GOVERNMENT POLYTECHNICKENDRAPARA

DEPARTMENT OF CIVIL ENGINEERING

LECTURE NOTES

Year & Semester: 2nd Year, 3rd Semester

Subject code/Name -Th-2

ESTIMATION AND COST EVALUATION-I

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INTROUDUCTION

Estimate :

Estimation is a process of calculating quantities and costs of various items required in connection with a work. It is prepared by calculating the quantities from the dimensions on the drawing for various items required to complete the project and multiplied by unit cost of the item concerned.

Purpose of Estimation :

- To assess the volume of work involved in the project.
- To arrange and organize material, manpower, equipment and tools-and-plant necessary for the project.
- To fix the project completion period.
- To ascertain the fund required for completing the purpose to work.
- To invite tenders and preparation of bill of quantities.
- To obtain necessary administrative approval, necessary technical sanction and arrangement and allocation of funds required for the project.
- For valuation of an existing property.

Data Required for Estimation:

To make an estimate following datas are necessary: i.e. drawings, specifications and rates

- **Drawings**:
  For calculating quantities of various items for the work, various drawings like plan, section and elevation are required
- **Specifications**:
  Specifications contain detailed descriptions of all workmanship, materials, and methods of preparation and execution of different items of the work.
- **Rates**:
  The rates per unit of various items of work, the rates of various materials to be used in the construction, the wages for various categories of labours are required for cost estimate. Moreover the distance between location of work and source of materials and cost of transportation of materials are required for calculating cost of materials at work site.

Types of estimate:

1. **Preliminary estimate:**
   This is also known as rough cost estimate. This estimate is prepared to work-out an approximate cost of the project in a short period without going into details. This estimate is done for preliminary financial evaluation of different alternatives and for administrative sanctions.
   It is again of two types:
   a) **Plinth area estimate** :
      - This is prepared on the basis of plinth area of the building.
      - Plinth area estimate is calculated by finding the plinth area of the building and multiplying by the plinth area rate.

- Plinth area is calculated for the covered area by taking external dimension of the building at the floor level.
- Plinth area rate being obtained from the cost of similar building having similar specification, height and construction in the same locality.

b) **Cube rate estimate** :

- It is calculated by finding out cubical content of the building (length, breadth and height) and multiplied by cube rate.
- The length and breadth should be taken as external dimension of the building at floor level and height should be taken from floor level to top of roof.
- The cube rate is obtained from the cost of similar building having same specification and construction in the locality.

2. Detailed estimate :

- This estimate is prepared by working out the quantities of different items of work and then working out the cost by multiplying the quantities by their respective rates.
- In detailed estimate provisions for any other expenses like contingencies, T&P, work-charged establishment etc. are added to the above cost to calculate the total amount required for project completion.

The procedure for the preparation of a detailed estimate is divided into 2 parts:

a) Details of measurement and calculation of quantities
b) Abstract of estimated cost

(a) Details of measurement and calculation of quantities :

- The whole work is divided into different items of work as earthwork, concrete, brickwork etc. and the items are classified and grouped under different sub heads and details of measurement of each item of work are taken out and quantities under each item are computed in prescribed form i.e details of measurement form

Details of measurement form

Sl no.	Description of item	No.	Length	breadth	Depth	quantity	remark

(b) Abstract of estimated cost :

The cost of each item is calculated by multiplying the quantities computed in the measurement form with a specific rate in a tabular form known as abstract form as shown below:

Abstract of Estimate form

Sl no	Description of item	Quantity	unit	rate	amount

3. **Revised estimate**:
    - A revised estimate is a detailed estimate for the revised quantities and rate of item of work originally provided in the estimate without material deviation of a structural nature from the design originally approved for a project.
    - It is accompanied with a comparative statement abstract form showing the probable variation for quantity, rate and amount for each item of work as compared with the original estimate side by side stating the reason of variation**.**
    - Revised estimate is generally prepared under the following circumstances:
        - When a sanctioned estimate is likely to exceed by more than 5%.
        - When the expenditure of work exceed by more than 10% of the administrative approval.
        - When it is found that the sanctioned estimate is more than the actual requirement.
4. **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.
    - The method of preparation of a supplementary estimate is the same as that of a detailed estimate and it should be accompanied by a full report of the circumstances which render its necessity.

5. **Revised and supplementary estimate:**

    - During execution of a project it may be necessary to revise the original estimate due to increased volume of original proposed work and at the same time sanction of supplementary works.
    - For such case a revised estimate is prepared for the increased volume of original work and a detailed estimate for the supplementary work which are not included in the original schedule.

6. **Annual Maintenance or repair 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 buildings this includes work like white washing, colour washing, painting doors and windows and minor repairs etc.

Units of measurements for various items of work:

- The unit of different item of work depends on their nature, size and shape.
- In general, the units of different items of work are based on the following principle:

- Mass, voluminous and thick works shall be taken in cubic unit or volume. The measurements of length, breadth and height or depth shall be taken to compute the volume or cubic contents.
- Shallow, thin and surface works shall be taken in square unit or in area. The measurement of length and breadth or height shall be taken to compute the area.
- Long and thin work shall be taken in linear or running unit and the linear measurements shall be taken.
- Piece work and job work etc. shall be taken in number.

Sl no	Particulars of items	Unit
1	Earthwork in excavation	cum
2	Rock excavation	Cum
3	Earth filling in excavation in foundation	Cum
4	Surface dressing and leveling	sqm
5	Cutting of trees	No.
6	Sand filling	Cum
7	Quarrying of stone and boulder	Cum
8	Blasting of rock	Cum
9	Lime concrete in foundation	Cum
10	Lime concrete in roof terracing	Sqm
11	Cement concrete in foundation	Cum
12	Reinforced cement concrete	Cum
13	Jail work	Sqm
14	Damp proof course (D.P.C)	Sqm
15	Brick work in foundation, plinth and superstructure	Cum
16	Honey comb brickwork	Sqm
17	Thin partition wall	Sqm
18	String course, weather course	Metre
19	Brick on edge flooring	Sqm
20	Wood work in door and window chowkhat/frame	Cum
21	Woodwork in shutter	Sqm
22	Door and window fittings i.e door bolt, tower bolt, handle	No.
23	Steel reinforcement bar	Quintal
24	Barbed wire fencing	Metre
25	Iron gate	Sqm/quintal
26	Corrugated iron roof, asbestos cement sheet roof	Sqm
27	Plastering	Sqm
28	Pointing	Sqm
29	Skirting	Metre
30	White washing, colour washing, distempering	Sqm
31	Polishing of woodwork	Sqm
32	Cement concrete flooring	Sqm

33	Pipes – rain water pipe, water pipe	Metre
34	Jungle clearance	Sqm
35	Glazing	Sqm
36	Washbasin, manhole	No.

Terminology

1. **Contingencies:**
   - **The term contingencies** indicates the incidental expenses of a miscellaneous character which cannot be reasonably predicted during preparation of the estimate and to meet such unforeseen expenses additional amount of 3% to 5% of the estimated cost of the work is provided in the total estimate.
   - **The miscell**aneous expenses which cannot approximately be classified under any distinct sub head is taken under contingencies. For example – purchase of a small tool.
   - **But in case** an expenditure is necessary due to change of design or due to increased volume of work and whose cost cannot be covered from contingency fund , supplementary or revised estimate are to be submitted for its sanction.

2. **Lump sum item:**
   - These are small items, such as, front architectural or decoration work of a building, fireplace, site-cleaning and dressing, etc., for which detailed quantities cannot be taken out easily or it takes sufficient time to find the details. For such items a lump-sum rate is provided in the estimate
3. **Work charged establishment :**
   - During the construction of a project considerable number of skilled supervisors, work assistance, watch men etc., are employed on temporary basis.
   - The salaries of these persons are drawn from the amount allotted towards the work charged establishment. That is, establishment which is charged directly to work.
   - An lump sum amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.
   - The work charged employees are temporary staff and their appointment shall have to be sanctioned by the competent authority for a specified period.
4. **Tools and plants (T&P):**
   - Use of special type of tools and plants, like concrete mixture, batching plants etc., may be required for efficient execution of large projects.
   - To meet such expenses about 1% to 1½ of the estimated cost is allotted under the head tools and plants (T&P).
5. **Actual Cost:**
   - The actual cost is the actual expenditure incurred in completing a work excluding profit but including other incidental, establishment and travelling charges.
   - The actual cost is the cost incurred by the contractor to complete the project.
6. **Administrative approval** :

- Administrative approval denotes the formal acceptance by the department concerned of the proposal and after getting the administrative approval the Engg. department take up the work and prepares detailed design, plan and estimates.

7. Technical sanction :

- Technical sanction means the sanction of the detailed estimate, design calculation, quantities of works, rates and cost of the work by the competent authority of the Engg. department.
- After the technical sanction of the estimate is given, then only the work is taken up for construction.

8. Schedule of rate:

- Schedule of rate is a list of rates of various item of works.
- In order to facilitate the preparation of estimate and also to serve as a guide in setting rates in connection with contract agreement schedule of rates for all items of work is maintained in the Engg. department in the form of a printed book known as schedule of rate book.
- Rate per unit of various items of work and material, rate of wages of labour and rate of transport are given in the schedule of rate.
- The schedule of rate is prepared on the basis of analysis of rate.

9. Plinth area:

- Plinth area is the built up covered area of a building measured at the floor level of any storey.
- It is calculated by taking the external dimension of the building at the floor level excluding the plinth offset if any.
- Open areas, balconies, cantilever projections are not included in the plinth area.
- The following should be included in the plinth area
  - All floors, area of wall at the floor level excluding plinth offset if any.
  - Internal shafts for sanitary installations provided these do not exceed 2 sqm in area.

  The following should not be included in the plinth area

  - Inter sanitary shafts which are more than 2 sqm in area.
  - Unenclosed balconies.

10. Floor area :

- Floor area of a building is the total area of floor in between walls and consists of floor of all rooms, verandahs, passages, corridors, staircase room, entrance hall, kitchen, store, bath and latrine etc.
- Sills of door and openings are not included in the floor area.
- Area occupied by walls, pillars and other intermediate supports are not included in the floor area.
- In short floor area is equal to plinth area minus area occupied by walls.

11. Circulation area :

- Circulation area is the floor area of verandahs, passage, corridors, balconies, entrance hall, staircase etc. which are used for movement of persons using the building.

- The circulation area of any floor shall comprise of the following:
  - Verandahs and balconies
  - Passages and corridors
  - Entrance halls
  - Staircase
  - Lift

The circulation area may be divided into two parts

(a) Horizontal circulation area
(b) Vertical circulation area

a) Horizontal circulation area :

- It is the area of verandah, passage, corridors, balconies etc. which are required for the horizontal movement of users of building.
- This may be 10% to 15% of the plinth area of the building.

b) Vertical circulation area :

- It is the area occupied by the staircase, lift which are required for vertical movement of users.
- This may be 4% to 5% of the plinth area of the building.

12. Carpet area:

- Carpet area is the liveable area of the building.
- This is the total floor area excluding circulation area (verandahs, passage, corridors) and areas of sanitary accommodation, kitchen etc.
- The carpet area of an office building may be 60% to 75% of plinth area of the building and in case of residential building may be 50% to 65% of the plinth area of the building.

Building Estimate:

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., can be workout by any of following three methods

a. Long wall - short wall method
b. Centre line method.

- Long wall-short wall method:In this method, the wall along the length of room is considered to be long wall while the wall perpendicular to long wall is said to be short wall. To get the measurement of materials and works length of long wall or short wall, calculate first the center line lengths of individual walls. Then the length of long wall, (out to out) may be calculated after adding half breadth at each end to its center line length. Thus the length of short wall measured into in and may be found by deducting half breadth from its center line length at each end. The length of 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
- Centre line method:This method is suitable for walls of similar cross sections. Here the total center line length is multiplied by breadth and depth of respective item to get the total quantity at a time. When cross walls or partitions or verandah walls join with main all, the center line length gets reduced by half of breadth for each junction. Such junction or joints are studied carefully while calculating total center line length. The estimates prepared by this method are most accurate and quick.

Estimate the quantities of following items from the given plan and sectional elevation

(a) Earthwork in excavation in foundation
(b) Concrete work in foundation
(c) Brickwork in foundation and plinth
(d) Brickwork in superstructure

Solution:

The centre to centre length of long wall = 5.00 + (0.3/2)+(0.3/2)= 5.30 m

The centre to centre length of short wall = 4.00 +(0.3/2)+(0.3/2) = 4.30 m

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Details of measurement and calculation of quantities

Sl no.	Particulars of item	No.	Length	Breadth	Depth	Quantity	Remark
1	Earthwork in excavation in foundation						
	Long wall	2	6.20	0.90	0.90	10.04	L = 5.3 + 0.90 = 6.20 m
	Short wall	2	3.40	0.90	0.90	5.51	L = 4.30 – 0.90 = 3.40 m
					Total	15.55 cum	
2	Concrete work in foundation						
	Long wall	2	6.20	0.90	0.30	3.35	
	Short wall	2	3.40	0.90	0.30	1.83	
					Total	5.18 cum	
3	Brickwork in foundation and plinth						
	Long wall						
	1st footing	2	5.90	0.60	0.30	2.13	L = 5.30 + 0.60 = 5.90
	2nd footing	2	5.80	0.50	0.30	1.74	L = 5.30 + 0.50 = 5.80
	Plinth wall	2	5.70	0.40	0.60	2.74	L = 5.30 + 0.40 = 5.70
	Short wall						
	1st footing	2	3.70	0.60	0.30	1.33	L = 4.30 – 0.60 = 3.70
	2nd footing	2	3.80	0.50	0.30	1.14	L = 4.30 – 0.50 = 3.80
	Plinth wall	2	3.90	0.40	0.60	1.87	L = 4.30 – 0.40 = 3.90 m
					Total	10.95 cum	
4	Brickwork in superstructure						
	Long wall	2	5.60	0.3	3.50	11.76	L = 5.30 + 0.30 = 5.60
	Short wall	2	4.00	0.3	3.5	8.40	L = 4.3 – 0.3 = 4.0
					Total	20.16 cum	

Example :

Estimate the quantities of following items of a two roomed building from the given plan and section

(a) Earthwork in excavation in foundation
(b) Concrete work in foundation
(c) Brickwork in foundation and plinth
(d) 2.5 cm c.c damp proof course
(e) Brickwork in superstructure

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Details of measurement and calculation of quantities:

Sl.no.	Particulars of item	No	Length	Breadth	Depth	Quantity	Remark
1	Earthwork in excavation in foundation						
	Long wall	2	11.70	1.10	1.00	25.74	L = 10.60 + 1.10 = 11.70
	Short wall	3	5.20	1.10	1.00	17.16	L = 6.30 – 1.10 = 5.20
					Total	42.90 cum	
2	Cement concrete work in foundation						
	Long wall	2	11.70	1.10	0.30	7.72	
	Short wall	3	5.20	1.10	0.30	5.15	
					Total	12.87 cum	
3	First class brickwork in foundation and plinth						
	Long wall						
	1st footing	2	11.40	0.80	0.20	3.65	L = 10.60 +0.80 = 11.40 m
	2nd footing	2	11.30	0.70	0.10	1.58	L = 10.60 + 0.70 = 11.30 m
	3rd footing	2	11.20	0.60	0.10	1.34	L = 10.60 + 0.60 = 11.20 m
	4th footing	2	11.10	0.50	0.10	1.11	L = 10.60 + 0.50 = 11.10 m
	Plinth wall above footing	2	11.00	0.40	0.80	7.04	L = 10.60 + 0.40 = 11.00 m
	Short wall						
	1st footing	3	5.50	0.80	0.20	2.64	L = 6.30 – 0.80 = 5.50 m
	2nd footing	3	5.60	0.70	0.10	1.18	L = 6.30 – 0.70 = 5.60 m
	3rd footing	3	5.70	0.60	0.10	1.03	L = 6.30 – 0.60 = 5.70
	4th footing	3	5.80	0.50	0.10	0.87	L = 6.30 – 0.5 = 5.80
	Plinth wall above footing	3	5.90	0.40	0.80	5.66	L = 6.30 – 0.40 = 5.90
					Total	26.10 cum	
4	Damp proof course 2.5 cm thick C.C						

	Long wall	2	11.00	0.40	---	8.80	
	Short wall	3	5.90	0.40	---	7.08	
					Total	15.88	
	Deduct door sills	2	1.20	0.40	---	0.96	
					Net total	14.92 sqm	
5	First class brick work in superstructure						
	Long wall	2	10.90	0.3	4.20	27.47	
	Short wall	3	6.00	0.30	4.20	22.68	
					Total	50.15 cum	
	Deduct						
	Door opening	2	1.20	0.30	2.10	1.51	
	Window openings	4	1.00	0.30	1.50	1.80	
	Shelves	2	1.00	0.20	1.50	0.60	
	Lintels over door	2	1.50	0.30	0.15	0.14	Bearing 15 cm
	Lintel over window	4	1.30	0.30	0.15	0.23	Bearing 15 cm
	Lintel over shelves	2	1.30	0.30	0.15	0.12	Bering 15 cm
					Total of deduction	4.40	
					Net total	45.75 cum	

Example :

Estimate the quantities of the following items of a residential building from the given plan and section

(1) Earthwork in excavation
(2) Cement concrete work in foundation
(3) First class brickwork in foundation and plinth
(4) 2.5 cm Damp proof course
(5) First class brickwork in superstructure

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Solution :

Drawing and left hand side bed room combined :

Centre to centre length of long wall = 6.00 + 4.00 + 0.3 + 0.15 + 0.15 = 10.60 m

Centre to centre length of short wall = 5.00 + 0.15 + 0.15 = 5.30 m

Bed room right side (both combined):

centre to centre length of long wall = 5.00 + 4.00 + 0.30 + 0.15 + 0.15 = 9.60 m

centre to centre length of short wall = 4.50 + 0.15 + 0.15 = 4.80 m

Front verandah :

Front wall centre to centre length = 5.00 + 4.00 + 0.30 + 0.3 + 0.3 – 0.15 – 0.10 = 9.65 m

Side wall centre to centre length =2.00 + 0.30 + 0.20 – 0.15 – 0.10 = 2.25 m

Back verandah including bath room:

Rear wall centre to centre length = 9.65 m

Side wall centre to centre length = 2.5 + 0.1 + 0.15 = 2.75 m

Details of measurement and calculation of quantities:

Sl no.	Particulars of item	No.	Length	Breadth	Height	Quantity	Remark
1	Earthwork in excavation Drawing room and left bed room						
	Long walls	2	11.50	0.90	1.00	20.70	L = 10.60 + 0.90 = 11.50 m
	Short wall	3	4.40	0.90	1.00	11.88	L = 5.30 – 0.90 = 4.40 m
	Bed room right side (both)						
	Long walls	2	9.60	0.90	1.00	17.28	L = 9.60 – 0.45 + 0.45 = 9.60
	Short walls	2	3.90	0.90	1.00	7.02	L = 4.80 – 0.90 = 3.90
	Front verandah						
	Front long wall	1	9.50	0.60	0.50	2.85	L = 9.65 – 0.45 + 0.3 = 9.50 m
	Side short wall	1	1.50	0.60	0.50	0.45	L = 2.25 – 0.45 – 0.30 = 1.50
	Back verandah including bath room						
	Long wall (rear wall including bath)	1	9.50	0.60	0.50	2.85	L = 9.65 – 0.45 + 0.30 = 9.50
	Short wall	2	2.00	0.6	0.5	1.20	L = 2.75 – 0.45 –

							0.30 = 2.00
					Total	64.23 cum	
2	Cement concrete work in foundation Drawing and left bed room						
	Long walls	2	11.50	0.90	0.30	6.21	
	Short walls	3	4.40	0.90	0.30	3.56	
	Bed room right side (both)						
	Long walls	2	9.60	0.90	0.30	5.18	
	Short walls	2	3.90	0.90	0.30	2.11	
	Front verandah Front long wall	1	9.70	0.60	0.20	1.16	L = 9.65 – 0.25 + 0.30 = 9.70
	Side short wall	1	1.70	0.60	0.20	0.20	L = 2.25 – 0.25 – 0.30 = 1.70
	Back verandah including bath room Long wall including bath	1	9.70	0.60	0.20	1.16	L = 9.65 – 0.25 + 0.30 = 9.70
	Short wall	2	2.20	0.60	0.20	0.53	L = 2.75 – 0.25 – 0.30 = 2.20
					Total	20.11 cum	
3	First class brickwork in foundation and plinth						
	Drawing and left bed room Long wall 1st footing	2	11.20	0.60	0.20	2.69	L = 10.60 + 0.60 = 11.20

	2nd footing	2	11.10	0.50	0.20	2.22	L = 11.20 – (2 x 0.5) = 11.10
	Plinth wall above footing	2	11.00	0.40	0.90	7.92	L = 11.10 – 0.10 = 11.00
	Short wall 1st footing	3	4.70	0.60	0.20	1.69	L = 5.30 – 0.60 = 4.70
	2nd footing	3	4.80	0.50	0.20	1.44	L = 4.70 +(2 x 0.05) = 4.80
	Plinth wall above footing	3	4.9	0.40	0.90	5.29	L = 4.80 + 0.10 = 4.90
	Bed room right side (both) Long wall 1st footing	2	9.6	0.60	0.20	2.31	L = 9.60 – 0.30 + 0.30 = 9.60
	2nd footing	2	9.6	0.50	0.20	1.92	L = 9.6 – 0.25 + 0.25 = 9.6
	Plinth wall above footing	2	9.6	0.4	0.9	6.91	L = 9.6 – 0.20 + 0.20 = 9.60
	Short wall 1st footing	2	4.2	0.6	0.2	1.01	L = 4.80 – 0.60 = 4.20
	2nd footing	2	4.3	0.5	0.2	0.86	L = 4.2 + (2 x 0.05) = 4.3
	Plinth wall above footing	2	4.4	0.4	0.9	3.17	L = 4.3 + 0.1 = 4.4
	Front verandah Front wall Footing	1	9.65	0.4	0.20	0.77	L = 9.65 – 0.20 + 0.20 = 9.65
	Plinth wall above footing	1	9.6	0.3	0.7	2.02	L = 9.65 – 0.20 + 0.15 = 9.60
	Side short wall footing	1	1.85	0.40	0.20	0.15	L = 2.25 – 0.20 – 0.20 =

							1.85
	Plinth wall above footing	1					

Analysis of rate :

The determination of rate per unit of a particular item of work from the cost of quantities of materials, the cost of labour and other miscellaneous expenses required for its completion is known as Analysis of rate.

- Rates of materials are usually taken as the rates delivered at the site of work and include first cost (cost of origin), cost of transport, taxes if any etc.
- The rate of material and labour vary from place to place and therefore the rates of different item of work also vary from place to place.

The rate of a particular item of work depends on the following

- Specification of works and materials, quality of material
- Quantities of material and their rates, number of different types of labour and their rate.
- Location of site of work and its distance from the sources of material, rate of transport and availability of water.
- Profits and overhead expenses of contractor.

Overhead cost :

Overhead cost include general expenses, rent, taxes, supervision and other cost which are indirect expenses and not productive expenses on the job.

The miscellaneous expenses on overhead may be under the following heads:

General overhead :

1. Establishment
2. Stationary, printing, postage
3. Travelling expenses
4. Telephone bill
5. Rent and taxes

Job overhead :

1. Supervision (salary of engineers, supervisors)
2. Handling of materials
3. Repairs, carriage and depreciation of tools and plants
4. Workmen compensation, insurance etc.

Schedule of rate :

A booklet containing rates of various engineering items for the preparation of detailed estimate of a building. It also gives the rate of materials, daily wages of labour, carriage expenditure etc.

Dry material calculation :

Cement concrete 1:5:10 in foundation with stone ballast for 10 cum

Cement = $\frac{15.2}{1+5+10}$ = 0.95 cum or 28 bags

Sand = 0.95 x 5 = 4.75 cum

Aggregate = 0.95 x 10 = 9.5 cum

Cement concrete 1:2:4 with graded stone chips for 10 cum

Cement = $\frac{15.2}{1+2+4}$ = 2.17 cum or 64 bags

Sand = 2.17 x2 = 4.34 cum

Aggregate = 2.17 x 4 = 8.68 cum

Brickwork in cement mortar with 1:6 for 10 cum

no. of bricks having size with mortar 20 cm x 10 cmx 10 cm = $\frac{10}{0.2\times0.1\times0.1}$ = 5000 nos.

size of brick without mortar = 19cm x 9cm x 9cm

mortar required for 10 cum = 10 – (5000 x 0.19 x 0.09 x 0.09) = 2.3 cum

due to frog filling, brick bonding courses and wastage etc increase this quantity by 15%

volume of wet mortar = 2.3 + (2.3 x 0.15) = 2.64 cum

when dry increase this volume by 1/3rd = 2.64 + (2.64/3) = 3.5 cum

cement = $\frac{3.5}{1+6}$ = 0.5 cum

sand = 0.5 x 6 = 3 cum

12 mm thick cement plastering (1:6)in walls for 100 sqm

Volume of wet mixed mortar = 100 x 0.012 = 1.2 cum

Add 20% extra to fill up joint, uneven surfaces = 1.2 + (1.2 x 0.2) = 1.44 cum

Increase 1/3rd volume for dry condition = 1.44 + (1.44/3) = 1.92 or 2 cum

Cement = $\frac{2}{1+6}$ = 0.5 cum

Sand = 0.3 x 6 = 1.8 cum

20 mm thick cement plastering (1:2)in walls for 100 sqm

Volume of wet mixed mortar = 100 x 0.02 = 2 cum

Add 20% extra to fill up joint, uneven surfaces = 2 + (2 x 0.2) = 2.4 cum

Increase 1/3rd volume for dry condition = 2.4 + (2.4/3) = 3.2 cum

Cement = $\frac{3.2}{1+2}$ = 1.06 cum

Sand = 1.06 x 2 = 2.12 cum

2.5 cm thick cement concrete flooring in 1:2:4 proportion for 100 sqm

For 2.5 cm thick C.C flooring for 100 sqm of area the quantity of cement concrete = 100 x 0.025 = 2.5 cum

Add 10% extra for uneven surface = 2.5+(2.5x0.1) = 2.75 cum

Dry volume of material = 2.75 + (2.75 x 0.5) = 4.125 cum

Cement = $\frac{4.125}{1+2+4}$ = 0.6 cum

Sand = 0.6 x 2 = 1.2 cum

Aggregate = 0.6 x 4 = 2.4 cum

2 cm thick cement concrete flooring in 1:2:4 proportion for 100 sqm

Cement = $\frac{4.125}{1+2+4}$ = 0.6 cum

Sand = 0.6 x 2 = 1.2 cum

Aggregate = 0.6 x 4 = 2.4 cum

4 cm thick cement concrete flooring in 1:2:4 proportion for 100 sqm

Quantity of cement concrete = 100 x 0.04 = 4 cum

Add 10% extra for uneven surface = 4+(4x0.1) = 4.4 cum

Dry volume of material = 4.4 + (4.4 x 0.5) = 6.6 cum

Cement = $\frac{6.6}{1+2+4}$ = 0.6 cum

Sand = 0.6 x 2 = 1.2 cum

Aggregate = 0.6 x 4 = 2.4 cum

Details of measurement and calculation of quantities

Sl no.	Particulars of item	No.	Length	Breadth	Depth	Quantity	Remark
1	Earthwork in excavation in foundation						
	Long wall	2	6.2	0.90	0.90	10.04	Length = 5.30+0.9 = 6.20 m
	Short wall	2	3.40	0.90	0.90	5.51	4.30 – 0.90 = 3.40 m
					Total	15.55 cum	
2	Concrete in foundation						
	Long wall	2	6.20	0.90	0.30	3.35	
	Short wall	2	3.40	0.90	0.30	1.83	
					Total	5.18 cum	
3	Brickwork in foundation and plinth						
	Long wall						

	1st footing	2	5.90	0.60	0.30	2.13	
	2nd footing	2	5.80	0.50	0.30	1.74	
	Plinth wall	2	5.70	0.40	0.60	2.74	
	Short wall						
	1st footing	2	3.70	0.60	0.30	1.33	
	2nd footing	2	3.80	0.50	0.30	1.14	
	Plinth wall	2	3.90	0.40	0.60	1.87	
					Total	10.95 cum	
4	Brickwork in superstructure						
	Long wall	2	5.60	0.30	3.50	11.76	
	Short wall	2	4.00	0.30	3.50	8.40	
					Total	20.16 cum	