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Design and Analysis of a G+4 Commercial Building by Using STAAD PRO

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Abstract - *The main objective of this project is to design a G+4 commercial building with verandah by using STAAD PRO V8i. The design includes load calculation and analysis of structure by using STAAD Pro software and input generated AUTO CAD based file. In this project we had analysis G+4 commercial building in "L" shape and find out shear force, bending moment, deflection, maximum absolute and reinforcement details of different component of the structure. The load applied on structure are Dead Load, Live Load and total height of the building is 15 m and area of each floor is approximate 381.52 m².*

Key Words: *STAAD PRO, Design and analysis, AUTO CAD planning, Dead Load, Live load, Shear force, Bending Moment and Max. Absolute on plate.*

1. INTRODUCTION

STAAD-PRO is a structural analysis design software, it includes a state of the art user interface, visualization tools and international design codes. It is used 3D models generation, analysis and multi material design, the commercial version of STAAD PRO supports several steel, concrete and timber design codes, it is the software application created to help structural engineer to automate their task and remove the tedious and long procedure of the manual calculation for designing method. In this project there is a commercial building G+4 in "L" shape having 8 rooms in one direction and 6 rooms in other direction of size 3.8×4.35 m with verandah on both direction.

2. OBJECTIVE

- Creating layout plan of building on AUTO-CAD software and model of structure on STAAD-PRO.
- To carry out various load cases (DL, LL) applied on structure.

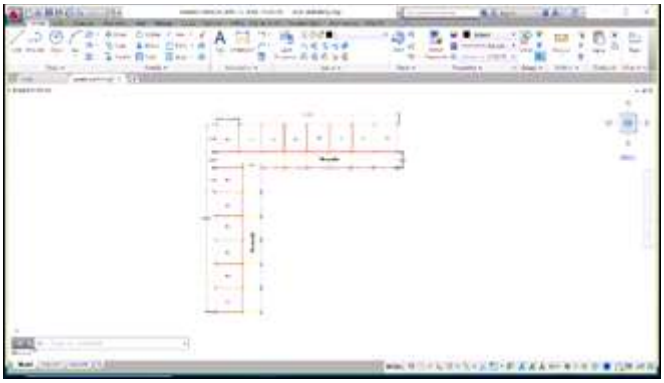


Fig-1 Plan of commercial building

3. METHODOLOGY

3.1 Modeling :

Preparing model of structure by using STAAD PRO software.

Fig-2 3D modeling with fixed support from STAAD PRO

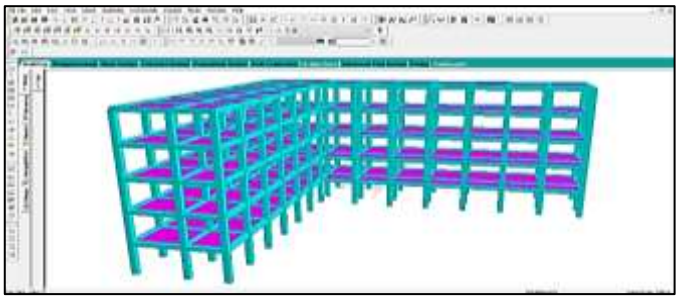


Fig-3 3D rendering from STAAD PRO

3.2 Calculation of load :

Dead Load calculation includes self-weight factor 1 KN/m, member load i.e. wall load 5 KN/m in GY direction and

member load i.e. parapet wall load 1.5 KN/m in GY direction.

Live load includes floor load in global Y direction range min 0 max 15 is 1.5 KN/m^2.

3.3 Analysis and design :

Analysis of bending moment, shear force, deflection and maximum absolute of beam, column and slab.

Table-1: Building Data

1	Type of building	L shape Multi story commercial building
2	Number of stories	G+4 (5 storey's)
3	Floor height	3.0m
4	Material	Concrete (M25) and Steel (Fe 500)
5	Size of column	0.40m×0.50m
6	Size of beam	0.40m×0.40m
7	Dead load	SW 1KN/m Wall load 5 KN/m in GY direction Parapet wall load 1.5 KN/m in GY direction
8	Live load	Floor load 1.5 KN/m^2 in GY direction min 0 m to max 15 m
9	Size of wall	20 cm thick
10	Plates thickness	130 mm

Step – 1 Creation of nodal point based on the column positioning of plan we entered the node points into the STAAD file.

Step – 2 Representation of beam and column, by using add beam command to draw the beam and column between the corresponding node points.

Step – 3 Now go to 3D view of structure for it we have used the transitional repeat command in global direction Y to get the 3D view of structure.

Step – 4 From STAAD pro modes in modeling menu select general go to support and property assigning after the creation of structure the support at the base of structure are specified at fixed. Also the material were specified and cross section of beam and column members was assigned.

Step – 5 3D rendering view. After assigning the property the 3D rendering view of the structure can be shown.

Step–6 Assigning of dead loads. Dead load are calculated as per IS875 PART 1 for external walls, internal walls, parapet wall including self-weight of the structure.

Step–7 Assigning live loads. Live load are for every floor 1.5 KN/m^2 based on IS 875 PART 2.

Step–8 Adding of load combination. After assigning all the loads, the load combination are given with suitable factor of safety as per IS 875 PART 5.

Step–9 Analysis after the completion of all the above steps we have performed the analysis and cheeked for error and warning.

Step–10 Design finally concrete design is performed as per IS 456:2000 by defining suitable design commands for different structural components. After the assigning of commands again we performed analysis for any error and warning.

Step–11 Finally from the STAAD tool bar go to STAAD output print the whole structure analysis report.

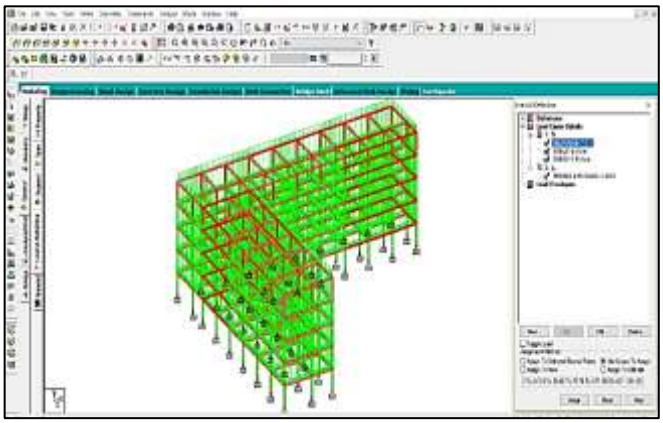


Fig-4 When dead load is applied

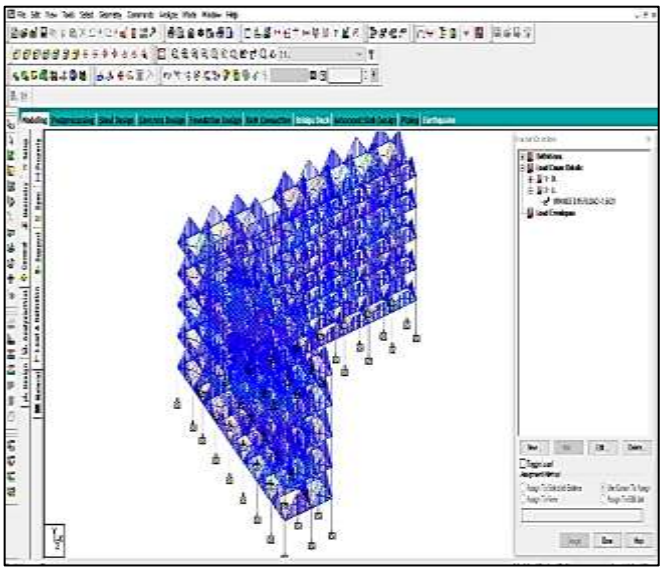


Fig-5 When live load is applied

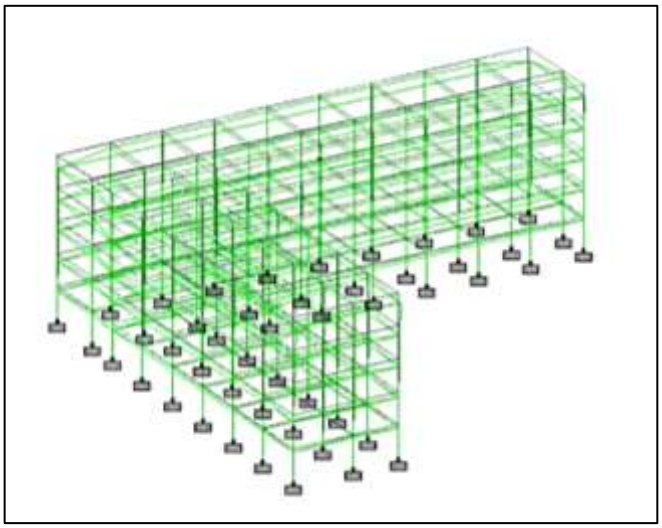


Fig-6 Displacement of structure

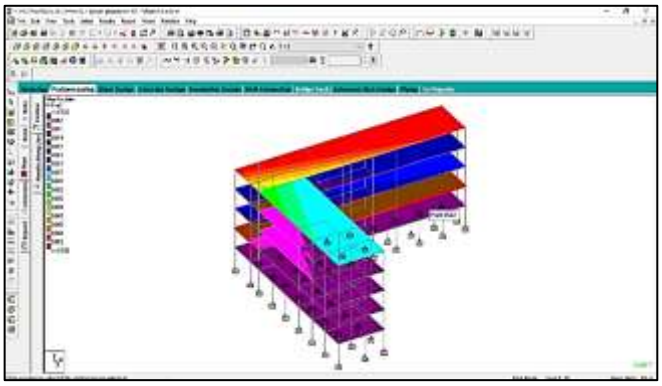


Fig-7 Max absolute on plate

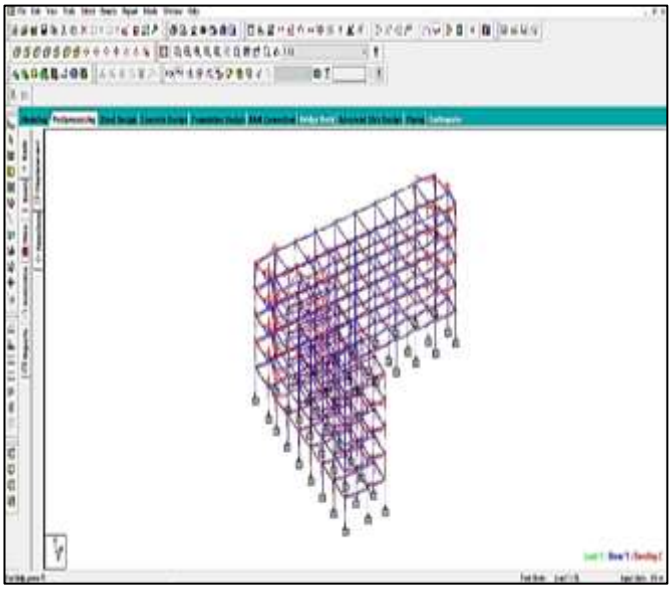
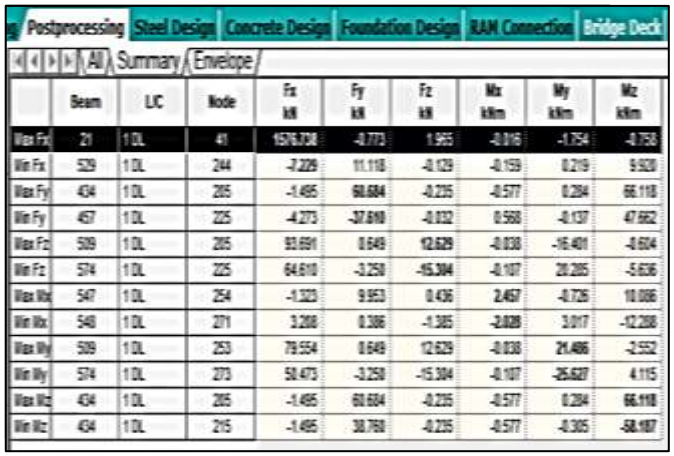


Fig-8 Bending moment in Z and Shear force in Y direction

4. RESULT



	Beam	LC	Node	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
Max Fx	21	1 DL	41	1576.708	-0.773	1.965	-0.016	-1.754	-0.758
Min Fx	529	1 DL	244	-7.229	11.118	-0.129	-0.159	0.219	9.928
Max Fy	434	1 DL	205	-1.495	60.684	-0.235	-0.577	0.284	66.118
Min Fy	457	1 DL	225	-4.273	-37.618	-0.032	0.568	-0.137	47.662
Max Fz	509	1 DL	205	93.691	0.649	12.629	-0.038	-16.401	-5.604
Min Fz	574	1 DL	225	64.810	-3.258	-15.394	-0.107	20.285	-5.636
Max Mx	547	1 DL	254	-1.323	9.953	0.436	2.457	-0.726	10.086
Min Mx	548	1 DL	271	3.268	0.386	-1.385	-2.828	3.017	-12.288
Max My	509	1 DL	253	79.554	0.649	12.629	-0.038	21.486	-2.552
Min My	574	1 DL	273	50.473	-3.258	-15.394	-0.107	-25.627	4.115
Max Mz	434	1 DL	205	-1.495	60.684	-0.235	-0.577	0.284	66.118
Min Mz	434	1 DL	215	-1.495	38.768	-0.235	-0.577	-0.305	-58.187

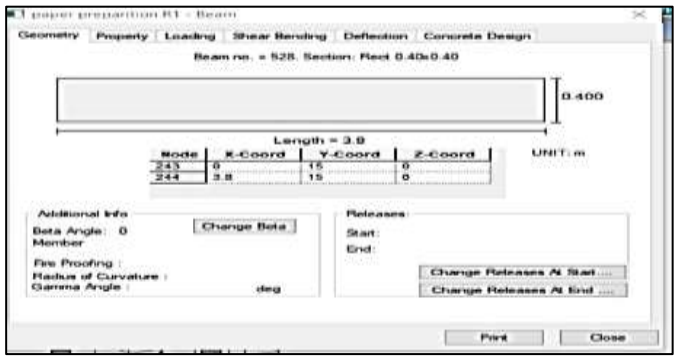


Fig-9 Geometry of Beam

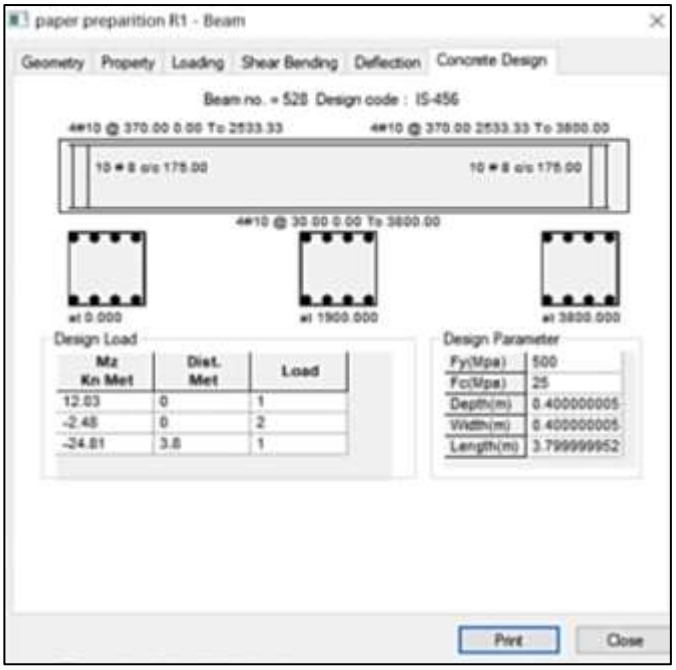


Fig-10 Reinforcement design of Beam

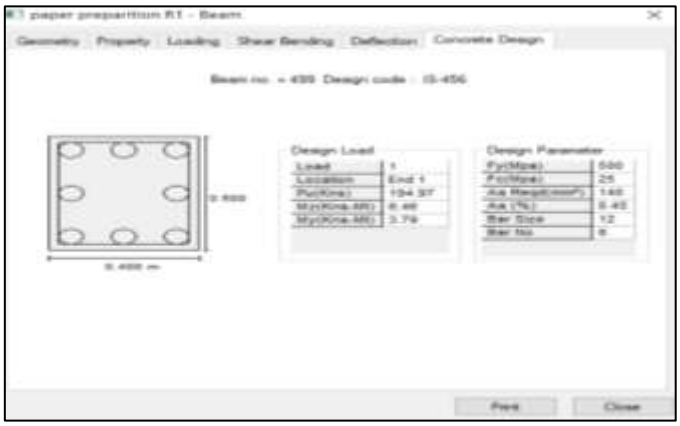


Fig-11 Reinforcement design of Column

5. CONCLUSION

- The structure is completely analyzed using STAAD PRO v8i.
- Proposed sizes of the elements can be used in the structure.
- The structural components of the building are safe in shear and flexure.
- Also check the deflection of various member under the given loading combination.
- Very less space is required for the storage of the data.
- It is simple to change the value at the place where error occurred and the obtained result are generated in the data.
- Structure model can viewing in both 2D & 3D situation.

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7. BIOGRAPHIES

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