

CCM307 COST ESTIMATION

What is cost estimation: Cost estimating is a method of approximating the probable cost of a project before its construction.

The purpose of cost estimating is to forecast the cost of a project prior to its actual construction.

Learning unit 1: Identify the area to be paint

Learning outcomes

1.1. Use tools and Equipment for Measuring

Types, definition and function of tools and equipment used for measuring:

- ✓ Tape measure
- ✓ Topographic instruments: dumpy level, theodolite
- ✓ Measuring wheel

Tape measure: A **tape measure** or **measuring tape** is a flexible ruler and used to measure distance.

Dumpy level: It is also called as automatic **level** or builder's **level**. Its use to determine elevations of different points and distance between the points of same elevation can be determined by **dumpy level**. The telescope of **dumpy level** can rotate only in a horizontal plane.

Theodolite: A theodolite is a precision instrument used for **measuring** angles both horizontally and vertically as well as determining the distance. Theodolites can rotate along their **horizontal** axis as well as their **vertical** axis.

Measuring wheel: A surveyor's wheel, also called a click wheel, way wiser, trundle wheel, measuring wheel or perambulator is a device for measuring long distance with accuracy especially in road

1.2. Identify the state of surface

The identification of the state of the surface will base on the description of the surface and the types of surface defects

- Description of the surface
 - ✓ Nature: the nature of surface deals with smoothness and roughness of the surface.
The nature of the surface can be either rough or smooth
 - ✓ Feasibility: **Feasibility** in painting describes how is possible or convenient to paint the surface of the wall or other surface i.e. the easiest way to paint the surface without interruption due to the obstacles.
Surface not convenient
 - ✓ Painting under ceiling
 - ✓ Painting under water
 - ✓ Painting in hot area
 - ✓ Painting in grooved surface
 - ✓ Accessibility: **Accessible** can **mean** easy to get to. The accessibility in painting means painting at any level of surface without difficulties.
The surface to paint can be accessible easily by using your hand brush or roller, or using extension pole to extend the length of roller or using ladder where you can not reach with your human height.

Surface not accessible and solution

- ✓ Surface exceed the normal human height such as story buildings, here you can use ladder, mobile elevator or use cranes
- ✓ Painting the extended parts of building such as balcony, veranda. You can use telescope table, table or stand ladder.

Depending on the description of the surface stated before, the state of the surface can be identified by its smoothness, roughness, how easy or difficult it is to perform painting on the surface and the easy way to perform painting on that surface.

- Types of surface defects:

- ✓ Cracks: a defect appears in wall, pavement, usually caused by internal stress, poor adhesion

Solution: repair the crack by filling with cement plaster or stucco or other sealing materials.

- ✓ Holes: a defect also appear in wall, pavement caused by impact load, sharpened falling object.

Solution: Like on crack, fill also the holes with cement plaster, stucco or other binding materials.

- ✓ Uneven surface: this is unlevelled surface

Solution: As this defect is due to unlevelled surface, the solution that can provide to this defect is to level the surface with leveling marks, plumb bob or plastering and using straight edge to level the wall.

- ✓ Dampness surface: this is the surface with contact with water i.e. bathroom, kitchen surface, toilet and urinal wall.

Solution: the guaranteed solution for dampness surface is to apply water proofing materials or using special paint for this surface such as epoxy paint, whether guard paint and other special paints which can improve the impermeability of the surface.

- ✓ Knots: is the one of timber defect appeared as result of cut branch of tree.

Solution: if the knot appearing in wood, you can not do any thing else, but if the knot has leave a hole in wood or seems to be removed, you have remove that knot and seal the hole remain with saw dust mixed with wood glue and apply sanding.

1.3. Calculate the surface area according to the type of paint

- Introduction to Measurement

- ✓ Definition of measurement units (distance and surface)

- a. **Distance:** is the measurement of length between two points.

- b. **Surface:** surface is a space between more than two point.

Examples of units' conversions

10 millimeters (mm)	= 1 centimeter (cm)
10 centimeters	= 1 decimeter (dm) = 100 millimeters
10 decimeters	= 1 meter (m) = 1000 millimeters
10 meters	= 1 dekameter (dam)
10 dekameters	= 1 hectometer (hm) = 100 meters
10 hectometers	= 1 kilometer (km) = 1000 meters

Units of Area

100 square millimeters (mm ²)	= 1 square centimeter (cm ²)
100 square centimeters	= 1 square decimeter (dm ²)
100 square decimeters	= 1 square meter (m ²)
100 square meters	= 1 square dekameter (dam ²) = 1 are
100 square dekameters	= 1 square hectometer (hm ²) = 1 hectare (ha)
100 square hectometers	= 1 square kilometer (km ²)

Units of Liquid Volume

10 milliliters (mL)	= 1 centiliter (cL)
10 centiliters	= 1 deciliter (dL) = 100 milliliters
10 deciliters	= 1 liter [†] = 1000 milliliters
10 liters	= 1 dekaliter (daL)
10 dekaliters	= 1 hectoliter (hL) = 100 liters

10 hectoliters = 1 kiloliter (kL) = 1000 liters

Units of Volume

1000 cubic millimeters (mm³) = 1 cubic centimeter (cm³)

1000 cubic centimeters = 1 cubic decimeter (dm³)
= 1 000 000 cubic millimeters

1000 cubic decimeters = 1 cubic meter (m³)
= 1 000 000 cubic centimeters
= 1 000 000 000 cubic millimeters

Units of Mass

10 milligrams (mg) = 1 centigram (cg)

10 centigrams = 1 decigram (dg) = 100 milligrams

10 decigrams = 1 gram (g) = 1000 milligrams

10 grams = 1 dekagram (dag)

10 dekagrams = 1 hectogram (hg) = 100 grams

10 hectograms = 1 kilogram (kg) = 1000 grams

1000 kilograms = 1 megagram (Mg) or 1 metric ton(t)

✓ Purpose of measurement

The main purpose of measurement is to determine the area to paint through those measurement units both distance and surface.

- Means of Measuring:

As we stated before, we can measure by using

- ✓ Tools and
- ✓ Equipment (instruments)

The purpose of that tools and equipment are to determine the length, width and height which can be used to calculate the surface to be painted.

i.e. that if it is the vertical surface such as a wall you want to paint, you have to know the length of that wall and its height so that you can calculate the surface to paint. If is horizontal surface like pavement, ceiling or other horizontal plan surface, you have to calculate the surface by taking length and width.

- Measurement of distance:

During the measurement of the surface, you will need to measure

- ✓ Vertical and
- ✓ Horizontal measurement.

For instance, if it is a vertical wall, you will need to measure the height of the wall as vertical measurement and length or width of wall as horizontal measurement which can help to calculate the surface of that wall.

- Surface calculation according to the type of paint

When calculating the surface to paint, you will need to separate the surface depend on the type of paint you will use for each surface i.e. the surface will be divided into different surface depend on the type of paint will be applied on that surface.

Let take an example of a wall having door and window. For this type of wall, you will need to calculate four surfaces.

1. Surface of wall include door and window i.e. the entire surface of the wall without considering the openings.
2. Surface of door
3. Surface of window
4. After calculate the surface of entire wall and openings (door and window), you have to calculate the surface to be painted i.e. entire surface of the wall minus all surface of the openings.

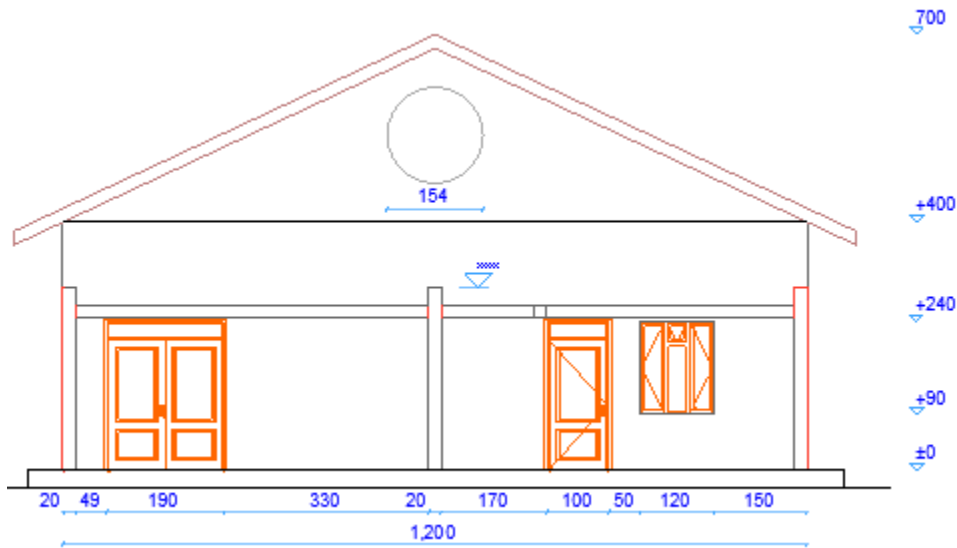
Notice: after Calculating those areas, you have to determine which type of paint you have to apply for each type of surface according to the type of surface. For stance if the remained surface means that left after subtracting the

areas of opening may be calculated for latex paint and those areas of opening may be also calculated for oil-based paint because can be metal door or metal window.

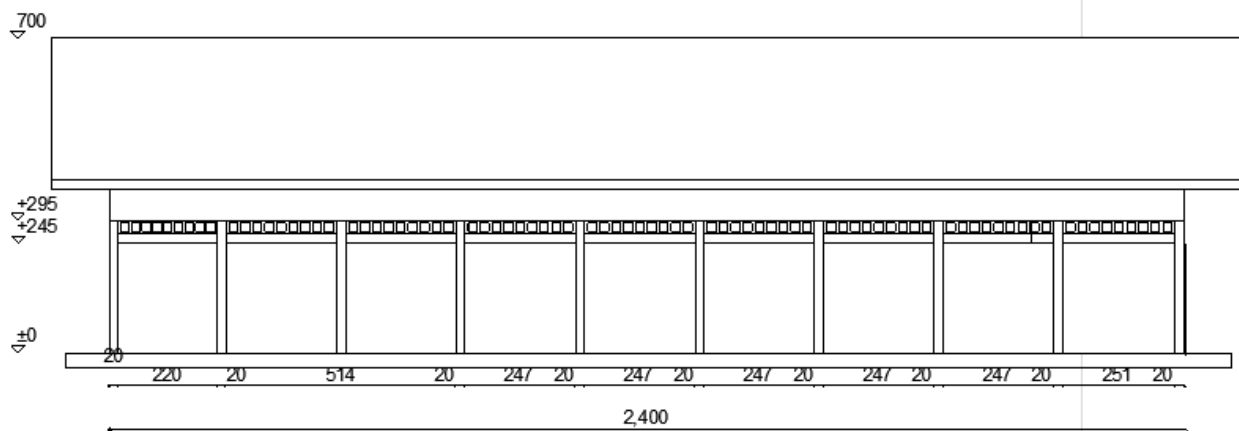
During the calculation of surface to paint, you have to consider the following geometric shapes:

- ✓ Rectangle (Length, Width) Area= L x W
- ✓ Square (Side) Area= S x S
- ✓ Triangle (Side, Height) Area= (B x H) /2
- ✓ Circle (Radius) Area= $r^2\pi$
- ✓ Trapezoid (Great base, Small Base and height) Area= $1/2 \times h \times (a + b)$
- ✓ Oval (small radius, great radius) =a x b x π

Side Elevation



Fron Elevation



Learning unit 2: Perform costing 2.1. Select material, Tools and equipment

- Types of material, tools and equipment used for estimating the quantity (office equipment)
 - ✓ Calculator machine
 - ✓ Computer
 - ✓ Paper
 - ✓ Ruler

- ✓ Pen
- ✓ Table and chair

2.2. Determine the quantity for each type of paint

- Definition of measurement units of capacity/volume)

Capacity/Volume: Volume is the amount of fluid gas or other materials expressed in times of volume can be hold into a container, for example solid, liquid, or gas.

The capacity is measured in the SI base unit called liter (L). the most common units for capacity are liter (L) and milliliter (mL)

- Calculate the paint quantity according to the surface

As we said before, when you are calculating the surface to paint, you have to base on the type of paint you are going to apply to each surface calculated.

Some surface may be calculated to be painted with Oil paint or latex paint.

Oil paint

Oil paint is mainly used for door, windows and some special area like, kitchen, bathroom, toilet.

Latex paint

Latex paint is mainly used for wall surface include ceilings

Some examples of paint calculations:

- ✓ 1 Kg of any type of paint coats 1.5 m² of a plastered wall Example:
A wall with (300 cm x400) cm, a door (100x210) cm and has to be painted.
Calculate the surface and quantity of latex, oil paint
Note that 1kg of any type of paint coats 1.5 m² of a plastered wall

Solution:

Surface area of wall= 300 x400 cm² =120000 cm²
=12 m²

Area of door to be paint with oil paint = 100 cm x210 cm = 21000 cm² =2.1 m²

The surface of wall to be painted with latex paint = the whole surface excludes surface of door = (12 -2.1) m² = 9.9 m²

Quantity of latex paint = 9.9 m² / 1.5 m² x 1kg = 6.6 kg

Quantity of oil paint = 2.1 m² /1.5 m² x 1kg = 1.4 kg

2.3. Calculate elements of costing

- Introduction to cost
 - ✓ Definition: Cost is the price paid to acquire, produce, accomplish, or maintain anything
 - ✓ Purpose in costing: It is used to predict the quantity, cost and price of the resources required by the scope of a project.
- Form of cost estimation

cost and Estimation					
No	Items	Units	Qty	Units Price	Total Price
1	Excavation	Lump Sum	1	60000	60000
2	Foundation	Trucks	4	50000	200000
3	Wall (blocks)	Pcs	4100	400	1640000
4	Ceilling (Triplex)	pcs	14	5500	77000
5	Wood for ceilling	pcs	20	3000	60000
6	Metal Door (180x240)	Pcs	1	80000	80000
7	Metal Door (240x100)	pcs	1	60000	60000
8	Metal Windows (120x100)	Pcs	4	30000	120000
9	Internal wood Doors (210x90)	Pcs	4	30000	120000
10	External wood doors (210x80)	Pcs	2	20000	40000
11	Metal windows (80x60)	Pcs	2	20000	40000
12	Wood for trusses	Pcs	120	4000	480000
13	Crostrat	Pcs	60	500	30000
14	Caorse sand	Trucks	4	30000	120000
15	Fine sand	Trucks	3	30000	90000
16	Painting	Gallon	8	18000	144000
17	Roof sheets	Pcs	87	6000	522000
18	Electrical installation	Lump Sum	1	120000	120000
19	Water and sanitation	Lump Sum	1	200000	200000
20	Gutter	m	42	3000	126000
21	Plastic sheet for roofing	Pcs	1	30000	30000
	Total				4359000

- Elements of cost:
 - ✓ Equipment cost
 - ✓ Consumables cost
 - ✓ Labor cost
 - ✓ Taxes
 - ✓ Benefit

EQUIPMENT COSTS

For construction firms, it is important to accurately estimate the equipment cost as part of the total cost of the construction project. The total cost of a piece of construction equipment consists of two components namely ownership cost and operating cost. This is also referred as O&O cost of the construction equipment. The details about equipment ownership cost and operating cost are presented below.

I. Ownership cost:

Ownership cost is the total cost associated with the construction equipment for owning it irrespective of the equipment is employed or not in the project. The ownership cost consists of the following;

a) Initial cost, b) Salvage value, c) Interest cost or cost of capital investment, d) Taxes, e) Insurance cost, and f) Storage cost

a) Initial cost

Initial cost is the capital investment required to own the equipment. It includes purchase cost, sales tax, transportation cost (or freight charges) to bring the equipment to company's storage yard or construction site and cost of assembly and installation of the equipment.

b) Salvage value

salvage value represents expected cash inflow that will be received by disposing of equipment at the end of its useful life.

c) Interest cost or cost of capital investment

It is the annual cost of interest charged on the borrowed money or that of capital investment to acquire the ownership of the equipment.

II. Operating cost:

Operating cost is acquired only when the equipment is operated. The operating cost of the equipment is influenced by various parameters namely number of operating hours, location of job site, operating conditions, category of equipment etc. The operating cost consists of the following;

a) Repair and maintenance cost, b) Fuel cost, c) Cost of lubricating oil, filter and grease, d) Tire cost
e) Equipment operator wages, f) Cost of replacing high-wear items and g) Cost of mobilization, demobilization and assembly.

a) Repair and maintenance cost

Repair and maintenance cost are incurred as the construction equipment is subjected to wear and tear due to the operations it performs. The repair and maintenance cost include the cost of replacement parts, labor charges and the cost of setting up and operating facilities to carry out major repair and maintenance operations.

b) Fuel cost

The construction equipment is generally powered by internal combustion engines which use either gasoline (petrol) or diesel as the fuel. The fuel consumption depends on the rated flywheel horsepower (fwhp) of the engine and the nature of working conditions. The flywheel horsepower represents the power available for operating a piece of equipment. The hourly fuel cost can be calculated by multiplying the hourly fuel consumption by its unit price.

c) Cost of lubricating oil, filter and grease

The quantity of lubricating oil, filter and grease required depends on operating hours, frequency of changes, engine characteristics and working conditions at the job site.

d) Tire cost

The cost of pneumatic tires (rubber tires) is considered as a part of operating cost. The tire cost includes the tire repair and replacement charges.

e) Equipment operator wages

The operator cost includes the hourly wages and benefits paid by the company to the operators. It includes normal wages, workmen's compensation insurance premium, fringe benefits, bonus etc.

f) Cost of replacing high-wear items

It represents the cost of high-wear items and these items have a shorter life as compared to the service life of the equipment. The high-wear items include blades, cutting edges, drill bits, bucket teeth etc.

g) Cost of mobilization, assembly and demobilization

This cost includes transportation charges from one project site to another, cost required for getting road permits, unloading charges, cost of assembly at the project site etc.

CONSUMABLES OR MATERIAL COST

This is the cost of material or the commodity used by the organization for its production purpose. Material is the substance, from which a product is made.

THE COST OF LABOR

It should be noted that the payment made to the labour in exchange for its service is called labour cost, which comprises of a major part of the total cost of construction.

Labour cost is normally called as wages. Labour cost represents the expense received on both direct and indirect

Labour cost can be defined also as the sum of all wages paid to employees, as well as the **cost** of employee benefits and payroll taxes paid by an employer. The **cost of labor** is broken into direct and indirect (overhead)**costs**

a) Direct Labor Cost is the cost incurred on those employees who directly take part in the manufacturing process.

This is not just how much you pay the person, but also how much having an employee impacts your insurance premiums, benefits costs, payroll tax donations, etc. To accurately measure direct labor cost, you must include all expenditures, not just wages. It covers:

- ✓ employer-paid Social Security
- ✓ Medicare
- ✓ unemployment taxes
- ✓ workmen 's compensation insurance

b) Indirect Labor Cost is the cost incurred on those employees who do not directly take part in the manufacturing process. Indirect labor cost explains about the wages paid to workers which helps in performing the tasks that do not directly contribute to the production of goods or performance of services, such as support workers who help enable others to produce goods. For example, foremen to oversee production workers and security guards to keep facilities safe. All of these workers are involved in indirect labor, because they do not actually produce any goods. Examples of other workers engaged in indirect labor which includes:

- ✓ Managers
- ✓ Accountants
- ✓ maintenance staff

Expenses: are the costs of services provided to the organization. It can be direct or indirect.

a) Direct Expenses are the expenses which can be directly identified with the individual cost centers. Example: hire charges of machinery, cost of defective work for a particular job or contract etc.

b) Indirect Expenses are the expenses which cannot be directly identified with the individual cost centers. Example: rent, lighting, telephone expenses, etc.

What are overheads? How are they classified?

Overheads are the aggregate of Indirect Material cost, Indirect Labor and Indirect Expenses. Thus, sum of all indirect costs are overheads. They are of **three types**:

- a) Factory Overheads
- b) Office and Administration Overheads
- c) Selling and Distribution Overheads

a.) **Factory Overheads:** are the overheads which are incurred from the stage of procurement of materials till the stage of finished goods. They include:

- Indirect Materials such as lubricants, cotton waste, consumable stores etc.
- Indirect Labor such as storekeeper, time keeper, works manager's salary etc. - Indirect Expenses such as cost of factory lighting, carriage inward cost, depreciation on factory building, rent/insurance of building/machinery etc.

b.) **Office and Admin overheads:** are the overheads incurred for the overall administrative work of the organization. They include:

- Indirect Materials such as office supplies, stationery and printing items, brooms etc.
- Indirect Labor such as salaries payable to manager, clerk etc.
- Indirect Expenses such as lighting, bank charges, legal/audit charges, rent/insurance of office.

c.) **Selling and Distribution Overheads:** are the overheads incurred from the stage of final manufacturing of finished goods till the stage of goods sold in the market and collection of dues from the customers. They include:

- Indirect Materials such as samples, packing materials, etc.
- Indirect Labor such as salaries and commission payable to sales manager, salesmen etc.
- Indirect Expenses such as rent, carriage outwards, warehouse charges, discount offered to customers, advertising expenses, bad debts etc.

TAXES: Compulsory monetary contribution to the state's revenue, assessed and imposed by a government on the activities, enjoyment, expenditure, income, occupation, privilege, property, etc., of individuals and organizations. **Taxes** can be defined also as an amount of money that you have to pay to the government so that it can pay for services. When a person or company is taxed, they have to pay a rate of money as a part of their income or profits to the governments. When goods or services are taxed, a percentage of their price has to be paid to the government.

Services rendered within **Rwanda** although consumed outside **Rwanda** will be subject to **VAT** at the **rate** of 18%. A withholding **tax** of 15% is levied on dividends, interest, royalties and other listed payments made by resident individuals or resident entities including **tax-exempt** entities.

This comes under **income** from capital gains. So, your total **income** is the sum of your salary, rental **income**, and capital gains. Next, subtract the tax-free **earnings** from the total **income**.

Dividend is a sum of money paid regularly (typically annually) by a company to its shareholders out of its profits.

BENEFIT AND PROFIT

Benefit and profit are a company's revenue minus its cost of goods sold. It is also known as gross margin and gross income. It is calculated by subtracting all costs related to sales i.e. manufacturing expenses, raw materials, labor, selling and advertisement expenses from sales.

Gross Profit = Net Sales – Cost of Goods Sold

Employee **benefits** are defined as a form of compensation paid by employers to employees over and above regular salary or wages. Employee **benefits** come in many forms and **are** an important part of the overall compensation package offered to employees.

There are four major **types of employee benefits** many employers offer: medical insurance, life insurance, disability insurance, and retirement plans.

