Bar bending & Concreting Level II

Learning Guide-12

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

Module Title: carrying out measurements and calculations for building structures

LG CODE: EIS BBC2 M041019 LO_3 -LG -12

TTLM CODE: EIS BBC2 TTLM 1019V1

LO3: Perform calculations

Instruction Sheet	Learning Guide #12

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

- Determining calculation factors and selecting correct method
- Calculating Material quantities for the project using appropriate 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**:

- Select appropriate calculation factors are determined and correct method for achieving required result.
- Calculate material quantities for the project are correctly using appropriate factors.
- Confirm and record Results

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information "Sheet 1, Sheet 2, and Sheet 3,below
4. Accomplish the "Self-check 1, Self-check 2, and Self-check 3 below
5. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet below
6. Accomplish the "LAP test below

Information sheet 1	Determining calculation factors and selecting correct method

3.1 Determining calculation factors and selecting correct method

3.1.1 Introduction 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.

. definitions of some static characteristics

- **Accuracy**

  Accuracy is the closeness with which the instrument reading approaches the true value of the variable under measurement. Accuracy is determined as the maximum amount by which the result differs from the true value. It is almost impossible to determine experimentally the true value. The true value is not indicated by any measurement system due to the loading effect, lags and mechanical problems (e.g., wear, hysteresis, noise, etc.). Accuracy of the measured signal depends upon the following factors: • Intrinsic accuracy of the instrument itself; • Accuracy of the observer; • Variation of the signal to be measured; and • Whether or not the quantity is being truly impressed upon the instrument.

- **Precision**

Precision is a measure of the reproducibility of the measurements, i.e., precision is a measure of the degree to which successive measurements differ from one another. Precision is indicated from the number of significant figures in which it is expressed. Significant figures actually convey the information regarding the magnitude and the measurement precision of a quantity. More significant figures imply greater precision of the measurement.

- **Resolution**

  If the input is slowly increased from some arbitrary value it will be noticed that the output does not change at all until the increment exceeds a certain value called the resolution or discrimination of the instrument. Thus, the resolution or discrimination of any instrument is the smallest change in the input signal (quantity under measurement) which can be detected by the instrument. It may be expressed as an accrual value or as a fraction or percentage of the full scale value. Resolution is sometimes referred as sensitivity. The largest change of input quantity for which there is no output of the instrument is called the dead zone of that instrument.

  The sensitivity gives the relation between the input signal to an instrument or a part of the instrument system and the output. Thus, the sensitivity is defined as the ratio of output signal or response of the instrument to a change of input signal or the quantity under measurement

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

3.1.2 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.

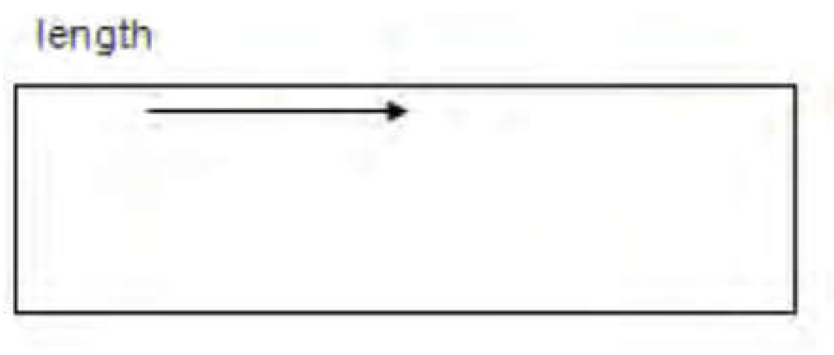

Figure 1.1 rectangle length

Height

The height of an object is a linear measurement of how high it is.

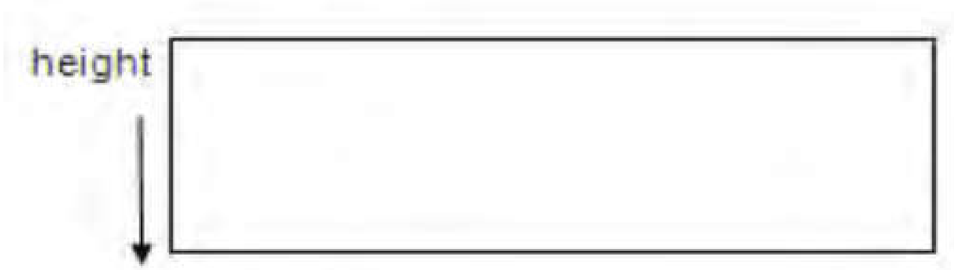

Figure 1.2 rectangle height

Width
The width of an object is a linear measurement of how wide it is.

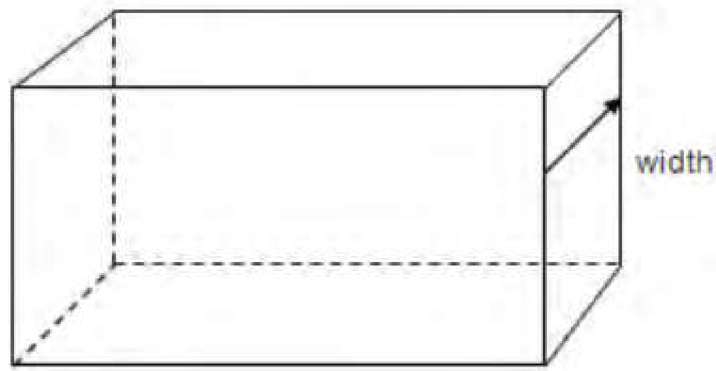

Figure 1.3 rectangle width

- **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).

$$Area = l \times w$$

Rectangle or square
Multiply the length by the height to find the area.

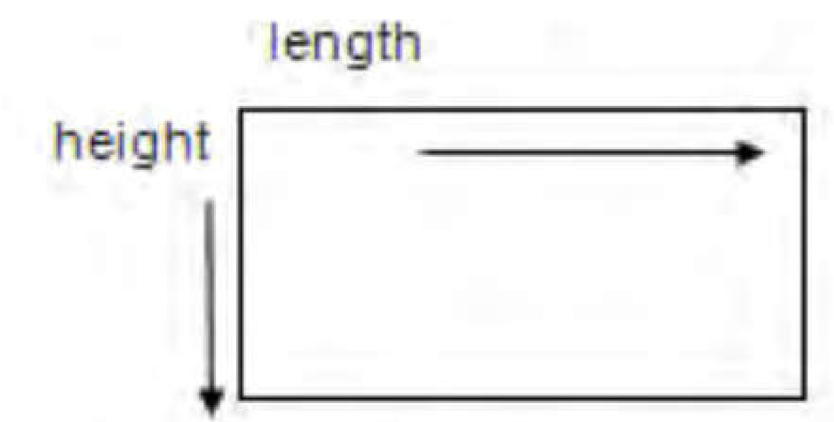

Figure 1.4 square

The following is an example is how to calculate the area of a rectangle.

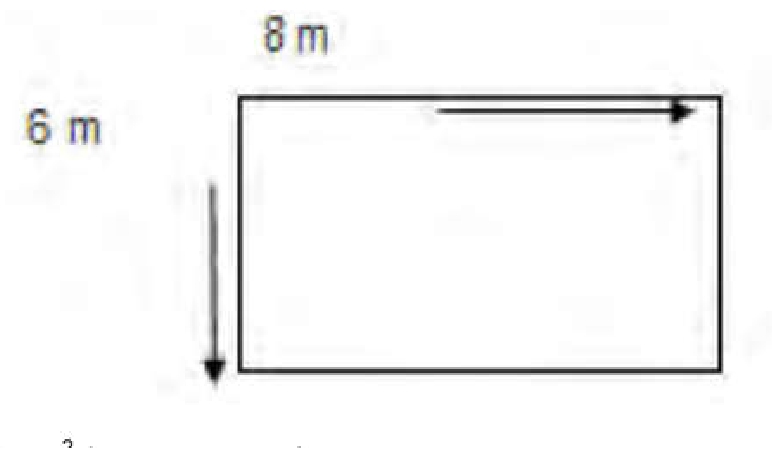

Figure 1.5 rectangle

Area = 8 m × 6 m = 48 m^2 (square metres)

Triangle

Multiply the vertical height by the base and divide the result by 2.

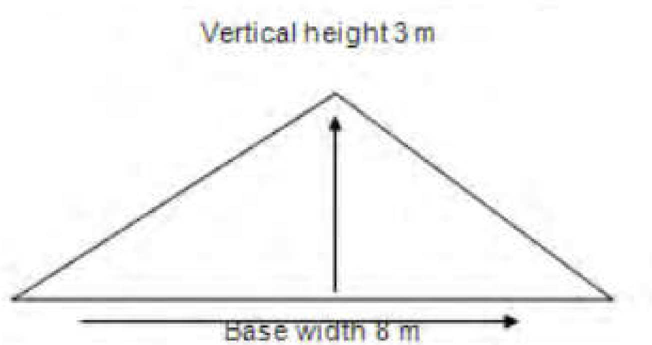

Figure 1.5 Triangle

Area = 3 m × 8 m = 24 m^2 (square metres)

24 m ÷ 2 = 12 m^2 (square metres

Circle

Definitions:

The **circumference** is the distance around a circle.

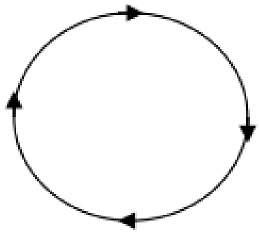

Figure 1.6 Circle

The **diameter** is the length of a straight line passing through the centre of a circle and connecting two points on the circumference.

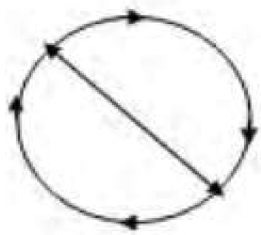

Figure 1.7 Circle diameter

Pi is the circumference of a circle divided by its diameter and is always the same. It is approximately 3.142 and is represented by the Greek letter for Pi which is π

The **radius** is the measurement from the centre of a circle to any point on its outer circumference, which is half the diameter.

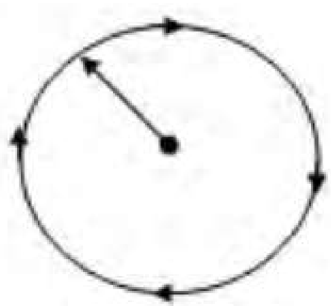

Figure 1.8 Circle radius

Important Formula

A = *π r*2

The area of a circle is worked out by multiplying π (Pi = 3.142) by the radius squared. And just a reminder that a number is **squared** if it is multiplied by itself, and is represented by a number2. For example 5 × 5 = 5 2

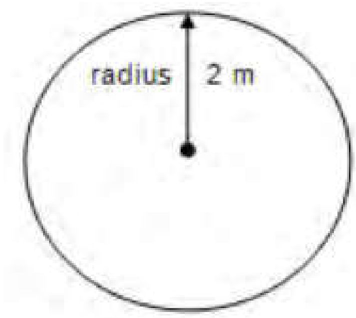

Figure 1.9 Circle radius

Area = 2 m × 2 m (radius2) × 3.142 = 12.568 m^2

or another way of writing it is:

Area = 22 m × 3.142 = 12.568 m^2

- **Volumes:** $1m^3$ is the volume of a cube where each side is 1m. Volumes are calculated by multiplying a base area (e.g. m^2) 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.

To work out the volume of a cubed shape = length × height × width.

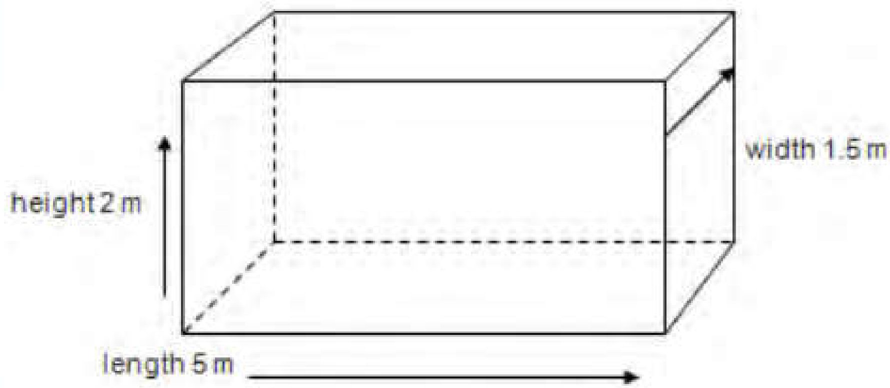

Figure 1.10 volume

Volume = 5 m × 2 m × 1.5m = 15 m^3 (cubic metres)
15 m^3 (cubic metres) = 15 m × 15 m × 15 m

- **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.

Cylindrical shape formula V = h x πr^2
To work out the volume of a cylindrical shape such as a pipe, then you must use the following formula.
$\pi \times r^2 \times h$ (pi multiplied by the radius2 and then multiplied by the height)

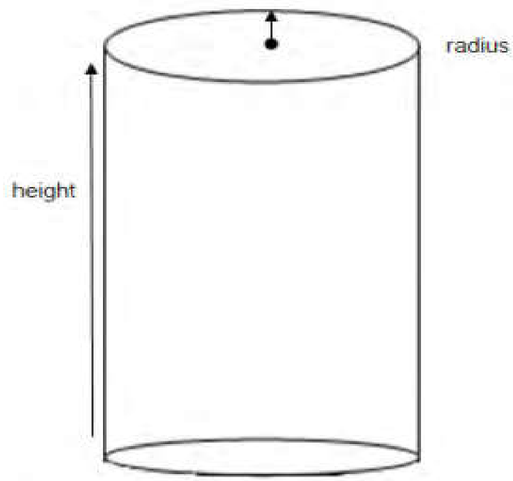

Figure 1.11 Cylindrical

Percentages

Per cent (%) means out of 100 and is a way of expressing a proportion. For example 10% means 10 out of 100.

Knowing how to convert a number into a percentage is a very important skill to have. It is relatively easy to perform.

Use the following formula to convert into a percentage.

To find a percentage of a number, multiply the number by the per cent and divide by 100.

Example:

To determine 15% of 520 kg:

1. Multiply 520 kg with 15, which gives you 7800 kg
2. Divide 7800 kg by 100, and you get 78 kg
3. The answer – 78 kg is 15% of 520 kg

Mathematically this can be shown as:

15% of 520 kg = 520 kg × 15 ÷ 100 = 78 kg

Adding a percentage to a number

To add a percentage to a number, first work out the per cent then add it on.

Example:

I've worked out that I need 120 trees to cover an area. I want to add 10% extra to allow for variables. How many trees would this be altogether?

10% of 120 = 120 × 10 ÷ 100 = 12

So altogether I need 120 + 12 = 132 trees

Conversions

The following list provides you with a reference for metric conversions.

Length	
10 mm (millimetres)	= 1 cm (centimetre)
100 cm	= 1 m (metre)
1000 m	= 1 km (kilometre)

Area	
100 mm^2 (square millimetres)	= 1 cm^2 (square centimetre)
10 000 cm^2 (square centimetre)	= 1 m^2 (square metres)
100 ha (hectares)	= 1 km^2 (square kilometres)

Volumes	
1 m^3 (cubic metre)	= 1000 litres
1 L (litre)	= 1 dm^3 (cubic decimetres)
1 L	= 1000 cm^3 (cubic centimetres)
1 L	= 1000 millilitres (ml)

Weight	
1000 mg (milligram)	= 1 g (gram)
1000 g	= 1 kg (kilogram)
1000 kg	= 1 t (tonne)

Self-Check -1	Written Test

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

1. weight in kg per m3 volume in normal processed condition of the material.

   A Density: B. mass C length D.all

2. is the distance around a two dimensional shape, or the measurement of the distance around something; the length of the boundary.

   A. Lengths **B.** Perimeter C. Weight D. none

Note*:* Satisfactory rating –above 4 points

Unsatisfactory - below -4 points

Answer Sheet

Score = ____________

Rating: _____________

Name: ___________________________ Date: ________________

Key answer

1.______________________

2.______________________

information sheet 2	Calculating Material quantities for the project using appropriate factors.

2.1. Calculating Material quantities for the project using appropriate factors.

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.

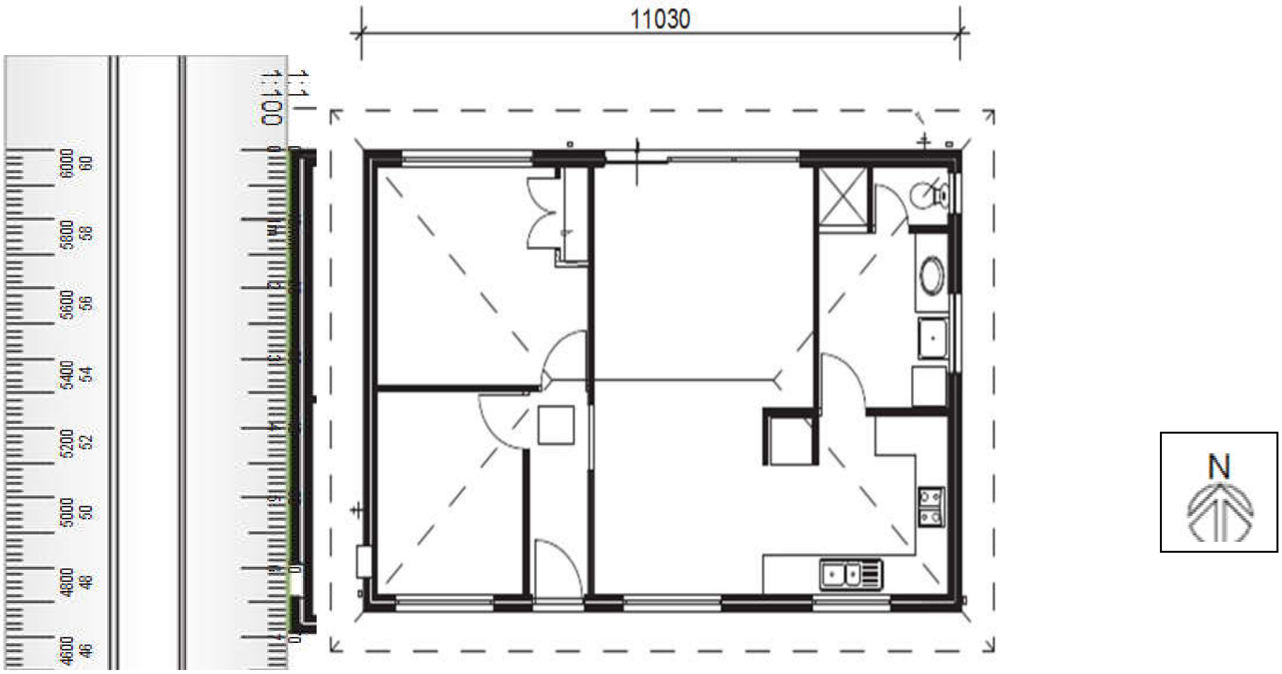

Figure 2.1. FLOOR PLAN,

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 scale 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.

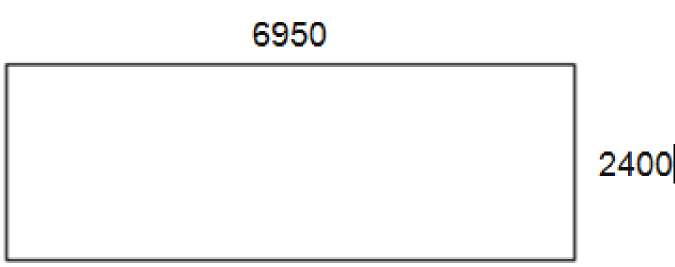

Figure 2.2 rectangle area

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 wa ll 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: multiple choose item

Instruction choose the correct answer

1.___________ is a term used in the building industry for the number or amount of materials required for a particular task.

A. Quantity B. Mortar C. Calculate brick quantity D. all

2. :the measure area is

A.m^3 B .m^2 C.ml D, all

Answer Sheet

Score = ___________

Rating: ____________

Name: _________________________ Date: _______________

Answer Questions

1. _______________
2. ________________

3.3 Confirming and recording Results

3.3.1 introduction of Results Recording

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

3.3.2 Recording measurements

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

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

3.3.3 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 multiple choose item

Instruction choose the best answer

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

A. Recording measurements B. Tests Results Record

C. Slump tests D. dialog box

2. 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.

A .report B. Records C. tests D. all

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: _______________

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 1	**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 1calculating material quantities using factors?

Self check 1

Key answer

1.A 2.B

Self check 2

Key answer

1.A 2.B

Self check 3

Key answer

1.A 2. B

Reference

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

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