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Estimating & Costing

Estimate Estimate is the process of calculating the approximate quantities & probable cost of various item of work before construction of structure.

Purpose of Estimate

→ Find quantity of various material & labour required.
→ Find probable cost of work. (main objective)
→ To arrange labour as per works.
→ for timely procurement of construction material.
→ for an existing property, estimate is required for Valuation.
→ Idea of time of completion of work.
→ To help department for inviting tender.
→ To help checking Workdone by contractor.
→ To measure benefit cost ratio.
→ Determine requirements of tools, equipments & plants.

Estimated cost	Actual Cost
→ Theoretical / probable cost.	→ practical / Real cost
→ Obtained before completion of work.	→ after completion of work

Requirement for Estimate (good)
① Drawing ② Specifications ③ Rates ④ Mode of measurement

Accuracy of Estimate
Depends → Skill & experience of estimator → Careful study of dimension of drawing → Method of estimating → Consideration of rate.

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Main Item of Work

→ Excavation & filling. → Plaster → Brick Work

→ Compaction → DPC → Steel Work

→ Brick Soling → Painting → Masonry Work

→ PCC|RCC → Wood Work → Flooring

Unit of Measurements

Depends on → shape → size → Nature of Work

Principle of Unit of Measurements.

① Mass, Voluminous & thick Work Measured in Cubic unit (M^3).

② Shallow, Surface & Thin Work Measured in Square unit (M^2).

③ Long & thin Work Measured in running unit (M).

④ Piece Work Measured in number unit (N).

A. Unit of Measurement in Civil Engineering

Details of Material/Item	Unit of Measurement
1. Cement	Bag.
2. Sand, aggregate, brick bats	Cu.m.
3. Bricks	Nos.
4. White cement	kg.
5. Slacked lime	Quintal.
6. Wood	Cu.m.
7. Reinforcement Steel	kg.
8. G.I. Sheet	Kg.
9. A.C. Sheet	Sq.m.
10. Steel Section (angles, Channel, I-section)	Kg.
11. Adhesives	kg.
12. Turpentine, primer, Varnish, oil paint	Liter.
13. Water proof ower, distemper.	kg.

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14. Kotah stone	Sq. m.
15. Mozai Tiles	Sq. m.
16. W.C. tube	Nos.
17. Nanhi trap, gully trap	Nos.
18. GI pipe, CI pipe, PVC pipe	M.
19. Rolling shutter	Sq. m.
20. Wire grill	Sq. m.
21. Plywood sheet	Sq. m.
22. Wash basin	Nos

B. Unit of Measurement for Earthwork

Details of Material/Item	Unit of Measurement
1. Earthwork in an excavation in ordinary Soil, in hard soil, in Murcom in rock	Cu. m.
2. Surface dressing	Sq. m
3. Filling in plinth & foundation	Cu. m.
4. Excavation for pipe, cable etc.	m

C. Unit of Measurement for brick/stone Masonry

Details of material/Item	Unit of Measurement
1. Brickwork in Foundation, plinth, superstructure	Cu. m.
2. Brickwork in partition wall	Sq. m.
3. Honeycomb brickwork	Sq. m.
4. Stone/random rubble/coursed masonry	Cu. m.

D. Unit of Measurement for concrete Work

Details of material/Item	Unit of Measurement
1. PCC	Cu. m.
2. RCC	Cu. m.

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3. Brick bat cement Concrete	cu.m.
4. DPC	Sq.m.
5. centering & shuttering	Sq.m.
6. Reinforcement steel	kg

E. Unit of Measurement for Wood Work

Details of material/Item	Unit of Measurement
1. Door, Window frame	cu.m.
2. Door, Window Shutter	Sq.m.
3. Wooden floor	Sq.m.

F. Unit of Measurement for Steel Work

Details of material/Item	Unit of Measurement
1. Steel Section	kg
2. Steel doors & windows	Sq.m
3. Steel gate	Sq.m
4. Steel Railing	m
5. Steel grill	Sq.m
6. Steel C.I pipes	m

G. Unit of measurement for Roofing

Details of material/Item	Unit of Measurement
1. Tiled roof	Sq.m
2. Country tile roof including bamboo jaffri	Sq.m
3. G.I Sheet Roof	Sq.m
4. Waterproofing of roof	Sq.m

H. Unit of measurements for plastering, Pointing, Finishing.

Details of material/Item	Unit of. Measurement

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1. Cement plaster	Sq·m
2. Pointing	Sq·m
3. Skirting	m
4. Dado	Sq·m
5. White Washing	Sq·m
6. Painting of doors, Windows	Sq·m Any
7. painting of letters	NO

I. Unit of Measurements for Flooring

Details of Material / Item	Unit of Measurement
1. Tiles flooring, Terrazzo Flooring	Sq·m
2. I.P.S flooring, Brick flooring	Sq·m Any
3. Kotah stone flooring, marble Flooring	Sq·m

J. Unit of Measurements for Miscellaneous Item

Details of Material / Item	Unit of Measurement
1. Glazing Work	Sq·m
2. Plaster, Repairing	Sq·m
3. Brick / Stone pitching	Cu·m
4. Fixing frame to Wall	

Nearest Measurement

① Length $= 0.01$ m   ③ Volume $= 0.01 m^3$

② Area $= 0.01 m^2$ ④ Weight $= 0.001$ ton   1 ton $= 100$ kg

$= 1$ kg.

Exception

① Length   ⓐ Wood Work $= 0.002$ m $= 2$ mm

beam, column ⓑ Rcc slab $= 0.005$ m $= 5$ mm

     ⓒ < 20 cm road $= 5$ mm

     ⓓ steel reinforcement $= 5$ mm.
        Diameter $= 0.1$ mm.

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② **Area** : Steel plate = 0.0001 m²

③ **Volume** : Wood work = 0.001 m³

Rules for deduction

① for opening less then 0.1 m²   **No deduction**

② for woodwork (formwork) opening < 0.4 m²

③ for steel in volume of concrete.

④ for bearing of floor & roof.

⑤ for pipe diameter having area less then 100 cm².

⑥ Rules for deduction of plastering & painting work.

   ⓐ for opening less then 0.5 m² — No deduction

   ⓑ for opening 0.5 – 3 m² — one side deduction.

   ⓒ for opening > 3 m² — Both side deduction

Types of Estimate

① Preliminary estimate / Rough Estimate

→ It is also known as approximate or abstract cost or budget estimate. → Prepared on the basic of cost of similar works.

→ main purpose is to decide financial position & policy for administrative sanction. → Detail drawing is not necessary.

② Plinth area Estimate / square rate Method

→ Also known as preliminary estimate. → Applicable for general building. → plinth area is the area covered by the floor at ground.

→ plinth area Estimate = plinth area X plinth area rate.

→ Less accurate

③ Cube rate estimate

→ Also known as preliminary estimate. → Based on Volumetric measurement of structure. → Best suited for multi storied building. → Cubic rate estimate = Cubical content X cubical rate

→ more accurate then plinth area method.

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④ Approximate quantity estimate.

→ Also known as preliminary estimate → Whole structure is divided into two part. ① foundation including plinth ② superstructure. Approximate quantity estimate = Length of foundation x rate per R.M. + length of superstructure x rate per R.M.

⑤ Detailed estimate / Item rate estimate

→ It is the most accurate & reliable estimate.

→ Because it evaluates each item of work separately.

→ Prepared after preliminary estimate has been approved.

→ Done on two stage ① Detail of measurement of each item from drawing & calculate quantity.

② Cost of each item of work is calculated & all cost are added to give total cost.

⑥ Revised estimate

→ It is a detailed estimate prepared a fresh when original sanctioned detail estimate exceed by 5%.

Reason rates being too insufficient or sudden other reasons.

⑦ Supplementary estimate

→ It is a detailed estimate, prepared when a work is partially abandon then re-estimate is done. → When the cost of remining work is less then 95% of original sanctioned or work then it is done.

⑧ Annual repair & maintenances estimate.

→ It is a detailed estimate. prepared to maintain the structure or work in proper condition. → generally 1 – 1.5% of capital cost

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Methods of Calculating quantity.

① **Long & short Wall method**

→ **for long wall** running in longitudional direction. i.e. out to out.

→ **for short Wall** running in cross direction. i.e. in to in.

→ ~~~~~~~~~~~~

→ **Suitability** Irrespective of variable sections of walls.

② **center line Method**

→ Total length of center line of walls (long & short) are summed

& multiplying by breadth & height to get total quantity.

→ **Quick method** then Long & short wall method.

→ **Suitability** circular, hexagonal, octagonal shaped building.

③ **crossing Method**

→

Standard estimate format of government offices

① **Detail Estimate**

Item no.	Description of Work	Unit	NO.	L	B	H	quantity	Remarks

② **Abstract of Cost**

Item no	Description of Work	Unit	quantity	Rate	Amount	Remarks

(i) Total cost = A

(ii) Contingency @ 4% of A

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(iii) Total with contingency = (i) + (ii)

(iv) VAT = 13 % of (iii)

(v) Grand Total = (iii) + (iv)

③ Bill of Quantity.

Item no.	Description of work	Unit	Quantity	Rate in fig	Rate in word	Amount	Remarks

Rate Analysis

The method of determining unit rate of item of work, considering the Cost of materials, Cost of labour, hire charge of tools & plants & overhead cost is called rate analysis.

Purpose of rate analysis

→ To revise schedule of rate.

→ To workout actual Cost.

→ To workout economical use of material.

→ To examine validity of tender rate.

→ To fix labour contract rate.

Requirement of rate analysis

→ Correct information of market rate of material

→ Correct information of various categories of labour.

→ Output of labour. (outturn of worker per day)

→ knowledge, rate & outturn of equipment.

→ Up to date knowledge of Construction work.

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Factors Affecting Rate Analysis

→ Quantity of materials

→ Location of site of work

→ Transportation facilities available

→ Overhead of cost

→ Experience of workers

→ Proportion of mortar (1:3, 1:4, 1:6)

→ Construction facilities available

→ Transportation charge

→ Profit desired.

→ Management

Government procedure of preparing rate analysis

① Total cost of material = 65−70% of total cost = Rs. X

② Total cost of labour = 30−35% of total cost = Rs. Y

③ Hire charge of tools/plants + fuel cost = 3% of labour cost = Rs. Z

④ Total cost = X+Y+Z = A

⑤ Contractors overhead = 15% of A = 0.15A

⑥ Unit rate of item = ④ + ⑤ = A + 0.15A = 1.15A

Norms of Rate Analysis

① To get dry or unmixed Volume of PCC, increase quantity by 50−55%

② To get dry or unmixed Volume of mortar, increase quantity by 30−35%

③ To account wastage of steel reinforcement, " Weight by 5%:

④ To account wastage of brick, increase number by 5%:

⑤ To account wastage of tile, marbel & wood, increase quantity by 10%

Note :

→ Contractor profit + contractor overhead = 15%

→ Contractor profit = 10%

→ Overhead according to PPA = 15% (GON)

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PCC

Item	Skilled	Unskilled
1:2:4 Pcc for per m³	1.0	4.0
1:2:4 Pcc 40 mm thick, per 10m²	1.25	2.4
1:2:4 Pcc 50 mm thick, per 10m²	1.25	2.5
1:2:4 Pcc 75 mm thick, per 10 m²	1.25	3.0
Pcc M20 for RCC	0.8	7.0

Plaster

Item	Skilled	Unskilled
12 mm thick plaster per 10m²	1.2	1.6
20 mm thick plaster per 10m²	1.4	1.9
ceiling plaster 12.5 mm	1.5	2.0

Salwood for door & window frame

Skilled = 3.0 nos   Unskilled = 3.4 nos.

Outturn (Task Work) The quantity of work of any item which is the **output of a skilled labour in a day** is known as outturn.

Nature of Work	Outturn
1. Brickwork in cement mortar in foundation & plinth	1.25 m³
2. Earthwork in excavation in ordinary soil.	3 m³
3. Half brick Partition Wall	5 m²
4. Concrete Work (M15)	5 m³
5. plastering (12 mm thick cement mortar)	8 m²
6. cement flooring (25 mm)	7.5 m²

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specification

specification is defined as written instruction limiting & describing in detail of Construction Work to be done.

Specification describes the Construction to be done, quality of materials, Workmanship to be used, tools & plants to be used, method of testing etc.

→ In general, Drawing shows what to be done & Specification shows how to do.

→ In Conflict between Drawing & specification.

↳ specification Should give first Priority.

Purpose of specification

→ specify the nature of work.

→ Estimate the quantity & Cost.

→ To Clearify any ambiguity (असद्धता)

→ To identify the quality of material.

→ To identify material proportion.

→ To identify the types of Workman ship.

Types of specification

① General specification

General specification are also known as brief specification. general Specification are provided in drawing which gives brief (छोटे) information about nature of work & quality of material.

② Detailed Specification

Detailed specification describes the item of work in detail, accurately & Complete information in all aspects.

③ standard specification The specification which is same for all & standardized by department of engineering is called standard specification.

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ⓑ **Special specification** some specification of construction Work are **special nature** & that are not published in Standard Specification are called special specification.

→ Special specification are **written by engineer in-charge of Construction project.**

General specification	Detailed specification
→ No contract document.	→ Part of Contract document.
→ General idea of whole Work.	→ Detail information-
→ Useful for Cost estimate.	→ Technical, Standard provision.
→	→

Valuation

It is a technique to determine the **present fair price or value of property.** such as building, land, factory etc known as Valuation.

Value of property depend on

① Life ② Location ③ structure ④ supply & demand ⑤ Bank interest rate

Purpose of Valuation

→ Buying & selling of property.

→ Fixation of tax.

→ Rent fixation.

→ Auction bid of property.

→ Security of loan

→ Insurance of property. (fire, earthquake, flood etc)

→ Partition of property.

→ Acquisition of property.

→ prepartion of balance sheet of property.

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Method of Valuation

① Cost Based method

Value of property. = Value of building (by detail estimate) — Total depreciation + Value of land

② Plinth Area Method

Value of property = Total plinth area in m^2 × plinth area rate — Total depreciation + Value of land.

③ Depreciation method

Value of property = Depreciated Value of building + Value of land.

\# Depreciated Value of building $= P\left(1 - \dfrac{r_d}{100}\right)^h$

Where,

	Life of building	r_d
P = Cost of building at present market rate	100 years	1%
= Plinth area × plinth area rate.	75 "	1.3%
r_d = depreciation rate. $= \dfrac{100}{\text{Life of building}}$	50 "	2%
h = age of structure in year.	25 "	4%
④ Rental Method of Valuation	20 "	5%

④ Rental Method of Valuation

Value of property = Capitalized Value of building + Value of land

→ Capitalized Value = net rent × years purchase

→ Net rent = gross rent — total expanses.

→ Years purchase $(Y_p) = \dfrac{1}{i_p + i_c}$

Where, i_p = highest prevailing rate

i_c = coefficient of sinking fund $= \dfrac{i}{(1+i)^n - 1}$

⑤ Profit Based Method

Value of property = Capitalized value of building + Value of land

→ Capitalized Value = net income × years purchase.

→ Net income = gross income — total expanses

→ Years purchases $(Y_p) = \dfrac{1}{i_p + i_c}$

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Depreciation It is a the, gradual decrease in the Value of property due to wear & tear, decay, obsolescence,

Method of Depreciation

① **Straight line Method**

→ Depreciation is constant in each year.

→ Annual depreciation % = $\dfrac{C - S_v}{n} \times 100$

where; C = original Cost

$\quad\quad S_v$ = Scrap/salvage Value

$\quad\quad n$ = life of structure

② **Declining balance Method** (Constant % depreciation method)

→ property is assumed to lose Value annually at Constant % of its Value (Book Value).

→ Depreciation = $1 - \left(\dfrac{S}{C}\right)^{1/n}$

→ Value of property at end of N year = $C(1-D)^n$

Where; D = % rate of annual depreciation.

③ **Sinking fund Method**

→ In this method depreciation assume to be annual sinking fund plus the interest of accumulated sinking fund till that year.

Steps

→ Calculate total depreciation (D) for total duration (n).

→ Calculate Sinking fund factor for given interest (i).

→ Calculate interest on sinking fund.

→ Calculate of depreciation.

Depreciation $(D_1) = D \times SF = D \times \dfrac{i}{(1+i)^n - 1}$

$$D_2 = D_1 \times \dfrac{i}{(1+i)^n - 1}$$

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Conversion chart

A Length

→ 1 cm = 10 mm = 0.3937 inch = 0.01 m = 0.0328 ft

→ 1 m = 100 cm = 1000 mm = 39.37 inch = 3.281 ft

→ 1 km = 1000 m = 39370 inch = 0.6214 mile

→ 1 Inch = 2.54 cm = 0.254 m = 25.4 mm

→ 1 Nautical mile (knot) = 1.852 km

→ 3 Nautical mile = 1 league

→ 12 inch = 1 ft   → 3 ft = 1 yard   → 220 yardi = 1 furlong

→ 8 furlong = 1 mile = 0.625 km   → 5 mile = 8 km

→ 6 ft = 1.83 m = 1 fathom

→ 120 fathom = 219.52 m = 0.22 km

→ 1 kosh = 3.281 km

B Weight

→ 1 kg = 2.205 pound

→ 1 quintal = 100 kg = 41.781 Dharni

→ 1 MT = 10 quintal = 1000 kg = 417.814 Dharni = 26.729 man = 5013.768 pau

→ 1 man = 37.324 kg = 0.373 quintal = 0.037 ton = 15.595 Dharni

→ 1 dharni = 2.393 kg = 0.024 qt = 0.0024 ton = 12 pau

→ 1 ser = 933 gm = 0.39 dharni = 0.933 kg = 80 tola = 16 chatak

→ 1 pau = 200 gm = 4 chatak = 0.199 kg

→ 1 tola = 11.6638 gm = 12 masha = 100 lal   → 1 masha = 8 rattic

→ 1 chatak = 58 gm = 5 tola = 4.973 tola

→ 1 muri = 20 pathi = 80 kg = 160 mana = 87.215 lit

→ 1 Dhak = 5 kg.   → 1 cylinder = 14.2 kg (gas)

C Area

→ 1 dhur = 182.25 sft (13.5 × 13.5 ft²)

→ 1 katha = 20 dhur = 3645 ft²

→ 1 biga = 20 katha = 72900 ft²

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→ 1 ropani = 74 × 74 = 547.6 ft² = 1.502 katha

→ 1 bigha = 72900 / 5476 = 13.39 ropani

→ 1 hectare = 10⁴ m² = 107638.7 ft²

→ 1 hectare = 29.53 katha = 19.657 ropani = 2.471 Acar

→ 1 Acar = 208.71 × 208.71 = 43560 ft²

→ 1 bigha = 13.31 ropani = 6772.66 m² = 0.6772 ha

= 53.25 mato muri = 20 katha = 0.533 khetmuri = 79900 ft²

→ 1 khet muri = 100 matomuri

→ 1 ropani = 16 anna

→ 1 anna = 4 paisa

→ 1 paisa = 4 Dam

→ 1 mana = 8.55 sft

→ 1 pathimato = 0.0006 He   → 1 pate = 0.0458 He.

→ 1 halo = 0.0677 He   → 1 kodalo = 0.0305 He

D] Volume

→ 1 lit = 1000 ml = 1.7597 mana = 0.2199 pathi = 0.011 muri

→ 1 pathi = 4 kg   → 1 kg = 2 mana

→ 1 dharni = 2.4 kg

→ 1 gallon = 4.546 lit (British) = 3.785 lit (US)

→ 1 Barrel = 159 lit (US)

→ 1 m³ = 11 muri = 959.365 lit.

E] Temperature

→ $\dfrac{C}{5} = \dfrac{F-32}{9}$

F] Power

→ 1 HP = 736 Watt (metric) = 746 Watt (mechanical)

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Important Topics

① Administrative Approval
→ The formal acceptance by the administrative department for incurring an expenditure on the work.

② Contingency
→ The incidental expenses of miscellaneous character that could not be predicted during preparation of estimate.
→ The amount of Contingencies is limited to 4% (3—5%)
→ physical Contingencies = 10% ⇒ expenses in design, planning & implementation
→ Price adjustment contingency = 10% ⇒ price unpredictability.

③ Workcharge Establishment
→ To provide payment to Chaukidar, Supervisers, Watchmen of amount of 1.5 to 2% is charged directly to the estimated Costs.
→ Generally 1.5%.

④ Departmental Charge
→ When engineering department takes works from others, departments some amount is charged towards establishment, planning, design, implementation Supervision etc.   → Also Called Centage Charge.
→ 10 — 15 of estimate Cost.
→ for electrification = 8% of estimate cost.
→ for sanitary & Water Supply = 8% of estimate Cost.

⑤ Contract Tax
→ It is the tax paid by Contractor against the Workdone.
→ 1.5% of the paid bill

⑥ Market Value
→ It is the Value of property which can be obtained at any particular time from the open Market, if the property is put for sale.

⑦ obsolescence
→ The Value of property or structure become less by its becoming out of date in style & this terms is Called obsolescence.

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⑧ Overhead Cost

→ It is the Cost for running offices, staff, phone, electricity, etc.

→ The Overhead cost includes the cost which are not productive in work.

→ 2 - 5 % in rate analysis.

→ Overhead according PPA ⟹ 10 % (purchase price allocation).

→ Contractor profit ⟹ 10 %. → Contractor overhead profit ⟹ 15 %.

⑨ Scrap Value

→ Scrap Value is the Value of a property after being dismantled at the end of its utility period. (excluding labour Cost)

Scrap Value = Material Value — Labor Cost.

→ Scrap Value may be +ve, -ve & zero / equal.

Note: Market Value > Labor Cost → +ve

Market Value < Labor Cost → -ve

Market Value = Labor Cost → zero / equal

→ Scrape Value = 10% of total cost of Construction.

⑩ Salvage Value

→ Salvage Value is the Value of property without being dismantle after its ends of utility period.

→ Salvage Value is always +ve.

⑪ Book Value

→ Book Value is the amount shown in the account book after allowing necessary depreciation.

→ Book Value = Orginal Cost — Depreciation

⑫ Capitilized Value

→ Capitilized Value of a property is the amount of money whose annual intrest at the highest rate intrest will be equal to the net income from property.

⑬ Gross Income → Total income not any outgoings (expenditure)

⑭ Net Income → Gross income — outgoing.