Masonry

Level-II

Learning Guide-19

Unit of Competence: carry out measurements and calculations for building structures

Module Title: carrying out measurements and calculations for building structures

LG CODE: EIS MAS2 M05 0919 LO1 -LG -19

TTLM CODE: EIS MAS2 M05 TTLM 0919V1

LO1: Plan and prepare

Instruction Sheet	Learning Guide #19

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

- Confirming and Appling relevant Work instructions
- Obtaining and applying *Safety* (*OHS*) requirements
- Selecting Measuring and calculating *equipment*

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

- Confirm and apply Work instructions using relevant *information*.
- obtain *Safety* (*OHS*) requirements from the site safety plan
- consistent Measuring and calculating *equipment* selected to carry out tasks

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information “Sheet 1, Sheet 2, and Sheet 3
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, Self-check 4 and Self-check 5” in page -6, 11, and 14 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to next information sheet.

Information sheet-1	Confirming and Appling relevant Work instructions

1.1 Work Instruction

In the building industry, most of the information required by the people performing anyof the work related to a construction project comes from project documentation. So it'sextremely important for you to be able to read and interpret plans, drawings, detailsand specifications correctly.Plans and drawings are used to communicategreat amounts of technical information betweenthe designer and builder. This technicalinformation must be able to be communicatedwithout any misunderstandings, which can only happen if the technical language of plans anddrawings is understood by everyone who uses them.

The technical language for plans and drawings uses standardised layouts, symbolsand abbreviations, so that things look similar in any plan or drawing. With study,practice and experience, you'll get to know and understand this language and be ableto follow work instructions.

1.1.1 How to write step-by-step instructions

- Describe the detailed instructions for the work.
- Identify roles and responsibilities.
- Give each activity its own title.
- One role activities.
- Don't combine two roles in the same step.
- Number each step.
- Use consistent formatting.

1.1.2. nine (9) basic steps of writing Work Instructions

- Know exactly how to do the task.
- Plan how to write steps in order.
- Write instructions beginning with a verb.
- Write each step as a small piece.
- Include warnings as pre-steps.
- Write the steps in logical order.
- Review and edit instructions carefully.
- Express steps in the positive.
- Avoid expressing opinions, preferences, or choices

1.2 Types of relevant information

Before you begin a work task, it's important that you review and understand relevant information so that you can apply correct processes to the planning and preparation of a work activity.Such information can come in either written or verbal form. Here are a few examplesof the types of information you may need to plan and prepare for a task involving measurements and calculations.

- **Verbal information** Instructions received verbally from:
  - ✓ clients
  - ✓ workman ship
  - ✓ employers
  - ✓ supervisors, builders, contractors and subcontractors
  - ✓ architects.
- **Written information** : written instructions such as:
  - ✓ plans, drawings and specifications
  - ✓ manufacturers' instructions and specifications on plant, tools, equipment andmaterials
  - ✓ maps on job location
  - ✓ safety data sheets (SDSs)
  - ✓ job safety analyses (JSAs)

1.2.1 plans and drawings

There are many types of plans and drawings that may be created for a building project. The size and complexity of the project will determine which ones are required. The minimum set usually includes:

- ✓ a site plan
- ✓ a floor plan
- ✓ elevations
- ✓ sections.

- Others that may be required, depending on the project, include:
  - ✓ details
  - ✓ electrical plans
  - ✓ hydraulic plans
  - ✓ engineering plans

1.3. Construction Work schedules/specifications

Construction schedules typically focus on two major aspects; determining how long each activity will take to complete and determining who is responsible for completing each activity A construction project's schedule outlines each step that should be completed by a specific date before the next step can be taken It also helps you with the planning of various resources including equipment and labor, among other things. A big construction project requires a lot of building materials which means you can use a schedule to buy the right materials at the right time allowing you to complete the project on time.

Specification for construction. Specifications describe the materials and workmanship required for a development. They do not include cost, quantity or drawn information, and so need to be read alongside other information such as quantities, schedules and drawings.

Self-Check -1	**Written Test**

Directions: choose the Answer all the questions listed below. Use the Answer sheet provided in the next free space

1. Which of the following Verbal **information** Instructions received verbally from(2 points)

A. workman ship C. clients

B. Employers D. all

2. one of the following basic steps of writing Work Instructions(2 points)

A. Know exactly how to do the task.

B. Plan how to write steps in order.

C. Write instructions beginning with a verb.

D. All are correct

Note: **Satisfactory rating – above 2 points** **Unsatisfactory - below 2 points**

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. ----------

2. ----------

Information sheet 2	Obtaining and applying Safety (OHS) requirements

2.1 Safety requirements

Safety in the workshops is subject to a number of various risk assessments and safe codes of working practices which have to be observed and adhered to by all workshop users and enforced by the person in charge of these areas. Due to high risk activities taking place in the workshops access to these areas is restricted to authorized personnel only. No other person may enter the workshops without permission.

OHS requirements are followed in accordance with safety plans and policies. Plant**,** tools and equipment selected to carry out tasks are consistent with the requirements of the job, checked for serviceability and any faults are rectified or reported prior to commencement.

2.1.1. Regulatory requirements

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

2.1.2 Applying safety

- Use protective clothing and equipment, use of tools and equipment, workplace environment and safety, handling of materials, use of fire fighting equipment, organizational first aid, hazard control and hazardous materials and substances
- Personal protective equipment is to include that prescribed under legislation, regulation and workplace policies and practices

Site is a permanent working place for masons, concrete workers and others. Masons and concrete workers are working for longer times in construction sites. Due to the nature of their trade while finishing workers like plasterer tile painter and other finishing workers are on site during finishing work stages of the construction process so that they are short time workers.

Care and proper order supports the construction process, and avoid accidents!

2.2. First aid

Is the assistance given to any person suffering a sudden illness or injury?

The key aims of first aid can be summarized in three key points, sometimes known as 'the three P's':

- **Preserve life:** The overriding aim of all medical care which includes first aid is to save lives and minimize the threat of death.
- **Prevent further harm:** Prevent further harm also sometimes called prevent the condition from worsening, or danger of further injury, this covers both external factors, such as moving a patient away from any cause of harm, and applying first aid techniques to prevent worsening of the condition, such as applying pressure to stop a bleed becoming dangerous.
- **Promote recovery:** First aid also involves trying to start the recovery process from the illness or injury, and in some cases might involve completing a treatment, such as in the Case of applying a plaster to a small wound.

A building site should have a first aid box which as minimum contents: -

- ✓ Plasters;
- ✓ Bandages;
- ✓ Ointments;
- ✓ Disinfectant

Self-Check -2	Written Test

Directions: choose and short answer all the questions listed below. Use the Answer sheet provided in the blank space:

1. Site is a permanent working place for :- (3 points)

   B. Masons works C. quality control

   C. Concrete workers D. 'A' and 'B' Answers

2. A building site should have a first aid box which as minimum contents: -

   Plasters C. Ointments

   Bandages D. All

3. List First aid box which as minimum contents (4 point)

Note: **Satisfactory rating – above 5 points Unsatisfactory - below 5 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. **----------**
2. _____
3. _____

_____

_____

INFORMATION SHEET 3	Selecting Measuring and calculating equipment

3.1 introductions

"Measurement" is the act of determining a target's size, length, weight, capacity, or other aspect. There are a number of terms similar to "measure" but which vary according to the purpose (such as "weight," "calculate," and "quantify.") In general, measurement can be understood as one action within the term "instrumentation."

3.1.1 measuring instrument

Is a device for measuring a physical quantity. In the physical sciences, quality assurance, and engineering, measurement is the activity of obtaining and comparing physical quantities of real-world objects and events. Established standard objects and events are used as units, and the process of measurement gives a number relating the item under study and the referenced unit of measurement. Measuring instruments, and formal test methods which define the instrument's use, are the means by which these relations of numbers are obtained. All measuring instruments are subject to varying degrees of instrument error and measurement uncertainty

3.1.2 Measuring tools

- **Flexible measures**: Retractable steel tape measures, often referred to as spring tapes, are available in a variety of lengths. They are useful for setting out large areas or marking long lengths of timber and other materials.
- **Zigzag rule (folding rule)**: collapsible joined poke rule. sliding metal or wood extension in to the first segment in to assist depth and side measure
- **Self-adhesive bench tap**: that is amounted to a work surface or the front edge of the work bench. handy for checking dimension while work is progress
- **Hook rule**: usually scaled both directions. This rule at one end facilitates accurate outside measures from the edge. in side measures can be taken from the straight end
- **Extension rule** : is zigzag rule ,which made up of flexi able like radio antenna it is used to accurate measure length or width,

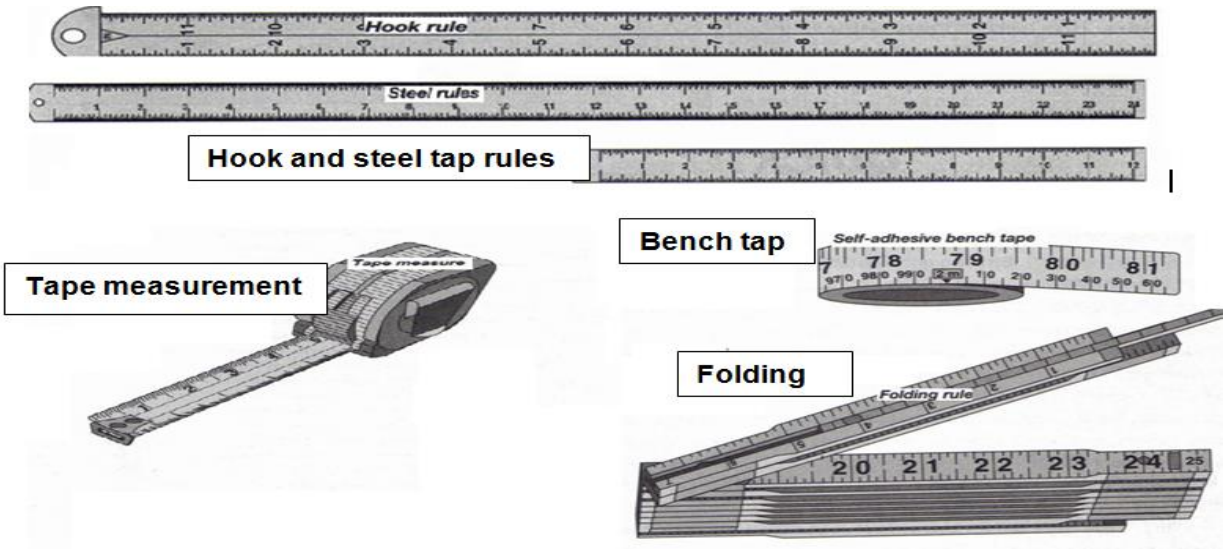

Figure 3.1 measuring tools

3.2 Difference between Measurement and Inspection

Measurement refers to the quantification of results obtained by using measurement tools. As such, inspection refers to comparing the values obtained through measurement with available references to determine whether a product is acceptable or not. When measuring a length using a ruler, it is possible to make some sort of decision based on the value, such as “The measurement is a little too long/short.” This determination is another way of saying, “Based on the value obtained using a ruler (measurement), it has been determined that this value is slightly longer (or shorter) than the length of interest.” Although there is often no need to use these definitions separately, it is a good idea to at least recognize the difference between the two.

3.2.1 Differences in Measurement Methods

Measuring a target can be done through either direct measurement or indirect measurement.

- **Direct Measurement:-** Direct measurement is measurement done by bringing the target into contact with the measurement system to read the length, height, or other aspect directly. Although direct measurement allows measurement results to be known as they are, errors may occur depending on the skill of the person doing the measurement.

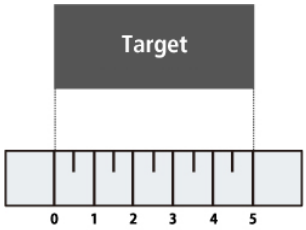

Figure 3.2 reading tap measurement

- **Indirect Measurement: -** Indirect measurement is done, for example, by using a dial gauge to measure the height difference between a measurement target and a gauge block and using

that height to indirectly determine the target's height. Because this type of measurement is based on a reference, indirect measurement is also referred to as “comparative measurement.”

3.2.2 Measurement system

Any of the systems used in the process of associating numbers with physical quantities and phenomena. Although the concept of weights and measures today includes such factors as temperature, luminosity, pressure, and electric current, it once consisted of only four basic measurements: mass (weight), distance or length, area, and volume (liquid or grain measure). The last three are, of course, closely related.

Basic to the whole idea of weights and measures are the concepts of uniformity, units, and standards. Uniformity, the essence of any system of weights and measures, requires accurate, reliable standards of mass and length and agreed-on units. A unit is the name of a quantity, such as kilogram or pound.

3.3. Selecting Measuring *equipment*

One of the tasks at planning of quality inspection is selection of measuring *equipment*. The measuring instruments are the most important part of the measuring process so their selection has to be done carefully. The selection of measuring instruments is a complex task, which depends on the size, the character and the value of measured magnitude. The purpose of this paper is to analyze the existing methods for selection of measuring equipment.

Self-Check -3	Written Test

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

1. All measuring instruments are subject to varying degrees of----------and ----------(3 points)
2. Measuring a target can be done through either ----------or----------.(3 points)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____**and** _____
2. _____**or**_____

List of Reference Materials

1. **ISO 14253-2:2013 Geometrical product specifications (GPS) - Inspection by measurement of work pieces and measuring equipment - Part 2:**
2. **ISO measuring equipment and in product verification - Technical Corrigendum 1 14253-2:2011/Cor 1:2013).**
3. **Chrisler Corporation, Measurement System Analysis, Reference Manual, , Ford Motor Company, General Motors Corporation, 1995.**

3. General Motors Corp. GMPT Specification MS 1. Adam Opel AG Russelsheim, October 1998.

4. E. Dietrich, Measurement System Capability, Reference Manual, Q-DAS® GmbH, Birkenau, 2002.

5. ISO 14253-1:2013 Geometrical product specifications (GPS) - Inspection by measurement of work pieces and measuring equipment – Part 1: Decision rules for proving conformity or nonconformity with specifications.

Masonry

Level-II

Learning Guide-20

Unit of Competence: carry out measurements and calculations for building structures

Module Title: carrying out measurements and calculations for building structures

LG CODE: EIS MAS2 M05 0919 LO2 -LG -20

TTLM CODE: EIS MAS2 M05 TTLM 0919V1

LO2: Obtain measurements

Instruction Sheet	Learning Guide # 20

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

- selecting and applying Methods of measurement
- obtaining Measurements using a rule or tape
- Confirming and recording measurements

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

- select and apply method of obtaining the measurement
- obtain *Measurements* using a rule or tape, accurate to 1mm
- confirm and record Measurements including *areas and volumes*

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, and Sheet 3
4. Accomplish the “Self-check 1, Self-check 2, and Self-check 3 in page -5, 8, and respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 in page -16.
6. Do the “LAP test” in page – 16 (if you are ready).

Information Sheet-1	Selecting and applying Methods of measurement

1.1 Selecting of measurement

Measurement is the transformation of drawn information into descriptions and quantities, undertaken to value, cost, and price construction work, as well as enabling effective management.

It is not just about a quantity surveyor producing a bill of quantities for contractors to price during tendering. It is used in both pre- and post-contract work, helping assess the likely cost of the works, and determining what contractors and subcontractors should be paid for work that has been completed.Plans and drawings show things that are to beconstructed, such as foundations, walls and fences. They also show what's already on or near the site, such as trees, services and neighbouring As well as these tangible items (things we can actually see or touch), plans and drawings also show lots of other important information, including levels, gradients, heights and measurements.

figure 1.1 measuring tape

1.2 Method of Measurement

Standard Method of Measurement (SMM) is a reference document used to determine a localized technique of construction measurement protocol needed in producing a good Bills of Quantities (BQ) which is then incorporated into the contract document for the project. The preparation of the BQ based on SMM that is reflective of the actual work will actually help the contractor to price the tender realistically. Tendering is a serious business, whereby failure to properly price it at a realistic and profitable level can give a bad impact to the contractor's organization. Thus, it is crucial to conduct research which aimed to investigate the two edition of the SMM for building works between the SMM1 and SMM2 version in the preparation of the BQs, focusing towards improving the appreciation of the contractors during the course of tender and construction. In view of the above matter, this paper will attempt to identify a few differences on the method of measurement

between SMM1 and SMM2 and to analyze the contractors' perception on the application of the SMM in determining the tender realistically and reflective of the work on site..

1.2.1 Measuring Using a Tape

A tape measure, also called measuring tape, is a type of flexible ruler. Tape measures are made from a variety of materials, including fiber glass, plastic and cloth. They are among the most common measuring tools used today.

Generally speaking, the term "tape measure" refers to a roll-up, self-retracting style tape measure that's designed for carpentry. The actual tape potion of the measure, called the 'ribbon,' is usually constructed from a stiff metallic material that can stiffen when needed but can also roll up for simple use and storage. However, the term covers all types of tape measures – even tailor's tape**.**

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Self-Check -1	Written Test

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

3. What is Standard Method of measurement? (4 points)

4. _____is made up of a flexible metal blade housed in a metal or plasticcase.(2 points)

5. Plans and drawings show things that are to be constructed, such as:- .(4 points)

Note: **Satisfactory rating -5 out of 10 points Unsatisfactory - below 5 out of 10 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
_____

2. _____

3. . _____

_____

Information Sheet-2	obtaining measurements using a rule or tape

2.1 Measuring rule or Tape

A rule measure: simply stated the “Rule of Ten” or “one to ten” is that the discrimination (resolution) of the measuring instrument should divide the tolerance of the characteristic to be measured into ten parts. In other words, the gage or measuring instrument should be 10 times as accurate as the characteristic to be measured.

A tape measure or measuring tape: is a flexible ruler and used to measure distance. It consists of a ribbon of cloth, plastic, fiber glass, or metal strip with linear-measurement markings. It is a common measuring tool.

When it comes to construction and craftsmanship, taking accurate measurements can be the difference between a great finished product and a subpar one. Luckily, with the proper approach, using a tape measure can be a quick, easy way to get you the information you need about your project. Knowing how to use and read both a retractable measure and a traditional ribbon-style tape measure can be a major asset to anyone working with his or her hands, so learn today and start measuring!

2.2 Reading the Tape measure

reading,measuring or calculating quantities for building projects The most common used unit of measurement in the construction industry is millimetres (mm).Lengths,widths,depths and heights are usually given in millimetres Where larger dimensions are shown, such as the length of boundarieson a site plan, metres (m) will be used.

Centimetres are very rarely used. Often the unit itself is not written. For example, everyone just knows that if 3600 is written it means millimetres, whereas if 3.600 is written it means metres.

Table 2.1 abbreviation and conversetion

Unit	Abbreviation	Example	Conversion
Millimetre	mm	A fence could be 1200 high	1 mm = 0.001 m
Centimetre	cm	Rarely used in the construction industry.	1 cm = 10 mm 100 cm = 1 m
Metre	m	A fence could be 14.60 long	1 m = 1000 mm

2.3 Converting metres and millimetres

Sometimes it's necessary to convert metres to millimetres. One metre is 1000 times longer than one millimetre, so you just need to remove the decimal point and make sure there are three figures after the metre

For example 2.657 m becomes 2657 mm

4.32 m becomes 4320 mm.

To convert millimetres to metres, move the decimal point three places to the left to make the number read as one thousand times smaller.

For example:

2460 mm becomes 2.46 m

12795 mm becomes 12.795 m.

If the number of millimeters is less than 1000, put a zero before the decimal point.

For example: 795 mm becomes 0.795 m.

If the number of millimeters is less than three figures, add zeroes to the left end and Then place the decimal point. For example: 65 mm becomes 0.065 m

8 mm becomes 0.008m

Self-Check -2	Written Test

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

1. Convert the folowing metres to millimetres .(8 points)
   A. 256 m
   B. 345 m
   C. 432 m
   D. 222 m

Note: **Satisfactory rating –above 4 points** **Unsatisfactory - below 4 points**

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
3. _____
4. _____

Information sheet-3	Confirming and recording measurements

3.1 Recording Measurements

We record all the numbers of which we are certain (the 9.6) and the first digit we are not sure of (the 0.00). The number must be recorded as 9.60. Now just count the digits in this number. There are three, so 9.60 have 3 significant digits.

If you are going to understand significant digits, you have to be sure you are recording your measurements properly. Sounds simple, right? And it is, yet it also has a few "gotcha's" to be careful about.

For example, suppose that you were told to measure the length of the black line, using a normal centimeter ruler.

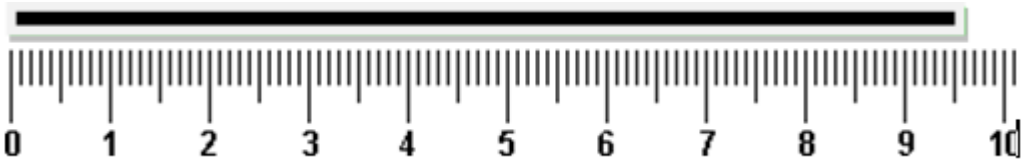


Figure 3.1 recording centimeters

Most of us wouldn't have much trouble at all indicating that the line is longer than 9 cm, but not quite10. Therefore we would be absolutely positive in reporting that the line is between 9 and 10 cm long. We can pretty easily tell that the line is more than 9.5 and less than 9.7 cm long, so we could be sure about reporting the line to be 9.6 cm. In fact, since it looks like the line is exactly 9.6 cm long, you might be tempted to record its length as 9.6 cm.

3.2 Uncertainty recording in Measurement; Significant Figures

Each time we make a measurement of length, volume, mass, area or any other physical quantity, the measurement has some degree of uncertainty. Suppose you have a quantity of liquid whose volume you wish to measure. You are given three different containers in which you might make the measurement - a 50-mL beaker, a 50-mL graduated cylinder, and a 50-mL burnet. Figure 3.2 shows these containers, each holding an identical volume of liquid.

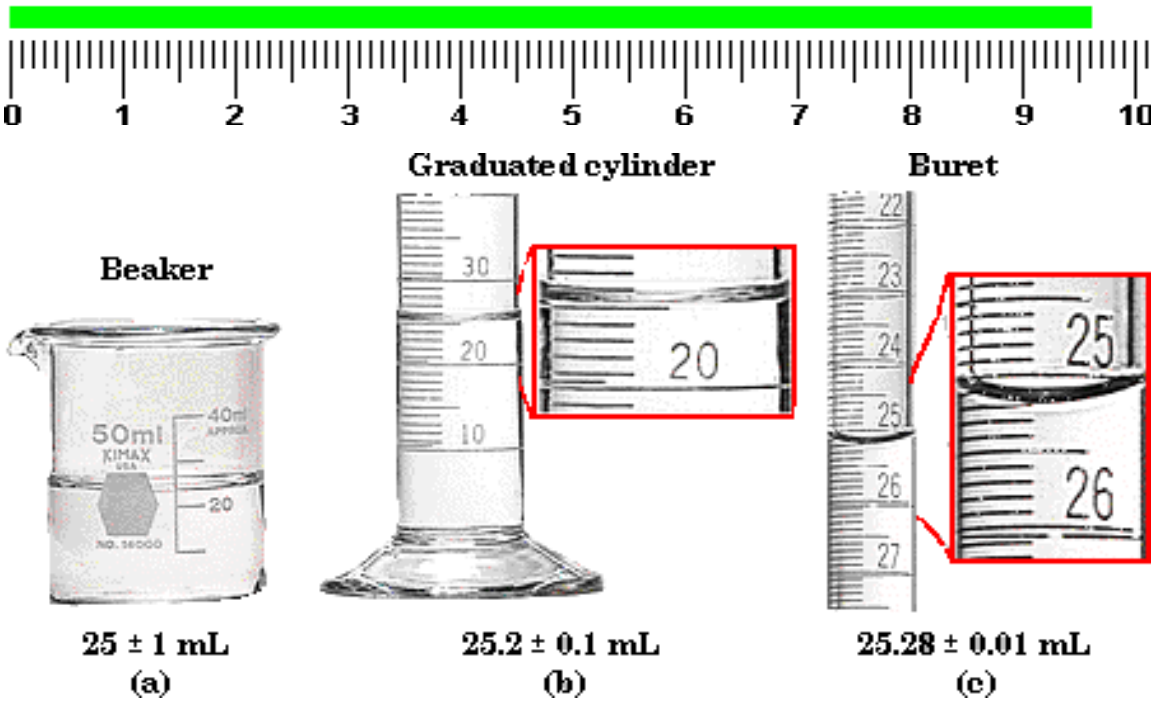
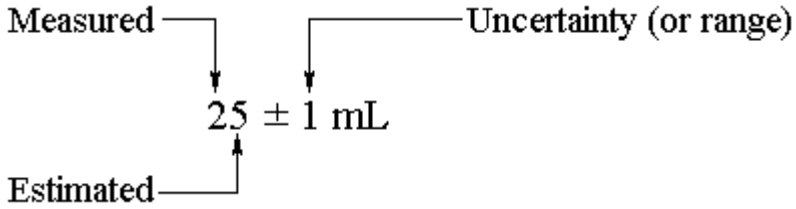


Figure 3.2 experimental uncertainties in measuring volume.

NOTE : mL : means milliliter

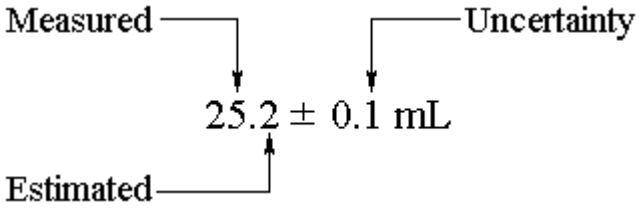
Look first at the 50-mL beaker [Figure 3.2(a)]. It has divisions or calibrations every 10 mL. You can see that the level of the liquid in the beaker is between the 20-mL and 30-mL marks. If you look more closely, you can see that the level of liquid is approximately midway between the two marks. You estimate that the volume is 25 mL; however, there is some uncertainty. The volume could be as little as 24 mL or it could be as much as 26 mL. If you record this volume as



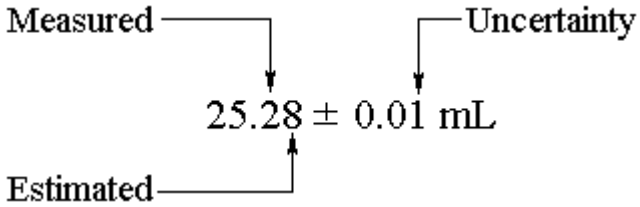
you can show the number you are certain of (20 mL), the number you think is the best estimate (5 mL), and the range within which you are certain the number falls (1 mL), called the uncertainty or range of the reading.

In Figure 3.2(b), the same volume of liquid has been placed in a 50-mL graduated cylinder. Divisions on the cylinder are marked every 1 mL. You can read that the volume is between 25 mL and 26 mL and estimate that it is about 0.2 mL above the 25-mL mark. However, it could be

as little as 25.1 mL or as much as 25.3 mL. Therefore, you should record the volume of the liquid as



Finally, you measure the liquid in the 50-mL buret [Figure 3.2(c)]. Calibration marks on the buret are 0.1 mL apart. You can read that the volume is between 25.2 mL and 25.3 mL and estimate that it is 0.08 mL above the 25.2-mL mark. Therefore, you should report the volume of the liquid as



To summarize, the uncertainty of any measurement is assumed to be ±1 in the last recorded digit. This uncertainty is rarely shown but is understood to be present. For example, if we write a measurement as 372, we understand that the uncertainty is ±1; if we write 0.017, we understand that the uncertainty is ±0.001.

Uncertainty in measurements is indicated by the number of significant figures used. Significant figures (or significant digits) are all those figures measured plus one that is estimated. Using our volume measurements taken from Figure 3.2, we count the significant figures as follows:

25 mL contains two significant figures

25.2 mL contains three significant figures

25.28 mL contains four significant figures

3.2.1. Zero as a significant figure

a zero that serves only to locate the decimal point is not significant; zeros that are not needed to locate the decimal point are significant, for they report a measurement. If the above measurements were given in terms of liters, they would be 0.025 L, 0.0252 L, and 0.02528 L.

The number of significant figures in each measurement is the same as before; the zeros have been added only to show the location of the decimal point.

Suppose you had reported the volume of liquid in a buret as 30.50 mL, or 0.03050 L. Are any of these zeros significant? The zeros to the left of the 3 are not significant, for their purpose is to locate the decimal point. The zero between the 3 and the 5 is significant because it shows that the measured volume in that place is 0. The zero after the 5 is also significant. It does not locate the decimal point; rather, it reports a measurement.

The use of exponential notation clarifies the significant figures. Any zero that disappears when a number is expressed exponentially is not significant. For example, the mass of a someone construction materials has been given as

0.000 000 000 000 000 000 000 001 67 g

In exponential notation this number becomes

1.67×10^{-24}g

Because the zeros in the number have disappeared, we know that they merely showed the location of the decimal point and the magnitude of the number; they were not significant. Similarly, the mass of the Earth expressed exponentially is

5.976×10^{27}g

The zeros shown in the original expression of the measurement (Section 2.2B) have disappeared; they were not significant. Table 2.6 gives further examples.

TABLE 3.1Significant figures and exponential notation

Number	Exponential expression	Number of significant figures
560,000	5.6×10^5	Two (The zeros show only the location of the decimal point.)
560,000.	5.60000×10^5	Six (The decimal point in the original number shows that all the zeros are significant.)
30,290	3.029×10^4	Four (The first zero is between two digits and is

		significant. The last shows only the location of the decimal point.)
0.0160	1.60×10^{-2}	three (The first two zeros show the location of the decimal; they are not significant. The last one does not show the location of the decimal point; it reports a measurement and therefore is significant.)

A problem arises when a zero shows both a measurement and the location of the decimal point. The problem is solved by putting a decimal point after such a zero. Thus 250. Means that the zero reflects a measurement; 250 means that the zero shows only the magnitude of the number. Similarly, 480,000 mean the same as 4.8×10^5, but 480,000. Means 4.80000×10^5.

3.3 areas and volumes

Area and volume are NOT interchangeable. Area refers to the two-dimensional surface measurement of an object while volume refers to the three-dimensional special measurement of an object. Units will always be squared for area while units will always be cubed for volume.

3.3.1 Area

Area is the amount of space inside a boundary or outside edge. Square units are used for area measurements, such as metres squared (m^2). In the building and construction industry, area is used to determine things like the:

- floor area of a building, as a way of describing the size of the building
- wall and ceiling area, for quantities of tiles required to cover the walls in
- bathrooms, or the number of plasterboard sheets needed to cover a ceiling
- floor area of individual rooms, to determine the quantities of flooring or floor
- coverings required, eg floor tiles, timber flooring and vinyl
- roof area, to determine the number of roof tiles or amount of sheet roofing required

area of a building block, to determine the minimum and/or maximum coverage tomeet building re gulations.The shelving unit to be installed on a wall measures 1 m × 1 m.This means that the total area the front of the unit will cover

3.3.2. Volume

The volume of an object is the amount of space it takesup in three dimensions. For example, when you buy a litre bottle of water, or order a truckload of sand, you're buying these items by volume.

To measure volume, we use three-dimensional units or cubic units, such as mm3 and m3.

Calculations of volume in the construction industry are used to determine things like the amount of:

- soil to be excavated
- tile adhesive required
- sand to use in bricklayer's mortar or a tiler's screed
- tins and/or buckets of paint
- tubes of fixative required for a job
- concrete required to pour a slab.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the give space

1. Define Zero as a significant figure? (2 points)
2. define volume and areas .(4 points)

Note: **Satisfactory rating - 3 out of 6 points Unsatisfactory - below 3 out of 6 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

   _____

   _____

2. _____

   _____

   _____

Operation Sheet 1	obtaining Measurements using a rule or tape techniques

Techniques for obtaining Measurements using a rule or tape

Procedure:-

Steps1 Prepare yourself before for the work

Step 2: Prepare measurement tools

Step 3: start measurement with given distance

Step 4: read carefully without sagging

Step 5: finally summit your reading to your teacher

Step 6: collect and store measuring tools

- **by using the above procedure do the following LAP test**

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks with in **1** hour.

Task 1 obtaining Measurements using a rule or tape

List of Reference Materials

https://www.youtube.com/watch?v=1ZownXypwUU

https://www.youtube.com/watch?v=hRDjZHvb4QQ

https://www.youtube.com/watch?v=hRDjZHvb4QQ

Masonry

Level-II

Learning Guide-21

Unit of Competence: carry out measurements and calculations for building structures

Module Title: carrying out measurements and calculations for building structures

LG CODE: EIS MAS2 M05 0919 LO3 -LG -21

TTLM CODE: EIS MAS2 M05 TTLM 0919V1

LO3: Perform calculations

Instruction Sheet	Learning Guide # 21

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

- determining Appropriate calculation factors
- calculating material quantities using factors
- confirming and recording Results

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

- determine Appropriate calculation factors and correct method
- correctly calculated Material quantities for the project using the appropriate factors
- confirmed and recorded Results

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information “Sheet 1, Sheet 2, and Sheet 3,
4. Accomplish the “Self-check 1, Self-check 2, and Self-check 3 in page 5, 9,and 12 respectively
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 in page -13.
6. Do the “LAP test” in page – 13 (if you are ready).

Information sheet 1	determining Appropriate calculation factors

1.1. **calculation factors**

Calculations is a manual that provides end users with a comprehensive guide for many of the formulas, mathematical vectors and conversion factors that are commonly encountered during the design and construction stages of a construction project. It offers readers detailed calculations, applications and examples needed in site work, cost estimation, piping and pipefitting.

The book is divided into sections that present the common components of construction. The first section of the books starts with a refresher discussion of unit and systems measurement; its origin and evolution; the standards of length, mass and capacity; terminology and tables; and notes of metric, U.S, and British units of measurements.

1.2 Key Features

- Work in and convert between building dimensions, including metric system
- Built-in right-angle solutions
- Areas, volumes, square-ups
- Complete stair layouts
- Roof, rafter and framing solutions
- Circle: arcs, circumference, segments

1.3 Performing calculations factor

- **Lengths**: the standard unit for length is the meter (m). For shorter lengths centimeter (1m = 100cm) is used which is again subdivided into millimeters (1cm = 10mm). For longer distances however, kilometer (1000m = 1km) is used.
- **Area:** The area of a section of road is normally rectangular in shape and the area is obtained by multiplying the length of the road by the width of the road. The unit used for *l* and ***w*** must be the same (normally both are expressed in meters (m).

$$Area = l \times w$$

- **Volumes:** 1m3 is the volume of a cube where each side is 1m. Volumes are calculated by multiplying a base area (e.g. m2) with a third dimension.

The calculation of volumes is the most common calculation for road construction work. This is required to develop the bill of quantities, then to measure work for actual construction purposes

(estimating resource requirements and time to complete work, material requirements, etc.), and finally to measure the completed work items.

- **Weight: 1** kilogram (kg) is the weight of one cubic decimeter (dm3) or one liter of water with a temperature of 4° C. Other units commonly used in construction are: gram (g) and tone
- **Capacity**: 1 liter of water is the volume of water contained in one cubic decimeter (dm3) at 4°C
- **Density**: weight in kg per m3 volume in normal processed condition of the material.
- **Perimeter:** is the distance around a two dimensional shape, or the measurement of the distance around something; the length of the boundary.
- **A perimeter:** is a path that surrounds an area. The word comes from the Greek peri (around) and meter (measure). The term may be used either for the path or its length - it can be thought of as the length of the outline of a shape. The perimeter of a circular area is called circumference.

Self-Check -2	Written Test

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

1. List key futures (**5 points)**
2. Write the definition of factors. (**3 points**)

Note: **Satisfactory rating –above 4 points** **Unsatisfactory - below -4 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

_____

2._____

_____

information sheet 2	calculating material quantities using factors

2.1. Material quantities

Quantity is a term used in the building industry for the number or amount of materials required for a particular task. For instance, before constructing the roof frame for a house, a carpenter must be able to calculate the sizes, lengths and amount of timber needed so that the correct quantities can be ordered from the supplier.

Now that you know how to take measurements for materials you might need to use, it's time to put it all together by calculating quantities.

2.1.1. Calculating Bricks and mortar

Calculating how many bricks are needed to build a wall is a multi-step process. We're going to work through how to do that now. Then we'll calculate the materials needed to make the mortar.

- **Bricks** :- the wall we're going to work out is the west wall on the drawing below, and just the External leaf (the outside wall). We're going to assume an external wall height of 2400, and that standard bricks will be used.

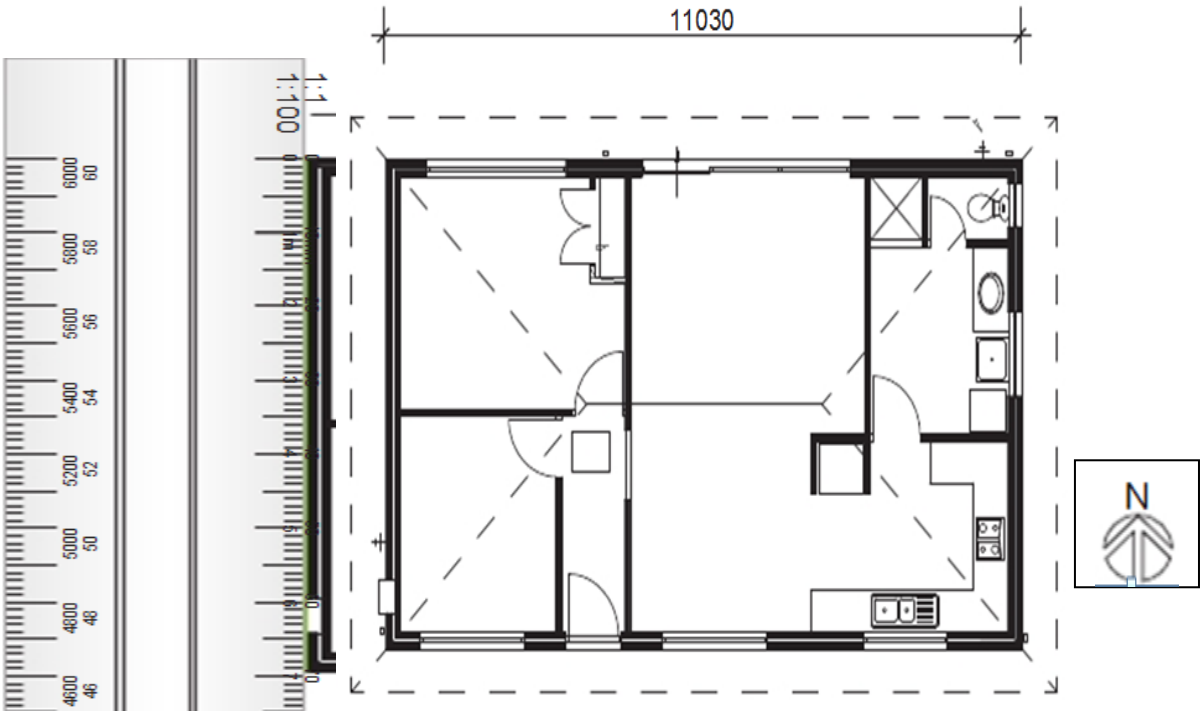


Figure 2.1. FLOOR PLAN,

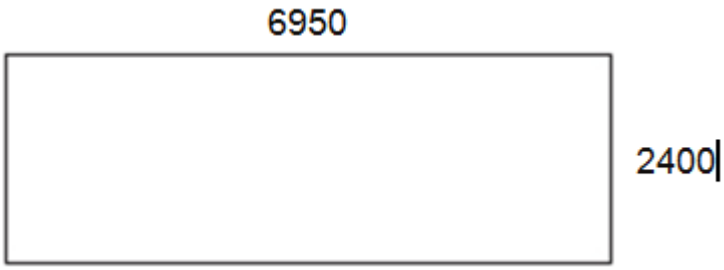
SCALE 1:100

1: Identify the wall:-Use the north point to determine that the west wall is on the left-hand side of the plan.

2: Find the length of the wall:the wall hasn't been dimensioned, so we'll have to measure it using a sc ale rule. Wecan see that the floor plan has been drawn at a scale of 1:100 (100 times smaller than real life) so we need to use the side of the scale rule showing 1:100.

❖ The scale rule says that the length of the wall is 6950. Can you just go ahead and use that?

3: Calculate the area: Draw a diagram of the wall to help.



4: Check the units:we usually measure area in square metres (m2), so let's convert those dimensi ons

From millimetres to metres first, so we can calculate the area more easily. To do that, we move the decimal point three places to the left, so 6950 mm becomes 6.95 m, and 2400 mm becomes 2.40 m.

5: Apply the formula: Area (rectangle) = W × H = 6.95 × 2.40 = 16.68 m2

6: Determine bricks per square meter (m2):now that we know the area of the wall to be built, it's t ime to work out how many bricks

Are needed. The first part of doing that is to find out how many bricks are needed to Build 1 m^2 of wall. To do that, we need to know what kind of bricks are being used and Then check the manufacturer's information on those bricks.

The table that follows shows the kind of information you would find on a brick Manufacturer's website – it shows how many bricks of each size are needed for 1 m^2 Of wall. The one that's in bold (6cm * 25cm) is a standard brick, which is the size we're Using. .

7: Calculate brick quantity:

To work this out, we simply multiply the number of square metres of wall by the number Of bricks required per square meter.

Square meters of wall = 16.68 Bricks required per square meter = 48.5

Multiply 16.68 × 48.5 = 808.98

We can't order 0.98 of a brick, so we'll need to round that number up to 809 bricks.

Solution: 809 bricks are needed to build the west wall.

- **Mortar:-** Cement, lime and sand are used to make mortar. The manufacturer's mortar table below tells us the ratio of cement to lime to sand reired.

Table 2.1 mortare mixe ratio

Mortar			
M^3 mortar – GP cement + Hy Lime	**Cement**	**Lime**	**Sand**
	1	1	3/4

The ratio of cement to lime to sand shown in the table above is 1:1:3/4.This means thatFor every on e bucket (or barrow load or shovel full) of cement in the mortar mix, weneed to add thesame amount of lime and six times that amount of sand,which isacalculation involving ratio for quantities

Self-Check -2	Written Test

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

1. List material of mortar (**5 points)**
2. Write the definition of quantities. (**3 points**)

Note: **Satisfactory rating – above 4 points Unsatisfactory - below -4 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

2. _____
_____
_____

2._____
_____

information sheet 3	confirming and recording Results

3.1 introductions

Once you have recorded and valuated the inspection results for a characteristic in the results recording function, you can also confirm the activities for the operation. Depending on the setting of the operation control key for an inspection operation, the system displays the dialog box for entering the activity times automatically or you must call it up manually:

- If the confirmation indicator for the operation control key is set to "milestone confirmation" or "confirmation required", the system automatically displays the dialog box Record Work Done.
- If the confirmation indicator is set to "confirmation possible, but not necessary," you must call up the dialog box for entering the activity times manually by choosing Edit ® Confirm activities in the overview screen for characteristics.
- In the dialog box Record Work Done, enter the values for the setup time, machine time or labor time, whichever is applicable. The dialog box also displays the activity times that have previously been recorded.
- Only one person can confirm activities for a specific QM order at any given time. If several people are trying to confirm activities for the same QM order, the system will display a message, indicating that the QM order is currently locked.
- After you have entered the activity times, choose Continue to close the dialog box and to return to the main screen in the results recording function.
- Save the data

3.2. Recording measurements

How you record a measurement will depend on how it's goingto be used. Different tasks and differe nt workplaces will have different requirements.

The most important thing is that all measurements, calculationsor totals need to be recorded clearly And accurately, including using the correct units. It's important that anyone reading the information can understand it and rely on it.

3.2.1 Tests Results Record

This is an important record to be maintained at construction site as a proof for construction quality. This record consists of tests of various materials such as cement, sand, aggregates, water, steel reinforcement used at construction site, test records of concrete cubes, concrete cylinders, slump tests etc.

These records are arranged as an index page with details of each material, page numbers of records etc. Individual pages consists of each materials, with their test dates, results etc.

All the tests carried out at site or in laboratory are recorded in the record book. Some of the tests carried out at construction sites for civil works are:

- Cube tests for concrete works for each location or structural members.
- Sieve analysis of coarse aggregates, impact or abrasion tests.
- Sieve analysis of coarse sand for concrete works, masonry sands for masonry works, plastering and pointing works etc.
- Tests for impurities of aggregates and sands.
- Bulking of sand test for concrete and masonry works.
- Slump tests and compacting factor tests for concrete works.
- Crushing strength test, tolerance, and water absorption test, efflorescence tests of bricks, stones or masonry work.
- Moisture contents of timber.
- Manufacturer tests reports provided by the vendors for admixtures, reinforcing steels etc.

Self-Check -3	Written Test

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

1. Define Recording measurements (**4 points)**
2. List the tests carried out at construction sites for civil works are: (**4 points)**

Note: **Satisfactory rating - above 4 points** **Unsatisfactory - below 4 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____
2. _____
   _____
   _____

Operation Sheet 1	calculating material quantities using factors techniques

Techniques for calculating material quantities using factors

Procedure:-

Steps 1 Prepare yourself before for the work

Step 2: Prepare calculation instruments and A4 paper

Step 3: start calculate mortar ingredients and bricks to $2m^2$

Step 4: Properly collate your result

Step 5: finally summit to your teacher

❖ **by using the above procedure do the following LAP test**

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks with in **2** hour.

Task 1 calculating material quantities using factors

List of Reference Materials

- www.newton.dep.anl.gov, Daniel Ryan, silica sand
- www.state.ar.us/asc/silica.htm, Arkansas geological

Masonry

Level-II

Learning Guide-22

Unit of Competence: carry out measurements and calculations for building structures

Module Title: carrying out measurements and calculations for building structures

LG CODE: EIS MAS2 M05 0919 LO4 -LG -22

TTLM CODE: EIS MAS2 M05 TTLM 0919V1

LO4: Estimate approximate quantities

Instruction Sheet	Learning Guide # 22

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

- taking Calculations for determining material requirements
- Selecting Appropriate formulas
- estimating Quantities
- Calculating confirming and recording material quantities

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

- taken *Calculations* for determining material requirements
- select Appropriate formulas for calculating quantities
- estimate Quantities from the calculations taken
- calculate confirm and record Material quantities for the project

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, , and Sheet 4
4. 4. Accomplish the “Self-check 1, Self-check 2, Self-check 3 and Self-check 4 **in page 4, 8,14 and 17** respectively
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 in page -18.
6. Do the “LAP test” in page – 18 (if you are ready).

Information sheet 1	taking Calculations for determining material requirements

1.1. determining material requirements

Is a system for planning material requirements suitable for managing components needed to produce finished product. This technique is now widely used to plan production and procurement orders, taking into account market demand, bill of materials and production lead times.

This is all very well as long as demand is “regular”, but what happens when this is not the case? What happens if demand is concentrated into certain periods (when the finished product is placed into production) but then drops off entirely? The error is a basic one: demand for these materials cannot be predicted but must be calculated on the basis of demand for the finished product. Production must be scheduled according to the quantity of finished products to be produced, and from this quantity you can arrive at the actual requirements for materials that go into them.

1.2 Methods of calculation requirement

- **Calculating gross requirements**: Gross first-level component requirements are calculated using orders to be issued (or launched) for finished products that they contain. This calculation is cascaded down through to the end of the bill of materials: from the first-level component orders to be issued we obtain the gross requirements for second-level components, and so on.
- **Calculating net requirements:** you now need to calculate net requirements for each finished product, component, assembly and sub-assembly, taking into account how many of each of these you already have in stock. The net requirement is therefore obtained by subtracting stock in hand at the end of the previous period from the gross requirement. Gross and net requirements must be accurately linked to a point in time: the date on which the finished products have to be available comes from the production plan, whilst the dates for components must be calculated backwards taking into account production or procurement lead times.

Self-Check -1	Written Test

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

1. List Methods of calculation requirement (**3 points)**
2. Write the definition material requirements? (**3 points**)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

   _____

2. _____

information sheet 2	select Appropriate formulas

a. select appropriate formulas

The formulas & equations are essential for construction professionals to work out the quantities as well as cost & subtotals of building material. These formulas can be used in a wide array of construction projects and design applications which range from reinforced concrete, bridge construction, highway design etc.

A formula refers to equation demonstrating one variable as an amalgamation of other variable(s) with the use of algebraic operations like add, subtract, multiply, divide, raise to a power, apply the natural logarithm as well as the cosine, or other mixture of operations. Various issues related to construction can be easily resolved with proper application of these formulas.

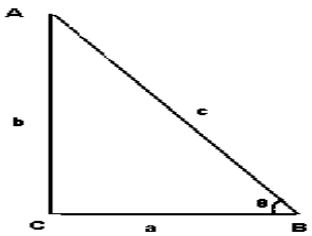
This content takes you through some formula basics, including constructing simple arithmetic are :- **Masonry work :** determining 1) number of concrete hollow blocks used and 2) number of cement volume of sand for mortar.

Concreting work: determining volume of concrete (number of cement bags, etc.) for footings, wall footing, floor slab, concrete columns (circular, rectangular), concrete beams, concrete and stairs **Steel reinforcement:** determining 1) number of bars in for footings, floor slab, columns (circular, rectangular), beams, and stairs

Carpentry: determining 1) total board foot of a lumber, understanding the all-important topic of operator precedence, and moving worksheet formulas.

2.1.1 Basic trigonometric formula

Pythagoras formula $a^2+b^2 = c^2$

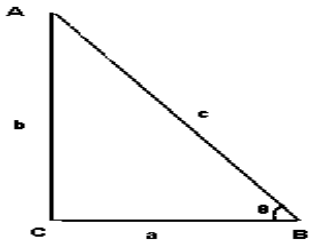


Sin $\theta = \frac{b}{c}$ cosec $\theta = \frac{1}{\sin\theta}$

Cos $\theta = \frac{a}{c}$ sec $\theta = \frac{1}{\cos\theta}$

Tan $\theta = \frac{b}{a} = \frac{\sin\theta}{\cos\theta}$ cot $\theta = \frac{1}{\tan\theta}$

- For any triangle
  - ✓ Cosine law



$a^2 = b^2 + c^2 - 2 * b * c * \cos A$

$b^2 = a^2 + c^2 - 2 * a * c * \cos B$

$c^2 = a^2 + b^2 - 2 * a * b * \cos C$

b. General formula for calculating construction material

2.2.1 Stone Masonry

a) 50cm thick basaltic or equivalent foundation wall bedded in cement mortar 1:4

1. Stone = $1m^3/m^3$
2. Mortar = $0.4\ m^3/m^3$
   - 2.1 Cement = $150\ kgs/m^3$
   - 2.2 Sand = $0.42m^3\ /m^3$

b) 50cm thick roughly dressed super-structure stone wall bedded in cement mortar 1:4

1. Stone = $1.25\ m^3/m^3$
2. Mortar = $0.4m^3/m^3$
   - 2.1 Cement = $150\ kgs/m^3$
   - 2.2 Sand = $0.42m^3/m^3$

c) 40cm thick dressed super structure stone wall bedded in cement mortar 1:4

1. Stone = $1.50m^3/m^3$
2. Mortar = $0.40m^3/m^3$
   - 2.1 Cement = $150kgs/m^3$
   - 2.2 Sand = $0.42m^3/m^3$

2.2.2. Brick Masonry for Super-structure

a. ½ brick wall bedded in compo- mortar 1:2:9 both sides left for plastering

- Brick with 5% wastage = $58\ pcs/m^2$
- Compo-mortar (10mm joints) = $0.0353m^3/m^2$

15% wastage

- ✓ Cement = $5kgs/m^2$
- ✓ Lime = $14kgs/m^2$
- ✓ Sand = $0.034m^3/m^2$

b. One brick wall bedded in compo-mortar 1:2:9 both sides left for plastering.

- Brick with 5% wastage = 115pcs/m^2
- Compo-mortar with 15% wastage =0.085m^3/m^2
  (10mm joints)

  - ✓ Cement = 12.5kgs/m^2
  - ✓ Lime =34kg/m^2
  - ✓ Sand =0.081m^3 /m^2

2.2.3 Hollow Block Masonry for Super-Structure

A. 10cm thick hollow concrete block wall bedded in cement mortar 1:4

- Hollow block with 5% wastage = 13 pcs/m^2
- Mortar 10mm joints 20% wastage = 0.0135m^3/m^2
  - ✓ 2.2 Cement = 5 kgs/m^2
  - ✓ 2.2 Sand = 0.014m^3/m

B. 15cm thick hollow concrete block wall bedded in cement mortar 1:4.

- Hollow block with 5% wastage = 13 pcs/m^2
- Mortar 10mm joints 20% wastage = 0.020m^3/m^2
  - ✓ Cement =7.5kgs/m^2
  - ✓ Sand = 0.022m^3/m^2

C. 20cm thick Hollow concrete block wall bedded in cement mortar 1:4

- Hollow block with 5% wastage = 13pcs/m^2
- Mortar 10mm joints 20% wastage = 0.027m^3/m^2
  - ✓ Cement =10kgs/m^2
  - ✓ Sand = 0.028m^3/m^2

2.2.4 Concrete work

- **Basic data**
  - ✓ Density of cement - - - - 1400 kg/m^3
  - ✓ Density of Sand - - - - 1840 kg./m^3
  - ✓ Density of Stone Aggregate - - - - 2250 kg/m^3
  - ✓ Assume 30% Shrinkage and 5% wastage.

Assume:-

- ✓ Concrete Mix = 1:3:6

- ✓ Let volume of concrete = Zm^3
- ✓ Assuming 30% Shrinkage
  - 5% Wastage

- ✓ For: Mechanical mix Water /Cement = 0.4-0.5

Hand mix Water / Cement = 0.4-0.65

$$then \quad a)\ Cement = \frac{1}{10} \times Zm^3 \times 1400\ kg/m^3 \times 1.30\ shrinkage \times 1.05\ wastage$$
$$= 191\,kg\ Z$$
$$= 0.41 m^3 Z$$

$$b)\ Sand = \frac{3}{10} \times Zm^3 \times' 1840\ kg/m^3 \times 1.30\ shrinkage \times 1.05\ Wastage$$
$$= 754\ kg\ Z$$
$$= 0.41\ m^3$$

$$c)\ Aggregate = \frac{6}{10} \times Zm^3 \times 2250\ kg/m^3 \times 1.30\ Shrinkage \times 1.05\ Wastage$$
$$= 1843\ kg \times Zm^3$$
$$= 0.82 \times Zm^3$$

Self-Check -2	Written Test

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

1. Write the definition of formula (**3 points)**
2. Calculate HCB block for 3 m^2. (**5points**)

Note: **Satisfactory rating –above 4 points** **Unsatisfactory - below -4 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____
2.

information sheet 3	Estimating Quantities

3.1 introductions

Building construction estimating is the determination of probable construction costs of any given project. Many items influence and contribute to the cost of a project; each item must be analysed, quantified, and priced. Because the estimate is prepared before the actual construction, much study and thought must be put into the construction documents.

During the design process, the contractor prepares and maintains a cost estimate based on the current, but incomplete, design. In addition, the contractor may prepare estimates that are used to select between building materials and to determine whether the cost to upgrade the materials is justified. What all these estimates have in common is that the design is incomplete. Once the design is complete, the contractor can prepare a detailed estimate for the project.

3.1.1 Purpose of estimating

Is to give a reasonably accurate idea of the cost.The estimate of a work and the past experience enable one to estimate quite closely the length of time required to complete an item of work or the work as a whole

The process of calculating the quantities (The quantity with reference to the measurement in the drawings, i.e. plans, elevation, section) and cost of various construction items i.e. excavation, concreting, masonry, plaster etc. of the project is called an “estimate”.

As the word suggests, it is an estimate of what the cost would be on completion. It can be based on “lump sum” i.e. thumb rule bases like plinth area or per sqft rate at the conceptual stage. Once plans are decided it has to be in details for its methodical & scientific planning and execution or say for right construction management and selection of materials. It will form the bases of so many decision and documents and will play an important role in the choice/selection of material as well as /construction technology.

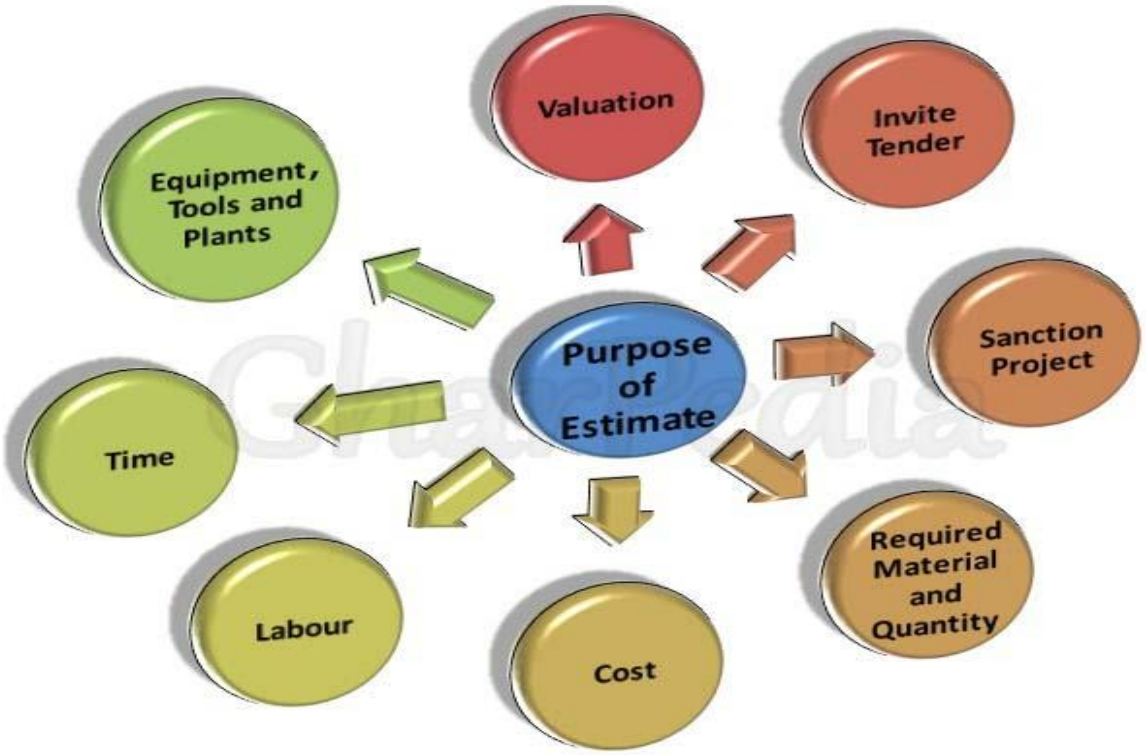


Figure 3.1 **Purpose of estimating**

3.2. Estimating methods

The required level of accuracy coupled with the amount of information about the project that is available will dictate the type of estimate that can be prepared. These estimating methods require different amounts of time to complete and produce different levels of accuracy for the estimate.

The different estimating methods are discussed below:-

- **Detailed Estimate:** - The detailed estimate includes determination of the quantities and costs of everything that is required to complete the project. This includes materials, labor, equipment, insurance, bonds, and overhead, as well as an estimate of the profit. To perform this type of estimate, the contractor must have a complete set of contract documents. Each item of the project should be broken down into its parts and estimated
- **Assembly estimating: -** In assembly estimating, rather than bidding each of the individual components of the project, the estimator bids the components in groups known as assemblies. The components of an assembly may be limited to a single trade or may be installed by many different trades.

- **Parametric Estimates: -** Parametric estimates use equations that express the statistical relationship between building parameters and the cost of the building. The building parameters used in the equation may include the gross square footage, number of floors, length of perimeter, percentage of the building that is common space, and so forth. For an equation to be usable the parameters used in the equation must be parameters that can be deter-mined early in the design process; otherwise the equation is useless.
- **Square-Foot Estimates: -** Square-foot estimates are prepared by multiplying the square footage of a building by a cost per square foot and then adjusting the price to compensate for differences in the building heights, length of the building perimeters, and other building components. In some cases, a unit other than square footage is used to measure the size of the building. For example, the size of a parking garage may be measured by the number of parking stalls in the garage
- **Model Estimating: -** Model estimating uses computer models to prepare an estimate based on a number of questions answered by the estimator. Model estimating is similar to assembly estimating, but it requires **less input** from the estimator.
- **Project Comparison Estimates: -** Project comparison estimates are prepared by comparing the cost of a proposed project to a completed project. When preparing an estimate using this method, the estimator starts with the costs of a comparable project and then makes adjustments for differences in the project

Self-Check -3	Written Test

Directions: say true or false all the questions listed below. Use the Answer sheet provided in the given space:

3. The detailed estimate includes determination of the elevation (**3 points)**
4. Purpose of estimating is to give a reasonably accurate idea of the cost? (**2 points**)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

3. _____
   _____
   _____
4. _____
   _____
   _____

information sheet 4	Calculating confirming and recording material quantities

4.1 introductions of material quantities

Construction Materials quantities seeks to publish original research and practice papers of the highest quality on procurement, specification, application, development, performance and evaluation of materials used in construction and civil engineering. Papers are particularly sought on metals, timbers, glass, ceramics, bricks, terracotta, stone, rubber, finishes, plastics, sealants, adhesives, bitumen and fabrics. Papers on innovative and recycled materials and novel applications of other materials such as concrete and cement are also encouraged. All aspects of a material's life are addressed including embodied energy, environmental impact, service life, refurbishment, recycling and reuse.

Records to be maintained at construction sites play important role in construction activities. It is a document required to prove any construction activity has taken place at site during billing or any other claims.

These records have all the data of various construction activities carried out at site. If any additional work has been carried out and it is claimed during billing, these documents need to be produced as a proof.

Maintenance of records also helps during audits of construction projects at any point of time. These documents helps to defend any claims such as liquidated damages or false claims or violations of any guidelines by authorities or clients.

1.2 Records at Construction Site

The following are the various records that need to be maintained at construction site,

1. Drawings: First and foremost import records to be maintained on site are the working drawings approved by the clients and design engineer, based on which all the construction activities takes place on site. There are different types of drawings required for construction; some of the basic required drawings are,

- Architectural drawing
- Structural drawing
- Plumbing & sanitary drawing
- Electrical drawing
- Finishing drawing etc.

2. Contract Agreement: Contract agreement documents including all sets of drawings, including amendments, a co estimating of approval of municipality, corporation or urban development authorities need to be maintained at construction sites till the completion of construction projects. These documents provide permission and guidelines for all the activities carried out at the construction site.

3. Work Orders Book: All the orders given by clients to the contractors need be maintained with serial numbers, signatures and dates. These orders should be specific for works. This order should also have a compliance column.

4. Works Diary: Works diary of a construction project should indicate contract agreement number, name of work, amount of contract, date of commencement of work, date of completion and extension time granted.

All the relevant details need be entered daily in the works diary. This diary serves as an authentic record.

Self-Check -3	Written Test

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

1. the basic required drawings are :(3 points)
   A. Architectural drawing
   B. Structural drawing
   C. Plumbing & sanitary drawing
   D. All are correct
2. Records at Construction Site (3 points)
   A. drawing C) work orders book
   B. Work diary D) All

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
   _____
   _____

Operation Sheet 1	Select Appropriate formulas techniques

Techniques for select appropriate formulas:

Procedure:-

Step 1: Prepare your self before the calculation

Step 2: prepare calculation instrument and A4 size paper.

Step 3: prepare calculation format on the A4 paper

Step 4: calculate brick, block and mortar materials for $3m^2$.

Step 5: collect your calculation result and summit your teachers.

❖ **by using the above procedure do the following LAP test**

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks with in **2** hour.

Task.1. Select appropriate formulas

List of Reference Materials

- https://www.youtube.com/watch?v=l7K2Vl9GZ3I
- https://www.youtube.com/watch?v=l7K2Vl9GZ3I
- https://www.youtube.com/watch?v=KEvHwvrkwbU

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