Bar bending & Concreting Level II

Learning Guide-11

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 M04 1019 LO_2 -LG 11

TTLM CODE: EIS BBC2 TTLM 1019V1

LO2: Obtain measurements

Instruction Sheet	Learning Guide #11

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

- Method of obtaining the measurement.
- Measuring by a rule or tape accurate to 1mm.
- 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:

- Method of obtaining the measurement is selected and applied.
- Measurements are obtained using a rule or tape accurate to 1mm.
- Measurements, including areas and volumes, are confirmed and recorded

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 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”

Information Sheet-1	Method of obtaining the measurement.

2.1 Method of obtaining the measurement

2.1.1 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 be constructed, 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 2.1 measuring tape

2.1.2 Standard 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..

2.1.3 How to Measure 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**.**

Everyone involved in the construction industry needs to be able to understand, obtain and use measurements accurately in a variety of situations, whether you need to read a plan to find out the length or check the width of a road before it's loaded for delivery.

Figure 2.2 ruler

Being able to measure quickly, confidently and accurately is a valuable skill, as it will enable you to get the job done quickly and without mistakes – something all employers value.

2.1.4Types of measurements

Let's look at some of the different measurement types that you'll need to be familiar with.

- **Linear measurements**

Linear measurements measure lines or distances between two points. Common linear measurements include length, width, depth and height.

Figure 2.3 trench excavation

These are the most commonly used types of measurement in the construction industry. For

example, wall and floor tilers use linear measurements to calculate the number of skirting tiles they need.

- **Perimeter**

Perimeter is a boundary or outside edge. In the building industry it's used to refer to things like:

- fencing
- gutters
- external wall lengths.

Figure 2.4 Perimeter

- **Area**

Area is the amount of space inside a boundary or outside edge. Square units are used for area measurements, such as metres squared (m²). In the road and building construction industry, area is used to determine things like the:

This term is mostly encountered in determining the area to be:

- Cleared
- Compacted
- Surfaced
- Grassed
- 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 to meet building regulations.

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 is 1 m². Area measurements are also used for the calculation of the number of bricks required to construct a wall, or for the number of pavers required for a path or driveway.

- **Volume**

The volume of an object is the amount of space it takes up 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 mm^3 and m^3. 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.

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

figure 2.5 volume measure

- concrete required to pour a slab

Self-Check -1	Written Test

Directions: multiple choose item

Instruction choose the best answer

What is Standard Method of measurement? (4 points)

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

   A. measuring tape B. ruler C. scale D. none

2. is the amount of space it takes up in three dimensions

A length B. volume C. area D. all

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____

Information Sheet-2	**Measuring by a rule or tape accurate to 1mm.**

2.2 Measuring by a rule or tape accurate to 1mm

2.2.1 introductions of 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 bemeasured 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!

Measuring tapes

A measuring tape is made up of a flexible metal blade housed in a metal or plastic case. The blade is coiled, usually under the control of a strong spring. Tapes are used for measuring long distances with a reasonable degree of accuracy. They offer greater convenience than using a series of measurements made with a shorter steel ruler.Common types of measuring tapes can be from three to 10 metres long; however,

longer lengths, such as 30 metres, are also available

Figure 2.1 Measuring tapes

Retracting mechanisms

Smaller tapes normally retract (pull back) under spring tension once their locking button is released. Care should be taken when doing this, as the tape can snap back violently. To do it safely, hold the end of the tape in your hand, and guide it until it's fully coiled again

Steel tapes

Steel tapes are used for measuring long distances. They are usually 10 or 30 metres long, but longer lengths are available.Steel tapes are returned into their case by operating a turning mechanism. The handle can be folded away when not in use.

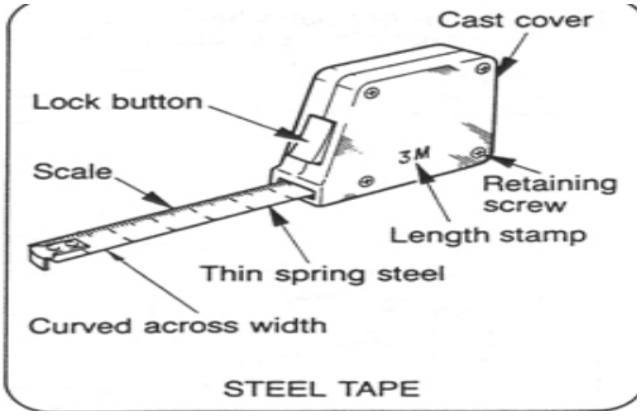


Figure 2.2 steel tape part

Steel tape rules

Steel tape rules are available in two, three, five, seven, eight and 10 metre lengths. The three and five metre tapes are the most common. Steel tape rules have a power return spring which automatically returns the tape blade into the housing. Do not allow the tape to suddenly return, as the hook will break off. A lock is often included to hold the blade in the open position and to slow its return into the case.

Looking after measuring tapes

Measuring tapes will last for many years if you look after them properly.

- Don’t be rough with the blade or the tape housing.
- Retract the blade gently.
- Keep the blade free from grit and moisture.

- Don’t leave the measuring tape exposed for long periods to the direct rays of the sun. This can buckle the blade or degrade the housing.

Pictured below are some of the different ways measuring tapes can be used.

Using measuring tapes

Measuring tapes in Australia are marked in metric measurements. Markings are placed at 1 mm apart, and numbers are written every 10 mm. Major units are written every 100 mm.

A steel tape rule is used for all types of measuring and setting out, within the range of its length. A tape rule has an advantage over a solid steel rule which can give errors when used to measure distances greater than its length.

A steel tape can be used in most situations, but is best suited for on-site setting out and taking measurements on the building site.

The fixed-end hook on a steel tape compensates for the thickness of the metal when taking inside or outside measurements, so it’s important to place the tape correctly.

Figure 2.3 steel tape

Four-fold ruler

Trades people in the construction industry are known to use the four-fold ruler. Markings are placed at 1 mm, and numbers are written every 10 mm.

When fully extended, the total length of the ruler can measure up to 1 metre. When the ruler is folded, each section of the ruler has a length of 250 mm. The ruler itself is usually made from either plastic or boxwood, and has stainless steel or brass fittings.

Figure 2.4 Four-fold rule

Reading a ruler

Below is an example of how to read a four-fold ruler using the black line as the end point. As with a tape measure, notice that from zero, the first major unit left of the black line is 30 mm, the second is 5 mm, then two increments have been counted from the five.

30 mm + 5 mm + 2 mm = 37 mm

2.2.2 Reading the Tape measure

reading,measuring or calculating quantities for building projects The most common used unit of measurement in theconstruction 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

2.2.3 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 4.32 m becomes 4320 mm.

2.657 m becomes 2657 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. 2460 mm convert to meter.(8 points)

   A 2.46 m C.0.2460m

   B.345m D.222m

2. _____are used for measuring long distances

A. Steel tapes B. steel balance C A & B D all

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

1. _____
2. _____

Information sheet-3	Confirming and recording measurements

2.3 Confirming and recording measurements

2.3.1 Measuring accurately

figure 3.1 measuring

Measurement is carried out almost every day and by almost all trades people. Whether you're a carpenter, a wall and floor tiler, a bricklayer, a plasterer, a solid plasterer or a painter – or involved in any other kind of trades work within the building and construction industry, measurements will be required and performed no matter how big or small the job is. Accurate measuring is very important, as incorrect measuring can result in wasted time which puts you behind schedule, wasted material which may cost you money to replace, or a less than aesthetic look on a completed job. For example, incorrectly sized tile cuts that are visible for all to see will not go over well with a client or employer. Remember the saying, '**measure twice – cut once**', as this may save you time and money.

- **Rounding off**

Rounding off is reducing the number of digits in a measurement or calculation to the nearest decimal point or whole number. Most of the time, rounding off to two or three decimal places will be accurate enough for the calculations performed in the construction industry.

When performing any calculations you must keep proper records as required by your

workplace policy and procedures. Keeping records will also provide evidence of your results if you need to refer to the calculation again. This will save time in the future. When doing any calculations and measurements, record these clearly so if you need to consult them again you can immediately understand what each one refers to.

A word on accuracy

It is very important to have a methodical approach to getting measurements right by checking your calculations and not rushing what you are doing. Even the smallest mistake can jeopardize accuracy, quality and efficiency, and could end up being very costly. You should confirm that your measurements are correct before beginning any calculations.

Remember – measure twice, cut once.

Rounding off

Rounding is most commonly used to limit the amount of decimal places. Instead of having a long string of decimals places, you can get a ballpark or general value.

This would be used when you need to get an approximate value, maybe for the quote of material or to get an idea of how much material will be needed.

Rounding up

Usually you round up if a decimal place is greater than five. For example:

5.7 will be rounded up to 6

5.79 will be rounded up to 5.8

Rounding down

Usually you round down if a decimal place is smaller than five. For example:

5.4 will be rounded down to 5

5.73 will be rounded down to 5.7

Generally when you are taking measurements you will not round off a number as this will decrease accuracy

- **Confirming measurements**

Always check any measurements you've taken before you use them. That way if you've made a mistake, you can correct it before it's too late.

2.3.2 Recording measurements

figure 3.2 recording

How you record a measurement will depend on how it's going to be used. Different tasks and different workplaces will have different requirements.The most important thing is that all measurements, calculations or 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.

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.

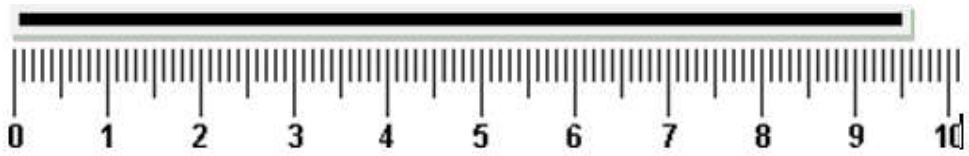
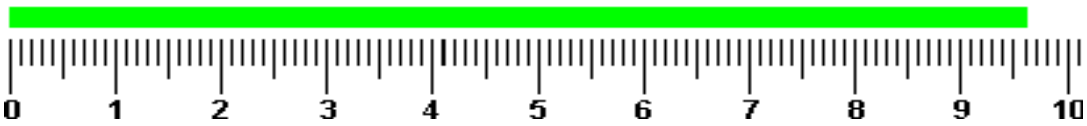


Figure 3.3 recording centimeters

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.

2.3.3 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.



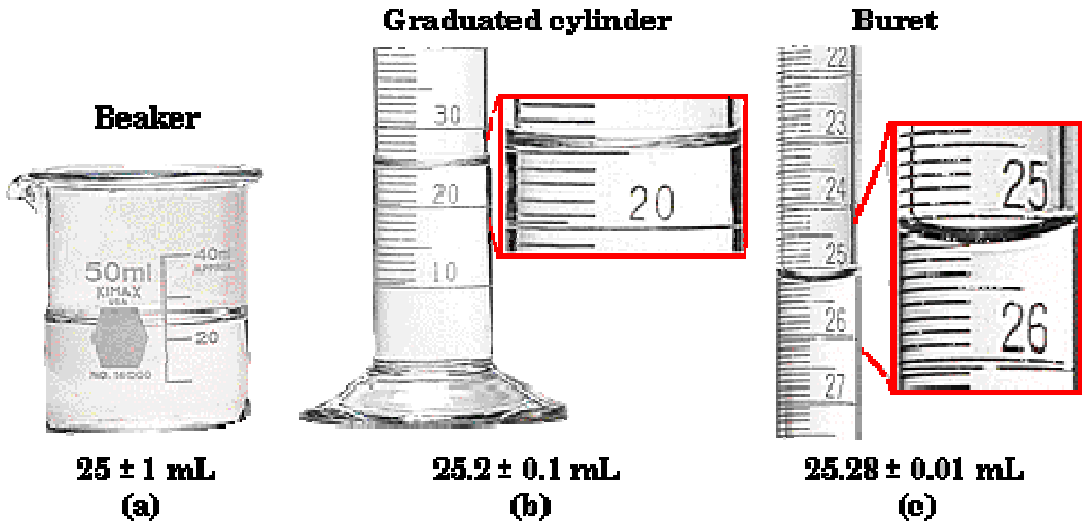
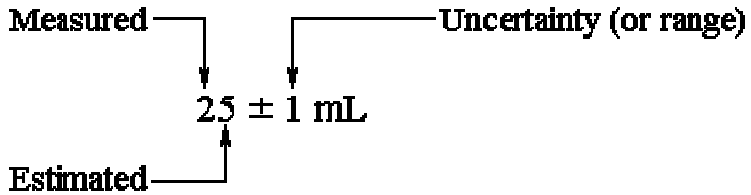


Figure 3.4 experimental uncertainties in measuring volume.

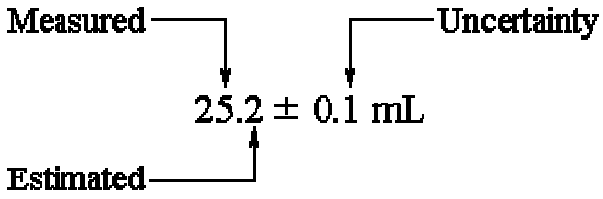
NOTE : mL : means milliliter

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

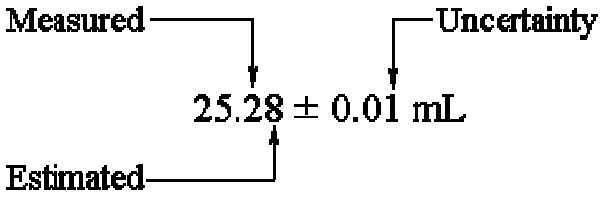


you can show the number you are certain of (20 mL), the number you think is the best estimate (5 mL), and the range within which you are certain the number falls (1 mL), called the uncertainty or range of the reading.

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

2.3.4 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 hydrogen atom 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 3.1 Significant 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.

2.3.5 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.

- **Area**

Area is the amount of space inside a boundary or outside edge. Square units are usedfor area measurements, such as metres squared (m²). In the building and constructionindustry, area is us ed 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 regulation

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- **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 multiple chose item

Instruction chose the correct answer

1. _____is reducing the number of digits in a measurement or calculation to the nearest decimal point or whole number.

A. Rounding off B. Confirming measurements

C. Rounding up D. Rounding down

2. It is very important to have a methodical approach to getting measurements right by checking your calculations and not rushing what you are doing.

A. measuring tape B. accuracy

C. recording D. all

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

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

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

1. _____
2. _____

Operation Sheet 1	obtaining Measurements using a rule or tapetechniques

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 summitry our 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 1obtaining Measurements using a rule or tape

Self check 1

Key answer

1.A 2.B

Self check 2

Key answer

1.A 2.A

Self check 3

Key answer

1.A 2.B

Reference

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

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

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

The trainers who develop this Learning Guide are

N0	Name	Qualification	Region	E.mail
1	Tesfaye Assegidew	MSC in CoTM	SNNPR	tesfayeassegidew@gmail.com
2	HabtamuWendmagegn	BSc in Civil Eng	Dire Dawa	Joniyitna9@gmail.com
3	YazachewGeneti	MSc in CoTM	BGRS	0917858176
4	GebresilasieJemal	BSc in Con. Tech	Addis Abeba	Gebrajemal@gmail.com
5	Getachew Mohammed	MSC in CoTM	Amhara	Gerimom07@gmail.com
6	KibryisfawTulema	BSc in ConTech	Somalie	kibrutulema@gmail.com