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Costing & Estimation

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ABSTRACT

Estimating is the technique of calculating or knowing the various quantities and the expected Expenditure to be experienced on a particular work or project. In case the funds present are less than the calculated cost the work is done in part or by deducting it or specifications are altered, the following requirement is worth essential for preparing an estimate. Drawings like plan, elevation, and sections of important points. Detailed specifications about workmen ship & properties of materials etc. A cost estimate is the approximation of the cost of a program, project, or operation. The cost estimate is the product of the cost estimating process. The cost estimate has a single total value and may have identifiable component values. A problem with a cost overrun can be avoided with a credible, reliable, and accurate cost estimate. A cost estimator is a professional who prepares cost estimates. There are different types of cost estimators, whose title may be preceded by a modifier, such as building estimator, or electrical estimator, or chief estimator. Other professional titles may also prepare cost estimates or contribute to cost estimates, such as quantity surveyors, cost engineers, etc Standard of construction can be achieved by careful supervision and selecting proper specifications whereas, for Economy, planning is a must. The total quantity of various materials used in construction, if known beforehand, can help the planning towards the economy.

Keyword: Cost Estimate, Project Planning, Planning and Economic Component Value,

1. INTRODUCTION

Estimating is the method of estimating or computing the various quantities and the expected expenditure to be incurred on a particular work or project. In case the money provided for a purpose known to us are less than the estimated cost the work is done in part or by deducting it or by reducing it or specifications are changed, the following requirement are necessary for making an estimate

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

1.1 NEED FOR ESTIMATION AND COSTING

Estimate provides an idea of the work and hence its possibility to be done easily i.e., whether the project could be taken up within the funds available or not estimate gives an idea of time necessary for the completion of the work. The estimate is required to invite the tender to plan economy before actual construction.

2. PROCEDURE OF ESTIMATING AND COSTING

Estimating involves the following operations

- Preparing detailed Estimate.
- Estimating the rate of each unit of work

- Making abstract of the estimate.

DATA REQUIRED TO PREPARE AN ESTIMATE

- Drawing i.e., plans, elevations, sections etc.
- Specifications.
- Rates.

DRAWINGS

If the drawings are not as clear as it should be and without complete dimensions, the preparation of estimate become much difficult. So, it is very important before preparing an estimate.

SPECIFICATIONS

General Specifications: This gives the nature, quality, class and work and materials in general terms to be used in various parts of work.

Detailed Specifications: These give the detailed descriptions of the various items of work laying down the quantities workmanship and implementing of work

RATES

- For preparing the estimate the unit rates of each item of work are essential to be known
- For arriving at the unit rates of each item.
- The rates of different materials to be used in the construction.
- The cost of transport materials.
- The wages of workers, skilled or unskilled of masons, carpenters, labour, etc.

LUMPSUM

While preparing an estimate, it is not easy to work out in detail in case of petty items. Items other than civil engineering and construction such items are called lump sum items or simply Lump sum items.

The following are some of the lump sum items in the estimate:

- Water supply and sanitary arrangement
- Electrical installations like meter, motor etc.
- Architectural features.
- Contingencies and unforeseen items.

In general, a certain percentage on the estimation is provided for the above lump sum items. Even if sub estimate made or prepared at the end of execution of work, the real cost should not exceed the L.S. amounts provided in the main estimate.

WORK CHARGED ESTABLISHMENT

During the construction of a project a considerable amount of skilled supervisors, work assistance, watchmen etc., are employed on a temporary basis.

The salaries or wages of these peoples are drawn from the L.S. amount allotted towards the work charged established, that is, established which is charged directly to work and L.S. amount of 1.5% to 2% of the estimated cost is given towards the work charged establishment.

UNITS OF MEASUREMENT

The units of measurement are mainly classified by their nature, shape, and size and for making payments to the contractor. The principle of units of measurements eventually consists the following:

- Single units like doors, windows, trusses etc., are expressed in numbers
- Works consists linear measurements involve length like a cornice, fencing, hard rail, bands of specified width etc., are expressed in running meters.
- Works consists cubical contents which include volume like earthwork, cement concrete, masonry etc are mentioned in cubic meters.

RULES FOR MEASUREMENT

The rules for measurement of each item are normally described in IS -1200. However, some of the general and normal rules are listed below.

- Measurement shall be made for finished item of work and description of each item shall include materials, transport, labour, fabrication tools and plant and all kinds of overheads for finishing the work in required shape, size, and specifications.
 - In booking, the order shall be in the sequence of length, breadth and height or thickness.
1. All works shall be measured subject to the following tolerances.
 - Linear measurement shall be measured to the nearest 0.01m.
 - Areas shall be measured to the nearest 0.01sq.m.
 - Cubic contents shall be worked out to the nearest 0.01 cum
 - The Same type of work under different conditions and nature shall be measured separately under separate items.
 - The bill of quantities shall fully describe conditions and nature shall be measured separately measured separately under separate items.

METHODS OF TAKING OUT QUANTITIES

The quantities of earthwork, foundation concrete, brickwork in plinth and superstructure etc., can be a workout by any of following two methods:

- Longwall - short wall method
- Centre line method
- Partly center line

Long wall short wall method

In this method, the wall along the length of the room is considered to be long wall while the wall perpendicular to the long wall is said to be a short wall. To get the length of the long wall or short wall, calculate first the center 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 centerline length.

Centerline method

This method is suitable for walls of similar cross sections. Here the total centerline 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.

Partly center line and partly cross wall method

This method is adopted when external (i.e., all-around the building) wall is of one thickness and the internal walls having different thickness. In such cases, centerline method is applied to external walls and long wall short wall method is used to internal walls.

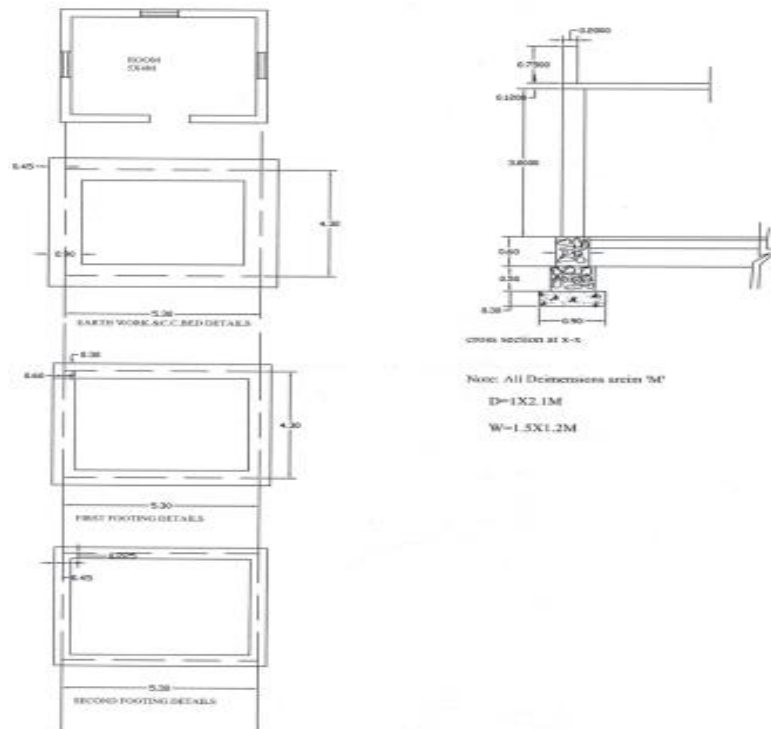
Estimation and Costing

P.B.-1: From the Drawing given below determine (a) Earth work excavation

(b) CC (1:5:10) Bed (c) R.R.Masonry in C.M. (1:6) (d)

Brick Work in C.M. (1:6).

Single Roomed Building (Load Bearing type structure)



TYPES OF ESTIMATE

- **PRELIMINARY ESTIMATE:** These are employed in the early planning phases of a proposed project to match client needs, assessed programmatic requirements and budget constraints in order to establish project scope and quantity expectations. Estimate comparisons at this stage are utilized in evaluating the feasibility of strategic alternative being considered to satisfy current and projected space requirement.
- **MEASURED ESTIMATE:** Measured Estimate is developed after proceeding with preferred solutions during the latter part of the study phase. These estimates maintain accountability for initial budget projections and are used as a means of evaluating competing alternative construction assemblies, system, and materials.
- **FINAL ESTIMATE:** At the completion of design development and during construction documentation, a complete pre-bid estimate can be prepared using Unit price estimate as described below. These estimate can be prepared using Unit price estimate as described below. The estimate is organized in the same format required of bidders, usually the CSI Master under MGL 149. This estimate allows for a comparison of the final estimate with the bids received and may aid in any contract negotiations.
- **SCHEDULE OF RATES:** A project may contain significant quantities of repetitive elements, without the exact amounts being defined. In this instance, DCAM may issue the Bid document as a partial or complete Schedule of rates contract. A list of items and projected quantities is provided, leaving the bidder the opportunity to provide a rate for each item.
- **ESTIMATING FORMAT:** The two most commonly used Unit Price formats are CSI Master Format 2004 which provide a 31 division master list of numbers and titles for arranging products and activities and ASTM UNIFORM 2TM , which hierarchically groups building elements into 12 “systems based” levels. Master Format is widely used within the design and construction industry and is the usual format for construction specifications and most private sector project based cost estimating activity.

HISTORICAL DATABASES

These are several historical databases available that provide current values for estimating costs of the various units of project work. The databases are compiled from records of actual project costs, and are published in the form of books.

ESTIMATE COMPONENTS

Backup detailed estimating data may be in any format. As long as the items or work are properly grouped by level 3 account numbers, estimating details workups below level 3 need not be identified UNIFORMAT account numbers. To ensure that all components of an estimate are allowed for the following points need to be considered.

1. Regardless of format or type, every estimate can be rolled up to provide Total Project Cost(T.P.C.)
2. Standard contracts consider only ECC (Estimated Construction Cost) with additional “soft costs” added separately as margins or actual estimated amounts.
3. Projects delivered using an RFP, Design Build or CM. At risk have some or all of the “soft costs” built into the estimate, mingling ECC and soft cost components.

TPC COMPONENTS

CONSTRUCTION COSTS

- Elemental: Section A through G plus General Conditions.
- CSI: Sections 1 through 4 plus General Conditions.
- Insurances, Escalations, Contractors, Overheads and Profits.

Non-construction Costs (“Soft” or “Budget” Costs)

- Feasibility study with supporting studies and reports
- Design fees and specialist Consultants
- Site acquisition
- Permits, Certifications, and legal fees
- Community allowances, utility or other relocations
- FFE (furniture, fixture, and equipment)
- Financing and insurance costs through to startup
- Development fees

PLANING THE WORK

It is important to thoroughly understand the project scope of work and the bid ability and constructability aspects of the projects being estimated. The cost estimator must thoroughly review drawings, specifications, and other references to formulate a construction sequence and duration. A site visit for all consultant is recommended to relate the physical characteristics of the project to the available design parameter and details.

QUANTITIES

The cost estimator is responsible for the accuracy of quantity take-offs from drawings and specifications prepared by the architects or others consultants.

- The quantity takes off is an important part of the estimate and should be based on all available design data. All quantities should be shown in standard units of measures.
- The details in which the quantities are prepared for each task is dependent on the development phase of the design. Quantity calculations and unit build ups beyond design details may be necessary to determine a reasonable price to complete the overall scope of work for the cost estimate.

UNIT PRICING

As a general rule, approximately 80 percent of the direct costs of projects are represented by only 20percents of the estimated work item. Therefore the greatest estimating efforts are concentrated on these elements. The unit rates for each of these items are carefully analyzed and developed as the summation of all direct and direct costs that will likely be incurred by an experienced and well-equipped contractor.

BID SCHEDULE

The bid schedule is part of the procurement package and is included in the solicitation for bids. The estimate must show the unit prices, quantities, an extension of unit prices, lump sum items, and costs consistent with the schedule provided with the Bid Documents.

CONSTRUCTION SCHEDULE

The designer and consultant team will prepare a construction schedule to support the estimate that is consistent with the plans and specifications for completion of the work. It may be in the form of a GANTT chart or a PERT diagram, but it must identify the sequence and duration of the tasks upon which the costs estimates is developed.

ESTIMATE NOTES

“Notes” are any explanation necessary to support the development of cost for individual items in the cost estimate. This descriptive information covers areas such as manufacture quotes, overtime requirements and materials availability. These should be entered as notes to the appropriate detail level of the cost estimate.

ESTIMATING CONTINGENCIES

To develop appropriate contingency allowances the estimator must identify the uncertainty associated with an item of work or task, forecast the risk/cost relationship and assign a value to this task that will limit the cost risk to an acceptable degree of confidence. Consideration must be given to the details available at each stage of planning, design or construction for which a cost estimate is being prepared.

OVERHEAD

Overhead costs are those costs that cannot be attributed to a single task of construction work. Costs that can be given to a particular item or work should be considered direct costs to that item and not be involved in overhead costs.

The overhead costs are customarily divided into two categories:

- General conditions, including all job overhead, general site costs, and field office overhead. When estimating items cost over the entire duration of construction, the Cost Estimator should utilize the job schedule.
- OH&P covering Overhead, Administrative costs, and Profit. OH&P expense is those incurred by the contractor in the overall management of business.

PROFIT

Profit is shown as a percentage loading and provide the contractor with an incentive to perform the work as best as possible. The Cost Estimator must use old historical data to provide an appropriate industry profit loading, modified by a depth knowing of marketing conditions likely to impact the present project.

DATABASE SPACE MEASURES

The designer will provide or give the estimator with a space analysis mentioning the program areas mentioned or given for in the concept design, the support areas and the gross areas., The designer should try very hard for high space efficiency that may result in a building with less gross are than the estimated maximum gross areas provided by DCAM as the basis for the project.

DCAM will use the space and program areas at each phase as a basis for judging and cost modeling the building to ensure program and cost budgets are met. During each phase, the Estimator is expected to give cost information support for the Designer.

Space Measures/ Phase	Bud get	Stu dy	S D	D D	C D	Bi d	Co nst
Functional Unit Measure (Accommodat ion)	√						
Program Area Measures	√	√	√				
Program Area Factors	√	√					
Building Area Factors	√	√					
Program Area Detailed Measures	√	√	√				
Building Area Detailed Measures	√	√	√	√			
Building Performance Measures	√	√	√	√			

BUILDING FLOOR AREA MEASUREMENT

- **THE STANDARD ASTM E1836-98**
DCAM uses the ASTM E1836-98, "Standard Classification for building floor area measurement" as a basis for preparation of program areas and support areas to make up the total gross floor area of the project. DCAM model groups program areas according to the type and nature of the project.
- **DCAM SPACE MODEL FOR ADMINISTRATIVE BUILDING**
The table below illustrates a typical space model configuration for an administrative building function. Sections D, E, and F are common to all buildings. Note that section C, "Assignable Area Loading", is only applied at preliminary study phase, when standardized program areas are utilized to assess the project scope.
- **SUMMING THE TABULAR MODEL**
The diagram below demonstrate and shows how the tabular model is shown below is to be summed to match the gross floor area at each phase. The accuracy of measurement is indicated below.

SUMMARY

The main motive is to give a reasonable idea of the cost. An estimate is essential to give the owner a reasonable right idea of the cost to help him understand whether the work can be undertaken as proposed or needs to be curtailed or abandoned, depending on the availability of funds and prospective direct and indirect benefits. For government works proper sanction has to be obtained for allocating the required amount. Works are often let on a lump sum basis, in which case the estimator must be in a position to know exactly how much expenditure he is going to incur on them.

- **ESTIMATING MATERIALS**
From the estimate of a work, it is possible to determine or know what materials and in what quantities will be required for the works so that the arrangements to procure them can be made.
- **ESTIMATING LABOUR**
The number and types of workers of different categories and forms who will have to be employed to complete the work in the specified time can be found from the estimate.
- **ESTIMATING PLANT**
An estimate will help in knowing amount and kind of equipment or tools needed to complete the specific work.

CONCLUSION

Estimate give an idea of the cost of the work and hence its feasibility can be determined i.e whether the project could be taken up within the funds available or not. The estimate gives an idea of the time required for the completion of the work. The estimate is required to invite the tenders and Quotations and to arrange a contract. The estimate is also required to control the expenditure during the execution of work. Estimate decides whether the proposed plan matches the funds available or not.

REFERENCES

- This example was adapted with permission from a paper "Forecasting Industry Resources", presented by A.R. Crosby at the Institution of Chemical Engineers in London, November 1981.
- See H.T. Johnson and R.S. Kaplan, *Relevance Lost: The rise and fall of Management Accounting*, Harvard Business School Press, and Boston, MA 1987, p.185.