BHUBANANANDA ODISHA SCHOOL OF ENGINEERING, CUTTACK

DEPARTMENT OF CIVIL ENGINEERING

LECTURE NOTE ON: ESTIMATION AND COST EVALUATION-I (TH-4)
3RD SEMESTER

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CHAPTER-1

INTRODUCTION

ESTIMATE

An estimate is the probable cost of work and usually prepared before the construction is taken up.

Data Required for Estimate :

The following 3 types of data are required for estimate .

(1) Drawing (plan ,elevation ,section)
(2) Specification(It includes nature, quality ,and type of work ,material etc)
(3) Rate (The rate per unit various items of work, labour etc)

TYPES OF ESTIMATE

The different types of estimates are :

1. Prelimnary estimate /Aproximate estimate
2. Plinth area estimate
3. Cube rate estimate
4. Aproximate quantity method estimate
5. Detailed estimate
6. Revised estimate
7. Supplimentary estimate
8. Supplimentary and revised estimate
9. Annual Repair /Maintenance estimate

1. Prelimnary estimate /Aproximate estimate

- **I**t is required for preliminary studies of various item of work or project to decide the financial position and policy for administrative sanction by the competent authority .
- **I**n case of commercial projects such as irrigation project or similar projects which earn revenue income ,then it may be seen wheather investment is justified or not.

2. Plinth area estimate :

- This is prepared on the basis of plinth area of building .The rate being deduced from the cost of similar building having similar specification ,height and construction in the locality .
- Plinth area estimate is calculated by taking 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 dimensions of the building at the floor level .Courtyards and other open areas should not be included in the plinth area estimate .

3.Cube rate estimate:

- Cube rate estimate is a preliminary estimate or an approximate estimate and is prepared on the basis of cubical content of a similar building having similar specification and construction in the locality .

- This is calculated by finding the cubical content of the building and multiplying it with the cube rate .The length and breadth should be taken as the external dimension of the building at the floor level and the height should be taken from the floor level of one storey to the top of next higher floor .
- The foundation ,Plinth and the parapet above roof are not taken into consideration in finding the cubical content.

4. Aproximate quantity method estimate :

- In this method approximated total length of wall is found in running meter and this total length multiplied by the rate per running meter wall gives fairly accurate cost .
- For this method the structure is devided into two parts .
  (1) Foundation including plinth
  (2) Superstructure.
- The running meter cost for foundation and superstructure should be calculated first and these running meter should be multiplied by the total length of wall.
- Similarly for superstructure the prices or rate per running meter is determined from the approximate quantities of bricks , wood works , roof , floor , finishing etc.

5. Detailed 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 such as length ,breadth and height of each item are calculated and abstracting and billing are done .
- The detailed estimate is prepared in two stages .
  (1) Details of measurement and calculation of quantities
  The details of measurement of each item of work are taken out correctly from the quantities under each items was csomputed in a tabular form.

  (2)Abstract of Estimate cost :

  The total cost of a item is calculated from the analysis of rates or schedule of rate chart.

6. Revised Estimate :

Revised estimate is a detailed estimate and is 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 proposed even through the cost may be met from the sanctioned amount.

7. Supplimentary estimate :

Supplimentary estimate is a detailed estimate and is requied when additional works are required to supplement the original works or when further development is required during the progress of work .

The abstract should show the amount of the original estimate ad the amount including the supplementary amount for which sanction is required.

8. Supplimentary and Revised estimate :

If at any time either before or during the execution of original work it is found that original estimate is excessive then divisional office may sanction a revised estimate of reduced amount and informed .

It is prepared when work is partially abandoned and the estimated cost of remaining work is less than 95 percent of original work.

9. Annual repair or maintainance estimate :

Annual repair or Annual maintainance estimate is a detailed estimate and is prepared to maintain the structural work in prepared order and safe condition .

For building this includes white washing , colour washing ,pointing ,minor repairs etc.

Further there may be special estimate such as Monsoon damage repair estimate etc.

ESTIMATE OF A BUILDING:

The estimate of a building is done in two stages.

(i) Measurement of quantities
(ii) Calculation of costs

MEASUREMENT OF QUANTITIES :

The whole work is devided into different items of work such as earthwork ,cement 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 – Details of measurement form.

Details of measurement form:

ITEM NO	PARTICULARS OF ITEMS	NO	LENGTH	BREADTH	HEIGHT	QUANTITY	EXPLANATORY NOTES

CALCULATION OF COST:

The cost under each item of work is calculated from the quantities already computed at workable rate and the total cost is worked out in a prescribed form known as Abstract of Estimate form.

A percentage of 3 to 5 percent is added for contingencies to allow petty contingent expenditure and unforeseen expenditure.

The grand total thus obtained is the estimated cost of the work.

Abstract of Estimate Form:

ITEM NO	PARTICULARS OF ITEM	QUANTITY	UNIT	RATE	AMOUNT

TYPES OF AREA OF A BUILDING

There are three types of area of a building.

(1) Plinth area (2) Floor area (3) Carpet area

PLINTH AREA :

- It is the built up covered area of a building measured at floor of any storey.
- It is calculated by taking external dimension of building at the floor level excluding plinth offsets if any.
- The following shall be included in plinth area
  - All floor area of walls at the floor level
  - Internal shafts for sanitary installation whose area do not exceed 2 m^2 .
  - Area of porches other than cantilevers.
- The following shall not be included in plinth area.
  - Area of loft
  - Internal shaft for sanitary installation whose area exceed 2m^2 .
  - Uncovered balconies

FLOOR AREA :

- It is the area of building that is the total area of the floors in between walls and consists of floor of all rooms, Verandah , passage ,staircase room ,entrance hall , bathroom , kitchen and store rooms etc .
- In short
  Floor area = Plinth area - area of occupied by walls
- The floor of each stores of different types of floors measured and taken separately .The floor area of the basement , barsati , mumty and porches etc should be measured separately .

CARPET AREA

- Carpet area of a building is the livable area or useful area. This is the total floor area minus area of verandah , corridor , passenger ,stair case ,entrance halls and other non usable area.
- For office building carpet area is the restable area or usable area .For residential building it is the livable area and should be used for living purpose.
- The carpet area of an office building is upto 75% of the plinth area and for residential building it is 50 to 65% of the plinth area .

PRINCIPLE OF UNITS FOR VARIOUS ITEM OF WORKS :

The units of different works depend on their nature ,size and shape. In general , the units of different items of works are based on the following principles :-

- Mass ,voluminous and thick works shall be taken in cubic unit or volume .The measurement 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 linear measurement shall be taken.
- Piece work , job work etc shall be taken in number.

UNIT OF MEASUREMENT OF VARIOUS ITEM OF WORK

S I NO	PARTICULARS OF ITEMS	UNITS
1	Earthwork in excavation	M^3
2	Rock excavation	M^3
3	Earthwork in filling	M^3
4	Sand filling	M^3
5	Surface dressig	sqm
6	Cutting of trees	nos
7	Quarrying of stone or boulder	M^3
8	Lime concrete in foundation	M^3
9	Lime concrete in roof terracing , thickness specified	sqm
10	Cement concrete	M^3
11	Reinforced cement concrete	M^3
12	Jali work	sqm
13	Damp proof course	sqm
14	Brickwork in foundation in plinth and superstructure	M^3
15	Sun dried brickwork	Cu .m
16	Honey comb brickwork	sqm
17	Half – brickwork	Sq m
18	Thin partition wall	sqm
19	Reinforced brick work	Cum
20	String course, weather course, Coping(projection specified)	meter
21	Brick edging	Meter
22	Stone masonry , Rubble masonry	Cu m
23	Stone work in wall facing	Sq m
24	Wood work in door and window framing	Cu m
25	Door and window shutters	Sq m

26	Timbering of trenches	Sqm
27	Woodwork in partition	Sqm
28	Steel reinforcement bars etc In R.C.C , R.B , work	Quintal
29.	Bending and binding of steel reinforcement	Quintal
30	Barbed wire fencing	Meter
31	Iron railing	Meter
32	Iron hold fast	Quintal
33	Steel door and windows	Sqm
34	Asbestos cement sheet	Sqm
35	R.C.C / R.B roof slab	Cum
36	Centering and shuttering form work	Sqm
37	Plastering	Sqm
38	Pointing	Sqm
40	White washing	Sqm
41	Distempering	Sqm
42	Painting ,distempering	Sqm
43	Polishing of wood work	Sqm
44	Cement concrete floor	Sqm
45	Bituminous road surfacing	Sqm
46	Dismantling of brick masonry	Cum
47	Supply of cement	Bag

Chapter-2

ESTIMATE METHODS :-

There are 2 types of estimate methods .

(1) Long wall –short wall method
(2) Center line method

LONG WALL SHORT WALL METHOD :-

- In this method the center to center length of long wall and short wall is calculated separately.
- The long wall is always calculated from out to out .
- The short wall is always calculated from in to in.
- Length of long wall=center to center length +$(2\times\frac{\text{width of item}}{2})$
- Length of short wall= center to center length --$(2\times\frac{\text{width of item}}{2})$

CENTER LINE METHOD :-

- In this method the center to center length of long wall and short wall is calculated separately.
- This method is used to calculate the quantities rapidly.
- A special deduction is applied at junctions in this method .
- The point at which more than 2 walls meet is called as a joint.
  At joints Total length of walls = Sum of centre to centre length of all walls –(no of joints $\times\frac{\text{width of item}}{2}$)

4. ADMINISTRATIVE SET UP OF ENGINEERING ORGANISATION

DUTIES AND LIABILLITIES OF OWNER

- To appoint an engineer and give him power to work on his behalf.
- To intimate the engineer required for the project including his desired time of completion.
- To obtain necessary sanction for his construction from competent authority.
- To give possession of the site to the contractor
- To make payment to the contractor on production of certified bill from the engineer .
- To take over possession of the completed project timely from the contractor.
- In case of conflict(problem) with the contractor, he will appoint lawer for defending his side.

DUTIES OF CONTRACTOR :

- To inspect the site and study soil conditions before tendering. He should investigate the availability , accessibility of electric power, water supply etc.
- He should collect the local rates of material , labors and accordingly prepare the analysis of rates of all the items.
- It is duty and liability of the contractor to follow the labor act truly.
- The contractor is liable to safeguard his own men and material issued to him.
- The contractor should submit his claims for extra works and submit bills for payment in due time.
- It is the responsibility of contractor to handover the completed work in a sound condition.

DUTIES OF ENGINEER :

- To prepare the necessary drawing , specifications and estimate in accordance with the requirement of the owner.
- To check up the soil condition
- To supervise the work and ensure that the drawing and specifications are faithfully followed.
- To check up the progress of work with passage of time and submit progress report to the owner.
- To check the quality of work, measurement of works done , quantities , rates and pass the bill for payment.
- To notify the owner about the progress of work , if the work progress very slowly.
- To ensure that no damage is being made on any part of the completed work at the time of handling over the same to the owner.

DUTIES OF EXECUTIVE ENGINEER :

- ✓ To organize and supervise the execution of works and to see that they are economically and suitably carried out with specified quality of material.
- ✓ To prepare estimate of proposed works through his sub-ordinates and submit the same to the super-intending engineer.
- ✓ To invite tenders for works valued under his power.

- ✓ To inform the probability of excess of actual over estimated cost of work to his superintending engineer before execution of work.
- ✓ To check that the accounts are posted from day to day and that the accountant carries his duty regularly and punctually.
- ✓ To prevent encroachment on govt lands under his division.
- ✓ To inspect works and checks measurements of at least 10 % of works according to the standing rule.

DUTIES OF ASSISTANT ENGINEER OR SUB-DIVISIONAL OFFICER :

- ❖ Efficient management and execution of works within his jurisdiction.
- ❖ To maintain the initial account records of cash and stores under his charge.
- ❖ To ensure all correct account returns and submit it punctually to the divisional officer.
- ❖ To check a certain percentage (at least 25 %) of measurements recorded in the measurement book.
- ❖ To keep a control over the expenditure against the sanctioned estimate and to report monthly progress work.
- ❖ To check stores at least twice a year and tools and plants once in a year.
- ❖ To modify the tools, plants and labors whenever required.

DUTIES OF SECTIONAL OFFICER /SUB-ASSISTANT ENGINEER :

- To supervise the day-to-day progress of works under his control. To check up whether the materials, proportion of mix , details of item, workmanship etc. are provided as per specification.
- To take detailed measurement of works during progress and enter the same in the measurement book and prepare timely bill for payment.
- To maintain accounts of materials , tools and plants issued for the work and to make timely recovery of the same from the bill of contractors.
- To draw the attention of his assistant engineer in charge for any irregularities of contract, specifications , shortage of supply of departmental materials or any other difficulties .
- To maintain accounts of material, tools and plants , labor etc.

DUTIES OF DIVISIONAL ACCOUNTANT:

- To assist divisional officers in the discharge of their responsibilities .
- Compile the accounts of the division with the prescribed rules and from the data furnished to him.
- To apply certain preliminary checks to the internal accounts , voucher etc. .
- Advice the divisional officer in all matters relating to account and budget estimates .
- To see the comparative statements correctly and incorporate the totals are checked on individual tenders.

LEAD AND LIFT :

Normally earthwork is estimated for 30m horizontal distance and 1.5 m vertical distance or height . The horizontal distance of 30m is known as lead and the vertical distance of 1.5m is called as lift . Normal rate of earthwork is for 30m lead and 1.5m lift. For greater horizontal distance (30m) and greater vertical distance (1.5m) , the rate of earthwork is different.

SUNDRIES AND OVERHEAD CHARGES :

SUNDRIES :

It is the item of work which can not be measured , but it is required in the work at site. A lumpsum amount is kept as provision to meet sundry expenditure.

OVERHEAD CHARGES :

It includes general office expenses , rent ,tax , purchase of stationary , printing of paper , telephone bill , electric bill and postage etc. . This is an indirect expense .

DIFFERENT GOVT AND PUBLIC SECTORS EMPLOYING CIVIL DIPLOMA HOLDER :

- Govt organizations employing civil diploma holders in Odisha are –
  i. Opsc,Ssc
  ii. Housing Board Organization
  iii. PWD, Irrigation department , NHPC , R & B department ,RWSS etc.
- Public sectors organizations employing civil diploma holders in Odisha are –
  i. Indian oil
  ii. JINDAL ,TATA ,ONGC , OPTCL, NALCO ,SAIL , HAL etc. .

Explain the term A.R ESTIMATE :

Annual repair estimate is a detailed estimate and is prepared to maintain the structure or work in proper order and safe condition . For building , this includes white washing ,colour washing , painting and minor repairs etc. For road it includes patch repairing , renewals , repair of bridge and culvert .

UNIT RATE ESTIMATE :

In this estimate the unit rate of all materials and labors are noted . Then this unit rate is multiplied with quantity of item or labor to calculate cost of all items.

LIST OUT THE ENCLOSURES/ ATTACHMENTS TO BE SUBMITTED WITH AN ESTIMATE :

- Detailed measurement
- Rate analysis for material and labor
- Labor rate chart
- Proposed drawing including plan

MENTION THE DIFFERENT TYPES OF INCLINED ROOFS AVAILABLE :

- Lean to roof
- Gable roof
- Hip roof
- Gambrel roof
- Mansard or curb roof
- Deck roof

SPECIFY SIZE OF NOMINAL BRICK AND TRADITIONAL BRICK .

TYPES OF BRICK	ACTUAL SIZE	NOMINAL SIZE
Standard brick	19cm×9cm×9cm	20cm×10cm×10cm
Traditional brick	22.9cm×11.2cm×7cm	22.9cm×11.4cm×7.6cm

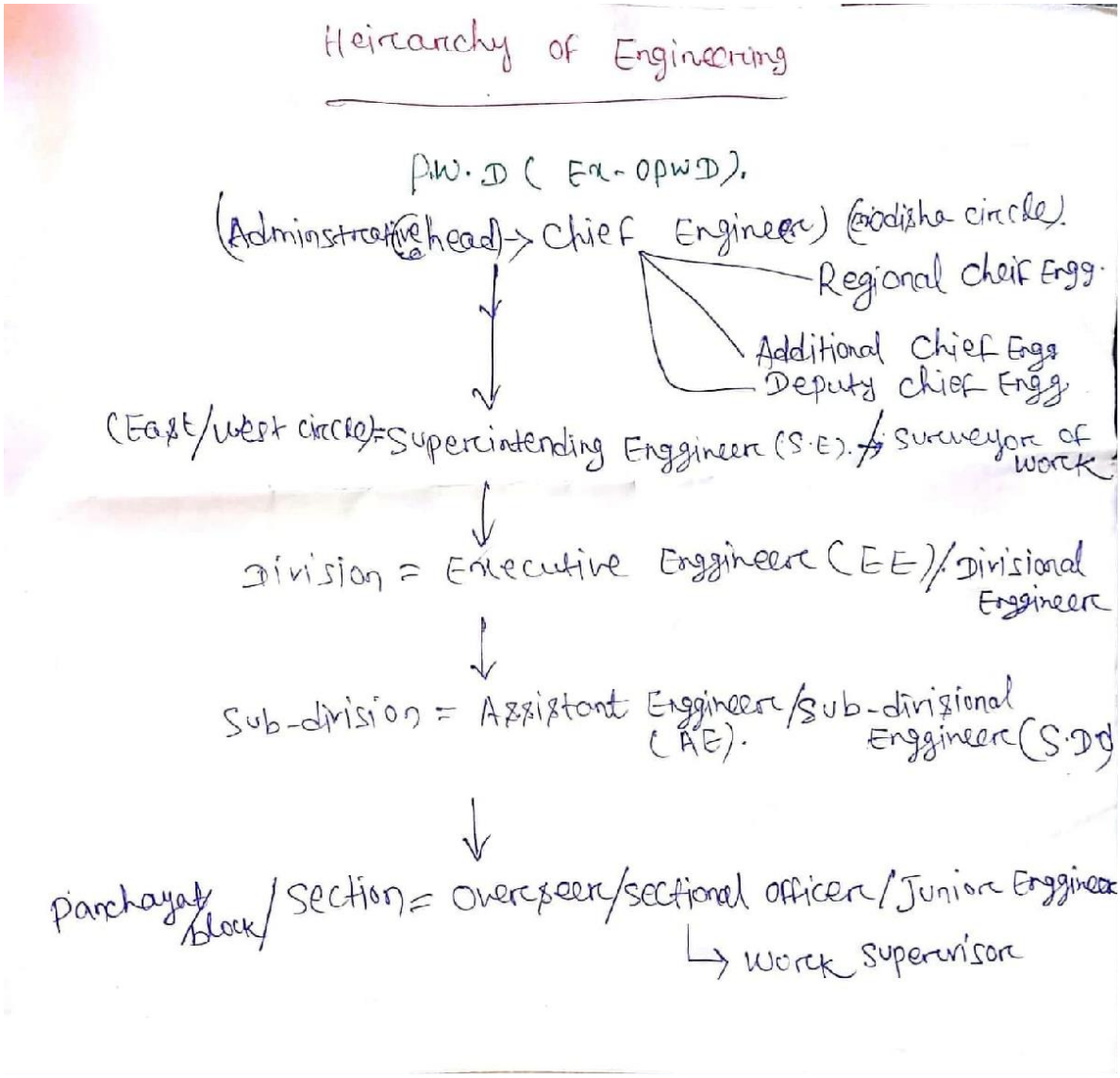
ADMINISTRATIVE APROVAL OR SANCTION :

- For any work or project required by a department ,an approval or sanction of the competent authority of the department with respect to the cost or work is necessary at the first instance.
- It denotes the formal acceptance by the department concerned of the proposal and after administrative approval is given , the engineering department take up the work and prepares details designs , plans ,estimates and then executes the work.

TECHNICAL SANCTION :

- Technical sanction means the sanction of detailed estimate , design calculations ,quantities of work by the competent authority of the engineering department .
- After the technical sanction of the estimate is given , then only the work is taken up for construction .
- In case of original work ,the counter signature of the local head of the department should be obtained in the plan and estimate, before technical sanction is accorded by the engineering department.
- The power of technical sanction differs from state to state.

HEIRARCHY OF ENGINEERING DEPARTMENT :



Write the size of cement batch box .

ans- 400mm ×300mm×300mm