cubic metre (m^3)

Simple calculations on volume and area

Volume of concrete for a straight trench

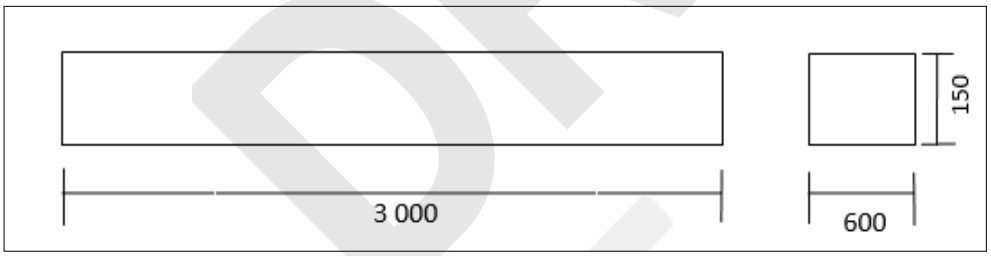
In order to calculate the quantity of concrete needed for a foundation, you need to determine the volume of the trenches. The total length, width, and depth (thickness) of the foundation should be multiplied together. Remember that the volume of concrete is calculated in cubic meters (m^3).

Use the following formula:
Volume = total length of the foundation × width of the foundation × depth (thickness) of the foundation.



Example

The diagram below shows the front and left views of one section of a concrete foundation needed to build a boundary wall.



1. Determine the length of the concrete foundation in metres.
2. Determine the width of the concrete foundation in metres.
3. Determine the depth of the concrete foundation in metres.
4. Calculate the volume of concrete required for this foundation. Round off your answer to two decimals.

Solution

1. 3 000 mm = 3 m
2. 600 mm = 0.6 m

3. 150 mm = 0.15 m
4. Quantity of concrete required

Volume = length of foundation x width of foundation x depth of foundation
= 3 m × 0.6 m × 0.15 m (units are converted to metres to simplify the calculation)
= 0.27 m^3

Figure 1 Square meter of brick wall

Square meter of materials such as brick walls

The number of bricks per square meter is determined by the type of bricks used. It is, therefore, better to provide the brick manufacturer with the surface area detentions of the walls when buying bricks in bulk. Before bricks can be ordered, the surface area of the structure must be calculated. This means that the length and width of the area must be known, i.e., either indicated on the plans or measured.

Formula used to calculate the area of brick walls:

Length x width for rectangular surfaces
or
side x side for square surfaces

Example

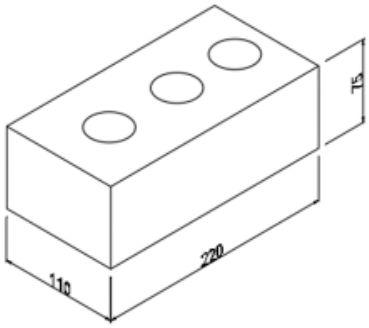
The diagram below shows the front view of a 220 mm thick foundation wall.

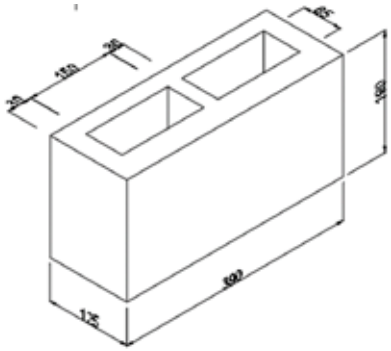
1. Calculate the total area of bricks required to build the wall.

Solution

Total area of bricks required
Area = length x width
= 5,5 m × 0,35 m
= 1,93 m^2 (always round off your answer to two decimal places)

Dimensions of different materials





Calculation of bricks in a square building

Calculate the number of bricks needed for a small building:

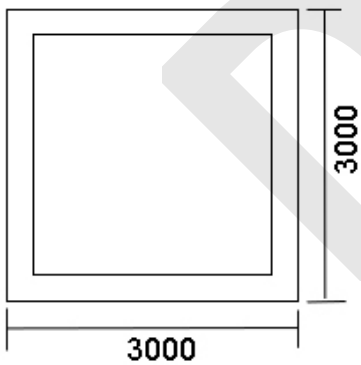
The dimensions of a brick is 220 × 110 × 75mm.

The centre line is provided for a half-brick wall. When calculating the number of bricks, the number of bricks per square meter will be:

- 50 bricks per square meter for a half-brick wall
- Parts/fractions of bricks should always be rounded up to the nearest whole brick.

Example

The diagram below shows the foundation wall of a small square structure. Calculate how many bricks are needed to build the substructure.



Use the following specifications:

- The wall of the substructure is 110 mm thick.
- The height of the substructure measured from the foundation is 450 mm.
- Work on 50 bricks per square metre for a half-brick wall.
- The centre line measurement of the building is 11 560 mm or 11.56 m

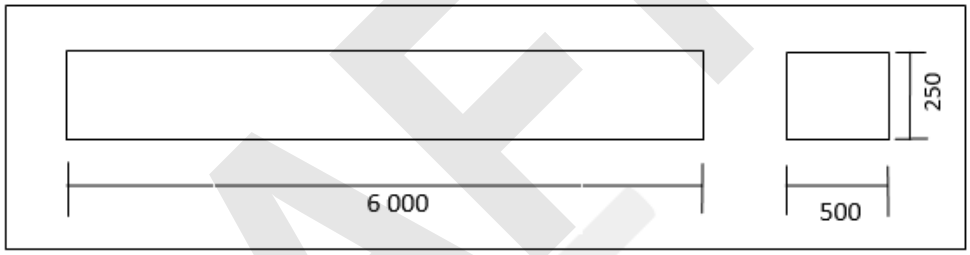
Solution

Number of bricks required = total length (centre line) x height of wall x number of bricks per square metre
= 11.56 m × 0.45 m × 50 bricks/m²
= 260.1
= 261 bricks

QUANTITIES

Activity 13

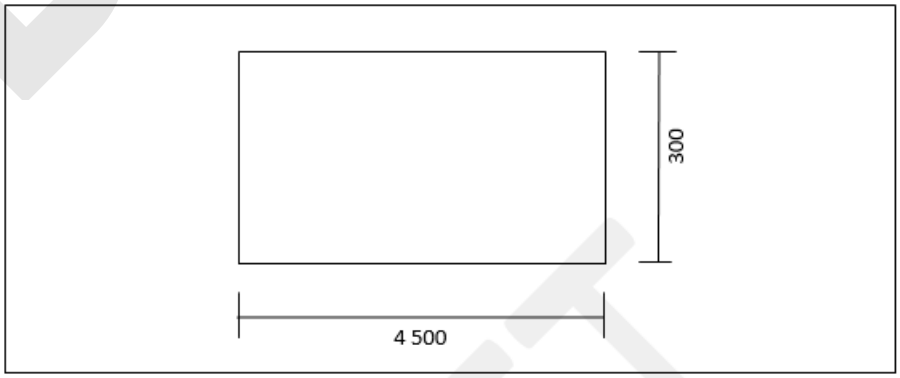
The diagram below shows the front and left views of one section of a concrete foundation needed to build a boundary wall.



13.1.1 Determine the length of the concrete foundation in meters.
13.1.2 Determine the width of the concrete foundation in meters
13.1.3 Determine the depth of the concrete foundation in meters.
13.1.4 Calculate the volume of concrete required for this foundation..

Activity 13.2

The diagram below shows the front view of a 220 mm thick foundation wall.



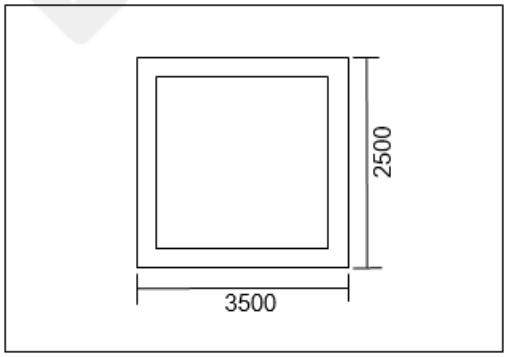
13.2.1 Calculate the total area of bricks required to build the wall

Activity 13.3

Calculate the number of bricks needed for a small building.

If a brick is 220 x 110 x 75mm

The centre line will be provided for a half-brick wall



When calculating the number of bricks, the number of bricks per square meter will be:

- 50 bricks per square meter for a half-brick wall
- Parts/fractions of bricks should always be rounded up to the nearest whole brick.

The diagram below shows the foundation wall of a small square structure.

Calculate how many bricks are needed to build the substructure.

Use the following specifications:

- The wall of the substructure is 110 mm thick.
- The height of the substructure measured from the foundation is 450 mm.
- Work on 50 bricks per square metre for a half-brick wall.
- The centre line measurement of the building is 11 560 mm or 11.56 m

Entrepreneurship

CHAPTER

14

LEARNING OUTCOMES

By the end of this chapter, learners should be able to understand what entrepreneurship is. The following will be covered in this chapter:

- Defining entrepreneurship
- Who is an entrepreneur
- Differentiating between different types of entrepreneurship

What is entrepreneurship?

Traditionally, the definition of entrepreneurship has been limited to starting a new business, scaling for profit and creating business capital. For outside-of-the-box thinkers, that definition was quite narrow. It leaves out the idea that entrepreneurship is a way of thinking. It's a mindset that is opportunity obsessed, holistic in approach and leadership balanced. This new definition of entrepreneurship is about innovation; about seeing problems as opportunities, and about changing the world.

The desire to create something that will forever change the customer experience—that rests at the very centre of an entrepreneur's soul. Entrepreneurs are driven with the passion to change the way the world views and uses products.

Figure 1 Characteristics of an entrepreneur

Who is an entrepreneur?

1. An entrepreneur is a starter. An entrepreneur is an initiator, a challenger and a driver. Someone that creates something new, either an initiative, a business or the number of bricks per square meter company. He or she is the beginning (and sometimes the end) of a venture, project or activity. The entrepreneur might not be the idea-tor, but he or she is the one that decides to make that idea a reality.
2. An entrepreneur is the driver. The entrepreneur is the person in charge, the leader and the person to look to for leadership. He or she is the one that pushes forward and inspires a team to follow. The entrepreneur is the one that sits in the driver's seat, and can change direction, accelerate, slow down or even stop a venture.
3. An entrepreneur is accountable and responsible. The entrepreneur is the ultimate responsible for the destiny of its venture, which can be a company, a project, or any other endeavour. The entrepreneur is the one that has the highest stakes at the venture, thus the one that needs to be empowered to fully direct the endeavour.

Types of entrepreneurships

There are 4 types of entrepreneurships. Anyone interested in starting and running their own business should consider which entrepreneurial model they prefer:

Small business:

Small business entrepreneurship is the idea of opening a business without turning it into a large conglomerate or opening many chains. A single-location restaurant, one grocery shop, or a retail shop to sell your handmade goods would all be an example of small business entrepreneurship.

These individuals usually invest their own money and succeed if their business turns a profit, which they live off. They don't have outside investors and will only take a loan if it helps continue the business.

Scalable start-up:

These are companies that start with a unique idea; think Silicon Valley. The hopes are to innovate with a unique product or service and continue growing the company, continuously scaling up as time moves on. These types of companies often require investors and large amounts of capital to grow their idea and reach multiple markets.

Large company:

Large company entrepreneurship is a new business division created within an existing company. The existing company may be well placed to branch out into other sectors, or it may be well placed to become involved in new technology.

CEOs of these companies either foresee a new market for the company or individuals within the company generate ideas that they bring to senior management to start the process.

Social entrepreneurship

The goal of social entrepreneurship is to create a benefit to society and humankind. They focus on helping communities or the environment through their products and services. They are not driven by profits but rather by helping the world around them.

ENTREPRENEURSHIP

Activity 14

14.1 State the definition of entrepreneurship.

14.2 Name the two things that entrepreneurs want to change in the world.

14.3 Choose a description from Column B that matches an item in Column A

Column A		Column B
14.3.1	Small business	A. Someone that starts something new
14.3.2	Scalable start-up	B. A new business division created within an existing company
14.3.3	An entrepreneur is a starter	C. Single-location restaurant, one grocery shop, or a retail shop
14.3.4	Large company	D. The hopes are to innovate with a unique product or service
14.3.5	An entrepreneur is accountable and responsible	E. A person that is used to loitering around
14.3.6	Social entrepreneurship	F. Helping communities or the environment through their products
		G. The one that has the highest stakes at the venture
		H. Companies that are on the brink of bankruptcy