

# **ATME College of Engineering**

**13<sup>th</sup> K M Stone, Bannur Road, Mysore – 570028**



**A T M E**  
**College of Engineering**

**DEPARTMENT OF CIVIL ENGINEERING**

**(ACADEMIC YEAR 2024-25)**

**SUBJECT: QUANTITY SURVEYING & CONTRACT MANAGEMENT**

**SUBJECT CODE: 21CV71**

**SEMESTER: 7<sup>TH</sup>**

## **INSTITUTE**

### **Vision of the Institute**

Development of academically excellent, culturally vibrant, socially responsible and globally competent human resources.

### **Mission of the Institute**

- To keep pace with advancements in knowledge and make the students competitive and capable at the global level.
- To create an environment for the students to acquire the right physical, intellectual, emotional and moral foundations and shine as torchbearers of tomorrow's society.
- To strive to attain ever-higher benchmarks of educational excellence.

## **DEPARTMENT**

### **Vision of the Department**

To develop globally competent civil engineers who excel in academics, research and are ethically responsible for the development of the society.

### **Mission of the Department**

- To provide quality education through faculty and state of the art infrastructure.
- To identify current problems in the society pertaining to Civil Engineering disciplines and to address them effectively and efficiently.
- To inculcate the habit of research and entrepreneurship in our graduates to address current infrastructure needs of society.

### **PROGRAM EDUCATIONAL OBJECTIVES (PEO's)**

- Graduates who complete their UG course through our institution will be,
- **PEO 1** - Engaged in professional practices, such as construction, environmental, geotechnical, structural, transportation or water resources engineering by using technical, communication and management skills.
- **PEO 2** - Engaged in higher studies and research activities in various Civil Engineering fields and a life time commitment to learn ever changing technologies to satisfy increasing demand of sustainable infrastructural facilities.
- **PEO 3** – Serve in a leadership position in any professional or community organization, or local/ state engineering board.
- **PEO 4** - Registered as a professional engineer or developed a strong ability leading to professional licensure being an entrepreneur.

### **PROGRAM SPECIFIC OUTCOMES (PSO's)**

- **PSO1:** Provide necessary solutions to build infrastructure for all situations through Competitive plans, maps and designs with the aid of a thorough Engineering Survey and Quantity Estimation.
- **PSO2:** Assess the impact of anthropogenic activities leading to environmental imbalance on land, in water & in air and provide necessary viable solutions revamping water resources and transportation for a sustainable development

### **PROGRAM OUTCOMES (PO's)**

**PO1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2:** Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3:** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4:** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**COURSE SYLLABUS:**

<b>Quantity Surveying &amp; Contracts Management</b>	
Sub Code: <b>21CV71</b>	IA Marks: <b>40</b>
Hrs/ Week: <b>03</b>	Exam Hours: <b>03</b>
Total Hrs. <b>40</b>	Exam Marks: <b>60</b>
<b>Module -1</b>	
<b>Chapter 1:</b> Estimation: Type of estimates, Understanding the enclosures of an estimate, General terminology, units of measurement, Preparation of abstract, approximate methods of estimating buildings, cost of materials and recommended labour coefficients. Building Estimate: Methods of taking out quantities and cost (center line method & long and short wall method).	
<b>Chapter 2:</b> Preparation of detailed and abstract estimates for– Buildings – Masonry structures, framed structures. Flat, slopped RCC roofs with all building components.	
<b>Module -2</b>	
<b>Chapter 1:</b> Estimation of flat slopped RCC roofs, steel truss. Culverts (including box culvert, pipe culvert and RC slab culverts) manhole and septic tank. Measurement of Earth Work for Roads: Methods for computation of earthwork by mid-section formula, trapezoidal or average end area or mean sectional area formula, prismoidal formula.	
<b>Chapter 2:</b> Project Preparation: Preliminary Survey Report and Detailed Project Report.	
<b>Module -3</b>	
<b>Chapter 1:</b> Significance of Microsoft Excel or any other equivalent software in estimation.	
<b>Chapter 2:</b> Specifications: Definition of specifications, objectives of writing specifications, essentials in specifications, general and detailed specifications of item of works in buildings, specifications of aluminium and wooden partitions, false ceiling, aluminium and fiber doors and windows. Various types of claddings.	
<b>Module -4</b>	
<b>Chapter 1:</b> Rate analysis: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works or doors, windows and ventilators.	
<b>Module -5</b>	
<b>Chapter 1:</b> Contracts: Types of contract-essential of contract –legal aspects, penal provision on breach of contract. Definition of the terms-Tender, Earnest money deposit, tender forms, documents and types. Comparative statements, acceptance of contract documents and issue of work orders, duties and liabilities, termination of contract, completion certificate, quality control, right of contractor refund of deposit. Administrative approval - Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.	

**MODULE 1**

1.0 TERMINOLOGIES IN ESTIMATION & QUANTITY SURVEYING

1.1 PRINCIPLES OF MEASUREMENTS

1.2 QUANTITY SURVEYOR

1.3 TYPES OF ESTIMATION

1.4 APPROXIMATE ESTIMATE

1.5 DETAILED ESTIMATE

1.6 BUILDING ESTIMATE

1.7 MAIN ITEMS IN BUILDING WORK

1.8 IMPORTANT QUESTIONS

## 1.0 TERMINOLOGIES IN ESTIMATION & QUANTITY SURVEYING

- **Taking off in quantity surveying:** This is the process of finding out the quantities for various items of works involved in a project by taking off various dimensions from the plan, sections of the drawings and tabulating in a measurement sheet. The measurement sheet contains following columns like description, number, length, breadth, thickness/height and quantity.
- **Contingencies:** There are certain expenses which are incidental in nature and it is not possible to predict them with reasonable accuracy. To cater all such expenses an additional amount of 3% to 5% of estimated cost is provided in the total estimate.
- **Lump sum items:** These are small items, such as, front architectural or decoration work of a building, fire-place, 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.
- **Work charged establishment:** During the construction of a project considerable number of skilled supervisors, work assistance, watch men etc., and are employed on temporary basis. The salaries of these persons are drawn from the L.S. amount allotted towards the work charged establishment. That is, establishment which is charged directly to work. An L.S. amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.
- **Tools and plants (T&P):** Use of special type of tools and plants, like concrete mixture, batching plants or WMM plant, etc., may be required for efficient execution of large projects. To cater such expenses about 1% to 1.5% of the estimated cost is allotted under the head tools and plants (T&P).
- **Day work:** During execution of a project there may be certain type of works, for which the actual quantities of labor required is difficult to measure. For example fine architectural works, and drawings in the wall. The payments towards such items are made on the basis of actual number of days or actual quantity of materials required. Such works are known as day works.
- **Sub work:** A large project may consist of several independent small works. Such small works are known as sub work. For example setting of a university may contain the

construction of administrative building, classrooms, faculty chambers, hostels and faculty residences. Estimations for each of the sub works are done separately and accounts of expenditure are kept sub work wise.

- **Deposit work:** The construction or repair works whose cost is not met through government funds but through some non-government sources is called deposited work. The cost is deposited in cash or placed at disposal of the divisional officer. The works executed for municipalities or other bodies fall under this category.
- **Provisional quantities:** During preparation of an estimate if it is apprehended that additional quantities against some items may be required due to variation of site conditions, then those quantities are estimated separately from the dimensions of the drawing and kept separately in the estimate under a heading Provisional Quantities.
- **Provisional sum:** While preparing the estimate some amount is provided in it for items whose details regarding cost or specifications are unknown during the preparation. For example the cost and specifications for a lift may be unknown during estimation for the building. Such amounts are known as provisional sum. However the payments for these provisional items are done as per actual rate.
- **Prime Cost:** Prime cost is the purchase cost of articles at a shop. Prime cost is generally referred to the supply of a particular article and not for carrying out a work. The prime cost includes the cost for carriage but excludes the cost of fixing or fitting. For example: the door and window fittings are purchased from the shop at a cost of Rs 1000.00. The transportation cost is Rs.50.00 and the cost for fixing and fitting is Rs.100.00. Then the prime costs of the fittings are Rs. 1050.00.
- **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.
- **Capital Cost:** Capital cost is the actual amount incurred in completing a work. This includes expenditure incurred in surveying, designing, planning, drawing, cost of material, equipment, laborers, supervision, legal expenses, travel expenses, taxes, electricity and water charges, contingencies and any other expenses related to the work but excluding profit.



- **Work value:** This is the total amount provided for all scheduled items of work in the estimate. Thus work value is the estimated value for the work excluding the amount for contingencies, work charged establishment, tools and plants etc. as per actual rate.
- **Abstracting in quantity surveying:** In abstracting the works of a similar description are assembled, grouped and transferred from the measurement sheet to a special rolled abstract paper where they are totaled and reduced to their specified unit of measurement.
- **Summary of estimated cost:** This is the summation of abstract of estimated costs for different sub-works involved in the project and is drawn up separately. Such a summary page is prepared when a project contains different sub-works.
- **General abstract of cost:** This is the summarization of abstract of costs of several individual items of sub-works or works as a whole, like: cost of land, earthwork, bridges, pavement, retaining wall, etc. required to complete a road project. The amount required for contingency, work charged establishment, T&P, maintenance are added on percentage basis to the general abstract of a cost.
- **Bill of quantities (BOQ):** This is defined as a list of brief descriptions and estimated quantities. This lists in a tabular form all the items of work involved in connection with estimate for a project with the description, corresponding quantity, unit rate and amounts column. The columns indicating unit rate and amounts are kept blank. BOQ is provided in a tender form for item rate tenders. Contractors' put up their own competitive rates and calculate the totals to offer their estimate amount to complete the whole work. The BOQ is also required to calculate the quantities of different materials required for the project.

## 1.1 PRINCIPLES OF MEASUREMENTS

### 1.1.1 Units of measurement

The units of measurements are mainly categorized for their nature, shape and size and for making payments to the contractor. The principle of units of measurements normally consists of the following:

Measurement type	Unit	Characteristics of item	Example
Length & width	m	Works have specific length	As pipes
Area	m <sup>2</sup>	Works with specific thickness	As plastering, painting
Volume	m <sup>3</sup>	Variable dimensions	Footings, columns, stairs
Lump-sum (L.S)	Lump-sum (L.S)	Works have details difficult to be calculated	Earth work, earthling system (electrical).
No.	No.	Works have 3 dim. fixed	Windows, doors
Weight	Ton / kg	Have specific width	As steel
Time	Day / hrs	Labor / equipment	Worker's wages, equipment

### 1.1.2. Rules for measurement

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

- Measurement shall be made for finished item of work and description of each item shall include materials, transport, labor, fabrication tools and plant and all types of overheads for finishing the work in required shape, size and specification.
- In booking, the order shall be in sequence of length, breadth and height or thickness.
- Same type of work under different conditions and nature shall be measured separately under separate items.
- All works shall be measured subject to the following tolerances.
  - (i) Linear measurement shall be measured to the nearest 0.01m.
  - (ii) Areas shall be measured to the nearest 0.01 sq.m
  - (iii) Cubic contents shall be worked-out to the nearest 0.01 cum

- In concreting works any opening more than 0.1 m<sup>2</sup> (for items measured by area) or 0.1 m<sup>3</sup> (for items measured by volume) are deducted in the quantity calculation.
- The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.
- In case of masonry (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described.

### 1.1.3. Measurement for common items of work

Item	Unit	Method of measurement
<b>Measurements for earthwork</b>		
Site leveling	Lump sum	It takes into consideration all site leveling including the excavation, fill, till reach 0+B.M according to design drawing
Excavation (cut)	m <sup>3</sup>	Measured by 2 methods : 1. Footing areas according to blinding area × depth of excavation according to drawings. 2. External dimensions of the building x depth of footings
Fill (backfill)	m <sup>3</sup>	= Excavation – concrete work for footings and columns under ground level = Ground plan × depth of ground beams – (concrete for ground beams and ground floors)
<b>Concrete Work</b>		
Blinding concrete, ground concrete, benching, and slabs concrete with fixed thickness	m <sup>2</sup>	= Length × width (the thickness should be specified in the drawings and specifications) {Ribs blocks don't subtract from the slabs concrete.}
Footings, columns, ground beams, stairs, and canopies,	m <sup>3</sup>	= length × width × thickness • Ground beams are measured from its connection with columns • Concrete stairs include the stairs, steps, stair slabs, walls supporting the stairs.
Concrete decoration works as curves.	No.	The dimensions must be specified in the drawings.
<b>Plastering and Painting work</b>		
Plastering and Painting	m <sup>2</sup>	= length × width • Engineering measurement after subtracting the openings, more than 0.1 m <sup>2</sup> . • The area is measured above the skirting (terrazzo chips)
		Internal plastering = walls + slabs

<b>Miscellaneous Work</b>		
Block works	m <sup>2</sup>	= length × width (the thickness should be specified in the drawings and specifications) - Subtract all openings more than 0.1 cm <sup>2</sup> .
Terrazzo, marble, ceramic	m <sup>2</sup>	= length × width (engineering measurement)
Doors/ Windows	No.	The exact dimensions should be specified in the design drawings.
		Sometimes carpentry works measured in m <sup>2</sup> or m length according to the item described in BOQ.
Electrical and sanitary pieces / accessories	No.	The dimensions should be specified clearly in the design drawings as the sockets, lamps, fluorescent lighting, etc.
		W.C., washing basins, sinks, manholes, pumps... etc.
Piping	MR	The dimension and details should be specified in the drawings, as (cables, pipes, etc.)
Works with special detail	Lumps sum	All details should be specified in the drawings, as earthing, gas network, etc.

## 1.2 ESTIMATION

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.

### 1.1.1 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 justify the investment from cost benefit ratio.
- 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.

## 1.2 QUANTITY SURVEYOR

Quantity surveyor is a person who is responsible on estimating the quantities from the design drawings, and measurement of the quantities in the site during the project implementation, and preparing the current and final payments

### 1.2.1 Duties of quantity surveyor:

- Preparing bill of quantities (Taking off, squaring, Abstracting and billing)
- Preparing bills for part payments at intervals during the execution of work.
- Preparing bill of adjustment in the case of variations ordered during the execution of work
- Giving legal advice in case of court proceedings

### 1.2.2 Essential qualities of a good surveyor

- The quality surveyor must be well versed with the drawings of work.
- He should be able to read the drawing correctly and bill the quantities accurately
- He should have a thorough knowledge of the construction procedure to be adopted, the various items of works involved in the execution: and the different materials to be used in the work.
- He should be able to prepare schedule to be priced by tenderor.

## 1.3 TYPES OF ESTIMATION

There are five types of estimate:

- a. Approximate Estimate
- b. Detailed Estimate
- c. Quantity Estimate
- d. Revised Estimate
- e. Supplementary Estimate

**a. Approximate Estimate:** This is also known as preliminary/rough 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.

**b. 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.

**c. Quantity Estimate:** Quantity Estimate/Quantity Survey is a part of detailed estimate which list the quantities of all the items required to complete the project. These quantities are worked out from the drawings. The purpose of Quantity Estimation is to prepare bill of quantities.

**d. Revised Estimate:** It is a detailed estimate for the revised quantities or revised rates of items of work originally provided in the estimate without any deviation in original design and specifications approved for the project. It is required when the material cost or the material quantities deviates significantly ( $> 5\%$ ) from sanctioned value.

**e. Supplementary Estimate:** This estimate is worked out during progress of work due to any changes or addition of works to originally approved. A supplementary estimate is different from the revised estimate in the aspect that, the former is worked out for the works which are not present in the original design whereas the latter is worked out when there is a deviation of materials from original proposal.

**f. Abstract Estimate:** This is the third and final stage in a detailed estimate. The quantities and rates of each item of work, arrived in the first two stages, are now entered in an abstract form. The total cost of each item of work is now calculated by multiplying the quantities and respective rates.

## 1.4 APPROXIMATE ESTIMATE

Approximate Estimate is made to find out an approximate cost in a short time and thus enable the administrative authorities to evaluate the financial aspects of various schemes and subsequently allows them to sanction them.

### 1.4.1 Importance

Approximate estimate is prepared with preliminary investigation and survey. It does not require detailed surveying design, drawing etc. It is basically done to evaluate feasibility of a project. If it is observed from approximate estimate that the cost of the project is very high then the project may be abandoned without preparing a detailed estimate. Thus the cost required for detailed surveying design or drawing required for preparation of detailed estimate is saved.

### 1.4.2 Purpose of approximate estimate

- Approximate estimate provides an idea about the cost of the project, which enables the authority to check the feasibility of the projects considering the funds available for the project.
- Approximate estimate does not require any detail investigation, design or drawing and hence saves both time and money.
- If several alternatives are available for the original works, a comparison is done from approximate estimate and the decision is made to select the project according to this comparison.
- Approximate estimate is required for getting the administrative approval for conducting detailed investigation, design and estimation.
- Approximate estimate for a property or project is required for insurances and tax scheduling.

### 1.4.3 Methods of Approximate Estimate

There are seven methods used for approximate estimate of the building.

- Plinth area or square meter method
  - Cubic rate or cubic-meter method
  - Approximate quantities with bill
  - Service unit or Unit rate method
  - Bay Method
  - Cost comparison method
  - Cost from materials and labor
- **Plinth area or square meter method:** This is prepared on the basis of plinth area of the building. The rate for unit plinth area is deducted from the cost of a building having similar specifications and dimensions in the locality. The plinth area is calculated for the covered area by taking external dimensions of the building at the floor level. Plinth area does not include the courtyard or any other open spaces.
- **Cubic rate or cubic-meter method:** In this method the cost is estimated by multiplying the cubical contents of the building (length  $\times$  breadth  $\times$  height) with the rate calculated in cubic meter which is deducted from a building having similar specifications and dimensions in the locality.

- **Approximate quantities with bill:** In this method the total length of walls is calculated from the plant. Length of different sections of the wall like foundation including plinth and super structure and area of wood work, flooring and roofing is calculated separately. These items are then multiplied by their cost per running meter length or area in sq. to obtain the total cost.
- **Service unit or Unit rate method:** In this method all costs of a unit quantity such as per km. (highway), per meter (bridge), per classroom (may be school or colleges), per bed (hospitals), per cubic meter (water tank) is calculated and multiplied with the cost per unit deducted from similar structures in the locality.
- **Bay Method:** The rate for one additional bay is calculated. Then the approximate estimated cost for the building is worked out by multiplying the number of bays in the proposed building with the cost of one such bay.
- **Cost comparison method:** When a number of dwellings of similar specification and dimensions are constructed as a part of a larger project for example staff quarters, the approximate estimates for all such dwellings can be estimated by multiplying the quantities of various items for a prototype structure with present market rates.
- **Cost from materials and labor:** Here approximate quantities of materials and labor per sq. of plinth area are calculated with some empirical equations or from past experience. This is then multiplied by total plinth area of the building to calculate the total quantity of materials and labor required for the building. The total cost is calculated by multiplying these quantities with prevailing unit rate.

## 1.5 DETAILED ESTIMATE

Detailed 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. The unit-quantity method is followed to prepare a detailed estimate where, the rates per unit work of one item including profit are estimated first and the total cost for the item is found, by multiplying the cost per unit of rate by the quantity of items.

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

### **1.5.1 Details of measurement and calculation of quantities**

Representative measurements for dimensions of all individual items involved in the whole work are taken off from the drawing of the work and entered in respective columns of a standard measurement form as shown below. Then multiplying, item wise respective dimensions of the quantities of all items are worked out in the measurement form.

### **1.5.2. 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.

A percentage of 3% to 5% is added for contingencies, to allow for petty expenditures, unforeseen expenditures due to changes in design, changes in rate, etc. which may occur during execution of the work. Further, a percentage of 2.0% to 2.5% is also added to meet expenditure of the work charged establishment. For big projects an amount of 1% to 1.5% of the estimated cost is also provided to purchase special tools & plants for specific purpose.

The main functions of an abstract of estimate are as follows:

- The total estimated cost and the different items of works required to complete project can be known.
- Basis on which percentage rate tenders are called after excluding the amount for contingency and work-charged establishment.
- A part of tender document and a contractor can arrive at his own rates from the schedule of work described in the description column.
- This is the basis on which bills are prepared for payment.
- Comparative costs of different items of works can be known.

### **1.5.3 Data Required for Detailed Estimate**

Following data are required for calculation of detailed estimate:

- **Drawing:** The quantities of various items are taken off from the drawings mainly: plans, sections, and other relevant details for the works.
- **Specifications:** The specification of the work describes the nature, class, workmanship, method of preparation etc. which are required to calculate the cost of various items.

- **Rates:** The rates for different items of work are derived from schedule of rates or from rate analysis. The estimated cost is calculated by multiplying the rates with the quantities of various items.
- **Standing circulars:** The taxes and insurance etc. prevailing at the locality of the work is required to fix up rates of various items.

#### 1.5.4 Steps in Detailed Estimate

A detailed estimate can be analyzed in five distinct steps:

- Divide the whole project or work in various items.
- Divide the various items and group them under different sub heads.
- Enter the detailed of measurement of each item of work in measurements form and calculate the total quantity of each of them.
- After the quantities are taken off, the numbers, length, area or volumes are estimated and entered in last two columns of measurements sheet. All these values must be checked by different persons by tick-mark in other color ink. If any correction is done it must be cross checked.
- Finally, the cost under item of work is calculated from the quantities computed at workable rates. These costs along with rates are entered in '*Abstract Form*'. Therein, expenditures towards contingencies, work charge establishment and tools and plants are added to the estimated cost and then totaled. This grand total gives the estimated cost of work.

#### 1.5.5 Factors Affecting the Cost of a Project

- **Quantity of materials:** For a large project, the quantity of materials required is large and thus it can be procured at a lower price.
- **Availability of materials:** The cost of materials, which are easily available, is comparatively lower.
- **Transportation of materials:** The cost of transportation is added to the cost of the material at site. Thus more is the transportation cost; the more is the cost of material.
- **Location of Site:** If the site is located at an odd place for which loading, unloading, staking and restacking of materials are necessary for several times. Thus, apart from cost incurred by such operations the possibility of damage or loss in transit is more which affects the cost.
- **Labor charges:** The skill and daily wage of the local labor affects the rate of a item.

### **1.5.6 Documents Accompanying Detailed Estimate**

The detailed estimate is generally accompanied by following supporting documents:

- a. Report on the design
- b. Specifications
- c. Working drawing (Plans, section, elevation and other details)
- d. Design charts and calculations
- e. Particulars of scheduled rates or rate analysis

### **1.6 BUILDING ESTIMATE**

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

- a. Long wall - short wall method
- b. Centre line method.
- c. Partly center line and partly cross wall method

#### **1.6.1 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.

#### **1.6.2 Center 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 wall, 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.

### 1.6.3 Partly center line and partly cross wall method

This method is adopted when external (*i.e.*, around the building) wall is of one thickness and the internal walls having different thicknesses. In such cases, center line method is applied to external walls and long wall-short wall method is used to internal walls. This method suits for different thicknesses walls and different level of foundations. Because of this reason, all Engineering departments are practicing this method.

### 1.7 MAIN ITEMS IN BUILDING WORK

Main items of work are given below:

Sl No.	Particulars	Unit	Remarks
1	Earthwork	Cum	Earthwork in excavation and in filling should be taken out separately under different types. Foundation trenches are usually dug to the exact width of foundation with vertical sides.
2	Bed concrete in foundation	Cum	It is calculated by taking length, breadth and thickness of concrete bed.
3	Soiling	sqm	When the soil is soft, one layer of brick or stone is laid below the bed concrete.
4	Damp proof course	Cum	It is a course provided at the plinth level under the wall for the full width of plinth wall. It is not provided at the sill of door and verandah openings for which deduction is made while calculating length of D.P.C.
5	Masonry	Cum	Masonry for foundation and plinth is taken under one item and masonry for superstructure is taken under separate item. In case of wall footing, masonry for steps is calculated separately and added together. In buildings having more one floor, the masonry for superstructure for each floor is computed separately. Deductions for openings like lintels, doors, windows, cupboards, etc. is done. Thin partition walls of thickness less than 10 cm, honeycomb brickwork is taken under separate item in square meter and no deduction for holes is done.
6	R. C. C. works	Cum	R.C.C. Work is calculated for beams, lintels, columns, footing, slabs etc. No deduction for steel is done while calculating the quantity of concrete, which includes centering, shuttering and fixing of reinforcement in position. Reinforcement (quantity of steel) is taken under separate item.
7	Reinforcement	Ton	The reinforcement quantity is taken off from detail

			drawing and bar bending schedule. If detail drawings are not available 0.8 to 3% of concrete may be taken by volumes as a quantity of steel which is further multiplied by density.
8	Flooring	Sqm/ Cum	For grounds floor, cement concrete and floor finishing of stone, marble or mosaic tiles taken under one item and quantity is calculated in square meter. For upper floors, bed of R.C.C. is taken cubic meter and other member is calculated in cubic meter.
9	Roof	Cum/ Sqm	In case of roof, flat roofs are calculated in cubic meter like slab and for pitched roof. Quantity of trusses and other members is calculated in cubic meter. In case of roofing material tiles, G.I. sheets or A.C. sheets are measured in square meter. Tiles on hip and valley are measured running meter.
10	Plastering and pointing	Sqm	Plastering is expressed with specified thickness. For masonry the measurements are taken for whole face of wall for both sides as solid and deduction for openings are made. External and internal plastering for building are taken out separately, under different items.
11	Doors and Windows	Cum/ Sqm	It consists of frame and shutter. Doors and windows framers are calculated in cubic meter. Quantity is obtained by calculating length including jamb, head and sill and multiplied by cross-section of frame. Doors and window shutters are calculated in square meter. Shutter of different types should be taken separately because the rates differ. Hold-fast are taken as a separate item.
12	Painting, Varnishing, white washing and distempering	Sqm	-
13	Electrification	LS	Generally 8% of estimated cost of building works is taken for this item.
14	Sanitary and water supply works	LS	Generally 8% of estimated cost of building works is taken for this item.

### 1.8 IMPORTANT QUESTIONS

1. Explain the purpose of estimation. List any two types of estimates and explain.
2. What are the different types of estimates? Explain any three different types of estimation.
3. Estimate the quantities of different works w.r.t residential building/ double room/ single room.