RTB | RWANDA TVET BOARD

RQF LEVEL 3

BDCCF301

BUILDING CONSTRUCTION

Perform Cement Flooring Construction

TRAINEE'S MANUAL

December 2023

PERFORM CEMENT FLOORING CONSTRUCTION

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LIST OF ABBREVIATIONS AND ACRONYMS

BDC: Building construction

F.R.C: Fibre-reinforced concrete

P.P.E: Personal Protective Equipment

P.S.C: Prestressed Concrete

R.B.C: Reinforced Brick Concrete

R.C.C: Reinforced Cement Concrete

RQF: Rwanda Qualification Framework

RTB: Rwanda TVET Board

TVET: Technical and Vocational Education and Training

INTRODUCTION

This trainee's manual encompasses all necessary skills, knowledge and attitudes required to perform cement flooring construction. Students undertaking this module shall be exposed with practical activities that will develop and nurture their competences. The writing process of this training manual embraced Competency-Based Education and Training (CBET) philosophy by providing practical opportunities reflecting real life situations.

The trainee's manual is subdivided into units, each unit has got various topics, you will start with a self-assessment exercise to help you rate yourself on the level of skills, knowledge, and attitudes about the unit.

A discovery activity is followed to help you discover what you already know about the unit.

After these activities you will learn more about the topics by doing different activities by reading the required knowledge, techniques, steps, procedures, and other requirements under the key facts section, you may also get assistance from the trainer. The activities in this training manual are prepared such that they give opportunities to students to work individually and in groups.

After going through all activities, you shall undertake progressive assessments known as formative and finally conclude with your own self-reflection to identify your strengths, weaknesses, and areas for improvements.

Do not forget to read the point to remember section which provides the overall key points and takeaways of the unit.

Module Units:

Unit 1: Prepare Tools, Equipment and Materials

Unit 2: Prepare the Hard-Core Base

Unit 3: Prepare Concrete

Unit 4: Perform Screeding.

UNIT 1: PREPARE TOOLS, EQUIPMENT AND MATERIALS

Unit summary:

This unit provides you with the knowledge, skills and attitudes to prepare the tools, equipment and materials used in cement pavement. It covers the selection of tools, equipment and materials needed in the preparation of cement flooring.

Self-Assessment: Unit 1

1. Study the unit illustration above and answer the following questions.
    a. What do you see in the illustration?
    b. What are the tools, equipment and materials shown in the figure above?
    c. What topics do you think will be covered under this unit based on the illustration?
2. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes under this unit.
    a. There is no right or wrong way to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
    b. Think about yourself: do you think you have the knowledge, skills or attitudes to do the task? How well?
    c. Read the statements across the top. Put a check in a column that best represents your level of knowledge, skills and attitudes.
3. At the end of this unit, you will assess yourself again.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Select tools used for making cement pavement					
Select equipment used for making cement pavement					
Explain The handling techniques of tools and equipment					
Prepare materials used for cement pavement					
Explain the properties of materials used in making cement floor					
Handle safely tools and equipment used in cement flooring					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Minimise wastage of materials preparing for cement flooring					
Manage time while selecting tools and equipment and preparing materials used in cement flooring					
Demonstrate team spirit while working with others					
Be attentive to details while selecting materials, tools and equipment					
Take responsibility for tools and equipment maintenance					
Comply with national and international standard during work execution.					

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify types of tools and equipment used in cement flooring	**1.** Select tools and equipment used for making cement pavement	**1.** Manage time while selecting tools and equipment and preparing materials used in cement flooring
2. Explain safety precautions for handling tools and equipment	**2.** Handle safely tools and equipment used in cement flooring	**2.** Demonstrate team spirit while working with other
3. Identify materials used for cement flooring	**3.** Prepare materials used for cement pavement	**3.** Be attentive to details while selecting materials, tools and equipment
4. Describe properties of materials used in cement flooring	**4.** Minimise wastage of materials while preparing for cement flooring	**4.** Take responsibility for tools and equipment maintenance

Discovery activity:

Task 1:

Read and answer the questions below

a. What are the tools that can be used in cement pavement construction?
b. Give at least five examples of equipment which can be used in cement flooring construction.
c. Describe the different materials required in construction of cement floor.
d. How can you maintain tools and equipment in good working condition?
e. What are the types of cement you know?
f. Outline different factors you can consider while selecting cement pavement materials.

Topic 1.1: Selection of tools and equipment used for cement pavement

Activity 1: Problem Solving

Task 2:

1. Read the scenario below and answer the questions that follow:

   X-company in Kigali city won a tender of making the cement pavement in a commercial building and the company has reached the stage of purchasing the tools and equipment to be used for the project.

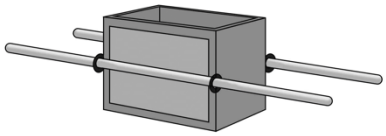
   a. What tools does X-company need for the above project?
   b. What equipment does X-company require for the project?
   c. Suggest how X-company can maintain these tools and equipment safe and good condition.

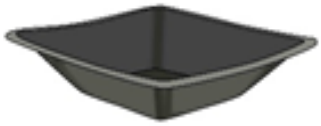
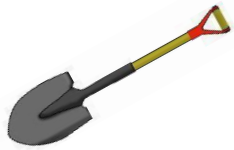
2. Refer to the **Key facts 1.1a** for clarifications.

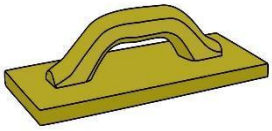
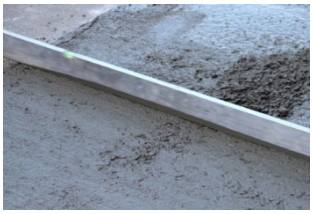
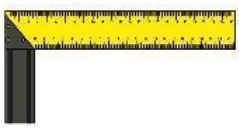
Key Facts 1.1a: Selection of tools and equipment used for cement pavement

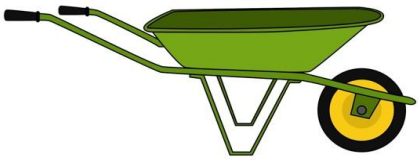
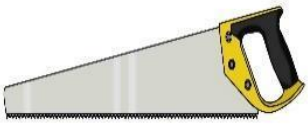
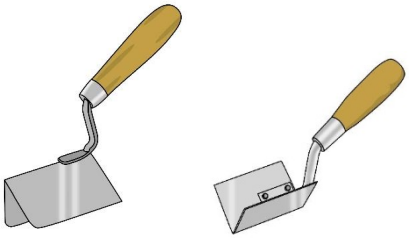
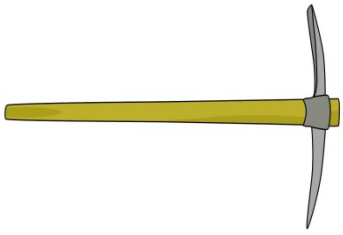
- **Types tools and equipment used for cement pavement**

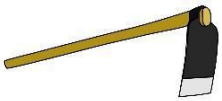
Cement pavement activities require a series of tools and equipment to be accomplished**.** These tools and equipment are categorised in the table below.

Type of tools	Function
Trowel 	It is a small tool used for spreading, applying and smoothing or moving small amounts of viscous materials like mortar or concrete.
Gauging box 	This is a box made from timber boards or metal sheet having the dimensions of 33.3cm x 30 cm x 35 cm, which holds 0.035 m3 of material. It is used in measuring or batching of mortar or concrete ingredients.

	Gauge box: Is used for measuring the proportion of materials and to control the ratio by volume.
Mortar pan/tray 	It is a vessel made of steel or rigid plastic used to hold or carry sand, cement, mortar and concrete.
Spade 	It is a hand tool used for mixing concrete, mortar and also it is used to dig, remove excavated soil and backfill.
Spirit level 	A Spirit Level consists of two or three tubes filled with a liquid such as ethanol and a single bubble of air suspended in the opposite direction from gravitational pull. To use the Spirit Level, place it on the surface whose level you would like to check. This is used to check vertical and horizontal levels.
Building line 	This is used for horizontal levelling and setting out of the building.
Hose pipe 	This is a flexible transparent pipe that requires water in its function. It is used to verify the horizontal plan of different points.

Club hammer 	This is a kind of hammer used to break down the stones.
Float 	This is a hand tool used to finish a concrete surface. A float is used after the surface has been made level using a screed. In addition to removing surface imperfections, float will compact the concrete as preparation for further steps.
Screed board 	It is a strip of timber or metal used to level the concrete surface by removing excessive materials. This is also known as straight edge or floating board.
Tape measure 	This used for measuring lengths
Pencil 	It is used for marking and drawing
Claw hammer 	It is used in fixing and pulling out of nails
Steel square 	This is used for controlling right angles when building walls and setting out

Bucket 	It is used for carrying water
Wheelbarrow 	Transporting small quantities of materials. It can be used in batching types of material: bricks, sand, cement, etc.
Hand saw 	It is used for steel and plastic cutting
Steel float 	It is used for making surface smooth
Corner shaper (angle tool) 	Used for making corners Inside: for inside corner shaping Outside: for inside corner shaping
Pick Axe 	It is used for digging and excavation

Hoe 	It is used for digging
Machete 	It is used for shaping the pegs and cutting the timbers and poles.
Axe 	This is used for cutting timbers or trees.

- **Types of equipment and their uses**

✓ **Water spraying machine**

This machine is used in concrete works for curing and spraying water while mixing.

✓ **Grinding machine**

Grinding machine is a tool equipped with abrasive wheel used for producing fine finishes or light cuts on concrete or metal.

✓ **Wheelbarrow:**

It is a metal, wood or plastic transportation device that has one wheel, a bucket (barrow) and two handles.

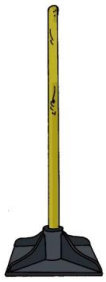
✓ **Concrete mixer**

(Often called a cement mixer) It is a device that homogeneously combines cement, aggregate such as sand or gravel, and water to form concrete.

✓ **Concrete Vibrator:**

It is a mechanical device for creating vibration in "wet" concrete.

✓ **Rammer:**



It is a hand operating equipment used for compacting small areas by providing impact load to the soil.

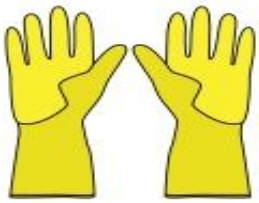
- **P.P.E (Personal Protective Equipment)**

A PPE is defined as “all equipment (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects them against one or more risks to their health or safety”.

PPE is essential for the safety and protection of all individuals on your construction site.

Examples of PPE

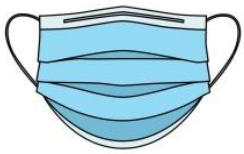
✓ **Safety hand gloves**:



They are used to protect the hands from sharp materials and cement powder that can affect your hands.

✓ **Safety goggles:**

They are most used to protect eyes from flying particles and intense radiation.

✓ **Face mask:** For respiratory protection 
✓ **Overall:**  For body protection against dirty
✓ **Safety shoes**:  For feet protection against sharp objects. Safety shoes are categorised into two types, rubber and strong boot.
✓ **Helmet:**  For head protection against any object that can drop.

Activity 2: Guided Practice

Task 3:

1. Visit your school masonry workshop and perform the following tasks:
   a. Select the tools and equipment used for cement pavement.
   b. Apply maintenance techniques to the selected tools and equipment.
2. Refer to the **Key facts 1.1b** for clarifications.

Key Facts 1.1b: Maintenance of tools and equipment

- **Introduction**

Tools and equipment suffer a lot of wear and tear; it is important therefore to maintain them regularly to increase the service life as well as the performance of the equipment. Preventive maintenance helps to reduce unwanted expenses related to broken or faulty equipment as minor faulty generally leads to bigger issues if left unattended.

- **Tools and equipment maintenance techniques**
  - ✓ **Cleaning:** Cleaning the tools regularly is essential to their proper functioning. After a day of work, your tools will be covered with some amount of dirt.
  - ✓ **Lubrication:** Lubricating tools & equipment helps them to perform better and reduces wear and tear of components.
  - ✓ **Regular inspection:** Regularly inspect your tools and equipment for signs of damage and faulty functioning. Inspections should take place at the end of each construction job. Ensure that you repair them immediately if there is any damage. This will avoid any last-minute hassle.
  - ✓ **Careful storing:** Storing tools and equipment properly is of prime importance. Although they are designed for rough use, it is important to store them properly.

Activity 3: Application

Task 4:

1. Visit a nearby construction site, select from their store tools and equipment used to cement pavement.
   a. Identify tools and equipment found at the site.
   b. Describe how the tools and equipment are maintained at the site.
2. Make a report on the types of tools and equipment found at the site as well as the maintenance techniques used to keep them safe and in good condition.

Topic 1.2: Preparation of materials used in cement pavement

Activity 1: Problem Solving

Task 5:

1. Assume Mr. Gasana is your neighbour, he is constructing a residential building and wants the floor to be made of cement pavement.
   a. What are the materials to be used in the aforesaid activity?
   b. Describe physical properties for each material listed.
2. Refer to the key facts and ask more clarifications to your trainer

Key Facts 1.2: Materials used in cement pavement

- **Types of materials used for cement pavement**

The followings are different materials used in cement pavement:

- ✓ Cement
- ✓ Lime
- ✓ Sand
- ✓ Aggregates
- ✓ Additive (Admixtures)
- ✓ Water
- ✓ Soils
- ✓ Stones
- ✓ Steel
- ✓ Steel wires

- **Properties of Materials**

Good quality material should fulfil the following:

- ✓ It should be durable
- ✓ It should have enough strength to resist applied loads
- ✓ It should be fire resistant
- ✓ It should have sound insulation properties
- ✓ It should be cheap
- ✓ It should be easily available

- **Function for some materials are:**
  - ✓ Cement: Used as binding material
  - ✓ Lime: Used as binding material and also for painting
  - ✓ Water: used for mixing of concrete, watering and curing.
  - ✓ Fine aggregates are those which pass through a standard 47.5mm sieve. They are generally called sand.
  - ✓ Coarse aggregates: are those which are retained on a standard 4.75mm sieve, crushed stone or gravels to 60mm grains.
  - ✓ Stones: these are used for filling up on the floors as hard-core
  - ✓ Admixtures: they are added to modify properties of concrete
  - ✓ Steel: Is used for reinforcement of concrete e.g. column, beam and slab.
  - ✓ Binding wire: used for binding of steel bars
- **Pavement materials selection criteria**

While choosing any type of flooring material, we have to take into account the following factors:

- ✓ Initial cost: the cost of materials should be in comparison with the type of building and its intended use.
- ✓ Appearance: the floor covering should produce a pleasing appearance. Where it gives desired colour and architectural beauty. Floor tiles; marble and terrazzo will give a good appearance.
- ✓ Cleanliness: the flooring should be capable of being cleaned easily. Also, it should be non-absorbent.
- ✓ Durability: the flooring should have sufficient resistance to wear, temperature change, disintegration with time, and decay. The floor of marble; floor tiles, concrete, mosaics, terrazzo etc. are more durable.
- ✓ Damp resistance: The flooring should provide sufficient resistance against dampness. Where there is the risk of dampness; we can use concrete floor, mosaic floor, tile floor and terrazzo. But wood, rubber, brick flooring, will not resist dampness very well.

- ✓ Sound insulation: The flooring should not produce noise when the users are walking on it. Where we need more sound insulation, we can use: rubber floor, or timber floor, Linoleum and cork.
- ✓ Thermal insulation: the flooring should provide a good barrier to the heat transfer in order to give comfort to the users of the building. For this wood, rubber, PVC, and tile floor can provide more thermal resistance.
- ✓ Fire resistance: flooring material should offer adequate fire resistance to have fire barriers between different levels of building. From this point concrete, tile, mosaic, marble, and terrazzo have good fire resistance.
- ✓ Smoothness: The flooring material should provide the desired smooth and an even surface. However, it should not be slippery.
- ✓ Hardness: The flooring material should be sufficiently hard to have resistance to indentation marks. This is likely to occur because of the shifting of furniture, equipment, etc.
- ✓ Maintenance: The flooring material should require least maintenance. Whenever repairs are required, it should be such that repairs can be easily done, with least possible expenditure (expenses). (Norbert J. Delatte, 2016).

Activity 2: Guided Practice

Task 6

1. Read the scenario below and answer the questions that follow.

Your school needs to undertake the cement pavement activities for the expanded masonry store room for tools and equipment. You are requested to assist the construction activities by visiting a construction supplies store and:

a. Select all the materials to be used for the pavement
b. Describe the functions of every material in making cement floors selected
c. Describe the properties for the different materials to be used.

Activity 3: Application

Task 7

1. Read the scenario below and do as instructed.

   Visit different construction sites carrying out cement pavement and carry out the following tasks:

   a. Identify various materials used to make cement pavement
   b. Describe properties of materials at different sites
   c. Describe physical properties of cement at the construction sites

2. Make a report of what you performed.

Formative Assessment

1. Choose the most correct alternative.
   a. The following tools are used in cement pavement construction except:
      A. Hand brush
      B. Steel float
      C. Pan/bucket
      D. Painting roller
   b. The following are the examples of equipment which can be used in cement flooring construction except:
      A. Wheelbarrow
      B. A5 printing machine
      C. Grading machine
      D. Concrete Vibrator
      E. Rammer machine
   c. The main materials required in construction of cement floor are:
      A. Sand, cement, water, stones, glasses and admixtures
      B. Sand, cement, water, stones, plywood and admixtures
      C. Sand, cement, water, stones, gypsum board and admixtures
      D. Sand, cement, water, stones, coarse aggregates and admixtures

d. We use Admixtures in mortar to:

   A. Modify the properties of mortar

   B. Improve the properties of mortar

   C. i and ii are correct answers

   D. None of the above is the right answer

2. Outline different factors you consider while selecting cement pavement materials.
3. What are the different PPEs to wear while working the cement floor?
4. What are the tips for maintaining the tools used in cement flooring?

Points to Remember

- Cement pavement requires materials such as cement, sand, water, lime and aggregates.
- Various tools and equipment are also needed for levelling and mortar mixing.
- Materials have physical properties that determine the quality of good materials, you should consider these while selecting the materials to be used in cement pavement.
- Always remember to conduct basic maintenance to your tools and equipment before, during and after use. Some common techniques are such as lubricating, inspecting regularly, cleaning and storing them carefully.
- The following are the tips to maintain tools in good condition:
  - ✓ Always clean tools after use
  - ✓ Oil tools after use
  - ✓ Store tools appropriately
  - ✓ Replace damaged parts of any tools immediately
  - ✓ Respect all instruction provided by manufacturer

Self-Reflection

1. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes after covering this unit.
2. There are no right or wrong ways to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process. Think about yourself:
    a. Do you think you have the knowledge, skills and attitudes to do the task?
    b. How well?
    c. Read the statements across the top. Put a check in a column that best represents your level of knowledge, skills and attitudes.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Select tools used for making cement pavement					
Select equipment used for making cement pavement					
Explain the handling techniques of tools and equipment					
Prepare materials used for cement pavement					
Explain the properties of materials used in making cement floor					
Handle safely tools and equipment used in cement flooring					
Minimise wastage of materials preparing for cement flooring					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Manage time while selecting tools and equipment and preparing materials used in cement flooring					
Demonstrate team spirit while working with other					
Be attentive to details while selecting materials, tools and equipment					
Take responsibility for tools and equipment maintenance					
Comply with national and international standard during work execution.					

3. Fill in the table below and share results with the trainer for further guidance.

Areas of strength	Areas for improvement	Actions to be taken to improve
1. **2.** **3.**	**1.** **2.** **3.**	**1.** **2.** **3.**

UNIT 2: PREPARE THE HARD-CORE BASE

Unit summary:

This unit provides you with the knowledge, skills and attitudes to prepare the hard-core base. It covers the compaction and levelling of the ground base, the laying and levelling of hard-core materials on the ground base as well as the checking of hard-core base level.

Self-Assessment: Unit 2

1. Study the unit illustration above and answer the following questions:
    a. What does the illustration shows?
    b. What activities are performed in the illustration above?
    c. What topics do you think this unit is about based on the illustration?

2. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes under this unit:
    a. There is no right or wrong way to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
    b. Think about yourself: Do you think you have the knowledge, skills or attitudes to do this? How well?
    c. Read the statements across the top. Put a tick in the column that best represents your level of knowledge, skills or attitudes.

4. At the end of this unit, you will assess yourself again.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Identify methods of preparing ground base					
Describe types of hard-core					
Identify the methods of compacting ground base					
Explain steps of laying hard-core					
Apply methods of preparing ground base					
Lay different types of hard-core					
Apply the methods of compacting ground base					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Follow steps of laying hard-core material					
Apply safety precautions while preparing hard core					
Avoid wastage of materials					
Taking care on steps of laying hard-core.					
Comply with national and international standards					

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify methods of preparing ground base	**1.** Apply methods of preparing ground base	**1.** Apply safety precautions while preparing hard core
2. Describe types of hard-core	**2.** Lay different types of hard-core	**2.** Avoid wastage of materials
3. Identify the methods of compacting ground base	**3.** Apply the methods of compacting ground base	**3.** Taking care on steps of laying hard-core.
4. Explain steps of laying hard-core	**4.** Follow steps of laying hard-core material	**4.** Comply with national and international standards

Discovery activity:

Task 8:

Read and answer the following questions

a. What is a hard core in cement pavement?
b. What are the methods used for preparing the ground base?
c. What are the purposes for compacting ground base?
d. What are the types of hard core to be used?
e. What are the methods of checking ground base level?
f. What are the steps followed for laying a hard core?
g. How can you adjust the hard-core base level?

Topic 2.1. Compaction and levelling the ground base

Activity 1: Problem Solving

Task 9:

Read carefully the following scenario and answer the questions that follow:

There is an on-going construction of a multipurpose hall at GITI TVET School. The next step is to prepare a compaction and levelling of ground base cement pavement. Using your own experience in construction, answer the following questions:

a. What are the methods to be used to prepare the ground base?
b. Why compact the ground base?
c. What are the possible methods used to compact the ground base?

Key Facts 2.1. Compaction and levelling the ground base.

- **Definitions**
  - ✓ **Hard-core.** Hardcore is the construction term used to denote 'engineered' infill material that is placed within the confines of a building foundation (after removal of any unsuitable ground layers) in order to support a ground-bearing floor slab.[1] The hardcore must provide a firm, dry, level base, at an appropriate height. Materials for hardcore should be granular and drain and compact readily, as well as being chemically inert and not affected by water. They should also be well compacted in layers of appropriate thickness.
  - ✓ **Compaction**: is the process of increasing soil density and removing air by using manual or mechanical means. (Frederick S Merritt, 2000)
- **Methods of compacting ground base**
  - ✓ **Manual method:** is a method of compacting ground base by using manual means like ramming, rodding, tamping. It entails two ways of doing it:
    - **Ramming:** this method involves compacting the ground base by using a wooden cross beam.
    - **Rodding:** this method involves using steel rod about
  - ✓ **Mechanical method:** is method of compacting ground base by using machines like compactors.
- **Purpose of compacting ground base**
  - ✓ To improve the strength and stiffness of ground
  - ✓ It increases ground stability
  - ✓ Reduce undesirable settlement of structure
  - ✓ Increase load bearing capacity of the ground
- **Check ground base level**
  - ✓ The purpose of checking the ground base level is to make sure the ground is set to desired levels according to the client's wishes. Tools used for checking ground levels (Dasare, 2008).

Activity 2: Guided Practice

Task 10:

Read the scenario below and answer the questions that follow:

Your trainer wants you to compact the ground base of the parking lot under construction at your school.

a. Make a list of tools and equipment you will need.

b. Explain the methods of compacting the ground base that you are going to use for the parking.

c. Compact ground base for the parking

Activity 3: Application

Task 11:

Visit one construction site in your neighbourhood where preparations of hardcore activities are under way. Assist the mason on the site to perform compacting of the ground base. All materials, tools and equipment are available on site.

Make a report of the masonry works performed which includes:

a. The tools and equipment used

b. Methods of compacting applied

c. Steps followed

Topic 2.2: Laying and levelling of hard-core materials on the ground base.

Activity 1: Problem Solving

Task 12:

Read and answer the questions below:

a. What are the steps of laying hard core materials on the ground base?
b. What are the types of hard-core materials used on a ground base?
c. Describe the importance of laying and levelling hard core materials on ground base

Key Facts 2.2: Laying and levelling of hard-core materials on the ground base.

- **Introduction**
  - ✓ Hard-core is the term used to describe the mass of solid, not easily degraded materials of low absorbency that is employed in creating a base for heavy load-bearing stone and concrete floors.
  - ✓ A Hard-core is a layer of a building immediately after filling.
  - ✓ A hardcore material is an essential part that makes a strong foundation for building work. This type of material offers a well-compacted base that provides reassurance for the builder when infilling upper layers
- **Types of hard-core**
  - ✓ Stone hard-core: this is a crushed rock that can be used as a stable and strong sub-base under garden paths, paving areas and driveways.
  - ✓ Brick hard-core: this is a mixture of damaged and broken bricks ranging from full size bricks to half bricks and brick fragments. Good brick hard core is perfect for bases for new tracks or driveways or as a product to use as infill.
  - ✓ Murrum hard-core: this is fragmented weathered rock naturally occurring with varying proportions of silt and clay. Murrum is practically used for filling work in case of road construction and in an embankment.

- **Steps of laying hard-core material**
  - ✓ Selection of hard-core materials
  - ✓ Mark hard-core level
  - ✓ Laying of hard-core
- **Checking the marked level of hard-core methods**

While we are levelling hard-core, we may use following tools:

  - ✓ Levelling hand tools like spirit level, building line, tape measure
  - ✓ Levelling instruments like dumpy level, theodolite, staff reading
- **Adjusting hard-core base level**

As such, the hard core must provide a firm, dry, level base at appropriate height.

If the hardcore base is not levelled you may bring another material to fill or cut excess if it exceeds the marked level. (Flynn, 2015)

- **Importance of laying and levelling hard core materials on ground base**
  - ✓ Hard cores are important for the stability of the foundation
  - ✓ It further adds strength or solidifies the base upon which the concrete sits. This means that it helps to resist pressure of dead and live loads on the ground floor as it helps transfer this to the foundation.
  - ✓ Hard cores provide a good base for buildings. It serves as a platform for the base of the building.
  - ✓ Application of hard cores helps to save cost. This is because the amount of cement and granite that would have been used for over site concrete is reduced as stones or boulders are used to reduce the depth of void
  - ✓ Hard cores provide space for air. This exists between the hardcore systems and serves as restriction to the movement of water.
  - ✓ Hard cores help to shorten the time required for casting. This is so because the amount of concrete required to cast is totally reduced on addition of stones.
  - ✓ Hard cores are very important as they help protect the substructure (Foundation). It however saves cost of maintenance, underpinning in the future.

Activity 2: Guided Practice

Task 13:

Referring to the scenario of your school parking yard, that you finished compacting the ground base. You are tasked to lay the hard core on the ground base built previously.

You are expected to perform the following

a. Identify the types of hard-core materials

b. Explain the steps to be followed laying hard-core materials on the ground base.

c. Check marked level of hard-core methods and adjustment of hard-core base level for ground base.

Activity 3: Application

Task 14:

1. Read the scenario below and perform the tasks related.

Visit one of the construction sites, where laying and levelling hard core materials on the ground base is conducted and lay and level hard core materials on the ground.

2. Compile a report describing the following:

a. Describe the types of hard-core materials used.

b. Describe the steps to be followed laying hard-core materials on the ground base.

c. Check marked level of hard-core methods and adjustment of hard-core base level for ground base.

Formative Assessment

1. Read the following questions and choose the best alternative.

a) The following are the types of hard-core used in cement pavement construction except:

   A. Hand brush

   B. Stone hard-core

   C. Brick hard-core

   D. Murrum hard-core

b) The following are the methods of preparing ground base except:

   A. Fill method

   B. Cut and fill method

   C. Concrete Vibrator

   D. Cut method

2. What do you understand by the term compaction in cement flooring?
3. Outline the steps followed while levelling hard-core materials.
4. What is are the purpose of compacting the ground base for cement pavement?

Points to Remember

- Various methods for preparing ground base of a cement pavement
- The different types of hard-core used in cement pavement construction.
- Purpose of compacting ground base for cement pavement.
- Steps to follow while laying and levelling hard-core materials.

Self-Reflection

1. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes gained under this unit.
2. There is no right or wrong way to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
3. Think about yourself: do you think you have the knowledge, skills or attitudes to do the task? How well?
4. Read the statements across the top. Put a check in a column that best represents your level of knowledge, skills and attitudes.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Identify methods of preparing ground base					
Describe types of hard-core					
Identify the methods of compacting ground base					
Explain steps of laying hard-core					
Apply methods of preparing ground base					
Lay different types of hard-core					
Apply the methods of compacting ground base					
Follow steps of laying hard-core material					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Apply safety precautions while preparing hard core					
Avoid wastage of materials					
Taking care on steps of laying hard-core.					
Comply with national and international standards					

5. Fill in the table above and share results with the trainer for further guidance.

Areas of strength	Areas for improvement	Actions to be taken to improve
1.	**1.**	**1.**
2.	**2.**	**2.**
3.	**3.**	**3.**

UNIT 3: PREPARE CONCRETE

Unit summary:

This unit provides you with the knowledge, skills and attitudes to prepare concrete. It covers the selection of ingredients for concrete, application of mix ratio as well as carry out concrete mixing.

Self-Assessment: Unit 3

1. Referring to the unit illustration above discuss the following:
    a. What is happening on the illustration?
    b. What materials are used in the activity on the illustration?
    c. What do you think this unit is about based on the illustration?
2. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes under this unit.
    a. There is no right or wrong way to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
    b. Think about yourself: do you think you have the knowledge, skills or attitudes to do the task? How well?
    c. Read the statements across the top. Put a check in a column that best represents your level of knowledge, skills and attitudes.
3. At the end of this unit, you will assess yourself again.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Define concrete					
Explain the types of concrete					
Explain the ingredient for concrete					
Explain the properties of concrete ingredients					
Explain the uses of concrete ingredients					
Explain the method of batching					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Explain the methods of concrete mixing					
Explain the procedures of concrete mixing					

Key Competencies:

Knowledge	Skills	Attitude
1. Describe the types of concrete	1. Select ingredients for concrete	1. Safe handling of tools and equipment
2. Describe the properties of concrete ingredients	2. Apply batching methods	2. Avoid wastage of materials
3. Explain the role of concrete ingredients	3. Follow the procedures of concrete mixing	3. Comply with national and international standards
4. Describe methods of batching	4. Mix concrete ingredients	4. Being organised to achieve the required result

Discovery activity:

Task 15:

Read and answer the questions below

1. Define the term concrete which is mainly used in construction of structures.
2. What are the types of concrete you know?
3. What are the materials used in preparing concrete?
4. State the use of every material used for preparing concrete.

Topic 3.1: Selection of ingredients for concrete

Activity 1: Problem Solving

Task 16:

1. Read the scenario and answer the questions below

Mr. Paul wants to cast the concrete as the cement pavement base of his commercial building floor.

a. What are the different ingredients (composition) that Mr. Paul's project needs?
b. Which type of concrete would you suggest for the project?
c. Describe the use of each ingredient in the concrete
d. What is the meaning of term batching?
e. What are methods of mixing the ingredient of concrete?
f. What are different procedures of mixing concrete?

Key Facts 3.1: Selection of ingredients for concrete

- **Introduction**

Concrete is good in resisting compression but is very weak in resisting tension. Hence reinforcement is provided in the concrete wherever tensile stress is expected.

- **Types of concrete**
  - ✓ **Plain concrete** (commonly known as concrete), is an intimate mixture of binding materials, fine aggregates, coarse aggregates and water. This can be easily moulded to desired shape and size before it loses plasticity and hardens. Plain concrete is strong in compression but very weak in tension.
  - ✓ **Reinforced cement concrete (R.C.C.):** is good in resisting compression but is very weak in resisting tension. Hence reinforcement is provided in the concrete wherever tensile stress is expected. The best reinforcement is steel, since the tensile strength of steel is quite high and the bond between steel and concrete is good.
  - ✓ **Reinforced brick concrete (R.B.C):** is the combination of reinforcement, brick and concrete. It is a well-known fact that concrete is very weak in tension.

Hence in the slabs, lintels and beams the concrete in the portion below the neutral axis do not participate in resisting the load. It acts as a filler material only. Hence to achieve economy the concrete in the tensile zone may be replaced by brick.

- ✓ **Pre-stressed concrete (P.S.C):** is one of the methods of utilizing the entire concrete. The principle of prestressed concrete is to introduce calculated compressive stresses in the zones wherever tensile stresses are expected in the concrete structural elements. When such a structural element is used, stresses developed due to loading have to first nullify these compressive stresses before introducing tensile stress in concrete.
- ✓ **Fibre-reinforced concrete (F.R.C):** this is a composite material of concrete or mortar with discontinuous and uniformly distributed fibres. Commonly used fibres are steel, nylon, asbestos, glass, carbon and polypropylene.
- ✓ **Cellular concrete:** it is lightweight concrete produced by introducing large voids in the concrete or mortar. Its density varies from 3kN/m3 to 8kN/m3 whereas plain concrete density is 24kN/m3. It is also known as aerated, foamed or gas concrete. (Dasare, 2008)

- **Types of ingredients for concrete in compliance with Rwanda standards (RS 108 mortar masonry specification)**
  - ✓ **Cement.** Cement is a commonly used binding material in the construction. Cement is obtained by burning a mixture of calcareous (calcium) and argillaceous (clay) material at a very high temperature and then grinding the clinker so produced to a fine powder. Cement comes in the following types:
    - Ordinary Portland cement.
    - Portland Pozzolana Cement.
    - Rapid Hardening cement.
    - Extra Rapid Hardening Cement.
    - Quick Setting Cement.
    - Low Heat Cement.
    - Sulphate Resisting Cement.

- ✓ **Sand**
  - Sand is a natural product which is obtained as river sand and pit sand.
  - Sand consists of small angular or rounded grains of silica
  - Sand is commonly used as the fine aggregate in cement concrete
  - Both natural and artificial sand are used for this purpose
- ✓ **Gravel /coarse aggregates.** In concrete, aggregates are added to provide good quality concrete. Aggregate is used in two size groups:
  - Fine aggregate (sand): Particle size less than 4.75 mm
  - Coarse aggregate: Particle size more than 4.75 mm
- ✓ **Water.** The water used in concrete plays an important part in the mixing, laying, compaction, setting and hardening of concrete. The strength of concrete directly depends on the quantity and quality of water used in the mix.
- ✓ **Admixtures.** Admixture is a material other than cement, aggregate and water used as an ingredient of concrete, added to the batch immediately before or during mixing, to modify the properties of ordinary concrete to make it more suitable for required situations. Instead of using special cement, properties of cement can be changed by additives to cement.

- **Properties of concrete ingredients**
  - ✓ **Properties of Ordinary Portland Cement**
    - **Chemical properties.** Portland cement consists of the following chemical compounds:
      - Tricalcium silicate 3 CaO.SiO2 (C3S): 40%
      - Dicalcium silicate 2CaO.SiO2 (C2S): 30%
      - Tricalcium aluminate 3CaO.Al2O3 (C3A): 11%
      - Tetracalcium aluminate 4CaO.Al2O3.Fe2O3 (C3AF): 11%
    - **Physical properties.** The following physical properties should be checked before selecting a Portland cement for the civil engineering works:
      - Fineness
      - Setting time
      - Soundness
      - Crushing strength
      - Chemical composition

✓ **The properties of good sand are:**

- It should be chemically inert.
- It should be free from organic or vegetable matter.
- It should be free from salt.
- It should contain sharp, angular and coarse grains.
- It should be well graded.
- It should be hard and durable.
- It should be free from coatings of clay and silt.

- **Uses of concrete ingredients**

✓ **Cement:** It is a commonly used binding material in the mixture of concrete.

✓ **Sand:** Sand is used in mortar and concrete for the following purpose:

- It sub-divides the paste of binding material into thin films and allows it to adhere and spread.
- It fills up the gap between the building blocks and spreads the binding material.
- It adds to the density of the mortar.
- It prevents the shrinkage of the cementing material.
- The cost of cementing material per unit volume is reduced as this low-cost material.
- It reduces shrinkage and cracking of concrete.

✓ **Coarse aggregates:**

- Coarse aggregate makes solid and hard mass of concrete with cement and sand
- It increases the crushing strength of concrete.
- It reduces the cost of concrete, since it occupies the major volume.

✓ **Water:**

- Water is only the ingredient that reacts chemically with cement and thus setting and hardening takes place.
- Water acts as a lubricant for the aggregate and makes the concrete workable.
- It facilitates the spreading of cement over the fine aggregate.

✓ **Admixtures.** The major reasons for using admixtures are to:

- Reduce the cost of concrete construction.
- Achieve certain properties in concrete more effectively than by other means.

- Maintain the quality of concrete during the stages of mixing, transporting, placing, and curing in adverse weather conditions.
- Overcome certain emergencies during concreting operations.

Activity 2: Guided Practice

Task 17:

1. Read the scenario below and answer the questions that follow.

Visit the masonry store where the construction consumable materials are stored in school and select the ingredients for concrete.

Activity 3: Application

Task 18:

1. Visit one of the construction sites in your school neighbourhood where the construction has reached the pavement of the floor. During the visit, assist the mason to select all the concrete materials required for that cement pavement floor.

   Compile a report based on the information gathered from the site during the visit.

   a. Name all the ingredients required.
   b. Explain the use of each ingredient for concrete.
   c. Describe the properties of the ingredients.

Topic 3.2: Apply mix ratio for a concrete

Activity 1: Problem Solving

Task 19:

1. Read and answer the questions below:
   a. What are the methods of batching?
   b. What are the equipment and tools used to perform the batching?
   c. What are the mixing ratios for different ingredients?

Key Facts 3.2: Mixing ratios

- **Methods of batching**

  Batching: is the process of measuring concrete ingredients. There are two methods of batching:

✓ **Batching by volume:** materials are measured on the basis of volume. It is less precise method of batching. Measurement boxes or gauge boxes of known volume are used to measure materials.

Figure 1: Gauge box

Cement is taken in form of bags, where volume of one bag of cement (50 kg) is taken as 35liters.

✓ **Batching by weight:** materials are measured on the basis of weight. It is accurate method of batching. Weigh **batchers** or other types of weighing equipment are used to measure weight of materials. Cement, fine aggregate, coarse aggregate and water are taken by weighing.

Note:

- Cement is always measured by weight. It is never measured in volume generally for each batch mix; one bag of cement is used.
- The volume of one bag of cement is taken as 35 litres.
- Gauge boxes are used for measuring the fine and coarse aggregates. The volume of the box is the batch volume of materials for various mixes.

- **Calculation of ingredients of concrete**

The following are procedure for calculation of ingredients of concrete:

- ✓ Density of cement = 1440 kg/m3
- ✓ 1 bag of cement =50kg
- ✓ Density of sand = 1920 kg/m3
- ✓ Dry volume of concrete= 1.52 * wet volume
- ✓ Dry volume of mortar = 1.33 * wet volume

- **Mixing ratio**

Table below shows the proportion of cement, sand and coarse aggregates in concrete

No.	Proportion	Nature of Work
1.	**1:1:2**	For machine foundation, footings for steel columns and concreting under water.
2.	**1:1(½) :3**	Water tanks, shells and folded plates, for other water retaining structures.
3.	**1:2:4**	Commonly used for reinforced concrete works like beams, slabs, tunnel lining, bridges
4.	**1:3:6**	Piers, abutments, concrete walls, sill of windows, floors.
5.	**1:4:8**	Mass concretes like dam, foundation course for walls, for making concrete blocks.

Activity 2: Guided Practice

Task 20:

Read the scenario below and perform the related tasks

Your trainer wants you to perform mixing ratios for 3m*2m cement pavement floor of the new workshop which is under construction at your school. Materials, tools and equipment are available on site.

a. Make batching by volume method
b. Make batching by weight method

Activity 3: Application

Task 21:

1. Read the scenario below and perform the tasks as instructed

   Visit the construction sites in the neighbourhood where the concreting works are being done. Assist in the batching of the mixing ingredients.

2. Compile a report based on the information gathered from the site during the visit, which will include:
   a. Calculation of ingredients of concrete
   b. Mixing ratios.

Topic 3.3: Carry out concrete mixing

Activity 1: Problem Solving

Task 22:

1. Read the scenario and answer the questions that follow:

Y-construction Company in Bugesera District wants to pour and cast the concrete to the floor base of the market building. Answer the different questions below:

a. What are the methods of concrete mixing the Y-company will need in the application of the cement floor for that market?
b. List the different procedures to be performed in concrete mixing.
c. What are the tools and equipment that will be needed by Y-company in the mixing of different ingredients for the concrete?
d. Make the comparison between the methods of mixing and advise the Y-company to use the methods which can speed up the work of mixing.

Key Facts 3.3: Methods of concrete mixing

- Concrete can be mixed by two methods as follow:

✓ **Hand mixing:** It is used as a mix for small scale unimportant concrete works.

Disadvantages of hand mixing

- Concrete mix is not uniform
- Concrete output is small
- Time consumption is high
- Quality of concrete is poor

✓ **Machine mixing:**

It is achieved by the use of concrete mixers at the construction sites for medium and large scale mass concrete work.

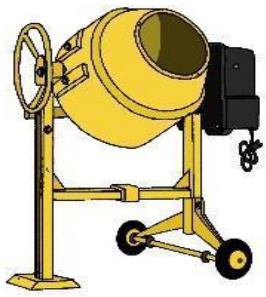


Figure 2: Mixing machine

- **Advantages of machine mixing of concrete**
  - The concrete mix is uniform
  - Concrete output is large
  - Time consumption is less
  - Concrete quality is excellent
  - It is economical for large scale concrete work

- **Procedures of concrete mixing**

✓ **Procedure for hand mixing**

- Measured quantity of sand is spread evenly.
- The required quantity of cement is dumped on the sand and spread evenly.
- The sand and cement is mixed intimately with spade until it gains even colour.
- The sand mixture is then spread out and a measured quantity of coarse aggregate is spread on its top.
- The whole mass is mixed at least three times by shovel.
- The hallow is made in the middle of mixture.
- Pour water in the hole made in mixture.
- Mix until mix became homogeneous.

✓ **Procedure for machine mixing**

- Start or turn on the mixer.
- Put in about 2/3 of the water you need.
- Add the sand and then the cement.
- Mix together until it all looks the same colour.
- Add the rest of the water a bit at a time until you get a mix that is workable but not too wet. Use the least water you can
- Mix for another 2 minutes
- Pour out and make the next batch.

Activity 2: Guided Practice

Task 23:

Visit the school's construction workshop where some materials and tools and equipment are arranged. Perform the following tasks with the respective ratio (1:2:3) for hand mixing method and (1:2:4) for machine mixing method:

a. Mix the concrete by using the hand mixing method
b. Mix the concrete by using machine mixing method

Activity 3: Application

Task 24:

1. Read the scenario and perform the tasks below

Visit one of the construction sites where the concrete works are performed. Assist the staff on the site by performing both the hand and machine mixing methods.

2. Compile a report based on the information gathered from the site during the visit.

    a. Mixing methods used
    b. Reason of using the methods
    c. Procedures of mixing followed

Formative Assessment

1. Outline the procedures for proper hand mixing step by step
2. Distinguish volume batching from weight batching of concrete.
3. What is a reason why volume batching is not a good method for batching?
4. Among those two methods, which one is used to make measurements of cement?
5. Discuss the methods of mixing concrete
6. Calculate the quantity of materials for the following ratio; (1:3:6) for 20 m3 of wet concrete.

Points to Remember

- Types of concrete
- Method of batching
- Application of mixing ratio
- Methods of concrete mixing
- Procedures of concrete mixing

Self-Reflection

1. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes gained under this unit.
2. There is no right or wrong way to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
3. Think about yourself: do you think you have the knowledge, skills or attitudes to do the task? How well?

4. Read the statements across the top. Put a check in a column that best represents your level of knowledge, skills and attitudes.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Define concrete					
Explain the types of concrete					
Explain the ingredient for concrete					
Explain the properties of concrete ingredients					
Explain the uses of concrete ingredients					
Explain the method of batching					
Explain the methods of concrete mixing					
Explain the procedures of concrete mixing					
Apply methods of concrete of concrete					
Follow procedures of concrete mixing					
Apply safety precautions while mixing concrete					

5. Fill in the table above and share results with the trainer for further guidance.

Areas of strength	Areas for improvement	Actions to be taken to improve
1.	**1.**	**1.**
2.	**2.**	**2.**
3.	**3.**	**3**

UNIT 4: PERFORM SCREEDING

Unit summary:

This unit provides you with the knowledge, skills and attitudes to perform screeding for cement pavement. This covers the application of screed layers on the hardcore at a regular interval, pouring fresh concrete on top and slightly deep into hardcore, screeding concrete for levelling the floor with reference to set screeds and application of layer of smoothing surface.

Self-Assessment: Unit 4

1. Study the unit illustration above and answer the following questions:
   a. What do you see in the illustration?
   b. What is happening in the illustration?
   c. What topics do you think will be covered under this unit based on the illustration?
2. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes under this unit.
   a. There is no right or wrong way to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
   b. Think about yourself: do you think you have the knowledge, skills or attitudes to do this? How well?
   c. Read the statements across the top. Put a check in the column that best represents your level of knowledge, skills or attitudes.
3. At the end of this unit, you will assess yourself again.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Describe types of screeds					
Describe properties of concrete					
Pour fresh Concrete					
Describe defects of concrete					
Explain the steps of concrete screeding					
Explain steps of smoothing surface with cement					
Follow the steps of concrete screeding					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Follow steps of smoothing surface with cement					
Check defects of concrete					
Clean tools and equipment					
Clean working area					
Store tools and equipment					

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe types of screeds	**1.** Pour fresh Concrete	**1.** Taking care on steps of laying hard-core.
2. Describe properties of concrete	**2.** Follow the steps of concrete screeding	**2.** Demonstrate team spirit while working with others
3. Describe defects of concrete	**3.** Follow steps of smoothing surface with cement	**3.** Demonstrate endurance in your daily activities
4. Explain the steps of concrete screeding	**4.** Check defects of concrete	**4.** Comply with national and international standards during work execution
5. Explain steps of smoothing surface with cement	**5.** Clean working area	**5.** Take responsibility for safety measures at workplace and equipment maintenance
6. Identify cleaning tools and equipment	**6.** Store tools and equipment	

Discovery activity:

Task 25:

Read and answer the following questions:

a) What are the types of screeds used to perform cement screeding?

b) What are the properties of concrete?

c) What are the defects of concrete?

d) What is the purpose of screeding on the floor?

e) List the requirements of a good screed.

Topic 4.1 Application of screeds layers of the hard-core at a regular interval

Activity 1: Problem Solving

Task 26:

Read and answer the questions below:

a. What is screeding?
b. What is the purpose of screeding?
c. What are the types of screed?
d. What is the difference between screeding and concrete?
e. What are the requirements of a good screeding?

Key Facts 4.1: Layers application of screeds on the hard-core at a regular interval

- **Introduction**

Screeding a floor is the simple act of applying a well-blended mixture of ordinary Portland cement with graded aggregates and water to a floor base, in order to form a sturdy subfloor that is capable of taking on the final floor finish or act as a final wearing surface. The term "screeding" is a familiar one in the building trades, where it refers to the action of flattening poured concrete into a smooth, flat layer prior to finishing the surface.

- **Purpose of screeding**
  - ✓ The screed's primary purpose, using one-part cement to three to five parts sharp sand, is to give a smooth and level floor on which to lay your chosen floor finish.
  - ✓ The thickness of the screed allows it to take up normal variations in flatness and levelness of the base on which it is laid.
- **Difference between screeding and concrete**
  - ✓ Concrete has a much coarser mixture than screed, consisting of larger, hard-core aggregates, which are the key elements that give it its durability and make it strong and long lasting.

- ✓ Screed however is a smoother mix, which consists of considerably less aggregate to that of the mix used for concrete.

- **Purposes of screed**
  - ✓ To obtain a defined level
  - ✓ To carry the final flooring
  - ✓ To provide a wearing surface.
- **Requirements of good screed**
  - ✓ It should have adequate strength and stability
  - ✓ It should have friction resistance
  - ✓ It must be economic
  - ✓ It should be sound insulation
  - ✓ It should be thermal insulation
- **Types of screeds**
  - ✓ **Unbonded Screed**: are not bonded directly to the base. This is ideal for thickness greater than 50 mm for standard screed.
  - ✓ **Bonded Screed**: This type of screed is bonded onto the substrate by slurring bonding to the concrete substrate. This is the ideal type of screed for thinner applications where heavy loading is anticipated. Bonded screeds would be from a thickness of 15mm to a thickness of 50mm.
  - ✓ **Floating Screed:** Floating screed is generally laid on a layer of insulation with a slip membrane over it separating the insulation from the screed. The build-up is generally a slip membrane (sheet of Polythene) 150mm+ Insulation another Slip Membrane, then 65mm of screed for domestic dwellings (75mm for commercial locations).
- **Thickness of screeds**

When applying floor screed, there are recommended thickness requirements, depending on the type of surface, as well as application frequency.

Here is a list of recommended screed thickness according to the floor condition and type of application:

- ✓ The optimum thickness of a sand and cement bonded screed is 25–40mm,

- ✓ An unbonded screed should have a minimum thickness of 50mm,
- ✓ Whilst a floating screed should have a thickness greater than 65mm for lightly loaded floors and 75mm for more heavily loaded floors.
- ✓ When using traditional sand cement screeds, the minimum thickness of heating screed is 65 mm. Ideal thickness is between 65 mm and 75 mm approximately, however 100 mm thick screeds have been used successfully.

Activity 2: Guided Practice

Task 27:

1. Read the scenario below and perform the tasks that follow:

Go to the school construction site of a classroom for the short courses, where the application of screed layers is undergoing. Perform the layers of screeding over the hard-core.

Activity 3: Application

Task 28:

1. Read the scenario and perform the tasks below:

   Visit some construction sites near the school where they are undertaking cement pavement activities. Apply the screeds on the hard-core at a regular interval.

2. Make a report based on the information gathered during the site visit, by emphasising on the following:
   a. Type of the screed done.
   b. Requirements of good screed versus the achieved one.
   c. Thickness of screed done.

Topic 4.2: Pour fresh concrete on top and slightly deep into hard-core

Activity 1: Problem Solving

Task 29:

1. Read and answer the questions below:
   a. What is the state of concrete?
   b. What are the properties of hardened concrete?
   c. What are the defects of concrete?

Key Facts 4.2: Pour fresh concrete on top and slightly deep into hard-core

- There are two states of concrete
  - **Fresh concrete (plastic concrete).** Plastic state refers to the state of concrete before it has set and hardened. During this state, concrete is placed in a formwork and compacted. It should be workable so that it can be easily mixed, placed, compacted and finished at the surface. After the concrete has been placed in the formwork, it hardens and gains strength. Fresh concrete possesses the following properties:
    - **Workability.** Is defined as the property of concrete that determines the amount of useful internal work needed to overcome internal friction between individual particles of mix to produce full compaction.
      - **Characteristics of workability**
        - **Compatibility:** This refers to the property of concrete which determines how easily concrete compacted to remove air voids.
        - **Mobility:** It is defined as a property of concrete which determines how easily the concrete can flow into moulds and around the reinforcements.
        - **Stability:** It is defined as the property of concrete which determines the ability of concrete to remain stable and coherent mass during handling and vibration.

- **Factors affecting workability of concrete**
  - Water cement ratio
  - Mix proportion
  - Surface texture of aggregates/shape
  - Size of aggregates
  - Use of admixture
  - Temperature
  - Time

✓ **Segregation.** It is a separation of coarse aggregate from mortar which results in their non-uniform distribution (non-homogeneous). (Norbert J. Delatte, 2016).

- **Causes of segregation**
  - Difference in sizes of particles ingredients of concrete
  - Difference in specific gravities of ingredients of concrete
  - Improper mix proportions
  - Incorrect handling of mixed concrete during transportation and placement.
  - Over-compaction
- **Effects of segregation**
  - Honey comb which creates voids and hence less strength.
- **Prevention of segregation**
  - Proper grading of aggregates (sieve analysis should be done properly)
  - Avoid over compaction
  - Ensure a certain minimum proportion of finer materials.

✓ **Bleeding.** Bleeding is the form of segregation in which water in a concrete mix rises to the surface during its placing.

- **Causes of bleeding**
  - More water present than which is required for cement paste to lubricate the aggregate particles and solid constituents of mix cannot be able to hold all the mixing water when they settle down.
- **Effects of bleeding:**
  - It reduces the strength of concrete

- **Prevention bleeding:**
  - Control water content
  - Control compaction
  - Use finely ground cement
  - Add Pozzolans or aluminium powder to reduce bleeding.

- **Hardened concrete.** Hardened concrete should be durable, impermeable and should have adequate strength. Hardened concrete possesses the following properties:
  - **Shrinkage.** It is the volume reduction /contraction which occur as the concrete hardens and dries out. Or it is the reduction in volume of concrete when it hardens.
    - **Causes of shrinkage**
      - Absorption of water by the paste and concrete aggregate
      - Loss of absorbed water in the gel due to evaporation
      - Evaporation of water from concrete
    - **Effects of shrinkage**
      - Causes cracks in concrete
      - Promotes the strengthening bond between concrete and steel bars.
    - **Factors affecting shrinkage**
      - **Water/ cement ratio**: Higher w/c ratio higher shrinkage
      - **Cement content:** higher cement content- higher shrinkage
      - **Type of content:** finer the content, the higher the shrinkage
      - **Type of aggregates:** higher size, lower shrinkage
      - Ambient **relative humidity:** lower the humidity higher the shrinkage
      - **Admixtures:** Ca cl2 Ca (OH) 2
  - **Defects of concrete**

Some defects are obvious only to a trained eye, others, such as cracking, are obvious to anyone. Some common defects, their causes and how to prevent and repair them are explained below. If in doubt, consult an expert.

- **Colour variation.** Variations in colour across the surface of concrete may appear as patches of light and dark.

- **Causes**
  - Uneven or variable compaction and curing conditions
  - Addition of excess water
  - Segregation of materials (in coloured concrete) Variable colour dosage.(Roy chudley, 2006).
- **Prevention**
  - Use uniform concrete mix and use consistent placing, compacting, finishing and curing procedures. Do not use dryers.
- **Repair**
  - Many colour variations from workmanship will be permanent. To hide the variation a surface coating can be applied.
  - Rectification of colour variation from stains is a very difficult operation and may need repeated gentle treatments with a weak acid.

✓ **Crazing.** A network of fine cracks across the surface of concrete.

- **Causes:**
  - Crazing is caused by minor surface shrinkage in rapid drying conditions (i.e. low humidity and high temperatures, or alternate wetting and drying).
- **Prevention:**
  - Use an evaporative retarder and initiate curing immediately after finishing the concrete.
- **Repair**
  - Repair may not be necessary because crazing will not weaken concrete. If the appearance is unacceptable, a surface coating of paint or other overlay sealer can be applied to hide the cracks.

✓ **Dusting:** A fine powder on the concrete surface which comes off on your fingers

- **Causes**
  - Finishing before the bleed water has dried.
  - Finishing during the rain.
  - Not curing properly or the surface is drying too quickly.

- Concrete of too low a grade for the end use (eg subject to severe abrasion).

Prevention

- Let any bleed water dry up before trowelling or, in cold conditions, remove the water.
- Cure correctly.
- Protect concrete from drying out too quickly in hot or windy conditions.
- For harsh conditions use stronger concrete.
- Do not add excess water before placing.

Repair

- Where surface dusting is minimal, the application of a surface hardener can be beneficial.
- If the surface is showing significant wear, it is essential to remove all loose material by grinding or scraping the surface to a sound base and then applying a suitable topping, if required. (Frederick S Merritt, 2000).

✓ **Rain damage:** The surface has bits washed away or many small dents.

Causes

- Heavy rain while concrete is setting or rainwater being allowed to run across the concrete surface.

Prevention:

- Do not place concrete if rain looks likely. If concrete has already been placed and rain looks likely, cover it and prevent water from running across it.

Repair

- If the concrete has not hardened and damage is minimal the surface can be re-floated and re-trowelled taking care not to work excess water into the surface.
- If the concrete has hardened it may be possible to grind or scrape off the damaged surface layer and, if required, apply a topping layer of new concrete or a repair compound. This may not always be possible and should be done only on expert advice.

✓ **Spalling:** When the slab edges and joints chip or break leaving an elongated cavity.

- **Causes**
  - Edges of joints break because of heavy loads or impact with hard objects.
  - As concrete expands and contracts the weak edges may crack and break.
  - Entry of hard objects, such as stones, into joints may cause spalling when the concrete expands.
  - Poor compaction of concrete at joints.
- **Prevention**
  - Design the joints carefully.
  - Keep heavy loads away from the joints and edges until the concrete has hardened.
  - Ensure proper compaction.
  - Keep joints free from rubbish.
- **Repair**
  - For small spalled areas: scrape, chip or grind away the weak areas until you reach sound concrete, making sure you brush any loose material off the slab.
  - Then refill the area with new concrete or repair mortar (after applying a bonding agent to the old concrete if necessary).
  - Compact, finish and cure the new patch carefully.
  - Care should be taken that all joints are maintained and not filled.
  - For large spalled areas: seek expert advice. (Flynn, 2015)

✓ **Efflorescence:** A white crystalline deposit sometimes found on the surface of concrete.

- **Causes**
  - Water with dissolved mineral salts collects on the concrete surface, as water evaporates salt deposits are left on the surface.
  - Excess bleeding may also result in efflorescence.
- **Prevention**
  - Use clean, salt-free water and washed sands. Avoid excessive bleeding.
- **Repair**

- Remove efflorescence by dry brushing and washing with clean water. Do not use a wire brush. If this fails to remove the deposit, wash with a dilute solution of hydrochloric acid. (Taylor J.B., 1990).

✓ **Honeycombing:** Course, stony surface with air voids.

Causes

- Poor compaction, segregation during placing or paste leakage from forms.
- A poor concrete mix with not enough fine aggregate causing a stony mix.
- Workability is too low.

Prevention

- Use a better mix design. Take care during placing concrete to avoid segregation. Compact concrete properly. Good watertight formwork.
- If honeycombing occurs only in a thin surface layer it can be rendered (i.e applying a layer of mortar).
- If honeycombing occurs to a greater depth, the **concrete** may need to be **removed** and replaced.

✓ **Blistering.** Blisters are hollow, low-profile bumps on the concrete surface filled with either air or bleed water.

Causes

- They are caused when the fresh concrete surface is sealed by premature trowelling, trapping air or bleed water under the surface layer.
- This is more likely to occur in thick slabs or on hot, windy days when the surface is prone to drying out.

Prevention

- After placing, screeding and floating leave the concrete as long as possible before trowelling.
- If blisters are forming, delay trowelling as long as possible and take steps to reduce evaporation by using an evaporative retarder. (Frederick S Merritt, 2000).

✓ **Pouring of fresh Concrete**

Concrete operations or production is a process involved for the manufacture of concrete in sites, laboratories or factories.

- The process of relative properties of cement, sand, coarse aggregates and water so as to obtain a concrete of desired quality is known as proportioning of concrete.
- There are other operations made on concrete such as:
- Storage of materials
- Batching of materials
- Mixing of concrete
- Transportation of concrete
- Placing of concrete
- Compaction of concrete
- Finishing of concrete
- Curing of concrete

Activity 2: Guided Practice

Task 30:

Refer to the scenario of your school classroom for the short courses, where the application of screed layers was done, pour the fresh concrete on top and slightly deep into hard-core.

Activity 3: Application

Task 31:

1. Read the scenario below and perform the tasks that follow.

Visit one of the construction sites in your neighbourhood, where cement flooring is undergoing. Pour fresh concrete on top and slightly deep into hard-core.

2. Make a report on the tasks performed by focusing on the below
   a. The properties of the poured concrete
   b. Factors affecting the concrete
   c. The defects concrete observed. The repair is done.

Topic 4.3 Screed concrete for levelling the floor with reference to set screeds

Activity 1: Problem Solving

Task 32:

Read and answer the questions below.

1. What are the steps of concrete screeding?
2. What are the procedures for floor screeding?

Key Facts 4.3: Screed concrete for levelling the floor with reference to set screeds

- **Steps of concrete screeding**

Five essential steps to get your floor screeding right:

- ✓ The right floor screeding contractor
- ✓ The right floor screeds
- ✓ The right screed mix
- ✓ The right process for installing the screed
- ✓ The right measures for screed protection

- **The Right Floor Screeding Contractor**
  - ✓ The right screeding contractor would hold extensive experience, a skilled workforce and modern equipment, be up to date with the latest technology and have strong references to back up their claims.
  - ✓ The more the experience, the better adept the screeder will be in managing the nuances of screeding- all the way through planning, choice of screed, mix design, screed laying and screed protection to delivering on time and within the agreed budget. (Norbert J. Delatte, 2016).
- **The Right Floor Screeding**

With the different kinds of screed types, screed constructions and screed brands available, it could be a difficult task to arrive at a decision quickly.

It is important to consider what each type has to offer and how well it fits in with your requirement and make an informed choice.

- ✓ **Traditional screed:** The standard screed mix of cement and sand mixed in the ratio of 1:3-5 is used for creating a defined layer for installing the final floor finish such as tiles, wood, linoleum, vinyl etc. Traditional screeds are generally suitable for use in hospitals, schools, retail, homes etc.
- ✓ **Free flowing screeds:** The anhydrite free flowing, self-levelling and self-compacting screeds present the major advantage of easy placement and provide reliable results. However, the anhydrite screeds are not suitable for areas that are prone to getting wet. They cannot be used as a final wearing surface and are not compatible with cementitious products.
- ✓ **Floor levelling compounds:** These compounds vary from the general screeds that they are used for levelling or as the final layer of screed to increase the tolerance while laying the floor finishes such as tiles, vinyl etc. They are generally expensive and are used for screeding in warehouses and areas which require a very high level of surface regularity or flatness.
- ✓ **Structural Screeds:** This type of screed suitable for installing on precast floor surfaces. It is important to seek accurate specifications and calculations from a structural engineer before the installation of structural screeds as the information is vital to decide on the load requirements, flexural strength, bending moment, point loadings, etc.
- ✓ **Fast drying floor screeds/Accelerated Screeds:** If your project is on a strict timeline and you do not have the time to wait for the industry benchmark of 1mm per day and 0.5mm thereafter (110 days for 75mm) for the screed to dry, it would be best to go for fast drying floor screeds like Flexi Dry which allows you to go for the installation of the final floor finish as early as 3 days after screeding.

- **The Right Screeding Mix**

The right screed mix is one that is homogeneously blended in the right proportion, following the agreed mix design.

When there is the option to choose between ready mix and site mixing of screeds, it is important to consider the viability of each option depending on the location and available space at the work site.

Site mixing of screed is a very efficient and economical way of screed mixing and is suitable for most projects, provided the screed is force action mixed and the work is handled by a skilled workforce.

The three methods that are generally applied by screeders for site mixing of screeds are:

- ✓ **Hand Mixing:** This is suitable only for very small areas and is not recommended for bigger projects, as the work is tough and the estimated quantities and manual errors while mixing can seriously affect the quality of the screed.
- ✓ **Free Fall Mixers:** Free fall mixers are sometimes used by screeders for mixing larger quantities of screed at the work site. When these are sufficient for mixing general concrete mixes and mortar which are of a fluid consistency, screeds mixed using free fall mixers are often found to be of poor quality, weak and crush easily under impact.
- ✓ **Forced Action Mixers:** Forced action mixing is the most efficient and economic method for producing high quality screed mixes on site. Forced action mixing blends the cement and mix homogeneously and is ideal when additives or admixtures are to be added.

  Forced action mixers are usually of two types:

  - **Screed Pumps:** These are generally used for forced action mixing of large quantities of screed at the work site.
  - **Pan mixers:** These are portable forced action mixers which are ideal for producing high quality screed mix at work sites where the use of bigger equipment is difficult.
- ✓ **Ready Mix Screeds** are a good option for work sites where the storage of materials is difficult. But there is always the problem of heavy traffic posing as a barrier in getting the screed at the site on time, and might result in a considerable amount of wastage and economic loss. (Norbert J. Delatte, 2016).

- **The Right Process for applying the Screed**

It is important to carry out the process of screed application in a systematic manner to achieve the best results. There are several steps to be followed while preparing to install the screed:

- ✓ Check the specification is fit for purpose
- ✓ Make sure the substrate is ready to receive the screed.
- ✓ Check the access and egress is suitable for screed installation, plant and materials.
- ✓ Check the building is watertight.
- ✓ Check the datum levels, record the measurement down to finished screed level to ensure minimum and maximum depths are achievable and compliant with tendered nominal allowance.
- ✓ Check that running potable water is available at an adjacent point of the material location.
- ✓ Check that a waste facility is adjacent to the working areas.
- ✓ Check the mixing plant is safe and suitable to use.
- ✓ Mix the screed in the correct proportion.
- ✓ Apply the screed in a sequential manner, avoiding dry joints.
- ✓ Apply trowel cuts where necessary for crack control.
- ✓ Keep the working area tidy.

- **The Right Screeding Protection Measures**
  - ✓ The last step in screeding – but this is definitely not the least important of the lot.
  - ✓ Appropriate screed protection measures right after screed installation until the laying of the final floor finish is an extremely important step in preventing screeding failures, and is of greatest importance in achieving a screed of high quality, finish and durability.
  - ✓ From the regulation of site traffic to covering the screeded surface with screed protectors, there are several measures to be considered for protecting the screed.

At a basic level, it is imperative to ensure that:

- No site traffic is allowed at least for 24-48 hours after the application of the screed .
- Heavy site traffic is regulated until the application of the final finish
- Heavy weights are not loaded unless after the consultation with a structural engineer.

- **Procedures of Floor Screeding**
  - ✓ Evaluate the surface of the base
  - ✓ Estimate materials used for screeding
  - ✓ Prepare the base
  - ✓ Prepare the floor screed mixture
  - ✓ Apply bonding agents such as water or bonding slurry
  - ✓ Place the floor screed mixture
  - ✓ Finally, properly cure the placed materials

Activity 2: Guided Practice

Task 33:

Visit the masonry workshop at your school and perform screeding concrete for levelling the floor with reference to set screeds.

Activity 3: Application

Task 34:

1. There is a construction of a warehouse in your neighbourhood, with other masons making screed concrete for levelling the floor with reference to set screeds.
2. Compile a report showing:
   a) The steps followed for concrete screeding
   b) Procedures undertaken

Topic 4.4 Application of layer of smoothing surface

Activity 1: Problem Solving

Task 35:

1. Referring to the previous task 34 answer the questions below
   a. What are the steps required to make the floor smooth?
   b. What are the steps to be followed to achieve it?

Key Facts 4.4: Application of layer of smoothing surface

- **Required layers for cement pavement**

The structure of a rigid pavement consists of the following layers:

- ✓ Concrete slab or surface course
- ✓ Granular base or stabilized base course
- ✓ Granular sub base or stabilised subbase course
- ✓ Frost protection layer
- ✓ Subgrade soil.
- ✓ Hard core base
- ✓ Concreting works
- ✓ Layer of smooth cement.

- **Steps of smoothing surface with cement**

Before curing, to achieve the smoothest surface you may follow the following steps:

- ✓ Level the concrete. Once you have laid your concrete, you need to level it.
- ✓ Wait for the water to Bleed off
- ✓ Float the concrete
- ✓ Trowel the concrete with cement powder
- ✓ Allow the concrete to cure.

Activity 2: Guided Practice

Task 36:

Visit your masonry workshop and apply the layer of smoothing surface to the cement pavement floor.

Activity 3: Application

Task 37:

Andre has bought a house under construction. You have been contracted to carry out finishing works on the house. Perform the application of a layer of smoothing surface and prepare a report describing:

a. The number of layers

b. The steps followed while smoothing surface

Topic 4.5: Cleaning workplace

Activity 1: Problem Solving

Task 38:

Read and answer the questions below

a. Why do we clean the tools and equipment after being used?
b. What are the methods of cleaning tools and equipment?
c. Classify the different unwanted materials on construction site
d. Why is important to clean the workplace
e. What is the importance of proper storage of tools and equipment?
f. List the different factors to follow while storing tools and equipment
g. Explain the procedures of storing tools and equipment

Key Facts 4.5: Cleaning workplace

- **Methods of cleaning the working area**

There are **two methods of cleaning** a working area of cement flooring:

✓ **Manual cleaning:**

- Try cleaning masonry by hand with a bucket and brush or pressurised water before using chemical cleaners.
- Brush off the deposit with a stiff dry bristle brush after the floor has dried out.
- Collect the removed sand with a dust pan or a vacuum cleaner to prevent the sand re-spreading the floor.
- Alternatively, an absorbent cloth could be used to sponge down the surface.

Tools for manual cleanings:

- **Broom:** a tool with a long handle and stiff bristles (usually made of straw or plastic) for sweeping dust, dirt and crumbs from the floor.

Broom:

A tool with a long handle and stiff bristles (usually made of straw or plastic) for sweeping dust, dirt and crumbs from the floor.

Dust pan:

A pan with a small handle that is used to pick-up dust after it has been swept in a pile with a broom or duster.

Mop:

a tool for cleaning the floor which has a long handle and cloth or a sponge at the end.

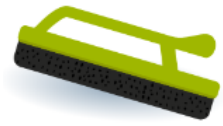
Sponge mop

A tool with a long handle and a sponge at the end that is used to clean floors.

Trash can/wastebasket:

A container for trash (garbage).

Scrub brush: a brush



With stiff bristles that is used for scrubbing.

✓ **Mechanical cleaning:** Pressure washers are ideal for cleaning because the high pressure can blast away dirt and accumulated grime, and leave the surface **clean**.

The importance of cleaning a workplace are:

- Provide safety to the employees
- Improve health to the employees
- Increase the appearance of the workplace
- Elevate your brand

✓ **Mechanical cleaning equipment**

- **Vacuum cleaner:** an electrical machine that is used for cleaning floors, carpets/rugs, furniture, etc., by sucking the dirt and dust into a bag in the machine.

- **Scrubber**: is a cleaning machine that can be used to efficiently and effectively clean floors, replacing traditional mops and buckets. They work to apply a cleaning solution and aggressively scrub and dry surfaces in one pass.

- **Air compressor:** An air compressor is a machine that takes ambient air from the surroundings and discharges it at a higher pressure.it serve for cleaning by air pressure or by water with pressure.

- **Dumper:** A dumper has a body which tilts or opens at the back for unloading and is usually an open 4-wheeled vehicle with the load skip in front of the driver.it serve for loading dumping materials.

- ✓ **Purpose of cleaning tools and equipment**
  - Avoid rust of the tools and equipment
  - Preventing equipment damage.
  - Increase the durability of the tools and equipment.
  - Improve safety and health of the employees.
  - Reduces overall tool cost through maintenance.
- ✓ **Methods of cleaning tools and equipment**
  - By water
  - By oil
  - By brush
  - By air compressor
- ✓ **Safe storage of tools and equipment**
  - Tools and equipment should never be stored on the ground.
  - Invest in some shelving for small tools and equipment, or hang a pegboard along your workbench or on a wall in your storage.
  - Hang tools and equipment so they will be easy to access at any time.
- ✓ **Importance of proper storage of tools and equipment**
  - Improve safety and health of the employees.
  - Improves the appearance of construction areas.
  - Reduces overall tool cost through maintenance
  - It ensures that tools are in good repair at hand.
  - Teaches workers principles of tool accountability.
  - Avoid rust of the tools and equipment (Taylor J.B., 1990)
- ✓ **Factors to follow in storing tools and equipment**
  - Have a designated place for each kind of tools and equipment.
  - Label the storage cabinet or place correctly for immediate finding.
  - Store them near the point of use.
  - Wash and dry properly before storing.
  - Store sharp tools properly when not in use with sharp edges down.
  - Put frequently used items in conveniently accessible locations.

- Gather and secure electrical cords to prevent entanglement or snagging.
- Cutting boards should be stored vertically to avoid moisture collection.
- Metal equipment can be stacked on one another after drying such as storage dishes and bowls.
- Make sure the areas where you are storing the equipment are clean and dry.

✓ **Process of storing tools and equipment**

- Selection of area for storing tools and equipment.
- Prioritise tools and equipment.
- Separate tools and equipment.
- Discard unused tools and equipment

Activity 2: Guided Practice

Task 39:

Read the following scenario and perform the tasks that follow.

Your trainer wants you to perform cleaning of 30m*20m floor of the new workshop building at your school.

a. Describe the procedures for cleaning the floor.

b. Make a list tools and materials required for cleaning.

c. Describe the methods you will use to clean the working site/area, and the tools and equipment.

d. Store the tools and equipment after use.

Activity 3: Application.

Task 40:

Read the following scenario and carry out the tasks below

H&H designs have been constructing a residential house in Uwinka village in Nyarugenge District. The finishing works were completed a couple of days ago. As a mason from the aforesaid contractor company, you are requested to perform cleaning of the cement pavement floor.

Make a report of the cleaning activities you performed which includes:

a. The procedures of cleaning the floor.
b. The methods of cleaning the working area.
c. The tools and equipment you will use for cleaning.
d. Safe storage of tools and equipment after use.

Formative Assessment

1. What are the types of screeds used to perform cement screeding?
2. What are the properties of concrete?
3. Identify the defects of concrete.
4. What do you understand by the term screeding?
5. What are the purposes of screeding?
6. What are the properties of fresh concrete and hardened concrete?
7. Classify the different unwanted materials on construction site.
8. What is the importance of proper storage of tools and equipment?
9. What is the importance of storing tools and equipment?
10. Outline different factors to follow while storing tools and equipment.

Points to Remember

- The types of screeds used to perform cement screeding
- The properties of concrete
- The defects of concrete.
- Steps of concrete screeding
- Safe store of tools and equipment
- Importance of proper storage of tools and equipment
- Factors to follow in storing tools and equipment
- Process of storing tools and equipment

Self-Reflection

1. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes gained under this unit.
2. There is no right or wrong way to answer this assessment. It is for your own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
3. Think about yourself: do you think you have the knowledge, skills or attitudes to do the task? How well?
4. Read the statements across the top. Put a check in a column that best represents your level of knowledge, skills and attitudes.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Describe types of screeds					
Describe properties of concrete					
Pour fresh Concrete					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Describe defects of concrete					
Explain the steps of concrete screeding					
Explain steps of smoothing surface with cement					
Follow the steps of concrete screeding					
Follow steps of smoothing surface with cement					
Check defects of concrete					
Describe different methods of cleaning the workplace					
Clean tools and equipment					
Store tools and equipment					

5. Fill in the table above and share results with the trainer for further guidance.

Areas of strength	Areas for improvement	Actions to be taken to improve
1. **2.** **3.**	**1.** **2.** **3.**	**1.** **2.** **3**

Summative assessment

Integrated situation

La novella Motel located in Bugesera District has gained the competitive edge over its competitors and the market increased dramatically, therefore is facing the problem of a contract with GOOD APPEARANCE CONSTRUCTION AND SERVICES LTD to construct a five-room house. The project is at the phase of making cement pavement in the rooms, and each room with $4m^2$ should have a mason to prepare materials, tools and equipment, prepare the hardcore base and also perform screeding. As a Mason in GOOD APPEARANCE CONSTRUCTION AND SERVICES LTD, you are requested to work in one of the rooms within 7 hours, given that: the mix ratio of mortar is 1:3. All materials, tools and equipment are provided, and furthermore the smoothness is very important.

RESSOURCES

Tools:
- ✓ Wood floater
- ✓ Steel floater
- ✓ Tape measure
- ✓ Sprit level
- ✓ Spades
- ✓ Steel squares
- ✓ trowel
- ✓ Notch trowel
- ✓ Steel ruler
- ✓ Hammer
- ✓ Scraper
- ✓ Blade
- ✓ Straight edge

Materials
- ✓ Sand
- ✓ Cement
- ✓ Water
- ✓ Aggregate/Gravels
- ✓ -Hard core stones

Equipment:
- ✓ Wheelbarrow,
  Concrete mixer,
  Concrete vibrator

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