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Analysis and Design of G+10 Residential Building Using STAAD.PRO V8i

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ABSTRACT:- The main aim of structural engineer is to design the structure for a serviceable, safe, durable and economical. The entire process of structural planning and design is required imagination and sound knowledge. Analysis and design of G+10 storey residential building structure as per IS Code methods. Analysis and design of entire structure have been completed by manual design and verifies using STAAD.PRO V8i Software.

Now a day large number of application software's are available in the civil engineering field. All these software's are developed as the basis of advanced. Finite element analysis which includes the effect of dynamic load such as wind effect, effect bets etc. in the present work, an attempt has been made to study the efficiency of certain civil engineering applications software's such as STAAD.PRO V8i and ETABS.

All the drafting and detailing was done by using AutoCAD 2021. In this project, the design of beam, column, slab, staircase, shear wall is calculated by "Limit State Method" using IS: 456-2000 IS code book. Different loads active on the member are consider according to IS:875-1987(part1,part2,part-3). Hence residential building is properly planned in accordance with Indian Standard Codes of India.

KEY WORDS :- Analysis of structure(G+10) ,Design of structure (G+10), Auto cad 2021 ,STAAD.PRO V8i.

1.INRODUCTION

India is a developing country; huge construction systems are yet to come as uninhabited metropolises are demanded to develop since so numerous times. In current century, numerous systems all over the world are going on, time detention takes place which in turn affects the growth of the construction of huge systems. To avoid time detention and thereby the growth, profitable construction methodology should be espoused. To pinch the structure, structural optimization ways should be used. numerous metropolitan metropolises are facing vast growth of structure whether it may be in terms of vertical development or perpendicular development. In high rise structures, we should concern about all the forces that act on structure, its weight as well as the soil behavior , for loose soil, we preferred deep foundation(pile). computation for high rise construction manually also it'll take redundant time in addition to mortal individual crimes conceivably will passed. The software's used in this design are.

- AutoCAD 2021
- STAAD.PRO V8i

1.1 AutoCAD 2021

AutoCAD 2021 is a drafting software which is used for developing 3-Dimensional and 2-Dimensional structures, sold and developed by Autodesk Inc. It is a vector graphics drawing program. AutoCAD's native file format DWG and to a lesser extent, its interchange file format DWG and DXF.

1.2 STAAD.PRO V8i

STAAD.PRO V8i is user friendly software which is used for analyzing and designing of structures by structural engineers. STAAD.PRO V8i provides a lot of precise and correct results than manual calculations.STAAD.PRO V8i software is used for both static and dynamic analysis for structures such as bridges, low rise and high-rise buildings, stadiums, steel structures etc. First step in STAAD.PRO V8i is to specify the geometry of the structures and then the properties of the members are mentioned, then the supports are generated and loadings are specified on the structures. Finally, the structure is analyzed.

2.LITERATURE REVIEW

Ibrahim, et al (April 2019): Design and Analysis of Residential Building(G+4):

After assaying the G+4 storey domestic structure, conducted that the structure is rate in lading like dead cargo, live cargo, wind cargo and seismic loads. Member confines are assigned by calculating the cargo type and its Volume applied on it. bus CAD gives detailed information at the structural members length, height, depth, size and figures etc.STAAD.PRO has a capability to calculate the program contains number of parameters which are designed as per IS456- 2000. shafts were designed for flexure, shear and pressure and it gives the detail number, position and distance detail.

Devi Krishna Chaitanya, et al (January 2017): Analysis and Design of a (G+6) Multi storey Building using STAAD.PRO:

They used static Indeterminacy styles to calculate figures of unknown forces. Distributing known fixed end moments, the condition of comity by replication system, Kani's system was used to distribute moments at successor joints in frame and continues ray for stability of members of structure. They used to design software which reduced a lot of time in design, gives delicacy.

R. D. Deshpande, et al (June 2017): Analysis, Design and Estimation of B+G+2 Residential Building:

They found that check for deflection was safe. They carried design and analysis of G+2 residential building by using Etabs software with the estimation of building bymethods of center line. They safely designed column using SP-16 checked with interaction formula.

3.Building Description :-

Purpose of Building	Residential
No.of Storeys	G+10 Storeys
Shape of Building	Rectangular
Height of Storey	3 meters
Depth of Foundation	2 m
Area of building	600 m^2
Location	Sri city
Zone	II

4.Procedure of Structure :-

4.1 Design of Structure:

- G+10 Residential

4.2 Load considerations :-

- Dead Load
- Super imposed Load
- Wind Load

4.3 Analysis &iterate the result :

- Analysis & Design of RCC framed structure
- Bending moment, Shear force ,Deflection and Axial force
- Design of this (G+10) structure as per guidelines of IS:456 – 2000

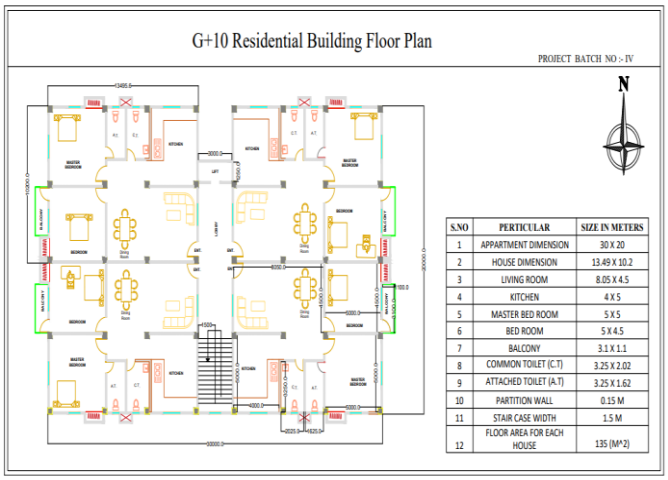
4.4 Designing of Structural elements :-

- Design of Beams
- Design of columns
- Design of slabs
- Design of foundation

4.5 Structure input data :-

- Slab thickness = 150mm
- Beam size = 400mm X 300mm
- Column size = 400mm X 400mm
- Surface wall = 125mm

5.Floor Plan of Structure :-



S.NO	PERTICULAR	SIZE IN METERS
1	APPARTMENT DIMENSION	30 X 20
2	HOUSE DIMENSION	13.49 X 10.2
3	LIVING ROOM	8.05 X 4.5
4	KITCHEN	4 X 5
5	MASTER BED ROOM	5 X 5
6	BED ROOM	5 X 4.5
7	BALCONY	3.1 X 1.1
8	COMMON TOILET (C.T)	3.25 X 2.02
9	ATTACHED TOILET (A.T)	3.25 X 1.62
10	PARTITION WALL	0.15 M
11	STAIR CASE WIDTH	1.5 M
12	FLOOR AREA FOR EACH HOUSE	135 (M^2)

6.Referred Indian Code books :-

- IS :456 – 2000
- IS :875-(part -1) for Dead Load
- IS :875-(part -2) for Live Load
- IS :875-(part -3) for Wind Load

7.Design of structure :-

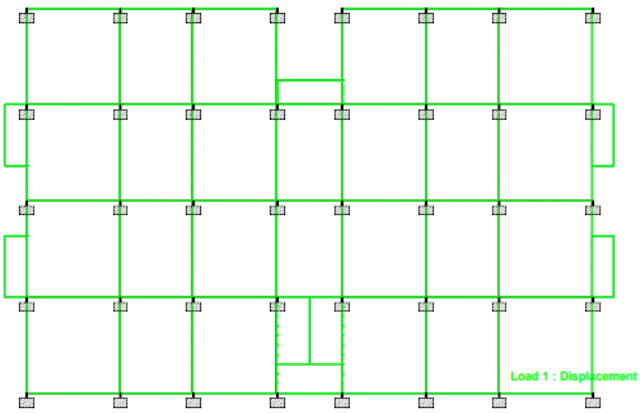


Figure 7.1 -Top view of structure

8.Assigning of Load details :-

- Dead load = Self weight of Structure + Floor Finishing load (1KN/m^2)
- Live Load = As per IS :875 (Part -2) guidelines taken as (2KN/m^2)
- Wind Load = As per IS :875 (Part -3) guidelines taken as (1.2 KN/m^2)
- Seismic Zone = Zone (II) Neglected Based on previous records
- Load combinations = STAAD.PRO V8i generated load combinations

8.1 3 – Dimensional view of structure :-

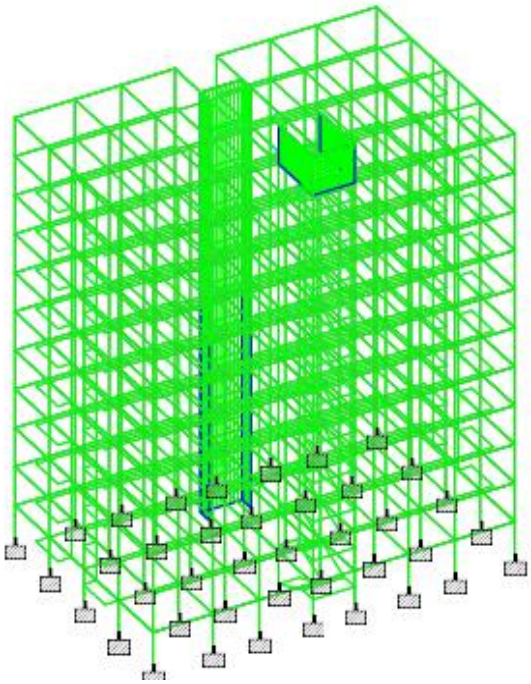


Figure 8.2 -3D view of Structure

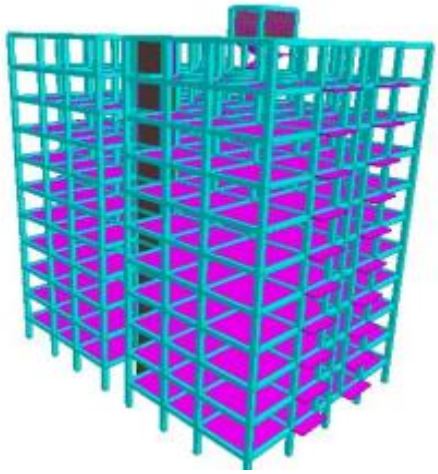


Figure 8.3 -3D Rendaring View

9.Live Load – IS:875 (Part-1) :-

Area	Live load (KN/m^2)
Dining Room	2
Bed room & Kitchen	2
Toilet & Bathroom	2
Stair case	2
Lift	4

10.Analysis & Iterate the result :-

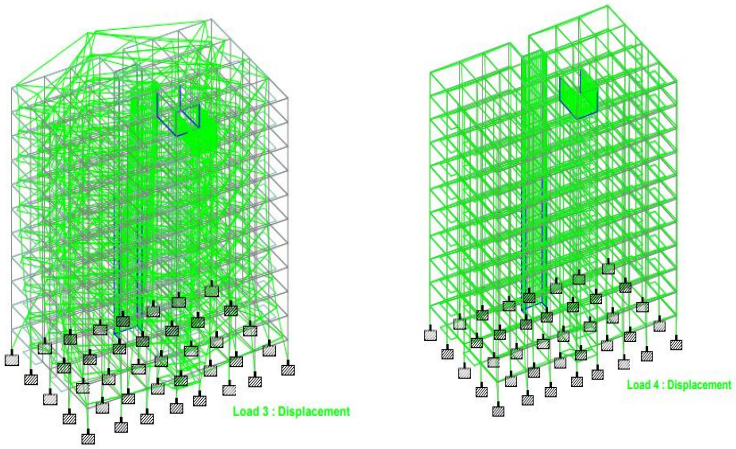


Figure-1 :-Deflection due to wind load acting on structure (X and Z) Directions10.1 Interpreting the shear force :-

Fr

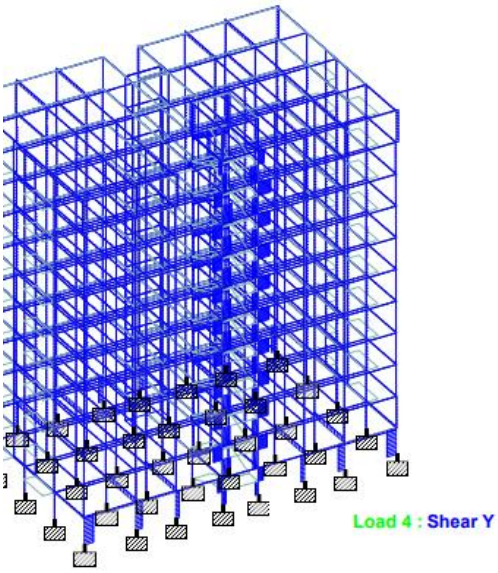


Figure -2 Shear force of Structure

10.2 Interpreting the Bending moment :-

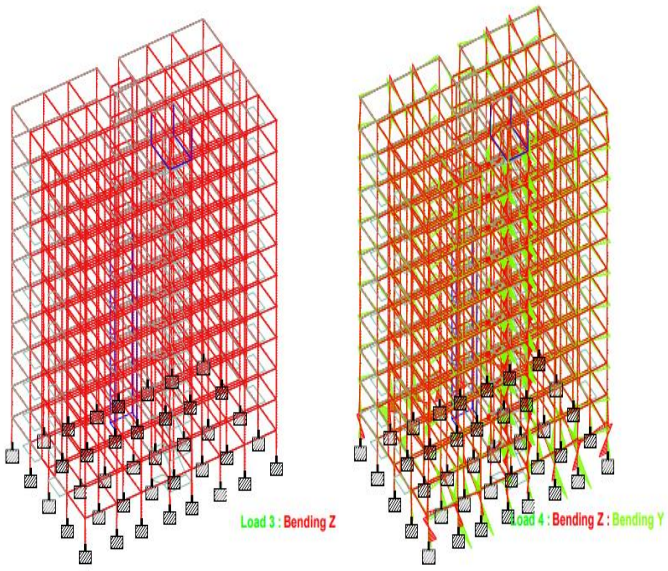


Figure-3 :- Bending moment of structure in (Y and Z) directions

10.3 Interpreting the axial Force :-

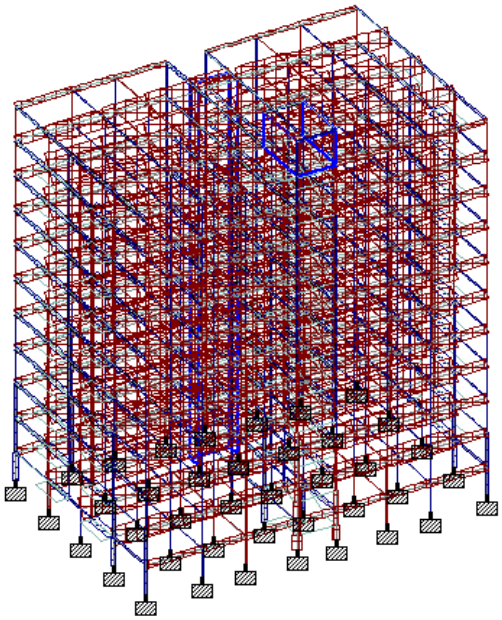


Figure -4 :- Axial force of the structure

11.Material Specifications :-

S.no	Type of Material	Grades	Strength
1	Grade of Concrete	M35	35N/mm^2
2	Grade of steel main	Fe415	415N/mm^2
3	Grade of steel secondary	Fe415	415N/mm^2

12.Clear cover for Structural elements :-

- Clear cover of slabs = 25mm
- Clear cover of Beams =25mm
- Clear cover of column =40mm
- Clear cover of footings =50mm

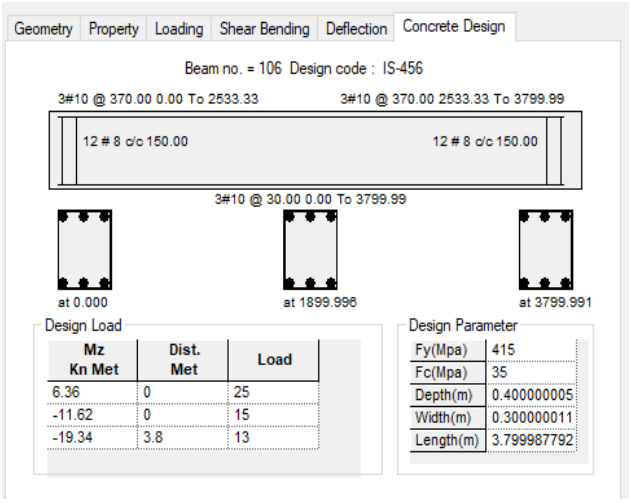
13.Design of slab :-Crossbeams are most extensively used structural rudiments forming bottom and roof of structure. Arbor supports substantially transverse cargo and transfer them to supports by bending conduct in both the directions. On the base of gauging direction, it's of two types.

- One- way Slab
- Two- way Slab

14.Design of Beams of structure :-

The Beams are designed into following types,They are

- Singly reinforced beams,
- Doubly reinforced beams



Beam Design STAAD.PRO V8i

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                    B E A M   N O.     106   D E S I G N   R E S U L T S

 M35                          Fe415 (Main)                  Fe415 (Sec.)

 LENGTH:  3800.0 mm      SIZE:   300.0 mm X  400.0 mm    COVER: 25.0 mm

                        SUMMARY OF REINF. AREA (Sq.mm)
-------------------------------------------------------------------------------
SECTION      0.0 mm      950.0 mm     1900.0 mm     2850.0 mm     3800.0 mm
-------------------------------------------------------------------------------
 TOP        227.35       227.35       227.35        227.35        227.35
REINF.     (Sq. mm)     (Sq. mm)     (Sq. mm)      (Sq. mm)      (Sq. mm)

BOTTOM     227.35       227.35       227.35        227.35        227.35
REINF.     (Sq. mm)     (Sq. mm)     (Sq. mm)      (Sq. mm)      (Sq. mm)
-------------------------------------------------------------------------------

                      SUMMARY OF PROVIDED REINF. AREA
-------------------------------------------------------------------------------
SECTION      0.0 mm      950.0 mm     1900.0 mm     2850.0 mm     3800.0 mm
-------------------------------------------------------------------------------
 TOP        3-10i        3-10i        3-10i         3-10i         3-10i
REINF.   1 layer(s)   1 layer(s)   1 layer(s)    1 layer(s)    1 layer(s)

BOTTOM     3-10i        3-10i        3-10i         3-10i         3-10i
REINF.   1 layer(s)   1 layer(s)   1 layer(s)    1 layer(s)    1 layer(s)

SHEAR   2 legged  8i  2 legged  8i  2 legged  8i  2 legged  8i  2 legged  8i
REINF.  @ 150 mm c/c  @ 150 mm c/c  @ 150 mm c/c  @ 150 mm c/c  @ 150 mm c/c
-------------------------------------------------------------------------------


SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT
-------------------------------------------------------------------------------

SHEAR DESIGN RESULTS AT   570.0 mm AWAY FROM START SUPPORT
  VY =     9.77 MX =     0.01 LD=   15
  Provide 2 Legged  8i  @ 150 mm c/c

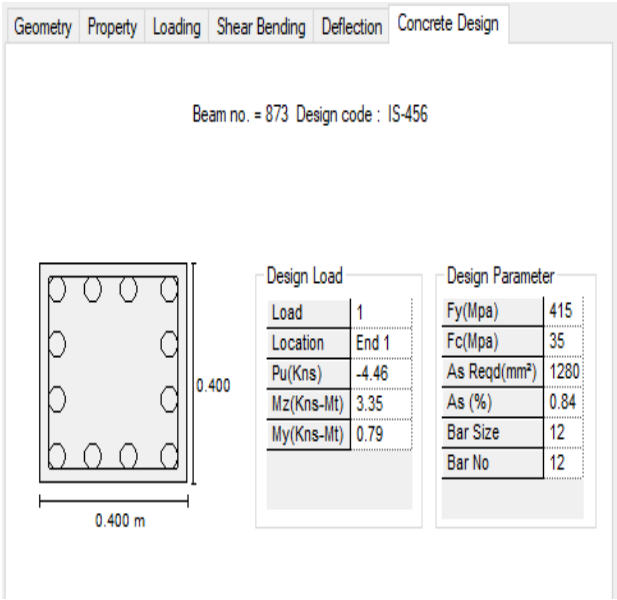
SHEAR DESIGN RESULTS AT   570.0 mm AWAY FROM END SUPPORT
  VY =   -14.12 MX =     0.01 LD=   13
  Provide 2 Legged  8i  @ 150 mm c/c

-------------------------------------------------------------------------------
```

Detailing of Beam reinforcement and reactions

15.Design of column of structure :-

The columns are designed to repel the axial loads and the side loads and transfer them effectively to the foundation of the structure. So, as all the loads from shafts, crossbeams are transferred through the columns, it's important to design strongcolumns.A column may be defined as an element used primary to support axial compressive loads and with a height of a least three times its side dimension. The strength of column depends upon the strength of accoutrements , shape, size of cross section, length and degree of commensurable and dedicational conditions at its ends.



Column design by STAAD.PRO V8i

15.1 Design parameter about column :-

- Column no = 873
- Fy = 415(MPA)
- Fc = 35 (MPA)
- Area of steel requried =1280mm^2
- Area of steel = 0.84%
- Bar size = 12mm
- Bar No = 12
- Mz =3.35 (Kns-mt)
- My = 0.79 (Kns-mt)

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=====================================================================

        C O L U M N   N O.   873  D E S I G N   R E S U L T S

      M35                 Fe415 (Main)              Fe415 (Sec.)

LENGTH:  3000.0 mm   CROSS SECTION:  400.0 mm X  400.0 mm  COVER: 40.0 mm

** GUIDING LOAD CASE:    1 END JOINT:   346  TENSION COLUMN


REQD. STEEL AREA   :     1280.00 Sq.mm.
REQD. CONCRETE AREA:   158720.00 Sq.mm.
MAIN REINFORCEMENT : Provide  12 - 12 dia. (0.85%,   1357.17 Sq.mm.)
                     (Equally distributed)
TIE REINFORCEMENT  : Provide  8 mm dia. rectangular ties @ 190 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
---------------------------------------------------------
Puz :   2898.24   Muz1 :     77.09   Muy1 :     77.09

INTERACTION RATIO: 0.05 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)
---------------------------------------------------------
WORST LOAD CASE:    21
END JOINT:   393 Puz :   2921.04   Muz :    169.66   Muy :    169.66   IR: 0.29
=====================================================================


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```
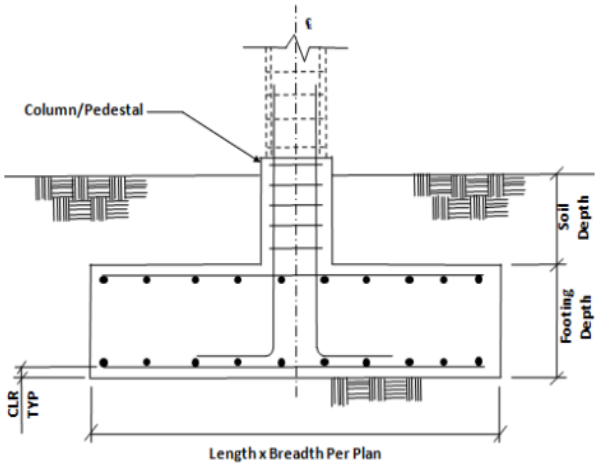
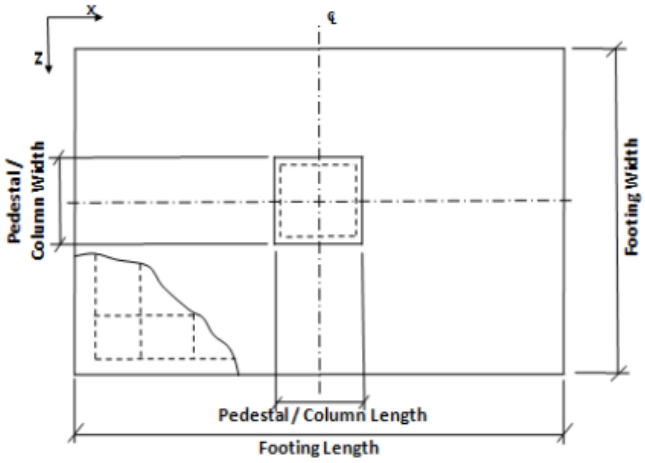

Detailing of column reinforcement and reaction

16.Design of Foundations :-

Foundation design is the creation of a construction plan for a structure foundation. It's a largely technical function and generally performed by a structural mastermind. The foundation is the structural base that stands on the ground and supports the rest of thebuilding.Foundations are structural rudiments that transfer the loads from the structure or individual column to the earth. Foundations must be designed to help inordinate agreement or gyration, to minimize discriminational agreement and to give acceptable safety against sliding andcapsizing.



Elevation of Isolated Footing



Plan of Isolated footing

16.1 Footing Geometry :-

Design Type	Calculate Dimension
Footing length -X(Fl)	1000.00mm
Footing width -Z(Fw)	1000.00mm
Footing Thickness (Ft)	305.00mm
Eccentricity along X (Oxd)	0.00mm
Eccentricity along Z (OZd)	0.00mm

16.2 Design parameters :-

Unit Weight of Concrete	25.000 kN/m3
Strength of Concrete	25.000 N/mm2
Yield Strength of Steel	415.000 N/mm2
Minimum Bar Size	Ø6
Maximum Bar Size	Ø32
Minimum Bar Spacing	50.000 mm
Maximum Bar Spacing	500.000 mm
Pedestal Clear Cover (P, CL)	50.000 mm
Footing Clear Cover (F, CL)	50.000 mm

16.3 Column Dimensions :-

Column Shape	Rectangular
Column Length - X (Pl)	0.400 m
Column Width - Z (Pw)	0.400 m

16.4 Soil Properties :-

Soil Type	Drained
Unit Weight	22.000 kN/m3
Soil Bearing Capacity	100.000 kN/m2

17.Check for Stability against overturning and sliding :-

-	Factor of safety against sliding		Factor of safety against overturning	
Load Case No.	Along X-Direction	Along Z-Direction	About X-Direction	About Z-Direction
101	153.515	218.199	807.474	441.326
102	160.969	228.794	846.681	462.755

17.1 Design of reinforcement :-

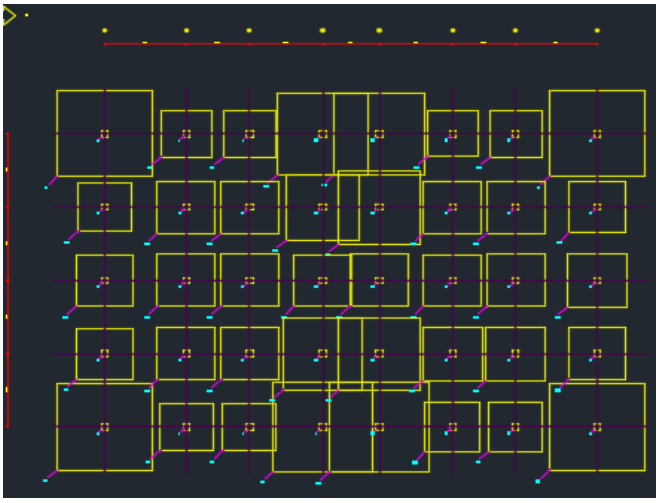
- Minimum Area of Steel (Astmin) = 5205.240 mm2
- Calculated Area of Steel (Ast) = 5731.621 mm2
- Provided Area of Steel (Ast,Provided) =5731.621mm2
- Astmin<= Ast,Provided Steel area is accepted

18.Result of Footing :-

Footing No.	Group ID	Foundation Geometry		
-	-	Length	Width	Thickness
1	1	5.700 m	5.700 m	0.761 m
2	2	5.700 m	5.700 m	0.761 m
3	3	5.800 m	5.800 m	0.761 m
4	4	5.750 m	5.750 m	0.761 m
5	5	3.200 m	3.200 m	0.456 m
6	6	3.100 m	3.100 m	0.407 m
7	7	3.200 m	3.200 m	0.456 m
8	8	3.100 m	3.100 m	0.407 m
9	9	5.950 m	5.950 m	0.811 m
10	10	5.500 m	5.500 m	0.761 m
11	11	6.050 m	6.050 m	0.811 m
12	12	5.400 m	5.400 m	0.711 m
13	13	3.300 m	3.300 m	0.457 m
14	14	3.050 m	3.050 m	0.407 m
15	15	3.250 m	3.250 m	0.407 m
16	16	3.100 m	3.100 m	0.407 m
17	17	3.450 m	3.450 m	0.457 m
18	18	3.400 m	3.400 m	0.457 m
19	19	3.550 m	3.550 m	0.457 m
20	20	3.450 m	3.450 m	0.457 m
21	21	3.350 m	3.350 m	0.457 m
22	22	3.250 m	3.250 m	0.457 m
23	23	3.500 m	3.500 m	0.457 m
24	24	3.500 m	3.500 m	0.457 m
25	25	4.400 m	4.400 m	0.607 m
26	26	4.900 m	4.900 m	0.659 m
27	27	3.500 m	3.500 m	0.457 m
28	28	3.500 m	3.500 m	0.457 m
29	29	3.500 m	3.500 m	0.457 m
30	30	3.500 m	3.500 m	0.457 m
31	31	3.450 m	3.450 m	0.457 m
32	32	3.500 m	3.500 m	0.457 m
33	33	3.450 m	3.450 m	0.457 m
34	34	3.500 m	3.500 m	0.457 m
35	35	3.500 m	3.500 m	0.457 m
36	36	3.500 m	3.500 m	0.457 m
37	37	4.800 m	4.800 m	0.659 m
38	38	4.850 m	4.850 m	0.659 m
39	39	3.550 m	3.550 m	0.457 m
40	40	3.550 m	3.550 m	0.457 m

Geometry of Footing

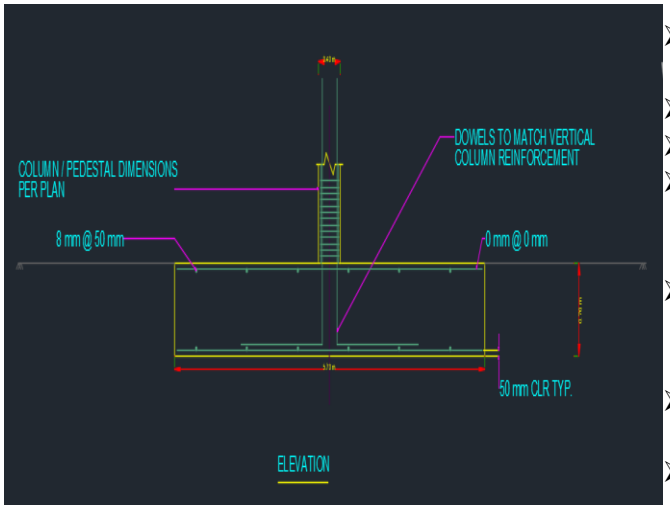
18.1 Layout of Foundation :-



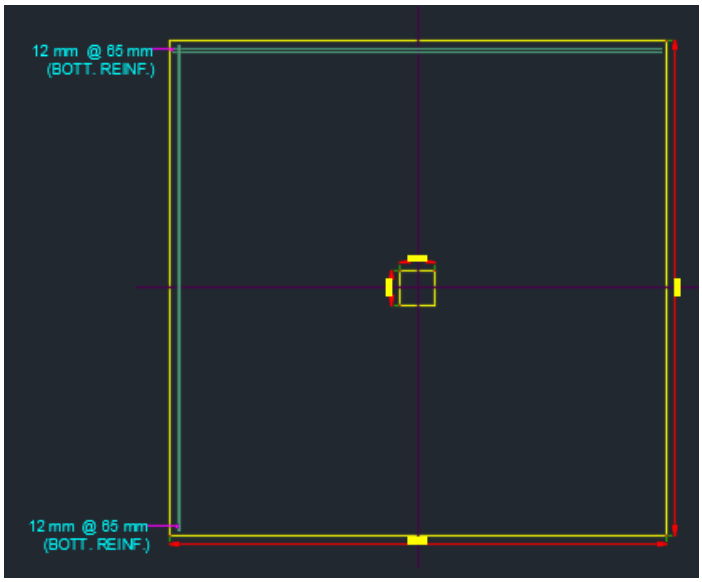
18.1 Detailing of Footing reinforcement :-

-	Bottom Reinforcement(M_x)	Bottom Reinforcement(M_y)	Top Reinforcement(M_x)	Top Reinforcement(M_y)
1	Ø12 @ 65 mm c/c	Ø12 @ 65 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 50 mm c/c
2	Ø12 @ 60 mm c/c	Ø12 @ 60 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 50 mm c/c
3	Ø12 @ 60 mm c/c	Ø12 @ 60 mm c/c	Ø10 @ 70 mm c/c	Ø8 @ 50 mm c/c
4	Ø12 @ 60 mm c/c	Ø12 @ 60 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 50 mm c/c
5	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 75 mm c/c
6	Ø10 @ 70 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 55 mm c/c	Ø6 @ 70 mm c/c
7	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 75 mm c/c
8	Ø10 @ 70 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 55 mm c/c	Ø6 @ 70 mm c/c
9	Ø12 @ 60 mm c/c	Ø12 @ 65 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 50 mm c/c
10	Ø12 @ 65 mm c/c	Ø12 @ 70 mm c/c	Ø8 @ 50 mm c/c	Ø8 @ 50 mm c/c
11	Ø12 @ 60 mm c/c	Ø12 @ 60 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 50 mm c/c
12	Ø12 @ 65 mm c/c	Ø12 @ 65 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 55 mm c/c
13	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø6 @ 75 mm c/c
14	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 55 mm c/c	Ø6 @ 75 mm c/c
15	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 70 mm c/c
16	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø8 @ 55 mm c/c	Ø6 @ 70 mm c/c
17	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
18	Ø10 @ 70 mm c/c	Ø10 @ 70 mm c/c	Ø8 @ 55 mm c/c	Ø6 @ 60 mm c/c
19	Ø10 @ 60 mm c/c	Ø10 @ 60 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 60 mm c/c
20	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
21	Ø10 @ 70 mm c/c	Ø10 @ 70 mm c/c	Ø8 @ 55 mm c/c	Ø6 @ 60 mm c/c
22	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø10 @ 75 mm c/c	Ø6 @ 70 mm c/c
23	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
24	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
25	Ø10 @ 55 mm c/c	Ø10 @ 55 mm c/c	Ø10 @ 65 mm c/c	Ø6 @ 50 mm c/c
26	Ø10 @ 50 mm c/c	Ø10 @ 50 mm c/c	Ø8 @ 55 mm c/c	Ø8 @ 60 mm c/c
27	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
28	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
29	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
30	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
31	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
32	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
33	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
34	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
35	Ø10 @ 65 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
36	Ø10 @ 60 mm c/c	Ø10 @ 65 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 65 mm c/c
37	Ø10 @ 50 mm c/c	Ø10 @ 50 mm c/c	Ø8 @ 55 mm c/c	Ø8 @ 60 mm c/c
38	Ø10 @ 50 mm c/c	Ø10 @ 50 mm c/c	Ø8 @ 55 mm c/c	Ø8 @ 60 mm c/c
39	Ø10 @ 60 mm c/c	Ø10 @ 60 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 60 mm c/c
40	Ø10 @ 60 mm c/c	Ø10 @ 60 mm c/c	Ø8 @ 50 mm c/c	Ø6 @ 60 mm c/c

19.Reinforcement details of footing :-



19.1 Plan of reinforcement of footing :-



Plan of reinforcement details

20.Conclusions :-

On the following work carried out, we conclude that :-

- This design has given an occasion tore-collect and coordinate the colorful styles of designing and engineering principles which we've learnt.
- Analysis and designing were done by using software and successfully vindicated manually as per IS456-2000.
- computation by both manually as well as softwareanalysis, gives nearly same result.
- . Chance of sword needed in column is0.82 to 3.14 .
- relegation Increases as the storey height increases.
- Maximum deviation in Horizontal(X-direction) is 50.756 mm. Maximum deflection in Horizontal (Z-direction) is 48.379 mm.
- Maximum deflection in Vertical (Y-direction) is 6.702 mm. Maximum gyration in X, Y, Z- directions are0.004 rad,0.001 rad,0.005 rad independently.
- Maximum & minimal Bending Moment in Z direction are377.68 KN- m &-248.45 KN-m.
- Maximum & Minimum Shear Force in Y- directionare197.77 KN &-167.74 KN.
- Maximum & Minimum Axial Force inX-direction areKN &-684.92 KN.

20.1 References:-

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- IS:456-2000, Code of practice for plain and reinforced concrete cement.
- IS:875-1987(part -1), Code of practice for design Dead loads.
- IS:875-1987(part -2), Code of practice for design Imposed loads.
- IS:875-1987(part -3), Code of practice for design wind loads.
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