Estimation and Costing of RCC Floors, Column and Footing using RCF Software

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Abstract: In this research paper RCF software is used and summary of reinforcement in kilogram, foundation quantities and cost, project cost and quantities of residential buildings are discussed in detail. Before calculating the quantity and costing, the slabs, beams, columns, footings are designed and all the loads are assigned and analyzed. Data describing technical and managerial parameters are also highlighted in this research paper. Methodology to create slab reinforcement and bar bending schedule is also described in detail which justifies the applicability of RCF software in design and consultancy firms.

Index Terms - **RCF, Floor, Beams, Columns, Foundation, Estimation**

I. INTRODUCTION

Before starting the construction, designing and analysis of the structure is important process but in economical point of view estimation and costing of the structure is also very important which help us to determine the probable cost of the construction of RCC floors, Column, slab and Footings. For any type of construction work a detailed estimation is required which decides the future of that project. It is especially important in large construction site, complex or any government project. To perform the cost estimation, a proper and accurate methodology is require. There are different types of methods available for estimation which can be performed manually, but performing estimation manually can be a very time consuming and tedious process. Even after this, precision and accuracy is not ensured. To overcome this difficulty software are used, which are programmed for accurate results. In this era of rapid industrialization and digitalization, the engineers should not hesitate to try their hands on the software to overcome the laborious process. RCF is one of those software.

RCF software provides you with the estimation of whole RCC structure or the estimation of separate members like beam, column, slab or footing. Performing estimation in RCF software is not a big deal and a fresher can also come up with the precise result by only putting some basic details of the structure. To get the result, after putting the detailed values structure needs to be analyzed. This analysis process may take some time depending upon the type of structure being analyzed. This analyzed structure can later be designed and cost estimation is performed

2. METHODOLOGY/ANALYSIS

The method of quantity and cost estimation through RCF software is very effortless. The user interface of the software is very much understandable to even a fresher. In this RCF software, the user is only require to enter the floor data for joints, columns, slabs, beams, point load & continuity. Other things of the operation will be taken care by the software itself. User can also add, remove or rename the beam, column, slab and footings even after entering these data at the beginning.

In the floor plan designed in this RCF software, a large number of joints are established. Each joint in this plan represents intersection of 2 or more beams and a column. The beams are shown in the plan in the form of Right Hand Side (R.H.S) joint and Left Hand Side (R.H.S) joint number. Every joint will consists of X & Y co-ordinates. Top left corner will be considered as origin (0, 0). The numbering of the joints/ column/ beam/ slab should always be start with the"1" and numbering should not be repeated. This RCF software will automatically generate joint/ beam/ column and slab numbers from the input provided by the user in project file. It may be possible that some of these numbers are not required in the plan and hence can be deleted in systematic manner which is explained further in upcoming chapters. At final result floor plan and final plan graphics should look exactly same.

Explaining the methodology in steps.

Figure 1 user interface

Figure 2 project detail input table

- Go to the "New" tab and create a new file shown in figure1.
- Add project details like dimensions, grade of concrete and steel, cost of the products etc. as shown in the figure 2.
- Designing the members is one of the most important step as it will inform us about the quantity and grade of steel, cement, concrete and other aggregates.
- After adding details, analyze the structure by "Analysis" tab given in Analysis section. This process of analysis will take some time which depends on the type of structure or number of members present in the structure.
- Analysis of structure will open the other options. Design of beams, columns, footings and slab is necessary before moving for further proceedings. Designing can be done through their respective tabs given in "Floor/col Fdn Design" section

After designing of the different members of the structure go directly to the "Quantity" tab where you can calculate the cost estimation of the whole structure in just one click. Estimation of the members of the structures individual is also possible through the "Quantity tab".

Item	Quantity	Rate	Cost
M20 Concrete in M3	7.64	5000	38200
Total Reinforcement in Tons	0.442	50000	22100
Total Masonry Work in M2	83.49	300	25047
Total Plaster in M2	237.68	150	35652
Total Painting in M2	237.68	100	23768
Total Floor Area in M2 (Flooring)	35	300	10500
Total Door / Windows in M2	5.25	2500	13125
Total Cost of Floor			168392
Unit Cost of Floor in Rs / M2			4811.2
Unit Cost of Floor in Rs / sqft			447.553
Total Cement Bags Required in Nos.	121		
Total Sand Consumption in M3	14		
Total Aggregate Required in M3	7		

Figure 3 quantity and cost of beams and slabs

Total Concrete in M20 Grade in M3 = 6.48
Total Reinforcement in Tons = 0.683
Total Plaster / Painting in M2 = 64.8
Total Cement in Bags = 56
Total Aggregate in M3 = 5.184
Total Sand in M3 = 3.888
Total Concrete Cost = 32400
Total Reinforcement Cost = 34150
Total Plaster Cost = 9720
Total Painting Cost = 6480
Total Column Cost = 82750

Figure 4 quantity and cost of column

Total Concrete in M20 Grade in M3 = 1.064
Total Reinforcement in Tons = 0.018
Total Excavation and Re-Filling in M3 = 10.166
Total Cement in Bags = 8
Total Aggregate in M3 = 0.851
Total Sand in M3 = 0.425
Total Concrete Cost = 5320
Total Reinforcement Cost = 899.999
Total Excavation and Re-Filling Cost = 1524.9
Total Foundation Cost = 7744.899

Figure 5 quantity and cost of foundation

All the foundation of the plan is designed as the isolated footing under the pure compression. Moments on footing is not allowed in any direction. The software user is required to analyze all building frames consider the base as hinged. The design of the isolated footing is fully automatic, user is not require to give any input regarding this. Size of the footing is governed by allowable bearing capacity (SBC) of the soil and the initial size given by the user. Footing is optimized by having offset in either direction from column as equal, hence reinforcement for footing is same in both the directions. The overlapping of the footing can be corrected by changing the footing dimensions, whereas the required base area is constant or can be corrected by making combine footing/raft/piles etc.

Project # : 2

Concrete Grade : M20

Total Concrete in M20 Grade in M3 = 15.184
Total Concrete Cost = 75920
Total Reinforcement in Tons = 1.143
Total Reinforcement Cost = 57150
Total Masonry in M2 = 83.49
Total Masonry Cost = 25047
Total Plaster in M2 = 302.479
Total Plaster Cost = 45372
Total Painting in M2 = 302.479
Total Painting Cost = 30248

REINFORCEMENT SUMMARY IN KG

6 MM Dia :	115.215
8 MM Dia :	346.674
10 MM Dia :	21.875
12 MM Dia :	36.026
16 MM Dia :	625.063
20 MM Dia :	0
25 MM Dia :	0
32 MM Dia :	0

Bldg. ID : Admin

fy = 415

SBC in T/M2 : 20

Fdn. below GL in M = 1.5

No. of Floors = 1

Effective Cover - Beams = 40 MM
Effective Cover - Slabs = 20 MM
Effective Cover - Columns = 50 MM
Effective Cover - Foundation = 60 MM

Total Flooring in M2 = 35
Total Flooring Cost = 10500
Total Door / Window in M2 = 5.25
Total Door / Window Cost = 13125
Total Excavation+Refilling in M3 = 10.166
Total Excavation+Refilling Cost = 1524.9
Total Cement Bags in Nos. = 185
Total Sand in M3 = 18.313
Total Aggragates in M3 = 13.035
Total Project Cost = 258887
Total Floor Area in M2 = 35
Cost per M2 = 7396.768
Cost per sft = 688.071
Cement Bags per sft = 0.491
Reinforcement in Kg per sft = 3.037
Steel in Kg / M3 of Concrete = 75.276
Conc. Cost as % of Total = 29.325
Steel Cost as % of Total = 22.075
Masonry Cost as % of Total = 9.674

Figure 6 quantity and cost of overall structure and reinforcement summary

Some points should be kept in mind while performing quantity and cost estimation in RCF software.

- After data input of the plan, the user needs to switch to the graphics option for visual checking of beam/column/slabs/joints. When the data entered are free from any kind of error then the user can run the Analysis, Design and Quantity options. Display or print options can be used to see various results.
- To avoid unexpected results, A Quantity options should be performed in a strict order.
- As per the numbers of horizontal and vertical grids, software creates automatic joint numbers. While creating the project, user needs to enter the information regard horizontal and vertical grids.
- Any joint present in the plan which is no more required can be deleted easily. Other joint will be automatically re-numbered after clicking "UPDATE" or "EXIT". Joints are made from beams and columns and hence don't forget to delete those beams and columns which are associated with that joint.
- Editing of the beam/column/slab members should be performed from the "END" to carry further editing. After deleting the members press "UPDATE" to re-number the members.

3. Conclusion

Estimation of beam, slab, columns, footings, project quantities and cost are explained in this research paper using RCF software. Summary reports and output of RCF software are also mentioned briefly. This software is highly effective and can be used in consultancy firms which not only gives output with great accuracy but also saves time offering flexibility to the users in case of alteration of drawing during the construction work which often took place in actual practice.

4. References

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