GOVERNMENT POLYTECHNIC FOR GIRLS , AHMEDABAD

Civil Engineering Department

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Subject:- Estimating, Costing and Valuation

Subject Code:- 3350604

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UNIT- 3

Rate Analysis of Civil Works

Rate Analysis:

- The process of determining rate per unit of any work in Civil Engineering project like earthwork, concrete work, brickwork, plastering, painting etc. is known as Analysis of Rates or simply Rate Analysis.
- The rates of materials and labor vary from place to place and hence the rates of different items of works also vary from place to place. The rates of these works further help in determining cost of particular work and in turn cost of the project

Necessity of Rate Analysis

1. To determine the actual cost per unit of the items.
2. To work out the economical use of materials and processes in completing the particulars item.
3. To calculate the cost of extra items which are not provided in the contract bond but are to be executed as per the directions of the department.
4. To revise the schedule of rates due to increase in the cost of material and labor or due to change in technique.

Factors Deciding Rate of Items

- The various factors that are involved in determining rate of any item, process or work are mentioned below:

 Specifications of works and material about their quality, proportion and Construction al operation method.

 Quantity of materials and their costs.

 Cost of labor and their wages.

 Location of site of work and the distances from source and conveyance charges.

 Overhead and establishment charges

 Profit and miscellaneous expenses of the contractor

Procedure of Rate Analysis

- The analysis of rates is worked out for the unit payment of the particular item of work under two heads:

  Materials and Labor.

1. The cost of items of work = Material cost + Labor cost
2. Other costs included to the above cost of items of work are

- Tools and Plants (T & P) = 2.5 to 3 % of the labor cost
- Transportation cost (if conveyance more than 8 km is considered.)
- Water charges = 1.5 to 2 % 0f total cost
- Contractor’s profit = 10 %

Material cost:

The rate of various materials as per specifications for the items under consideration can be chalked out from market survey. The costs of materials are taken as delivered at site of work. This is inclusive of:

- The first cost (cost at origin),
- Cost of transport, railway freight (if any), etc.
- Local taxes and other charges.

Labor cost:

To obtain labor cost the number and wages of different categories of labor, skilled (Skilled 1st Class), semi-skilled (Skilled 2nd Class) and unskilled, required for each unit of work should be known and this number is multiplied by the respective wage per day.

TASK WORK:

- The capacity of doing work by an artisan or skilled labor in the form of quantity of work in a working day of eight hour is known as the task work.
- The task work is not same at all place but varies from place to pace and person to person.
- It depends on various factors

1. Type of labor- male/female
2. Nature of work- ordinary/special
3. Climatic condition- Hot ,cold, Rainy
4. Situation of work- soil condition/time limit
5. Skill of labor- skilled/unskilled
6. Site organization- poor/good
7. Size of work- quantity of work
8. Location of work –congested/ isolated area

Task or out-turn work

- This is the quantity of work which can be done by an artisan or skilled labor (with the help of semiskilled and unskilled labors) of the trade working for 8 hours a day.
- The outturn of work per artisan varies according to the nature, size, height, situation, location etc.
- Out-turn is more in larger cities, as the more specialized and experienced labors are available, than the small cities and country sides.

OUT-TURN OR TASK

Particulars of items	Quantity of work per day (8 hrs a day)
1. Earthwork in excavation in foundation in ordinary soil, lead up to 50m and lift up to 1.5 m	3.00 cum per mazdoor/Beldar
2. Earthwork in excavation in hard soil for 100m lead and 1.5 m lift.	2.00 cum per mazdoor/Beldar
3. Excavation in rock	1.00 cum per mazdoor
4. Sand filling in plinth	4.00 cum per mazdoor
5. Breaking of brick ballast 40mm gauge	0.75 cum per labour/breaker
6. Breaking of stone ballast 40mm gauge	0.40 cum per labour
7. Breaking of stone ballast 20mm gauge	0.25 cum per labour
8. Brickwork in cement mortar in foundation and plinth	1.25 cum per mason
9. Brickwork in cement mortar in superstructure	1.00 cum per mason.
10. Half brick wall in partition	5.00 square meter per mason
11. Brick work in cement mortar in arches	0.55 cum per mason
12. Lime concrete in foundation/ flour	8.50 cum per mason
13. Lime concreting in roof terracing	6.00 cum per mason
14. Cement concrete (1:2:4)	5.00 cum per mason
15. R.C.C. work	3.00 cum per mason

LABOUR REQUIREMENTS

	Description of work	Quantity	Labour
1.	Earthwork in excavation in foundation, trenches etc. in ordinary soil including disposal up to 30 m and lift of 1.5 m	28.30 m^3 (1000 cft)	Beldar - 5 nos. Mazdoor-4 nos.
2.	Refilling of excavated earth in foundation, plinth etc. including consolidation in 150 mm layer.	28.30 m^3 (1000 cft)	Beldar-3 nos. Mazdoor-2 nos. Bhisti-0.5 nos.
3.	Laying cement concrete	2.83 m^3 (100 cft)	Beldar-2 nos. Mazdoor-3 nos. Bhisti-3/4 nos. Mason-1/4 nos.
4.	Laying of R.C.C. work	2.83 m^3 (100 cft)	Beldar-3 nos. Mazdoor-3 nos. Bhisti-1.5 nos. Mason-0.5 no.
5.	Reinforcement work for R.C.C.	1 quintal	Blacksmith-1 no. Beldar-1 no.
6.	First class Brickwork in 1:4 cement morter in superstructure	2.83 m^3 (100 cft)	Mason-2.25 nos. Mazdoor-4.5 nos. Bhisti-0.5 no.
7.	Wood work in door/window fromes	0.18 m^3	Carpenter-2 nos. Beldar-1 nos.
8.	Wood work in panelled, glazed shutters etc.	0.30 m^3	Carpenter-15 nos. Beldar-4 nos.
9.	40 mm cement concrete flooring	40 m^2	Mason-5 nos. Beldar-4 nos. Mazdoor-3 nos. Bhisti-1 no.
10.	12 mm cement mortar plastering	40 m^2	Mason-3 nos. Mazdoor-3 nos. Bhisti-1 no.
11.	Three coats white washing/colour washing	60 m^2	White washer-1 no. Mazdoor-1 nos.
12.	Two coats painting on wood or steel	10 m^2	Painter-3 nos. Mazdoor-2 nos.

LUMPSUM:

- While preparing an estimate, it is not possible to work out in detail in case of petty items. Items other than civil engineering such items are called lump sum items or simply L.S. Items.
- Sometimes while preparing estimate for the certain small items like front architecture or decoration work of a building it is not possible to workout detailed quantities so far such lump sum items a lump sum rate is provided.

The following are some of L.S. Items in the estimate.

1. Water supply and sanitary arrangements.
2. Electrical installations like meter, motor, etc.,
3. Architectural features.
4. Contingencies and unforeseen items.

Rate Analysis of Important Items:

[1] Earthwork in excavation in foundation including filling in trenches up to 30m, lead and 1.5 m lift

Assume volume of excavation = 100 cu m OR Take unit qty =100 cu.m.

Sr. No.	Description	Quantity	Rate	Unit	Amount
1	Materials:	--	--	--	---
2	Labors: Head mason Male labor/ Female labor- Mazdoor Bhisti/ Beldar T.P. &Sundries etc.	 ½ 7 7 18 L.S.	 800 400 400 350 200	 Per day “ “ “ L.S.	 400=00 2800=00 2800=00 6300=00 200=00
				Total	12500=00
		Add: 10% contractors’ profit Grand Total Rate =13750/100=137.5=138.00 Rs. per Cu.m.			 1250=00 13750=00

[2] First class brickwork in super structure with cement mortar (1:6)

(a) Estimation of Materials:

Assume volume of brickwork = 10 cu m

Nominal size of modular brick = 20 cm×10 cm× 10 cm

Hence, the number of bricks required = 10/ 0.2x0.1 x0.1= 5000 Nos.

Actual size of modular brick = 19 cm× 9 cm× 9 cm

The remaining space is filled by mortar, hence the volume of mortar required for 10 cum

= 10 – (5000 × 0.09 ×0.09 × 0.19) = 2.3 cu m. (Wet volume or qty.)

Additional mortar required for frog filling, brick bonding and wastages @ 15%.

Thus volume of set mortar = 2.3 + 2.3 × 15\100 = 2.64 cum.

But, 1.25 cu m of dry volume of mortar materials produces 1.0 cu m set mortar.

Hence, volume of dry materials required for 2.64 cu m of set mortar

= 1.25 × 2.64 cu m = 3.30 cu m. dry vol. or dry qty. of mortar

- [Note: As a thumb rule, dry volume of mortar materials is 30% of brick work]

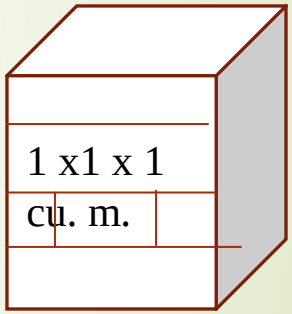
Sum of proportion of cement and sand = 1+6 = 7

Hence, volume of cement = 3.3/7 = 0.47 cu m.

However, cement is available in 50 kg bag whose volume is 0.0347 cu m.

[*Mass = 50 kg; Density =1440 kg/m3; Thus, Volume = 50/1440 = 0.0347 cu m*]

[*Thumb rule: 1 cu m of cement = 30 bags of cement*.]



Therefore, number of bags required = 0.47 / 0.0347 ≈ 13.5 bags.

Volume of sand required = 0.47 × 6 = 2.82 cu m.

b) Rate Analysis

Assume, the volume of brickwork = 10 cu m.

Particulars	Qnty/Nos.	Rate (Rs.)	Cost (Rs.)
Material Charges			
1. Brick	5000 Nos.	250.00 (/100 nos.)	12500.00
2. Cement	13.5 bags	320.00 per bag	4320.00
3. Sand	2.82 cu m	350 per cu m	987.00
Labour Charges(Old rate)			
1. Head Mason	2 Nos.	450.00 per day	900.00
2. Mason	6 Nos.	350.00 per day	2100.00
3. Mazdoor	16 Nos.	220.00 per day	3520.00
4. Bhisti	08 Nos.	220.0 per day	1760.00
T&P, Sundries, etc.	LS	200.00 LS	200.00
		Total Materials and Labour	**26287.00**
		Add 1.5% water charges	394.30
		Add 10% Contractors profit	2628.70
		Grand Total	**29310.00**

Rate per cu m Rs. = 29310.00/10 = 2931.00 Rs.

Name or work: **First class brickwork in super structure with cement mortar (1:6)** Assume, the volume of brickwork = 10 cu m.

Sr.No.	Description	Quantity	Rate	Unit	Amount
1	Materials: Bricks	5000	5000=00	Nos./1000	25000=0
	Cement	13.5	325=00	Per bags	4387=5
	Sand	2.82	425=00	Cu.m.	1198=5
				Total Rs.	30586=0
2	Labors:				
	Head mason	1/2	800=00	Per day	400=00
	Mason	6	700=00	"	4200=00
	Male labor				
	Female labor/ Mazdoor	16	400=00	"	6400=00
	Bhisti/Beldar	8	350=00	"	2800=00
	T.P. &Sundries etc.	L.S.	250=00	L.S.	250=00
4				Total Rs.	14050=0
				Net Total	44636=0
		Add:		1.5% water charge	669=54
				10% contractors' profit	4463=60
				Grand Total	49769=14
		Rate = 49769.14/10= 4976.911=4977.00		per Cu.m	

[3] Rate analysis of P.C.C.(1:4:8)for foundation

- Calculation of Materials:
  Assume, the volume of Concrete = 10 cu m

Dry Volume of C.C. =

Add 27 % shrinkage = 10+0.27 x 10= 12.7

25% wastage = 10+ 0.25x10= 12.5 +127=15.2 Cu.m.

Or 52% as shrinkage and wastage= 10 + 10 x 0.52=15.2 Cu.m

Net dry volume = 15.2 cu.m.

Qty = (dry vol/sum of proportion)x part of that material

Ratio = 1+4+8=13

Calculation of material:

1. Cement vol = (15.2/13)x1=1.17 cu.m

   No. of cement bag= 1.17/0.035= 33.43 =34 Nos.
2. Vol. of sand = 4 x 1.17= 4.68 cu.m.OR (15.2 /13) x 4=4.68
3. Coarse Aggregate= 8 x 1.17 = 9.36 cu.m.

[3] Rate analysis of P.C.C.(1:4:8)for foundation

Sr.No.	Description	Quantity	Rate	Unit	Amount
1	Materials: Cement Sand Coarse Aggregate	34 4.68 9.36	325=00 425=00 1945=00	Per bags Cu.m. “	11050=00 1989=00 18205=20
				Total	31244=20
2	Labors: Head mason Mason Male labor Female labor/ Mazdoor Bhisti/Beldar T.P. &Sundries etc.	 ½ 2 8 10 2 L.S.	 800=00 700=00 400=00 400=00 350=00 200=00	 Per day “ “ “ L.S.	 400=00 1400=00 3200=00 4000=00 700=00 200=00
4	=41344 x10/100=				9900=00
				Net	41144=00
cost agg.55 x 100=5500 / 100 cft 100 cft =2.83 cu.m. For 1 cu.m =5500/2.83=1943.46=1945.0.0Rs/cu.m			Add: 1.5% water charge 10% contractors’ profit Grand Total Rate = 45875.56/10 =4587.56= 4588.00 per Cu.m.		617=16 4114=40 45875=56

4. Rate analysis: 20mmTh. rough cement plaster (1:6 CM) on Brick wall of super structure

- Calculation of materials:
- Assume unit area for plaster= 100 sq.m.
- Qty.of wet motar required= 100 x 0.02=2.0 cu.m.
- Add.30 % for joint filling, wastage, finishing= 2.0+2 x 0.3= 2.6
- OR 2 X1.3 =2.6
- Add. 25% for shrinkage = 2.6 + 2.6 x 0.25= 3.25 Cu.m.
- OR 2.6X1.25 =3.25 Cu.m.
- OR Dry vol = 2.0 + 2 x 0.55= 3.10
- Take dry vol =3.25 cu. m.,, total sum = 1+6=7
- Vol. of cement =(3.25/ 7)*1=0.464cu.m
- No. of Cement bag =0.464/0.035=13.265=14 bag
- Vol. sand = 0.464 x 6=2.784 cu. m

4. Rate analysis: 20mmTh. Rough(sand faced) cement plaster (1:6 CM) on Brick wall of super structure

Sr.No.	Description	Quantity	Rate	Unit	Amount
1	Materials: Cement Sand	14 nos. 2.784	325=00 425=00	Per bags Cu.m.	4550.00 1183.20
				Total	5733.20
2	Labors: Head mason Mason Male labor Female labor/ Mazdoor Bhisti/Beldar T.P. &Sundries etc.	 ½ 10 10 10 2 L.S.	 800=00 700=00 400=00 400=00 350=00 250=00	 Per day “ “ “ L.S.	 400.00 7000.00 4000.00 4000.00 700.00 250.00
4				Total labor+ material cost	16350.00 22083.20
			Add:1.5% water charge 10% contractors’ profit Grand Total Rs. Rate = 24622.77/100=RS.		331.25 2208.32 24622.77

[5] Rate analysis: 12mmTh. Smooth cement plaster (1:4 CM) on Brick wall of super structure

- Calculation of materials:
- Assume unit area for plaster= 100 sq.m.
- Qty. of wet motar required= 100 x 0.012= 1.2 Cu.m.
- Add.30 % for joint filling, wastage, finishing= 1.2 +1.2 x 0.3= 1.56

  OR 1.2 X1.3 =1.56
- Add. 25% for shrinkage = 1.56 + 1.56 x 0.25= 1.95 Cu.m.

  OR 1.56 X1.25 =1.95 Cu.m.
- OR Dry vol. = 1.2+ 1.2 x 0.55= 1.86
- Take dry vol =1.95 say 2.00 Cu. m., Total proportion sum = 1+4=5
- Vol. of cement =(2.0/ 5) x1= 0.40 Cu.m
- No. of Cement bag =0.4/0.035=11.43=11.5 =12 bag
- Vol. sand = 0.4 x 4 = 1.6 Cu. m

Sr.No.	Description	Quantity	Rate	Unit	Amount
1	Materials: Cement Sand	12 nos. 1.6	325=00 425=00	Per bags Cu.m.	3900.00 680.00
				Total	4580.00
2	Labors: Head mason Mason Male labor Female labor/ Mazdoor Bhisti/Beldar T.P. &Sundries etc.	 ½ 10 10 10 2 L.S.	 800=00 700=00 400=00 400=00 350=00 150=00	 Per day “ “ “ L.S.	 400.00 7000.00 4000.00 4000.00 700.00 150.00
4				Total labor+ material cost	16250.00 4580.00 20830.00
			Add:1.5% water charge 10% contractors’ profit Grand Total Rs. Rate = 23225.45/100=RS. 232.25=232.0 per Sq..m.		312.45 2080.30 23225.45

[6] R.C.C work (1:2:4)for slab

- Calculation of materials:
- Take unit = **10 cu.m.**
- Dry vol .of concrete required = 10 + 10 x 0.52= 15.2 Cu.m.
- Total proportion = 1+2+4 =7
- Vol. of cement=(15.2/7) x 1= 2.17 Cu.m. ,
- No. of bags= 2.17/0.035= 62 bags
- Vol. of sand = 2.17x2=4.34 Cu.m.
- Vol. of Aggregate = 2.17 x 4=8.68 Cu.m.
- steel @ 1% of concrete vol.= vol. steel 0.01 x 10= 0.1 cu.m.
- Density of steel 7850 Kg/cu.m.
- Wt.of steel = 7850 x 0.01= 785 Kg.

Sr.No.	Description	Quantity	Rate	Unit	Amount
1	Materials: Cement Sand Aggregate Steel Binding wire Sundries	62 nos. 4.34 8.68 785 K 8 kg	325=00 425=00 1900=00 50=00 45=00	Per bags Cu.m. Cu.m Kg. Kg L.S.	20150.00 1844.50 16492.00 39250.00 360.00 200.00
				Total	78296.00
2	Labors: 1) Labour for concrete work 2) Mixing machine 3) Labour for bar bending ,cutting, placing of steel 4)Centering and shuttering	 10 . -- 785 kg --	 4000.00 -- 10.00 --	 cum L.S. Kg L.S.	40000.0 1500.00 7850.00 7000.00
4				Total labor+ material cost Total	56350.00 134646.0
			Add:1.5% water charge		2019.70

THANKS.....