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Analysis of Commercial Building Using Staad-Pro

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ABSTRACT

Whole-building simulation and analysis has demonstrated a significant energy savings potential in a wide variety of design projects. Commercial building design, however, traditionally integrates simulation and modeling analyses too late in the design process to make a substantial impact on energy use. The National Renewable Energy Laboratory (NREL) commercial building group created an optimization platform called Opt-E-Plus that uses multivariate and multi-objective optimization theory to navigate a large parameter space and find economical. The purpose of this Major Qualifying Project was to analyze and design a structural system for an illustrative commercial building in Worcester, Massachusetts. The design process included an architectural layout, structural framing options using both steel and concrete, a dome roof, and a partial glass curtain wall. The work was completed in compliance with the IBC and local building codes.

I. INTRODUCTION

Commercial buildings represent a large portion of new construction projects throughout the world. Commercial buildings designed for consumer interaction and sales often present unique structural and architectural design challenges due to the emphasis on aesthetics and performance. This Major Qualifying Project investigated the design of a two-story commercial building with a large span lobby for sales agents and consumers. The group used the project to demonstrate fundamental knowledge of civil engineering gained from undergraduate courses at WPI. Topics not covered in the undergraduate curriculum were researched and explored including the design and construction of a dome roof and partial glass curtain wall.

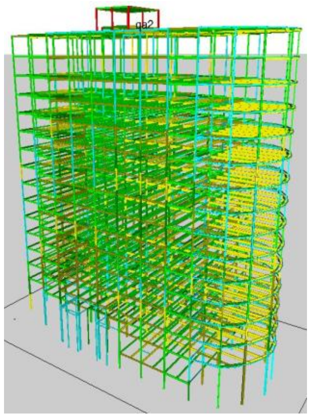


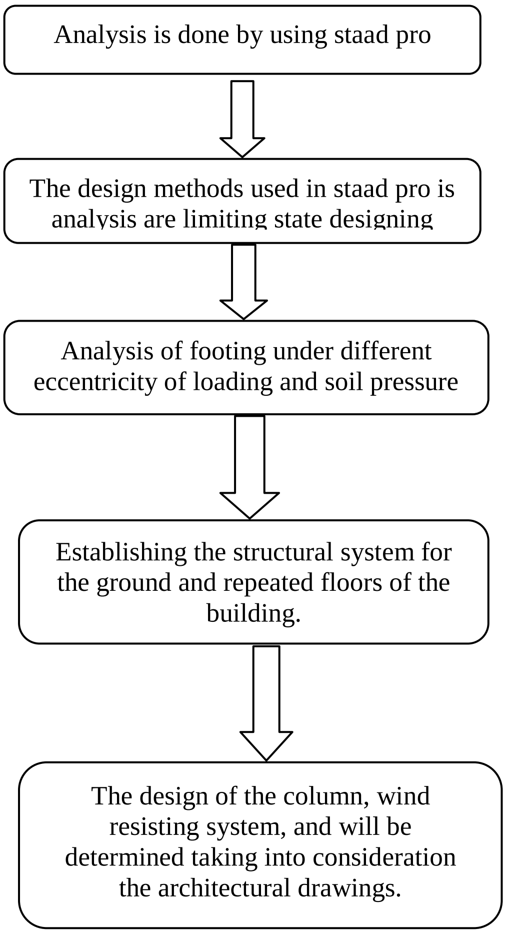
Fig.1 Multi Storey Commercial Building

II. LITERTURE REVIEW

P. Jayachandran structural design of Multi-storey Building in Salem, India. The students did a literature survey, problem definition and did a complete structural analysis and design of the four story residential building in reinforced concrete. They followed the Indian code BIS 456 – 1978 and used ACI-1999 and wind/earthquake loads by using Canadian Code 1995, and ANSI standards 1995 for checking. The analysis and design of slabs, beams, girders, columns and footings were completed using theory from Reinforced Concrete Design and Structural Analysis by STAAD-PRO software, which uses finite elements. Design for slabs, beams , columns and footings were carried out using the software. Drawings were done using Auto-CAD. To prevent the misuse of these software applications, the Limit State Design was exclusively used as a hand calculation method to verify the output from STAAD-PRO.

Bhatacharjee Analysis and Design of Multistoreyed Building. The principle objective of this project is to analyze and design a multi-storeyed building [G + 21 (3 dimensional frame)] using STAAD Pro. The design involves load calculations manually and analyzing the whole structure by STAAD Pro. The design methods used in STAAD-Pro analysis are Limit State Design conforming to Indian Standard Code of Practice.

III. METHODOLOGY



IV. LOADS

The following loads are to be taken. They are

1. Live load
2. Dead load(combination of floor loads and wall loads)
3. Wind load(IS875-part3)

4. Seismic loads

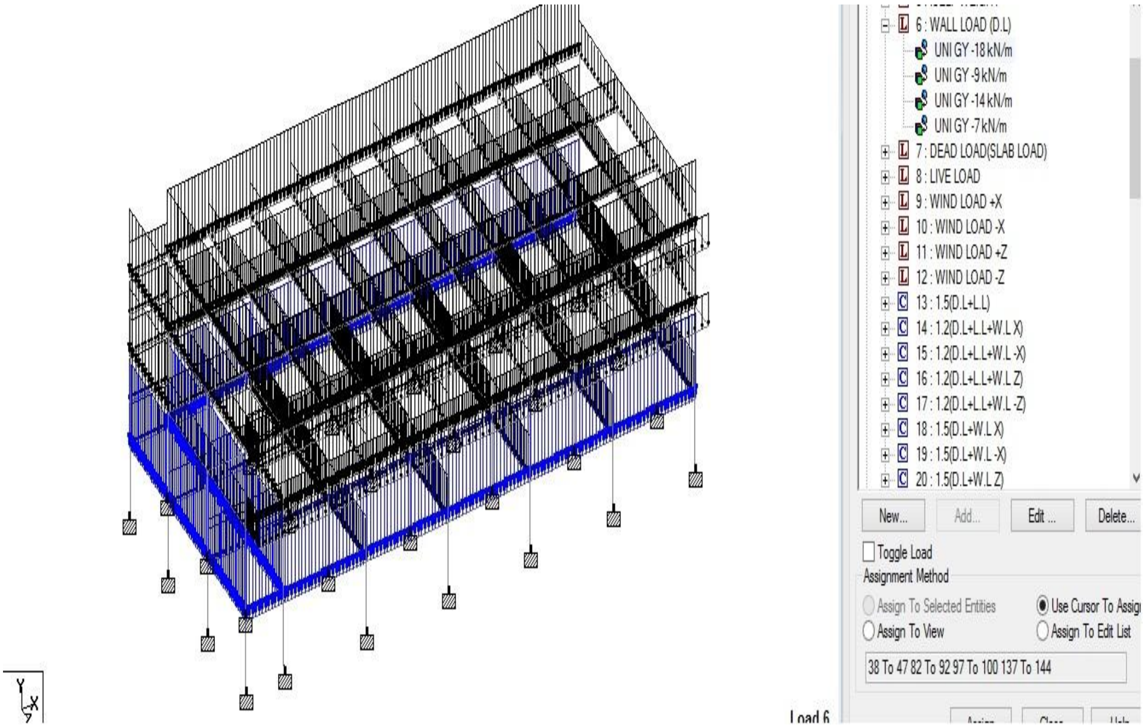


Fig.2 Wall Loads

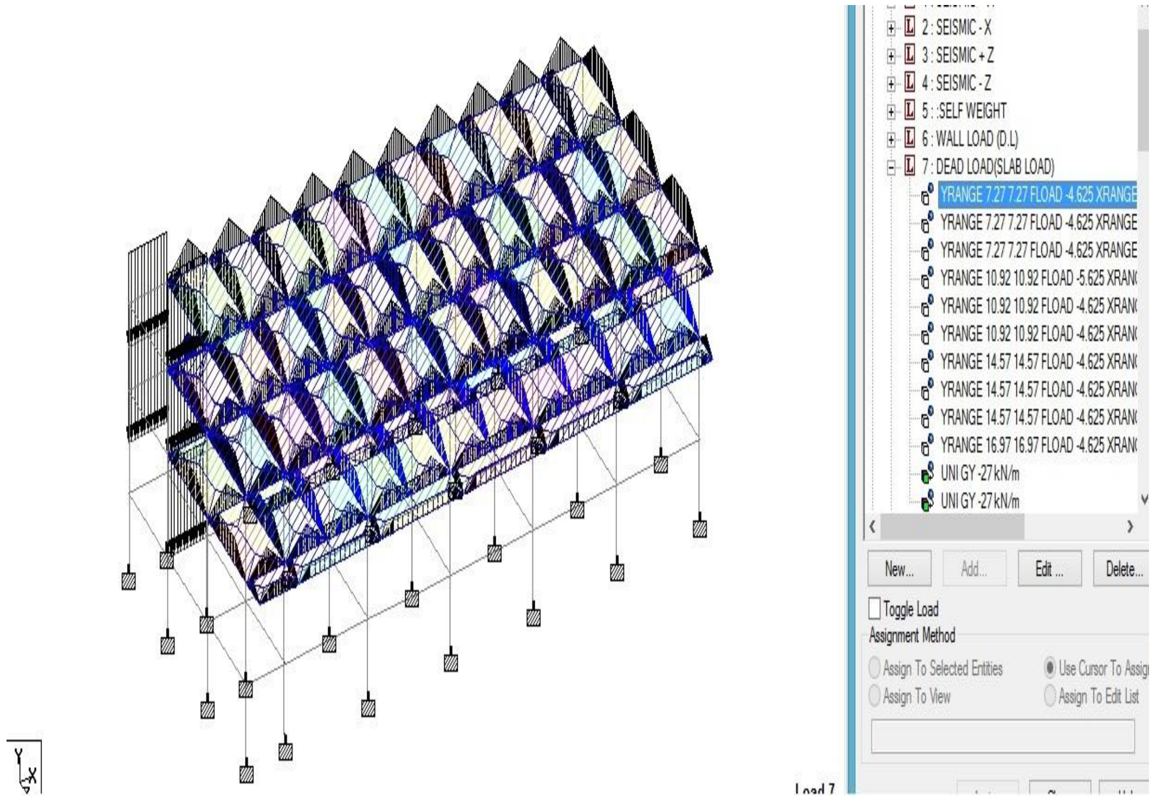


Fig.3 Floor Load

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V. LOAD COMBINATIONS

The following loads combinations should be taken.

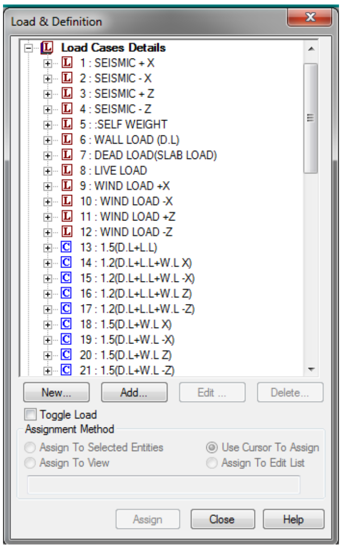

fig.4

VI. RESULTS

The following tabular form shows the bending moment Shear force of the walls and floors of the building.

Beam	L/C	Node	Fx KN	Fy KN	Fz KN
	28 1.5(D.L+E	579	-3.830	156.741	5.235
		580	3.830	-136.576	-5.235
	29 1.5(D.L+E	579	4.006	155.650	-3.403
		580	-4.006	-135.485	3.403
	30 0.9(D.L)+	579	0.025	93.828	0.443
		580	-0.025	-81.728	-0.443
	31 0.9(D.L)+	579	0.044	93.604	0.302
		580	-0.044	-81.504	-0.302
	32 0.9(D.L)+	579	0.474	93.894	2.740
		580	-0.474	-81.795	-2.740
	33 0.9(D.L)+	579	-0.377	93.537	-1.623
		580	0.377	-81.437	1.623
	34 0.9(D.L)+	579	-0.072	94.672	6.120
		580	0.072	-82.572	-6.120
	36 0.9(D.L)+	579	0.177	92.763	-5.021
		580	-0.177	-80.664	5.021
	37 0.9(D.L)+	579	-3.865	94.263	4.868
		580	3.865	-82.164	-4.868
	50 1.0(D.L)+	579	3.970	93.172	-3.769
		580	-3.970	-81.072	3.769
	51 1.0(D.L)+	579	0.080	131.858	0.832
		580	-0.080	-111.935	-0.832
	52 1.0(D.L)+	579	0.061	126.372	0.731
		580	-0.061	-107.624	-0.656

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	53 1.0(D.L)+	579	0.071	126.407	1.956
		580	-0.071	-107.624	-0.656
	54 1.0(D.L)+	579	-0.154	126.216	-0.370
		580	0.154	-107.589	0.370
	551.0(D.L)+	579	0.040	104.204	0.539

Beam	L/C	Node	Mx KNm	My KNm	Mz KNm
	28 1.5(D.L+E	579	0.245	-5.285	260.960
		580	-0.245	-4.137	3.025
	29 1.5(D.L+E	579	-0.133	3.302	259.616
		580	0.133	2.824	2.405
	30 0.9(D.L)+	579	-0.683	-0.521	156.365
		580	0.683	-0.275	1.635
	31 0.9(D.L)+	579	0.759	-0.294	155.973
		580	-0.759	-0.250	1.624
	32 0.9(D.L)+	579	0.148	-2.782	156.400
		580	-0.148	-2.149	1.547
	33 0.9(D.L)+	579	-0.075	1.560	157.887
		580	0.075	1.360	1.623
	34 0.9(D.L)+	579	-6.018	-6.243	154.449
		580	6.018	-4.773	1.635
	36 0.9(D.L)+	579	6.086	5.053	156.845
		580	-6.086	3.985	1.939
	37 0.9(D.L)+	579	0.223	-4.889	155.501
		580	-0.223	-3.874	1.319
	50 1.0(D.L)+	579	-0.15	3.698	217.281
		580	0.156	3.086	2.133
	51 1.0(D.L)+	579	0.106	-0.901	208.632
		580	-0.106	-0.598	2.072
	52 1.0(D.L)+	579	-0.290	-0.813	208.423
		580	0.290	-0.502	2.066
	53 1.0(D.L)+	579	0.479	-0.692	208.651
		580	-0.479	-0.489	2.117
	54 1.0(D.L)+	579	0.153	-2.019	208.400
		580	-0.153	-1.502	
	551.0(D.L)+	579	0.034	0.297	

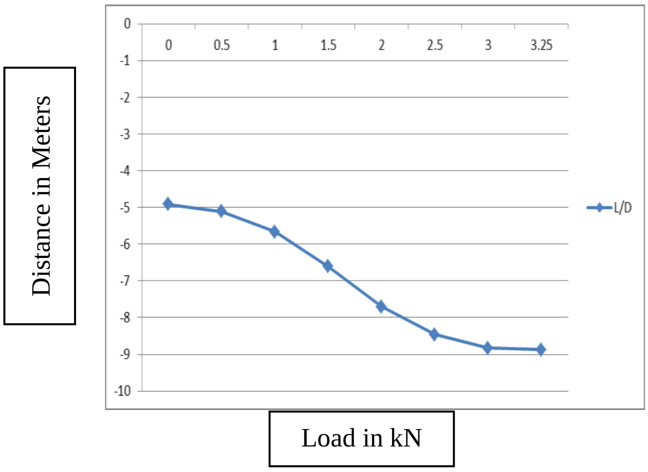

Fig.5

VII. CONCLUSION

The objective was to lay out a plan for G+3 commercial building design beams and columns for the structure using staad pro. This project helps us understand the efficiency of software and how it eases our work with accurate results in minimum time. By the end of project i have learnt the aspects to be considered for planning and achieved the aim of determining the reinforcement details and designing beams and columns which are capable to resists all the loads of the structure.

From the STAAD PRO analysis and design for the given structure, the total deflection due to dead load and live load for different load combinations differ . The failure loads are identified and the structure is designed for loads that can withstand wind loads and seismic loads.

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