PLANNING, ANALYSIS, DESIGN AND ESTIMATION OF AN IT COMPANY BUILDING

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Abstract- Any construction project to begin with starts with the Layout of the building or structure followed by Design and Analysis of the structure which is succeeded by cost estimation and planning for the said project. This project involves the layout, design, analysis, planning and cost estimation of a G+2 IT building. In this present project we are going to do a layout of an IT company which will be locate in our college ground. The total survey work will be carried out by Total Station. The area of the college ground is 4.65 acres complete plan of the survey work is going to be developed by using AUTO Cad software and detailing is done. The layout of the proposed G+2 IT building is based on a plot of size 1758m^2. All the drafting work was done by AutoCAD. The analysis the entire structure has been completed using STAAD pro. Designing is done manually. The cost estimate for the project has been calculated using separate wall method in Microsoft Excel. For the bstract cost CPWD Schedule of rates has been followed by government of Telangana for the year 2020 and a total cost of Rs 191582120 has been calculated.

Keywords—Survey, Analysis, Structural design, Estimate

I. INTRODUCTION

To start any construction project we should perform Survey, planning, analysis, design and estimation activities. Building design refers to the broadly based architectural, engineering and technical applications to the design of buildings. Analysis is important as it provides a basis for structural design and also it evaluates whether a specific structural design will be able to withstand external and internal stresses and forces. The Estimating is the technique of calculating or computing the various quantities and the expected expenditure to be incurred on a particular project.

II. LAYOUT OF THE BUILDING

Layout of building or a structure shows the plan of its foundation on the ground surface according to its drawings so that excavation can be carried out exactly where required and position and orientation of the building is exactly specified.

A. Surveying of college ground using total station:

Surveying of college ground is done by using total station. In this project, first survey of college ground is performed by using total station. We have calculated the area of college ground. Total area is 4.65 acres. levels of the ground are also taken to find cutting and filling of the ground. At last by using rdm command, reference point, target point, horizontal angles, vertical angles are known. Area is known to construct IT building. The clear view of the college aground is shown below.

Fig 1. Surveying of Ground

B. Planning of Layout using Autocad:

The layout is planned as in total area of land is 4.65 acres. The layout was then prepared using AutoCAD. It is a commercial type building. The plot size for the project was 1758m^2. Number of floors are G+2. Below is the line diagram showing the centre line for beam and column layout. The various layers that have been used are like walls, doors, beams, columns, and slab.
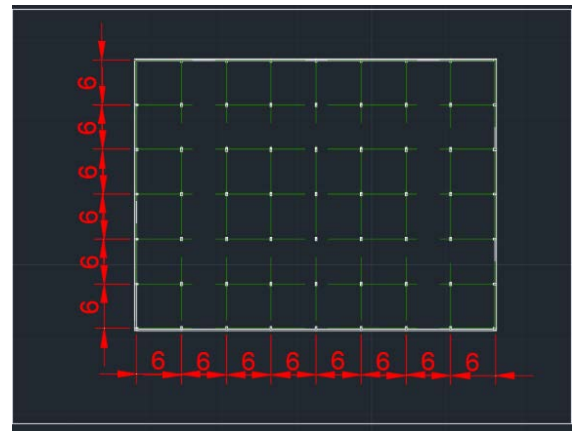

Fig 2. Ground Floor Plan

Fig 3. First Floor Plan

Fig 4. Column center line diagram
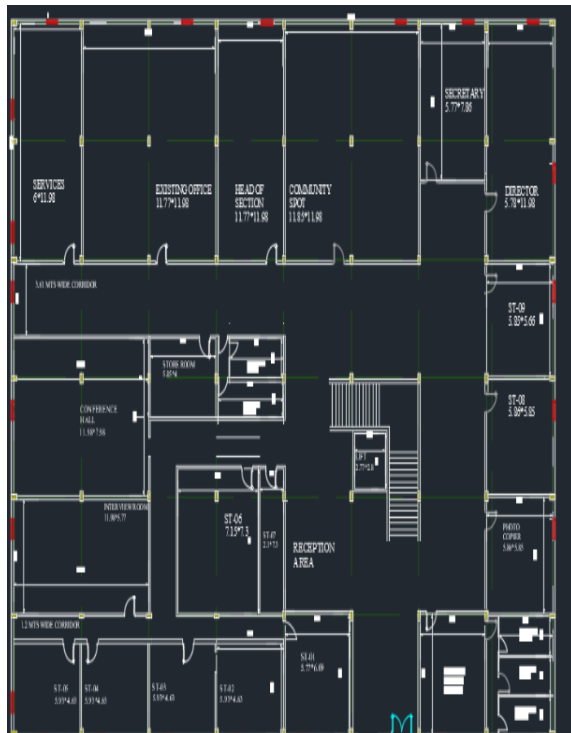
III. ANALYSIS OF STRUCTURE

The layout from AutoCAD is transferred to Staad pro using a dxf file. The elevation is then created by using translational repeat tool. The above figure shows the beam and column layout that has been transferred from AutoCAD.

Table 1. Structural details

Length of Building	48.35m
Width of Building	36.35m
Height	11.1m
Live load on the floor	4 kN/m^2
Grade of concrete	M20
Steel	Fe 415
Column Size	0.23m×0.46m
Beam Size	0.23m×0.45m
Slab Thickness	170mm
No Columns	63
No Beams	104
No of Footing	63

A. Materials

The materials for the structure is selected as concrete with their property and constants as per IS Codes.

B. Loading

The loading that have been considered on the structure are as follows. Self-Weight, Dead Load, Live Load, & Load combinations. The weight of the entire structure generated by STAAD Pro itself with the Self Weight command.

IV. STRUCTURAL DESIGN

After the analysis by STAAD Pro proceed to the design part of the structure. Design of beam, column, slab and footing, is done manually by using the values which are obtained from the Staad pro analysis

A. *Design of slab (Two way slab):*

It is a two way slab. lx=6m, ly=6m, f_{ck} =20 N/mm^2, f_y =415 N/mm^2, Depth of the slab D=170mm, Self weight of slab =0.17×25=4.25 kNm^2, Live Load = 4 kN/m^2 (for commercial buildings) , Floor finish load = 0.60 kN/m^2.
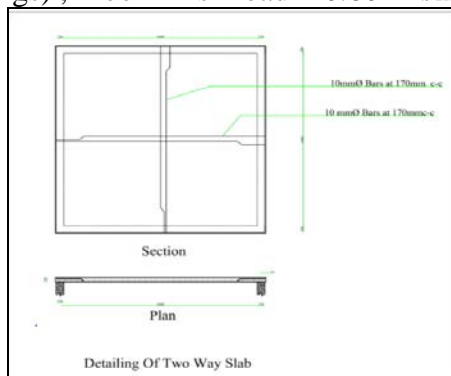

Fig 5. Detailing of slab

B. Design of column:

The column was designed as short column. f_{ck} = 20N/mm^2, f_y = 415N/mm^2, Length of column = 3.2m, Dimensions of column = 230mm×460mm, Axial load = 948kN , Dx = 460mm, Dy = 230mm. Size of column=230mmx460mm , Axial service load = 1555 kN.
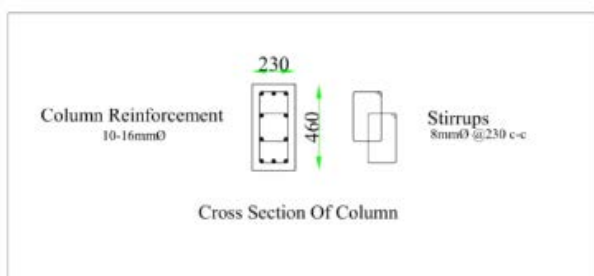

Fig 6. Detailing of column

C. Design of Beam:

The beam was designed as doubly reinforced beam. f_{ck}=20N/mm^2, f_y = 415N/mm^2 , m_u = 83.9kN-m , v_u = 83.7kN, Overall depth of beam (D) = 450mm , Width of beam (b) = 230mm
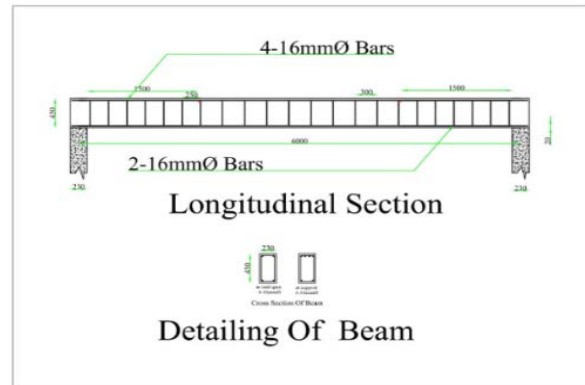

Fig 7. Detailing of Beam

D. Design of footing:

The footing was designed as isolated rectangular footing. Safe bearing capacity of soil = 290kN/m^2, f_{ck} = 20N/mm^2, f_y = 415 N/mm^2
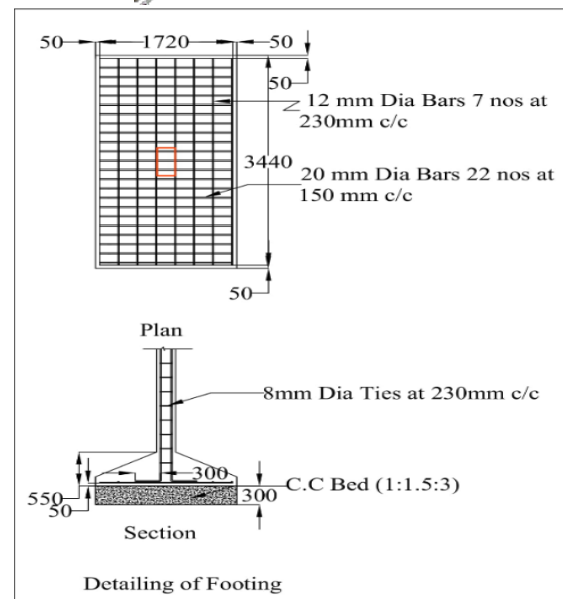

Fig 8. Detailing of footing

V. ESTIMATION

Estimating and costing in construction is the calculation of quantities of materials, tools, equipments, labors etc. and cost associated with them. The front elevation of the building shown in Fig.9.

Fig 9. Elevation of the building
Table 2. Estimation of the building

SNO	QUANTITY	DESCRIPTION	RATE (Rs)	PER	AMOUNT (Rs)
1)	1006.44 m^3	Earth work excavation for hydraulic machine	101.85	M^3	102505
2)	3033.627 m^2	Ground leveling	101.85	m^2	308977
3)	24603.56 m^3	Sand filling for basement & foundation	760	m^3	18698705
4)	5158.37 m^3	P.C.C (1:1.5:3) for M20	3500	m^3	18054295
5)	1418.92 m^3	R.C.C (1:1.5:3) for M20	4100	m^3	5817572
6)	102.21Tonnes	Fe 415 Steel	44000	Tonne	4497240
7)	1023464 Nos	First class bricks (0.19×0.09×0.09)	6.70	1 No	6857208
8)	170.73 m^2	Solid panel pvc one side openable door frame with shutter	2153	m^2	367581
9)	33 m^2	Sliding pvc Window frame with shutter	6799	m^2	224367
10)	720.45 tonnes	Cement required for plastering	5300	Tone	3818385
11)	2188.96 m^3	Sand required for plastering	760	m^3	1663610
12)	153073.38 m^2	Marble flooring	432	m^2	66127700
13)	646.8 kgs	Painting to doors & windows	22	Kg	14229
14)	195432 kgs	White wash to ceiling & walls	5	Kg	977160
15)	194927 kgs	Painting to ceiling & walls	22	Kg	4288394
16)	153073.38 m^2	False ceiling gypsum board tiles (0.595×0.595×0.0125)	225	m^2	34441510

		Hire charges for centering & scaffolding			
17)					
	174.34 m^3	a) footing	951	m^3	165797
	50.12 m^3	b) plinth beams	2987	m^3	149708
	18.03 m^3	c) lintels	2876	m^3	51854
	68.15 m^3	d) columns	2736	m^3	186458
	197.61 m^3	e) beams	4083	m^3	806841
	5255.16 m^2	f) slabs	476	m^2	2501546
			Total Cost of building		Rs. 17,01,21,642

Water supply, sanitary arrangements, cupboard & compound wall arrangements, Electrification arrangement, Material conveyance, machinery hire charges, labour charges & contractors profit (including all). The total cost of the building is Rs. 19,30,88,061.

VI.   CONCLUSION

This project includes the planning of G+2 IT building using AutoCAD, Analysis and Design made by STAAD Pro and manual design as per IS:456-2000, Surveying using total station and concludes with the cost estimate for the entire project.

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