

1.1 QUANTITY ESTIMATION

1.1.1 PHILOSOPHY

An estimate is the anticipated or probable cost of a work and is usually prepared before the construction is taken up. Before undertaking any work or project it is necessary to know its probable cost which is obtained or derived by estimating. The estimate is prepared by computing or calculating the quantities required and then calculating the cost at suitable rates, to get the expenditure likely to be incurred in the construction of the work or structure.

The primary object of an estimate is to enable one to know beforehand the cost of work. The actual cost is known only after the completion of the work from the account of the completed work. If the estimate is prepared carefully and correctly there will not be much difference in between the estimated cost and the actual cost. For accurate estimating the estimator should be experienced and fully acquainted with the methods of construction.

The estimate may be prepared approximately as a preliminary estimate by various methods without going into details of the different items of work, to know the approximate cost or rough cost.

Accurate estimate is prepared in detail item-wise by Detailed Estimate. For 'Detailed Estimate' the work is divided into different items of work, and the quantities under each item are taken out and then an 'Abstract of estimated cost is prepared at suitable rates. Provision for contingencies, 3% to 5% of the estimated cost, is made in the estimate to cover the miscellaneous petty expenditures which do not come under any item of work. Provision is also made in the estimate for work charged establishment at 12% to 2% of the estimated cost.

From the detailed estimate the quantities of various materials and labour required may also be calculated. The estimate also gives an idea of the time required for the completion of the work. The estimate is also required for inviting tenders and to arrange contract and to control the expenditure during the execution.

For complete estimate of a project, besides the estimated cost of the different items of main work, the cost of preliminary works and surveying, cost of land including cost of acquisition, cost of leveling and dressing of ground and the cost of other external services are required to be provided in the estimate. Provision for supervision or departmental charges 5% to 10% of the estimated cost is also made to get the estimated cost of the whole project.

1.1.2 PURPOSE

Estimating is the technique of calculating or computing the various quantities and the expected Expenditure to be incurred on a particular work or project. In case the funds available are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following requirements are necessary for preparing an estimate.

- Drawings like plan, elevation and sections of important points.
- Detailed specifications about workmanship & properties of materials etc.
- Standard schedule of rates of the current year.

1.2 METHODS OF ESTIMATION

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., can be worked out by any of the following two methods

- a) Long wall - short wall method
- b) Centre line method.
- c) Partly centre line and short wall method.

1.3.1 LONG WALL-SHORT WALL METHOD

In this method, the wall along the length of the room is considered to be the long wall while the wall perpendicular to the long wall is said to be the short wall. To get the length of the long wall or short wall, calculate first the centre line lengths of individual walls. Then the length of the long wall, (out to out) may be calculated after adding half breadth at each end to its centre line length. Thus the length of the short wall measured into and may be found by deducting half breadth from its centre line length at each end. The length of the long wall usually decreases from earth work to brick work in super structure while the short wall increases. These lengths are multiplied by breadth and depth to get quantities.

1.3.2 CENTRE LINE METHOD

This method is suitable for walls of similar cross sections. Here the total centre line length is multiplied by breadth and depth of the respective item to get the total quantity at a time. When cross walls or partitions or verandah walls join with the main wall, the centre line length gets reduced by half of the breadth for each junction. Such junctions or joints are studied carefully while calculating the total centre line length. The estimates prepared by this method are most accurate and quick.

1.3.3 PARTLY CENTRE LINE AND PARTLY CROSS WALL METHOD

This method is adopted when the external (i.e., around the building) wall is of one thickness and the internal walls have different thicknesses. In such cases, the centre line method is applied to external walls and the long wall-short wall method

issued to internal walls. This method suits for different thicknesses walls and different level of foundations. Because of this reason, all Engineering departments are practicing this method.

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1.3 TYPES OF ESTIMATES

The following are the different types of estimate

- (1) Preliminary Estimate or Approximate or Abstract Estimate or Rough Cost Estimate.
- (2) Plinth Area Estimate
- (3) Cube rate Estimate or Cubical Content Estimate
- (4) Approximate Quantity Method Estimate
- (5) Detailed Estimate or Item Rate Estimate
- (6) Revised Estimate.
- (7) Supplementary Estimate
- (8) Supplementary and Revised Estimate.
- (9) Annual Repair or Maintenance Estimate (A.R. or A.M. Estimate).

(1) Preliminary or Approximate Estimate or Abstract Estimate

Preliminary" or Approximate or Abstract Estimate is required for preliminary studies of various aspects of a work or project, to decide the financial position and policy for administrative sanction by the competent administrative authority. In case of commercial projects as Irrigation projects, Residential building project and similar projects which earn revenue income, the probable income may be worked out, and from the preliminary estimate the approximate cost may be known and then it may be seen whether the investment, on the project is justified or not. For non-commercial projects or for projects giving no direct return, their necessity, utility, availability of money, etc., may be considered before final decision is taken. The approximate estimate is prepared from the practical knowledge and cost of the similar works. This estimate is prepared showing separately the approximate cost of all important items of work as cost of land, cost of each building, cost of roads, water supply sanitary works, electrification, etc. The estimate is accompanied by a brief report explaining the necessity and utility of the

project and showing how the cost of separate items have been arrived at. This is also accompanied with a site plan or layout plan. A percentage of about 5% to 10% is added as contingencies.

The preliminary estimate may be prepared by various ways for different structures and

Works :-

(a) Buildings -

Per unit basis-Per student for schools and hostels, per class room for schools. Per bed for hospitals, per seat for cinema and theatre halls, per bay for factories, barrack and dormitories, per tenement for residential buildings.

Approximate cost of a hostel building for 100 students @ Rs. 10,000/- per student works out as Rs. 10 lakhs.

Approximate cost of a 100 bed hospital @Rs. 50,000/-per bed comes to Rs. 50 lakhs. Approximate cost of a barrack of 10 bays [each bay of 3 m (10') and 6 m (20) wide]@10,000/- per bay comes to Rs. 1 lakh.

Approximate cost of a two roomed quarter may be Rs. 60,000/- a three roomed quarter may Cost Rs. 1 lakh.

(i) Plinth area basis

(ii) Cubic content basis.

(iii) Approximate quantity method

(b) Roads and Highways-

Per kilometer (per mile) basis depending on the nature of road, width and thickness of metalling, etc. For 10 kilometer of a state highway approximate cost@Rs. 5,00,000/-per 1 km works out as Rs. 50 lakhs.

(c) Irrigation Channels

Per kilometer (per mile) basis depending on the capacity of the channel.

Area of land commanded i.e., per hectare basis (per acre basis).The

approximate cost of 10 kilometer length of irrigation channel of 3 cu m per sec.capacity @ Rs. 70,000/- per km works out as Rs. 7 lakhs.

For an irrigation project having. a commanded area 2000 hectares, approximate cost Rs. 1000/-per hectare comes to Rs. 20 lakhs.

(d) Bridges and Culverts-

Per running meter (running feet) of span depending on the road way, nature and depth of foundation, type of structure, etc, For small culverts approximate cost. may also be per number of culverts of different spans.

Approximate cost of a bridge of 3 spans of 50 metre each span @ Rs. 30,000/- per running meter of span comes to $3 \times 50 \times 30,000 = \text{Rs. } 45 \text{ lakhs.}$

Approximate cost of bridges may also be worked out separately for sub-structure and superstructure.

(e) Sewerage Project and water supply project -

(i) On the basis of per head of population served.

(ii) On the basis of area covered i.e., per hectare basis (per acre basis). Approximate cost of sewerage project for a population of one lakh @ Rs. 100/- head works out as Rs. 100 lakhs.

Approximate cost of water supply project for a population of 75000 people @Rs. 90/- per head comes to Rs. 67.5 lakhs.

(f) Over head water tank-

On the basis of capacity, per liter (per gallon) of tank depending on the type of structure height of tank etc.

Approximate cost of an overhead R.C.C, water tank of 50,000 litre capacity Rs. 2.00 per litre works out as $50,000 \times 2.00 = \text{Rs. } 1 \text{ lakh.}$

(2) Plinth Area Estimate for Building (P.A. Estimate)-

This is prepared on the basis of plinth area of building, the rate being deducted from the cost of similar building having similar specification, heights and construction, in the locality. Plinth area estimate is calculated by finding the plinth area of the building and multiplying by the Plinth area Rate. The plinth area should be calculated for the covered area by taking external dimension of the building at the floor level. Courtyard and other open area should not be included in the plinth area. Plinth area Estimate is only approximate, and is a preliminary estimate, to know the approximate cost before hand.

If the plan of the building is not ready or available, at the beginning just prepare a proposal, floor area of rooms, etc. may be determined from the requirement and 30 to 40 per cent of the total area thus found may be added for walls, circulation and waste to get the approximate total plinth area which multiplied by the plinth area rate gives the approximate cost of the building.

The approximate cost of a building having plinth area of 100 sq m @Rs. 900/-per sq m works out as Rs. 90,000/-

For storeyed building, the Plinth Area Estimate is prepared for each storey separately.

(3) Cube Rate Estimate for Building-

Cube Rate Estimate is a preliminary estimate or an approximate estimate, and is prepared on the basis of the cubical contents of the building the cube rate being deducted from the cost of the Similar building having similar specifications and construction, in the locality.

This is calculated by finding the cubical content of the building, (length x breadth x height) and multiplied it by the cube rate. The length and breadth should be taken as the external dimensions of the buildings at the floor level and the height should be taken from the floor level to top of roof (or half way of the sloped roof). For storeyed

building the height should be taken between the floor level of one storey to top of next-higher floor. The foundation and plinth, and the parapet above roof are not taken into account in finding the cubical content. (Based on Indian Standard-IS3861).

Cube rate estimate is most accurate as compared to the Plinth Area Estimate as the height of the building is also compared.

The approximate cost of a building of cubic content (volume) of 400 cum @ Rs. 180/-per cu m comes to Rs. 72,000/-

Note-The technical data and information given in Chapter 15 will be helpful for Preliminary estimates for various original works and maintenance works.

(4) Approximate Quantity Method Estimate

In this method approximate total length of walls is found in running meter and this total length multiplied by the rate per running metre of wall gives a fairly accurate cost. For this method the structure may be divided into two parts viz. (i) foundation including plinth and (ii) superstructure. The running metre cost for foundation and superstructure should be calculated first and the running metre rate should be multiplied by the total length of walls.

To find the running metre rate for foundation, the approximate quantities of items such as excavation, foundation, brickwork up to plinth, and damp proof course are calculated per running metre and by multiplying by the rates of these items the price or rate per running metre is determined.

Similarly for superstructure the price or rate per running metre is determined from the approximate quantities of brickwork, wood works, roof, floor finishing, etc.

For this method the plan or line plan of the structure should be available.

(5) Detailed Estimate or Item Rate Estimate

Detailed estimate is an accurate estimate and consists of working out the quantities of each item of works, and working the cost. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculated, and abstracting and billing are done.

The detailed estimate is prepared in two stages

(i) Details of Measurement and Calculation of Quantities

The details of measurements of each item of work are taken out correctly from plan and drawings and quantities under each item are computed or calculated in a tabular form named as Details of Measurement Form.

(ii) Abstract of Estimated Cost

The cost of each item of work is calculated in a tabular form from the quantities already computed and total cost is worked out in Abstract of Estimate Form. The rates of different items of work are taken as per schedule of rates or current workable rates or analyzed rates for finished items of work. A percentage usually 3% of the estimated cost is added to allow for contingencies for miscellaneous petty items which do not come under any classified head of items of work and a percentage of about 29% is provided for work charged establishment. The Grand total thus obtained gives the estimated cost of work.

The detailed estimate is usually prepared work-wise, under each sub-work as main building, servant quarters, garage, boundary walls etc.

The detailed estimate is accompanied with:-

- (1) Report.
- (2) General specifications.
- (3) Detailed specifications
- (4) Drawings Plan, elevation, Sectional elevations, Detailed drawings, Site plan or

Layout plan or Index plan etc.

(5) Calculation and designs, Designs of foundation, beam, slab, lintel, design of channel incase of irrigation channel, design of thickness of metal crust in case of road etc.

6) Analysis of rates, if rates are not as per schedule of rates or for the non-scheduled items. Detailed Estimate is prepared for technical sanction of the competent authority, for arranging contract and for the execution of work,

if the 'Abstracts of Estimate' form the columns of rates and amounts are left blank (to be filled by contractor)it is then known as bill of Quantity.

6) Revised Estimate

Revised Estimate is a detailed estimate and is required to be prepared under any one of the following circumstances -

- (i) When the original sanctioned estimate is exceeded or likely to exceed by more than 5%.
- (ii) When the expenditure on a work exceeds or likely to exceed the amount of administrative sanction by more than 10%.
- (iii) When there are material deviation from the original proposal, even though the cost may be met from the sanctioned amount.

The revised estimate should be accompanied by a comparative statement showing the variations of each item of works, its quantity, rate and cost under original and revised, side by side, the excess or saving and reason for variation.

7) Supplementary Estimate

Supplementary Estimate is a detailed estimate and is prepared when additional works are required to supplement the original works, or when further development is required during the progress of work. This is afresh detailed estimate of the additional works in addition to the original estimate.

The Abstract should show the amount of the original estimate and the total

amount including the Supplementary amount for which sanction is required.

(8) Supplementary and Revised Estimate

When a work is partially abandoned and the estimated cost of the remaining work is less than 95 per cent of the original work, that is less than 95 per cent of the original sanctioned estimate, or when there are material deviations and changes in the design which may cause substantial saving in the estimate, then the amount of the original estimate is revised by the competent authority. A supplementary and Revised Estimate is then prepared and fresh Technical sanction of the competent authority is obtained.

If at any time either before or during the execution of original work, it is found that the original estimate is excessive, then Divisional officer may sanction a revised estimate of reduced amount. While giving such sanction the Accountant General and other higher authorities are informed.

(9) Annual Repair or Maintenance Estimate (A.R. or A.M. Estimate)

Annual Repair or Annual Maintenance Estimate is a detailed estimate and is prepared to maintain the structure or work in proper order and safe condition. For building; this includes whitewashing, colour washing, painting, minor repairs etc. For road works the A.R. estimate provides for patch repairing, renewals, repairs of bridges and culverts, etc.

Further, there may be special repair estimate, Monsoon damage repair estimate, etc.

1.4 ESTIMATION OF QUANTITIES FOR BUILDINGS

1.4.1 APPROXIMATE ESTIMATES

The cost of each item of work is worked out from the quantities that already computed in the details measurement form at workable rate. But the total cost is worked out in the prescribed form is known as abstract of estimated form. 4% of estimated Cost is allowed for Petty Supervision, contingencies items.

ABSTRACT OF ESTIMATE FORM

Item No	Description/Particular	Quantity	Unit	Rate	Amount

1.4.2 DETAILED ESTIMATE

The complete work is divided into various items of work such as earth work concreting, brick work, R.C.C. Plastering etc., The details of measurements are taken from drawings and entered in respective columns of prescribed preformed. The quantities are calculated by multiplying the values that are in numbers column to Depth column as shown below

DETAIL ESTIMATE FORM

S.NO	Description Of item	NO	Length (L) m	Breath (B) m	Depth/Height (D/H) m	Quality	Explanatory Notes

Example 1. Estimate the quantities of the following items of a two roomed building from the given plan and section (Fig.1.5.1) :-

- (1) Earthwork in excavation in foundation,
- (2) Lime concrete in foundation,

- (3) 1st class brickwork in cement mortar 1 : 6 in foundation and plinth,
- (4) 2.5 cm c.c. damp proof course, and
- (5) 1st class brickwork in lime mortar in superstructure.

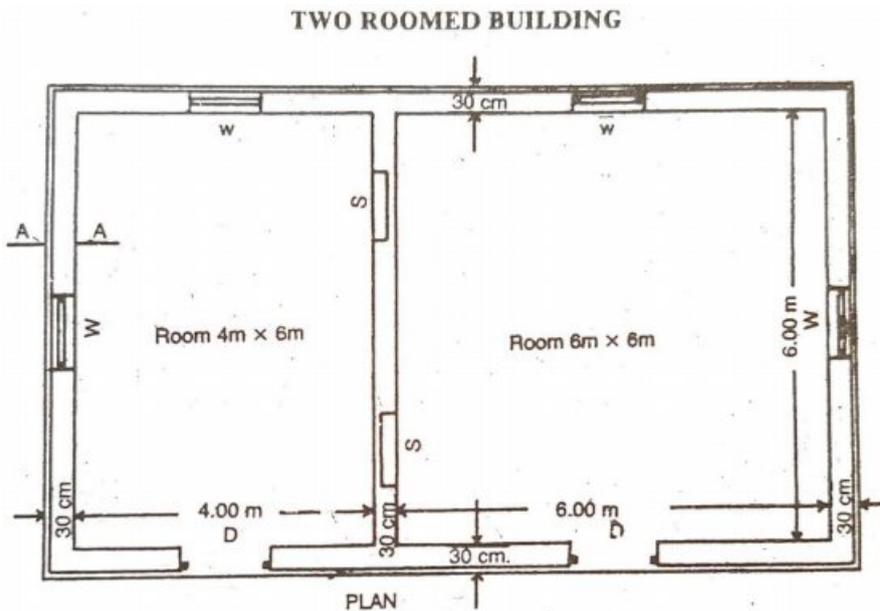


Figure 1.5.1 Two Room Building Plan

[Source: "Estimation and Costing in civil Engineering" by B N Dutta, Page: 35]

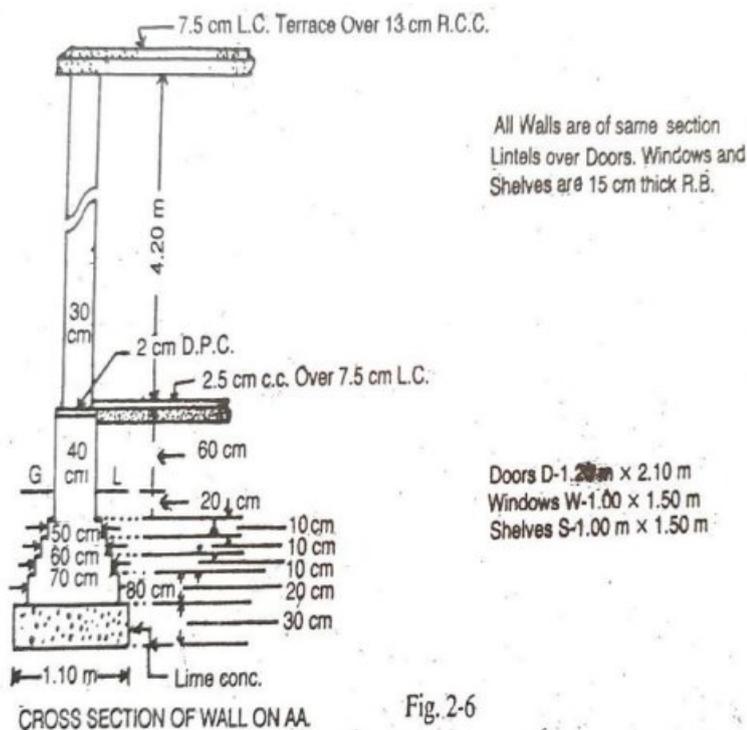


Figure 1.5.2 Two Room Building Cross Section

[Source: "Estimation and Costing in civil Engineering" by B N Dutta, Page: 35]

Item No	Particulars of Items	No.	Length	Breadth	Height or Depth	Quantity	Explanatory note
1	Earthwork in excavation in foundation Long walls...	2	11.70 m	1.10 m	1.00 m	25.74	$L=10.60+1.10 = 11.70$ m
	Short walls ...	3	5.20 m	1.10 m	1.00 m	17.16	$L=6.30-1.10 = 5.20$ m
						Total	42.90 cu m
2	Lime concrete in foundation – Long walls	2	11.70 m	1.10 m	0.30 m	7.72	Length same for excavation
	Short walls	3	5.20 m	1.10 m	0.30 m	5.15	
						Total	12.87 cu m
3	1 st class brick work in 1:6 cement mortar in foundation and plinth						
	Long wall						
	1 st footing...	2	11.40 m	0.80 m	0.20 m	3.65	$L=10.60+0.80=11.40$ m
	2 nd footing...	2	11.30 m	0.70 m	0.10 m	1.58	$L= 10.60+0.70=11.30$ m
	3 rd footing...	2	11.20 m	0.60 m	0.10 m	1.34	$L=10.60+0.60=11.20$ m
	4 th footing...	2	11.10 m	0.50 m	0.10 m	1.11	$L=10.60+0.50=11.10$ m
	Plinth and above footing...	2	11.00 m	0.40 m	0.80 m	7.04	$L=10.60+0.40=11.00$ m
	Short wall						
	1 st footing...	3	5.50 m	0.80 m	0.20 m	2.64	$L=6.30-0.80=5.50$ m
	2 nd footing...	3	5.60 m	0.70 m	0.10 m	1.18	$L=6.30-0.70=5.60$ m
3 rd footing...	3	5.70 m	0.60 m	0.10 m	1.03	$L=6.30-0.60=5.70$ m	
4 th footing...	3	5.80 m	0.50 m	0.10 m	0.87	$L=6.30-0.50=5.80$ m	
Plinth and above footing...	3	5.90 m	0.40 m	0.80 m	5.66	$L=6.30-0.40=5.90$ m	
						Total	26.10 cu m

4	Dampproof course 2.5 cm thick c.c --							
	Long walls...	2	11.00 m	0.40 m	-	8.8	Length same as for plinth wall	
	Short walls ...	3	5.90 m	0.40 m	-	7.08		
	Deduct Door sils	2	1.20 m	0.40 m	-	0.96		
				Total	15.88 sq m			
5	1st class brick work in lime mortar in superstructure							
	Long walls...	2	10.90 m	0.30 m	4.20 m	27.47	L=10.60+0.30=10.90 m	
	Short walls ...	3	6.00 m	0.30 m	4.20 m	22.68	L=6.30-0.30=6.00 m	
					Total	50.15 cu m		
	Deduct Door openings	2	1.20 m	0.30 m	2.10 m	1.51		
		4	1.00 m	0.30 m	1.50 m	1.8		
	windows opening shelves	2	1.00 m	0.20 m	1.50 m	0.6	back of shelves 10 cm thick wall	
	Lintel over doors	2	1.50 m	0.30 m	0.15 m	0.14	Bearing 15 cm	
	Lintel over windows	4	1.30 m	0.30 m	0.15 m	0.23	Bearing 15 cm	
	Lintel over shelves	2	1.30 m	0.30 m	0.15 m	0.12	Bearing 15 cm	
					Total Deduction	4.40 cu m		
					Net Total	45.75 cu m		