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RESEARCH ARTICLE

ANALYSIS AND DESIGN OF MULTI-STOREYED (G+2) RESIDENTIAL BUILDING

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Abstract

Structural design is an investigation method of the rigidity, strength and stability of the building. The essential aim in structural analysis and design is to construct a structure capable of overcoming all applied loads without failure during it's intended life. This project attempts to understand the structural behavior of various components in the multi-storied building. planning, analysis, designing of multi-storied building has been taken up for residential building (G+2). Thereby depending on the suitability of plan, layout of beams and positions of columns are fixed. Dead loads are calculated based on material properties and live loads are considered according to the code IS875-part 2, footings are designed based on safe bearing capacity of soil. For the design of columns and beams analysis is done by limit state method to know the moments they are acted upon. Slab designing is done depending upon the type of slab (one way or two way), end conditions and the loading. From the slabs the loads are transferred to the beams, thereafter the loads from the beams are taken up by the columns and then to footing finally the section is checked for the components manually and using STAAD Pro V8i software for the analysis of structure, maximum shear force, maximum bending moment are computed.

Introduction:-

General

Everything in the contemporary world is carefully constructed and created to achieve optimum utilization with a minimum input of the three M's, namely, mind, money, and labor. With the aid of modern technology, every process, whether manufacturing, processing, transportation, or production, is becoming more optimized and efficient. Construction and engineering are among those industries that are closely related to the economy and human safety as a consequence of their optimization of investment, which, together with ensured safety, is becoming a need. The home is the earliest social unit and the basic unit of human residence. The home is designed to provide wind and weather protection as well as insurance against physical vulnerability of any type Dormitories are available in such a structure. It consists of a living room, a bedroom, a kitchen, a hallway, a toilet, and a bathroom. It might be a three-story structure or apartments.

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Our projects entail the study and design of residential buildings utilizing the widely used design software STAAD pro. The building has a total size of 2196 square feet.
• A peaceful setting.
• Protection from all natural sources and weather conditions.
• General community facilities in his residential neighborhood.

When recommending a certain sort of plan to a customer, the engineer must take into consideration the municipal circumstances, building codes, surroundings, future provision, aeration, ventilation, and so on.

Building Components

The following articles provide a basic summary of the various building components (Super and Substructure), as well as the process of analysis and design.

SLABS

The aspect ratio of a slab determines whether it is a one-way slab or a two-way slab. When the aspect ratio (ly/lx) exceeds 2, It is intended to be a one-way slab. When the aspect ratio is 2, it is constructed as a two-way slab. A one-way slab is constructed as a beam with a width of one meter. Based on the boundary criteria, two-way slabs are further divided into nine categories as specified in IS 456:2000. The two-way slabs are separated into central and edge strips and are created accordingly.

BEAMS

These are the flexural members that support the slab. The beam is then supported by columns, to which the loads are transmitted. Beams' cross sections might be square, rectangular, or flanged (T or L shaped). Depending on the type of reinforcement used, beams can be reinforced single or double. STAAD Pro was used to design the beams. After designing the slabs on the various levels, the imposed loads are manually transferred to the various frames in the building. The yield line theory is used to calculate the distribution of dead and live loads coming from the slab onto each beam.

COLUMNS

These are vertical skeleton structural components with cross-sectional geometries that might be rectangular, square, circular, and so on. The size of the section is determined by the effective length of the column and the loads operating on it, which are determined by the kind of floor system, column spacing, number of stores, and so on. The column is often intended to withstand axial compression as well as uniaxial or biaxial bending moments caused by frame movement. It is also recommended that adequate tie beams be used to limit the unsupported length of the columns. If not, they may have to be designed as short columns if not.

Footings

It is a horizontal two-way slab that provides a wide base for a column for load distribution over a wider region. Load transfer is impacted by bending and, to a lesser extent, bearing. The footing is the element responsible for transferring the full building load to the earth.

Literature Review:-

Mohammad Kalim, Abdul Rehman, B S Tyagi (2018):

A comparative study on analysis of a G+14 building by STAAD and EATBS. They concluded for a G+14 building the axial forces obtained were same in both the cases, also the obtained economical sections in both software's however ETABS gave a lesser amount of steel reinforcement as compared to that obtained in STAAD.

Sayeed Ur Rahman, Dr. Sabih Ahmad (2019):

Proposed a comparative study on dynamic analysis of a multi-story building by STAAD and ETABS. They found the results obtained in both the software's to be approximately same also the study concluded that ETABS is a more user friendly, accurate, more compatible and less time consuming as compared to its counterpart.

Ibrahim, et.al (April 2019):

Design and Analysis of Residential Building(G+4): After analyzing the G+4 story residential building structure, conducted that the structure is rate in loading like dead load, live load, wind load and seismic loads. Member dimensions (Beam, column, slab) are assigned by calculating the load type and its quantity applied on it. Auto CAD gives detailed information at the structure member's length, height, depth, size and numbers, etc. STADD Pro has a capability to calculate the program contains number of parameters which are designed as per IS 456: 2000. Beams were designed for flexure, shear and tension and it gives the detail number, position and spacing brief.

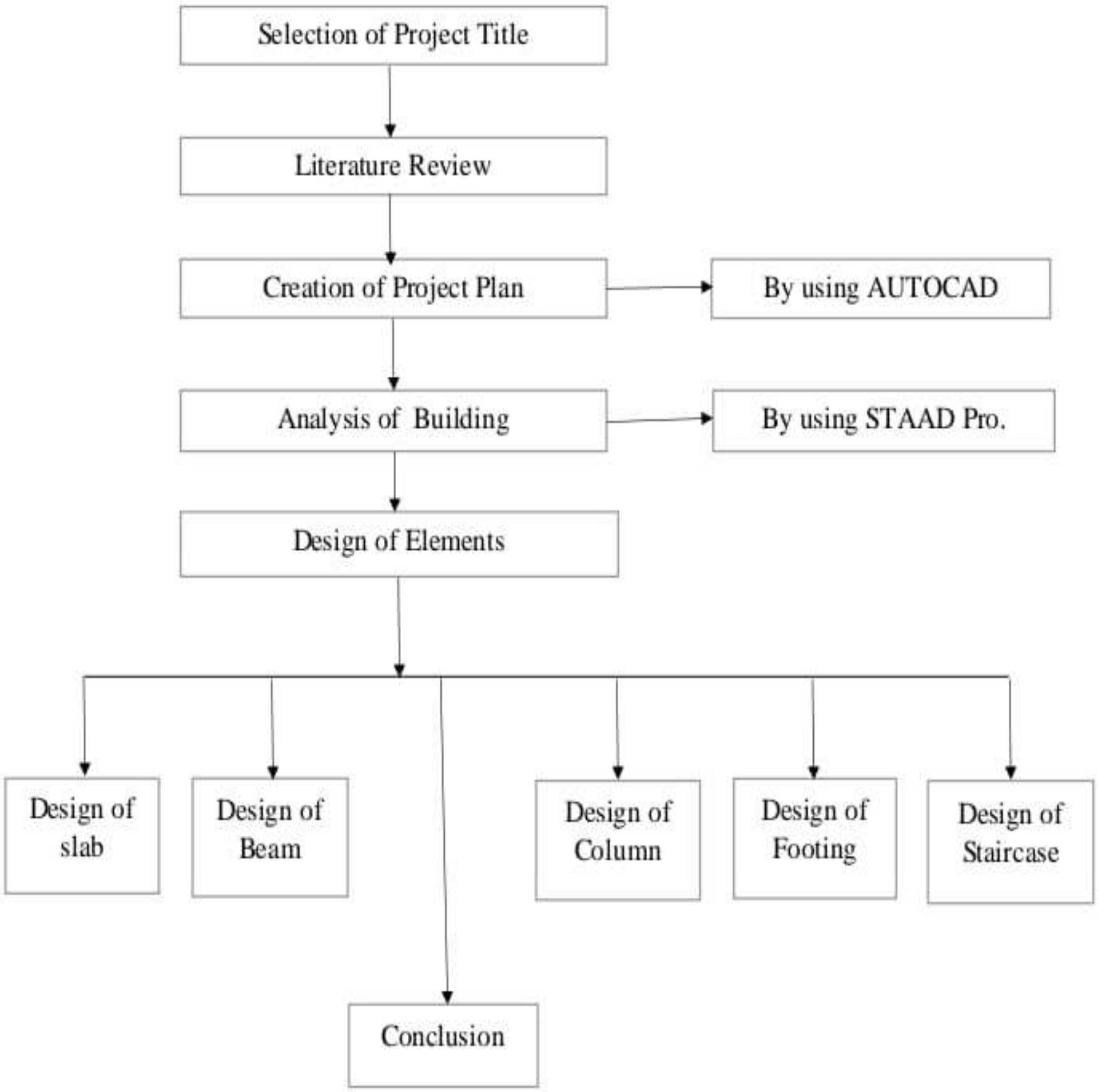
Dunnala Lakshmi Anuja, et.al (2019):
Planning, Analysis and Design of Residential Building (G+5) By using STAAD Pro.: Frame analysis was by STAAD-Pro, Slab, Beams, Footing and stair-case were design as per the IS Code 456-2000 by LSM. The properties such as share deflection torsion, development length is with the IS code provisions. Design of column and footing were done as per the IS 456-2000 along with the SP-16 design charts. The check like one way shear or two-way shear within IS Code provision. Design of slab, beam, column, rectangular footing and staircase are done with limit state method. On comparison with drawing, manual design and the geometrical model using STADD Pro.

Mr. K. Prabin Kumar, et.al (2018):
A Study on Design of Multi-Storey Residential Building: They used STADD Pro, to analysis and designing all structure member and calculate quantity of reinforcement needed for concrete section. Various structure action is considered as members such as axial, flexure, shear and tension. Pillar is delineated for axial forces and biaxial ends at the ends. The building was planned as per 1S: 456 2000.

Shubham Srivastava, Mohd. Zain, Vineet Pathak (2018):
They did an analysis on a multi-story building (G+7) due to seismic loading in ETABS and compared the results with those obtained using STAAD. The study was briefly done and the bending moment values for each floor showed higher values in case of STAAD and therefore ETABS gave lesser values for displacement since the bending moment for the overall structure was less.

Methodology:-

General
This method we are designed the entries' structure limit state Method.



Plan

General

The building plan and the column placement plan is drawn by using the software AUTOCAD.

Site Details

Plot area	=	2194.41 sq. ft
Built up area	=	2043.95 sq. ft
Column Size	=	9"x 11.8"
Beam size	=	9"x11.8"
Stair Rise	=	5.9"
Tread	=	9.8"
D1	=	3'5"x7'0"
D2	=	2'6" X 7'0"
MD	=	3'6" x 7'0"
W2	=	3'6" x 4'6"
W3	=	5'0"x 4'6"

Building Plan:

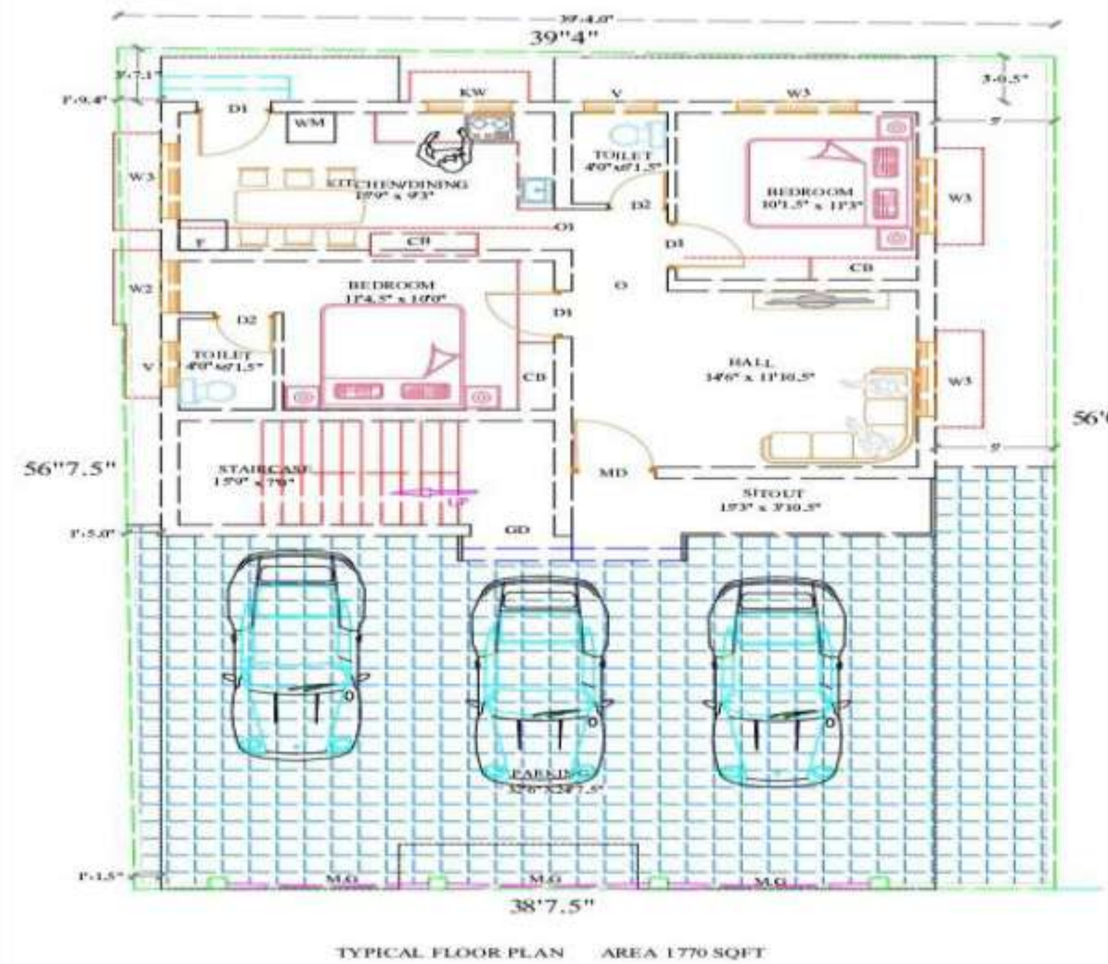


Fig 4.1:- Ground floor plan.

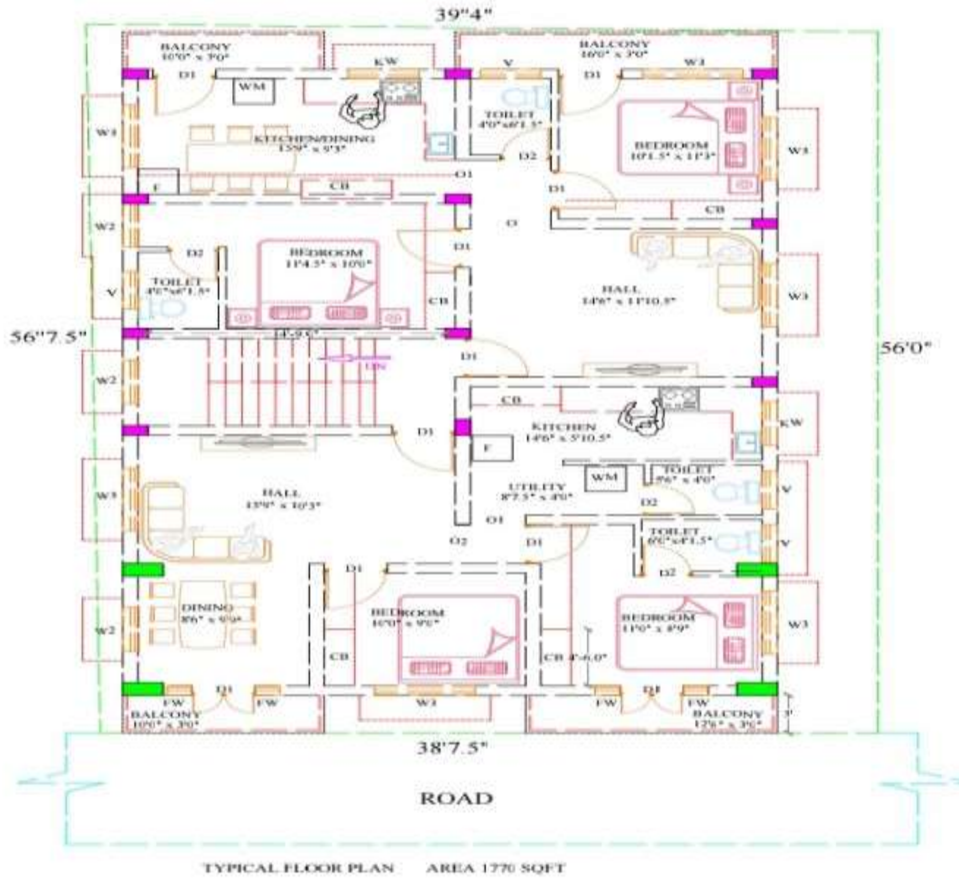


Fig 4.2:- First Floor Plan.

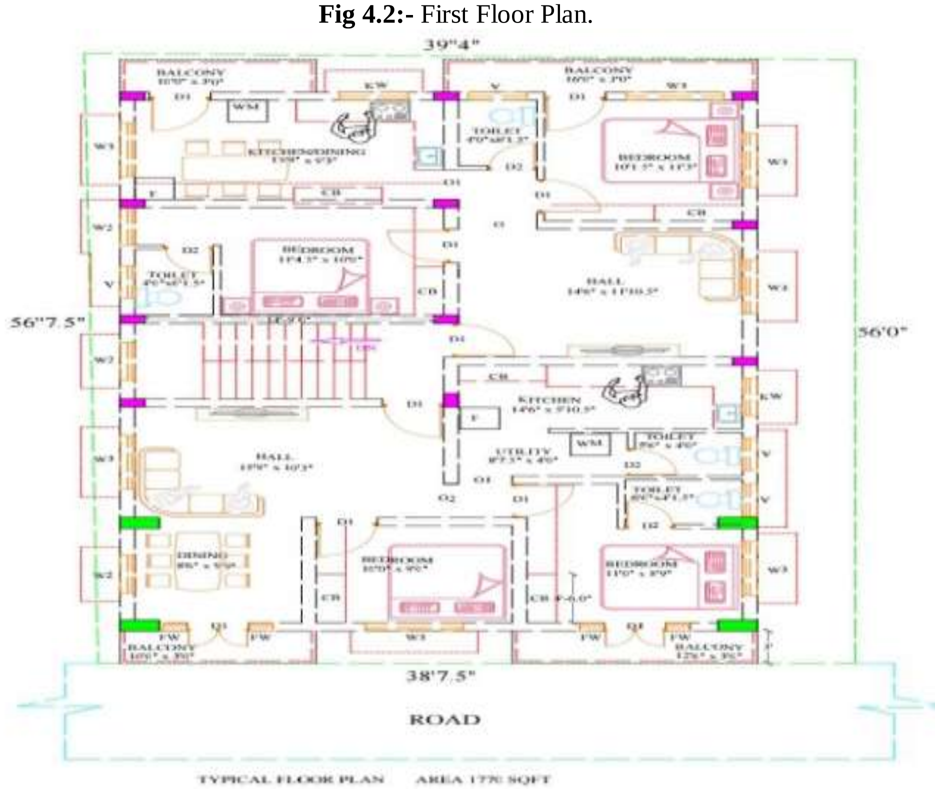


Fig 4.3:- Second Floor Plan.

Analysis Of Structure
Staad Pro Analysis
Basic Steps:
The frame is generated from the specified structural plane area of each Storey while creating the structural geometry. Each frame element is referred to as a member. In STAAD Pro, the joint of the frame is referred to as a node.

Assigning The Member Property:
By selecting the member, the assumed dimension of the member is assigned to each member.
Support Condition:
The nodes are assigned a support state such as pinned, fixed, or roller. Only a fixed condition was encountered in our scenario.

Loading:
Following the assignment of the support condition to the node, the various loads are applied to each member.

Running The Analysis And Design: .
After all of the conditions have been assigned, the frame is analyzed using the analysis command from the file menu.

Structural View
The structural view of the building is

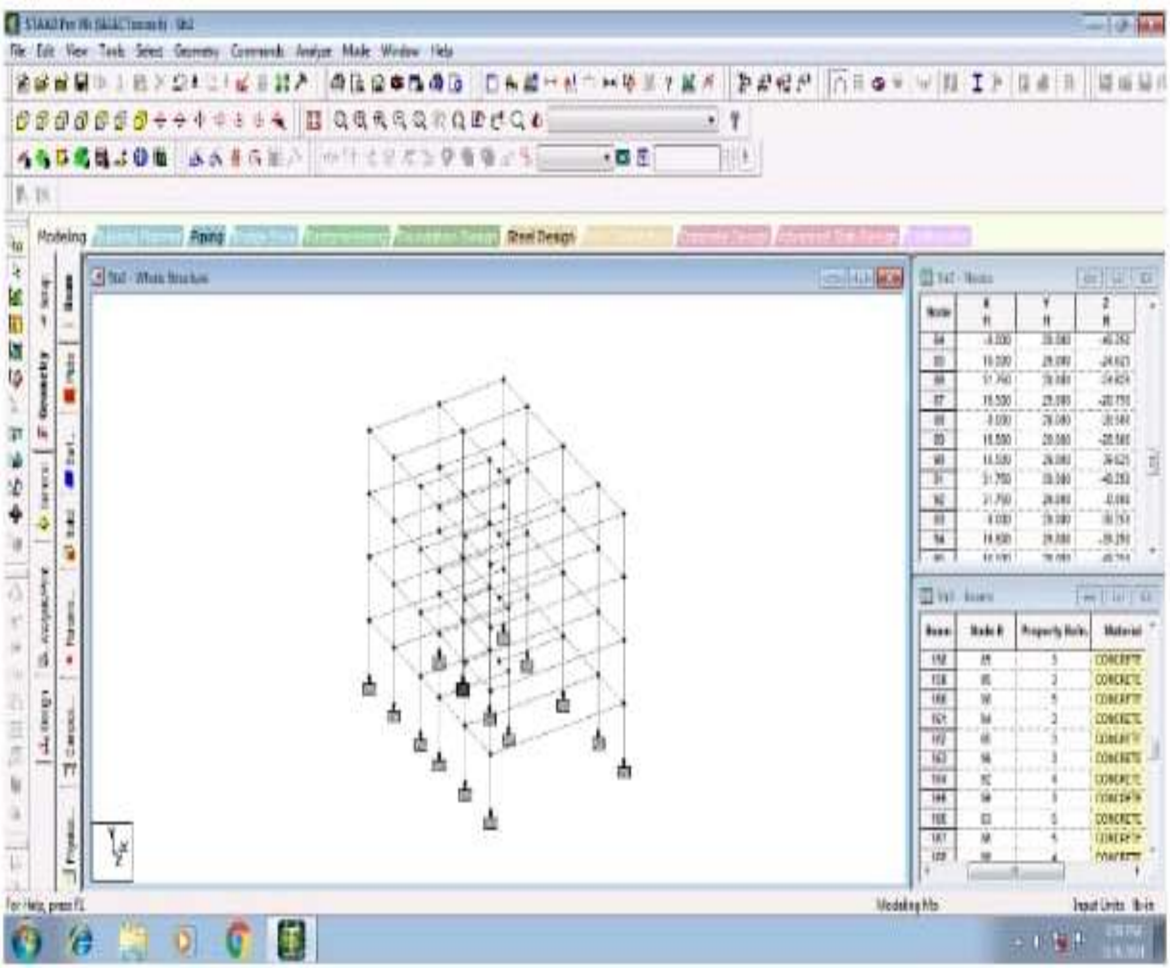


Fig 5.1:- Structural View.

3-D VIEW
The 3D view of the residential building is

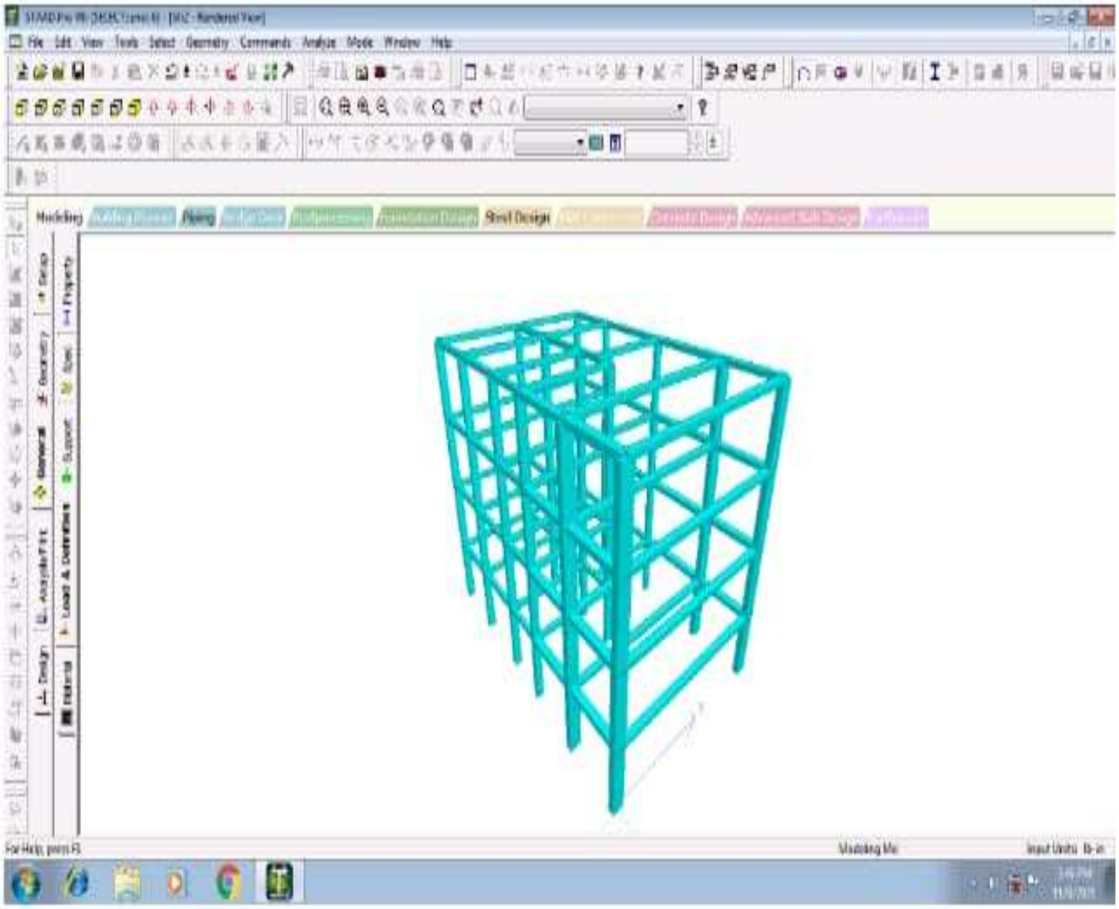


Fig 5.2:- 3D view.

Loads Distribution Diagram
The load distribution of the building is

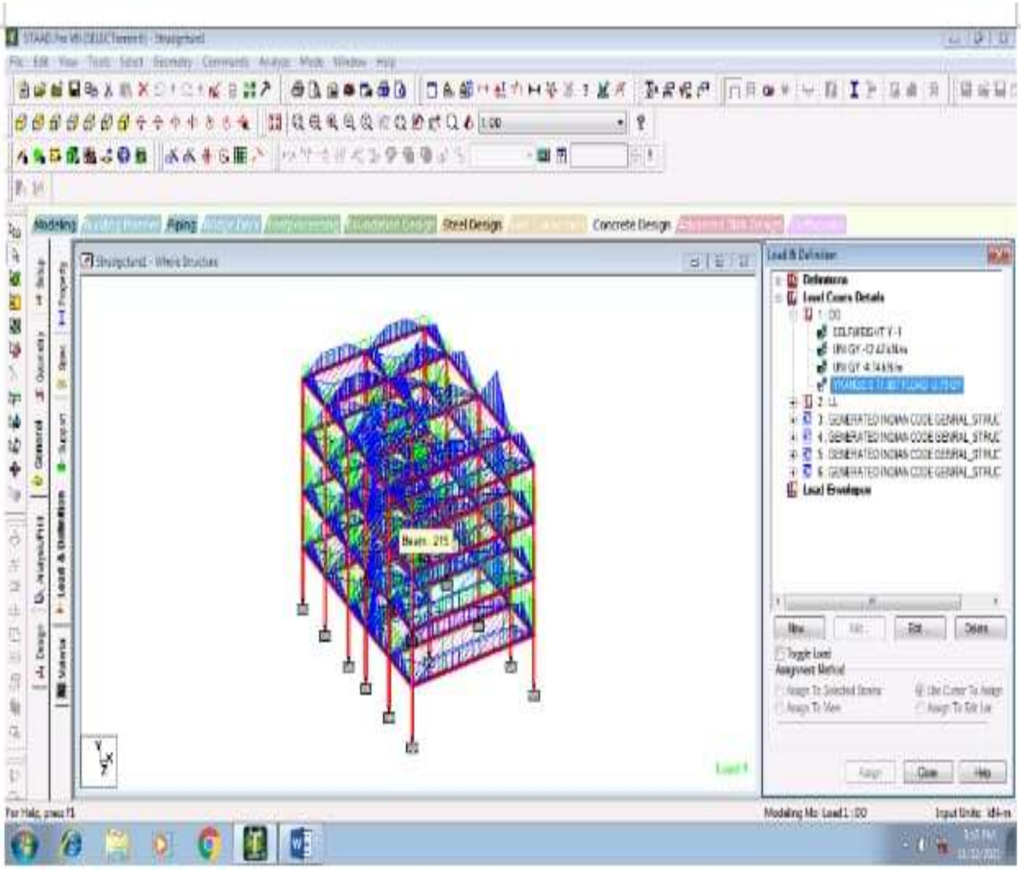


Fig 5.3:- Load Distribution Diagram.

Design Of Structure

Design Of Slab

General

A reinforced concrete slab is the most frequent form of structural element used to cover building floors and roofs.

Classification Of Slab

The slabs are classified into the following types. They are

1) One-way slab
2) Two-way slab

One Way Slab:

When the ratio of the slab's longer to shorter sides (L/S) is ***greater than 2.0,*** it is referred to as a one-way slab.

Two Way Slab:

When the ratio (L/S) is ***less than 2.0,*** the slab is referred to as a two-way slab.

Design Procedure

L_x = 3.6m = 3619.5mm
L_y = 4.4m = 4419mm
Live Load = 3 KN/m^2
F_{ck} = 25N/mm^2

Type Of Slab:

L_y/ L_x = 1.2 < 2
So, the type of slab is **Two-way slab**

Design Of Slab:

D = 105mm
Ø = 10mm
Clear cover = 25mm
Overall depth, D = 130mm

Effective Span:

Effective span = clear span + effective depth = 3.4578 m

Load Calculation:

Self-weight of slab = 3.25 KN/m^2
Live load of slab = 3 KN/m^2
Floor finish = 1 KN/m^2
Wu = 13.5 KN/m^2

Ultimate Design Moment And Shear Force:

Ly/Lx = 1.2
From table 27, IS 456:2000
α_x= 0.084
α_y= 0.059
$M_x = \alpha_x wlx^2 = 12.747$ KNm
$M_y = \alpha_y wlx^2 = 8.9$ KNm
V_{ux}= 22.63 KNm

Check For Depth:

$M_{max} = 0.138fck\ bd^2$
$d^2 = M_{max} / 0.138fck \times b$
$d^2 = 3694.78$
d = 60.78 < 105mm

Hence safe

Reinforcement:

$M_{ux} = 0.87A_{st}f_{yd}[\ 1- A_{st}f_y / bdf_{ck}\ ]$
$(12.747 \times 10^6) = 0.87 \times A_{st} \times 415 \times 105\ [\ 1- A_{st}\ 415 / 10^3 \times 105 \times 25]$
A_{st}= 356.10 mm^2
A_{st} min = 0.012 bd = 156mm^2
Using 10 mm dia bars
Ast = 78.53 mm^2
S = 78.53/356.10 x 1000
S = 220.52 mm
S ~ 230 mm
Provide 10mm dia bars @ 230mm C/C spacing
$M_{uy} = 0.87\ A_{st}f_y\ d\ [\ 1- A_{st}f_y / bdfck\ ]$
$A_{st(y)}$ = 244.19 mm2
A_{st} min = 0.012ba = 156 mm^2
a_{st} = 78.53 mm^2
S = 78.53/244.19 x 1000 = 321.59 mm
S = 300 mm

Check For Shear:

$\tau_v = V_u / bd = 0.215\ N/mm^2$
Pt = 0.339 N/mm^2
From Table 19 IS 456:2000
$\tau_c = 0.4\ N/mm^2$
$K\ \tau_c = 0.5\ N/mm^2 > \tau_v$

Hence safe

Check for deflection:

$F_s = 0.58 \times 415 \times [356.10/280.46] = 305.616$

Pt = 0.26

Modification factor, $K_t = 2$, $K_c = 1$, $K_f = 1$

$(L/d)_{max} = (L/d)_{basic} \times K_t \times K_c \times K_f = 56$

(L/d) act < (L/d) max

Hence Safe

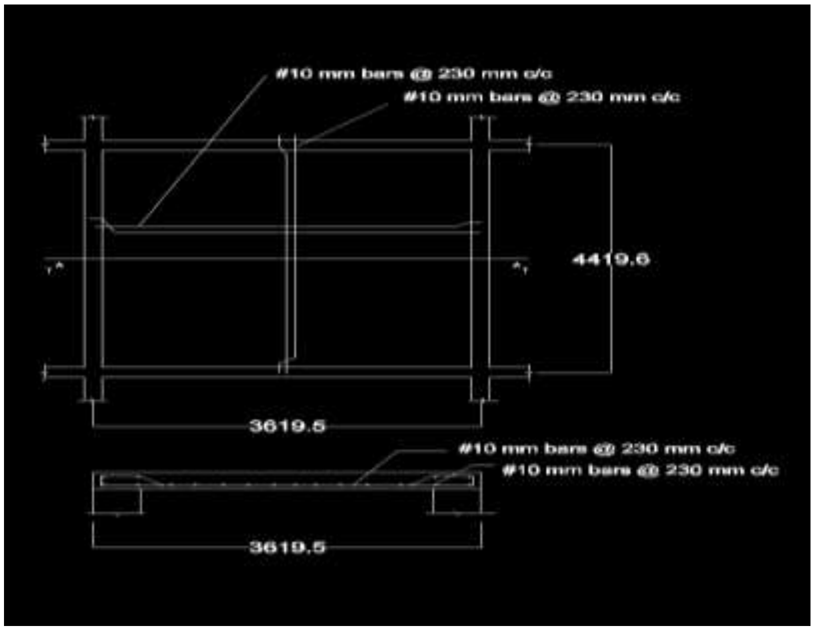


Fig 6.1:- Slab Reinforcement Details.

Design of beam

General

A beam is commonly defined as any element that is subjected primarily to transverse gravity or vertical loading. End moments are included in the definition of transverse loading. There are many different types of beams that are classified based on their size, how they are supported, and where they are located in a specific structural system.

(A) Single-reinforced beams

(B) Beams with two reinforcements

(C) flanged beams with one or two reinforcements.

Design Procedure:

$F_{ck} = 25$ N/mm^2

$F_y = 415$ N/mm^2

Assume, D = 300 mm = 0.30 m

B = 230 mm = 0.23 m

Assume, 20mm dia bar

d = 265 mm = 0.26 m

LOAD:

Self-weight = 1.725 KN/m

Wall load = 9.936 KN/m

Live load = 3 KN/m^2

Factored load = 4.5 KN/m^2

	D.L	**F.F**	**S.W**	**W.L**	**T.D.L**	**F.D.L**	**L.L**	**F.L.L**
S_8	5.38	3.429	1.725	9.936	20.47	30.705	10.287	15.43

S_6	5.83	3.619	1.125	1.725	21.11	31.665	10.857	16.28
S_5	8.46	4.305	1.725	9.936	24.42	36.637	12.915	19.37
S_1	4.18	2.59	1.725	9.936	18.43	27.645	7.77	11.65

		S_8	**S_6**	**S_5**	**S_1**
SPAN MONENT	$M = W_dL^2/12 + W_lL^2/10$	48.223 KNm	55.88 KNm	92.48 KNm	23.09 KNm
MOMENT	$M = W_dL^2/16 + W_lL^2/12$	37.683 KNm	67.39 KNm	78.33 KNm	19.40 KNm
SUPPORT MONENT	$M = W_dL^2/10 + W_lL^2/9$	56.261 KNm	87.55 KNm	107.8 KNm	27.23 KNm
MOMENT	$M = W_dL^2/12 + W_lL^2/9$	50.244 KNm	80.64 KNm	96.55 KNm	24.14 KNm

At support,
$M_u = 0{\cdot}87\ f_yA_{st}\ d\ [\ 1\text{-}A_{st}f_y/bdf_{ck}\ ]$
A_{st} = 1852.07 mm^2
a_{st} = 314-15 mm^2
No. of bars = 5.89 ~ 6 bars
S = 169.62 ~ 170 mm

At span,
$92.48 \times 10^6 = 95678.25A_{st} - 25.83\ A_{st}^2$
A_{st} = 1852.07 mm^2
a_{st} = 314.15 mm^2
No. of bars = 6 bars
S = 170 mm

Check For Shear,
At end support,
$V = W_d\ /0.4) + W_l(0.45) = 23.37$ KN
At support,
Next to end support,
$V = W_d(0.6) + W_l\ (0.6) = 33.60$ KN
At all other support,
$V = W_d(0.5) + W_l\ (0.6) = 29.94$ KN
$\tau_v = V_u / bd = 0.55$ N/mm^2
$Pt = 100\ A_{st}/\ bd = 3{\cdot}03$ %
Table 19, IS 456:2000
$\tau_c = 0.78$ N/mm^2
$\tau_c > \tau_v$

Shear reinforcement,
$V_{us} = V_u - \tau_c\, bd = 13.94$ KN
$S_v = 0.87\ (415)\ A_s\ v\ d\ /\ V_{us}$
A_{sv}= 50.20mm^2
S = 344.96
Adopt spacing 300 mm

Check For Deflection:
$L / d_{max} = L / d_{basic}$ x F1 x F2 x F3
L / d_{basic} = 26 (cl 23.2.1 IS 456:2000)
$F_s = 0.58\ F_y$ x $A_{st}req / A_{st}$ provided = 236.62
F1=1, F2=1, F3=1
$L / d_{max} = 26$
$L / d_{provided = 16.24}$
$L / d_{provide} < L / d_{max}$

Hence Safe

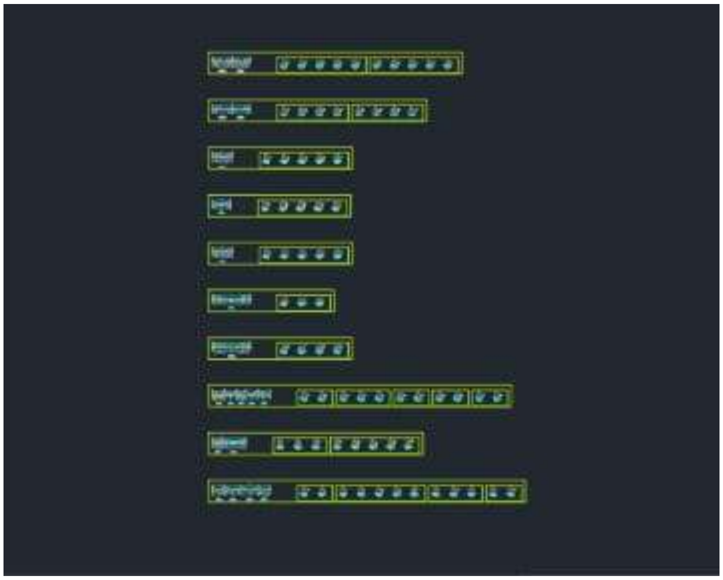


Fig 6.2:- Beam Reinforcement.

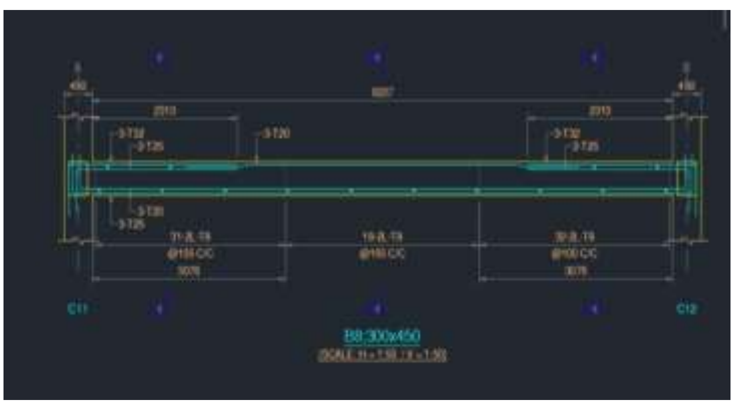


Fig 6.3:- Design of Beam.

Fig 6.4:- Beam Reinforcement Detailing

Design Of Column
General
Columns are a structure's vertical components. The columns of the building support the beams. The responses of the beams are conveyed to the column as loads. An axial load is an expression of a column's load.

The types of columns are as follows
Short columns-Fails by crushing
Long columns-Fails by buckling.

Design Procedure:
L = 3000 mm
B = 230 mm
D = 300 mm
f_{ck}= 25 N/mm ²
f_y = 415 N / mm^2
Pu = 740.108 KN
= 740.108 X1.5
= 1110.162 kN
Clear cover, d' = 50mm

Effective length if column
Leff = 0.65L = 1950 mm

Slenderness ratio:
$(L_{eff}/b) = 8.48 < 12$
$(L_{eff}/D) = 6.5 < 12$
Hence it is designed as a **short column**

Eccentricity:
e = L/ 500 + D/300 = 16
e = L/ 500 + B/300 = 13.67

Moment:
$P_{u.}$/ (fck x b x d) = 0.643
Mu/(fck x b x d²) = 0.034
d'/D = 0.166
From chart 32, Sp.16, Pt/F_{ck}= 0.07, Pt =1.75%
M_x = P x e = 17.76 KNm
M_y = P x e = 15.098 KNm
A_{sc} = 0.01 X 230 x 300 = 690 mm²
No. of bars = A_{sc}/ a_{sc} = 3.43
Provide 6 no's 16 mm dia bar

Maximum uniaxial moment
Major axis:
d'/D = 0.1
M_u / (f_{ck}x b x d²) = 0.26 (from chart 44)
M_{uxl}= 0.26 x f_{ck} x b x d² = 134.55 KNm

Major axis
d'/D=0.2
M_u / (f_{ck} x b x d²) = 0.22 (from Chart 46)
M_{uyl}= 0.22 x f_{ck} x b x d²
= 113.85 KNm

Check for adequacy of section

$P_{uz} = 0.45f_{ck} A_c + 0.75F_y A_{sc}$= 1151.75 KN

P_u / P_{uz} = 0.96

from IS 456, $\alpha n = 2$

$(M_{ux} / M_{uxl})^{\alpha n} + (M_y / M_{uyl})^{\alpha n} \leq 1$ (from IS 456.2000 cl. 39.6)

$0.03 \leq 1$

Hence safe

Transverse reinforcement

Dia = 16 / 4 = 4

use 6mm dia bars

Spacing,

1) 16 $\emptyset_L$= 16(16) = 256 mm

2) 48 $\emptyset_L$ = 48 (6) = 288 mm

3) Least lateral dimension = 230 mm

4) Maximum spacing =300 mm

Provide 6 mm $\emptyset$ bar @ 230 mm c/c spacing

Fig 6.5:- Column Reinforcement.

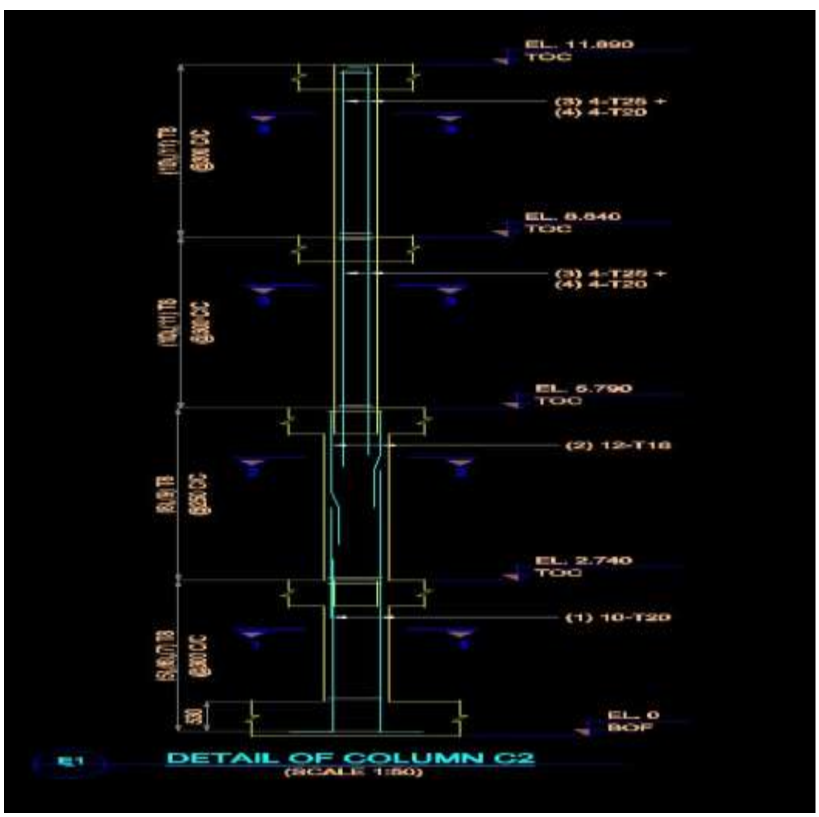


Fig 6.6:- Design of Column.

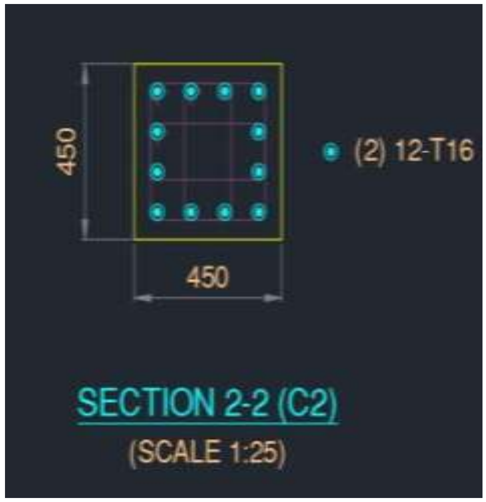


Fig 6.7:- Column Reinforcement Detailing.

Design Of Footing

The ultimate support for any structure is given by the underlying ground or soil material, and so the structure's stability is dependent on it. Because dirt is often weaker than other standard building materials such as steel and concrete, a larger surface area or volume of sail is required to bear a given load properly. As a result, a load transfer mechanism is required to transmit the loads carried by structural steel or concrete elements to the earth.

Types Of Foundation:

1) Shallow foundation
2) Deep foundation

Design Procedure

1) Depth:

Assume Ø = 30°, S_{sbc} = 230 KN/m²

D = SBC/Y [(1- Sin Ø) / (1+ sin Ø)] ² = 1.28 m

2) Area:

Load, P_u = 1110.162 KN

column size = 230 mm x 300 mm

SBC = 230 KN/m²

Footing area to the column Add 10 % of load = 111.0162 KN

Hence, total load = 1221.148 KN

Formula for footing area = (Increased load) / Soil bearing capacity = 5.3 m²

Footing Size, B = √A = 2.3 m

B = 2L +0.3

L= B - 0.3 / 2 = 1 m

Factored soil pressure at base, Pu= Pu / L x B

P_u = 482.67 KN/m²

P_u< SBC

Hence ok

Moment:

Mu = P_u x L^2 / 2 = 241.35 KNm

Mu_{max} = 0.138 f_{ck} x b x d²

d² = 69956.52

d = 264.49 mm ~ 300 mm

Based on shear, d = 750 mm

Overall depth, D = 200 mm

4) Reinforcement

M_u = 0.87 x f_y x A_{st} (d - 0.42 X_u)

$X_u = (0.87 \times f_y \times A_{st}) / (0.36 \times f_{ck} \times b \times d)$
$A_{st} = 850\ mm^2$
$a_{st} = 113.09\ mm^2$
Spacing, S = 133.047 mm
Adopt 150 mm c/c spacing
Provide 12mm dia bar at 150 mm center to center in both ways.
Check:
One way Shear:
$V_u = P_u (L-d) = 120.67$ KN
$\tau_v = V_u / b \times d = 0.161\ N/mm^2$
% Ast = (Ast / bd) x100 = 0.122%
$F_{ck} = 25\ N/mm^2$
From IS 456: 2000 Tab 19
$\tau_c = 0.29$
$\tau_v < \tau_c$
Hence Safe
Two-way shear:
$V_u = P_u$ (Area - Area of punching shear) = 2271.44 KN
$b_o = 2\ [0.23+0.35+0.3+0.35] = 2.46$ mm
$\tau_v = 0.73$
$K_s = 1.76$
$\tau'_c = 0.25\sqrt{f_{ck}} = 1.25\ N/mm^2$
$\tau_c = K_s \times \tau'_c = 2.20$
$\tau'_v < \tau_c$
Hence safe

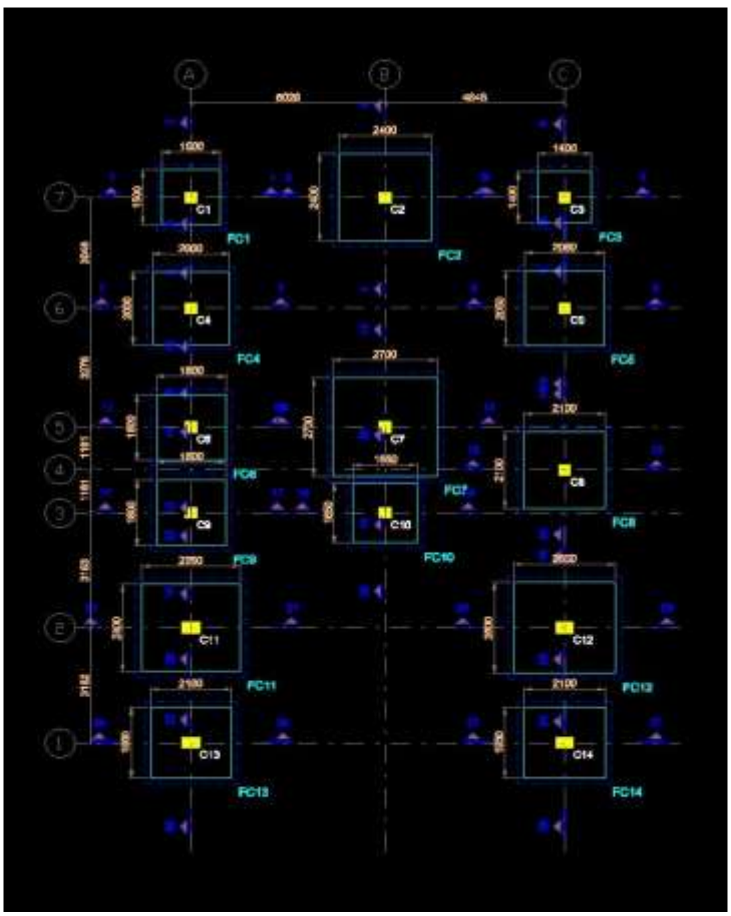


Fig 6.9:- Overall Footing Placement.

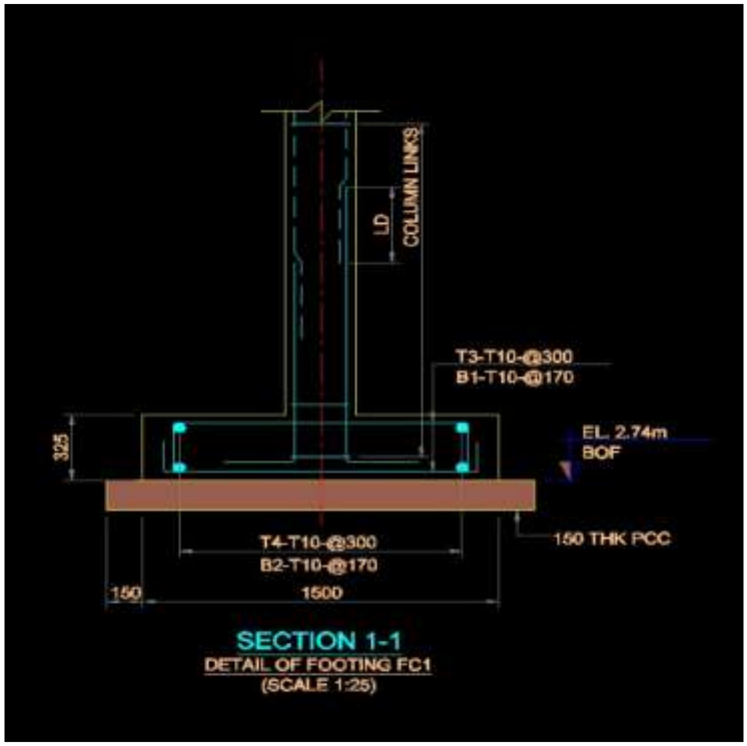


Fig 6.10:- Design of Footing.

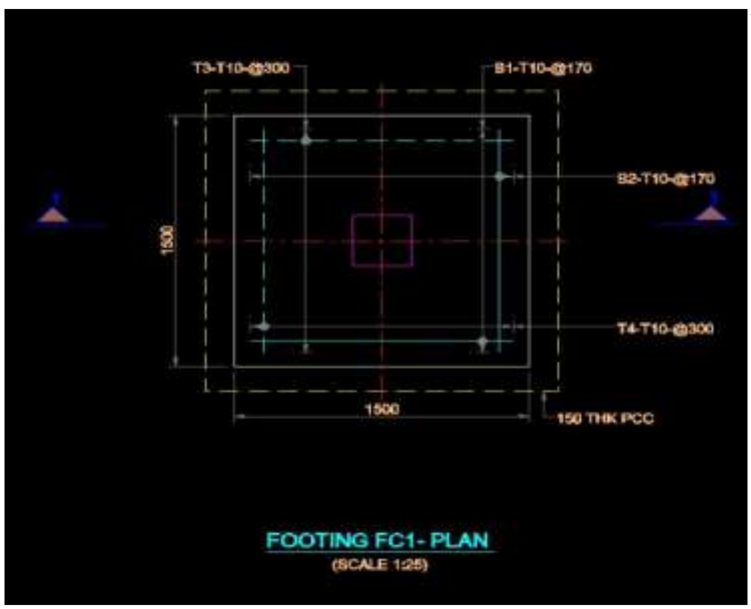


Fig 6.11:- Footing Reinforcement Detailing.

Design Of Staircase

A staircase is an important component of a structure since it provides access to the building's various floors and roof. It is made up of a flight of stairs and one or more intermediary landing slabs between the floor levels. By arranging steps and landing slabs, several sorts of staircases may be created. Thus, a staircase is a building that encloses a staircase.

Design Procedure

DATA: 5.79m x 2.13m

Live load = 3 KN/m²
f_{ck} = 25N/mm ²
Vertical distance between floor = 3m
Assume rise (R) = 150 mm
Thread (T) = 250 mm
Height of each flight = 3/2 = 1.5 m
No. of rises = 1.5 / 0.15 = 10 No's
No. of thread = R-1= 9
Space occupied by tread (G) = 9x0.25 = 2.25
Landing width and left for passage = 0.84 m
Eff length = 3.205 m
From IS 456:2000 Cl 24.1
D = eff length / (35 x 0.8) = 115 mm
D = 40 mm

Load calculation:

Dead Load = $25D\sqrt{\ }\ (R^2T^2)/T$ = 4.08 KN/m
Dead Load from 1 Step = 25 x R/2 = 1.875 KN/m
Live load = 3 KN/m
Total load = 8.95 KN/m
M = wl² /12 = 11.49 KN/m
$M_{u,lim} = 0.138\ f_{ck}\ bd^2$ = 45.62 KN/m
$M < M_{u\ lim}$

To find Ast:

$M_u = 0.87\ f_y A_{st}\ d\ (1- F_y A_{st}\ /bdf_{ck})$
A_{st}= 288.75 mm²
a_{st}= 78.5mm^2
S = 271.86
S = 280 mm
Provide 10 mm dia bar @ 280 mm spacing

Minimum reinforcement:

A_{st} = 138 mm²
A_{st} = 50.026 mm^2
S = 300 mm
Provide 8 mm dia bar @ 300 mmc/c

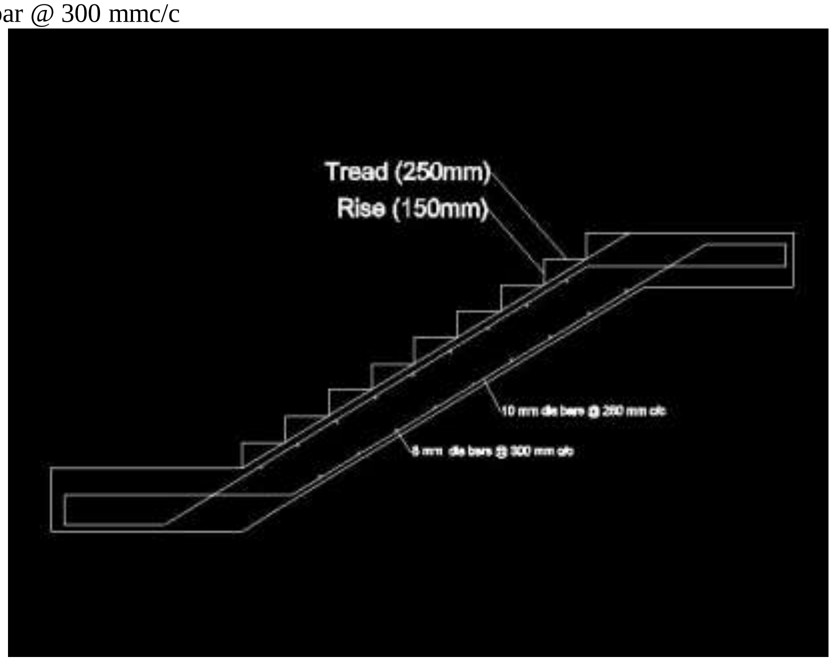


Fig 6.12:- Staircase Reinforcement Detailing.

Conclusion:-

We learned the approach of constructing a high-rise building while adhering to all of the codal regulations, as well as the process of applying specification principles to the design. We might infer that there is a distinction between theoretical and practical activity.

As a result of doing real work, the area of understanding will be considerably greater. As we gain more information in a setting where we have a lot of practical experience, Knowing the loads, we constructed the slabs based on the ratio of longer to shorter panel spans. In this project, we created slabs as two-way slabs based on the end condition and bending moment. The coefficients were computed using I.S. coding methods for the relevant Ix/ly ratio. Loads on beams and columns were calculated, and a frame analysis was built using the moment distribution technique. We have very poor bearing capacity, hard soil, and isolated footings completed here.

Reference:-

1. Mohammad Kalim, Abdul Rehman, BS Tyagi "Comparative study on analysis and design of regular configuration of building by Staad Pro and Etabs" 5[3], 1793-1797, IRJET, March-2018.
2. Sayeed Ur Rahman, Dr. Sabih Ahmad, "A comparative study on dynamic analysis of tall buildings using Staad Pro and Etabs"6[4], 350-358, JETIR, April- 2019.
3. Shaikh Ibrahim, MdArifuzzaman, Jisan Ali Mondal, MdTaukirAlamSanuwar Biswas, Sagar Biswas, Design and Analysis of Residential Building, International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 04 | Apr 2019.
4. Dunnala Lakshmi Anuja, V.S.Nagasai , Planning, Analysis and Design of Residential Building(G+5) By using STAAD Pro., International Journal of Engineering Development and Research (IJEDR), Volume 7, Issue 3 | ISSN: 2321-9939.
5. Mr. K. Prabin Kumar, R. Sanjaynath , A Study on Design of Multi Storey Residential Building -A Review, International Journal of Pure and Applied Mathematics (IJPAM), Volume 119 No. 17 2018, 2797-2802 ISSN: 1314-3395.
6. Shubham Srivastava, Mohd. Zain, Vineet Pathak "Analysis of multi-storey building (G+7) due to seismic loading using Etabs and compare its results with Staad Pro "5[7], 642-648, JETIR, July 2018.
7. Krishna Raju N. Limit state design for structural concrete proceeding of the institution of engineers (INDIA)
8. S.Ramamrutham&R.Naryanan "Design of Reinforced Concrete Structures"
9. IS 456-2000 "Indian Standard Plain and Reinforcement concrete of Practice"
10. SP-16 "Design Aids for Reinforcement Concrete to IS 456-2000
11. IS-875 Part-(I, II, III) -1957 code practice for design loads (Other than earth quake). For building structure, imposed load (second revision) BIS-1989.