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PROJECT ESTIMATION AND MANAGEMENT

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Abstract - *Project estimation and management are critical components of successful project execution, ensuring efficient resource utilization, timely delivery, and alignment with organizational goals. Estimation involves predicting the effort, time, and cost required to complete a project, while management focuses on planning, organizing, and controlling project activities. Effective estimation provides a foundation for realistic planning and decision-making, reducing the risks of underestimation or over-allocation. Techniques such as expert judgment, parametric estimation, and analogous estimation enable accurate forecasts, supported by tools like Gantt charts, Work Breakdown Structures (WBS), and Critical Path Method (CPM). Project management encompasses the coordination of resources, stakeholder communication, and adaptation to dynamic project constraints. Agile, Waterfall, and hybrid methodologies provide frameworks for managing diverse project types. Addressing challenges like scope creep, resource conflicts, and shifting priorities requires proactive monitoring and risk management. Ultimately, robust estimation and management practices enhance project success rates, optimize performance, and deliver value to stakeholders.*

Key Words: Project estimation,Project management,Resourse allocation,Cost estimation,Time management,Scope creep,Risk management.

1.INTRODUCTION

Design, analysis, and cost estimation are Project estimation and management are vital for achieving project objectives within defined constraints of scope, time, and budget. Estimation involves forecasting the resources, time, and costs required to complete a project, providing a foundation for effective planning and execution. Accurate estimates are essential to prevent delays, cost overruns, and resource misallocation. Meanwhile, project management encompasses the planning, organization, coordination, and control of tasks to achieve desired outcomes. Modern project management employs frameworks such as Agile, Waterfall, and hybrid models, along with tools like Work Breakdown Structures (WBS) and Critical Path Method (CPM), to enhance efficiency and adaptability. However, challenges such as scope creep, resource conflicts, and dynamic stakeholder expectations often arise, necessitating robust risk management strategies and clear communication. By integrating precise estimation with structured management practices, organizations can optimize performance, enhance project success rates, and deliver maximum value to stakeholders in competitive and evolving environments.

1.1 BACKGROUND OF THE WORK

The entire project revolves around 2D design, structural design, analysis, and cost estimation, all while adhering to a specific set of rules and regulations. The 2D design phase involvesdividing the interior space of the residential building into different functional areas, ensuring the layout meets the necessary requirements. We are designing atwo-story residential building, following basic Vaastu principles and ensuring sufficient space for each area. The structural design focuses on reinforcing concrete (RCC) elements to ensure the building can bear both its own weight andthe live loads acting upon it. This design process typically begins with the topmost part of the structure and continues down to the foundation. Structural analysis is the process of verifying whether the designed structure can withstandthe loads it is subjected to. If the structure fails duringanalysis, it must be redesigned to ensure safety and structural integrity. Cost estimation involves quantifying the required materials and calculating their realtime costs. This stepis essential for determining the total cost of the building's construction.

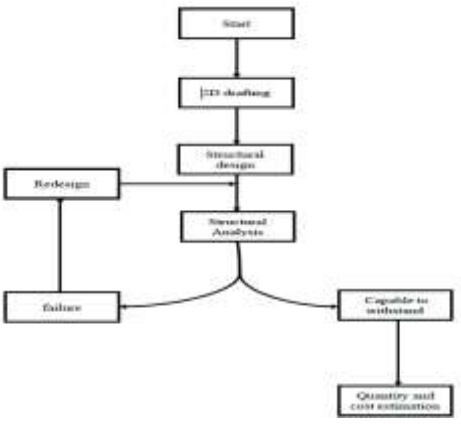

Fig -1: flow to the work

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2. 2D DRAFTING

In this phase we are working in 2d drafting in different views. This is the basic requirement for the project. In this phase we are using the software AutoCAD (student version) to draft the 2d drawings.

2.1 FLOOR PLAN

We are first collecting the information from the client the dimension of the site area, room requirements and number of floors they want. Next do the drafting the outline of the site and mention the directions (north, east, west south) and mention the road side of the plot area. We decide the building setback and front area based on TNCDBR (Tamil Nadu Combined Development and Building Rules - 2019) published by department of Municipal Administration and Water Supply Department. we are using the gride method to align the walls, beams and column in 2d drafting. It is useful to identify the column, beam and footing easily. First in starting the drawing set the units foot and inches in the AutoCAD. Next mention the direction and draw the site boundary. Next, we allocate the setback distance and building front side distance based on TNDCDBR rule book. the dimension of the site is 33'6" X 52' 3" the area is 1753.591 square ft and the site is facing north side so we draft the residential building facing north side. The client wants 2 bedrooms with attached bathroom, one kitchen, living room, parking. They want same floor plan for 2nd story.

Fig -2: Ground floor lay-out

Fig -3: first floor lay-out

3. STRUCTURAL DESIGN

This is the second step of the project in this we are choose correct structural elements, pace the structural elements in correct level, design the structural element to withstand the loads (dead load and live load (imposed load)) and create the detailed 2d structural element for the elements. The structural design is based on the 2d- drafting plan. Here we are following to design the structure element is limit state method (LSM). The structural design is basically designed up to bottom for example, we decided to structural design the 2-story building we have to design the both floor slabs, top floor beams, bottom floor beam, plinth beam, top floor column, bottom floor column and footing respectively. The detailed explanation of each element has been given below. All the structure design in the project is based on Indian standard code books (IS 456-2000, IS 875 part 1, IS 875 part2, SP 16).

Table -1: Site info

Description	Data	Units
Dimension of the site	33' 6.25" * 52' 3.5"	Ft and inches
Dimension of the building	27' 7" * 45' 2.3"	Ft and inches
Total site area	1753.591	Square ft
Total build up area	1240.924	Square ft
Carpet area	1056	Square ft
Number of stories	2	No's
Floor Hight	11	Feet

3.1 Desing of slab

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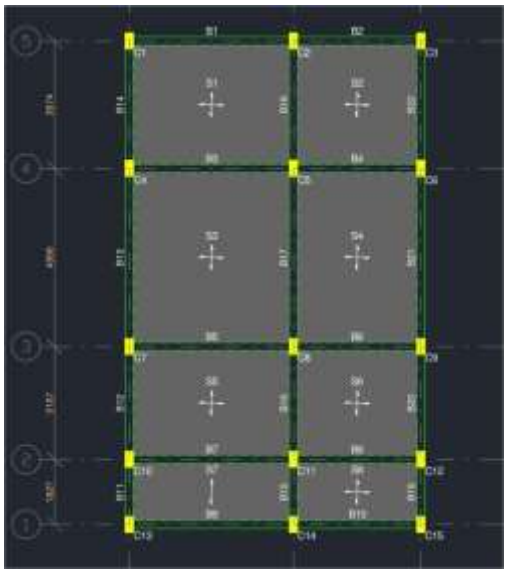

Fig -4: slab lay-out

we have to find the slab type is one way or two-way slab based on Ly/Lx ration if the ratio is below two the slab is one way otherwise the ratio is above two the slab considers as two-way slab. We design the slab based on its type. We take the load base on live load as per Is 875 part-1 and dead load as per is 875 part-2. we choose the partial safety factor base on is 456. In this design result we know minimum reinforcement required for each slab and how depth is required to with stand the applied load. In practical we provide the more than minimum requirement of the reinforcement and depth of the slab do not provide less than the minimum requirement arrived form calculations. Finaly the design of slab process end in detailed drawings. The drawings show how the reinforcement has provided and shows type of reinforcement to provide.

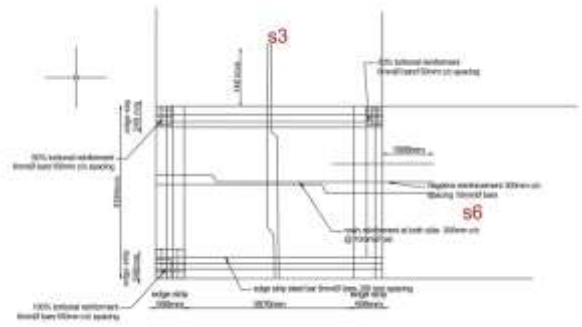

Fig -5: s5 slab reinforcement details

In the slab design we are using 10 mm Dia bar for main bar and 8 mm Dia bar for distribution bar, extra bar and tortional bar. above the image shows the reinforcement detailing of S5 slab. All the slab has same rebar spacing. only the tortional reinforcement has been change based on edge condition (is456-2000). If the slab in edge has no continuous the tortional reinforcement have to provide 100%, the one edge continuous we have to provide 50% of tortional reinforcement. The both edges are continuing there are not required to provide tortional reinforcements

3.2 Desing of beam

we take the load self-weight of the beam and load from slab. Here we have to find the beam type if the beam continuous beam or non- continuous each type has different design procedures. We calculate the load from slab for each and every beam and slab. First, we decide the method do design, here the design is moment distribution method because the Indian standard codebook IS-456-2000 says the load in the continuous beam the load and span difference between beams are below or equal 15 percentage we have to design in common method otherwise the difference is above 15 percentage we have to design the moment distribution method.In the beam design we classified the beam in to based on location and total number of spans. Here we make the layout of the beam and we do design. We are using 16 mm and 20 mm Dia bar the bottom bar and top bar and the 8 mm Dai bar is used for stirrups. The detail reinforcement details has been attached in Appendices. Spacing between stirrups in support is 100 mm and in the middle of the beam is 250mm center to center spacing

3.3 Design of column and footing

Each and every floor column has been designed separately. In the design procedure we have to find the column type base on its position and load acting type. In the top story column load is calculating the axial load using beam load (slab live load+ slab dead load+ beam dead load) and self-weight of the column. The bottom story column axial load has been calculated that level beam load (slab live load+ slab dead load+ beam dead load) and self-weight of the column and add the top column axial load is total axial load of the column in bottom story. The footing has been designed based on soil SBC (soil bearing capacity) and load acting on the footing. We are choosing the isolated footing for our building because the building is non high rise building and we can assume the soil SBC is good. We are using the software Staad pro to design the column and footing because

Level	Size (mm)	Material	LC	P (kN)	Mx (kNm)	My (kNm)	Pt (%)	Interaction Ratio	Main Reinforcement	Links
1 TO 2	230 X 450	M25 : Fe415 : Fe415	1	354.52	12.31	19.81	0.87	0.44	8-T12	T8 @ 65 + T8 @ 100
3 TO 4	230 X 450	M25 : Fe415 : Fe415	1	229.14	18.58	18.6	0.87	0.6	8-T12	T8 @ 65 + T8 @ 100
5 TO 6	230 X 230	M25 : Fe415 : Fe415	1	80.77	-11.61	-4.66	0.86	0.85	4-T12	T10 @ 70 + T8 @ 100

Table -1: C1 column desing

the column design in manual method is in some mistakes and calculation error so we decide to design the column and footing using Staad pro software in below we add the c1 column design in the building other column detail rcc design has been attached in the Appendices. Here level 1 to 2 is under plinth level, 3 to 4 is ground level to ground floor roof level and 5 to 6 is top story roof level.

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3.4 Design of staircase:

In this building we are choose the type of staircase is dog-legged because this type of staircase is no need special structure, economical, easy to build, it saves more spaces and compact. We design the staircase in front of the building to access the top floor and terrace. It has one lander in middle of the staircase and it has 2 flights in opposite side to climb.

4 . Structural analysis:

Analyze the designed structure to withstand the load applied on the structures. The load has been vary based on the structural element and where it can locate on the building. we are using the software "Staad pro" academic licensed software used to analysis the structural element under the loaded condition. The structural analysis of the structure shows the structural element can withstand the load acting on the building. this will help to find the failure element (not withstand the applied load). in the analysis we have to applied the imposed load, wall load acting on the building and appley the support (fixed support). Here we are using the Staad pro software to analysis and do redesign the beam and slab. This analysis process has been done in Staad pro with zero errors.

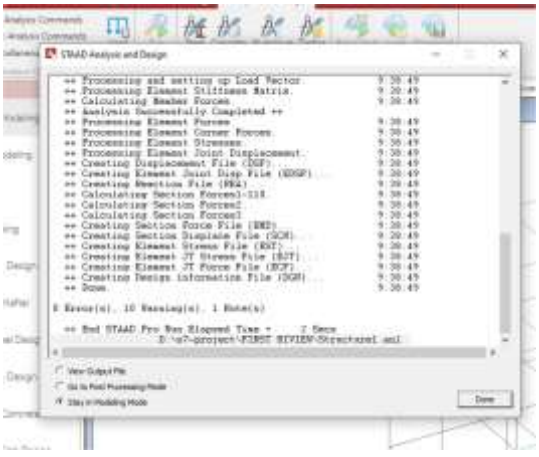

Fig -6: analysis result

5 .Quantity and cost estimation:

This is the last phase of the project. It can calculate the material and cost requirement for the full project to complete. We divide the quantity estimation in two type bases on structural elements and non-structural element. The structural element is column, beam, slab and footing these are contains cement, sand, coarse aggregate and steel (reinforcement). the non-structural element is wall and pcc this element contains brick, cement, and sand. We also calculate quantity of finishing materials like tiles and paints. Each and every material required different quantities of material and we also calculate the shuttering area to calculate total cost for the building. the price of the material has been taken from real time. We contact the particular construction material dealer and contractor to get the price of the materials cost and construction labor cost for the project. In this phase the software Microsoft excel make the quantity estimation and cost estimation easy. It will helpful to find the quantity, volume and area easily. The cement is calculated how many bags required, steel has been calculated in the unit kilo- gram, coarse and fine aggregate has been calculated in the unit of cubic feet, bricks calculated numbers required, paint has been calculated in unit of litter and the tile has been calculated in numbers required. The labor cost only for the masonry construction work has been calculated based on per square feet contract cost.

over all cost of the building		
footing	₹	240,462.09
column	₹	397,481.27
beam	₹	559,197.88
slab	₹	556,589.80
walls	₹	321,482.52
tiles	₹	560,600.73
paint	₹	123,144.58
door and windows	₹	383,000.00
labour cost	₹	987,108.95
over all cost	₹	4,335,521.21

Table -3: cost estimation

6. CONCLUSIONS

The structural design and analysis phase was fundamental in confirming the building's durability, resilience, and adherence to safety regulations. We evaluated various structural components, ensuring they could withstand expected loads and environmental factors. This phase of the project demanded precision and attention to detail, as each structural element impacts the building's overall stability. We utilized structural analysis tools and methodologies to validate the load-bearing capacity of critical elements, supporting our goal of creating a safe and secure structure that would meet residential needs effectively. An essential part of the project was estimating the quantities of materials required for construction and calculating the associated

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costs. This financial assessment allowed us to evaluate resource needs comprehensively and helped determine the project's financial feasibility. The total estimated cost of construction came to ₹4,335,521.21, excluding the expenses for plumbing and electrical installations. This estimate, grounded in detailed calculations, offers a realistic view of the investment required to complete the building. By providing a cost analysis, we ensured that the financial plan was accurate and feasible, giving future stakeholders or developers a clear view of budgeting needs and allowing for informed financial planning.

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