- For arriving at the unit rates of each item.
- The rates of various materials to be used in the construction.
- The cost of transport materials.
- The wages of labour, skilled or unskilled of masons, carpenters, Mazdoor, etc.,
- The rates of particular item of work depends on the following:
- Specifications of works and material about their quality, proportion and constructional operation method.
- Quantity of materials and their costs.
- Cost of labors and their wages.
- Location of site of work and the distances from source and conveyance charges.
- Profit
- Cost of materials at source and at site of construction.
- The costs of materials are taken as delivered at site inclusive of the transport local taxes and other charges.

Data:

- The art of finding rate per unit of individual item in a particular work is known as a Data.

Sub Data:

- The data which assists the main data is known as Sub data.
- After finding the sub data then only the main data can be worked out.

For Example: Brickwork in CM 1:5 in this CM 1:5 is a sub data.

Main Data:

- These are the main items of works. In which a particular item of work, rate is worked out.

For Example: Brickwork in Cement Mortar 1:5

Cost of Materials at Site:

- Cost of materials at site is the cost of material at source plus lead charges and handling charges.

No.	Materials	unit	Cost	Lead in Km	Rate for lead/Km	Handling Charges
1.	Sand	1 m^3	115.00	6	4.00	14
2.	Bricks	1000 Nos	1785.00	11	6.00	20
3.	Rough stone	m^3	160.00	12	8.00	10

Example: Cost of Materials and lead particulars.

Lead:

- The distance between the source of availability of material and construction site is known as lead and is calculated in Km.
- The conveyance cost of material depends on lead.

Materials	Unit	Cost	Lead in Km	Rate/ k m	Cost of conveyance	Handling charges	Cost at site
Sand	1 m^3	115.00	6	4.00	24.00	14	153.00 (115+24+14)
Bricks	1000 Nos	1785.00	11	6.00	66.00	20	1871.00 (1785+66+20)
Rough stone	m	160.00	12	8.00	96.00	10	266.00 (160+96+10)

MATERIALS REQUIREMENT FOR IMPORTANT DATAS:

- Unit Weight of Cement 1440 Kg/m^3 , Cement Mortar Quantities for various ratios.
- For Cement Mortar 1:1 – 1 m^3
- Cement – 1440/1 = 1440 Kg (unit Weight of cement is1440 Kg/m^3)
- Sand = 1 m^3
- Mixing Charges extra.
- For Cement Mortar 1:1.5 – 1 m^3
- Cement – 1440/1.5 = 960 Kg (unit Weight of cement is1440 Kg/m^3)
- Sand = 1 m^3
- For Cement Mortar 1:2 – 1 m^3
- Cement – 1440/2 = 720 Kg (unit Weight of cement is 1440Kg/m^3)
- Sand = 1 m^3
- Mixing Charges extra.
- For Cement Mortar 1:3 – 1 m^3
- Cement – 1440/3 = 480 Kg (unit Weight of cement is 1440Kg/m^3)
- Sand = 1 m^3
- Mixing Charges extra.
- For Cement Mortar 1:4 – 1 m^3
- Cement – 1440/4 = 360 Kg (unit Weight of cement is 1440Kg/m^3)
- Sand = 1 m^3
- Mixing Charges extra.
- For Cement Mortar 1:5 – 1 m^3
- Cement – 1440/5 = 288 Kg (unit Weight of cement is 1440Kg/m^3)
- Sand = 1 m^3

- Mixing Charges extra.
- For Cement Mortar 1:6 – 1 m^3
- Cement – 1440/6 = 240 Kg (unit Weight of cement is 1440Kg/m^3)
- Sand = 1 m^3
- Mixing Charges extra.

Cost of materials and Lead particulars

No.	Materials	Unit	Cost in Rs.	Lead in Km	Rate for lead/Km	Handling Charges
1.	Cement	1 tonne	7000.00	5	22	116.00
2.	Sand	1 m^3	110.00	3	15	40.00

Cost of materials at site

Materials	Unit	Cost in Rs.	Lead in Km	Rate/Km	Cost of conveyance	Handling charges	Cost at site
Cement	1 tonne	7000.00	5	22	110.00	116.00	7226.00 (7000+110+116)
Sand	1 m^3	110.00	3	15	45.00	40.00	195.00 (110+45+40)

Cement Mortar 1:3 – 1 m^3

Qty.	Description	Rate	Per	Amount
480 kg	Cement	7226.00	Tonne	3468.48 (7226.00 X 0.480)
1 m^3	Sand	195.00	1 m^3	195.00 (1 X 195)
1 m^3	Mixing Charges	37.00	1 m^3	37.00 (1 X 37)
		Rate for 1 m		= Rs. 3700.48

Cement Mortar 1:5 – 1 m^3

Qty.	Description	Rate	Per	Amount
288 kg	Cement	7226.00	Tonne	2081.08 (7226 X 0.288)
1 m^3	Sand	195.00	1 m^3	195.00 (1 X 195)
1 m^3	Mixing Charges	37.00	1 m^3	37.00 (1 X 37)
Rate for 1 m = Rs. 2313.08				

Cement Mortar 1:6 – 1 m^3

Qty.	Description	Rate	Per	Amount
240 kg	Cement	7226.00	Tonne	1734.24 (7226 X 0.240)
1 m	Sand	195.00	1 m^3	195.00 (1 X 195)
1 m	Mixing Charges	37.00	1 m^3	37.00 (1 X 37)
Rate for 1 m = Rs. 1966.24				

- Lime Mortar – 1 m^3
- Grinding Charges extra.

Mix Ratio	Lime	Sand
1:11/2	0.67 m^3	1 m^3
1:2	0.5 m^3	1 m^3

- Lime Surkhi Mortar – 1 m^3
- Grinding Charges extra.

Mix Ratio	Lime	Surkhi	Sand
1:1/2:1	0.67 m	0.33 m	0.67 m^3
1:1/2:11/2	0.5 m	0.25 m	0.75 m^3

Prepare Lime Mortar and Surki Mortar for the following Ratios:

- Lime mortar 1:2 – 1 m^3
- Lime – 0.5 m^3
- Sand – 1 m^3
- Grinding Charges extra.
- Lime Surki Mortar 1:1/2:11/2 – 1 m^3
- Lime – 0.5 m^3
- Surki – 0.25 m^3
- Sand – 0.75 m^3
- Grinding Charges extra.

Cost of materials and Lead particulars:

No.	Materials	Unit	Cost in Rs.	Lead in Km	Rate for lead/Km	Handling Charges
1.	Lime	m^3	1075.00	4	10.00	54.00
2.	Sand	m^3	110.00	6	14.00	38.00
3.	Surkhi	m^3	400.00	4	10.00	54.00

Grinding Charges for lime and surkhi mortar – Rs.120/m^3

Materials	Unit	Cost in Rs.	Lead in Km	Rate/Km	Cost of conveyance	Handling charges	Cost at site
Lime	m^3	1075.00	4	10.00	40.00	54.00	1169.00 (1075+40+54)
Sand	m^3	110.00	6	14.00	84.00	38.00	232.00 (110+84+38)
Surkhi	m^3	400.00	4	10.00	40.00	54.00	494.00 (400+40+54)

- Lime mortar 1:2 – 1 m^3

Qty	Description	Rate	Per	Amount
0.5 m	Lime	1169.00	m^3	584.50
1 m	Sand	232.00	m^3	232.00
1 m	Grinding Charges	120.00	m^3	120.00
		Rate for 1 m = Rs.936.50		

- Lime mortar 1:1.5 – 1 m^3

Qty	Description	Rate	Per	Amount
0.67 m	Lime	1175.00	m^3	787.25
1 m^3	Sand	203.00	m^3	203.00
1 m^3	Grinding Charges	125.00	m^3	125.00
Rate for 1 m = Rs.1115.25				

- Lime Surki Mortar 1:1/2:11/2 – 1 m^3

Qty	Description	Rate	Per	Amount
0.5 m^3	Lime	1169.00	m^3	584.50
0.25 m	Surki	494.00	m^3	123.50
1 m^3	Sand	232.00	m^3	232.00
1 m^3	Grinding Charges	120.00	m^3	120.00
Rate for 1 m = Rs.1060.00				

COSTING:

- Cost estimation in project management is the process of forecasting the cost and other resources needed to complete a project within a defined scope.
- Cost estimation accounts for each element required for the project and calculates a total amount that determines a project's budget.

Principles of Cost Estimation:

- Cost estimation is used to predict the quantity, cost and price of the resources required by the scope of a project.
- The accuracy of the estimate depends heavily on the level of project scope definition: as the design and conditions of the project become better defined, so do the estimated values.
- Cost estimation is needed to provide decision-makers with the means to make investment decisions, choose between alternatives and to set up the budget during the front end of projects.
- For this, estimates made by vendors and contractors need to be validated by clients as well.
- In later phases of the project, the budget estimate is used as a baseline to assess the

performance of a project.

- Estimating is done by breaking down the total scope of a project in manageable parts, to which resources can be assigned and cost.
- There are standardized ways of breaking down a project, like the Work Breakdown Structure (WBS) and the Cost Breakdown Structure (CBS), but depending on the needs of the project team and external parties multiple structures are often implemented to align reporting and sharing of cost data.
- A cost estimate is more than a list of costs. It also includes a detailed Basis of Estimate (BOE) report that describes the assumptions, inclusions, exclusions, accuracy and other aspects that are needed to interpret the total project cost.
- The BOE is required to communicate the estimate to the various parties involved in the decision making but is also handy during closeout when the performance of the project is compared with other projects.
- It is the vital part often overlooked, that allows you to learn from your experience and mistakes.

Meaning of Standard Data:

- Generally large number of man hours is spent in setting the time standards by using stopwatch time study.
- Further management is anxious to have the time standards before the jobs are actually manufactured for cost estimating, scheduling, planning and other decision-making purposes.
- In this case, advantage of previous time standards already on hand can be taken.
- Every operation consists of number of small work elements which are repeated in various combinations.
- The time values for these small work elements are established accurately, and these values are used without further time study, whenever the element occurs.
- These standardized timings for such elements are known as Standard Data.

Cost Control:

- Cost control is the practice of identifying and reducing business expenses to increase profits, and it starts with the budgeting process.
- Cost control is an important factor in maintaining and growing profitability.
- Cost Control is a technique which makes available the necessary information to the management that actual costs are aligned with the budgeted costs or not.

NOTE:

MIX PROPORTION OVERALL QUANTITY

- For 100 m^3 of finished concrete = 152 m^3 of dry ingredient material.
- For 10 m^3 of finished concrete = 15.2 m^3 of dry ingredient material.
- For 1 m^3 of finished concrete = 1.52 m^3 of dry ingredient material.

PROBLEMS:

1. To find mix proportion for 10 m^3 concrete with cement concrete 1:2:4

For 10 m^3 , dry ingredient quantity = 15.2 m^3

15.2/(1+2+4) = 15.2/7 = 2.17 m^3

Cement Quantity = 2.17 X 1 = 2.17 m^3

Sand Quantity = 2.17 X 2 = 4.34 m^3

Aggregate Quantity = 2.17 X 4 = 8.68 m^3

(a) Cement concrete (1:4:8) – 1 m^3 quantity

Mix ratio = 1:4:8

= 13 parts

Total volume of ingredients = 1.52 m^3 (40 mm stone)

Volume of stone required = $\frac{1.52}{13} \times 8$

= 0.9354 m^3

= 0.94 m^3

Volume of sand required = $\frac{1.52}{13} \times 4$

= 0.4677 m^3 = 0.47 m^3

Volume of cement required = $\frac{1.52}{13} \times 1$

= 0.117 m^3

Weight of cement required = 0.117 m^3 × 1440 kg/m^3

= 168.48 kg = 168.5 kg (say)

(*b*) Cement concrete of 1:2:4 – 1 m³ quantity

Mix ratio = 1:2:4

= (7 parts)

Total volume of ingredients = 1.57 m³ (20 mm stone)

Volume of stone required = $\frac{1.57}{7} \times 4$

= 0.897 m³

= 0.9 m³

Volume of sand required = $\frac{1.57 \times 2}{7}$

= 0.449 m³

= 0.45 m³

Volume of cement required = $\frac{1.57 \times 1}{7}$

= 0.2248 m³

= 0.225 m³

Weight of cement required = 0.225 m³ × 1440 kg/m³

= 324 kg

(*a*) First Class Brickwork in CM 1:5 – 1 m³

Size of the first class brick = 0.19 × 0.09 × 0.09 m³

Take 10 mm as mortar thickness

Size of the brick with mortar = 0.2 × 0.1 × 0.1 m³

= 0.002 m³

No. of bricks required = $\frac{1}{0.002}$

= 500

Actual volume of bricks in 1 m³ of brickwork = 500 × 0.19 × 0.09 × 0.09

= 0.7695 m³

Volume of cement mortar for 1 m³ of BW = 1 – 0.7695

= 0.2305 m³

Volume of sand required for 0.2305 m³ of mortar = 0.2305 m³

Cement required for 1:5 for 0.2305 m³ = $0.2305 \times \frac{1440}{5}$

= 66.384

= 66.5 kg (say)

(a) Plastering with CM 1:6, 12 mm thick – 10 m²

Thickness of the mortar layer = 12 mm

= 0.012 m

Plastering area = 10 m²

Volume of the mortar required = 10 × 0.012

= 0.12 m³

Add 15% allowance = 0.12 × 0.15

= 0.018 m³

Total volume of mortar required = 0.12 + 0.018

= 0.138 m³

Sand required for 1 m³ CM 1:6 = 1 m³

Sand required for 0.138 m³ CM 1:6 = 0.138 m³

Cement required for 0.138 m³ CM 1:6 = $\frac{0.138 \times 1440}{6}$

= 33.12 kg