

Revised Edition

A TEXTBOOK OF ESTIMATING AND COSTING (CIVIL)

Quantity Surveying

**[INCLUDING ACCOUNTS AND
BUILDING BYE-LAWS]**



**D.D. KOHLI
Ar. R.C. KOHLI**

S. CHAND

A TEXTBOOK OF
**ESTIMATING
AND COSTING**
(CIVIL)

Quantity Surveying

[INCLUDING ACCOUNTS AND BUILDING BYE-LAWS]

For Students of Engineering and Architecture

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FOREWORD

India is a fast developing country and a developing country can't afford to waste its resources, components, particularly in construction, due to wrong planning and estimation. A structure *i.e.* building, bridge, dam *etc.* is composed of various building materials. Due to the rising cost of materials, the structure has to be designed so that it is safe, serviceable and economical. Without proper design and estimation, it may lead to the increase in the cost of construction; thus the economical aspect of the structure is affected. A prior knowledge of various building materials, required for a construction, controls the cost of the structure, save wastage of labour-hours, helps in giving the correct amount required and quantity of various materials required. It also helps in scheduling of men, materials, money and machines to be used in the project at stages.

It gives me pleasure that the book written by Sh. D.D. Kohli and Ar. R.C. Kohli, on Estimating and Costing Building Bye-Laws and Accounts for field-staff and engineering students, serves the purpose it is meant for. The book is written in simple language and self-explanatory, reflects the image of the authors' long experience in field and teaching as well. The new revised edition of the book is a composite unit, complete in itself. The presentation of the matter is simple and excellent.

I wish them success.

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PREFACE TO THIRTEENTH EDITION

The Revised Edition of the book “A Textbook of Estimating and Costing” (Quantity Surveying) is again in your hands. The book is which written in systematic way following the methods adopted in P.W.D and in simple language, has been liked by degree students and Diploma students, of Civil Engg. and Architecture. The rates of items are fluctuating, hence to get the correct cost, it is advised to follow the prevailing rates of P.W.D and add premium. Quantities can be calculate with the help of book. Solved questions papers of different states have been added in the end of the book.

Although all efforts have been made to make the book mistake free, Suggestions for improvement are welcome.

In the end, Authors extend their sincere thanks to the Management Team and Editorial Staff of S. Chand & Co. Pvt. Ltd., New Delhi, for doing a lot of efforts in publishing the book.

AUTHORS

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PREFACE TO THE FIRST EDITION

The aim of the author's present attempt is to produce a book on "**ESTIMATING AND COSTING & CIVIL DRAWINGS**", which should fully meet the requirements of the students, preparing for the Diploma and Draftsman classes (Civil).

No doubt there are several books on this subject in the market, but it is a fact that no one exclusively satisfies in full, the need of the **Engineering students**.

The scheme of my book is very simple. I have started with the working out the quantities from an elementary stage. In my experience of teaching, I have noticed that it is difficult for the beginners to jump to the estimate of a building or a culvert without having the elementary knowledge of working out detailed quantities of various items. Hence, I have begun with the simple calculations of models and junctions of walls and then have passed on to the estimates of Buildings, Roads and Culverts etc.

All estimates are worked out by the method employed in the Punjab Public Works Department and the book completely covers the syllabus of Diploma and Draftsman Classes (Civil).

In my experience of about 32 years in the Public Works Department, both in the **Punjab** and outside, I have also seen that the theoretical knowledge acquired by the students in schools and colleges is not of much practical use to them when they are called upon to work in the various departments. The book aims at **BRIDGING** the gap between what a student knows and what he ought to know. It is primarily intended.

Every effort has been made to present the matter in a simple manner. However, suggestions for the improvement of the book will be gratefully accepted.

If the students face any difficulty regarding anything given in the book, the Author will welcome much queries.

D.D. KOHLI

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CHAPTER

INTRODUCTION

INTRODUCTION TO ESTIMATE, TYPES OF ESTIMATES, VARIOUS DRAWINGS ATTACHED WITH ESTIMATES, IMPORTANT TERMS, ROUGH COST ESTIMATE

1.1 INTRODUCTION

“What is the purpose and necessity of studying this subject ?” This is the first question which arises in mind. The answer lies in the following questions:-

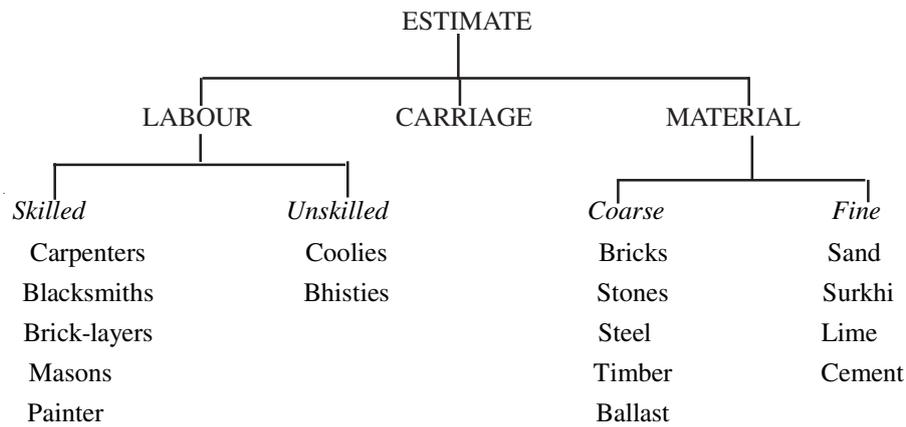
- (a) Has one got enough money to spend on the construction ?
- (b) Has one got ample time that one can wait for the completion of the construction for a long time ?
- (c) Has one got resources that one can arrange any amount of desired material to be used in construction ?

If the answer is *YES*, then the study of this subject is useless. But if the answer is *NO*, then the question arises, “*which are the factors necessitating the study of this subject.*” Any person indulged in the Civil Engineering profession can clearly think of these factors i.e. set amount of funds, costly labour (skilled and unskilled), difficulty in getting good building materials, particularly cement and day to day rising cost of steel, bricks, timber, sand, bajri etc. Also *economy* and *standard* of the construction are two important things required. 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 before hand, can help the planning towards economy i.e. if it is known before hand how much cement, sand, bajri, bricks, steel, timber etc, are required, then during construction, check can be had on more consumption of material and this check can prevent misuse of materials. Storing problem can also be solved by arranging the material at the time of need. A computer (estimator) having experience in this field can calculate the quantities of various materials from the supplied drawings, by using simple mathematical calculations. *Units* used for various items are those, which have been recommended by *Indian Standard Institute (I.S.I.)* now *B.I.S.* i.e. cubic metre for volume, square metre for area, metre or centimetre or millimetre for length, litres for liquids, kg or tonnes for weights. For example: unit for excavation for foundation is cubic metre (cub. m), the calculations for earth work is done as $\text{length} \times \text{breadth} \times \text{depth} = \text{cubic contents}$, similarly other items are calculated. After complete and accurate calculations have been done, these contents are multiplied with rates meant for each item. This will result in knowledge of total expenditure on materials required and commonly known as “*Abstract of Cost.*” The rates for calculating abstract of cost can be applied as given in the book “*Schedule of Rates.*” followed in P.W.D. of states. The details of calculations have been shown in the following chapters systematically. Beginners will generally find estimates of buildings easier to the estimates of bridges, not that the latter are more difficult, but most of the people are more familiar with the several parts of a building than they are with those of a bridge. In short the subject is not **difficult** one, being merely an application of the ordinary rules of mensuration to practical use. To attain a good and useful knowledge of it, a fair amount of practice and the ability to read the plans quickly is required.

Thus an Estimate is a calculation of the various items of an engineering works, so as to know its approximate cost and the quantities of various materials required with the labour involved for its satisfactory completion.

The computation involved in arriving at the above details is called **Estimating**.

The sketch given below gives its analysis.



1.2 TYPES OF ESTIMATES

The estimates may be divided into the following categories:-

- (1) Preliminary or Approximate estimate.
- (2) Rough cost estimate based on plinth area.
- (3) Rough cost estimate based on cubic contents.
- (4) Detailed estimate.
- (5) Annual repairs estimate.
- (6) Special repairs estimate.
- (7) Revised estimate
- (8) Supplementary estimate.

1. Preliminary or Approximate estimate

This estimate is prepared to decide *financial aspect, policy* and to give idea of the cost of the proposal to the competent sanctioning authority. It should clearly show the necessity of the proposal and how the cost has been arrived at.

The calculations for approximate estimate can be done with the following data. The data can be had from a similar construction already complete in the nearby area, excuted by the department.

For example: To calculate approximate estimate for a Hospital, per bed cost is calculated from the recent completed hospital and is multiplied with the number of beds required. Similarly for a house, per square metre plinth area cost is calculated and is multiplied with the proposed covered area. The specifications should also be same. For a road, expenditure of per kilometre length is taken and width also plays the role.

The following documents should be attached with it.

- (a) Detailed report
- (b) Site plan of the proposal
- (c) It should also clearly mention about the acquisition of land, Provision of electric and water supply etc.

2. Plinth area Estimate (Based on Rough Cost)

Plinth area of a building means Length × Breadth (roofed portion only) excluding plinth offsets.

The estimates are prepared on the basis of plinth areas of the various buildings proposed to be constructed. The **rates** are being arrived at by dividing the total cost of construction with its plinth area. For example: if total cost of a building is ₹ 3.5 lac and its plinth area is 50 sq. m., then plinth area

$$\text{rate} = \frac{3,50,000}{50} = ₹ 7000/- \text{ per sq. m.}$$

Using this rate as basis of the next construction,

approximate or rough cost of the proposal can be arrived at by multiplying the plinth area of the proposed building with this plinth area rate.

The following documents are attached with the estimate.

- (a) Line plan of the building with brief specifications.
- (b) Cost of various services added i.e. electric and water supply etc.
- (c) North line should be shown clearly on line plan.

3. Cubic Contents Estimate (Based on Rough Cost)

The cubic contents of a building means plinth area × height of the building. *The height is taken from top of floor level to top of roof.*

The cubic contents of the proposed building are multiplied with cubic rates arrived at for the similar construction i.e. total cost of construction divided by cubic contents = cost per cubic metre.

Documents attached are as in No. 2

(Administrative approval is granted on rough cost estimate)

4. Detailed Estimate

After getting *Administrative approval* on rough cost estimate, detailed estimates are prepared.

In this, the estimate is divided into sub-heads and quantities of various items are calculated individually.

In the end of the detailed quantities, an *abstract of cost* giving quantities of each item and rate of every item according to the sanctioned schedule of rates shall be attached. In case of non-schedule rates i.e. rates which are not given in the sanctioned schedule of rates, proper analysis of rates shall be attached. If however the work proposed to be constructed is located in a remote place, the provision for the *carriage* of the material shall be added in the estimate to avoid any excess over the administratively approved estimate later on. *Detailed Specifications & Report* should also be attached with the estimate. **Technical sanction** is given on detailed estimate.

The detailed estimate shall also provide for the cost of approach road, water supply, electric installations and acquisition of land etc, so as to call it a *comprehensive estimate*.

5. Annual Repair Estimate

In order to keep Buildings and Roads in perfect condition, annual repairs should be carried out as under :-

- (i) ***In Case of a Building***—white washing, oiling and painting of doors and windows, cement plaster repairs (inside & outside), repairs of floors etc. In no case this annual repair amount should increase more than $1\frac{1}{2}\%$ to 2% of the capital cost of the building.
- (ii) ***In Case of a Road***—filling patches, maintenance of berms etc.

6. Special Repairs Estimate

If the work cannot be carried out of the annual repair funds due to certain reasons resulting in the genuine increase in cost, then special repairs estimate is to be prepared.

The reason of increase may be:-

- (i) ***In case of a Building***—opening of new doors, change of floors, replastering walls etc.
- (ii) ***In case of Roads***—If the whole surface is full of corrugation & patches, then the total surface is to be scarified. The old metal is taken out, reconsolidation by adding more metal is done and top surface is repainted.

7. Revised Estimate

When the sanctioned estimate exceeds by 5% either due to the rates being found insufficient or

due to some other reasons, a fresh estimate is prepared which is called a **Revised Estimate**. A *comparative statement* on the last page of the estimate is attached giving therein the reasons of the increase of cost in case of each item.

8. Supplementary Estimate

This is a fresh detailed estimate in addition to the original sanctioned estimate prepared when additional works are deemed necessary during the progress of a work to supplement the original works. The abstract of cost should show the amount of the original sanctioned estimate as well as the supplementary amount for which sanction is required. For example: construction of generator room in the proposed office.

1.3 SOME IMPORTANT TERMS

1. Site Plan

With every estimate of building, a **site plan** to a scale of 1 cm. = 2 m. (1 : 200) or 1 cm. = 5m. (1 : 500) showing the following should be attached:—

- (a) Site of the proposed building.
- (b) Adjacent boundaries of the plot.
- (c) North point which will help in orientation of the building.
- (d) Position of roads, drains and utility of the building.

The site plan will give an idea about the value, comfort and utility of the building.

2. Lay-out Plan (For Buildings)

In planning the colonies or group of buildings, a **lay-out plan** is generally prepared which will give the following data:—

- (a) Adequate roads alignment so that every plot holder should have an easy approach to his house.
- (b) *Water Supply and Drainage* arrangements.
- (c) *North point* should be shown which will give an idea of the orientation of a plot.
- (d) The lay-out plan should also show the position of *Hospital, School, Market, Lawns* etc. The plots in a lay-out plan should also be numbered.

3. Index Plan (For Roads)

With every estimate of a road, an *Index plan* to scale of 1 cm. = 0.25 km. or 4 cm. = 1 km. should be attached. The Index plan will show the following:—

- (a) Alignment of the road followed.
- (b) Important towns and mandis, the road will be connecting.
- (c) Rivers, Nallahs etc. the road is crossing.
- (d) Number of bridges or culverts to be constructed.

In short an Index plan gives an idea whether the alignment of the road followed is suitable, useful and profitable or not, for the people.

4. Report

For the justification of the proposal, a report should be attached with the estimate which should consist of the following sub-heads:—

- (a) *History*: Brief history justifying the necessity of proposal should be given under this sub-head.
- (b) *Design*: In case of buildings, the **accommodation** provided should be mentioned and in case of roads, the **alignment** followed should be stated, mentioning how far it is beneficial to the public.

- (c) *Scope:* Provisions made under this sub-head *i.e.* of land, electric and water supply services to be given.
- (d) *Rates:* Rates followed are of sanctioned scheduled rates or non-scheduled rates. This fact is to be mentioned under this sub-head.
- (e) *Cost:* Total cost of the scheme to be given.
- (f) *Land:* Land to be acquired or not, to be mentioned under this sub-head.
- (g) *Time:* Time required for the completion of the work to be given.
- (h) *Carrying out the work:* Whether the work is to be carried out by **Departmental system** or on **Contract system**.
- (i) *Expenditure:* Whether the whole amount can be spent during the financial year or not.
- (j) *Income:* Any return of revenue from the construction in the shape of rent or tax.

In short, the report should be self explanatory and should give all the facts of the proposal to justify its necessity.

5. Contingencies

It is defined as incidental expenses of miscellaneous character which cannot be classified approximately under any distinct sub-head, but is added in the cost of construction necessarily. It is 5% of the estimate and added as contingencies & petty works, e.g. medicines for labour or purchase of tools.

6. Work Charged Establishment

During the construction of big projects of buildings and roads, a number of skilled Supervisors, Munshis, Mates and Chowkidars are employed to assist the existing staff. Their salaries are paid from work charged establishment accounts, the provision of which is made in the estimate. The payment to work charged establishment is made monthly on work charge rolls, which are charged direct to works. The provision is @ $1\frac{1}{2}\%$ to 2% of the cost of estimate.

7. Tools and Plant (T & P)

For the execution of big works, provision for the purchase of machinery etc. @ $1\frac{1}{2}\%$ to 2% of the estimated cost is provided. If the work is given on contract basis, it is the job of the contractor to arrange for tools and plant and the required machinery.

8. Sub-head

For finding the detailed estimate, the Head of the work is divided into sub-heads. This helps in dividing the cost sub-head wise resulting in the control of expenditure e.g. Earth work, Concrete, Brick work, Painting etc. are sub-heads, of the head **House**.

9. Sub-work

If the project is very big, it is divided into small works. This helps in keeping the accounts under control and a check on expenditure sub-work wise. For example if a Technical Institute building with hostels is under construction, then hostel is sub-work of main construction.

10. Provisional Sum

It is provided in the estimate and bill of quantities for some special work to be done by a special-firm whose details are not known at the time of "preparation" of estimate, e.g. anti-termite and sub-soil water treatment in basement.

11. Capital Cost

It is total cost of construction including all the expenditure incurred from beginning to the completion of the work.

12. Material Statement

A form showing total quantity of various building materials required for the completion of the construction is known as *material statement*.

13. Plinth Area

It is defined as covered area of a building measured at floor level. It is measured by taking external dimensions of the building excluding plinth offset if any.

14. Floor Area

It is defined as clear covered area i.e. plinth area excluding area of walls (generally 10%–15%). Sills of the doors are not included in floor area. The floor area of every storey shall be measured separately.

15. Carpet Area

This means area in a building which is useful one i.e. Area of drawing room, dining room, bedroom etc. Areas of kitchens, staircase, stores, verandahs, entrance hall, bath room, basement etc. are excluded. It is generally 50% to 60% of the plinth area.

16. Circulation Area

Area used for movement i.e. verandah, staircase, corridor, balconies etc. is termed as circulation area.

Circulation area is approximately equal to plinth area minus carpet area.

(Refer IS : 3861 for more details of area)

17. Premium and Rebate

The tendered percentage rate above the notified rates is called *Premium* while the tendered rate below the notified rates is called *Rebate*.

The premium depends upon the current price index and is decided by a team of Chief Engineers and Superintending Engineers from time to time, and the notified rates are rates approved in "Schedule of rates".

18. Bar Bending Schedule

A chart showing the shape and dimensions of every re-inforcing bar and number of bars required on a particular job for construction of R.C.C structure.

19. Rate of Cost: It is defined as the cost per unit of sub-head which is arrived at by dividing the up-to-date final charges on a sub-head by its up-to-date progress.

20. Sundries

This is defined as the provision made in the analysis of rates to meet with the cost of T & P etc.

21. Dismantling

This term implies carefully taking up or down and removing any article or structure without damage. Articles shall be passed by hand, and lowered to ground wherever necessary and not thrown. Nails, Screws etc. are taken out with proper tools and not by ripping off. For example: taking out a *wall* in between two rooms to make it bigger one. The material removed i.e. bricks are stacked carefully. This can be re-used after proper cleaning.

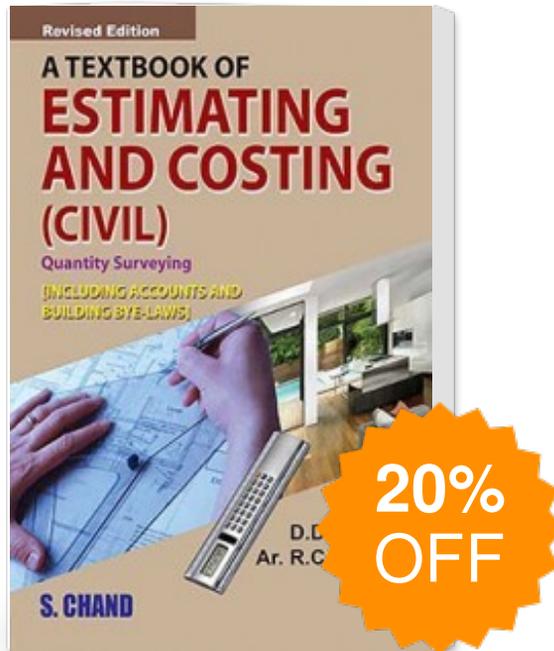
22. Demolition

This term implies taking up or down or breaking up a structure and clearing off the site. Anyhow useful material is to be taken out with care to fetch some cost.

23. Over Head Cost

In case of Labour Cost, provision of 21.5% has been added in the sanctioned schedule of rates of

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