Planning, Analyzing and Designing of IT Park By Using STAAD Pro

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ABSTRACT

Planning analysis and designing of IT Park is our project which is proposed at Salem dt. The IT Park building consists of, CEO Room, Manager Room& HR Room, Server Room& Sweepers Room, Security Room& Reception, Conference hall, Photographer Room, Project Room, Hardware Room Drafting method for design the plan is by AutoCAD. The framed type of construction is used for the construction and the designing of structure is carried out by limit state method with the IS 456: 2000 code book. The availability of men and materials is in local itself. The plan and structural elements are designed using STAAD Pro and the reinforced details has been obtained slabs and foundation has been designed using STAAD Pro etc. This project helps us in exploring knowledge about planning analyzing and designing of a IT Park.

Keywords: IT Park, AutoCAD, Planning and Analyzing

1. INTRODUCTION

Information technology (IT) is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Several industries are associated with information technology, including computer hardware, software, electronics, semiconductors, internet, telecom equipment, e-commerce and computer services. Devices have been used to aid computation for thousands of years, probably initially in the form of a tally stick. The responsibilities of those working in the field include network administration, software development and installation, and the planning and management of an organization's technology life cycle, by which hardware and software are maintained, upgraded and replaced.

2. MANUAL DESIGN

2.1 Design Two Way Slab

2.1.1 Available Data

fck = 25 N/mm^2
fy = 415 N/mm^2
Room size = 9.0 x 7.7m

Support = 300 mm
Thickness of slab =200mm

2.1.2 Effective Span

2.1.3 *For Shorter Span,*

- Center to center of supports = 7700+300=8000 mm
- Clear span + effective depth = 7700+180= 7880 mm

2.1.4 For longer span

- Center to center of supports = 9000+300=9300 mm
- Clear span + effective depth = 9000+180= 9180 mm

2.1.5 *Load Calculation*

Consider 1m width of slab

Live load = 2 KN/m^2
Self weight of slab = 1 x b x D x unit weight
=1 x 1 x 0.20 x 25
= 5 KN/m^2
Weight of floor finish =1x 1 x 0.05 x 20= 1.0 KN/m^2
Total load = 8 KN/m
Design load = 8 x 1.5 = 12 KN/m

2.1.6 Main Reinforcement

2.1.6.1 For shorter span,(max or m in shorter span)

M_x = 0.87 fy A_{st} d (1- fyA_{st} / fckbd)
38.74 x 10^6 = 0.87 x 415 x A_{st} x 180 (1- 415 x A_{st} / 25 x 1000 x 180)
$5.99A_{st}^2 - 64.98 \times 10^3 A_{st} + 38.74 \times 10^6 = 0$
A_{st} min = 633.13 mm^2

2.1.6.2 Spacing

Assume 10 mm dia bars

S = ast/A_{st} x b = 78.54/633.13 x 1000
= 130 mm
3d = 3 x 180 = 540 mm

300 mm c/c

Provide 10 mm dia bars @ spacing 130 mm c/c distance.

2.1.6.3 For Longer Span

M_y = 0.87 fy A_{st} d (1 – fy A_{st} / bd fck)
27.56 x 10^6 = 0.87 x 415 x A_{st} x 180 (1- 415 x A_{st} / 25 x 1000 x 180)
$5.99A_{st}^2 - 64.98 \times 10^3 A_{st} + 27.56 \times 10^6 = 0$
A_{st} min = 442.16 mm^2

2.1.7 Check For Deflection

Assume 10mm dia

Ast_{pro} =(ast/s) x b=(78.54/130) x 1000
=604.15mm^2
% of steel = 100A_{st}/bd
= 100 x 604.15 /1000 x 180
= 0.34%
fs = 0.58 x fy Ast_{req}/Ast_{pro}
= 0.58 x 415 x 633.13/604.15
= 240
M.F = 1.55
davi = span/(B_V x MF)

=7880/32 x1.55 = 160mm

d req < d pro

Hence design is safe.

Figure 1 shows the cross section of two way slab.

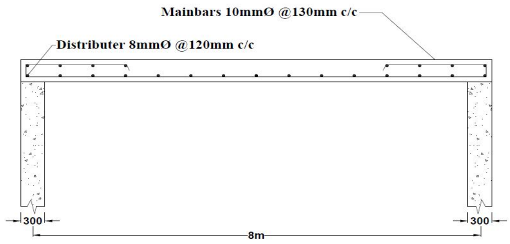

Figure 1 Cross section of Two way slab

2.2 Design of Simply Supported Roof Beam

2.2.1 Available Data

Center to center distance l_{eff} =9.30m

B =300mm

D =340mm

D =300mm (assumption)

Fy =415N/mm^2

Fck =25N/mm^2

Q =3.45

% Ast =1.197%

2.2.1 Load Calculation

Self weight of beam =b x D x unit Weight

=0.30x 0.34x 25=2.55 KN/m

Slab floor finish 1 = perpendicular distance x tk x unit Weight

= 3.85x0.05x 20 =3.85 KN/m

Slab self Weight1 =3.85 x 0.20 x 25=19.25KN/m

Wall load =0.30 x 3 x 19=17.1 KN/m

Total load =43 KN/M

Factored load =43 x 1.5

F_d =64.5KN/m

2.2.2 Reinforcement

Ast_1 =M_{ulim}/(0.87 x fy x (d-0.42 X_{umax}))

=226.71 x 10^6/ (0.87 x 415 x (670-0.42 x 0.48 x 670)

Ast_1 =1173.83mm^2

Ast_1 =M_{UA}/(0.87 X fy x (d-d'))

=226.71x 10^6/(0.87 x415 x (670-40))

Ast_2 =996.69mm^2

Total Ast =Ast_1+Ast_2

Ast =2170.52mm^2

Provide 20mm dia bars

ast =314.16mm^2

NOS =Ast/ast=2170.52/314.16=7nos

Ast =7 x π x 20^2/4=2199.11mm^2

Provide 7nos of 20mm dia barsas tension reinforcement

2.2.3 Check For Stiffness

% Ast = 100Ast/bd = 100 x 2199.11 /(300 x 670)

% Ast = 1.09

Fs = $0.58Fy\ (Ast_{req}/Ast_{pro})$
= 0.58x415x (2170.52/2199.11)
= 240 Curve MF = 1.0
d_{avi} = span/(B_V x MF)
d = 9300/32x1.0 = 300 mm< 670 mm

Hence design is safe.

Figure 2 shows the simply supported roof beam.

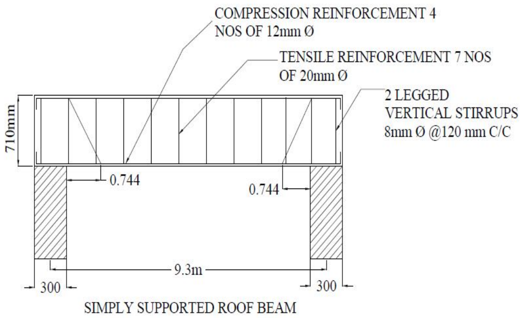

Figure 2 Simply supported Roof beam

2.3 Design of Dog Legged Stair Case

2.3.1 Available Data

Vertical height of floor = 3000 mm
Rise = 150 mm
Thread = 300 mm
Size of room = 3.5 x 1.5 m

2.3.2 Sizes of Staircase

No of riser = height/rise = 3000/150 = 20 nos
No of flight = 2
Riser per flight = 20/2 =10 nos
No of tread = 10-1 = 9 no
Length of going = thread x nos of tread
= 300 x 9 = 2700mm
Width of landing = (3500-2700)/2
= 400mm

2.3.3 Check For Deflection

Assume 10mm dia

Ast_{pro} =(ast/s) x b =(78.54/160) x 1000
= 490.87 mm^2
% of steel = $100A_{st}/bd$
= 100 x 490.87 /1000 x 165
= 0.2 %
fs = 0.58 x fy Ast_{req}/Ast_{pro}
= 0.58 x 415 x 468.61 /490.87
= 240
M.F = 1.4 (by using 240 curve in graph)
davi = span/(B_V x MF)
= 3730/32 x 1.4 = 83.25mm
d req < d pro

Hence design is safe

Figure 3 shows the Dogged legged stair case.

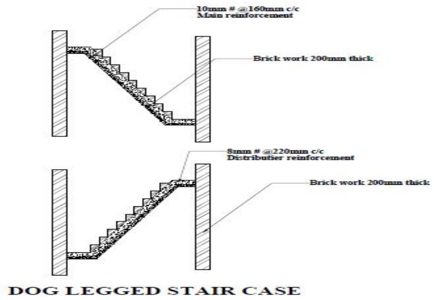

Figure 3 Dogged legged stair case

2.4 Design of Rectangular Column

2.4.1 Available Data

Size of column = 300 X 600mm
fck = 25 N/mm^2
fy = 415 N/mm^2

2.4.2 Load Calculation

2.4.2.1 Slab

Weight of slab (1) = L x B x D x unit Weight
= 7.55 x3.85 x 0.20 x 25 = 145.33 KN
Weight of slab ff (1) = L x B x D x unit Weight
=7.55 x 3.85 x 0.05 x 20 = 29.06 KN
Weight of slab (2) = L x B x D x unit Weight
= 4.5 x 3.85 x 0.20 x 25 = 86.63 KN
Weight of slab ff (2) = L x B x D x unit Weight
= 4.5 x 3.85 x 0.05 x 20 = 17.325 KN
Live load (1) = 7.55 x 3.85 x 2.0 = 58.135 KN
Live load (2) = 4.5 x 3.85 x 2.0 = 34.65 KN

2.4.2.2 Beam

Beam (1) = L x B x D x unit Weight
=7.55 x 0.3 x 0.71 x 25 = 40.20 KN
Beam (2) = 4.5 x 0.3 x 0.71 x 25 = 23.96 KN

2.4.2.3 Wall

Wall load (1) = L x B x H x unit Weight
= 7.55 x 0.3 x 3 x 19 = 129.105 KN
Wall load (2) = 4.5 x 0.3 x 3 x 19 = 76.95 KN

2.4.2.4 Longitudinal Reinforcement

Let assume Asc = 1% Ag
= 0.01 Ag
= 0.01 x180 x 10^3
= 1800 mm^2
Area of concrete Ac = Ag – 0.01 Ag = 0.99 Ag
= 0.99 x 180 x 10^3 = 178.2 x 10^3
Pu = 0.4fck Ac + 0.67fyAsc
Pu = 0.4 x 25 x 178.2 x 10^3+ 0.67 x 415 x 1800
Pu = 2285 KN
Say Pu = 2285 KN >1965 KN Hence safe
% Asc = 100 Asc/Ag

= 100 x 1800 / (180 x 10^3)
% Asc = 1 % > 0.8% < 6%
Hence ok.
Let us provide 6nos of 20mm dia bars
Asc = 6 x π x 20^2/4 = 1884.95mm^2

2.4.2.5Transverse Reinforcement

2.4.2.5.1 Minimum Diameter

1/4 x dia = 1/4 x 22 = 5.5mm
Not less than 6mm

2.4.2.6 Pitch

LLD = 300 mm
16 x 22 = 352 mm
300mm
Provide 6mm dia laterals at 300mm c/c

2.4.2.7 Result

Size of column = 300 x 600 mm
Longitudinal reinforcement = 6nos of 20mm dia bars
Transverse reinforcement = 6mm dia at 300 mm c/c
Figure 4 shows the Reinforcement details of R.C.C. Column.

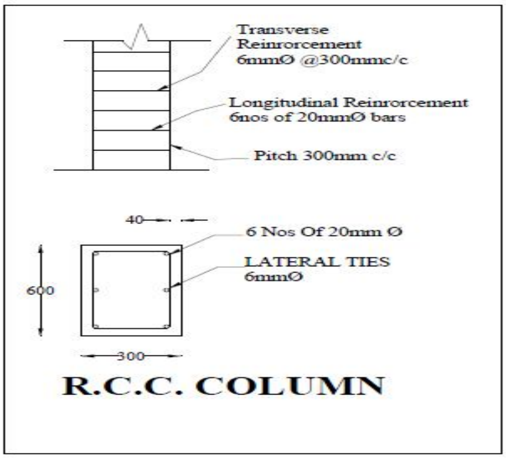

Figure 5 Reinforcement details of R.C.C. Column

2.5 Design Of Isolated Rectangular Footing

2.5.1 Available Data

Size of column =300 x 600mm
Safe bearing capacity =200 KN/m^2
fck = 30 N/mm^2
fy = 415 N/mm^2

2.5.2 Tension Reinforcement

2.5.2.1 In Long Direction

M_{UL} = 0.87 fy A_{st} d (1- fy A_{st} / fck bd)
2912.05 x 10^6 = 0.87 x 415 x A_{st} x1120 (1- 415 x A_{st} / 30 x 2300 x 1120)
2.17A_{st}^2 – 404.37 x $10^3 A_{st}$ + 2912.05 x 10^6 = 0
Ast_L = 7503.59 mm^2
Ast_{min} = 0.12/100 x (b x D)

= (0.12/100) x2300 x 1170

Ast_{min} = 3229.2 mm^2

ast = π x 22^2/4=380.13 mm^2

NOS = Ast_L / ast = 3229.2/380.13 = 9nos

Provide 9 nos of 22mm dia bars in long direction at uniform spacing

Ast = 9 x π x 22^2/4 = 3421.20 mm^2

2.5.3 Check For SBC Of Soil

Column load =1350 KN

Weight of footing =2.3 x 3.45 x 1.17x 25=232.1 KN

Total load on soil =1583 KN

Pressure on soil =1583 / (2.3 x 3.45)=199 KN/m^2

199 KN/m^2 < 200KN/m^2

Figure 6 shows the Reinforcement detailing of Isolated Rectangular Footing

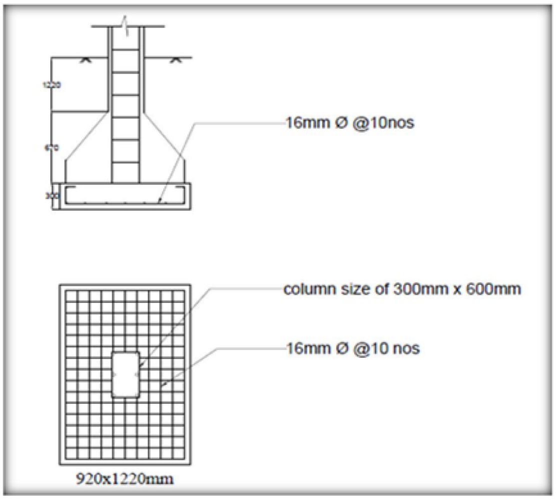

Figure 6 Reinforcement detailing of Isolated Rectangular Footing

3. STAAD REPORT

Figure 7 shows the whole structure of the building.

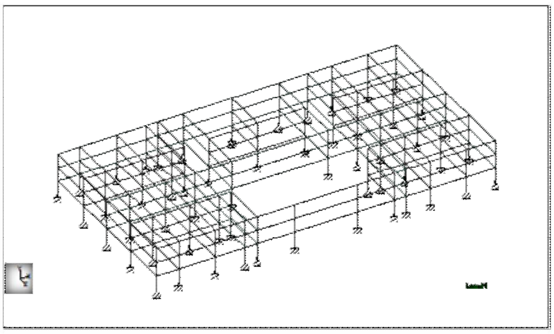

Figure 7 Whole Structure

Figure 8 shows the 3D rendering view.

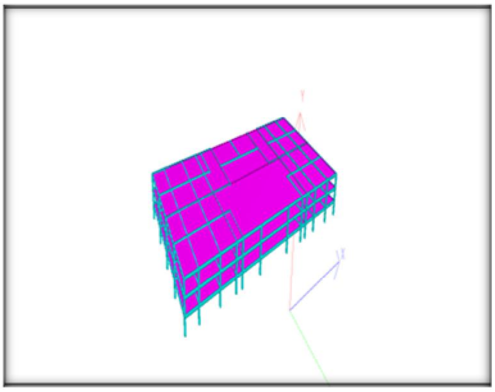

Figure 8 3D Rendered View

Figure 9 shows the column reinforcement design.

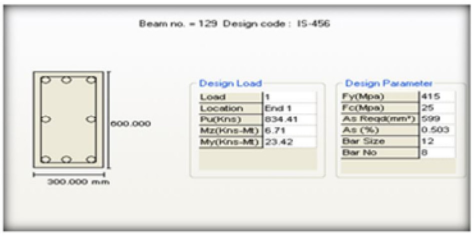

Figure 9 Column Reinforcement Design

3.1 Concrete Take Off

(FOR BEAMS AND COLUMNS DESIGNED ABOVE)

TOTAL VOLUME OF CONCRETE = 376.94 CU.METER

BAR DIA (in mm)	WEIGHT (in New)
8	87886.48
10	36405.51
12	64786.61
16	40508.11
20	64823.85
25	18602.85
32	2740.84
TOTAL=	315754.25

Figure 10 shows the blue print of the building.

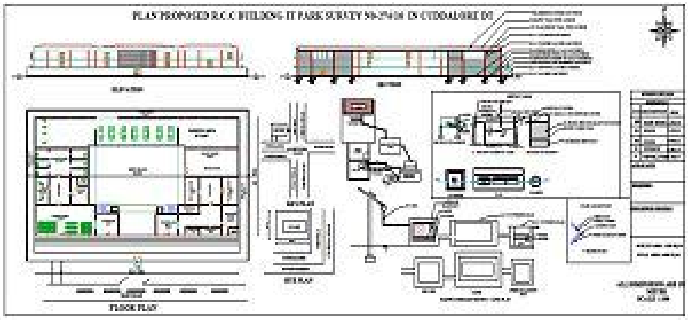

Figure 10 Blue Print

4. CONCLUSION

IT Parks are the landmark for a high-tech & well settled city, so we are tried to gave the status for our district and also utilize the minimum area for our project. The IT Park consists of advanced technical equipments & facilities in our project. For the official green building construction regulations should be followed in this project. Through our study we conclude that application of software in civil industry plays important role in our study. In our study IT Park building designed by adopt limit state method for analysis and design of building structure.

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