


# Chapter 7

## Rate Analysis, Estimation and Standard Specifications

### CHAPTER HIGHLIGHTS

 *Rate analysis*

 *Estimation*

### RATE ANALYSIS

For successful completion of any project, one should know the following major things:

1. How much is the cost of execution for unit amount of the work.
2. How many equipment or labours are required to execute unit amount of certain part of the work.

These things are helpful in several ways in construction project management, for example, material planning, resource allocation, minimizing the cost of construction, etc.

### Definition—Rate Analysis

Obtaining the cost of unit amount of an item is called ‘rate analysis’.

Generally, the following costs are considered to obtain the rate of an item.

1. Cost of material
2. Cost of labour
3. Cost of tools and equipment
4. Overhead cost, and
5. Profit

- The costs of these components are determined from the standard schedule of rates (generally referred as SSR’S) published by central and state governments.
- Locality and transportation charges (lead rates) also affects the rate of an item of work.
- Let us understand the costs in detail.

### Cost of material:

- Quantity of materials multiplied by rate gives the unit cost of the materials in the item of work.
- This cost includes freight and transportation charges, sales tax, insurance tax, and profit.

**Cost of labour:** Different types of workers, i.e., skilled and unskilled, mason, mazdoor, carpenter, painter, etc., are required for handling different categories of works in construction projects.

- Labour cost is generally calculated by considering the local government’s wage rules. This depends on the skill and productivity of the labour.

### Cost of tools and equipment:

- This mainly depends on the types and utilization of the equipment.
- In general, cost is calculated in consideration with working hours (or) amount of work done by equipment.

**Overhead cost:** Overhead cost is nothing, but the additional expenses incurred in the project in addition to construction. About 2–5% of unit rate is considered as the overhead cost while carrying out the rate analysis.

A part of the overhead cost is directly related to construction. Another part is independent of the individual item of works and, is permanent in nature.

- Expenses which are directly related to construction of an item of work includes cost of repair and depreciation of equipment, lighting arrangements, safety tools, temporary storage sheds or warehouse, etc.
- On the other hand, expenses which are not directly related to the item of the work and which prevails throughout the project are the salaries of office staff, printing and stationary charges, communication expenses, electricity charges, etc.

#### NOTE

Generally 1% water surcharge is also considered in rate analysis.

**Profit:** Generally, expected profit in construction works varies between 7–15%. It is added to the unit cost of the items of work.

**Prime cost:** The owner, or the department (in case of the government construction) sometimes supply items to contractors during construction. An example of such items includes doors and windows, electrical appliances, internet cables, etc. Here, a contractor's job is to fix all such items provided by the owner.

- The cost of these items at the shop is called 'prime cost'.
- In contrast to supply the materials, sometimes an owner specifies to purchase and use certain items only. In that case, payment is made based on prime cost which is generally obtained based on the cash memos (i.e., purchase bills).

## ESTIMATION

During the project planning and implementation stages, knowing about the quantities and costs of various items involved in the construction is important.

The process of calculation of quantities and costs of various items involved and related to the construction project is called an 'estimate'.

#### NOTE

The method of obtaining quantities of items involved is called 'quantity estimate', and the method of obtaining unit cost of items involved is called 'Rate analysis'.

## Types of Estimates

The various types of estimates associated with a construction projects are as follows:

### 1. Preliminary or approximate estimate:

- An estimate which is prepared for the purpose of giving idea about the cost of proposal and to implement the financial policy is called 'preliminary' or 'approximate' estimate. The calculation for approximate estimate can be performed by considering the data from a similar type of construction project executed in the nearby area.
- For example, to calculate the approximate estimate for a road construction project, the expenditure incurred for construction of every kilometer of the road in the nearby area is taken into consideration.
- The following documents are attached with this estimate:
  - (a) Detailed report
  - (b) Site plan of proposal
  - (c) Provision of electricity and water supply
  - (d) Land acquisition information, etc.

The preliminary estimate should be accurate enough to keep the cost of project within 10–15% variations.

### 2. Rough cost estimate/plinth area estimate: Plinth area of a building = Length × Breadth, excluding plinth offsets.

Generally, rates are arrived by dividing total cost of construction with its plinth area. Using this rate as the basis for next construction, approximate cost of the project can be obtained.

The documents attached with this estimate are:

- (a) Line plan with brief specifications
- (b) Cost of added services, i.e., electric, water supply, etc.

**Cubic contents estimate:** Cubic contents of a building = Plinth area × Height of the building.

The height taken here is from top of the floor level to top of the roof.

The procedure for cost estimation and accompanying documents are similar to plinth area estimate.

### 3. Detailed estimate:

- Detailed estimates are prepared only after the rough estimates are approved.
- In this, the estimate is divided into several sub-heads, and quantities of various items are calculated and given individually.
- An abstract of cost giving quantities of each item and rate of every item shall be attached at the end of the detailed estimate.
- Detailed specifications and detailed report should also be attached with this estimate.

### 4. Revised estimate: Generally, a fresh and revised estimate is prepared when the sanctioned estimate exceeds by 5%.

A comparative statement along with the reason of increase of cost should be attached to the last page of the estimate.

**5. Supplementary estimate:** Detailed estimate in addition to the original sanctioned estimate is prepared when additional works are deemed necessary during the progress of work to supplement the original works.

Generally, the type of estimate carried out depends on the purpose and the level of accuracy needed.

For example, estimate for the material supply has to be very accurate, whereas to estimate the cost of the feasibility studies of a project, the accuracy need not be very high.

## Methods for Estimation

Estimation can be done by applying various methods. A method chosen may depend upon the design and shape of the building.

The various methods of estimation are given below.

- Centre line method
- Long wall–Short wall method/out-to-out and in-to-in method
- Bay method
- Crossing method
- Service unit method

### Centre Line Method

- This method is suitable only when the offsets are symmetrical, and the building is more or less rectangular in shape.
- While determining the centre line length, proper care should be given to the deductions for repeated measurements.

### Out-to-out and in-to-in Method

This method is widely applied under all circumstances.

- In this method, wall lengths are measured separately out-to-out (for long walls) and in-to-in (for short walls).

### Bay Method

- Usually, followed in case of availability of several bays in the structure.

- Quantities and cost for one bay is worked out and, then it is multiplied by the number of bays in that building.

### Crossing Method

Lengths and breadths of the masonry walls at plinth level are taken in this method. Symmetry is essential to do estimate using this method.

### Service Unit Method

- This method is followed in some cases, e.g., school buildings, hospitals, cinema halls, etc. The cost required for unit service item is estimated. Then it is multiplied by the number of service units.
- For school buildings, class room is a service unit. Likewise, beds, chairs, and tables are service units for hospital buildings and cinema halls.

## Specifications

- Specification specifies or describes the nature and the class of the work, materials to be used in the work, workmanship, etc.
- Combination of drawings and specifications define the structure completely, as drawings alone do not furnish the complete details of different items of work, e.g., quantity of materials, proportion of mortar and workmanship, etc.
- Specifications generally depend on the nature and purpose of the work, availability and quality of materials, etc.
- Specifications are broadly classified into two types:
  - (a) General/brief specifications
  - (b) Detailed specifications
- General specifications give the nature and class of the work, and the materials to be used in various parts of the work from foundation to superstructure. This gives the general idea of the whole work and these are useful for preparing the estimate.
- Detailed specification of an item of work specifies the qualities and quantities of materials, proportion of mortar, workmanship, method of preparation, execution and measurement of the work, etc. These are helpful for execution of work, if prepared properly.

### General Specifications

Item of Work	Class Buildings	Second Class Buildings	Third Class Buildings	Fourth Class Buildings
Foundation and plinth	Shall be of first class brickwork in lime mortar, or 1 : 6 cement mortar over lime concrete, or 1 : 4 : 8 cement concrete. Shall be of 2.5 cm thick cement.	Shall be of first class brickwork with lime mortar over lime concrete.	Shall be of second class brickwork in lime mortar over lime concrete.	Shall be of sun-dried or <i>kutch</i> bricks in mud mortar
Damp proof course (DPC)	Shall be of 2.5 cm thick cement concrete 1 : 1.5 : 3, mixed with 1 kg of Impermo per bag of cement and painted with two coats of bitumen.	Shall be of 2 cm thick cement concrete 1 : 2 mixed with 1 kg of Impermo per bag of cement	Shall be of 2 cm thick cement mortar 1 : 2 mixed with standard water proofing compound.	–

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Item of Work	Class Buildings	Second Class Buildings	Third Class Buildings	Fourth Class Buildings
Super structure	Shall be of first class brickwork with lime mortar. Lintels over doors and windows shall be of RCC.	Shall be of second class brickwork in lime mortar. Lintels shall be of RB (reinforced brick work).	Shall be of second class brickwork in mud mortar. Doors and windows openings shall be provided with arches of second class brickwork in lime mortar or with wooden planks.	Doors and windows openings shall be provided with arches of second class brickwork in lime mortar or with wooden planks.
Roofing	Shall be of RCC slab with an insulation layer and lime concrete terracing above. Height of rooms shall not be less than 3.7 m.	Shall be of RB slab with 7.5 cm lime concrete terracing above.	Shall be of mud over tiles or bricks or planks over wooden beams or GI sheet or AC sheet sloping roof.	Shall be of tile roof over bamboo and wooden supports.
Flooring	Drawing and dining room floors shall be of mosaic (terrazzo). Bathroom and WC floors and dado shall be of mosaic. Bedroom floors shall be coloured and polished of 2.5 cm cement concrete over 7.5 cm lime concrete.	Floors shall be of 2.5 cm cement concrete over 7.5 cm lime concrete.	Shall be of brick on edge floor over well-rammed earth.	Shall be <i>kutchra</i> or earthen floor finished with <i>gubri</i> washing (cowdung smearing)
Finishing	Inside and outside walls shall be of 12 mm cement lime plastered in 1 : 1 : 6 ratios. For Drawing, dining, and bedrooms Inside shall be distempered. For others, inside should be 3 coats white washed. Outside shall be coloured over one coat of white wash.	Inside and outside walls shall be of 12 mm cement mortar plastered in 1 : 1 : 6 ratios. Ceiling shall be cement plastered 1 : 3 ratios. Inside shall be 3 coats white washed, 2 coats colour washed over 1 coat of white wash.	Inside and outside walls shall be plastered with lime mortar and three coats white washed.	–
Doors and Windows	Shall be of seasoned teak wood. All fittings shall be of brass. Doors and windows shall be 2 coats varnished or painted with superior quality enamel paint over 1 coat of priming. Windows shall be provided with iron gratings or grills.	Shall be of seasoned <i>Sall</i> wood, or <i>Shisham</i> , or <i>Deodar</i> wood, fitted with iron fittings. Doors and windows shall be provided 2 coats over 1 coat of priming.	Shall be of <i>Sall</i> wood, mango, or other country wood. Shall be painted 2 coats with ordinary paint over 1 coat of priming.	Shall be of chir or mango wood or country wood.

**Standard Specifications for Buildings (NBC, 2005)**

Components of a Building	Min. Height	Min. Area
<b>1. Plinth:</b>		–
For main building	450 mm	
For interior courtyards	150 mm	
<b>2. Habitable rooms:</b>		
Residential buildings	2.75	–
Education and Industrial buildings	3.6 m	
Where only one room with minimum width of 2.4 m is provided		9.5 m <sup>2</sup>
Where a second room of minimum 2.1 m width is provided		7.5 m <sup>2</sup>
<b>3. Kitchen</b>		
Where separate dining is provided	2.75 m	5 m <sup>2</sup>
When no separate dining and kitchen is intended for dining	2.75 m	7.5 m <sup>2</sup>
<b>4. Bathrooms</b>	2.1 m	1.8 m <sup>2</sup>
<b>5. Water closet (WC) Rooms</b>		
<b>6. Store Room</b>	2.1 m	1.1 m <sup>2</sup>
<b>7. Garage</b>		
<b>8. Parapet walls</b>	2.2 m	3 m <sup>2</sup>

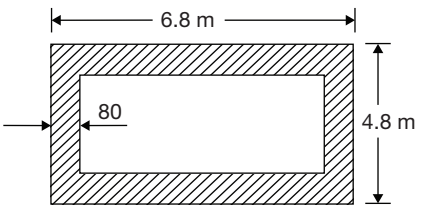
Components of a Building	Min. Height	Min. Area
<b>9. Compound walls</b>		
	2.4 m	–
	1–1.2 m	–
	1.5–2.4 m	–

Stair Case	Min.Width
• For Residential buildings	1.0 m
• Residential hotel buildings	1.5 m
• Assembly buildings, (e.g., auditorium, theaters, and cinema halls)	2.0 m
• Educational buildings	1.5 m

**NOTES**

1. Minimum width of tread shall be 250 mm for residential buildings and 300 mm for other buildings.
2. Maximum height of riser shall be 190 mm for residential buildings and 150 mm for other buildings.

## EXERCISES

- The wages of supervisor and material handlers are charged as \_\_\_\_\_.  
(A) overhead cost  
(B) direct labor cost  
(C) indirect labor cost  
(D) None of these
- A project construction cost estimate includes \_\_\_\_\_.  
(A) the labour and material cost  
(B) the equipment and overhead cost  
(C) the profit of contractor  
(D) All of these
- The project contractor relies on the cost of the estimates \_\_\_\_\_.  
(A) for submission of a competitive bid for the lump sum contract  
(B) for a unit price contract  
(C) for preparation of a definitive estimate to help negotiate the contract  
(D) All of these
- According to ISI method of measurement, the order of sequence is \_\_\_\_\_.  
(A) length, breadth, height  
(B) breadth, length, height  
(C) height, breadth, length  
(D) length, height, breadth
- If 'B' is the width of formation,  $d$  is the height of the embankment, side slope  $S : 1$ , for a highway with no transverse slope, the area of the cross-section is \_\_\_\_\_.  
(A)  $B/d \times Sd$   
(B)  $Bd + Sd^{1/2}$   
(C)  $Bd + Sd^2$   
(D)  $\frac{1}{2}(Bd + Sd^2)$
- The correct prismoidal formula for volume is \_\_\_\_\_.  
(A)  $D[\text{First area} + \text{Last area} + \sum \text{Even areas} + \sum \text{Odd areas}]$   
(B)  $\frac{D}{3}[\text{First area} + \text{Last area} + 4\sum \text{Even areas} + 2\sum \text{Odd areas}]$   
(C)  $\frac{D}{3}[\text{First area} + \text{Last area} + 2\sum \text{Even areas} + 4\sum \text{Odd areas}]$   
(D)  $\frac{D}{6}[\text{First area} + \text{Last area} + 2\sum \text{Even areas} + 4\sum \text{Odd areas}]$
- Due to change in price level, a revised estimate is prepared if the sanctioned estimate exceeds \_\_\_\_\_.  
(A) 2%  
(B) 2.5%  
(C) 4%  
(D) 5%
- The main factor to be considered while preparing a detailed estimate is \_\_\_\_\_.  
(A) quantity of the material  
(B) transportation of materials  
(C) location of site and local labour charges  
(D) All of these
- The plinth area of building does not includes \_\_\_\_\_.  
(A) area of the wall at the floor level  
(B) area of cantilevered porch  
(C) internal shaft for sanitary installations upto 2 sq. m in area  
(D) lift and wall including landing
- While estimating the quantities for the construction of a building, the correct metric unit is \_\_\_\_\_.  
(A) meter for length  
(B) cubic meter for volume  
(C) litre for capacity  
(D) All of these
- The long wall-short wall method is specially adopted for estimating \_\_\_\_\_.  
(A) circular building  
(B) hexagonal building  
(C) other geometrical shaped building  
(D) All of these
- The brick work is measured in sq. meter in case of \_\_\_\_\_.  
(A) honey comb brick work  
(B) brick flat soling  
(C) half brick walls or the partition  
(D) All of these
- Pick up the correct statements from the following:  
(A) Bricks are paid per thousand  
(B) Cement is paid for 50 kg bags  
(C) Brick aggregates are paid per cu. m  
(D) All of these
- Choose correct statement according to the the figure below:  


The diagram shows a rectangular building plan. The outer dimensions are 6.8 m (width) and 4.8 m (height). The inner dimensions are 80 (width) and 3.2 (height). The walls are shown with hatching. Arrows indicate the center line and the out-to-out dimensions.

  
(A) Total length of centre line of four walls is 20 m  
(B) Length of long wall out-to-out is 6.8 m  
(C) Length of short wall in-to-in is 3.2 m  
(D) All of these

15. In long wall and short wall method of estimation, the length of long wall is the centre to centre distance between the wall and  
 (A) breadth of the wall.  
 (B) half breadth of wall on each side.  
 (C)  $\frac{1}{4}$  breadth of wall on each side.  
 (D) None of these
16. The method of obtaining the unit cost of an item of work is called \_\_\_\_\_.  
 (A) cost estimation  
 (B) resource estimation  
 (C) cost analysis  
 (D) rate analysis
17. Find the cost of carrying 20,000 bricks, to a distance of 8 km in a cart at ₹50 per day, when a cart can carry 200 bricks in a trip. The speed of cart being 30 m per minute. Assume a working day of 9 hours, and time taken in loading and unloading 200 bricks as 15 minutes.  
 (A) ₹5000 (B) ₹5500  
 (C) ₹6000 (D) ₹6500
18. Which of the following are considered in rate analysis?  
 I. Material cost including wastage  
 II. Man power cost  
 III. Overhead cost  
 IV. Contractors profit  
 (A) I, II, III only (B) I, II only  
 (C) I, II, IV only (D) I, II, III and IV

### ANSWER KEYS

#### Exercises

- |       |       |       |       |       |       |       |       |      |       |
|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| 1. B  | 2. D  | 3. D  | 4. A  | 5. C  | 6. B  | 7. D  | 8. D  | 9. B | 10. D |
| 11. D | 12. D | 13. D | 14. D | 15. B | 16. D | 17. A | 18. D |      |       |