NOTICE TO THE READER

The reader is expressly warned to consider and adopt ALL safety precautions that might be indicated by the activities in this text, and to use common sense to avoid ALL potential hazards. By following the instructions contained in the text, the reader willingly assumes all risks in connection with such instructions.

BRAND DISCLAIMER

MIC does not necessarily recommend or endorse any particular company or brand name product that may be discussed or pictured in this text. Brand name products are used because they are readily available, likely to be known to the reader, or their use may aid in the understanding of the text. MIC recognizes that other brand names or generic products may be substituted and work as well or even better than those featured in the text.
## CONTENTS

### CHAPTER 1 - SAFETY
- MATERIAL SAFETY DATA SHEETS (MSDS)  
- PERSONAL PROTECTION EQUIPMENT (PPE)  
- ELECTRICAL SAFETY  
- FIRST AID  
- SCAFFOLDING  
- GENERAL SAFETY MEASURES  
- SAFETY WORK PRACTICE  
- HOW MUCH DO YOU KNOW?  

### CHAPTER 2 - TOOLS
- TOOLS COMMONLY USED IN MASONRY  
- POWER MASONRY TOOLS  
- HOW MUCH DO YOU KNOW?  

### CHAPTER 3 - MASONRY MATERIALS
- STONE  
- SAND  
- GRAVEL  
- CEMENT  
- MORTAR  
- CONCRETE  
- CLAY AND CONCRETE BUILDING MATERIALS  
- WIRE  
- HOW MUCH DO YOU KNOW?  

### CHAPTER 4 - BLUEPRINT READING AND DRAFTING
- BASIC INFORMATION ABOUT BLUEPRINTS  
- THE DIFFERENT TYPES OF SKETCHES/DRAWINGS  
- MASONRY ABBREVIATIONS  
- BLUEPRINT SYMBOLS  
- SCALES  
- DRAFTING  
- HOW MUCH DO YOU KNOW?  

### CHAPTER 5 - MEASURING/LAYING OUT WORK AREA
- LAYING OUT A WALL  
- PREPARING THE FOOTING  
- LAYING OUT A SIMPLE RECTANGULAR BUILDING WITH THE USE OF BATTER BOARDS  

---

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>4</td>
<td>59</td>
</tr>
<tr>
<td>5</td>
<td>77</td>
</tr>
<tr>
<td>SAFETY</td>
<td>1</td>
</tr>
<tr>
<td>MSDS</td>
<td>5</td>
</tr>
<tr>
<td>PPE</td>
<td>5</td>
</tr>
<tr>
<td>ELECTRICAL SAFETY</td>
<td>8</td>
</tr>
<tr>
<td>FIRST AID</td>
<td>8</td>
</tr>
<tr>
<td>SCAFFOLDING</td>
<td>9</td>
</tr>
<tr>
<td>GENERAL SAFETY MEASURES</td>
<td>10</td>
</tr>
<tr>
<td>SAFETY WORK PRACTICE</td>
<td>11</td>
</tr>
<tr>
<td>HOW MUCH DO YOU KNOW?</td>
<td>12</td>
</tr>
<tr>
<td>TOOLS COMMONLY USED IN MASONRY</td>
<td>16</td>
</tr>
<tr>
<td>POWER MASONRY TOOLS</td>
<td>29</td>
</tr>
<tr>
<td>HOW MUCH DO YOU KNOW?</td>
<td>32</td>
</tr>
<tr>
<td>STONE</td>
<td>34</td>
</tr>
<tr>
<td>SAND</td>
<td>36</td>
</tr>
<tr>
<td>GRAVEL</td>
<td>37</td>
</tr>
<tr>
<td>CEMENT</td>
<td>37</td>
</tr>
<tr>
<td>MORTAR</td>
<td>39</td>
</tr>
<tr>
<td>CONCRETE</td>
<td>42</td>
</tr>
<tr>
<td>CLAY AND CONCRETE BUILDING MATERIALS</td>
<td>49</td>
</tr>
<tr>
<td>WIRE</td>
<td>54</td>
</tr>
<tr>
<td>HOW MUCH DO YOU KNOW?</td>
<td>56</td>
</tr>
<tr>
<td>BASIC INFORMATION ABOUT BLUEPRINTS</td>
<td>60</td>
</tr>
<tr>
<td>THE DIFFERENT TYPES OF SKETCHES/DRAWINGS</td>
<td>60</td>
</tr>
<tr>
<td>MASONRY ABBREVIATIONS</td>
<td>64</td>
</tr>
<tr>
<td>BLUEPRINT SYMBOLS</td>
<td>65</td>
</tr>
<tr>
<td>SCALES</td>
<td>71</td>
</tr>
<tr>
<td>DRAFTING</td>
<td>72</td>
</tr>
<tr>
<td>HOW MUCH DO YOU KNOW?</td>
<td>74</td>
</tr>
<tr>
<td>LAYING OUT A WALL</td>
<td>78</td>
</tr>
<tr>
<td>PREPARING THE FOOTING</td>
<td>79</td>
</tr>
<tr>
<td>LAYING OUT A SIMPLE RECTANGULAR BUILDING WITH THE USE OF BATTER BOARDS</td>
<td>80</td>
</tr>
</tbody>
</table>
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This text has been developed for the purpose of assisting tutors and trainees in meeting the requirements of the Helping You Prepare for Employment (HYPE) training programme.

HYPE is premised on helping young people overcome unemployment barriers while gaining skills, knowledge and confidence that will help them to be self supporting.

With the rapid expansion of the construction industry fuelled by the building of thousands of homes per year and other mega projects, the real possibility exist for the creation of thousands of sustainable jobs through the various building construction programmes.

The HYPE programme offers trainees a golden opportunity to utilize these avenues for employment so that they can play a meaningful role in our country’s human resource development.

This text therefore is in keeping with MIC’s goal to provide trainees with the basic ability to develop skills in the occupational areas of Masonry and Tile setting.

N.B. This text is NOT a construction engineering text book and therefore it should NOT be used to solve problems of a building nature.

The text addresses the following:

- Knowledge of Tools and Equipment
- Knowledge of Masonry Materials
- Knowledge of Safety and how it relates to the Occupational Safety and Health Act 2004 of Trinidad and Tobago.

Processes involved in:

- Brick Laying
- Rendering/Plastering
- Tile Laying
- Laying out simple projects

Bricklaying modules include:

- Measuring and Laying out of walls and floors
- Erecting profiles
- Mixing mortar
- Laying blocks/bricks to line
- Finishes given to brick/block work
- Plumb walls and level floors.
- Cutting blocks and bricks.

Plastering/Rendering includes:

- Preparation of background
- Layout of background to place buttons
- Placing buttons and making screeds
- Applying plaster (mortar) to walls
- Rod/Float and Sponge background surfaces
- Making edges.

Tile Laying provides knowledge in the areas of:

- Preparation of surfaces
- Laying out of walls and floors
- Adhesives used in installing tiles
- Pointing/cleaning of tiles.

The text is divided into eight main chapters:

Chapter 1       Safety
Chapter 2       Tools Commonly used in Masonry
Chapter 3       Masonry Materials
Chapter 4       Blueprint Reading and Drafting
Chapter 5       Measuring/Laying Out Work Area
Chapter 6       Laying Blocks/Bricks To Line
Chapter 7       Applying Plaster (Mortar) To Walls
Chapter 8       Tiles and Tiling

As all trainees work towards acquiring skills that will give them confidence and the necessary competence geared towards a successful career in masonry, it is important to note that this is the start of a long journey with endless career opportunities.
This Masonry Text forms part of a series of Technical/Vocational books aimed at sharing knowledge applicable to level one Technical Vocational Education and Training (TVET). It takes the reader on a journey from general safety to tools and materials, to processes and outcomes. The text outlines the necessary skills in the specialized area of Masonry. It is simple in language and easy for a level one Masonry student/trainee to understand. The level outlined in this course is representative of the criteria for level one training outlined in the Trinidad and Tobago National Vocational Qualifications Framework (TTNVQ) and the Caribbean Vocational Qualification (CVQ) accepted by accrediting bodies in Trinidad and Tobago including the Accreditation Council of Trinidad and Tobago (ACTT) and the National Training Agency (NTA). According to the “Draft Tertiary Qualifications Framework” (2007), an individual who has achieved a level one qualification should be able to demonstrate the following:

- Knowledge and skills of/for various tasks required for the performance of a routine job.
- Practical skills necessary for the effective performance of jobs and/or tasks.
- Apply solutions to complex problems.
- Communicate effectively.
- Undertake the training necessary to implement changes in working practices.
- Display the necessary qualities for employment under supervision.
- Apply technology to research technical information.

In order to ensure that this course text facilitates different types of learning several techniques are used. The text is highly pictorial, with both picture diagrams and drawings meant to assist all explanations and ensure that learning is made easy.
Evident throughout the course text is the use of the character Vern. Vern is used to highlight reminders, safety requirements and points to note. The following is a graphical representation of the different ways Vern appears throughout this book and what each representation means:

Safety first!
Vern reminds you about safety tips and requirements that help prevent injury and the occurrence of accidents on the job.

Vern wields his trusty trowel as he informs you of important points to note. From time to time he also offers ideas and suggestions aimed at helping you increase your knowledge and productivity, and enhance your masonry skills and techniques.

Vern is looking for answers and he’s asking: “How much do you know?”
At the end of each chapter, you will encounter a practice test with Multiple Choice, True/False and Essay type items, to test your knowledge on the completed chapter.

Vern the graduate will give you moral support as you do those practice tests. So let’s see how much you know...

It is hoped that you are now equipped with all the information necessary to understand the material presented in this course text.
Safety and Health is the responsibility of every mason. It should be a ‘first priority’ at any job site or for any masonry activity. There are some safety factors that are universal – exist in all masonry activities – but there are others that are specific to a particular task/job. This section of the text focuses on general safety and as such will highlight the following:

- Safety
- Material Safety Data Sheets (MSDS)
- Personal Protection Equipment (PPE)
- Electrical Safety
- First Aid
- Summary
- How much do you know?
All technical working environments in Trinidad and Tobago are subjected to the rules and regulations outlined by the Occupational Safety and Health Authority/Agency (OSHA). According to the Occupational Safety and Health Act 2004 “Work of engineering construction” means the construction, structural alteration or repair (including re-pointing and re-painting) or the demolition of any other works prescribed by the minister.

Safety is necessary not only because it is cited by the Occupational Safety and Health Act 2004, but also because good safety practices and training can minimize work related injury and fatal accidents. Thus a safety prepared mason should be aware of his/her work environment as well as the safety required for specific masonry related tasks. Such a mason should also be aware that the jobsite is a hazardous environment, and not just in the area where he/she may be situated for the work day. Thus Personal Protection Equipment (PPE) should be warn at all times and the mason should be aware of various situations, for example, openings in the floor, objects that could fall, chemicals used on the site, ceilings, walls, vehicle movement and other potentially disastrous activities existing on the job site.

A diagram of a jobsite highlighting potentially hazardous circumstances

The mason must wear proper PPE and observe safe practices at ALL times to reduce the occurrence

Mason should wear gloves and helmet

Use leather gloves when using tools. These will protect the hands and fingers from cuts, bruises and scrapes. When working with mortar, avoid direct contact

Unsafe balancing act! Scaffolds should be properly constructed and

Try to keep work area as clean as possible and free from

Tools should be placed within easy reach on his person. Placing on the scaffold can result in a trip or
The following diagram shows some of the Safety Signs that may be seen at a job site.

<table>
<thead>
<tr>
<th>Type of Sign</th>
<th>Meaning(s) Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP</td>
<td><strong>Prohibition Signs</strong>&lt;br&gt;You must not, Do not, Stop!</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Do Not</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>OBEY</td>
<td><strong>Mandatory Signs</strong>&lt;br&gt;You must carry out the action shown.</td>
</tr>
<tr>
<td></td>
<td>Safety Boots</td>
</tr>
<tr>
<td></td>
<td>Face shield</td>
</tr>
<tr>
<td></td>
<td>Hard Hat / Helmet</td>
</tr>
<tr>
<td>DANGER</td>
<td><strong>Warning Signs</strong>&lt;br&gt;Caution, Risk of Danger, Hazard</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Industrial</td>
</tr>
<tr>
<td>SAFETY</td>
<td><strong>Safe Conditions and First Aid Signs</strong>&lt;br&gt;The safe way, First Aid equipment,</td>
</tr>
<tr>
<td></td>
<td>First</td>
</tr>
<tr>
<td>FIRE</td>
<td><strong>Fire Signs</strong>&lt;br&gt;Location and Type of fire fighting equipment.</td>
</tr>
<tr>
<td></td>
<td>Fire</td>
</tr>
<tr>
<td></td>
<td>Fire</td>
</tr>
</tbody>
</table>
The following chart is representative of the OSHA Safety Sign Classification Table

<table>
<thead>
<tr>
<th>Tag Type</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger (Emergency)</td>
<td>Danger tags shall be used in <strong>major hazard situations</strong> where an immediate hazard presents a threat of death or serious injury to employees.</td>
<td>OSHA §1910.145(f)(5)</td>
</tr>
<tr>
<td>Warning (Be on Guard)</td>
<td>Warning tags may be used to represent a <strong>hazard level between “Caution” and “Danger,”</strong> instead of the required “Caution” tag, provided that they have a signal word of “Warning” and an appropriate major message.</td>
<td>OSHA §1910.145(f)(7)</td>
</tr>
<tr>
<td>Caution</td>
<td>Caution tags shall be used in <strong>minor hazard situations</strong> where a non-immediate or potential hazard or unsafe practice presents a lesser threat of employee injury.</td>
<td>OSHA §1910.145(f)(6)</td>
</tr>
<tr>
<td>Notice (Information)</td>
<td>Other tags may be used in addition to those required by §1910.145(f), or in situations where §1910.145(f) does not require tags, provided that they do not detract from the impact or visibility of the signal word or major message of any required tag.</td>
<td>OSHA §1910.145(f)(9)</td>
</tr>
<tr>
<td>Safety (and First Aid)</td>
<td>Safety instruction signs shall be used where there is a need for <strong>general instructions and suggestions</strong> relative to safety measures.</td>
<td>OSHA §1910.145(c)(3)</td>
</tr>
<tr>
<td>Biohazard</td>
<td>Biological hazard tags shall be used to identify the <strong>actual or potential presence of a biological hazard</strong> and to identify equipment, containers, rooms, experimental animals, or combinations thereof, that contain or are contaminated with hazardous biological agents.</td>
<td>OSHA §1910.145(f)(8)(i)</td>
</tr>
</tbody>
</table>
A Material Safety Data Sheet (MSDS) is a “document that provides information about the hazards of a material or product, how to use the material safely and what to do in case of emergency.” This sheet can be found in any job site or technical environment and is placed in locations where it can be easily accessed.

PPE can be separated into the following categories:

- Eye
- Face
- Head
- Feet
- Hands
- Knees
- Ears
- Body
- Fall
- Fire
- Minor injury
- Respiratory/inhalation
- Electrical devices
- Welding, cutting, and brazing

The most commonly used apparatus for eye safety is the safety glasses and goggles. The main function of the protective goggles is to keep from the eye particles of material, dust and other harmful agents, while the mason is at work.

Although there are safety glasses that have side shields to keep debris from entering through the sides of them, they do not provide complete protection for all.
tasks or masonry environments. In most cases goggles provide more efficient protection and are therefore the preferred choice.

For face safety, the most commonly used form of PPE is the face shield. This instrument minimizes injury caused by flying debris. Most common incidences where this is used are therefore, those that involve cutting and brazing. It must be noted however, that the face shield does not provide adequate safety for the eyes. Safety glasses or goggles should therefore be worn while using a face shield.

The hard hat and/or helmet is used for head safety. It helps to protect the mason’s head from falling debris or objects which may have become loose, dislodged or blown with heavy winds, at higher levels on construction sites.

Steel tipped shoes/boots are used for feet protection. They protect the feet from protruding nails, splinters, sharp objects and falling debris of a heavy nature. These types of boots are made with strong leather material, and have reinforced steel toes and non-skid thick soles or rubber soles.

Leather gloves are used to prevent his/her hands from cuts, bruises and other abrasions during his/her work activity.

Rubber gloves are used when the mason is working within a wet environment or in other cases where materials are damp or of a wet nature. This type of glove keeps the mason’s hands dry and also prevents mortar and other materials from causing injury to fingers.

Kneepads are most commonly used for knee protection.

For protection of the body an overall is used.
For fall protection it is always necessary to use a secure harness, lifeline or lanyard. There are several types that are as follows:

- Lanyard
- Body belt
- Shork absorbing lanyard
- Anchor
- Lifeline
- Rope grab
- Harness

For noise protection, ear muffs/defenders or ear plugs can be used interchangeably depending on the environment.

Dust masks are used for protection of the respiratory system.

For minor injuries it is always wise to have a first aid kit nearby.

A fire extinguisher is handy in case of a fire emergency, however it must be noted that different classes of fires (for example Class A, B, C and D) require different extinguishing methods.
For electrical safety, a Ground Fault Circuit Interrupter (GFCI) is necessary. This is an electric component that interrupts the power supplied to a power tool if dangerous conditions exist.

If one is not installed in the job site it is recommended that a portable GFCI is used.

Safety Tip: Always ensure that an extension cord in use is unplugged from the power source before it is rolled or unrolled. Failure to follow this instruction can lead to unexpected electrocution.

First Aid items are necessary for every jobsite or technical environment or anywhere there is hazardous activity. Plumbers or any other ‘tradesman’ is accustomed to minor cuts and bruises that are simply in need of some antibacterial ointment and a band-aid. All plumbers should be aware however that the use of equipment such as power saws and hacksaws could lead to serious injury needing immediate attention. Thus all plumbers should be familiar with basic first aid as well as the use of a first aid kit. It would also be helpful to know methods to stop massive bleeding.

A first aid kit should always be accessible and fully equipped with cleaning products and antibiotic creams or ointments. This kit should be inspected on a regular basis to ensure that it is always fully stocked. The following is a list of items that can be found in a first aid kit:

- Plasters/band-aids
- Surgical gloves
- Burn cream
- Antibiotic cream
- Antibiotic ointment
- Bandages
- Gauze pads
A mason depends to a large extent on scaffolds to do his job. Because of this, when erecting scaffolds, care and attention must be given to all elements of safety. Towards this end, scaffolds must be erected and designed to support the load it is expected to carry.

Three main causes of injury that are associated with scaffolds are:

1. Falling from the scaffold with the loss of one’s balance.
2. Faulty construction of scaffolds.
3. Tools and materials falling from the scaffold and striking others below.

These accidents can in every case be prevented if the simple rules of safety are obeyed.

1. Plumb and level all scaffolds.
2. Fasten all braces securely.
3. Do not use ladders or makeshift devices on top of scaffolds to increase the height.
4. Do not overload scaffolds.
5. Inspect erected scaffolds regularly.
**GENERAL SAFETY MEASURES**

- Use leather gloves when using tools. These will protect the hands and fingers from cuts, bruises and scrapes.
- Prevent and correct burrs, teeth and dents on the sharp edges of tools.
- The handles of tools must be kept properly fitted, without splinters or cracks.
- When using cutting tools, always cut away from the body.
- Do not place tools on ladders or scaffolds where they may fall and cause injury to others.
- Keep eyes protected by wearing eye protection.
- Wash and clean tools after use and store them properly.
- Do not use ladders with broken rungs.
- Keep ladders out of walkways and traffic areas.
- Never stand on the highest rung of the ladder.
- When lifting heavy loads, lift with your legs, not with your back.

- Always store blocks and bricks in tiers that rest on a solid foundation. Do not stack higher than 7 feet.
- When stacking bags of cement, lay every other layer clockwise. Do not stack more than 8 sacks high.
- When pouring cement from the sack, do so slowly and as close as possible to the aggregate as this will prevent dust from rising and getting into eyes and nostrils.
- Always use gloves and boots when handling materials with sharp edges. The gloves will protect hands from the friction of the blocks and the boots will protect the feet from possible blows.
- Take care when using the trowel. The edges become sharp with constant use.
- When cutting with the chisel, always work with the chisel below eye level.

- When moving materials with the wheelbarrow keep the body erect and avoid putting strain on the back.
- Do not overload wheel barrows.
SAFETY WORK PRACTICES

The mason together with those who are on the work site must carry out a risk assessment exercise to identify potential safety hazards.

Everyone on the job must know where accidents are likely to occur and how to prevent them from happening. Above all, there must be a keen sense of responsibility for other workers.

Here are some points that the mason may use as guidelines:

1. Be alert and determine where accidents are likely to happen.
2. Properly secure tools after use and store them in places where they cannot be interfered with.
3. Do not use faulty tools and equipment.
4. Follow safe work practices. Do not take shortcuts or expose yourself to danger unnecessarily.
5. Keep the work area clean.
6. Wear all necessary PPE required for the job or task.
7. Do not exceed the capacity of machines when using them.
8. Ensure that machines are in stable positions before operating them.
9. Never operate a machine when someone is standing in the path of an object that might be thrown from the machine.
10. Never reach into the inside of a cement mixer while it is running or still in operation.

SUMMARY

This chapter provides general safety information for a healthy work environment. It is by no means the only source of health and safety information and any safety conscious mason would make himself/herself familiar with other literature on this topic. It is also recommended that you become familiar with the regulations outlined by OSHA keeping yourself up-to-date with safety for masons.

Remember that every job site has hazards that are common and those that are unique and you should be aware of all potential hazards in your work environment. Always wear PPE and be aware of the cautionary signs in your environment.
1. Why is it considered important to wear safety boots?

2. List six safety workshop rules.

3. Why are respirators worn/used?

4. Explain briefly four (4) causes of workshop accidents.

5. A hard hat is required on all construction sites. True/False

6. Wearing shorts and tennis shoes on the worksite is a good practice. True/False

7. Describe three causes of injury owing to faulty scaffolds.

8. What safety measures must be employed when using cutting tools?

9. What precautions must one take when lifting heavy loads?

10. Why must ladders be kept out of walkways and traffic areas?

11. Which of the following sources is not a component of the Fire Triangle?
   (a) Fuel  (b) Oxygen  (c) Mixture  (d) Heat

12. According to the OSHA Laws of Trinidad and Tobago, the primary responsibility for safety rests with the: (a) safety officer  (b) employer  (c) employee  (d) contractor

13. Which of the following accident types causes the most injuries in the workplace?
   (a) falls to the ground  (b) overexertion  (c) struck by an object
MULTIPLE CHOICE ITEMS: Circle the letter (only) of your answer. Circle one answer only.

1. What type of protection best describes the Safety Symbol diagram shown below?
   (a) Respiratory
   (b) Eye
   (c) Face
   (d) Head

2. Which one of the following best describes the Safety Symbol diagram shown below?
   (a) Safety Glasses
   (b) Gas Mask
   (c) Face Protection
   (d) Respiratory Protection

3. What type of protection, best describes the Safety Symbol diagram shown below?
   (a) Hand
   (b) Ankle/Toes
   (c) Foot
   (d) Heel/Instep

4. What type of protection best describes the Safety Symbol diagram shown below?
   (a) Hearing
   (b) Respiratory
   (c) Hand
   (d) Head

5. Which one of the following best describes the Safety Symbol diagram shown below?
   (a) Leather Gloves
   (b) Welding Gloves
   (c) Hand Protection
   (d) Fingers’ Protection
6. The symbols below, show items which must be worn on a construction job site.


Which one of the following ACRONYMS can best describe the symbols above?
(a) PAHO  (b) PPE  (c) O.S.H.A.  (d) WHO

FILL IN THE BLANK SPACES: Use the words in Part A, to fill in the four (4) blank spaces below each safety symbol in Part B.

**Part A**
- Gas mask
- Gloves
- Goggles
- Hand Protection
- Respirator
- Safety Glasses
- Face mask
- Respiratory Protection
- Dust mask
- Leather gloves
- Rubber boots
- Steel-Tip boots
- Oxygen mask
- Head gear
- Foot Protection
- Helmet
- Head Protection
- Eye Protection
- Steel-Toe shoes
- Plastic gloves
- Rubber gloves
- Hard hat
- Safety spectacles

**Part B**


- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
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- ______________________
- ______________________
- ______________________
The hallmark of a good mason is how well he puts to use the tools and materials at his disposal. Tools used in the correct manner greatly assist the mason in carrying out his job successfully. It is therefore important for every mason to learn how to use each tool skilfully if he is to make a success of his trade.
Trowel

The trowel is used for spreading and applying mortar unto various surfaces (masonry based and non-masonry based surfaces).

It is the tool that is most used by the mason however it is important to note that there are different types of trowels, also known as special purpose trowels, e.g. pointing trowel and pipe trowel.

The trowel is made of various parts as identified in the diagram below.

![Diagram of a trowel showing its parts: handle, ferrule, shank, blade, heel, and point.]

The blade is joined to the handle by the shank.

Wooden handles usually have a metal band called a ferrule around the end of the shank. This adds strength to the handle and prevents it from splitting.

The part of the blade nearest the handle is wide and is called the heel while the narrow end of the blade is called the point.

Large trowels are used in the construction of walls, facings and pavements.

The smaller trowel is used for finishing operations and decorative work.

In order for the trowel to provide maximum assistance to the mason, it must be kept clean and free from old mortar.

Towels are available in lengths from 2” to 9” and in widths from 4½” to 7”.

Mason’s trowels are produced with wide sharp heels or narrow rounded heels. Special purpose trowels allow the mason to perform some specialized jobs better.

The selection of a trowel for use should depend on the weight, size, thickness, quality of the material, flexibility of the blade and the angle in which the blade is set in the handle.

The blade must be made of a fine grade of steel to withstand rather rough usage. Cutting a brick with the edge of the blade can damage or destroy the tool and it also subjects it to considerable shock. The constant wearing action of brick and mortar requires a metal that is well tapered and of good quality.
For those just starting work as a mason, a manageable trowel should be selected. The larger trowel has a long handle and narrow blade which requires a stronger wrist, owing to the weight of the mortar so far out from the handle.

However, as the mason develops his skill, the large trowel can be handled with equal dexterity as a short trowel.

**Rules**

As in many other occupations, the rule is an essential tool that is used by the mason. It is a measuring tool and the most common are:

a. The folding rule
b. The retractable steel tape.

**Folding Rule**

The 6ft. folding rule is a standard tool used by the mason. It is equipped with a metal sliding extension.

This rule can be used to take accurate internal measurements. It can be extended and held above the head to measure heights. Thus, measurements can be taken by one person where a flexible rule may require two persons and a ladder.

**Please Note**

Avoid dropping the folding rule on its end. This may result in the joints being loosened causing inaccurate measurements. Even the slightest movement at each joint multiplies into fractions of an inch over several feet.

**Retractable Tape**

Many masons carry a retractable steel tape for their convenience, since the tape retracts into the case at the push of a button.

A hook at the end permits the tape to catch on the end or edge of a piece of stock so that it can be pulled out to make the measurement.

The newer, wide tapes are stiff enough when extended to permit overhead measurements to be made by an individual mason.

The wide tapes are generally 15ft., 25ft., or more in length. Tapes of comparable lengths are also available in metric measurements.
Squares

Squares are used for marking, testing for squareness and measuring. The type of square to be used depends on the job to be done.

Three main types of squares used by the mason are:

1. The Try Square
2. The Combination Square
3. The Framing/Steel Square

Try Square

This tool is used mainly for marking, measuring and testing for squareness.

It is made of two parts, the stock and the blade.

The stock is made of metal, plastic or wood.

The blade is set in the stock at exactly 90° and its length is usually 6” to 12” and is graduated in inches or centimetres.

Combination Square

The combination square is also made up of two parts, the stock and the blade. The blade moves through the head of the stock and is equipped with a 45° and 90° measure.

The blade is graduated in inches or centimetres.

This tool is generally used for measuring and testing for the sizes of angles.

Framing/Steel Square

The Framing Square is made up of two parts, the blade and the tongue.

The blade is 24” long and the tongue is 16” long.

It is used for marking, testing squareness and measuring.

The framing square is quite useful in laying out foundations and building sites.

It comes in various sizes, from 12” to 24” long. The smaller version of this tool is used mainly to square the sides of door and window openings.
Brick Hammer

The brick hammer is used to break or chip mortar, stones and other masonry materials. It is also used to drive nails and strike chisels. The head is flat on one side, so that it can be used as a conventional hammer. The other end is in the form of a chisel which is used for chopping/cutting material and dressing up masonry cuts.

Spirit Level

This tool is used constantly to determine whether walls are plumb (vertical) or level (horizontal). Several spirit bubble vials are built into the level to permit plumb (vertical) and level (horizontal) testing. The vials are generally embedded in a liquid-filled chamber. The position of the bubble tells the mason whether the surface is aligned or not.

A good general purpose level has at least three vials. One vial tests levelness, when the parallel edge of the level rests horizontally on the wall. The position of the bubble between the two lines in the vial will tell whether the wall is level or not. Only when the bubble is centred between the two lines is the levelling correct.

A second vial tests plumbness when the parallel edge of the level is placed vertically against the wall, only when the bubble is centred between the two lines, is the plumb correct. In order to establish accuracy of the plumbness, the level should be used on both sides.

A good level is light-weight and absolutely straight and may be made from wood or metal or a combination of the two.

Masonry levels are usually 42” to 48” in length, and can be described as the most delicate tool the mason uses.

The mason should avoid knocking the level or exposing it to the sun because it can lose its accuracy.

Plumb Bob

The Plumb Bob is a manually operated tool used to test for plumb of walls and columns.

The Plumb Bob is made up of the following parts:
- **Gauge**
- **Line**
- **Lead**
• The first step in using the Plumb Bob is to unroll the line from the gauge.

• Then set the gauge against the surface of the element to be plumbed.

• Care must be taken so that the line does not touch the ground.

To test for the plumb, check the position of the lead as it relates to the object being plumbed.

If the plumb is correct the lead will almost be rubbing against the object.

If the plumb is incorrect, the lead will be some distance from the object.

• Allow the line to slide so that the plumb weight or lead descends to the lowest part of the object being plumbed.

• Ensure that the gauge is properly seated against the element.

Chisel

Chisels come in different sizes depending on the work to be done. They are used to cut clay
and concrete blocks and bricks, and for splitting stones. In order for a chisel to work properly, it must be kept sharp and straight.

Burrs which are caused by the constant hammering on the head of the chisel must be removed in order to prevent injury to the mason.

Different chisels such as the bolster, plugging chisel and cold chisel, are used by masons for cutting different kinds of materials.

A brick chisel is used to cut bricks to exact dimensions.

A block chisel is used to cut concrete block.

The bolster chisel is considered to be both a brick and block chisel as it can be used to cut both bricks and blocks.

The plugging chisel is used to clean out hardened mortar.

A Thomochisel is a tool designed and developed in February 2010 by Trinidadian Technical Vocational Teacher III Derick Thompson.

Primary Use: Cutting of clay blocks.

Secondary Uses: boring holes, creating indents in timber and trimming slight edges.

The thomochisel was developed for the sole purpose of safeguarding masons from sustaining blows and causing injury to their fingers because of an old technique whereby a claw hammer & concrete nail was used to cut clay bricks.
The **cold chisel** is used for cutting, shaping, or removing cold metals softer than the chisel itself such as cast or wrought iron, unhardened steel, aluminum, brass, or copper.

Never use a Cold Chisel on concrete, stone, or a metal harder than the chisel’s cutting edge.

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**Shovel**

This is a manual tool and is used for the following:

a. Preparing dry mixtures of sand and cement.
b. Removing soil and other materials from trenches.
c. Loading barrows and/or trucks.

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**Line and Holders**

A mason’s line is a simple cord that is sufficiently strong to ensure that floors are level and that there are no bulges or hollows along walls.

The line is held at each end by holders, (also called line pins). Lines are usually made of nylon or dacron.

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The shovel is made up of three parts:

a. A **steel blade**, having one end flat and other end raised with a hollow cylindrical part into which the handle is inserted.
b. The **handle**, which is cylindrical in shape.
c. The **grip**, which is made of steel or wood.
Points to observe when using the shovel:

a. Grasp the shovel by the handle with one hand, and with the other hand, hold the lower end of the handle.

b. Guide the shovel into the edge of the material, while keeping it level with the ground. It might be necessary to use one foot pressing against the top of the blade, to help push the shovel forward into the material.

c. Lift the shovel, and then pull it backwards before emptying the material on the desired location.

d. Push the shovel forward, allowing the handle to slide between the hands holding it.

Two types of shovels are commonly used in construction; the **square point shovel** for working with material which offer little resistance, and the **round point shovel** used for removing hard compact earth and crushed stone.

To avoid injury to the hands, the shovel must not be used with a splintered or badly damaged handle.

Burrs, teeth and sharp edges on the blade of the shovel should be removed.

The grip and the handle must be tightly fitted so that there is no play.

Leather gloves should be used to protect the hands from blisters.

A float is a flat rectangular tool that is made of either wood or aluminium.

During the plastering process the wood float is used in the finishing stage to remove or smooth any high or low spots, left after rodding/screeding.
The float is also used for spreading neat cement paste and for levelling off plaster coatings, indents, humps and scratches, and for filling in the hollows which may have been left during the use of various tools.

The float is useful to the mason because it enables him to ‘float’ large areas of walls and floors.

The float is made of two parts:

a. The **grip** or **handle**

b. The **face**

The **grip** or **handle** is secured on one of its **faces**, by wooden pins, nails or rivets.

Floats come in different sizes and their selection is dependent on the type of job to be performed.

The standard size of a float varies between 4” to 10” in width. Smaller floats are used in reduced spaces or when the elements are small.

Floats, because of their simplicity, are often made by the mason himself. It is advisable, however, to use hard woods which are free from cross grains and not easily splintered or cracked.

### Narrow Float

This tool is similar to the float, but longer and narrower. It is used for finishing interior angles and edges. It is also used on facings, veneers and with neat cement paste.

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**Sponge Float**

This float is similar to the ordinary float except that it is narrower and carries a sponge sheet stuck to its surface.

It is used to obtain a fine granular finish on surfaces, such as walls and ceilings.

Using this tool involves rubbing it along the concrete surface that has been previously rendered in short circular motions.

**Note**

1. The sponge float must be inserted into a bucket of water before use so that it becomes pliable.

2. The pressure the mason applies on this float will depend on the texture of the sponge.
The hawk is used by the mason as a means of carrying around the required amount of mortar that has to be screed for spattering, facing or plastering walls and ceilings.

This tool is made of a sheet of wood or metal and a handle or grip by which it is held.

Two types of hawks are generally used by the mason:

- One, where the handle is held with the left hand, keeping the board in a horizontal position, while working.
  
  When using this type, great strain is put on the wrist in order to balance the hawk when it is loaded with mortar.

- The other type puts less strain on the mason because it can be supported on the arm. One disadvantage of this is that it can cause bruising of the arm because of the constant rubbing of the wood on the skin of the mason’s arm.

The bucket or pail is a container used preferably for carrying water and mixtures. It is produced in different shapes, sizes and materials. Most are of metal, plastic or thick rubber with a handle fitted at the top.

The thick rubber model is the one most used in construction, having a capacity of approximately two gallons. It is washable and easy to store.

This is a device used to sift sand that is required for producing a neat cement mortar or cement.
Paste. It is also used for eliminating lumps and other hardcore materials from cement and fine aggregates (sand).

It is made up of a wooden frame covered on one side with fine mesh metallic netting.

The mason in operating the sieve and screen would slide the material in the sieve from side to side to allow the fine grains to drop out.

An adaptation of this tool is one which is made of a wooden frame, covered on one side with a metallic mesh. Two movable feet or supports allow it to be placed at the required inclination.

This tool is very useful, since a considerable amount of material can be sifted quickly, very efficiently and with little effort.

**Straight Edge or Rod**

This tool is usually made of wood or metal with the firm requirement that its longitudinal edges are straight and parallel.

It is used for drawing and checking straightness and as an auxiliary tool to be used with the spirit level, plumb bob or square.

Wooden straight edges must be made with hard, dry wood, which prevent them from bending. Holes are also drilled in their sides, to lessen the chances of warping.

Care must be taken so that the straight edge is not dropped or struck wilfully or accidentally. It must not be left leaning against a wall, but must be kept lying flat on a level surface.

Exposure to the sun or water would increase its chances of bending.

When cleaning the straight edge, sharp objects should not be used because they can cause the edges to be rounded making the straight edge useless.

**Scaffold**

A Scaffold is a device used by masons that enables them to work on projects at a height that they cannot normally reach. It also makes work easier because it provides a place where they can rest their materials and tools.

Scaffolds can be constructed in different forms.

- The simplest one can be made from planks of wood laid length ways along the tops of horses to span the area to be worked on.
Wheelbarrow

This is a device consisting of a tray, equipped with a wheel, two handles and two legs or supports. There is a guard or stop at the front of the wheelbarrow which is used for raising it until it is standing without risk of rolling over.

The wheelbarrow is used for transporting material with little effort and in reduced time.

Loading the Wheelbarrow

a. The material which is loaded onto the wheelbarrow must be kept centred in the tray as far as possible.

Scaffolding constructed with ladder, hoist, platform and guardrail.

By combining several parts, large scaffolds can be made which can be very useful to the mason.

When this type of scaffold is being constructed, the legs must not rest directly on the ground, but must rest on pieces of board or plank, in order to give the scaffold greater stability.

This type of scaffold must be constructed solidly with guard rails, to ensure the safety of the mason and to prevent accidents.

- The more sophisticated type of scaffold is made from tubular metal pipes which are connected one on top the other by means of spigots. They are assembled with braces which are secured by knots and bolts.
b. To move the wheelbarrow forward, the handle must be raised, keeping the wheelbarrow balanced until the legs come far enough off the ground.

c. The wheelbarrow must then be pushed forward while the mason walks at a normal pace.

d. To unload earth, sand, debris or similar stuff, the handle of the wheelbarrow must be raised until the guard rests on the ground. The handle is then raised further and upward allowing the material to exit from the tray.

e. When bags of cement blocks, bricks etc. are to be unloaded from the wheelbarrow, it must be left stationary in the most convenient position for off loading.

When using the wheelbarrow, the mason’s body must be kept erect to avoid putting strain on the back.

The wheelbarrow must always be kept clean, the axel of the wheel greased and the handles and supporting feet steady. The wheelbarrow must not be loaded excessively or dropped suddenly.
Brushes and Brooms

Brushes and brooms are used by masons to do the following jobs:

a. To remove mortar from the masonry units after the wall has been constructed.
b. For general cleaning and removing dust and other foreign matter from surfaces.
c. For spattering water on joints and mortared surfaces prior to finishing.

Mortar Mixers are used to expedite the work of the mason. They are very helpful because they can save the mason a considerable amount of time especially when having to mix large batches of mortar or concrete.

Mixers may be electric or gasoline powered and are produced in several sizes.

When using the mixer, it is advisable to first mix the dry materials (cement, gravel, sand) then add water.

Mortar should not be allowed to harden in the drum of the mixer as this will prevent proper mixing of ingredients since the inside surface of the mixer will become clogged with hardened mortar or concrete.
Power Joint Cutters

Power joint cutters are used for large jobs when joints have to be cut through fresh concrete slabs. The joint is usually cut when the concrete has hardened 4 to 12 hours. These tools must be handled carefully to avoid injury from flying particles.

Masonry Saws

Masonry saws facilitate faster and more accurate cutting of masonry units than using the blocking chisel and hammer. They are very useful when cutting block tiles and concrete.

The blade of the masonry saw is usually 6” of 7” in diameter and about 1/8” thick. It is made of very hard material such as silicon carbide or industrial diamonds.

When using the masonry saw goggles should always be worn to protect one’s eyes from flying chips.

Power Drill

The power drill is used along with a masonry bit to drill into brick, block, stone, quarry tiles or concrete.

When mixing adhesives or grout, a paddle may be attached for easier mixing.
Portable Wet Tile Saw

The wet tile saw is used to cut tiles. It is a very convenient power tool since as the name suggests, it can be easily moved when necessary.

Power Trowel

The power trowel is the last tool used in the finishing process of large slabs of concrete. It has three or four rotating steel trowel blades.

The main use of the power trowel is to give the surface a smooth dense finish. This tool is powered by electricity or by a gas engine.
1. Explain briefly five factors that should be considered when purchasing a mason’s trowel.

2. A mason uses a ________________ to check if a wall is plumb or level.

3. A ________________ helps make a mason’s work easier by providing a place for material and tools at a convenient height.

4. Poor maintenance and incorrect use of tools can result in
   a. poor workmanship.
   b. common causes of injury.
   c. excessive cluttering of the work place.
   d. difficulty in taking accurate measurements.

5. Name the various parts of a shovel.

6. Give two (2) reasons why tools must be properly washed and greased after use.

7. State two (2) reasons why damaged tools should not be used.

8. A good mason can do a good job with tools that are in poor condition. True/False

9. Name two (2) tools that are used to cut blocks and bricks.

10. Which of the following parts of the bricklaying trowel surrounds the handle and keeps it from splitting?
    a. Shank
    b. Heel
    c. Ferrule
    d. Toe
The materials used in masonry are many and are of great variety. This gives the mason and those involved in construction, a wide variety of elements from which to choose. However, the right selection of materials will depend mainly on the function which they are required to perform.

Some of the major types of materials used in masonry are derived from clay, concrete and stone. Mortar, cement and grout also combine to provide variety, versatility and durability to these products.
The use of stone in masonry has a long and varied history. It is one of the oldest building materials used, but its use as a principal material for construction in Trinidad & Tobago has declined over the years. In modern time, stone is used as a non-structural material and generally applied as facing, veneer, or for decorative purposes.

**How Rocks/Stones are Formed**

Stone is classified as:
- Igneous
- Sedimentary
- Metamorphic

**Igneous rocks** in Trinidad and Tobago were formed as a result of volcanic activity, during the early cretaceous period. These rock/stones are formed from the solidification of molten rock material called magma, which migrates upwards into the earth’s crust and forms rock masses which are known as igneous intrusions and locally as andesite intrusions.

Basaltic Lava, Phillitic Shale, Basaltic Andersite and Granite are igneous stones/rocks. These stones are usually light in colour and very hard. The Basaltic Lava and Basaltic Andersite can be located at Sans Souci, Toco, Trinidad and the Phillitic Shale in Guayamara Bay, Trinidad. It is important to note, that their use can vary, for example the Phillitic Shale is best suited for flagging, facing and/or veneer, while the Basaltic Andersite is best suited for the building of stone retaining walls. This type of stone is known locally by masons as blue stone or blue metal.

**Sedimentary rocks** in Trinidad and Tobago consist of sandstone, shale and limestone dating back to the cretaceous period to recent in age.
Limestone (CaCO₃) can be located at Tamana Hill, Central Range Trinidad, Guaracara, Trinidad and Quinam, Cedros, Trinidad. Sedimentary rock are classified as stones and/or rocks which were broken on the earth surface under the action of wind, and other environmental conditions and which settled at the bottom of oceans and rivers in layers of sediments. The layers of sediments became hard and formed what is called sedimentary rocks. This type of stone varies widely in texture and colour. Limestone is considered to be the best stone that can be used for both the interior and exterior of masonry walls because of its pleasing appearance. This type of stone is known locally by masons as warrantal stone.

Metamorphic rocks in Trinidad and Tobago were formed at the end of the cretaceous period when the Caribbean and South American crystal plates collided. The resulting higher pressure and temperatures transformed the original sedimentary and igneous rocks into low grade metamorphic rocks. Rocks that are changed under the action of high heat and pressure are called metamorphic. Most rocks of a metamorphic nature can be found in the Northern Range. For example marble can be located at Grande Riviere (Coosals Quarry) Northern Range, Trinidad.

Marble and slate are two of the more popular stones that belong to the classification, metamorphic stone.

Marble is a classic stone used for the finest and most decorative work. It is noted for its great beauty and is found in colours of white, yellow, brown, green or black.

Slate is frequently of a blue and/or grey colour. It can be split into sheets and used for roofing or flagstones. It is also classified as a metamorphic stone.

Use of Stone in Masonry

Due to the different sizes and uneven surfaces of stone units, the use of stone in masonry could be very time consuming, because it is more difficult to lay and can require several trial placements before it fits properly. However, the natural good looks of stone go well with almost any landscape and building.
The laying of stone in masonry can be classified into three (3) main types:

- Rubble work
- Ashlar stonework
- Trimmings

Rubble is stone that has not been cut to regular shape and sizes. This type of stone is mostly used in areas where precise lines are not very important but where a rustic appearance is preferred.

Many sizes and shapes of rubble stone are used in creating patterns that are desirable by the builder.

Ashlar stone is that which is cut to dimensions with sufficient uniformity, dressed and finished to the job requirements. This allows for some regularity in assembly, allowing the pieces to fit together in a pattern. Because of this, Ashlar stone is much easier to work with.

Trimmings

Stones that are cut on all their sides in accordance with specific dimensions are known as trimmings. Most of this stone is used for ornamental purposes, but could also be seen on mouldings, sills and lintels.

Sand

Sand is the primary aggregate used in the preparation of mortar and concrete. Natural sand is excavated from sand pits or from seashores and riverbeds.
In countries where natural sand is not readily available, manufactured sand is used. This is made by crushing stone or gravel. Afterwards, the sand is screened and washed.

Sand is produced in various grades with sharp sand being of a coarser texture than fine sand.

Well graded sand improves the quality of work because sand with too few fine particles generally produces harsh mortar and sand with too many fine particles produces weak mortar.

**GRAVEL**

Gravel is the mixture of both fine and coarse aggregates, for example, sharp sand and other coarse aggregates.

Gravel is also excavated from pits and riverbeds. Gravel that is widely used in this country for constructional purposes is usually referred to as *half and half*, (half sharp sand and half other coarse aggregates) and when combined with water and cement produces concrete.

**CEMENT**

The manufacture of Portland Cement commenced in Trinidad and Tobago in June 1954 by the Trinidad Cement Limited a subsidiary of the Rugby Portland Cement Company Limited. On July 31st 1976 the government of Trinidad and Tobago purchased the Trinidad Cement Limited (TCL).

Cement is an important ingredient used in almost all masonry undertakings. Its functions are that of a binder and are therefore an essential material in the making of mortar and concrete.

There are several classes or types of cement: Normal, Modified, High and Early Strength and Low Heat, just to name a few. However the most commonly used in Trinidad & Tobago is known as Ordinary Portland Cement Normal. It is also known as grey cement, not only on account of its grey colour, but also because its inventor found that the colour of the cement resembled a stone...
quarried on the Isle of Portland off the British coast. Its accepted name is Portland Cement.

When cement is mixed with aggregates, (fine or coarse) to a particular ratio (by measurement or weight) with enough water added, the resulting material (mortar or concrete) hardens until it acquires great compressive strength. Its effective strength is usually reached approximately 28 days after being mixed.

However, depending on the type of cement used and the nature of the construction, effective strength can be attained in less time. This process of drying is referred to as “setting”.

For the setting to be perfect, the cementitious material must be protected from the sun for the first few days. It must also be dampened at least 12 hours after being prepared. This treatment is called “curing” which is necessary for the cementitious material to develop its strength.

### How to Protect and Preserve Your Cement

- Both wetness (actual water) and dampness (moisture in the atmosphere) can cause cement to lose its strength in storage.
- Cement sold in paper sacks must NOT be stored directly on concrete floors on the ground. It should be placed off the floor on wooden pallets.
- Cement must NOT be stored against outside walls which may be wet by rain or may absorb moisture from the ground.
- Do NOT store cement sacks on wooden pallets on soil or grass on the building site. The unstable soil and weight of the bags of cement can cause them to topple and fall.
- Cement stored in sacks must be handled with reasonable care to avoid tearing and loss. Avoid lifting sacks with sharp edged equipment.
  - Do NOT drop sacks from heights greater than 20 inches.
  - Never load cement on wet truck trays.
  - Always cover cement with plastic or tarpaulin during transportation.
  - Do NOT store cement sacks more than ten sacks high, this is to prevent the sacks from being compressed and lumps forming in the cement.

Cement covered with plastic and tarpaulin.

- To extend storage life of exposed cement, place opened sack in another sack or large paper bag and seal properly.
Good practices to observe when using cement

- Wear suitable protective clothing. (PPE)
- Avoid direct contact with skin and eyes.
- Do not breathe or inhale cement dust.
- Ensure cement is mixed to prescribed ratio mix.
- All water used for mixing mortar must be clean and drinkable without any pronounced taste or odor.
- Avoid salt or brackish water which can increase the risk of corrosion in mortar or concrete caused by dampness.
- Maintain a long dry mixing period, during the mixing process to ensure that all cementitious materials (sand, gravel, lime) are coated uniformly.
- Aggregates containing silt and organic matter (sewage, vegetable matter, manure) in excessive amounts, should be washed thoroughly before (cement is added) being put to use.
- Avoid the use of water from swamps which may contain organic impurities in amounts sufficient to interfere with the setting and hardening reactions of the cement.
- In mixing, ensure that all aggregates are uniformly distributed.

When lifting cement sacks, concentrate the weight on your legs; do not bend your back.

Avoid direct contact of cement with the skin. Freshly mixed cement may cause severe skin irritation and burns, therefore, wear protective clothing and gloves.

In case of eye contact rinse immediately and repeatedly with water and seek prompt medical attention.

Mortar is a material produced when water, sand, cement and lime are mixed together in specific ratio and proportions.

Mortar is widely used in all brick laying jobs, in rendering or plastering and in laying down floors.

**Mortar also serves the following functions:**

- It binds the units together, sealing spaces between them.
- It makes up for differences in sizes of the units.
- It provides bonding for metal ties or other reinforcing materials.

In the mixing of the various materials that are combined to produce mortar, care must be taken to ensure that the mixture is done according to specific proportions. This will involve the measuring of the materials, either by volume or weight, where the material used in greatest
quantity is indicated first. For example, 3:1 would mean three parts of sand, to one part of cement. Water is then added until a paste of suitable plasticity and workability is achieved.

**Mortars have two distinct sets of properties:**

- Plastic or wet mortar
- Hardened mortar

Mortars that have just been mixed are referred to as plastic mortar.

This type of mortar is uniform, cohesive and of a consistency which makes it workable. It also spreads easily and clings smugly to vertical surfaces. It eases readily from the mortar joint but does not drop or smear. It also readily supports the weight of the masonry unit being used.

Hardened mortar has both compressive and bond strength. It is also very durable.

**Mixing Mortar**

This is carried out by hand on small jobs and by machine on larger jobs.

During the dry mixing process, one should ensure that the ingredients of the mix are uniformly and thoroughly dispersed throughout the batch and that a uniform paste of water and cement coats the sand.

A well mixed mortar is uniform in texture, colour and appearance.

It is important to put together the ingredients of the mortar in quantities such that a practical, workable mix of enough strength and of suitable properties is achieved.

The most important single factor is usually the water / cement ratio of the mix. Too much water to cement means a weak mortar that is of low strength.

The strength of mortar is also affected by the proportion of cement and sand (fine aggregate).

The proportion of sand to cement that is generally used is 3:1 (three parts sand to one part cement).

Mixing mortar is a very dusty operation. Be sure to wear a suitable respirator, particularly when mixing the dry ingredients.

Mortar must be mixed on a clean spot and the water must not be allowed to filter out or spill over.

The sand and cement must be mixed together thoroughly before the water is added so that a uniform colour is obtained.

**The following steps should be taken when mixing mortar:**

1. Measure for the required amount of mortar and heap up the required amount of sand.

2. Spread the sand with the shovel.

3. Measure the specific amount of cement needed.
4. Spread the cement evenly over the heap of sand.

5. Heap up all the materials, moving them with the shovel to the centre of the heap.

6. Take shovels full of the material and transfer them to another heap. Turn over the shovel every time on emptying it.

7. Open the heap in the shape of a crown, taking back the sand towards the sides with the shovel and making a space in the centre.

8. Pour water slowly into the space formed.

9. With the shovel, push the material at the inner rim of the waterhole, to the centre.

10. Finish heaping up all the material making sure that the water does not run out.

11. Take shovels full of the material and turn it over, away from the heap until the mortar of the desired consistency is obtained.

Mortar should be prepared at the rate it is being used to maintain better workability. Mortar that has stood for a while before being used may dry out and stiffen, due to loss of water.

The workability can be restored by adding the water that was lost and mixing very briefly.

Mortar that has begun to harden because of hydration should be discarded.
When mixing mortar the following safety measures must be observed:

Safety boots must be worn to prevent the material from damaging one’s feet.

Gloves must be worn to prevent blisters to the hands.

When pouring out the cement, do so slowly and as close as possible to the sand. This will prevent dust from rising and getting into one’s eyes.

Concrete

Concrete is formed when three (3) basic materials are mixed together in specific proportions.

These materials are:

- Cement
- Aggregates (gravel, sand)
- Water

However, in today’s world, concrete is now formed when at least five (5) basic materials are mixed together in specified proportions.

These materials are:

- Portland Cement
- Fine aggregates
- Coarse aggregates
- Water (clean and drinkable)
- Admixtures (depending on purpose)

A recommended mix design for concrete to be used in domestic buildings is five (5) parts aggregates to one part cement. A reduced ratio mix of four (4) parts aggregates to one part cement can also be used.

These mixtures will achieve a cube compressive strength after twenty eight (28) days of curing.

If the specific/specified strength is NOT achieved in twenty eight (28) days, various reasons could have contributed to this, one being, the excessive amount of water in the mix.

Sometimes other materials called admixtures are added to the basic concrete mix. Their purpose is to produce certain properties in the finished product.

After mixing and left to dry, the concrete, on hardening, acquires great solidity and durability.

These qualities make concrete ideal for use in the construction industry.

In mixing concrete care must be taken to ensure that all materials are mixed thoroughly until uniformity in appearance, texture and colour are obtained.

The water that is used to mix concrete should be clean and free from oil, alkali and acid. It must be drinkable.

Admixtures can be added to the concrete batch before or during mixing. These materials have the effect of reducing the quantity of water required, slowing down or speeding up the setting time and developing the strength of the concrete.

Most of the desired properties of hardened concrete depend on the quality and quantity of the materials used.
The hardness, strength, durability and water resistance of concrete will depend on the proper proportioning of the cement aggregate and water.

It is important to put together the ingredients of the concrete in quantities such that a practical, workable mix of enough strength and suitable properties is achieved.

Handling the concrete on site is also the key to the proper performance of the concrete mixture.

The moving of the concrete by wheelbarrow, bucket etc. in getting it to its final resting place should be done in such a way that the mix does not separate into its different ingredients.

Sometimes, air becomes entrapped in the concrete, especially when constructing columns and beams. These pockets of air can cause large losses of compressive strength. In addition, the presence of air makes concrete more porous and permeable and can lead to earlier rusting of reinforcement or to unsightly growths of moulds or other microform.

**Compaction** is the process employed to remove the air that becomes trapped in the concrete. It is done either by hand or mechanical vibrations. It can also cause large amounts of honeycombing.

**Finishing** is the trowelling and floating of the concrete which is carried out after compaction. This must be done within the correct time-period when the concrete has stiffened sufficiently, but not too much.

**Slab Construction**

In floor slab construction, the placement of the concrete should start from the most distant point of the work so that each batch may be dumped against the previously placed concrete, not away from it.

It must also be noted that concrete should be placed around the outer edges first, in large flat open spaces.

Care must also be taken to prevent water from collecting at the ends and corners of forms.
Compacting the concrete

It is important that the concrete mix be compacted properly so as to expel any air that might be trapped in the concrete.

The mixture should be worked with a spade or rod to be sure that all air spaces are filled. This also helps to consolidate each layer with those previously placed. It also brings fire materials to the faces and top for proper finishing.

Finishing Concrete Floors

In order to achieve a smooth trowelled finish on a concrete floor the following steps must be taken.

Filling and Roding between Screeds

This is the process by which excess concrete is removed from the surface to bring it to the proper height and grade.

Procedure

1. Place a straight edge or rod on the top of the form or screed that encloses the concrete.

2. Move the rod across the concrete with a sawing motion.

3. Advance the rod slightly with each movement allowing an excess of concrete to be carried along in front of the rod filling low spaces.

4. Repeat the movement of the rod along the concrete surface taking care at all times to have the rod resting on the form (screed) until a smooth level surface is achieved.

Floating

After filling and rodding has been completed, the cement should be allowed to harden enough to support the weight of a person and leave only a slight foot imprint.

Floating should not begin until the water sheen has disappeared. This signals that the concrete has begun to stiffen.
**Procedure**

1. Damp the face of the float with clean water so that the float could spread the cement evenly.

2. Using the float, work the cement using both a clockwise and anticlockwise motion until a smooth surface is obtained.

**Make periodical checks to ensure the following:**
- Fine aggregate particles remain below the surface of the concrete.
- The surface is smooth and level
- The concrete is sufficiently compacted.

**Trowelling**

Trowelling is done after floating so that a smooth, dense, hard surface is achieved.

Trowelling can be done either by hand or with the use of a trowelling machine.

1. Press the trowel along the concrete surface making sure that the blade of the trowel is kept flat, or at an angle, against the surface as far as possible.

2. Again, work the trowel in both a clockwise and anticlockwise motion until a smooth surface is achieved.

**Finishing achieves the following:**
- It smoothes out marks left from vibrating screeds.
- It closes up small hollows and voids on the surface.
• It presses protruding particles of course aggregate into the surface so that they can be covered by the mortar application.

In properly proportioned concrete, each particle of aggregate must be completely surrounded by a uniform paste of water and cement. The spaces between aggregate particles must also be filled completely with paste.

Concrete is generally used in either of two forms:
• Ordinary concrete
• Reinforced concrete

Ordinary concrete is concrete without any reinforcements.

Ordinary concrete is used in situations where very high tensile strength is not required. An example of this would be in paving bases, sidewalks, curbs and pavements.

Reinforced concrete is concrete that contains steel reinforcements.

This type of concrete is used in all structural members that are subjected to great stress.

Examples are: foundations of buildings and retaining walls, columns, supporting beams and stairways.

Reinforced concrete must be properly vibrated so that optimum compaction and durability are achieved.

Steel is ideally suited as a reinforcing material because its rate of expansion and contraction is very similar to that of concrete.

Two main types of steel reinforcing used in concrete are reinforcing bars and welded wire reinforcement.

Placing steel reinforcement is a very important operation which is performed at the jobsite.

The reinforcement should be so placed that it is protected by an adequate coverage of concrete.
Ready-Mixed Concrete

Ready-mixed concrete is produced from commercial plants. It is convenient and is usually of a high quality. In some ready-mix operations, the materials are dry batched at the cement plant and then mixed en-route to the site in truck mixers. Concrete can also be prepared by using mechanical mixers. When mixing with this type of machinery the mixing time must be such that all the elements (sand, gravel, cement and water) are well blended.

Exposed Aggregates

Exposed aggregates can take the form of slabs of concrete, with all its aggregates exposed. It can be used on floors and walls, mainly external floors to avoid injury caused by slipping to pedestrians.
Cracks In Concrete

Why Cracks Appear In Concrete

Cracks that appear in concrete usually occur because of so many different reasons, that it is important for mason’s to have a clear understanding of what causes cracks and how to prevent them from occurring.

Cracks are usually created in concrete from the mixing stage, straight through to its final set. This situation can be attributed to one or more of the following:

- Incorrect ratio mix.
- Removal of formwork before the concrete has fully cured.
- The removal of formwork and the placement of load on the concrete before the concrete have fully cured.
- Very high slump concrete (concrete with too much water).
- Hot weather conditions.
- Weak and/or loose formwork assembly.
- Pouring of concrete in unstable and/or shifting soil.
- The use of corrosive/rusting reinforced steel.
- Incorrect placement of reinforced steel.
- Lack of control joints (Expansion Joints, Construction Joints, Contraction Joints and Dummy Joints).

Precautions When Using Concrete

Avoid prolonged contact with fresh concrete because of possible skin irritation. Wear protective clothing when working with newly mixed concrete gets into the eyes, flush immediately with water and get medical help.
In Trinidad and Tobago there are companies which are engaged in the manufacturing, selling and distribution of clay and concrete bricks or blocks. Two such companies are Trinidad Aggregate Products Limited (TAP) and Abel Building Solutions (ABS).

**Trinidad Aggregate Products Limited (TAP)**

Trinidad Aggregate Products Limited of Longdenville, Chaguanas was established in 1976. They are engaged in the manufacture of clay tiles, bricks and blocks.

*Source: Information on Trinidad Aggregate Products Limited provided by Alicia Dallas of Sales and Marketing*.

**Abel Building Solutions (ABS)**

Trinidad Clay Products (TCP), as the company was known at the time of its inception, was a local pioneer in the manufacture of clay building products at its plant located in Longdenville, Chaguanas, where it still stand today. In an effort to increase the popularity of clay building products, TCP built sample houses throughout Trinidad and offered free training to masons in clay construction. Since that time however, Aiston’s Building Enterprises Limited (ABEL) as the company has come to be known, has expanded.

In 1994, ABEL was grouped with Bestcrete - a company that manufactures concrete building products. Together they manufacture building supplies which are sold locally, as well as regionally. In November 2001, ISO 9002 Certification was achieved for the range of ABEL clay and Bestcrete products.

*Source: http://abelbestcrete.com/about/history/

### Building Materials made from Clay

#### Bricks

Bricks are made from earthen clay which is fired and heated to a specified temperature.

They are used as structural material, especially in the construction of walls, columns and ornamental jobs. There are two classes of bricks:

- **Solid bricks**
- **Hollow bricks**

**Solid bricks** are used in areas where durability and strength are of more importance than appearance, for example in the construction of walls and columns where they help support the structure. They may also be used as a decorative finish.
Some solid bricks have a 15% hollow content, with holes running through them. The cored holes help to reduce weight, permit easier handling and make the mortar joint stronger.

**Hollow bricks** have a larger core area and are lighter and serve as good insulators, particularly where heat and sound are concerned.

Clay bricks are best suited for use in temperate countries where the weather conditions could vary from hot to cold.

As a result they are frequently found around fireplaces.

In tropical countries (such as ours) clay bricks are mainly used for decorative purposes and on exposed surfaces where appearance is an important consideration.

A common size of a clay brick is 3 ¾” x 8 ¾” x 2 ¾”.

**Blocks**

Blocks used in construction are made from either clay or concrete. These blocks are either solid or hollow depending on their composition.

Clay blocks are hollow units made of clay and fired in kilns. They are put to many uses in countries of the Caribbean. They are used in the construction of partition walls and columns, walls and columns. They are mostly used in situations where they are not required to bear excessive loads.

The holes in the blocks, in the shape of little cells, along with the type and amount of clay being used, result in the blocks being lighter.

The holes also act as heat and noise insulators, since they form pockets of air which minimise the penetration of heat and noise.

Clay blocks whose cells are arranged in a vertical fashion are referred to as vertical core blocks. These are best suited for use as foundations in areas saturated by water. They are also ideal for use in areas with a high content of acid and ammonia. Towards this end, they are best suited for the construction of septic tanks.
Clay blocks of the vertical core type are usually of the size 6” x 8” x 16”.

Horizontal core clay blocks are more popular in usage that the vertical core types. They are widely used in the construction of walls and partitions.

The regular sizes of these blocks are 4” x 8” x 12” (full size) and 4” x 6” x 8” (half size).

On the faces of these blocks are grooves which facilitate the easy adhesion of mortar.

Solid clay blocks are also produced by some manufacturers. They come in the nominal size of 2 ¼” x 8” x 3 ¾”.

There are also large varieties of clay blocks which are used either for decorative purposes or for increased ventilation.

Building Materials Manufactured from Concrete

As the name implies, concrete blocks are made from concrete, that is, a combined mixture of coarse and fine aggregates, Portland cement, and clean drinkable water, mixed to a specified or specific ratio.

The concrete mixture is moulded into desired shapes through compaction, which is a squeezing action to make the materials denser. It then goes through another process of vibration before being put to “cure” under controlled moisture and temperature conditions. After a period of aging they are ready for use.

Concrete blocks bear several similarities to clay blocks in that they are processed in both solid and hollow classes.

Solid Concrete Blocks

A solid concrete block is one in which the hollow parts in the cross section are not more that 20% of the total cross-sectional area. A good example of a solid concrete block is the split block.

These blocks are used in the construction of walls and give the effect of quarried stone.

Hollow Concrete Blocks

A hollow concrete block is one in which the core or hollow area ranges between 80% - 85% of its total cross-sectional area.

Hollow concrete blocks are also produced as vertical core and horizontal core blocks.
The vertical core concrete blocks are widely used in the construction of retaining walls and partition walls since they are able to support great weight.

Horizontal concrete blocks are used mainly in the construction of upper flooring systems.

Solid and hollow concrete blocks are also used for veneers and decorative purposes.

Concrete blocks come in different sizes. The more popular sizes are:

4” x 8” x16” - (Hollow blocks) standard wall blocks

6” x 8” x 16” - (hollow blocks) foundation blocks

**Decorative Blocks**

Decorative blocks are products of both structural clay and concrete. Apart from creating surfaces that are pleasing to the eye, some also serve the purpose of ventilation by allowing the free flowing of air throughout buildings. Decorative blocks are manufactured in several sizes and patterns.
Some of the more popular decorative blocks included in this chapter are courtesy *ABEL Building Solutions (ABS)*.

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcadian</td>
<td>4” x 6” x 16”</td>
<td><img src="image1" alt="Arcadian Block" /></td>
</tr>
<tr>
<td>Harlequin</td>
<td>4” x 6” x 16”</td>
<td><img src="image2" alt="Harlequin Block" /></td>
</tr>
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<td>Roman</td>
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</tr>
<tr>
<td>Dominican</td>
<td>4” x 8” x 8”</td>
<td><img src="image4" alt="Dominican Block" /></td>
</tr>
<tr>
<td>Filigree</td>
<td>4” x 12” x 12”</td>
<td><img src="image5" alt="Filigree Block" /></td>
</tr>
</tbody>
</table>

Clay blocks should **not** be compared with concrete blocks. The following differences between the two are outlined.

**Clay blocks:**
- Light in weight.
- Could be worked in rainy weather.
- Cheaper in cost.

**Concrete blocks:**
- Easier to work.
- Hold mortar better especially when plastering.
- Allow for easy installation of electrical and PVC piping.
- More durable than clay blocks.
- More solid.
- Superior load bearing capabilities.
- Its surface can withstand normal to heavy wind pressure.
- Can be flush-pointed with mortar.
- Used for fire and sound resistance.
WIRE

Wire is a steel thread used to tie and join reinforcement in masonry construction. This is often placed inside masonry walls to give it greater strength and to keep steel rods, which make up frames or cages, in position. Wire is also used to permit or restrain movement between different materials in a wall.

Types of Tie

The Simple Tie

This is used on frames, grates, wall slabs, beams and in the securing of reinforcements for beams and slabs.

Procedure

Tie in the shape of the figure 8.
This type of tie is used on frames for columns and beams, because it allows the parts which make up the frames to be correct to the angles of the bars which make them up.

Crossed Tie

This is one of the safest types and is used in almost all assembled structures at the beginning of any framework. Generally, this tie is used for securing steel rods, since the possibility of the rods slipping is minimised.

Hanging Tie

This tie is used mainly in securing crosspieces for placing beams, some frames for beams and columns, when any of its parts gives difficulty in reaching its position.
Double Tie

This is used only for lapping steel rods on different frames.
MULTIPLE CHOICE ITEMS. Circle the letter of your choice.

1. Which one of the following is a metamorphic rock?
   a. Blue stone  
   b. Slate  
   c. Warrantal  
   d. Shale

2. Which one of the following local nicknames best describes the sedimentary rock used in constructing walls and drains?
   a. Yellow stone  
   b. Blue stone  
   c. Warrantal  
   d. Blue metal

3. A mortar mix of 1:3 was prepared/mixed for the purpose of building a stone walls. The number one (1) refers to
   a. cement  
   b. water  
   c. fine aggregates  
   d. course aggregates

4. The purpose of a concrete footing is to
   (i) distribute the load evenly throughout the foundation.  
   (ii) support the structure along with its imposed loads.  
   (iii) support the foundation walls.
   a. i only  
   b. i and ii only  
   c. ii and iii only  
   d. i, ii and iii

5. Which one of the following local nicknames best describes the igneous rock used for constructing retaining walls and giddon-basket?
a. Blue steel.
b. Warrental.
c. Blue metal.
d. Slate.

6. In what year did the manufacturing of Portland cement commence in Trinidad and Tobago?
   a. 1953
   b. 1954
   c. 1955
   d. 1956

7. Which one of the following cements are most frequently used in Trinidad and Tobago?
   a. Normal
   b. Modified
   c. High Early Strength
   d. Sulphate Resistant

**ESSAY TYPE. Attempt all questions.**

1. Explain briefly the meaning of the following terms:
   (I) Setting.
   (II) Igneous.
   (iii) Curing.
   (iv) Admixtures.
   (v ) Compaction.
   (vi) Reinforced concrete.

2. What are the differences between the Concrete block and the Clay block?

3. List three (3) decorative concrete blocks produced and used in Trinidad and Tobago?
4. List separately the correct step by step procedures involved in each of the following tasks:

   (i) Mixing Mortar using the correct ratio.
   (ii) Mixing Concrete using the correct ratio
   (iii) Packing, Stacking and /or storage of Cement.
   (iv) Proper storage of sand and gravel.
   (v) Filling and Roding Concrete between Screeds.

5. List the various types of ties used when joining reinforced steel to form a frame or cage?

6. Name the three (3) different types of cements used in the building construction industry?

7. Describe the processes by which Igneous, Sedimentary and Metamorphic rocks are formed?

8. State three (3) precautions which must be considered in order to preserve and protect Portland cement from becoming hard?

9. List five (5) basic materials used to mix concrete?

10. Give five (5) reasons /causes for the appearance of cracks in concrete work?

11. Using the map below, locate (with the use of arrows) and fully label (name of area and rocks) on the map where the following rocks can be found / located.

   a. IGNEOUS
   b. SEDIMENTARY
   c. METAMORPHIC
In this chapter you would learn the following as it pertains to Blueprint reading and Drafting:

- Basic Information about Blueprints
- The Different Types of Blueprints/Drawings
- Sketches
- Blueprint Symbols and Abbreviations
- Scales
- Drafting
- Summary
- How much do you know?
BASIC INFORMATION ABOUT BLUEPRINTS

The blueprint process also known as the cyanotype (a photographic picture obtained by the use of cyanide) process was developed by the British Astronomer- Sir John Frederick William Herschel in 1842.

A blueprint/drawing/plan, as it relates to construction drawings, is a print made that produces a white print on a blue background. It is often used to represent a broad scope of work with many different processes. A blueprint package is comprised of a number of blue prints, such as, Preliminary drawing, Presentation drawing, working drawing and shop drawing or sketch as a detail draft.

It must however be noted that traditional blueprint methods have largely been replaced by more modern printing methods and digital displays, such as Computer Aided Design (CAD).

Computer Aided Design (CAD) techniques transferred as a digital file directly to a computer printer or plotter (wide format printer). Also the use of large-format scanners which digitize an image to allow it to be printed with a large format plotter.

Blueprints drawings/plans are very important as it helps to ensure that laws, rules and regulations, as is stated in the Town and Country Planning Act, Section 17 (1) Cap.240 (a form and the mandatory drawing must be submitted to the Chief Town Planner when seeking planning authorization) are complied with.

Point to Note: When creating a sketch it must always be drawn so that someone else can interpret a design. This is because the sketch maker and the sketch user are sometimes two different persons. This is done using coming symbols and abbreviations.

THE DIFFERENT TYPES OF SKETCHES/DRAWINGS

Sketching is considered to be freehand drawing, that is, drawing without the aid of technical drawing instruments or drafting equipment. Sketching is convenient, since only paper, pencil and an eraser is required. Sketching has its advantages, it allows for fast visual communication and it helps to organize thoughts and reduce or minimize errors.

There are two types of sketches; Orthographic and Isometric.

Orthographic (sketch) Projection

This type of sketch is also known as multiview projection. In architectural drafting such drawings are referred to as elevation view. Elevation views are two-dimensional views of an object (a house, for example) that are established by a line of sight perpendicular (at a 90° angle) to the surface of the object.
Multiview Alignment

To ensure and keep your drawing in a standard form the front view should be sketched in the lower left corner of the drawing sheet and the top section (or roof) directly above it. The right-side view to the right of the front view, as shown in step 1 and step 2.

**STEP 1.** Block out views and establish a 45° line.

**STEP 2.** Block out shapes and darken all lines (check multiview).

Pictorial view of a house.
**Isometric sketches**

Isometric sketches provide a three-dimensional pictorial representation of an object, such as the shape of a building. Isometric sketches are fairly realistic, though the easiest to understand when reading, it can be a little difficult to draw at times, as all vertical lines are drawn vertically but all horizontal lines are drawn with a 30° degree slope.

**Isometric Axes**

In establishing isometric axes, you need four beginning lines: a horizontal reference line, two 30° angular lines and one vertical line. They should be drawn using very light construction lines (as shown below).

![Sample Isometric sketch of a simple object.](image)

Sample Isometric sketch of a simple object.

![Sample Isometric sketch of a house.](image)

Sample Isometric sketch of a house.
Facts About Sketches

- Sketches can be done on graph paper to maintain neatness and symmetry as well as to make it easier for the reader to understand measurements. They can however also be done on plain paper.
- They contain enough details to ensure that the job is properly represented and clearly identified.
- Measurements can be placed on the sketches even when they are NOT precisely proportional to the job site to ensure accurately.

- Special attention should be given to lettering and dimensions to ensure that they are easy to read and understand.
- Sketches must contain a title block. This title block includes the name of the person who made the sketch, the date, the address and area of the building, and what the sketch was drawn to represent; material to be used, the system being changed or put in and the view shown (Orthographic or Isometric).

![View of Title Block]

Point to note: Drawings with feet and inches usually represent them with a hyphen between them eg. 9-6 2/3. Take special note that this is not a minus sign but a method of separating the feet from the inches.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Stands For</th>
<th>Abbreviation</th>
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<th>Abbreviation</th>
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<td>MTL</td>
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<td>Tongue and Groove</td>
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<td>NTS</td>
<td>Not To Scale</td>
<td>WH</td>
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<td>Number</td>
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<td>Wood</td>
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<td></td>
<td></td>
<td></td>
<td>WI</td>
<td>Wrought Iron</td>
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LINE SYMBOLS

- Dark Thick Object Line
- Thin Line / Light Line
- Thin Hidden Line
- Centre Line
- Broken / Break Line
- Cutting Plane Line

*Dimension Line 1* gives the measurements of the length and width of the building.

*Dimension Line 2* gives the dimension size of the rooms inside.

*Dimension Line 3* states the dimension size (in length) of door and window openings on the exterior.

BUILDING MATERIAL SYMBOLS USED IN MASONRY

- Concrete
- Plaster / Sand
- Brickwork
- Hardcore
- Stone
- Earth
- Marble
- Timber (unwrought)
- Plywood
SOME OF THE TYPES OF MORTAR JOINTS

- **Flush Joint**
- **Weather Joint**
- **Concave Tooled Joint**
- **"V" Tooled Joint**

DOOR SYMBOLS USED ON WORKING DRAWINGS

- **Single Folding Doors**
CHAPTER 4   Blueprint Reading and Drafting

Double Folding Doors

Sliding Door

Pocket Door
WINDOW SYMBOLS USED ON WORKING DRAWINGS

- Fixed Window
- Jalousie or Louvre Window
- Sliding Window
SAMPLE SKETCH OF FLOOR PLAN WHICH CAN BE VIEWED AS A WORKING DRAWING
SAMPLE SKETCH OF FOUNDATION PLAN WHICH CAN BE VIEWED AS A WORKING DRAWING

FOUNDATION PLAN
SCALE: N.F.S
In attempting to draw a house on a drawing sheet of paper, the house must be decreased in size to allow it to fit on the drawing sheet. This means that the house must be drawn to a scale, which represents the actual measurements of the full sized house. Different types of plans and/or working drawings are used to communicate the measurements of the house. They are the Floor Plan, Foundation Plan, Elevations and Sections, just to list a few.

In drawing a plan to scale the basic fractions of the scale rule should be understood. The figure below shows a breakdown of a one inch fraction on a scale rule or measuring tape.

There are two (2) types of scales which are used to produce working drawings for masonry, they are Architectural and Metric.

### Sample Scales used to Produce Drawings / Blueprints

#### Architectural:

- \(\frac{1}{8}\)" = 1'-0"
- \(\frac{3}{8}\)" = 1'-0"
- \(\frac{3}{16}\)" = 1'-0"
- \(\frac{1}{2}\)" = 1'-0"
- \(\frac{1}{4}\)" = 1'-0"
- \(\frac{3}{4}\)" = 1'-0"

#### Metric:

- 1:10
- 1:20
- 1:50
- 1:100
- 1:500
- 1:200

Examples of architectural and metric scale rules
Drafting can be defined as the methodical depiction and dimensional requirements of mechanical and architectural structures. There are several tools used for drafting and they include the following:

**A scale rule**: used for reading measurements on blueprints that are drawn to scale;

**Drafting triangles or set squares**: used to draw straight lines and to demonstrate specific angles;

**Isometric triangles or set squares**: used to create 30 degree (30°), 60 degree (60°) and 90 degree (90°) angles; and

The diagram/picture above is taken from Masonry Skills fifth edition.

The picture shows a scale rule which represents a scale of \( \frac{1}{4}'' = 1'-0'' \) resting flat on a working drawing. The scale rule is actually being used to determine the length of the boiler room from the working drawing and/or blueprint. As shown above the length of the Boiler Room is fifteen feet also written as 15’-0”.
**Point To Remember:**

Drafting has three views:

- plan
- side and
- isometric

---

**SUMMARY**

This chapter outlines blueprint reading and drafting teaching the student what a blueprint is, how to draw a sketch and how to read a blueprint. It also highlights specific abbreviations and symbols that are important for the mason to know if he/she should understand the information communicated through a blueprint.

**Templates:** used to create squares, circles, arrows and other symbols that appear on a blue print.

**Drafting triangles.**

**Two examples of templates.**

**Miscellaneous tools used in drafting.**
The diagram identified as Figure 1 shows a sample floor plan with two lines identified as X and Y.

1. What type of line is identified as X?
2. What type of line is identified as Y?

Questions 3, 4 and 5 relate to the scale rule diagram, Figure 2.

3. Which of the following measurements relate to the measurement identified as X on the scale rule diagram above (Figure 2)?
   A. $\frac{6}{16}'' = \frac{3}{8}''$
   B. $\frac{5}{16}''$
   C. $\frac{4}{16}'' = \frac{1}{4}''$
   D. $\frac{3}{16}''$

4. Which one of the following measurements below relate directly to the measurement identified as Z on the scale rule diagram above (Figure 2)?
   A. $2\frac{13}{16}''$
   B. $2\frac{1}{2}''$
   C. $2\frac{5}{8}''$
   D. $2\frac{7}{8}''$

5. What is the measurement identified as Y in the diagram above (Figure 2)?
6. How many single folding doors are shown on the Floor Plan?

7. What is the length and width of the building?

8. How many double folding doors are shown on the Floor Plan?

9. What type of window is used in the living and dining room?

10. What type of window is used in bedroom-B?
11. The above diagram, Figure 3, shows a multi-view of a house. Which one of the following diagrams represents the top of the house?

A.   B.   

C.   D.   

Figure 3
This chapter outlines the various principles and practices with which the mason must be familiar.

He should master the skills of measuring, laying out work areas, building profiles and batter boards, laying out a simple rectangular building and laying blocks.

The mason must also be creative and have an appreciation of aesthetics so that the work he does will be both well constructed and pleasing to look at.

In order to achieve success in this trade, it is important that the mason plans and executes his work efficiently.
The process of measuring and laying out the area where work is to be carried out is one that requires proper planning. It also requires the mason to have some knowledge of reading and understanding working drawings, because these will provide information on all dimensions on the structure to be built.

Building a wall that will be accurate, level and plumb must first entail proper measuring and laying out of the area where the wall is to be constructed.

The following is the procedure to be adopted when laying out a wall so that the desired objectives will be met.

**Laying out a wall**

Working from an established line, such as a road or property line, the mason must locate on the ground, the exact position where the wall is to be erected.

**The steps are as follows:**

- Drive stakes to mark both ends of the proposed wall.

  *Stakes driven for both ends of property wall.*

- Approximately 12” from these points at both ends drive a second set of pickets (pegs or stakes) into the ground.

- Both pickets must be of equal distance from the established line referred to previously.

- Measure two inches from the ground and mark off these measurements on the second set of pickets.

  *Lines established on pickets.*

- Drive nails in the pickets on the points marked off.

  *Established property lines located.*
• Fix a line from the nails on each picket. Draw the line taut joining the two points.

• With the use of the spirit level or line level, test to ensure that the line is level.

• The next step is to determine the footing upon which the wall is to be built.

• The footing is a continuous foundation consisting of concrete poured in a dug trench longitudinally along the axis of the wall to be constructed. The footing is usually wider than the wall so that extra support for the wall will be provided.

The purpose of the footing is to spread the load of the wall over a broader area.

The depth of the footing is based on the stability of the soil. Where the soil is solid, the depth of the footing is about one and a half times the height of the block that is to be used. Where the soil is waterlogged, or unstable, the depth of the footing will be determined when a solid stratum line of the soil is reached.

It is to be noted that where the soil is stable, the standard depth of the footing is nine inches, since the standard width of a wall is six inches.

The width of the footing is usually three times the thickness of the block. Therefore with a four inch thick block, the footing will be twelve inches wide.

Preparing the Footing

• Excavate a trench to accommodate the footing, using the drawn line as a guide. The depth of the trench will depend on the size of the block and the stability of the soil.
- Along the line, measure areas where columns are to be placed. Drive pickets to indicate these points.
- At these areas dig an additional twelve inches deep. The extra depth will serve as an anchor for the columns.
- Place steel reinforcements horizontally along the trench and vertically along the areas for the columns.

Care must be taken to ensure that the steel reinforcements do not touch the earth. This is to prevent any rapid deterioration of the steel.

- Drive steel pegs (½” steel) in the trench at intervals to ensure level in accordance with the earlier established level line.

Laying out a Simple Rectangular Building with the Use of Batter Boards

Before laying out a simple rectangular building, it is important to note the following:

1. Site investigation should be conducted. This investigation should determine the suitability (soil type, road access etc.) of the site for building.
2. A surveyor should be appointed with the task of ensuring that all boundary irons and site datum levels (points) are accurate and placed in the correct position on the building site.
3. All the necessary Building Plans (working drawing approvals) and Documents have been approved by the necessary agencies such as the:
   - Town and Country Planning Division.
   - Ministry of Health.
   - Water and Sewerage Authority. (WASA)
   - Regional and Borough Corporation.
4. The building site must be cleaned and cleared (where necessary) of all unwanted vegetation and obstacles, such as boulders and trees which can turn out to be a hindrance to on site progress.

On completion of the site being cleaned, the boundary irons must first be located. A line must then be tied on one of the boundary irons and pulled along the perimeter of all the other boundary irons.

This line will establish the correct positioning of the boundary lines. This information can be obtained from the working drawing.

The second step is to establish building lines. These are to show the position and shape of the building. They also assist in maintaining the
dimensions of the building.

**Procedure**

- Take the required measurements from one side of the boundary line (the fence side) and from the front.
- Mark these points.
- Drive a picket into the ground where both lines meet.
- This point is referred to as a **jump off point**.

- Starting from the jump off point (A), measure the width of the front of the proposed building. At the end of this measurement, drive a picket into the ground (point B).
- Stretch a line tightly to join these two points (A and B).
- This line is now ‘**The first building line**’.
- From the end of the building line (point B), stretch a line that measures the length of the building. Use the framing square to ensure that both lines are at right angles to each other.
- Drive a picket at this point (C) into the ground.
- From point (A) at the end of the first building line, stretch a line that measures the length of the building.
- Once more, use the framing square to ensure that both lines are at right angles to each other.
- Drive a picket into the ground at point (D).
- Strike a nail at the top of each picket and tie a line along each nail to form a rectangle.
Pickets shown at points A, B, C and D.

- At each corner of the building drive 2”x 2” stakes at approximately 3ft. to 4ft. away from the original stakes to form an ‘L’ shape in the direction of the perimeter lines. The height of the stakes will be determined by the height of the floor slab which is established from the height of the site datum.

Illustration of Batter Boards with Datum Peg.

- From this point (datum point), transfer floor level marks on the remaining pickets at each corner.
- Attach 1”x 4” rough laths approximately 5ft. long (or less as required) to the pickets at the floor level marks. Use the spirit level to ensure that the laths are level.

Establishing heights from the site datum.

- With the use of the measuring tape, measure and mark the floor level on one picket. This is known as the datum point.

Laying out stakes and laths to assemble batter boards.
Transferring levels unto stakes.

Assembling batter boards.

These laths are referred to as **batter boards** and will serve to preserve definite and accurate building lines.

It must be noted that batter boards are boards that are fastened horizontally to vertical timber or wooden stakes, placed to the outside corners of a proposed excavation for a building. These boards, and the string tied between them, locate and mark the outside of the building.

This procedure must be repeated at the other three corners.

- Transfer the required measurements and levels from the datum peg or boundary line on the side to the top of the batter board facing the road.
- Repeat this procedure at the other end of the building on the fence side and place measurements on the batter board on the side facing the back of the building.
- Nails must then be inserted on the marks established.
- A line, pulled taut, is then fixed to the nails joining the two points.
- This establishes the **building line**.

Batter boards assembled.
Squaring using the Six-Eight-Ten Method

- The next step is to measure, from the boundary line at the front of the building, and place measurements on the first batter board facing the side.
- Using the 6ft.x 8ft.x 10ft. method, square the corner of the building.

Illustration of Batter Boards and 6ft. x 8ft. x 10ft. method used to square corners.

• From the point identified by the nail on the batter board at the front of the building, measure the width of the building. Mark the spot with a nail on the batter board where the measurement stops.

Close-up of squared corner.

• Using the same 6ft. x 8ft. x 10ft. method, square the second corner.

Using the 6-8-10 method to square corners.

• From the second corner that has been squared, mark off the length of the building and place measurement on batter board. Insert nail on that point. Join points with line parallel to the building line at front.

• The perimeter of the building has now been established.

• From the working drawings, determine the locations where intermediate walls will fall.

• Place stakes to mark off these positions.

• Batter boards must then be set up around the stakes (approximately 3-4ft away) following the procedure previously identified.

• Using the measuring tape, mark off on the batter board, the width and length of walls.

Marking off measurements on batter boards.
- At these points, insert nails. Connect nails to lines pulled taut and levelled.

**Squaring using the Diagonal Method**

- The **Diagonal Method** can/should also be used to determine if the building is square. If both diagonal lines are the same length, the building is square.

From Structural Clay Products Institute and F. Williams Rau “Bricklaying III” 1953 p.20. Illustration shows diagonal lines on a layout.

- Clean work area, wash tools and return them to storage area.
TRUE /FALSE ITEMS. Circle the correct answer.

1. A site investigation must be conducted before the laying out of a building. True / False.

2. The building site must be cleared and cleaned before the layout begins. True / False.

3. Boundary irons are used to determine the correct size and position of the building lots. True / False.

4. Diagonal measurements do not have to correspond with each other for the building layout to be square. True / False.

5. A site datum can be used to transfer levels at various points. True / False.

6. Boning rods are used to brace soil at various depths to avoid land slides. True / False.

7. It is NOT considered to be important to know the location of underground electrical and water lines, before excavation begins. True / False.

8. When excavating; soil should be placed at least 3’ - 0” away from the open trench. True / False.

9. The building setback can be any distance from the pavement or road. True / False.

10. A site datum peg can be removed at any time and adjusted if necessary. True / False.
MULTIPLE CHOICE ITEMS. Circle the letter of your choice.

1. Which one of the following methods is best suited for squaring the corners of a building during the layout process?
   a. 1.2.3
   b. 4.3.4
   c. 4.3.6
   d. 6.8.10

2. Which of the following terms best describes the process that ensures the building is square?
   a. 3.4.5 method.
   b. 6.8.10 method.
   c. Batter boards.
   d. Diagonal Method.

3. A concrete mix of 1:2:3 was prepared / mixed for a footing, the third number (3) refers to
   a. cement.
   b. additives.
   c. fine aggregates.
   d. course aggregates.

4. The purpose of a concrete footing is to
   (i) distribute the load evenly throughout the foundation.
   (ii) support the structure along with its imposed loads.
   (iii) support the foundation walls.
   a. i only
   b. i and ii only
   c. ii and iii only
   d. i, ii and iii
5. What is the approximate distance in feet, should excavated soil be placed away from an open trench?
   a. 2
   b. 3
   c. 4
   d. 5

ESSAY TYPE. Attempt all questions.

1. Explain briefly the meaning of the following terms:
   (i) Jump off point.
   (ii) Set back.
   (iii) Datum point.
   (iv) Excavation.
   (v) Site investigation.

2. Why is the concrete footing always wider than the block wall to be placed on it?

3. Why is it considered important to conduct a site investigation before the laying out of a building?

4. Explain the correct step by step procedure involved in using the 3 - 4 - 5 and/or 6 - 8 - 10 method?

5. Why is the diagonal method most frequently used in the final stage of the setout/layout process?
CHAPTER 6
LAYING BLOCKS/BRICKS TO LINE

This operation consists of carrying blocks to one or several lines established to achieve plumb, level proper alignment and square (if required).

It is important to remember that bricks and blocks can vary in weight depending on type. For example, concrete blocks are larger and heavier than clay bricks. They can also be a source of danger if handled incorrectly.

In masonry, the following procedure is followed when constructing walls.
To gain competence in laying blocks or bricks, the mason must possess knowledge of the materials to be used and an ability to use the tools properly. Only with a great deal of practice will a mason be able to spread mortar, hold the brick properly, form a head joint, cut the brick and use the mason’s line.

**Points to Observe Before Laying Blocks**

The following steps must be undertaken.

- Identify the reference points for the alignment.
- Using a spirit level, check to ensure that the base is level.
- Erect wooden/timber profiles into position.
- Insert guide nails at intervals on the profiles.
- Double check to ensure that the lines fastened from the nails are level and drawn taut.

**Preparation of the Mortar**

(Review Chapter 3, Mortar)

- Before selecting a particular type of mortar, consider carefully the types of project being undertaken.
- Admixtures (multi bond) can be used in mortar; however, it should be used only for a definite purpose or need.

- Ensure the mixing area is clean and damp, however if mixing takes place in a Mortar Power Mixer, ensure that inside the mixing drum is clean before mixing.
- Materials chosen to mix mortar must be clean, well graded, and free from organic matter (water and sand) and active (lime and cement).
- Use the correct proportioning and ratio mix to ensure the desired consistency of the mortar is met. This would also ensure that the mortar can be spread easily.
- Mix the dry materials (sand, cement, lime) together thoroughly with the use of a shovel. Add water (as required) to ensure that the final product (mortar) is plastic and workable.
- At this point, the mortar can be checked using an ON SITE MORTAR TEST to determine that it has the required elasticity, adhesiveness, plasticity, workability and consistency.

**Procedure**

- Flip a small portion of mortar on the trowel.
- Use a flex wrist movement to ensure that the mortar sticks to the blade of trowel.
- Turn the trowel upside down. If the mortar adheres or sticks to the blade of the trowel, then the mortar has met the requirements outlined above.
CUTTING WALLING MATERIALS

Very often when constructing walls, the mason is required to cut blocks/bricks so that a close bond can be obtained. Though the process appears to be a simple one, a certain amount of skill is required so that wastage of the material will not occur.

Cutting Blocks into Two Parts

Procedure

- Select a block that is free from defects, (crack free, well cured or baked)
- Mark with a line, the measurement to which the block must be cut.
- Draw the line all around the block.
- Using the proper chisel, cut the brick on the line until each cell between the webs of the block has been covered.
- Cut the webs all around the block, sticking between the cells.
- Using the chisel, cut the inside webs of the block until it is of the required dimension.
- Repeat the cutting process until an even cut of the block is achieved.

Please Note

When cutting concrete blocks, it is advisable to use a mason's hammer or chisel. However, the steps described above should be closely followed.
Trimming Blocks to Size

Procedure

- Select the block and mark off the measurement of the portion to be cut.

- With the use of a chisel, cut off the outer part of the excess section of the block.
- Cut the webs of the excess portion.
- Even off the cut with the use of a chisel and hammer.

Please Note

This procedure is used in two cases:

1. When the excess portion of the block is small.
2. When a section of the block is damaged but the major part of the block could be used.

Depending on the type of trowel, and the density of the steel from which the trowel blade is made, it is NOT RECOMMENDED to use the blade of the trowel to strike or cut masonry units, as this can damage or destroy the tool.

A chisel (depending on task and type) should ALWAYS be considered for cutting.
The strength, durability and appearance of a brick / block wall will depend to a great extent upon the bond used in the construction of the wall.

When used in masonry, the word bond has three meanings.

1. **Structural** Bond
2. **Pattern** Bond
3. **Mortar** Bond

### Structural Bond

Structural Bond is the term given to the interlocking or tying together of individual blocks to form a wall. Its purpose is to ensure proper cohesion or bonding of the units which make up the wall. It also serves to prevent cracking in a vertical direction.

Structural bonding in block masonry may be done in two main ways:

1. Arranging the block in an overlapping fashion.

### Pattern Bond

Pattern Bond is the pattern formed by the masonry units and the mortar joints on the face of a wall.

The pattern may be the result of the structural bond or may be purely for decorative purposes.
Pattern Bond may also be created by the way the mortar joint is handled.

**Mortar Bond**

Mortar Bond, also called mortar joint, is the adhesion of mortar to the masonry units.

Mortar joints use mortar between block units to perform one or more of the following four functions:

a. To bind units together and seal spaces between them
b. To bind blocks to reinforcing steel and cause them to be part of the wall
c. To compensate for the variation in the size of a block unit.
d. To provide a decorative effect.

**Mortar bonds can be made in two ways:**

1. With **continuous joints**
2. With **alternating joints**

**Continuous Joints**

Mortar bond using continuous joints is not as widely used as the bond using alternating joints. However, once certain requirements are met, this method will be acceptable.

The joints must be of the same thickness, approximately ½” or ¾” depending on the type of masonry units being used.

The horizontal joints must be perfectly aligned and level and the vertical joints must be straight and plumb at the corners.

These two images show how a mortar joint is created to seal a corner.

This bond is referred to as a **stack bond** and is used on walls that are non load bearing.

Stack bond.

**Alternating Joints**

The alternating joint is the bond that is most widely used in constructing walls. This provides a strong wall with good appearance.

Joints centre of block.
The joints must coincide correctly with the centre of the blocks and the joints of each course must be plumb with those of the other courses.

**Stud, Brace and Shoes**

- Select 1”x 4” rough laths. These will be used in assembling the profile.
- The areas where the profiles are to be placed must be cleared and cleaned of all debris.

**Installation and Erection of Wooden or Timber Profiles to Accommodate Lines**

Material to be used for the installation of profiles must be carefully selected because this will influence the plumbness of the wall.

**Uprights Selection**

Select 2”x 4” rough lumber. The length of the lumber will be determined by the height of the wall. The lumber (2”x4”) will be identified as upright members or studs in the following procedure.

Lumber selected must be very straight.
• Select braces (1” x 4” lath) and cut to the required length.
• Cut the top and bottom ends of the braces at angles of 45°, opposite to each other. Fasten shoes to the braces at the ends which will be anchored to the floor. Plumb one side of the upright member (stud) and fasten the brace to the ground.

• Fasten the other brace to the upright member (stud) in an adjacent position approximately 12” from the top allowing the foot of the brace to extend away from the upright.

• Plumb the other side of the upright member (stud) and fasten the brace to the floor.

• Using the procedure outlined, construct additional profiles approximately 12ft. from each other, again, in accordance with the guide line in place.

Ensuring upright member or stud is plumb.
Installing Guide Nails on Profiles

Before inserting guide nails on wooden or timber profiles the following must be taken into consideration.

a. The height of the blocks to be used.
b. The thickness of the mortar joint.

- After the above points have been determined establish a jump off point on the profiles.
- Fasten nails at these points.
- Draw a line from these points to each profile.
- Using the spirit level and/or line level, test the line to make certain that it is level.

- Take measurements of the block height including the thickness of the mortar joint starting from the jumper point marks.

- Scribe these measurements on each profile.

- Insert nails at the intervals on the profiles that have been marked.

- Attach lines to nails starting from the first row at the bottom of the profiles, leading upwards. Place nails approximately 1” to 2” from the foot of the profile, to accommodate guide lines (fort lines).
• Spread mortar, using the trowel on the area where the first course of bricks will be laid. This is referred to as the ‘bed mortar’.

• Furrow the mortar using the point of the trowel.
• Start the first course by laying the first unit from the corner. Set the first block on the mortar bed and press it firmly unto the mortar using a back and forth motion.

LAYING THE BLOCKS

• Prepare surface where blocks are to be laid so that it is clean and damp.

• Check regularly to ensure that the lines are level.
• Clean work area, wash tools and return them to storage area.

Level lines attached to nails.

Bed mortar.

Note: the amount of mortar spread must be slightly more than the length of the block.

Prepared surface for laying blocks.

Laying first unit from corner.
- Lay the second block to the line (by tapping the top with the brick hammer) to achieve a straight, level and plumb alignment.

- Leave a thickness of about ½” for the joint when using clay blocks.
- Leave a thickness of about 3/8” for the joint when using concrete blocks.
- With the edge of the trowel, cut and remove the excess mortar from the sides of the block.

**Laying One Block After Another**

- Apply mortar to the head joint of each block thereafter, using a swiping or throwing action across the end of the block.
• This action will attach the mortar to the block and form it into a wedge shape.
• Place the next block at the end of the previous one pressing it into place close to the line.

In laying out the second course, an important feature that must be employed is that each block must be placed on half of two units of the first course.

Procedure

• Place half a block over the first block of the first course.
• Test for plumb, level and alignment with the block below.

• Once more, test for level, plumb and proper alignment of each block.
• In each case, leave a thickness of about ½” to 3/8” for each joint.
• Trim away all excess mortar.
• This process is continued until the laying of the blocks for the first course is completed.

• Centre each block that follows over the cross joint of the first course of blocks.
• Make sure that all joints are of uniform width.
• Level, plumb and line up each block in the second course so that each block is aligned with the two blocks directly underneath.
• Continue with this method until the entire second course is laid.
• In laying the third, fifth, seventh course etc., ensure that their vertical joints are plumb with those of the first course laid.

• The remaining even courses, fourth, sixth etc. must be so placed that their vertical joints are plumb with those of the second course.

Note:

This alternating arrangement of the vertical joints is called a bond (as described earlier). Its purpose is to ensure proper cohesion or bonding of the units which make up the wall and to prevent cracking in a vertical direction. It also adds strength to the wall.

Lintels

A lintel can be described as a member placed over a door or window opening, with the purpose of removing load off the door and window frames. The lintel also bridges the existing walls horizontally between the opening (frame) and supports the wall immediately above the door and the window opening.

There are various types of lintels used in the construction industry; however, we will only focus on two (2) types:

• **Reinforced Concrete Lintel**

• **Block Lintel**
Reinforced Concrete Lintel

With this type of lintel, formwork is constructed according to length and thickness of opening.

Steel is then placed and concrete mixed, placed, levelled and vibrated.
Block Lintel

Commonly used, this type of lintel is constructed with reinforced steel placed in the core of the blocks while standing in a vertical position.

Concrete is then placed/poured into the core of the blocks and allowed to set.

1. Place mortar to lay the first clay block.
2. Lay the first block in a vertical position.
3. Level the clay block.
4. Plumb clay block on both sides.
5. Spread mortar to lay second block.
6. Lay blocks in a vertical position until the correct height/length is reached.
Check measurements.

Cut reinforced steel rods to place in the core of the blocks.

Set the reinforced steel in place. Ram/vibrate the concrete into the core of the blocks.

Pour concrete to set reinforced steel in place.

Reinforced steel set in place. Repeat the process for the second core.
Pointing is the process by which joints between blocks in a wall are finished in plain or ornamental style.

There are three (3) types of mortar joint finishes:

- Joints that are finished using the trowel.
- Joints that are finished using special tools.
- Joints that are rubbed and finished with the use of a paper sack and/or sponge float.

In the troweled joint, the excess mortar is struck off with the trowel and finished with the same tool.
The tooled joint is made with a special tool to compress and shape the mortar in the joint.

Jointing Tool with Tongue

This tool consists of a piece of broad, thin iron plate with a projected tongue which has the same width as that of the joints and whose lengths or projections are equal to the depth required for the joints.

The tongue can be made in the middle or at one side of the plate.

This allows joints to be grooved where there are corners. This joint is called a raked joint.

The paper sack or sponge float rubs off the excess (squeezed) mortar to produce a smooth flush joint finish.

Tools used by the mason in this exercise are called jointing tools.

Pressing the tool flush with the block, the tongue cuts down the joints uniformly.
Procedure for pointing

• Using a pointing trowel, fill all possible holes in the joints of the blocks with mortar.

• Move the jointing tool slowly along the bed joints. Apply some degree of pressure so that the jointing is left uniformly sunken and smooth.

• Trim off any rough edges projecting from the joint using a pointing trowel.

• Allow the mortar to dry to a finger touch.

• When the mortar is sufficiently stiff, use a brush to remove all remaining excess mortar.

• Clean work area, wash tools and return them to storage area.
TRUE /FALSE ITEMS. Circle the correct answer.

1. Furrowing of mortar should be done only when the mortar is of poor quality.  True / False.

2. Cement mortar is a mixture of sand cement and water mixed to a prescribe ratio.  True / False.

3. Lines on wooden profiles ensure that the masonry units are laid NOT to level and NOT to plumb.  True / False.

4. Before applying mortar to any masonry based surface, the surface must be cleaned and dampened. True / False.

5. Eye protection should always be worn especially when cutting masonry units into two parts  True / False.

MULTIPLE CHOICE ITEMS. Circle the letter of your choice.

1. Which one of the following sizes ,in millimeters, relates directly to a Foundation block?
   a. 100 x 100 x 400
   b. 100 x 200 x 400
   c. 200 x 200 x 200
   d. 200 x 200 x 400

2. Which of the following terms best describes mortar that lacks cement?
   a. Plastic.
   b. Grout.
   c. Oversanded.
   d. Initial set.

3. A mortar ratio mix of 3 : 1 was prepared / mixed to lay masonry units. The third number (3) refers to
   a. cement.
   b. lime.
   c. water.
   d. fine aggregates.

4. A building site that is better organized will
   (i) reduce on site accidents.
   (ii) improve working conditions.
   (iii) support and enhance productivity.
   a. i only
   b. i and ii only
   c. ii and iii only
   d. i , ii and iii
5. The horizontal member constructed of reinforced concrete and or reinforced concrete blocks, and placed directly above a door and window opening is called a
   a. beam
   b. span
   c. soffit
   d. lintel

ESSAY TYPE. Attempt all questions.

1. Explain the meaning of the following terms:
   (I) Pointing.
   (II) Profile.
   (iii) Bonding.
   (iv) Lintel.
   (v) Formwork.

2. Outline the various functions of mortar?

3. Why is it considered important to place lintel over doors and windows openings?

4. List (separately) the correct step by step procedures related to the following task listed below?
   (i) Laying a concrete block to a line.
   (ii) Constructing a clay block lintel.
   (iii) Cutting blocks into two parts.
   (iv) Pointing mortar joints with the use of a jointing tool.
   (v) Mixing mortar using the correct ratio.

5. What is the difference between the Structural bond and the Pattern bond?

6. In what direction / position is the bed mortar joint laid?

7. Explain the term “bond” used in reference to brick masonry work?

8. What type of defect can be readily seen and or identified on a second grade concrete or clay block?
The mason must also be creative and have an appreciation of aesthetics so that the work he does will be both well constructed and pleasing to look at. He therefore needs to know the proper methods of reinforcing, building forms, applying mortar, spreading and floating, sponging, making edges and finishing.
When applying plaster to walls, a number of basic operations must be followed in order to produce a job of high quality and which is pleasing to the eye.

These operations include:

1. Proper selection of tools for plastering.
2. Preparation of (background) wall.
3. Measuring the correct quantity and selecting the best quality materials for mortar.
4. Preparation of plaster mortar.
5. Placing reference points on walls to establish button positions in correct alignment and plumb.
6. Establishing screeds as guides.
7. Filling and roding between screeds.
8. Spreading and floating with mortar.
10. Sponging.

1. Proper Selection of Tools for Plastering

Tools used for the various stages in plaster work (preparation, application, finishing) was discussed explicitly and extensively in Chapter Two (2). Please review.

2. Preparation of (Background) Wall

Walls (background) must be prepared to receive the plaster before it is applied, for example:

- A smooth concrete surface should be rough and wetted before plaster mortar is applied.
• Holes appearing in walls should be wetted and filled.

Holes bring filled.

3. Measuring the Correct Quantity and Selecting the Best Quality Materials for Mortar

Materials in terms of quality and quantity were discussed extensively in Chapter Three (3). Please review.

4. Preparation of Plaster Mortar

Preparation of mortar can also be reviewed in Chapter Three (3).

Steps to be followed:
• Check to discover whether the wall is plumb and straight.

5. Placing of Reference Points

This is a technique used by the mason before the actual plastering of the wall. It consists of placing reference points on the surface to be plastered which are meant to establish the correct alignment and plumb of the wall.

The first task is to prepare the surface so that it is free from bulge, dust, old mortar, concrete and grease.

Preparing the surface.

Properly mixed mortar.

Ensuring the wall is plumb.
Ensuring the wall is straight.

- Decide on the number of reference points that will be used. These will be determined by the size of the surface to be plastered and the plumb and level of the wall.
- With the use of the hammer drive two nails at each of the upper ends of the wall.
- Attach a cord to both nails and pull it taut.
- The cord must remain properly taut for it to indicate a correct alignment.

- Place the cord approximately ½” away from the wall. This will represent the thickness of the plastering.

- Carefully select pieces of lumber 6” x 1 ½” x ¼” to be used as buttons.

Ensuring cord is correctly placed.

Wetting background / wall surface.

- Place a bit of mortar at one of the upper ends of the wall.

Mortar placed on damp surface at upper end of wall.

Button selection.
• The amount of mortar should be just enough to have the button almost touching the cord after the button has been placed.

• Place the first button, pressing it on the mortar and moving it in both directions (back and forth) until it is aligned with the cord.

• The button should now be almost touching the cord.

• Repeat the above procedure to place the second button at the opposite end of the wall.

• Once more press the button firmly unto the mortar until it is aligned with the cord.

• Place intermediate buttons along the wall, following the procedure described above. The distance between intermediate buttons will be determined by the length of the rod to be used in removing excess mortar.

• Only when satisfied that the buttons are firmly attached to the wall, should the cord be removed.

• Drive two nails at each of the bottom ends of the wall.

• The nails should be approximately 6” above the floor and directly below the first and second buttons.
• Attach a cord to both nails and pull it taut.
• Using the plumb bob, ensure that the line is plumb with the buttons above.
• Place a bit of mortar at each of the bottom ends of the wall at the points where the nails have been driven.
• Place buttons on the mortar, pressing firmly down until they are almost touching the cord. Plumb each button with the button above.
• Repeat this procedure when placing intermediate buttons.
• Test once more to ensure that the bottom buttons are plumb with the intermediate and top buttons on the wall.
• When this exercise has been completed, the cord must be removed.

6. Establishing Screeds as Guides

This procedure is considered as the second stage in the plastering of walls. It involves setting up screeds to act as guides for the subsequent mortar coating. It is a process always carried out by the mason when coating and consists of filling in with mortar, the vertical spaces between two buttons.

**Procedure**

• Sprinkle with clean water the area of the wall, identified for the screed.

**Clean water sprinkled before mortar is applied.**

• Mix mortar in small portions until a stiff mass is obtained to a ratio not exceeding 3:1, (three parts sand to one part cement).

• Apply the mortar to the surface where the screed is to go, that is, the area between the end button below and the corresponding button on the top part of the wall.

**Applying mortar between screeds.**
• The width of the screed must be the same as the width of the buttons.

• When applying the mortar, grasp the trowel in the right hand if you are right handed and with a quick turn of the wrist towards the body and a backward movement of the arm, spread the mortar on the surface of the wall.

• Direct the mortar so that it forms a first coat between two buttons, with a minimum width of 6”

• Apply the second coat of mortar and fill in the screed so that it levels off with the face of the two buttons.

• If the second coat does not level off with the buttons, a third coat must be applied.

• Level off the screed with a straight-edge, using a vertical seesawing motion, so that the rod in passing over the mortar always rests on the buttons. The rod must also touch the entire surface of the screed.

• Tilt the rod slightly so that its edge removes the excess mortar in an even fashion.

• Fill areas with mortar where there are hollows or where the rod has not leveled.

• This process is called **backfilling** or **buttering**.

• Screeds established to act as guides for subsequent mortar coating.
When this job has been completed:

- Clean the rod by removing the mortar with the trowel.

- Remove the buttons with the tip of the trowel as each screed is finished.

- After removing buttons, wet the resulting spaces and fill with mortar.

- Wash all tools and return them to the storage area.
7. Filling and Roding between Screeds

The third stage in plastering walls with mortar is the filling and roding between screeds.

It is important to note that plaster mortar can be applied in one coat, two coats and three (3) coats depending on the requirements of the job.

**In One Coat Plastering:**

The mortar is applied to the height of the screed or over in one layer and finished in accordance with the level of the screed. This process is called the **screed coat**.

**In Two (2) Coat Plastering:**

The first coat is called the **scratch coat** and should NOT be applied more than $\frac{3}{8}''$ thick.

The second coat is called the **finish/finishing coat** and should NOT be applied more than $\frac{1}{8}''$ to $\frac{1}{4}''$ thick.
In Three (3) Coat Plastering:

The first coat is called the **scratch coat** and should NOT be applied more than $\frac{3}{8}$" thick.

The second coat is called the **brown coat** and should NOT be applied more than $\frac{3}{8}$" thick.

The third coat is called the **finishing coat** and should NOT be applied to more than $\frac{1}{8}$" to $\frac{1}{4}$" thick.

The first coat that is applied to the wall is referred to as the **screed coat**. This consists of applying mortar with the trowel to the surfaces between the screeds, in successive layers, until a thickness slightly greater than that of the screeds is obtained.

**Procedure**

- Sprinkle the surface to be filled in with water.

- Mix mortar to a ratio not exceeding 3:1 (3 parts sand to 1 part cement).

- Work the mixture until the required plasticity is obtained.

- Place a quantity of mortar in the trough.

- Use the trowel and place mortar on the hand hawk.
• Remove mortar from the hawk with the trowel using the right hand, while the left hand holds the hawk.

Applying mortar with the use of a hawk and plastering trowel.

• Apply a first layer of mortar to the surface that has been bound by screeds.

Applying portions of mortar between screeds.

• Apply successive portions of mortar on the wall between the screeds, until a new layer is formed.

• Work on more than one panel at a time, so that there will be time for the mortar to set before a new coat is applied.

Working on more than one panel at a time.

• Repeat this procedure applying mortar as many times as necessary for the mortar to level off with the thickness of the screeds.

• Rod the panel with the rod resting on the screeds.

Rod resting on the screeds.
• Work from below and move upwards.

Working rod from below and moving upwards.

Closely monitor the progress of the work and where necessary:

• Fill in the holes on the panel with mortar where the rod did not touch.

• Rod the panel or pass over with the edge of the trowel if the retouching is a small quantity.

Filling in the holes and retouching with the trowel.

• Once more ensure that the rod rests on the screeds and touches every point of the surface in any direction in which it is placed, so that the surface will be flat and true.

8. Spreading and Floating

This is the fourth stage in the plastering of walls. In this operation a coat of mortar is applied with the float to the base coating (screed coat) and is leveled off with the same float. It is done as part of the plastering operation and at times as a finishing coat.

Rubber gloves should also be worn to prevent mortar from causing injury to the fingers.

Procedure

• Dampen the face of the float with clean water so that the float could spread the mortar evenly.

• With the use of the brush sprinkle water on the surface of the wall.

Sprinkling clean water on wall surface.
• With the use of the wooden float, work the mortar using both a clockwise and an anticlockwise motion until a smooth surface is achieved.

Clockwise and anti-clockwise motion being used.

• Repeat this action, spreading the mortar in an outward direction until the entire wall is smooth and true to the required standard.

Spreading/浮动 mortar in an outward direction.

• If sunken spots are noticed when leveling off, fill these in with mortar and float again.

Sunken spots on plastered wall.

Sunken spots being filled in.

• On completion of this process, use the sponge to remove all unwanted particles from the wall.

Using sponge to remove unwanted particles.

• Level off the entire spread area, sprinkling water with a brush where necessary.
9. Making Edges

This procedure involves applying mortar, of a neat cement paste, to columns, jambs, external corners and beams.

This is done for the following reasons:

1. To bring the columns, jambs, external corners and beams to the desired shape and dimensions.
2. To make them plumb, square and level
3. To obtain a uniform surface on completion of the job.

Procedure

Prior to the plastering of jamb, columns, etc.:

- Place a straight edge, also called guide rod, on each side of the jamb or column to allow for ½” thickness of mortar.
- Secure the rods with steel clamps, or concrete nails.

- Clean work area, wash tools and return them to storage.

Work area being cleaned.

Floating Internal Angles

- When floating internal angles, pass the float from the top, downwards and vice versa, and leave the angles very straight.
- Smoothen first one side of the corner from top to bottom and vice versa, wetting when necessary.
- Care must be taken to prevent the edges from being broken.
- Float the other side of the corner using the same method that is from top to bottom and vice versa.
- Fill in with soft mortar wherever material is missing.
- Pass over again with the float.
- Remove all mortar that is stuck on the float.
- Pass the clean, slanted float from the corner to the sides, to remove the rough bits.
- Shape the edges to produce a straight angle.

When this process has been satisfactorily completed, clean work area, wash tools and return them to the storage area.

Securing rods with steel clamps.
• Using the spirit level ensure that the rods are plumb and level.

• Using the trowel, apply mortar on the surface enclosed by the guide rods.

These rods will now serve as screeds.

• Apply mortar in the coats and ensure uniform thickness.

• Repeat this action until the mortar is flush with the guide rods.
- Mortar flush with guide rods.

- Mortar must cover the entire column spanning the length of the guide rods.

- Using a straight edge, rod off excess mortar.

- Apply mortar to areas where there may be hollows.

- Apply finishing coat in one thickness as quickly and smoothly as possible with plastering trowel.

- Jamb covered with mortar.

- Re-rod with straight edge to obtain a perfect horizontal and vertical surface.

- Float surface until it is smooth and true.

- Apply finishing coat.

- Floating to achieve a smooth surface.

- Remove the guide rods only when the mortar hardens sufficiently.
Horizontal guide rods being removed after mortar hardens.

Vertical guide rods being removed after mortar hardens.

- This will prevent the edges from being damaged.

Horizontal edges formed without damage.

Vertical edges formed without damage.

- Retouch the edge with a float if necessary.

Filling and flushing-off the horizontal edges.
10. Sponging Walls

This is a process carried out by the mason to produce a fine granulated finish on walls and ceilings.

It involves rubbing with a sponge float, a concrete surface that has been previously rendered to achieve a neat cement finish.

Check for accuracy with straight edge and square and correct where necessary.

Clean up work area, wash tools and return to store room.

Procedure

- Insert the sponge into a bucket of water for it to become pliable.
  If a sponge float is not available, the finishing can be done with a large, flat ordinary sponge.
- Use the finger method to check the state of dampness and consistency of the surface to be sponged.
- If the surface is very soft, the sponge will carry away the mortar;
If it is hard, it will drag away the grains of sand.

- Start at an angle, passing the sponge along the surface working on small sections at a time.
- Repeat this procedure, passing the sponge over other areas of the surface with short circular movements, until the entire wall has been completed.

Ensure that the sand grains in the mortar are uniformly distributed on the surface of the wall.

**The following are to be noted:**

a. When sponging ceilings the mason starts from the front moving backwards, and on walls from the top moving downwards.

b. The texture of the sponge finish will depend on the pressure the mason exerts on the sponge.

c. The sponge must be wet whenever necessary, or the surface sprinkled with a brush.

d. The sponge must not be passed again on the surface which has already been finished, since it will cause the grains to separate.

On the satisfactory completion of this process:

Clean work area, wash tools and return them to the storage area.

1. **Weather/ Temperature Conditions**

Weather and temperature conditions can affect plaster mortar. If the temperature is very hot (dry) and damp (wet) preventative measures must be taken to ensure the plaster mortar is NOT damaged as plaster mortar must cure properly regardless of the weather and/or temperature conditions.

An example of map-cracking and sweat-out (due to presence of moisture) on plasterwork.
2. Cracking

Cracks are usually created in plasterwork from the mixing stage to its final set. This situation can be attributed to one or more of the following:

- Over sanding of mortar.
- Poor quality mortar that is contaminated with organic matter.
- Very hot and/or dry temperature/weather conditions.
- Lack of air circulation in enclosed areas.
- Very rich mortar mixture.
- Lack of proper (background) wall preparation to receive plaster.

It is important to note that plaster cracks should/can be repaired in such a manner, so as to avoid its reoccurrence.
3. Human Character

The human characteristic of making errors, misjudgment and lack of interest and/or attention during skills training can be the cause of mason’s misuse of tools, materials and equipment. Masons can misuse them (tools, materials and equipment) regardless of how good they were as to quality.

The human character is the most important, because in the final analysis, it is the mason’s knowledge, skills, attitude and personal integrity that determines the outcome as it relates to the quality of the job.
MULTIPLE CHOICE ITEMS: Circle the letter of your choice.

1. The word rendering is directly related to the term
   a. grouting
   b. flushing
   c. plastering
   d. coating

2. Which of the following describes the order of application in which three (3) coat plastering is applied?
   a. Scratch, Setting and Brown
   b. Scratch, Brown and Finish
   c. Scratch, Finish and Scratch
   d. Finish, Scratch and Brown

3. The plaster mortar on masonry backgrounds should not exceed a thickness of more than
   a. 1/8”
   b. 3/8”
   c. 1/4”
   d. 1/2”

4. When applying mortar to a steel I-Beam or background, the material used to provide a background, for the mortar to adhere is called
   a. metal lath
   b. plaster force
   c. b.r.c fabric
   d. mesh wire

5. The purpose of making edges (using mortar) on columns and beams are to
   (i) ensure and obtain a uniform surface
   (ii) make them appear plumb, level and square.
   (iii) obtain the desired shape and dimension
ESSAY TYPE ITEMS. Answer all questions.

1. Explain the meaning of the following terms:
   a. Rendering.
   b. Buttons.
   c. Screeds.
   d. Scratch coat
   e. Plastering
   f. Stucco.

2. Why are screeds used in the plastering process?

3. What precautions should be taken to prevent made up edges from being broken, while still in its plastic stage?

4. How does the weather / temperature conditions effect plasterwork?

5. State four (4) reasons for the cracking of plasterwork?

6. List (separately) the correct step by step procedure related to the following task listed below:
   (i) Preparation of (wall) background.
   (II) Placing of reference points
   (iii) Establishing screeds as guides.
   (iv) Making edges.
TRUE / FALSE ITEMS: Circle the correct answer.

1. In plastering, the surface that the mortar is applied to is called background.   True / False

2. Mortar should be mixed at a ratio of three (3) parts sand to one (1) part cement with water added to make the mixture plastic and workable.   True / False

3. If mortar is mixed with an excessive amount of water; then large amounts of cement should be added to ensure strength and workability. True / False

4. It is NOT necessary to prepare the masonry (background) wall to receive mortar as long as the (background) wall is level and plumb. True / False

5. If intermediate buttons are to be placed on a (background) wall; the length of the masons rod should determine the buttons position on the (background) wall. True / False

6. The motion which is commonly used when sponging a freshly plastered (background) wall is from the top moving downwards. True / False

7. A clockwise and anticlockwise motion is used when floating a plastered (background) wall to create a smooth surface. True / False

8. In two(2) coat plastering the second coat is called the brown coat. True / False

9. It is NOT important to seek assistance when lifting heavy loads. True / False

10. When floating a wall its NOT necessary to wear rubber gloves. True / False.
A tiled surface can be defined as a laid out group of evenly spaced tiles, each fastened with the recommended adhesive to a well prepared subsurface, sealed and/or bonded to neighbouring tiles with a filler material called grout.

Tiles provide a surface that is fireproof, durable, soil and moisture resistant, and easy to maintain.
The tile body itself or back of the tile is called the **bisque**. The bisque can be classified by the percentage of water that it absorbs.

While traditional methods of setting and/or laying ceramic tiles directly into a level bed of cement mortar is still being used, the development of thinset mortar and other adhesives have made it possible to easily install tiles directly over a variety of subsurfaces.

All tiles are generally classified as **ceramic**, and they are categorized in many different ways. At the most basic level, tiles are either **glazed** or **unglazed**.

A glaze is a hard finish usually including a colour that is applied to the surface of the bisque before the final baking. An unglazed tile has no glazing on the surface.

Although at first ceramic tiles were used only in bathrooms, today they can be used in any room of any type of building being used for commercial, industrial and residential purposes.

It must be noted that tiles are now available in a number of types, colours and sizes depending on how they are made and of what use they are intended to be put, for example the Dairy and Food industry require the highest degree of hygienic, germ-free and sanitary conditions.

As such, bright and light coloured tiles should always be used in buildings of this nature, as this encourages cleanliness and the upkeep of proper sanitary conditions. On the other hand, dark and murky coloured tiles hide and conceal dirt.
Many of the tools used on basic masonry projects are also used in the setting of tiles. However, since tile setting has become a more specialized area, there are some tools that are specifically designed for use in this area. These tools are as follows:

- Notched Trowel
- Square Notched Trowel
- Notched Spreader
- Tile pointer
- Rubber-Backed Trowel
- Rubber Float
- Grout sponge
- Tile Cutter
- Tile Snips
- Tile Nippers
- Rubber Mallet
- Plastic Spacers

It is important to note that the various tools may be used to perform a variety of tasks such as:

- Layout
- Setting
- Spacing
- Cutting
- Grouting and Sealing

This tool is used for spreading adhesives over large areas or any area where sufficient room is available to allow the mason to work without obstructions. This tool is manufactured in various notch sizes.

This type of trowel is used when setting tiles in thinset or sand mortar.

It is important to note that there is the V-Notched trowel which is also used for the purpose of spreading any type of mastic adhesive.
Notched Spreader
This is an ideal tool used for applying adhesives to small surface areas such as the backs of tiles.

Tile Pointer
This is probably the most essential of the tools used in tile setting. Its purpose is to spread small quantities of mortar, to fill depressions on surfaces, to adjust spaces between the tiles and tap the tiles to set them in place.

Rubber Float
This tool is used to apply grout over large tiled floor and or wall surface areas.

Rubber-Backed Trowel
This tool is used for mainly spreading grout.

Grout Sponge
The grout sponge is used to remove most of the grout from the tiles, without upsetting the grout between the tiles.

Tile Cutter
As the name implies, this tool is used for cutting ceramic tile.
Rubber Mallet

This tool can be used for tapping tiles into place depending on its size, but it is mainly used to tap the bedding block.

Tile Snips

Tile snips are used for making curved and intricate cuts in resilient tile.

Tile Nippers

This tool is used for removing small bits of tile so that the amount of grinding of the cut tile will be minimized.

Plastic Spacers

Plastic crossed shape spacers come in various sizes. They provide even spaces and/or spacing between tiles. Spacers are easy to remove and no harm is done if they are left.

Review Chapter 2 – Tools, for other masonry tools used in the art of tile setting.
Tiling materials are divided into the following categories:

1. Floor and Wall finish materials. (Glazed and Unglazed tiles)
2. Setting Materials / Adhesives. (Mastic and Thinset mortars)
3. Filling Materials / Grouts. (Sanded, Unsanded, and Epoxy)
4. Cleaning Agents. (Biodegradable and Non-Acidic)
5. Substrates / Sub-Surface. (Concrete, Mortar and Wood)

1. Floor and Wall Finish Materials

Ceramic Tiles are a mixture of clay and other natural materials that are pressed together into shape and fired at high temperatures, which gives the tile its hardness.

There are different types of tiles used in and manufactured for the tiling industry. They are:

- **Porcelain**
- **Quarry** and
- **Mosaic** tiles.

The body of the ceramic tile, known as the bisque may (on one side) be glazed or unglazed, depending on its intended use.

**Glazed** tiles comprise of a liquid coloured glass coating, which is applied to the surface of the bisque, under very high temperature conditions. The liquid glass gives the tile its texture, design and colour.

**Unglazed** tiles have no glazing on the surface, which allows the bisque to be seen from top to bottom. This is similar to that of a quarry tile.
Classification of Tiles

According to the P.E wear rating from the Porcelain Enamel Institute, tiles are classified into five (5) groups or types. They are:

**TYPE / GROUP 1**

Tiles suitable for residential bathroom with light foot traffic. Wall tiles generally fall into this group.

**TYPE / GROUP 2**

This type of tile can be used in residential areas but not recommended for areas with high foot traffic such as kitchens and dining rooms.

**TYPE / GROUP 3**

Tile recommended for all residential (installation) construction with normal foot traffic.

**TYPE / GROUP 4**

Tiles that are suitable for light to medium commercial application such as offices, sales and show rooms.

**TYPE / GROUP 5**

Tiles suited for an environment where heavy commercial and industrial traffic occurs; such as malls, airports, hotels, lobbies, and public walkways.
2. Setting Materials / Adhesives

There are various types of tile adhesives being sold on the open market and used in the construction industry today. They vary in cost, quality and type, however, advice or guidance can be sought from a reputable tile dealership or tile contractor about the best adhesive for a particular type of job.

Tiling Adhesives fall into three (3) basic groupings:

1. Cement-based thinset mortar.
3. Epoxy-based adhesive.

THINSET MORTAR

This type of mortar is pre-mixed, sold in paper (bags) sacks and must be mixed with water to bring it to its plastic and workable state.

Thinset mortar can be used on shower walls and floors of almost any type.

MASTIC

Mastic is a solvent based adhesive which requires no mixing. However, it is recommended as a non-wet application and should not be used on floors and in showers.

EPOXY

Epoxy is a three-part chemical based adhesive, which when mixed together forms a very hard stiff putty-like substance.

When its cures it becomes a permanent part of what it is attached to. It is highly recommended for use in swimming pools and stones.

3. Filling Material / Grout

SANDED GROUT

This type of grout is recommended for wide joints between large ceramic tiles (except marble) that are laid on floors.

UNSANDED GROUT

This is a mixture of cement and a coloured additive, which is used to fill the areas or spaces between tiles that are laid on walls with joints less than 1/8” in width.

EPOXY GROUT

This type of grout is recommended for use where tiles are exposed to severe chemical attack. It is also resistant to stains.

4. Cleaning Agents

Tile and Grout Cleaning Agents

Tiles and Grouts need to be cleaned with the recommended tile and grout cleaner. This ensures that the tile surface is not damaged and the grout is not discoloured or bleached. It is important to use products which are specifically manufactured for tiles and grouts.
Biodegradable

Manufactures of cleaning agents specifically used in the tile setting industry are now focusing on the environment. This include the manufacturing of biodegradable cleaning agents, which when enters the environment, will break down easily and naturally.

Non-Acidic

Non-Acidic cleaning agents contains no acid and hence, this prevents the etching and destroying of the tile surface. With the introduction of so many new products into the local market, it has become increasingly important to follow the manufactures instructions before attempting to use the product.

5. Substrate / Sub-Surface

Concrete

This material was discussed in Chapter 3 – Materials. But for the purpose of this chapter, it must be noted that the concrete surface must be clean, level, plumb and rough before laying tiles.

Mortar

This material was already discussed in Chapter 3 – Materials. But for the purpose of this chapter, it must be noted that the mortar surface must be clean, level, plumb, and rough before tiles are laid.

PREPARATION OF WORK AREA FOR SETTING TILES

The procedure for preparing the work area for setting tiles on walls is basically the same as for setting tiles on floors.

This process determines the quality and durability of the finished tiled surface, therefore, the proper preparation of the sub-surface must be given paramount importance.

It is important to note that inadequate surface preparation is the most common cause of failure when bonding or setting tiles to masonry based (concrete, mortar, blocks/bricks) and non-masonry based (wood or ply) building surfaces.

All sub-surfaces / substrates must be sound, clean and free from paint and any other contaminants that can cause the tiled surface to lift.

Wood

When wood surfaces (substrate) are being used as background to lay tiles, it is important to prepare the wood, based on the type of adhesive, size of tiles to be used, and the purpose for which the tiles are being laid.
Concrete

The main problem as it relates to tiling on a concrete sub-surface/substrate, is the lack of effective adhesive penetration into the sub-surface. This does not only mean that the concrete must possess certain qualities before tiling can commence, but also that the sub-surface/substrate must be:

1. properly cured and or dry;
2. free from active cracking or cracking of any type;
3. free of contaminants such as oil, dust, and sealers;
4. broomed while still in its plastic state, leaving a rough exposed aggregate type finish, which allows for better keying and bonding with the adhesive.

Mortar

All plastered or cement rendered surfaces should be at least 10 days old, before tiles are laid on them. The mortar used should be mixed at ratio of 3 parts sand to 1 part cement with enough water added (Review chapter 3 - Mortar). Mortar can be applied to any masonry based and non-masonry based surface, once it is prepared correctly.

Mortar applied directly over block/brick work (Review Chapter 7 on Plastering) can be very porous and sandy on the surface when it dries, therefore certain precautions must be taken to prevent tiles from lifting or falling off the wall.

They are:

1. While the mortar is still in its plastic state, it should be scratched leaving a rough finish which allows for better keying with the adhesive.
Mortar being scratched, leaving a rough finish.

2. Wet the wall and clean the wall surface using a stiff bristle brush or broom.

Masonry-based surface being wetted.

3. A damp cloth can be used to wipe the wall to ensure removal of dust.

Metal lath placed and tacked with nails unto the plywood surface.

Ply/ Wood

When setting tiles on a wooden sub-surface / substrate, you must ensure that it is structurally sound, strong and free from any varnish stains, or any other coatings.

If it is a timber floor, it should be sanded to expose timber fibres and to smooth out any lipping in the joints between the wooden sheets. Once the floor is sanded, remove any dust and sanded material by sweeping and vacuum cleaning. The surface can also be cleaned with a damp cloth or mop.

Depending on the requirements of the floor and walls, they are usually outfitted with a metal or maple lath along with a thin mortar base coat to avoid tiles falling off walls or lifting off its sub-surface / substrate due to earth movement.
Wood surface being wetted.

Plastic, ordinary concrete being placed.

Spreading the concrete.

Rodding and levelling the concrete sub-surface / substrate.

Floating the sub-surface / substrate to remove excess cement grout.

Brooming the sub-surface / substrate.
There are two methods that can be used when laying tiles on floors. They are:

1. Laying tiles beginning from one end of the floor.
2. Laying tiles beginning from the centre of the floor.

Both methods will be discussed here.

Layout Floor to Begin
Laying Tiles from One End of the Floor

Step 1

The first step is to clear away all unwanted properties and clean the area thoroughly.
Step 2

- The next step is to layout **working lines**.

  ![Laying out working lines on the sub floor.](image1)

  *Laying out working lines on the sub floor.*

These are lines that are marked on the sub floor in order to keep the first tile course straight and to adjust for any crookedness that may occur in the walls of the room.

- A framing square can and should also be used to check the room for square corners and straight walls.

  ![Framing square being used to check the corners for squareness.](image2)

  *Framing square being used to check the corners for squareness.*

- The next step is to check the room for square corners and straight walls by placing a tile firmly against the wall in each corner of the room.

  ![Tile placed in corner of the room.](image3)

  *Tile placed in corner of the room.*
Step 3

- Snap a chalk line along the outside edges of the tiles from one corner to the next.

Any crookedness in the walls will be easily detected if there are variations in the distance between the chalk line and the wall.

- With the use of the framing square test to determine whether any of the lines intersect at right angles.

Before working lines are drawn, make a dry run by laying tiles on the floor to determine the best layout and to minimize the amount of tiles that have to be cut.

Making a dry run by laying tiles on the floor without adhesive.

- Select the walls that will be used as a guide and where full tiles are to be used. The walls chosen should meet at 90°.
- Snap a chalk line parallel to the line from where the laying of the tile will begin. The distance between these two lines will be the size of the tile plus allowances for plastic spacers on both sides of the tile.
Plastic spacers show allowances.

- Repeat this procedure, snapping a chalk line parallel to the line on the other wall selected. Ensure that both lines meet at 90°. These are the working lines.

- Place concrete nails in position and set lines level based on the height to be used for setting tiles.

- In order to determine the height of the level line to be used, one must add the thickness/height of the notch on the trowel to the thickness/height of the tile, for example ½ inch.

Using the spirit level, mark a level line on the wall.

Concrete nail placed into position.

Marking the distance from the floor.
• Measure the height from the floor to the level line on the wall, for example 2’-0” or 2 feet.

• Minus the half inch (½”) from the two feet (2’-0”). This is equal to one foot, eleven and a half inches (1’-11 ½”) or twenty-three and a half inches (23 ½”).

• Place measurement of 23 ½” just off the floor unto the wall.

• Tie or set the line on to the concrete nail estimating the height from the mark of 23 ½”.

Level line marked on wall.

Marking the level point of reference.

Measuring from level line to the floor.

Tying the line on to the nail.
• Using the point of reference at 23 ½”, transfer the measurements with the use of a spirit level from the wall unto the nail and lines.

Transferring the point of reference throughout the floor using level lines.

Layout lines can be reduced in height by 1/16” depending on the size and weight of the tile.

The next step to follow is the mixing and application of adhesives.

Mixing Adhesives

It is important to note that before the mixing of tile adhesives, one should read the manufacturer’s instructions carefully and follow their instructions carefully.

Before mixing the adhesives, carefully read and follow the manufacturer’s instructions.

On-the-job Mixing Procedures

• Pour a quantity of water into the mixing pail and add the adhesive.
• Use a paddle attached to an electric drill and mix until a plastic-like mass emerges.
Attaching paddle to electric drill.

Mixing the adhesive.

Adding thin-set adhesive to water.

Tightening the paddle into the drill.

Add water as required for workability.

The adhesive will then be ready for applying.

Thin-set adhesive ready for application.
Applying the Adhesives

- Use the float side of the notched trowel to work the adhesive unto the surface.

- Apply a layer of the adhesive, a minimum of $\frac{1}{8}$" thick unto the surface.

- Use the notched side of the trowel and install another layer of the adhesive at an angle of 45° to 60° to the surface.

- Press the trowel firmly against the adhesive so that ridges will be formed in the adhesive.

- Move the trowel in a back and forth motion forming a cross hatch pattern.

Caution

Spread only as much adhesive as can be tiled in 10 minutes.

If a skin appears on the surface, scrape off the adhesive and apply new adhesive.
Placing the tiles

• Place the first tile into the corner formed where the two working lines meet at 90°. This should be done using a gentle rocking motion.

First corner tile being placed.

• Place the second tile alongside the first, using the same motion.

Second tile being placed alongside the first.

Lightly hammering tiles with rubber mallet to set them firmly in the adhesive.

• Space the tiles, using the plastic spacers.

First corner tile being placed.

Plastic spacer being used on front end of tiles.

Plastic spacer being used on other end of tiles.

Laying tiles by row.

• Continue this process until a row of tiles is laid covering the length of the floor.
• Continue setting tiles and spacers until the entire floor has been tiled.

Tiles laid with spacers.

• Remove spacers once a section has been completed.

Using trowel to remove spacers.

It is important to note that some tiles are manufactured with spacers, and they should not be mistaken for tile defects and cut off or grinded down.

Porcelain tiles already fitted with spacers called silicone tabs.

Clay (unglazed) tiles manufactured with spacers also called nubs.

Glazed tiles manufactured with spacers also called nubs.
• Using the **framing square**, check periodically to make sure that the courses are straight.

<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Using the framing square" /></td>
<td>Ensuring that square and straight tile courses are maintained.</td>
</tr>
</tbody>
</table>

• After a section has been laid, use a **rubber mallet** and hammer each tile lightly to set the tile firmly in the adhesive and level each one with the other.

<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2.png" alt="Lightly hammering tiles into adhesives as required." /></td>
<td>Lightly hammering tiles into adhesives as required.</td>
</tr>
</tbody>
</table>

• Use the **spirit level** to ensure that the tiles are level.

<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Spirit level being used to ensure tiles are level." /></td>
<td>Spirit level being used to ensure tiles are level.</td>
</tr>
</tbody>
</table>

• Continue setting tiles and spacers until entire floor has been tiled.

• If there is a gap between the wall and the last tile laid, cut tile to the required size and lay following the same procedure.

<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Measuring the size of the gap on the floor, between the wall and last tile laid." /></td>
<td>Measuring the size of the gap on the floor, between the wall and last tile laid.</td>
</tr>
</tbody>
</table>
Transferring measurements unto portable wet saw.

Opening base cover of saw, to pour water into portable wet saw.

Plug saw into outlet and cut tile to size.

To avoid electrocution, be sure to plug wet saw into outlet AFTER adding the water.

Tile cut to gap size.

Piece of tile, cut to required size, being laid into position.

- Clear all excess adhesives from between tiles and remove remaining tile spacers.

Removing remaining tile spacers.
Cleaning excessive adhesive.

- Clean work area, wash tools and return them to storage area.

Layout Floor to Begin Laying Tiles from the Centre of the Floor

This method is used so that the cut tiles will be at the edges of the room.

Procedure

- To find the centre, measure each wall around the area to be tiled.
- Determine the centre points of each wall and mark those points on the floor.

Determining centre of wall.

Washing tools.

Marking centre point on floor.
• From one centre point snap a chalk line to the opposite point.

Snapping a chalk line to the opposite point.

• Repeat same for the other two points.

Lines intersecting at centre of floor.

• Using the framing square, ensure that the intersection made at the centre of the room is exactly 90°. This will be the starting point.

Using the framing square to ensure exactly 90° at intersection of lines.

• Place concrete nails in position and set line level based on height to be used for setting tiles.

Placing concrete nails into position.

Transferring measurements from level line on wall on to concrete nail.
• Carefully mix adhesive according to manufacturer’s instructions. Refer to section on Mixing and Applying Adhesives.

Placing the tiles

• Layout single rows of tiles along the two lines.
  This should be done using a gentle rocking motion.

• Use plastic spacers to space tiles.

• Continue the process until both rows have been completed.

• Test with spirit level and framing square to make sure that the tiles are level and square with the lines.

Laying tiles along two lines.
• Repeat tiling procedure on second row, using plastic spacers to space the tiles. Continue setting tiles and spacers until entire floor has been tiled.

• Remove spacers once a section has been completed.

• Use a rubber mallet and hammer each tile lightly to set the tile firmly in the adhesive and level each one with the other.

• If there is a gap between the wall and the last tile laid, cut tile to required size and lay following the same procedure.
Chapter 8 | Tiles and Tiling

As was mentioned earlier, the procedure for preparing the work area for setting tiles on floors is basically the same for setting tiles on walls. The sub-surface for walls, must also be given priority.

Layout Wall to Begin Laying Tiles Vertically

- Clear all excess adhesives from between tiles and remove remaining tile spacers.
- Clean work area, wash all tools and return them to storage area.

Procedure

- Measure to establish the length of wall to be tiled.
- Use the spirit level to ensure the base is level. If the base is not level, use the spirit level and mark a horizontal guide line above the base.

Cutting tile to required size.

Laying tile into position.

Measuring length of wall.

Cleaning excessive adhesive and removing spacers.

Spirit level being used to ensure base is level.
Use the spirit level to determine if the sub-surface / wall is plumb. If not, a secondary sub-surface must be done/applied to the existing sub-surface. (Refer to section on plasterwork).

Wetting the vertical sub-surface to remove dust.

Carefully mix adhesive according to manufacturer’s instructions. (Refer to section on Mixing and Applying Adhesive).

Placing the tiles

Apply a layer of adhesive close to the plumb chalk line on the sub-surface.

Lay a tile on the level base against the plumb chalk line.
• Place and use spacers as needed.

• Apply another layer of tile adhesive, next to the first tile.

• Place the second tile along side the first, using plastic spacers as required.

• Place and use spacers as needed.

• Continue setting tiles, until a row of tiles cover the length of the wall.

• Continue setting tiles and plastic spacers until the entire wall has been tiled.

• Clean work area, wash all tools and return them to storage area.
Before grout is applied, the tiles must be left undisturbed for an overnight period. This is to allow the adhesive to dry and the tiles to set properly.

**Mixing Grout**

The final step in completing the project of tile laying is sealing with grout. This important task (grouting) is the process of applying grout materials to fill joints, bond tiles together and add visual appeal.

It also allows for the prevention of water penetration to the sub-surface, which can result in the tile lifting from its base and weakening of the bond strength.

Properly mixed grout should be both plastic and workable, which allow it to spread evenly.

As with adhesives, read instructions carefully before mixing grout.

Grout can be purchased in different colours and textures to match the colour of the tiles being used.

Grout mixed, both plastic and workable, according to manufacturer’s instructions.

Grout should rest just below the surface of the tile so that the tile would be free from blemishes.

Section of tiled area showing level of grout below tile surface.
Applying Grout

It must be noted that there are various methods used when grouting tiles. Of these, only two methods will be discussed here. They are:

1. **Traditional method of Spreading, Sealing and Cleaning.**
2. **The Tape and Grout method.**

**Traditional Method of Spreading, Sealing and Cleaning**

- Hold the leading edge of the rubber-backed float at about a 30° angle and spread the grout firmly over the tile.

  ![Spreading grout firmly over the tile.](image)

- Work the rubber-backed float back and forth at different angles to the grout to force it into the joints.

  ![Forcing the grout into the joints.](image)

All joints must be completely filled so that no voids or air pockets will remain.

- On completion of the first area of grouting, scrape off the rubber-backed float and repeat the process.

  ![Rubber-backed float being cleaned.](image)

  On this occasion hold the rubber-backed float at about a 45° angle and work at a diagonal to the joints to minimize disturbance to the grout there.

  ![Working the rubber-backed float at 45° angle to minimize disturbance of grout.](image)

Clean the rubberback and pointing trowel repeatedly as work goes on.
Cleaning the Tiles

The layer of grout that is still on the tile must be cleaned off before it dries.

- Use the finger method to test whether the grout is firm enough for cleaning.

- When satisfied that the grout is sufficiently dry, wipe the tile with a damp sponge at an angle to the grout lines and rinse the sponge often.

- After the tiles have been cleaned to satisfaction allow the grout to dry until a haze appears over the surface of the tile.

- When the grout has been hardened, wipe off the haze from the tile with a soft clean cloth or sponge.

- Clean work area, wash tools and return them to storage area.

---

Cleaning the tile.

Checking the firmness of the grout.

Removing haze from the tile.

Do not disturb the grout in the joints.

Work area cleaned.
Tools should be properly washed before they are returned to the storage area.

Tape and Grout Method

- Ensure the surface of all tiles are clean.
- Place masking tape on top the tiles, against the joint line or tile edge. This task will take extra time, however less cleaning would be required in the long run.

- Whenever the tape meets at a junction, a scissors can be used to cut the tape.

- Use the rubber-backed float to ensure the grout goes into the tile spaces, keeping the grout within the taped area.

- Continue placing grout into the tile spaces between the masking tape.
- When satisfied that the grout is sufficiently dried, the masking tape can then be removed.
It is important to note, that grouting is one aspect of tiling that should never be taken lightly. Numerous problems occur because some tiling experts are in a hurry to complete the job, without first ensuring that the necessary precautions are taken. For example, depending on the size of the tile, the widest possible masking tape should be used.

This allows for more space to work the grout into the joints, without worrying about dirtying or staining the tiles. It must be noted that this method of grouting can be time consuming if not properly managed in the prepatation stage.

In Trinidad and Tobago, there are companies which are engaged in the manufacturing, selling and distribution of tiles. Two such companies are Ceramic Trinidad Limited and Trinidad Aggregate Products Limited.

Ceramic Trinidad Limited
Head Office: Wrightson Road, Port of Spain
Factory : Diamond Vale Industrial Estate, Diego Martin

In 1969, Ceramic Trinidad Limited began manufacturing and glazing tiles. However it is important to note that the Biscuit or Bisque which is used in the manufacturing process is imported.

Additionally, in 1995, this company entered into a partnership with an Italian based company called MAPEI. Together, these companies conduct training sessions for tile setters and/or tile layers.

Samples of Ceramic Trinidad Limited Tiles:

Crystal Burgundy and Crystal Tan 15x20cm tiles.
Bone Floor 20x20cm tile.
Mosaic tiles.

(Information on Ceramic Trinidad Limited provided by Roger Hadeed, Managing Director. July 12th, 2011)
Trinidad Aggregate Products Limited

Trinidad Aggregate Products Limited of Longdenville, Chaguanas was established in 1976. They are engaged in the manufacture of a variety of clay tiles, both glazed and unglazed. Their tiles are manufactures using a variety of locally mined clays which are mixed with crushed fired bricks at a particular ration. This allows for the Bisque of the tiles to be more compact and solid. These tiles are marketed not only in Trinidad and Tobago, but throughout the Caribbean, the U.S.A. and Europe.

Samples of Trinidad Aggregate Products Limited Tiles:

Unglazed Caroni Octagonal 10x10cm tile.

Field Roof tile.

Spanish Key tile.

(Information on Trinidad Aggregate Products Limited provided by Alicia Dallas, Sales and Marketing. July 11th, 2011)

TECHNICAL IMAGES USED IN TILING

The following diagrams represent various features of the tile. These images can be seen on the Tile box or at the back of the tile itself.

- Side Dimensions
- Crack/Crazing Resistance
- Stain Proof
- Substance / Chemical Proof
- Point of Rupture
- Abrasive Proof
- Water Level Porosity
MULTIPLE CHOICE ITEMS. Circle the letter of your choice.

1. The diagram below identified as figure 1, shows a section of a tiled floor area.

![Figure 1](image)

That section of figure 1, identified as A is known as the
a. tile surface.
b. thinset mortar.
c. grout.
d. sub-surface/substrate.

2. How many days should a plastered or rendered wall surface be allowed to cure before tiles are applied?
   a. Nine (9)
   b. Ten (10)
   c. Eleven (11)
   d. Twelve (12)

3. Which one of the following classifications/statements, best describes a type /group 5 tile?
   a. Wall tiles suitable for residential bathrooms.
   b. Tiles recommended for areas where, high foot traffic is required.
   c. Floor and wall tiles suited for heavy commercial and industrial traffic.
   d. Tiles suited for light to medium commercial traffic.
4. Which one of the following methods is best suited to determine the firmness of grout before cleaning?
   a. Sponge
   b. Trowel
   c. Hand
   d. Finger

5. When applying grout with the rubber back float, the leading edge of the float should be held at an angle of
   a. 20°
   b. 30°
   c. 40°
   d. 50°

6. Which one of the following local tile companies is in partnership with an Italian based tile company?
   a. Alstons Building Enterprises Limited. (ABEL)
   b. Trinidad Aggregates Products. (TAP)
   c. Industrial Skies Tile.
   d. Ceramic (Trinidad) Limited.

TRUE / FALSE ITEMS. Circle the correct answer.

1. Spacers are used to maintain even tile spaces between tiles, throughout the surface being tiled. True / False.

2. According to the Porcelain Enamel Institute, tiles classified as Type/Group 1 are suited for heavy commercial and industrial traffic. True / False.

3. Tiles can be laid on any type of surface with no preparation required. True / False.
4. Plaster work or cement rendering surfaces, should be at least ten (10) days old before tiles can be laid on them. True / False.

5. When preparing to use adhesives, it is important to read the manufacturer’s instructions before use. True / False.

ESSAY TYPE ITEMS

1. Name the different types of sub-surfaces/substrates that tiles are laid and/or placed on.

2. Why is surface preparation considered to be very important before tiles are laid?

3. Outline two (2) reasons why glazed wall tiles should NOT be used on floors.

4. Name two (2) adhesives used for the setting of tiles.

5. Why is it important to clean off tile grout immediately after applying?

6. What are some of the qualities needed to ensure effective adhesive penetration into the concrete sub-surface/substrate?

7. List three (3) types of tools that are used in the layout process when tiling?

8. Explain briefly the step by step procedures used in the following task;
   (i) Layout floor to begin laying tiles from one end of the floor.
   (ii) On-the Job Mixing Adhesive.
   (iii) Cutting Tile using Portable Wet Saw.
   (iv) Cleaning the tile.
ADMIXTURES: Materials added to a mortar or concrete mixture to produce a specific result, such as an accelerator to advance setting time.

AGGREGATE: Inserted particles of stone gravel or sand (natural or manufactured) that when mixed with cement and water can form concrete or mortar.

ASHLAR MASONRY: Masonry work which comprise of stone that is measured, cut, dressed and tooled to allow for enough uniformity and regularity during assembly.

BORNING ROD: This device is made using two pieces of wood in the shape of a “T” and carries the measurement from floor level to depth of trench and/or excavation.

BOUNDARY IRONS: Protruding pieces of reinforced steel placed in concrete (at the earth’s surface) by surveyors at certain points to establish boundary lines and property sizes.

BUTTERING: That process which involves the spreading and/or applying of mortar on masonry units with the use of a trowel.

BUTTONS: Thin strip of wood cut and placed on a wall with mortar as its base to assist in the straightness and plumpness of the wall. It is also used as a guide to make and establish screeds.

CELL: Cavity placed in a building block or brick.

CEMENT: In building construction, a binder produced by heating (to a very high temperature) and pulverizing (crushed very fine) a combination of clay, limestone and other additives.

CLOSED: Any section of a brick (masonry unit) that can be used to close the units laid in a course.

CODE (BUILDING): A set of laws and/or regulations adopted by a country or region for governing the construction of buildings.

COMPACTING: In masonry, the vibrating and compacting of plastic concrete to ensure closer compaction of all particles of aggregates to form a solid, smooth mass.
MASONRY

CONCRETE: A combined mixture of Portland Cement, fine aggregates, coarse aggregates and water mixed to a particular ratio to produce a specific strength.

CURING: Safety procedural measures taken to prevent the rapid loss of water from newly poured concrete through the process known as evaporation.

CURING: Safety procedural measures taken to prevent the rapid loss of water from newly poured concrete through the process known as evaporation.

DATUM LEVEL: In building construction, a level used as a reference for determining heights, depths and surfaces.

DIAGONAL: A line that is placed from corner to corner with the intention of ensuring that the building is square and or dividing a rectangle into two (2) equal triangles.

DRY STONE WALL: A stone wall erected without the use of mortar.

DRYOUT: This condition occurs on mortar, due to very dry or hot weather conditions which causes mortar to dry very fast.

EXCAVATION: In construction, a hollow or hole dug into the earth to be used for building construction purposes.

FLOATING: The process of creating a smooth, level, plumb and pleasing surface without imperfections on concrete and plasterwork.

FOOTING: The enlarged concrete section at the bottom of the foundation; which distribute load and prevents settling.

FOUNDATION: A member built to support the overall load of the building and/or super structure.

GRAVEL: Locally known as half (½) and half (⅛), it is a combination of fine and course aggregates.

GROUT: A filler material (sanded or unsanded) which is applied into joint spaces between ceramic tiles. This filler can be obtained in a variety of colours and should be applied while still in its plastic state.

HARDENED MORTAR: Mortar that was dried and set to its full strength.

HEAD JOINT: The vertical mortar joint on the ears of the masonry units to join them together.

IGNEOUS ROCKS: These rocks are formed on the earth’s surface after volcanic lava has cooled. Andesite stock at Sans Souci Point Trinidad.

INTERLOCKING: In masonry, the overlapping or fitting together with the use of mortar to form a completed structure.
J
JOINT: The horizontal, vertical and shaped space around stone, bricks and blocks which is filled in with the use of mortar.

JOINTING TOOL: In masonry, a tool used by masons to form different types and/ or shapes of mortar joints on the face of the wall (concave and v-tooled joint).

L
LAYING OUT EXCAVATION LINES: In building construction, the process of using lines on batter boards to establish the foundation lines for a structure.
LINTEL: A reinforced member placed over a door or window opening to remove load off door and window frames. It also functions as a support for the wall which goes directly over the window and door opening.

M
MASTIC: A term which refers to organic-based adhesive.
METAMORPHIC ROCKS: This rock is produced when igneous and sedimentary rocks are challenged as a result of high heat and pressure inside the earth.
MORTAR BOND: The adhesion of mortar to masonry units.
MORTAR MIXER: A mechanical mixing device, powered by electricity, gasoline or diesel, used for the purpose of mixing mortar.

N
NUBS: Protrusions formed and/or found on the tile edges. They ensure that even spaces are maintained between tiles.

O
ORGANIC (MATTER) IMPURITIES: Sewage, manure, vegetable matter and any substance of this nature.

P
PARAPET WALL: That section of an exterior wall which extended above the roof line of a building.
PARTITION WALL: Interior wall built to separate a building into various rooms or sections.
PATTERN BOND: In masonry, the pattern formed by the masonry units on the face of the wall.
PERIMETER: The distance around the outer of a building.
PLASTER WORK: The application of mortar as an interior and exterior surface finish.
PLASTERING: In masonry the process of covering and or applying mortar to a background (surface), for the purpose of providing interior and exterior protection against weather and a smooth surface for painting.
POINTING: A term used in masonry for the filling and finishing or mortar joints around masonry units or stone.
PROFILE: In masonry, series of timber boards, stud, braces and shoes fastened together with nails and lines attached to avoid the continuous plumbing and leveling of masonry units.

READY-MIX-CONCRETE: Concrete produced in a batching plant to design specifications and transported on site in its plastic state.

REBAR: Bar of reinforced steel rod.

REINFORCED CONCRETE: Concrete that contains reinforced steel.

RENDERING: A decorative exterior surface finish.

RETAINING WALL: Wall built stone or concrete, for the purpose of retaining heavy banks of earth.

RUBBLE: Rough broken stones direct from the quarry.

S

SCAFFOLDING: A temporary structure made of wood poles or metal for the purpose of allowing workmen to reach very high points of a building.

SCREED: In plastering, a thin strip of plaster mortar, laid on the background surface of a wall, which acts as a guide to the thickness of the final coat.

SCREEDING: In masonry today, it’s described as a combination of motions.

Vertical – bottom to top and left to right motion to plumb a plastered wall.

SEDIMENTARY ROCK: Gritty materials which solidify in layers after settling at the bottom of oceans and rivers for a period of years.

SET BACK: The distance from the road to the front of the building.

SPACERS: Plastic cross-shaped nubs of an even thickness, independently placed between tile spaces, to ensure and keep grout joints at one thickness throughout the tiled surface.

SUBSTRATE: The sub-surface or background onto which the tile is applied.

SWEATOUT: This condition occurs when plaster mortar stays wet and will NOT SET.

T

TEMPERATURE: The amount of hotness or coldness of a material shown by a thermometer.

TROWEL: In masonry a tool used for the application and spreading of mortar or concrete.

V

VENTILATION: The circulation of fresh air in a building.

V-TOOLED JOINT: In masonry, a special tool used to form a v-shaped mortar joint.

W

WARRANTAL STONE: A local nickname given to a sedimentary rock.

Bestcrete Concrete Products brochure. www.ansamcal.com/eng/2manufacturing.asp


Cinterfor Basic Collections. Civil Construction Vol. 2. Technological Information TIS. 159-293. Caribbean- For use with: (1) Plumber ISCO: 8-71.05; (2) Concrete Shutterer ISCO: 9-52.20; (3) Bricklayer ISCO: 9-51.20; (4) Reinforcing Iron Worker ISCO: 9-52.30


National Museum and Art Gallery, Royal Victoria Institute, Frederick Street, Port of Spain. Classification and locations of rock formations in Trinidad and Tobago.

National Quarries Trinidad Limited.


The Occupational Safety and Health Act 2004 of Trinidad and Tobago.


We look forward to hearing from you.

Every effort has been made to ensure that the information contained in this book is accurate and reflects current industrial practices at time of going to press.

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