

# Developing Android Application for Estimating Quantity and Cost of a Shop of Commercial Building

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**Abstract**— In any construction activity, quality and quantity aspect are the two-basic thing intricate that lead to form or direct the estimate of the work. The estimate is a means for planning and controlling the construction commotion of any project with respect to quality, time and finance. Estimate is consequently the prediction of its probable cost. One of the most important duties of the engineer or an architect is to formulate or forecast the possible cost of the anticipated building. The problem of preparing estimates has become somewhat multifaceted because of various factors and at the same time it has been abridged by contemporary and advance techniques. With this, engineer can store the obligatory information in his well-equipped computer section and make the progression of estimating not only simple but also quicker. The purpose of this work is to develop a newfangled android application of a cost and quantity calculator using detailed estimation of the proposed building which is capable of calculating the estimated cost as well as estimated quantity involved in the construction activity using computer based programming. The idea is to assemble basic construction activity like excavation, concrete, brickwork, steelwork, plastering, distemping etc. and transmute them into an android application in order to determine the actual cost per unit of item; quantity of the item brought in use; and to examine the item for economic processes and economic uses of the materials involved in making the item. The application is going to present a vibrant picture of the process of cost and quantity analysis and various forces acting behind the performance of an item. At the same time, it is going to eliminate the manual calculations involved in the estimation of the shop of commercial building. The project is based on theoretical aspect of the detailed estimation of cost and quantity that are involved in construction or of an item. It will serves as a convenient guide to arrive at a judicious cost and quantity involved in the construction.

**Keywords**— Android application, Shop, Estimation, Costing,

## I. INTRODUCTION

The approximate estimate is the normal practice to work out the structure before its detailed estimate is taken in hand. It is used in making preliminary studies of various aspect of the project; it can determine whether the investment in such project is justified or not; provides good idea of the approximate cost of construction; framing of the tax schedules; and approximate estimate can be used in framing up the value of the project for the insurance requirements. There are various methods by which approximate estimates of the structure can be prepared. But in general principal, they all consist of multiplying the number of items or units in the proposed structure by the known cost of the similar item or units in the similar existing structure. Thus, the process is very simple and it involves the following two operations:

- 1) Fix up the units and count the number of such units in the proposed work.
- 2) Fix up the unit cost by studying the actual cost of the similar existing structure constructed in near past [1].

A) *Brief to Detailed Estimate*: In case of detailed estimates, a complete schedule of all the possible items which are likely to occur is prepared and proper unit cost is applied to these items. Detailed estimates are accurate estimate as they provide an amount which is very near to the final amount of the structure and hence, they are prepared for execution process and obtaining technical sanction. The actual cost incurred in the project will be known when the project is completed in all respect and the necessary payments are made by the owner. If detailed estimate is prepared carefully and by keeping in mind all likely adverse conditions and circumstances, there will practically be little difference between the amount of the detailed estimate and the actual cost of the construction. If the actual cost happens to be less than the estimated one, there will be no difficulty as surplus amount will be left with the owner. If, however, the reverse is the case, in most of the case, the owner will be put into the financial trouble and he will have either to suspend the work or alter the specification of the work [2].

In case of preparation of the detailed estimate, the whole project is sub-divided into various stages and then, the entire stage is broken up into various items work having same specification and rates. The quantities of such items of work are accurately worked out from the detailed drawings. The detailed estimate includes taking out quantities and abstracting [3]. The detailed estimate comprises the cost as follows:

- 1) Total cost of various items of the work
- 2) Allowance for the contingencies to accommodate unforeseen expenditure or missed item and small variations in quantity and/or rate in different items of work.

- 3) Establishment charges for supervision.
- 4) Estimated amount for the service charges which include water supply connections, sanitary arrangements and electrical installations.

*B) Necessity:* The problem of preparing estimates has become somewhat multifaceted because of various factors and at the same time it has been abridged by contemporary and advance techniques. With this, engineer can store the obligatory information in his well-equipped computer section and make the progression of estimating not only simple but also quicker. The purpose of this paper is to develop a newfangled android application of a cost and quantity calculator using detailed estimation of the proposed building which is capable of calculating the estimated cost as well as estimated quantity involved in the construction activity using computer based programming.

*C) Scope of the Work:* The manual calibration of the detailed estimation of a one room shop of commercial building is tedious, time consuming, and demand experience. On the contrary, the work of detailed estimation is limited to the civil engineers and contractors and thus, there is a requirement of alternative methodology which is minimizing manual calculations and thereby resulting into an easier way of dealing with the estimation of cost and quantity involved in the construction activity of the building.

The conceptions of detailed estimation for cost and quantity estimation has been carried out using android application. The methodology has been tried to be designed in order to make android application more user-friendly and faster application. The scope of the paper is to develop an android application which can give us the precise detailed estimation of a one room shop of commercial building. The detailed estimates obtained using this application may be found useful in the proposed projects as to ascertain the probable time for contract; to control expenditure during execution; to estimates requirements of any controlled materials like cement and steel; to obtain administrative approval and technical sanction of the project etc.

## II. PROBLEM STATEMENT

The process of estimation requires a lot of time and heavy paper work under the supervision of licensed civil engineer or consultant. The process of detail estimation is difficult for a common man to perform on his own. He has to employ an engineer and contractor for carrying out the detail estimation of the work.

The best way to overcome the above stated problems is to provide a software system which user-friendly and can be handled easily for the calculations of quantities and cost of different works involves in the construction. In order to make it more user-friendly, the software must be easily available and it can access from anywhere. The problem of preparing estimates has become somewhat multifaceted because of various factors and at the same time it has been abridged by contemporary and advance techniques. With this, engineer can store the obligatory information in his well-equipped computer section and make the progression of estimating not only simple but also quicker.

## III. SOLUTION

The purpose of this work is to develop a newfangled android application of a cost and quantity calculator using detailed estimation of the proposed building which is capable of calculating the estimated cost as well as estimated quantity involved in the construction activity using Android Studio software. Now-a-days android interface has become more popular in the world. Android users are in abundant number. This work is basically to provide a user-friendly android application to the user to estimate the quantities and cost of various construction activities involved in the construction of a one room shop of commercial building.

### A) Terminologies

While handling this android application, the users are going to witness several technical terminologies involved based on the subject Estimation and Costing of Civil Engineering. The application twitches with the first page shows all the quantities from which we will calculate the cost of an item. While operating this application, the operators are going to find some of the technical terminologies whose mode of measurement as per IS: 1200 (Part I to XXV) [2] [3]:

- 1) *Earthwork:* Earthwork of different nature as in excavation in foundation in trenches or excavation in cutting and filling etc. or earthwork of different types of soil is classified separately and measured under separate items. Earthwork is measured in cubic meters.
- 2) *Excavation:* The item of excavation is paid per cubic meter and hence, the length and the breadth are measured. Unit of measurement of excavation is cubic meters.
- 3) *Soling:* When the soil is soft or bad, one layer of dry brick or stone soling is applied below the foundation concrete. The soling layer is computed in square meters specifying the thickness.
- 4) *Concrete in foundation:* The length and breadth of foundation concrete is same as for excavation, only thickness differs. The concrete is taken out in cubic meters by length breadth and thickness.
- 5) *Reinforced Concrete Cement (RCC):* RCC slab up to 15cm depth, RCC parade, RCC partition wall and RCC box are measured in square meter. RCC lintels, columns and beams are measured in cubic meters. RCC weather shed is measured in square meters and clear projection is taken for the measurement.
- 6) *Plain Cement Concrete:* The PCC work is paid in cubic meters.

- 7) *Masonry*: Foundation and plinth masonry is taken under one item and masonry in superstructure is considered under different item. Masonry is computed in cubic meters.
- 8) *Openings*: The frame windows are computed in cubic meter. Quantity of shutters for door is calculated in square meters by multiplying the breadth to the height of the shutters. Grillwork in windows are measured in square meters. Gnerally windows are not preferred to the shops.
- 9) *Plastering*: The measurement of plastering is recorded in square meters but bands in plaster, having thickness of 30cm or less, are measured in running meters.
- 10) *Flooring*: The measurements of floor finishes are taken in square meters for the net area covered.
- 11) *Skirting*: Up to 30cm height of skirting is measured in running meter and exceeding 30cm is measured in square meter mentioning the type of finish.
- 12) *Painting*: The item of painting is paid in square meters. The measurements are taken flat and then, multiplied by suitable coefficient to compensate for moldings, rebates etc.
- 13) *Steelwork*: Steel is measured by weight in quintal. Structural steel works such as girders, compound girders etc. is measured in separate item. Steel reinforcement is measured by weight in quintal mentioning the diameter.
- 14) *Neeru Finish*: Neeru finish is provided measured flat without any laps and are paid per square meter and no extra amount is paid for any wastage, cutting etc.

**IV. METHODOLOGY**

The application is going to present a vibrant picture of the process of cost and quantity analysis and various forces acting behind the performance of an item. At the same time, it is going to eliminate the manual calculations involved in the estimation of one room shop of commercial building. The application deals with load bearing structure of one room shop of commercial building only.

*A) Flow Diagram for One Room Shop of Commercial Building*

While handling this android application, the users are going to witness several technical terminologies. The application twitches with the first page shows all the quantities from which we will calculate the cost of an item. The application has been designed with respect to one room shop of commercial building.

The pathway for the operation carried for the load bearing structure is shown in the Fig. 1. This figure gave idea for the further development of the Application.

Following steps are considered as shown in the Fig. 1:

- Step 1: Start.
- Step 2 Choose any one item
- Step 3: Input Parameters (e.g. Length of long wall).
- Step 4: Input Deductions (e.g. Size of window).
- Step 5: Calculations.

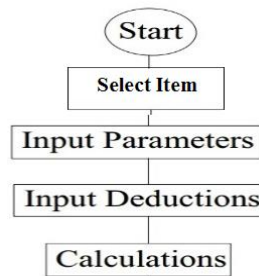


Fig. 1: Flow Diagram for Load Bearing Structure

*B) Flow Diagram of Work Executed*

The pathway of detailed operations as shown in Fig. 2. It also gave details of various inputs parameters and output results for cost and quantity.

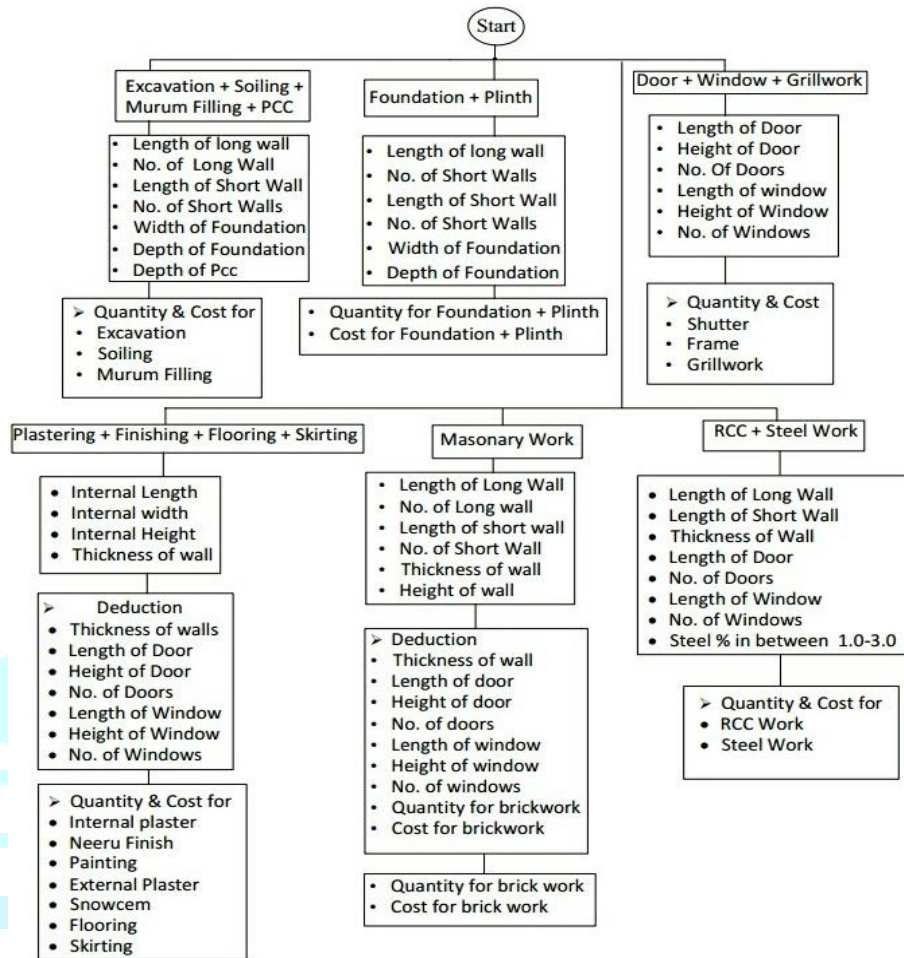


Fig. 2: Flow Diagram of Work Executed

C) Development of the App

Android Studio is the software which has been used to develop the *Quantity and Cost Estimator* application. This software is developed by the GOOGLE. The android is the operating system/ platform which is introduced by the GOOGLE in order to let users develop their own applications and thus helpful to the users across the globe. Android Studio software is free software available on the official website of the Android Developer.

- 1) *Planning*: Planning is the most important part of any work which needs to be executing without any obstacles and errors. The flowchart for each one room shop of commercial building is prepared first which describes the workflow of the application development. The parameters are the next thing to be introduced so the studies on PWD Method of Detailed Estimation helped us to identify the parameters which user can input in order to obtain quantity and cost of a particular construction activity. By arranging all required information, we have prepared a draft of how our calculation must execute.
- 2) *Designing the Layouts*: Android Studio uses XML language for designing the user-interface of an application which is very user-friendly to handle. Initially all the layouts have been according to the Figure 3.2 with all the required parameter that a user may input to estimate quantity and cost of particular construction activity. Basically, three types of widgets have been used so far those are namely- i) Text View, ii) Edit Text and iii) Buttons. Also, the three types of layout format have been used those are namely- i) Relative Layout, ii) Linear Layout and iii) Scroll View. These are basic widget that has been used for developing the application.
- 3) *Defining the Functions*: Designing of the Layouts has been done with Basic widgets and in those only the button needed to be coded. The Buttons must be assigned with function which has to execute as user click the buttons. In order to assign them with a particular function these functions must be first need to define in the java file of the same activity. This function includes the data transfer from one activity to another and also to show calculations. The coding for these functions was done in with help of JAVA language basics. Android Studio uses modified Java language which is not proper Java.
- 4) *Execution of the Work*: The present App is able to calculate and estimate the cost for single room only. The present App calculates the quantities and cost of various construction activities but unable to estimate the overall cost of that single room. Also, it estimates the quantities and cost which is based on the assumed type of material work with presumed condition.

Further it can be used only in the Maharashtra state because the cost of construction activities determined using state DSR of Current rates of various activities have been used [4].

#### D) Execution of the App

Quantity and Cost Estimator application twitches with the first page on which we have to select the item. The objective behind this page is to let user should come to know about the quantity of the materials required with respect to the input information. Selecting any of the option provided in this page will let them to go to the second page which is intended to give the quantity and cost involve in the particular construction activity.

*Step 1:* As we open this App, the first screen will be as shown in the Fig.1. On this screen, various works are available as buttons such as Earthwork (i.e. Excavation, Soling, Murum Filling, PCC), Foundation & Plinth, Masonry Work, Finishing Works(i.e. Plastering including both internal as well as external, Flooring, Painting, Skirting, RCC & Steel Work. From this screen user will be able to calculate the respective quantities and their cost for a particular room type that he selected on previous screen.

*Step 2:* After clicking the button for Excavation+ Soling+ Murum Filling+ PCC, the screen will pop up. On this screen user needs to feed the respective data entry in the empty space. After entering the proper data, click on the Results button for the quantity and cost of the quantity which will be displayed on next screen.

*Step 3:* As the result button, has been clicked the results for quantity of excavation, soling, Murum filling, PCC will be displayed. Here the cost of the work is also displayed with proper units.

*Step 4:* For Foundation + Plinth: Here again he needs to enter the data for foundation and room. (Note: For the initial stage we have considered the foundation to be rectangular only.). As all the data enter and after clicking the Results button the quantity and cost will displayed.

*Step 5:* For Masonry Work: Again, here user needs to input the data as shown in Fig. 2. After click on Save button this page will generate the quantity of brick work for entire room without considering any openings. But deduction in the opening quantity from the total quantity calculated on this page.

*Step 6:* For deduction of the openings the new screen will pop up as shown in Fig. 3 for entering the data for opening as the user click the save button of the previous page. Now after the entering the data, clicking the Results button will show the result for quantity and cost of Brick Work on the same screen.

*Step 7:* For Doors-Windows: Here user have to specify the dimensions and quantity of openings then on clicking the Results button the results for quantity and cost for Shutters, Frames and Grillwork(Windows) will display at the bottom of the screen.

*Step 8:* For Finishing Work: When users select the fifth button on the home screen then this page will ask for data of the room. Here on the same page the total quantity has been calculated but openings must be deducted from the total quantity to get appropriate quantity of the work.

*Step 9:* For Finishing Work Deduction: After clicking the Deduction button from the previous page, the new screen pop up. Now it will again ask for the data of openings for the room. After entering the data the appropriate quantity is calculated on this page only. But by click on the Results button the value for the work will transfer to the next screen where it displays the quantity for all work collectively.

*Step 10:* For Finishing Work Deduction Quantity Result: The screen will pop up which shows the results for the works such as Internal Plaster, Neeru Finish, Painting, External Plaster, Snowcem, and Skirting.

*Step 11:* For Finishing Work Deduction Cost Result: This screen will open when user will select the Cost button on the previous screen. This screen will display the cost of the work whose quantities have already been calculated on previous screen.

*Step 12:* For RCC Work: Here on this screen room dimension data is to be entered with percentage of the steel used in the construction (or going to be used in construction approximately). Now after click on the Results button, it opens new screen to display the results.

*Step 13:* For RCC Work Result: This screen will pop up, when user hit the button Result from the RCC work screen to display the result of the quantity and cost for both the RCC and steel work involved in the construction (or going to be involve in the construction).

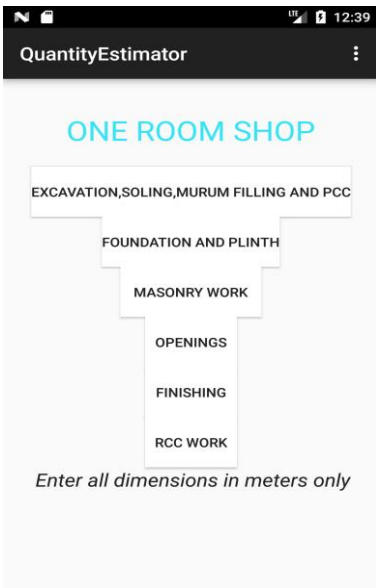


Fig. 3: List of Quantities

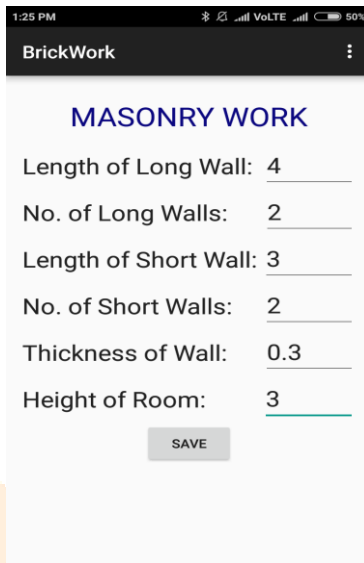


Fig. 4: Masonry Work Input

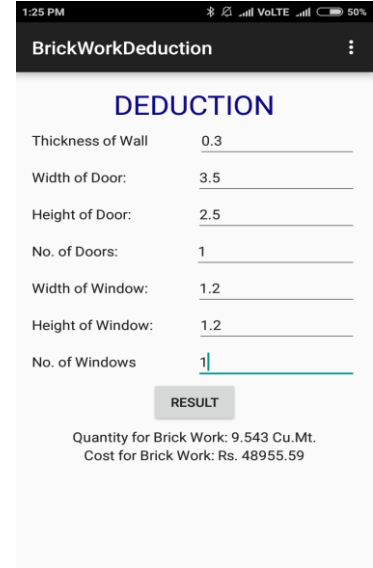


Fig. 5: Masonry Work Deductions & Result

**V. RESULT ANALYSIS**

In this section, a problem was solved by using the above equations manually and then obtained result was analysed with the android application discussed in order to validate the app for solving the problems of estimation and costing.

*Question:* Perform the detail estimation of a hall of size of 3.7m x 2.7m having one opening for shutter of 3.5m x 2.5m and one windows of size 1.2m x 1.2m as shown in Fig. 4.1 using:

1. In-to-in and out-to-out method of Public Works Department method and,
2. Quantity and Cost Estimator android application

Analyse and conclude the results obtained from the above two methodology

(1) Using detail plan of hall as shown in Fig. 6 (a), the centre-line plan of the given plan is developed as shown in Fig. 6(b).

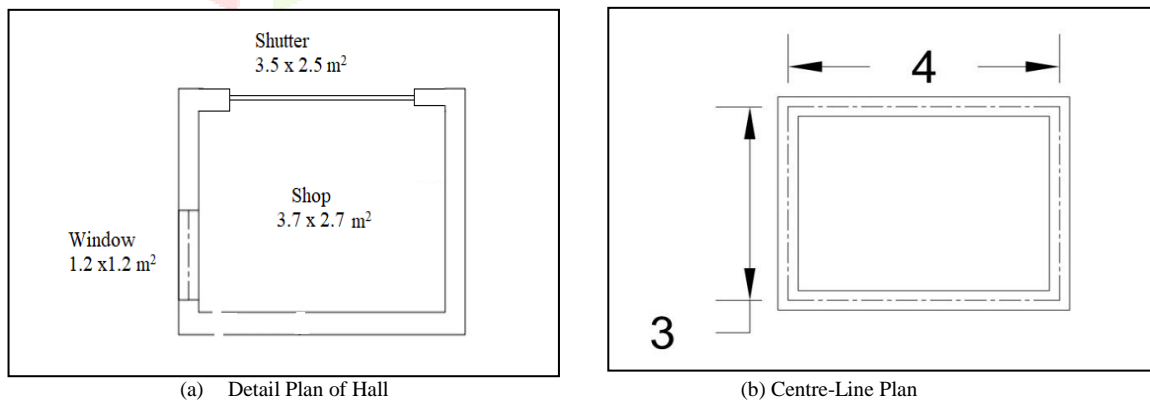


Fig. 6: Plan of Hall

Following table (Table I) is prepared for the given plan using in-to-in and out-to-out method of Public Works Department method, in order to solve the problem.

TABLE I  
 ESTIMATION OF A HALL BY USING PWD METHOD OF DETAILED ESTIMATION

Sr. No.	Description	Quantity	
		Manual	App
<b>1</b>	<b>Earthwork</b>	14m <sup>3</sup>	14m <sup>3</sup>
	1. Excavation	14m <sup>3</sup>	14m <sup>3</sup>
	2. Soling	7m <sup>3</sup>	7m <sup>3</sup>
	3. Murum Filling	14m <sup>3</sup>	14m <sup>3</sup>
	4. PCC	2.1 m <sup>3</sup>	2.1 m <sup>3</sup>
<b>2</b>	<b>Foundation and Plinth</b>	10.98m <sup>3</sup>	10.98m <sup>3</sup>
<b>3</b>	<b>Masonry Work</b>	9.543 m <sup>3</sup>	9.543 m <sup>3</sup>
<b>4</b>	<b>Openings</b>		
	Windows Frame	0.0384m <sup>2</sup>	0.038422m <sup>2</sup>
	Windows shutter	1.1449 m <sup>2</sup>	1.14492 m <sup>2</sup>
	Grillwork	1.44m <sup>2</sup>	1.44m <sup>2</sup>
<b>5</b>	<b>Plastering, Finishing, Flooring and Skirting</b>		
	1. Internal Plaster	45.333m <sup>2</sup>	45.333m <sup>2</sup>
	2. Neeru Finish	45.333m <sup>2</sup>	45.333m <sup>2</sup>
	3. Painting	45.333m <sup>2</sup>	45.333m <sup>2</sup>
	4. External Plaster	144m <sup>2</sup>	144m <sup>2</sup>
	5. Snowcem	144m <sup>2</sup>	144m <sup>2</sup>
	6. Flooring	9.99m <sup>2</sup>	9.99m <sup>2</sup>
	7. Skirting	12.8 m <sup>2</sup>	12.8 m <sup>2</sup>
<b>6</b>	<b>RCC &amp; Steel</b>		
	RCC Total	2.2815m <sup>3</sup>	2.28156m <sup>3</sup>
	Steel	537.30 Kg	537.2933 Kg

By comparing the measured values so obtained using manual calculation with the values so obtained from the android app discussed in this work, it can be concluded that there is no variation in the result of these two approaches. Hence, the app developed in this paper is found consistent with the methodology so adopted here within.

## VI. CONCLUSION

For all engineering works it is necessary to know the probable cost of construction and hence, estimation is important. In estimation, the quantities of different items of work are calculated and from these quantities the cost involved is premeditated. Accuracy in estimation is very important. Strictly speaking, all the estimates are more or less approximations because the actual cost of the construction of the structure cannot be known until it is completed in all respects. From the developed App, anyone can estimate the quantity and cost of any structures.

The present android application of cost and quantity calculator is found to serve the purpose of what the basic purpose of the detailed estimate. The application may be found useful for technical sanction; administrative approval, the execution of the contract with the contractor; framing and inviting tenders; accurate idea of cost of construction; to know the labours, materials and duration required; to determine earnest money and security deposit.

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