

# PNS SCHOOL OF ENGINEERING & TECHNOLOGY

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## Lab manual of Estimating and costing-2

(5th Semester)

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### **ABSTRACT**

In this paper MS-Excel 2010 is used for developing spreadsheets. Cost estimation is a main task in the management of construction projects. The quality and success of a construction project depends on accurate estimation and cost.. Excel spread sheets are becoming progressively popular in solving engineering related problems. Spread sheets can do basic calculation such as cost estimation, schedule, bidding of project and cost control as well as structural calculation of reaction, stresses, strain, deflection and slopes etc. This paper aims to provide a basis for the development of software estimation. Also this paper presents a comprehensive statistical research on the use of Microsoft Excel in quantity and cost estimation of different building work like excavation, PCC, brickwork, RCC work and plastering. Setting up a computer spread sheet is much the same as doing an estimate by hand. It takes a little longer to set up the first time, but once it's created, all of the estimates that you do afterwards can be done in a fraction of the time. Once your estimating spread sheet is set up, you only need to enter quantities for materials and

labor. Many quantities can be automatically calculated by formulas that you create. When price changes occur, they can be easily updated on your spread sheet. To calculate quantity and cost of various structural elements of building first we need details drawing of the project which includes drawings of elevation, sections, plan and foundations layout, etc. By using this drawing data's we have to inputs various properties of structural elements like length, width, breath , depth so we will easily estimate the quantity and cost.

**Keywords:** *Excel Sheet, Estimation Process, Construction Cost Estimation*

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## **I. INTRODUCTION**

Estimation of cost is a key factor in construction industry. The success and quality of a project depends on the accurate estimation. The estimate is the best source of information about deciding on a price for a project and the estimation helps to plan and organize the construction process properly. Cost estimation is useful and necessary in virtually every business. It is especially important to businesses that deal with large, complex projects. Without a methodology in place to accurately estimate the costs of a project, it is impossible to budget for a project or manage costs as the project unfolds. Almost every construction company has its own computer. It has become a powerful tool for those who use it. The problem is that many builders don't take time to use this great technology. Many large construction companies are set up with estimating programs and integrated systems that cost thousands or even tens of thousands of dollars to purchase – more money than most small-to-medium size builders can afford. However, there are inexpensive ways to do computer estimating. One way is to use computerized spread sheets which have the power of programs costing thousands of dollars.

Cost estimation can be done either manually or using a software. The manual cost estimation method depends upon expertise. This includes an expert who is familiar with this project type. Analysis of structure and the quantity of materials, labours, plant requirements and overhead costs will be done by the person. Then start with the estimation depending upon the knowledge. The second method is by using software's. This method looks into similar projects and compares the current project and then gives its estimated cost. This method is useful for the estimation of large projects.

### **History**

Before inventing the techniques of estimation in the beginning of 1970 the software estimation process was mainly depend on rules of thumb and some simple algorithms used for estimation. It means estimation made according to rough and ready practical rule, not based on exact measurement. A thumb rule is a principle with broad application

that is not intended to be strictly accurate or reliable for every situation. After that in 1975 Function point's analysis was developed first by Allan J. Albrecht in the mid-1970. The method was first published in 1979, than later in 1983. In 1977 PRICE-S, first commercial tool and 1979 SLIM, second commercial tool were developed by the end of this decade. In 1981 COCOMO i.e. The Constructive Cost Model (COCOMO) is procedural software of cost estimation model developed by Barry W. Boehm. It is an algorithmic approach to estimate the cost of a software project. By using COCOMO you can calculate the amount of effort and the time schedule for projects. From these calculations you can then find out how much staffing is required to complete a project on time. In 1990 the leader of software cost estimation researcher Barry Boehm reformulates his model into COCOMO II which consist of three main sub model Called Application Composition, Early Design and Post architecture models where he used many software sizing models like Object Points, Function Points and source line of code. In 1981 paper on function points published worldwide. Until today a lot of new commercial tools have been released, they range from Excel add-ons to enterprise-class.

### **Introduction to Ms-Excel**

Microsoft Excel one of the most used software application of all time. Hundreds millions of people around the world use Microsoft Excel. Excel is the spread sheet program created by Microsoft for windows, macOS, Android and iOS. It features calculation, graphical tool, pivot tables and micro programming language called Visual Basic for Applications (VBA). It is spread sheet program that it is used to record and analysis numerical data. It is a collection of columns and row that form a table. Alphabetical letters are usually assigned to columns and numbers are usually assigned to row. The point where column and row meet called a cell. The address of cell is given by the letter representing the column and number represent row. The benefits of having computer spread sheets are:

- They are inexpensive
- They are easy to use
- They can be customized to your style of doing business
- And they are very powerful.

### **Estimating and Costing**

Before construction of work any structure calculation of quantities of various items of work and its probable cost is done is known as estimating. Determining actual cost of work before construction of it is known as costing. To know cost of work detailed estimate is prepared in measurement sheet and cost of various items is entered in abstract sheet.

## **II. LITERATURE REVIEW**

Shri Hiren J. Chavda, Shri Tejas D. Khediya, Shri Mahipal J. Mer, Shri Deepak N. Mamaiya, Kum. Nikita K. Panwala (*Vol. 3, Issue 07, 2015*) "Design Aids for Cost Estimation of Structural Elements of Building": They are studied about Quantity survey and cost estimation material of various structural elements. In this paper excel spreadsheet developed for the quantity and material cost estimation of various structural elements like footing, beam, column and slab. To cost estimate of various structural elements of building first they collect details drawing of the project which includes drawings of elevation, sections, plan and foundations layout, etc. By using this drawing data's they inputs various properties of structural elements like length, width, breadth, depth etc. Paper present various computer programs for designing of structural elements. Also in this paper calculation of quantity and cost of material are as per schedule rates is given. This quantity and cost according to grade of concrete and steel. Also from this excel sheet they compute amount of labor required for completion of work.

Josephin.M.Baby Anusha M.E , Rajeswari Mukesh M.E, Ph.d (2013) "*A Study on Software Cost Estimation*" : In this paper they discussed about software cost estimation technique. In that they describe various method of cost estimation. They divide software cost estimation method into two groups Algorithmic and Non-Algorithmic method. In algorithmic groups are based on analytical comparisons and inferences and modal cost is analysed using mathematical formula. The formula used in modal is arises from analysis of historical data. For using the non-algorithmic method some information about previous project is required. Algorithmic group include following methods: Function Point, COCOMO, Putmans Modal etc. Non-algorithmic group include Expert Judgement, Analogy, Neural Network and Fuzzy etc. methods. Also comparisons between above methods are also given in this

paper based on the advantages and disadvantages of them. According to their research performance of each method is based on several parameters such as complexity of project, duration of project, expertise of staff and so on.

Nikhil K Gilson, Alester Joseph Vanreyk (2014) “A Review of Cost Estimation Models” : This paper presents a literature review of various cost estimation technique and survey of journals. The review also discussed about problem and errors in estimation model used for building and suggest a method for estimation and costing with better accuracy. Study also shows the different methods used for cost estimation they are multiple regression analysis, neural network and time series analysis. This review is very useful but there is no estimation method which can present the best estimation in any situation. According to study no one method is better or worse than the other due to this each technique suitable for special type of work

### III. OBJECTIVES OF STUDY

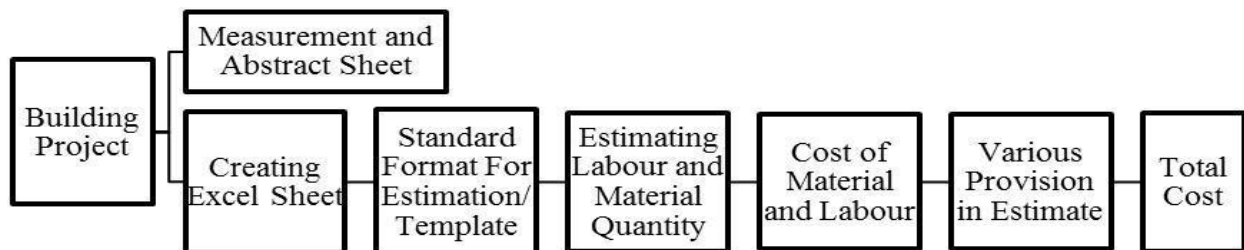
- Preparing various programs using computer applications like MS-Office Excel spreadsheets for faster calculations of quantity survey of various structural elements such as PCC, RCC, Brickwork, Plastering, Excavation etc. and materials used in them.
- Calculation of quantity and cost of sand, brick, aggregate, cement and steel for construction project by using Excel.
- Quantity survey and cost estimation material of various structural elements of entire building as per latest schedule of rates.

### IV. MATERIAL AND DATA

The preparation of Excel sheet for detailed estimate of building works consist of work out quantities of various works and then determine the cost of each item. This is prepared in three stages.

1. Creating standard format for estimation in MS-Excel 2010.
2. Details of measurement and calculation of quantities.
3. Abstract of estimated cost.

#### 1) Concept Structure



#### 2) Data Required for Preparation of Excel Sheet and Detailed Estimate:

1. MS-Excel 2010
2. Drawing
3. Specifications
4. Mode of Measurement
5. Rates
6. Formula and Function

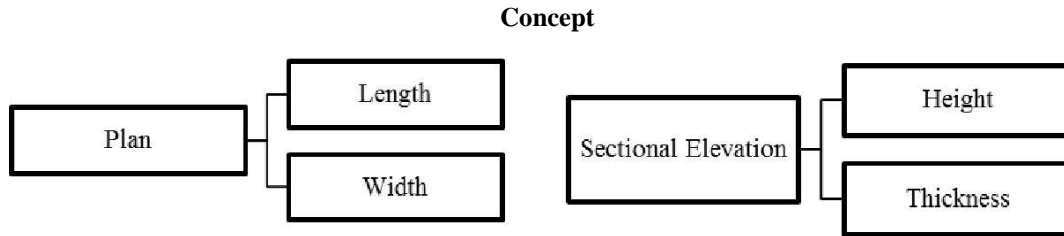
#### *MS-Excel 2010*

Excel is a spreadsheet program that can be used to organize, manipulate and analyse data. Excel is often used in the workplace to track statistics, create sales reports, financial modelling, scientific engineering, and making charts and graphics. However, it can also be useful at home to create budgets. Excel is a versatile and powerful program with a

lot to offer. In this paper it is required for to prepare template of various building works.

**Drawing**

A detail drawing necessary while preparing estimates. It is process in which dimensions from plan, elevation and section are understood for calculating quantities of various item of works. Drawing help to understand height of structure, hard strata available at what depth, thickness of wall, slab and so on.

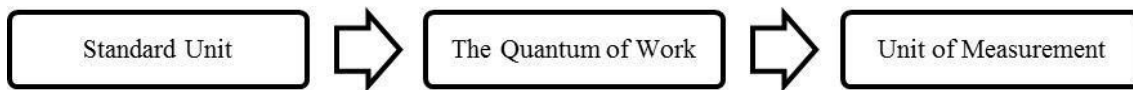


**Specifications**

From specification one can understand the description of material to be used, its quality and precaution to be used for concreting. The specification helps us to make estimate nearer to actual cost.

**Mode of Measurement**

These are helpful in find out quantities. These are standard measurement which is used to express the quantum of work involved in item. These modes of measurement are taken from IS-1200.



**Rates**

For accurate estimation it is necessary to know rates of material as well as labours. Also rates of equipment’s and tools and plant. These rates are available in DSR (District schedule rate) or in CSR (Current Schedule Rate). The rates are change place to place.

**Formula and Function**

Formula is the real power of excel worksheet. Formula uses standard mathematical symbol to operate on cell address. A formula can be combination of values (number or cell references) and mathematical operator into algebraic expression. Depending on your understanding and skill with Excel, the formulas and equations are used to quickly compute both simple and complex equations using large amounts of data. Mathematical operators include following symbol.

- + For Addition
- For Subtraction
- \* For Multiplication
- / For Division
- % For Percentage
- ^ For exponentiation (Power)
- = It is Important at Beginning of Formula

**Inserting Function**

A function is a predefined/prewritten formula that takes a value or values, performs an operation on a range of cells you select, and returns a value or values. Functions are used to simplify and shorten formulas on a worksheet, especially those that perform lengthy or complex calculations. Excel refers to each range of cells in the function as an argument. For complex calculations, it might be necessary to use as many as 3 to 4 arguments.

- Select the cell where you would like the average score to appear.
- From the Formulas tab, choose Insert Function.
- Or, you could also click on the Function button, found just before the formula bar to use any of Excel's preset functions.
- The Insert Function dialog box appears.
- Under Select a function, choose from the range of functions available.
- For example, choose the SUM function and click OK.
- Under the Number1 type the range of cells that you want to use or you can also drag the mouse to select the range of cells to be included as the function's arguments and click Ok.
- The formula result is displayed on the window.

## V. PROCEDURE

### Procedure to Prepare Excel Sheet

To cost estimate the quantity and cost of various material of building first we need details drawing of the project which includes drawings of elevation, sections, plan and foundations layout, etc. By using this drawing data's we have to inputs various properties of structural elements like length, width, breath , depth so we will easily estimate following

1. Excavation in Footing
2. Plain Cement Concrete (PCC)
3. RCC
4. Brickwork in Superstructure
5. Plastering

#### 1) *Creating a new workbook*

Start a new workbook by clicking the File menu and selecting New. In the New Workbook window, click Blank workbook. When you start Excel, a blank worksheet opens.

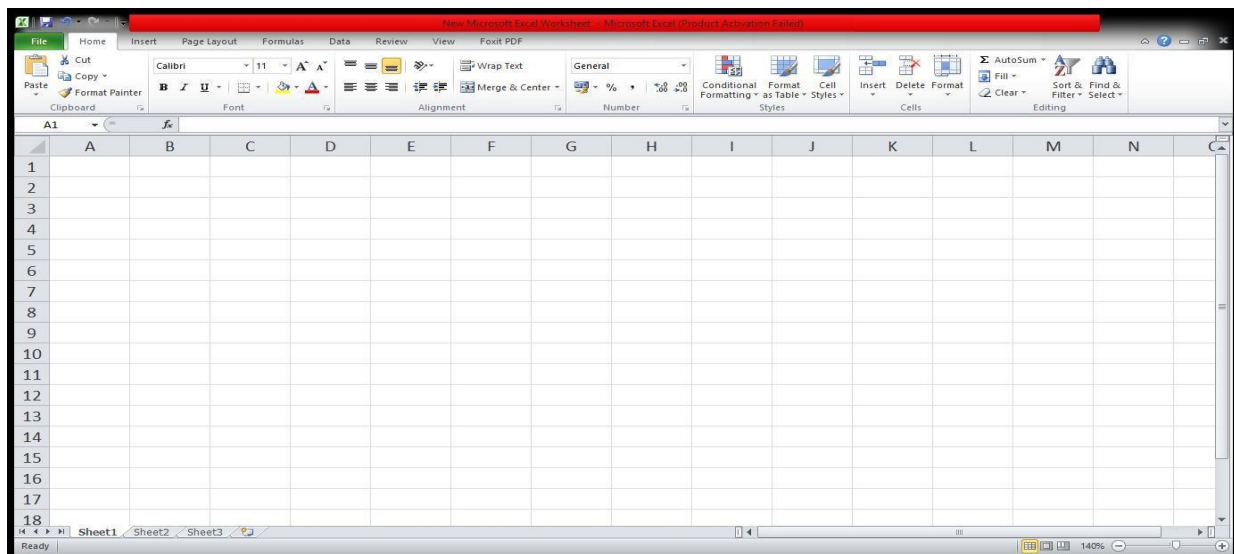


Fig.No. 1: Excel Sheet

#### 2) *Adding a new worksheet*

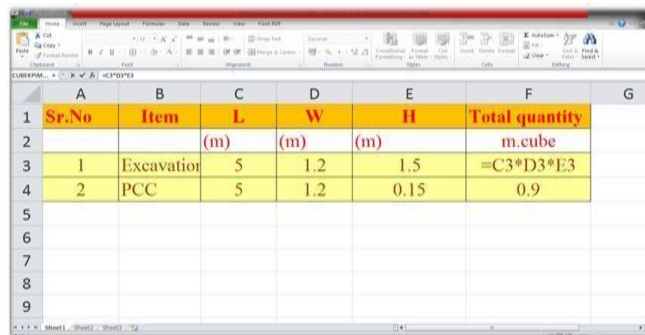
If you need more than three sheets you can easily add more. Click on Insert in the Cells group and click insert sheet.

### 3) *Setting up Summary Sheet*

The summary sheet is a quick overview of all the costs of construction broken down into major work categories such as excavating, PCC, RCC, Brickwork and Plastering. They are usually organized according to the sequence of construction. Then the templates for the above item of work created. These templates consist of abstract and measurement sheet for calculation of cost. Information or formulas can be entered into cells in the spread sheet. Cells are where the rows and the columns intersect. Each cell can be formatted. You can change the width or height of a cell, the style of font, currency, date, time, colour, justification (left, centre, right), and/or a number of other formatting options.

### 4) *Entering Formulas*

Excel requires that every formula begin with an equal sign (=). After entering a formula, press ENTER to display the total. If you just type without this symbol, Excel treats the entry as text. To start entering a formula in a cell, click in that cell and then type the formula. Formulas are easy entered into the cell where you want the value to be located. Formula is created by first entering = (the equals sign) and then adding, subtracting, multiplying, dividing etc. the values of other cells. In this example, concrete cubic yards and totals are automatically calculated. Formulas containing numbers will produce results that will not change. e.g., the formula = 100\*10 always produces the result 1000. However, a formula that contains cell references produces a result that may change depending on the data in the cell. In figure number 3 for calculation of quantity of earthwork the length, width and depth are entered into cell C3, D3, E3 respectively. And total quantity is update automatically into cell F3 by formula = C3\*D3\*E3 will produce a result based on the data in cells C3 and D3 and E3. To view the formulas that are contained in your worksheet, press CTRL and ` (the apostrophe key) together. Repeat to hide the formulas and show the values.



	A	B	C	D	E	F	G
1	Sr.No	Item	L	W	H	Total quantity	
2			(m)	(m)	(m)	m.cube	
3	1	Excavation	5	1.2	1.5	=C3*D3*E3	
4	2	PCC	5	1.2	0.15	0.9	
5							
6							
7							
8							
9							

Fig.No. 2: Formula

### 5) *Creating Detail Sheets*

Detail sheets are pages that contain the actual quantities and unit prices for each of the construction categories. For calculation of quantity of item we have required to enter specification of item of work such as length, width, depth, thickness and grade of material also. Formulas can easily to enter to perform the calculations that typically take up so much of a builder's time in the manually estimating process. Once the detail sheets are created, the estimator need only enter the quantities for the different items all the quantity are estimated easily by formula that you create. Line item totals, and category totals are automatically computed. If any Changes required to made it can easy to update.

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### 6) *Standard Format / template*

With the help of above procedure standard format/Template for estimation and costing of various building work in MS-Excel 2010 ready. We required only entering the specification of item for particular work (length, width and depth) to work out quantity of material and labour. Quantity and cost will update automatically from created formula.



## Example

### Template for RCC Work

RATE ANALYSIS FOR REINFORCED CEMENT CONCRETE				
DOWNLOADED FROM THECONSTRUCTOR.ORG				
Analysis for		Steel % by volume of Concrete		
BCC	1	1	2	
Wet Volume	1.00	m <sup>3</sup>		SLAB 1.00%
Dry Volume	1.54			BEAM 2.00%
				COLUMN 2.50%
				Road 0.80%
MATERIAL		Qty.	Units	AMOUNT
CEMENT BAGS	11.70	bags	300	3320
SAND	6.30	m <sup>3</sup>	900	347
Aggregate	6.77	m <sup>3</sup>	700	539
Reinforcement	157.00	Kg	40	9420
				13634.83
LABOUR With		Days		
Mechanical Mixer & Vibrator				
MASON	6.37		300	111.00
LABOUR	3.50		200	700.00
WATER CARRIER	1.30		200	270.00
BAR BENDER	1.57		200	314.00
MIXER OPERATOR	0.071		200	14.20
MIXER VIBRATOR	0.071		200	14.20
				1431.56

Fig.no.3: Template For RCC Work

Frequent studies have shown the process of detailed estimate through models. This detailed estimate in tender stage is very important for contractors in order to offer bidding as success as they wanted. Most of researchers built their models depending on the process of estimate ignoring the knowledge of the cost estimate. Leng developed an estimation model depending on past models and knowledge transfer.

## VI. ADVANTAGES OF MS-EXCEL IN ESTIMATION AND COSTING

1. Excel has the facility to organize large amounts of data into orderly spreadsheets and charts quickly, it is easy to enter and format the data.
2. The major advantage of using MS-Excel for estimating and costing is the speed. There is no other software product that you will use in your business that will save you as much time and money as your estimating software.
3. It is cost-effective and easy to use for calculation of quantities and cost of structural element.
4. It has the capability to create the graphical or the visual representations of your data, and it is easy to integrate Excel with other business applications.
5. Quantities of various materials (cement, sand, aggregate and steel) automatically fill in in corresponding cell from formula that you created, so accurateness will more in excel as compare to handbook method.
6. Excel file can be sent through E-mail and viewed by most smartphones which makes more useful.
7. Excel files can be password secure for extra safety; the user can create a password through Visual Basic programming.
8. Excel makes the calculations much easier than working things out yourself with a calculator, Depending on your understanding and skill with Excel, The formulas and equations are used to quickly calculate both simple and complex equations using large amounts of data.
9. Excel makes it easy to store the documents, perform arithmetical calculations, format the cells, and modify layouts to generate the output and reports to share with others.



## VII. DISADVANTAGES OF MS-EXCEL IN ESTIMATION AND COSTING

1. The viruses can be attached to an Excel file through shortcuts which are mini programs that are written into an Excel spread sheet. Using only one file can make the file size very large, and the program run slowly, so, you might have to breakdown it into smaller files, So There is an increased risk in Excel data being lost.
2. Complex, the spreadsheets become harder to change and manage.
3. While the spreadsheets are ideal for constructing one time analysis, they become problematical as the data grows and go forward over time.
4. Entering the data into Excel yourself can take a very long time especially if you have a lot of data to enter; the amount of time it takes to enter the data can be inefficient and can lead to boredom which leads to potentially costly inattentiveness.
5. While Excel's automatic calculation functions make most large-scale batch calculations stress-free or simple, it isn't foolproof. Excel has no means of examination for human mistake during data entry, which means that the wrong information can tilt all the results.
6. It restricts the number of rows and columns you can use.

## VIII. CONCLUSION

Frequent studies have presented the process of detailed estimate through models. From the study it is found that, the Excel spreadsheets are become prevalent and powerful tool used to record and examination mathematical data. It can be modified to your style for doing business. In this paper, spreadsheet used for calculation of quantities and cost of material (cement, sand, aggregate and steel required in RCC work) and labor for following work:

1. Excavation in footing
2. PCC
3. RCC work
4. Masonry in super structure
5. Plastering

The examples show the simple and powerful features of spreadsheets and its ability in solving Civil Engineering problems. These examples can be used by civil engineering students as templates/models for solving related problems or for developing models to solve other problems. Also model of detailed cost estimate can be used by the organizations to raise their estimator's performance to assure more correctness. Quantity estimation of every structural element for the whole building by using excel spreadsheet is more accurate than manual method. Also it required less time. This is inexpensive way to estimating quantity of different piece of work

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