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EXPERIMENTAL INVESTIGATION ON HIGHER ORDER LOAD ANALYSIS AND DESIGN OF COMBINED FOOTING USING STADD FOUNDATION

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ABSTRACT

As we know the foundation is the most important member of the building and a precise analysis of footing will result in more safe and economic design. In the present study the comparison of analysis of combined rectangular footing using Rigid (conventional) Method and Finite Element Analysis of combine footing using Winkler Model by using stadd pro is carried out, masonry or concrete a structure which carries the entire load from superstructure and it will distribute the load on soil bellow it. The strength, stability & support of structure are fully dependent on foundation. If some parts of superstructure fail, then repairs, modifications, additions & alterations are possible to save the structure, but in case of foundation failure it is much difficult and very costly.

INTRODUCTION:

Our project is based on the design and analysis of multi-storied building with combined footing design. Analysis is done through using the STADD-PRO .Notation adopted through out the project is same as in IS-456-2000 .Using software analysis for structural design is becoming more prevalent across the industry due to increasing technological resources. This project served as an investigation of foundation design alternatives and the feasibility of STAAD.foundation as a design aid for engineers at Stantec Consulting Ltd. Both design optimization and accuracy were tested against hand calculations in accordance with Indian code in order to identify the proficiencies and shortcomings of the software which were documented in a user tips manual.

A structure can be defined as a body which can resist the applied loads without appreciable deformations. Civil engineering structures are created to serve some specific functions like human habitation, transportation, bridges, storage etc. in a safe and economical way. A structure is an assemblage of individual elements like pinned elements (truss elements), beam element, column, shear wall slab cable or arch. Structural engineering is concerned with the planning, designing and the construction of structures. Structure analysis involves the determination of the forces and displacements of the structures or components of a structure. Design process involves the selection and detailing of the components that make up the structural system. The main object of reinforced concrete design is to achieve a structure that will result in a safe economical solution.

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STATEMENT OF THE PROJECT:

1. Utility of building: Residential building
2. No of storeys: G+7
3. No.of staircases: 7 no's
4. Shape of the building: rectangular
5. Type of construction: R.C.C framed structure
6. Type of walls: brick wall
7. Type of Footing : Combined footing

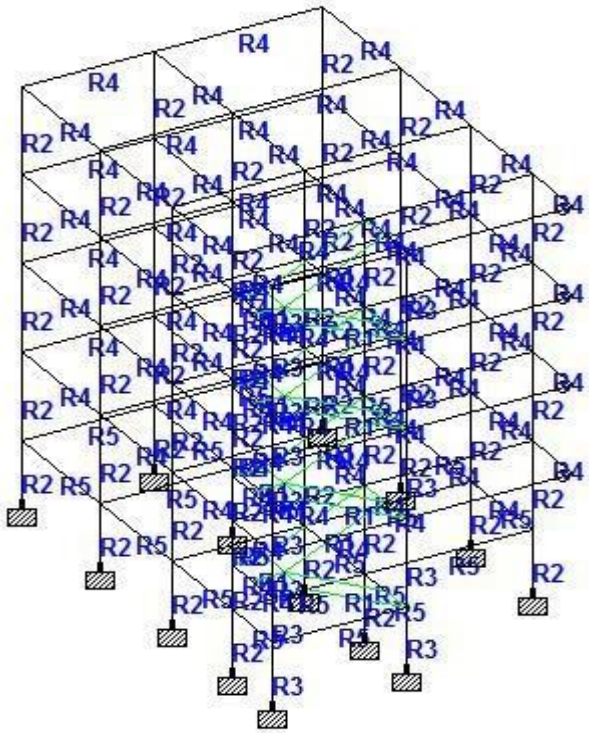
STRUCTURAL DESIGN:

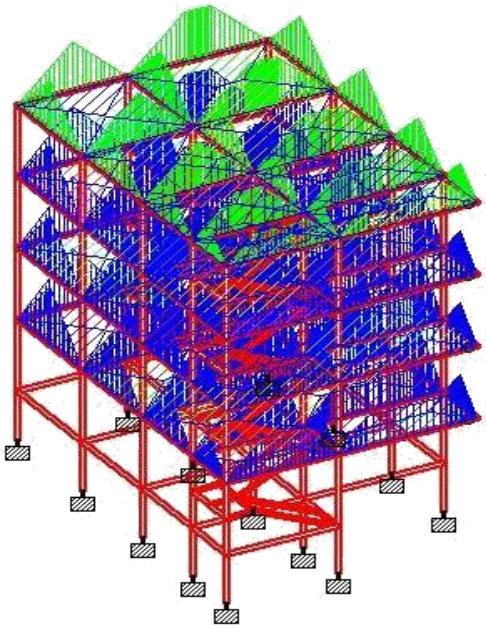
For slab, depth is 125 mm provided. For beams, after calculations are done. the dimensions of beam is 230*530mm factored load on beam is 15.87kn/m
Shape of column is rectangular

For columns, the dimension of column is 300*600mm Factored load on column 1090.10kn

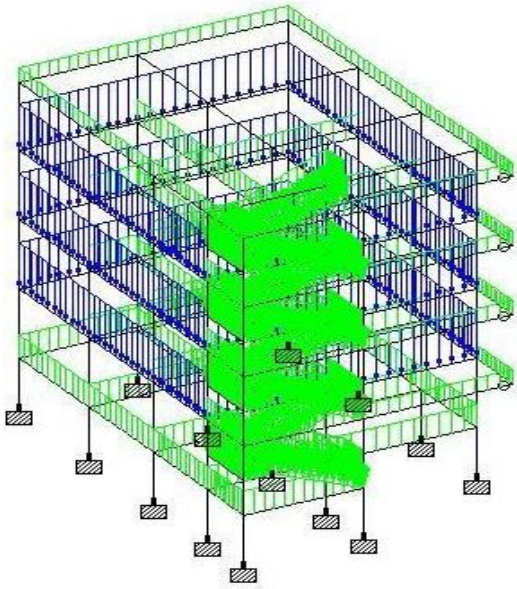
For footings, the bearing capacity of soil is 175kn/m2 To provide the dimensions of footing is 12.5m*2.7m

Assign the properties of structures:

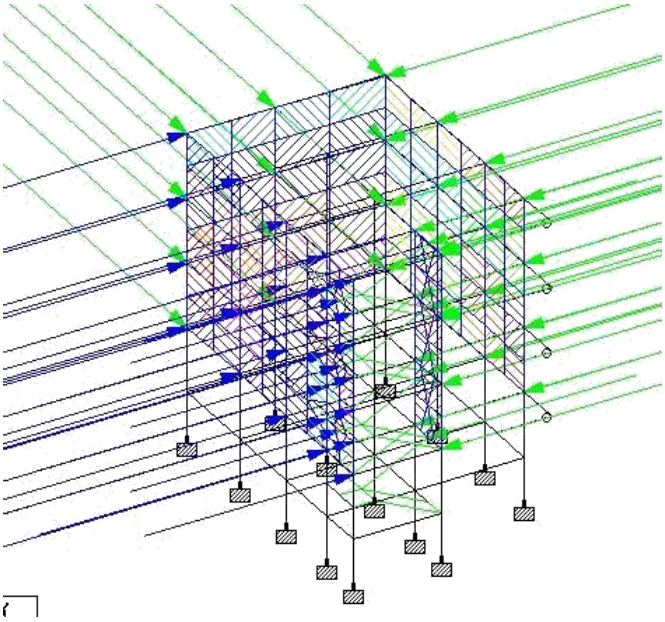




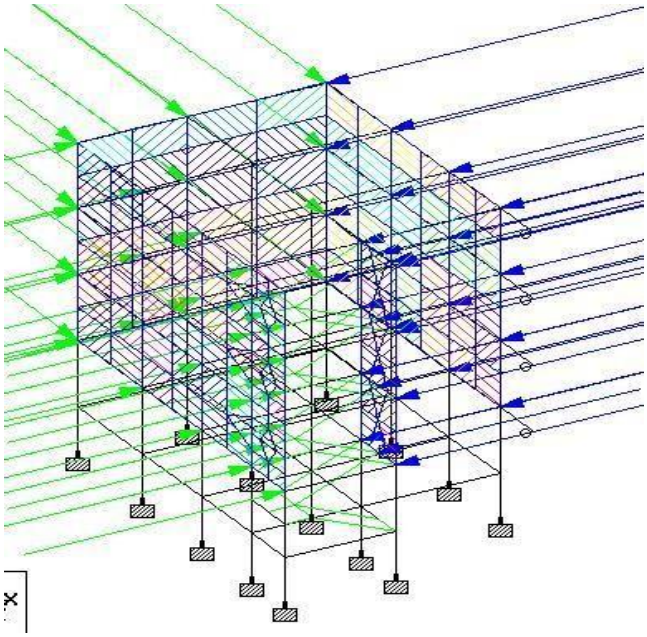
ASSIGN LOADS ON THE SLAB :



LOAD ASSIGN ON THE WALLS:



Assign Wind Load On The Structures (X+Ve Direction)



Assign Wind Load On The Structures (X-Ve Direction) :

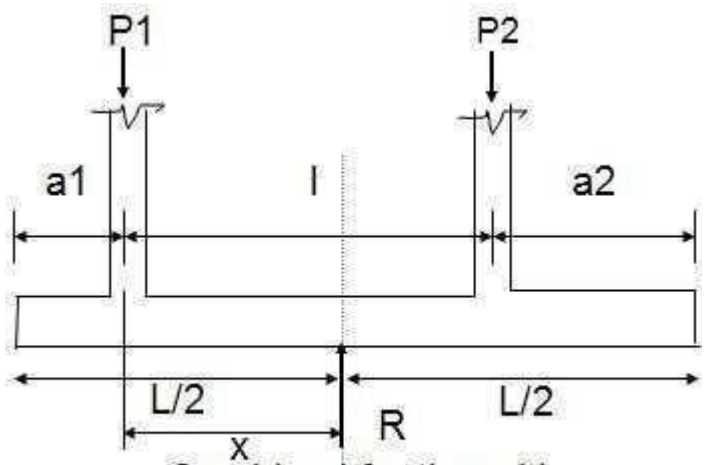
COMBINED FOOTING

The function of a footing or a foundation is to transmit the load form the structure to the underlying soil. The choice of suitable type of footing depends on the depth at which the bearing strata lay, the soil condition and the type of superstructure.

Combined footing

Whenever two or more columns in a straight line are carried on a single spread footing, it is called a combined footing. Isolated footings for each column are generally the economical. Combined footings are provided only when it is absolutely necessary, as

1. When two columns are close together, causing overlap of adjacent isolated footings
2. Where soil bearing capacity is low, causing overlap of adjacent isolated footings
3. Proximity of building line or existing building or sewer, adjacent to a building column.



Combined footing with loads

ULTIMATE LOADS

Footing No.	Left Overhang (m)	Right Overhang (m)	Length (m)	Width (m)	Thickness (m)
1	1.225	1.225	16.070	2.950	0.500
2	1.800	1.800	17.220	4.100	0.500
3	1.325	1.325	7.870	3.150	0.500
4	1.425	1.425	10.000	3.350	0.500

Footing No.	Footing Reinforcement			
-	Main Steel Top	Main Steel Bottom	Secondary Steel Top	Secondary Steel Bottom
1	Ø12 @ 185 mm c/c	) 175 mm c/c	Ø12 @ 185 mm c/c	Ø12 @ 185 mm c/c
2	Ø12 @ 185 mm c/c	Ø12 @ 60 mm c/c	Ø12 @ 185 mm c/c	Ø12 @ 110 mm c/c
3	Ø12 @ 105 mm c/c	Ø12 @ 185 mm c/c	Ø12 @ 185 mm c/c	Ø12 @ 185 mm c/c
4	Ø12 @ 140 mm c/c	) 190 mm c/c	Ø12 @ 185 mm c/c	Ø12 @ 170 mm c/c

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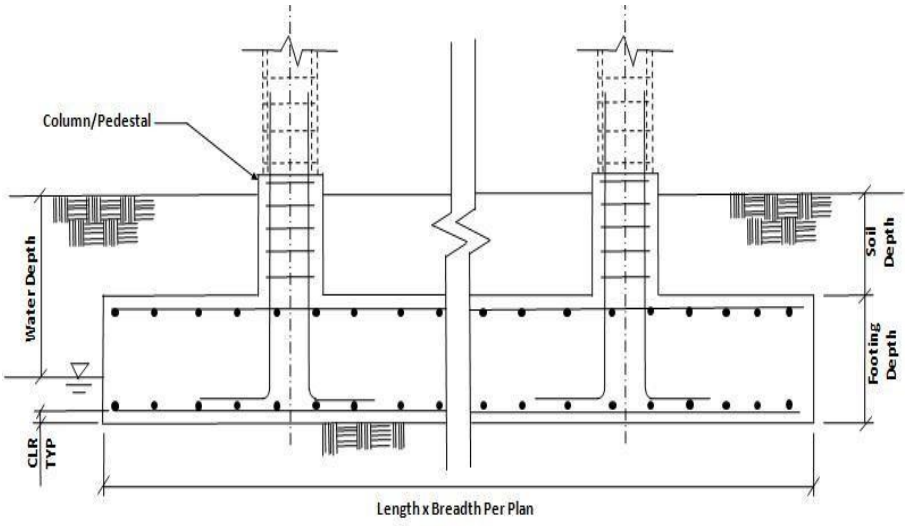
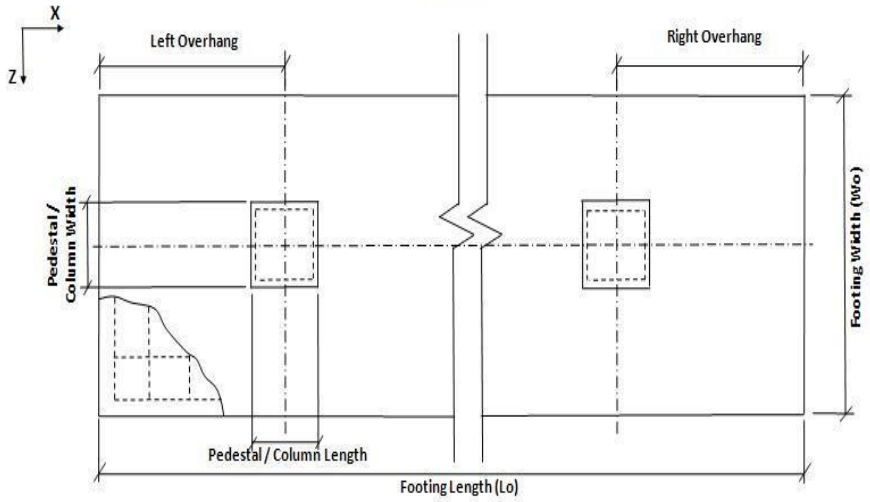


ELEVATION



PLAN

Design Calculations

Footing Size Calculations

Reduction of force due to buoyancy = 0.000 kN

Area from initial length and width, $A_o = L_o \text{ X } W_o$ = 39.050 sq m

Min. area required from bearing pressure, $A_{min} = P / q_{max}$ = 38.258 sq m

Note: A_{min} is an initial estimation.

P = Critical Factored Axial Load(without self weight/buoyancy/soil).

q_{max} = Respective Factored Bearing Capacity.

Final footing dimensions are:

Length of footing, L : 16.070 m

Width of footing, W : 2.950 m
Depth of footing, Do : 0.500 m
Area, A : 47.406 sq m
Length of left overhang, Lleft_overhang : 1.225 m
Length of right overhang, Lright_overhang : 1.225 m

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LOAD COMBINATIONS

Load Combination/s- Service Stress Level	
Load Combination Number	Load Combination Title
1	SW
2	DL
3	LL
5	COMBINATION LOAD CASE 5
6	WIND X
4	COMBINATION LOAD CASE 4

Load Combination/s- Strength Level	
Load Combination Number	Load Combination Title
1	SW
2	DL
3	LL
5	ON LOAD CASE 5
6	WIND X
4	ON LOAD CASE 4

Applied Loads - Service Stress Level

LC	Axial (kN)	Shear X (kN)	Shear Z (kN)	ment X (kNm)	Moment Z (kNm)
		-			
Column Number : 16					
1	77.274	-0.652	-0.783	-0.512	0.272
2	182.368	-2.344	-2.588	-1.729	1.306
3	109.989	0.744	0.656	0.538	-0.738
5	530.625	-1.592	4.402	9.485	-2.840

6	-15.881	1.192	5.650	8.026	-2.733
4	353.750	-1.061	2.935	6.323	-1.893
-					
Column Number : 19					
1	102.044	-0.736	0.094	0.061	0.460
2	238.828	-2.856	0.400	0.234	1.838
3	222.440	1.399	0.022	0.154	-1.317
5	844.193	-2.431	12.339	14.795	-0.672
6	-0.516	0.573	7.709	9.415	-1.430
4	562.796	-1.620	8.226	9.863	-0.448
-					
Column Number : 22					
1	97.537	-0.841	0.034	0.018	0.691
2	215.823	-3.092	0.331	0.191	2.354
3	186.907	1.461	0.343	0.386	-1.527
5	734.488	-3.307	13.332	15.597	1.158
6	-10.608	0.266	8.179	9.803	-0.746
4	489.659	-2.204	8.888	10.398	0.772
-					
Column Number : 25					
1	120.483	-1.050	0.168	0.101	1.211
2	238.593	-3.328	0.581	0.357	3.314
3	131.713	0.306	0.402	0.442	0.395
5	673.445	-9.439	14.050	16.252	13.213
6	-41.826	-2.220	8.216	9.934	3.889
4	448.963	-6.293	9.366	10.834	8.809
-					
Column Number : 28					
1	89.391	-0.401	0.014	0.007	0.378
2	144.562	-1.899	0.338	0.213	1.480
3	63.531	-0.475	0.205	0.258	0.595
5	554.939	-1.825	8.069	10.049	2.603

6	72.475	1.559	4.823	6.222	-0.718
4	369.959	-1.217	5.379	6.700	1.735

TABLE3: APPLIED LOADS

Applied Loads - Strength Level					
LC	Axial (kN)	Shear X (kN)	Shear Z (kN)	Moment X (kNm)	Moment Z (kNm)
-					
Column Number : 16					
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2	182.368	-2.344	-2.588	-1.729	1.306
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-					
Column Number : 22					
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2	215.823	-3.092	0.331	0.191	2.354
3	186.907	1.461	0.343	0.386	-1.527
5	734.488	-3.307	13.332	15.597	1.158
6	-10.608	0.266	8.179	9.803	-0.746
4	489.659	-2.204	8.888	10.398	0.772
-					

Column Number : 25					
1	120.483	-1.050	0.168	0.101	1.211
2	238.593	-3.328	0.581	0.357	3.314
3	131.713	0.306	0.402	0.442	0.395
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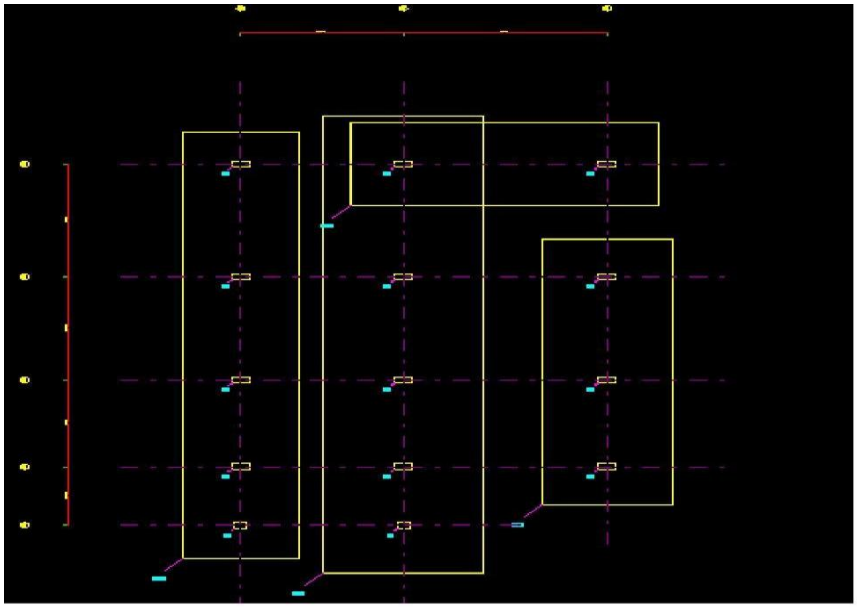
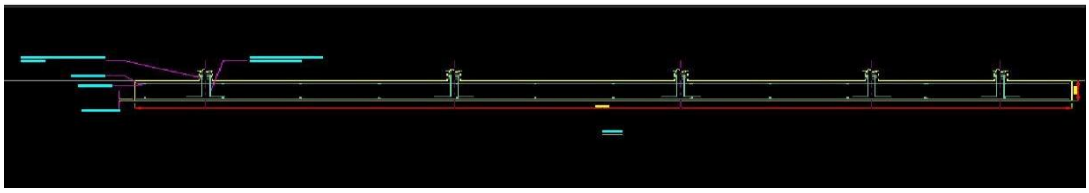
1	89.391	-0.401	0.014	0.007	0.378
2	144.562	-1.899	0.338	0.213	1.480
3	63.531	-0.475	0.205	0.258	0.595
5	554.939	-1.825	8.069	10.049	2.603
6	72.475	1.559	4.823	6.222	-0.718
4	369.959	-1.217	5.379	6.700	1.735





FOUNDATION LAY OUT

CONCLUSIONS &FUTURE SCOPE

- The design of beam, column, combined footing and staircase are done in limit state method which is safe at control of deflection and in all aspects
- Using staad.pro & stadd foundation software, the design consideration has been taken as per the is codes. The design is safe in all conditions
- On comparison with drawing, manual design and the geometrical model using staad.pro the area of AST required for the beam, column, footing and slab are comparatively similar to that of the requirement

REFERENCES:

1. Reinforced Concrete Limit State Design, 6th Edition, by Ashok K. Jain, Nem Chand & Bros, Roorkee, 2002.
2. Limit State Design of Reinforced Concrete, 2nd Edition, by P.C.Varghese, Prentice-Hall of India Pvt. Ltd., New Delhi, 2002.
3. Advanced Reinforced Concrete Design, by P.C.Varghese, Prentice-Hall of India Pvt. Ltd., New Delhi, 2001. Version 2 CE IIT, Kharagpur
4. Reinforced Concrete Design, 2nd Edition, by S.Unnikrishna Pillai and Devdas Menon, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
5. Limit State Design of Reinforced Concrete Structures, by P.Dayaratnam, Oxford & I.B.H. Publishing Company Pvt. Ltd., New Delhi, 2004.
6. Reinforced Concrete Design, 1st Revised Edition, by S.N.Sinha, Tata McGraw- Hill Publishing Company. New Delhi, 1990.
7. Reinforced Concrete, 6th Edition, by S.K.Mallick and A.P.Gupta, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 1996.
8. Behaviour, Analysis & Design of Reinforced Concrete Structural Elements, by I.C.Syal and R.K.Ummat, A.H.Wheeler & Co. Ltd., Allahabad, 1989.
9. Reinforced Concrete Structures, 3rd Edition, by I.C.Syal and A.K.Goel, A.H.Wheeler & Co. Ltd., Allahabad, 1992.
10. Textbook of R.C.C, by G.S.Birdie and J.S.Birdie, Wiley Eastern Limited, New Delhi, 1993.