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Analysis and Design of Multi Storied Building using STAAD PRO and Manually for Two Seismic Zones

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Abstract: ***In this paper, the principle objectives of this project are comparison between analyze and design of multistoried building for two different seismic zones by using staad pro and manually calculations. The design involves load calculations and analyzing the whole structure by STAAD Pro. The design methods used in STAAD Pro analysis are Limit State Design refers to Indian Standard Code of Practice. These involve Staad Modeling, Analysis the members due to the effect of Seismic load & Compare them Building with Concrete & Steel construction. The structure is a G+9 storied building.***
Keywords: STAAD PRO, BuildingAnalysis, Design, Seismic Zones, manual design.

I. INTRODUCTION

Construction of multistoried or high rise building is basic need because of huge increasing population and land scarcity. If we used conventional method of manual design of building is time consuming and more possibility of human errors. So it is necessary to use of software for getting more accurate results. Staad-pro is structural software accepted by much civil engineering. This can solve typical Problem like seismic analysis using various load combination to confirm various code like IS 456:2000, 1893:2002, IS875:1897etc. For multi-storied buildings, the conventional load bearing structures tends to distribute the loads more uniformly and eliminate the excessive effects of localised loads. Become uneconomical as they require larger sections to resist huge moments and loads. But in a framed structure, the building frame consists of a network of beams and columns which are built monolithically and rigidly with each other at their joints. Because of this rigidity at the joints, there will be reduction in moments and also the structure Therefore in non-load bearing framed structures, the moments and forces become less which in turn reduces the sections of the members.

II. LITERATURE REVIEW

A. A significant amount of research work on various structural aspects of use of structure and their mechanism has been published by many investigators. Reviews of some of the technical papers are briefed below.

B. Deevi Krishna Chaitanya (2017) [1] has indicate that in his paper, now a days where competition is more there time is most important factor for civil engineers it is requirement of saving time by using staad pro software in the replacement of manually calculations Where much accuracy is required by using staad pro it becomes easy to calculate and analyse various frames where different dead loads, live loads are applied. This software involves all the criteria of kanies method, portal frame method matrix method etc. for analyze frame structures.

C. K. Rama Raju et al., (2013) [2] he said that the taller buildings is the need for the new generation so the taller the structure, the loads comes on the structural members also huge. So by using staad pro we can analyze easily all the structural components easily and for that less time will be required. Has explained that the objective of the paper is to detect and scan a multi-storey building. Load calculations are done manually and STAAD.Pro software is used for analyzing the structure and their structural components. STAAD.Pro is the recommended software. STAAD.Pro is software which allows the users to make the mounted the loading values to be given and dimensions.

D. V.Varalakshmi1: [3] he has done analyze and design of multistoried building. In this study included analyse and design of structural component like column, beam footing slab by using staad pro and get result bearing capacity of soil is to be safe. He designs structural components like column, beam, footing, and slab. He has check all necessary data like bending moment, shear force And the result from staad pro are safe in all necessary checks.

E. Sayyed O.et al. (2017) [4], he work on study of impact of in filled mass inconsistency. In reinforcement concrete structure for various floors. He said that the different floor of structure have different seismic load and for different seismic zones also. It can be done easily by using staad pro software. In This project are completely deals with scrutiny of the building using the STAAD.Pro software. The results are compared with physical calculations. The elements are created as per IS: 456:2000 codes.

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III. OBJECTIVE AND SCOPE

To study the difference for same structure for two different seismic zones by comparing beam, column, footing, design and seismic data by using staad pro software and manually calculations. The analyze are done for G+9 building. Staad pro software is applicable for all types of structures which may be situated any zones. By comparing same structure for different zones we can get all different parameters which make same structure as a different structure for different seismic zones. It is more time saving. Because we have put the data in software and get the result after run analysis directly as a output..In manually calculation so much time is required and more mistakes may be occurs.

IV. METHODOLOGY

STAAD Pro is a general purpose program for performing the analysis and design of a wide variety of types of structures. The basic three activities which are to be carried out to achieve that goal.

A. Model generation
B. The calculations to obtain the analytical results.
C. Result verification - are all facilitated by tools contained in the program's graphical Environment.

Geometric details of building

S. No.	Description of Structure	Values	S. No.	Description of Structure	Values
1	No. of Storey's	G+9 storey	5	Floor Height	3 m
2	Material	Concrete M30 & Reinforcement Fe415	6	Seismic zone	Zone 2 and Zone 4 (Table 2, IS 1893 (Part I): 2002)
3	Size of Beam	300 x 400 mm 300 x 600 mm	7	SBC	200 KN/ sq. m
4	Size of Column	300 x 600 mm	8	Size of building	24 m x 24 m

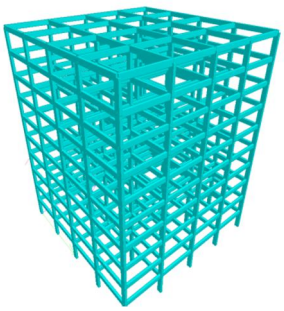
Fig.1 3D Rendered View

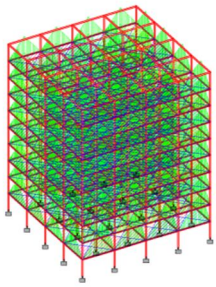
fig.2 Dead Load Distribution

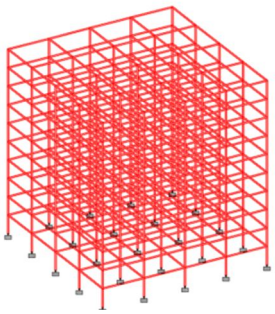
fig.3 live load

V. RESULT AND DISCUSSION

Analysis was done by using staad pro software and design are done by manually calculations.

Zones	Horizontal seismic coefficient	Seismic wt. By staad-pro	Seismic wt. By manually
Zone 4	0.0416	50655.45 KN	50561 KN
Zone 2	0.017	48375 KN	48271 KN

Table. 1

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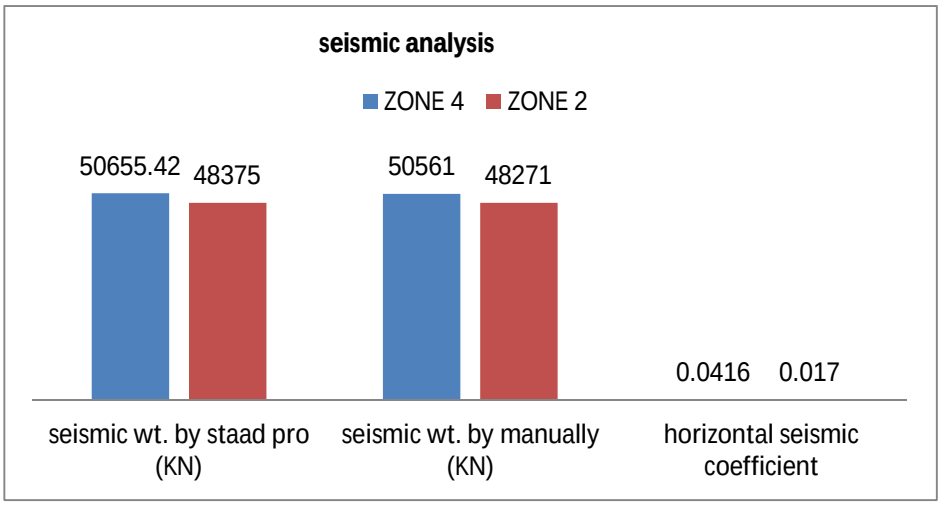

Fig. 4 seismic analysis

Fig. 4 shows the comparative study of seismic weight and horizontal seismic coefficient for two different zones by using staad- pro and manually design. In which for zone 4 the seismic weight is 50655.42 KN by using staad -pro and 48375 KN by manually and for zone 2 seismic weights 50561 KN by staad pro and 48271 KN by manually. The horizontal seismic coefficient for zone 4 is 0.0416 and for zone 2 is 0.017.

Column no.	Puz (KN)	zones	Design					
			Staad-pro			manually		
			Asc sq.mm	Transverse R/F	Longitudinal R/F	Asc Sq.mm	Transverse R/F	Longitudinal R/F
131	3037.75	. Zone 4	2013.15	8 mm dia. Ties @190 mm c/c	20 nos. 12mm dia. @300mm c/c	2041.15	8 mm dia. Ties @190 mm c/c	20 nos. 12mm dia. @300mm c/c
	2775.31	Zone 2	1149.15	8 mm dia. Ties @180 mm c/c	18 nos. 12mm dia. @300mm c/c	1158.69	8 mm dia. Ties @180 mm c/c	18 nos. 12mm dia. @300mm c/c

Table.2 column analysis

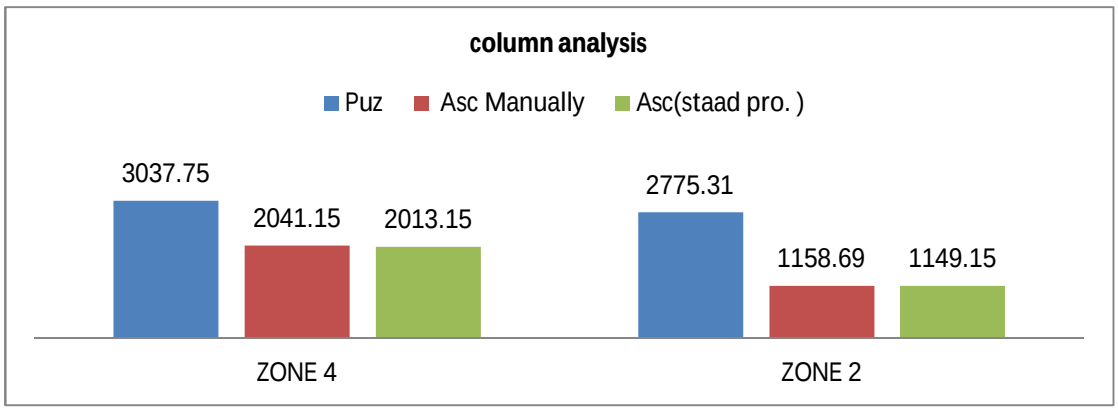

Fig. 5 column analysis

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In fig 5 shows the comparative study of column design for two different zones in which puz for zone 4 and zone 2 are different. The fig shows reinforcement area for two different zones by manually and staad pro design in which calculated the reinforcement like transverse reinforcement and longitudinal reinforcement for two different zones by staad pro and manually calculation and the result zone 4 required more reinforcement than zone 2.

Zones	Shear force (staad pro)	Shear force (Manually)	Bending moment (staad pro)	Bending moment (Manually)
Zone 4	213.2 KN	225 KN	312.89 KN-m	337.50 KN-m
Zone 2	184.8 KN	202.5 KN	301.48 KN-m	309.79 KN-m

Table.3

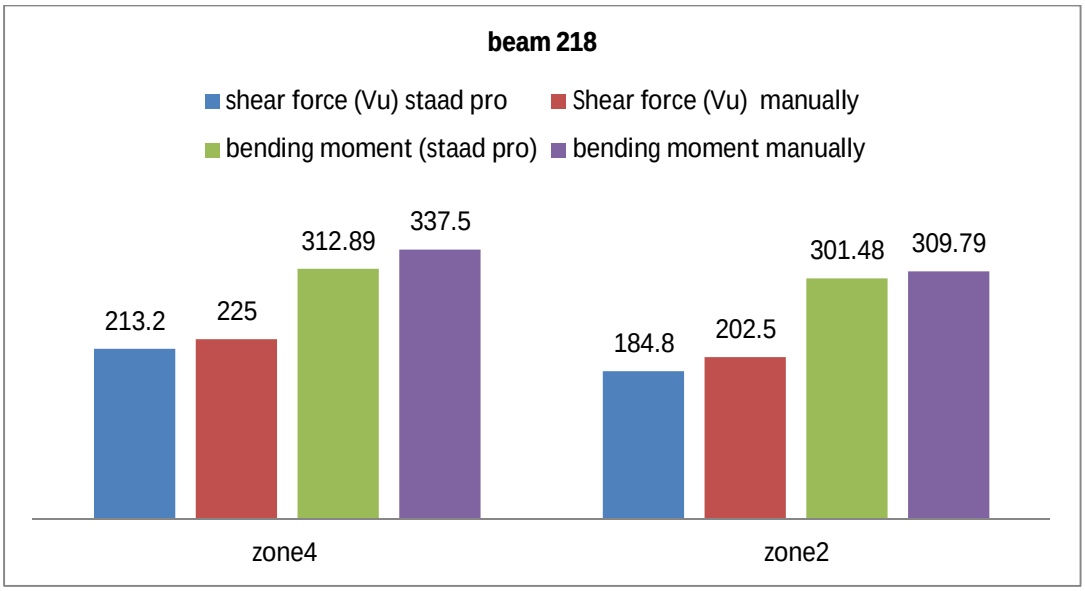

Fig. 6 beam result

In this fig.6 shows the comparative study of shear force and bending moment for zone 4 and zone 2. By using staad pro and manually calculation. The shear force for the zone 4 is calculated as 213.2 KN and 225 KN by staad pro and manually respectively.

VI. CONCLUSION

Seismic weight for zone 4 is greater than the seismic weight for zone 2.Design of horizontal seismic coefficient obtained by staad pro and manually is same for same zone but different for different zones. Designs of structural components of building for both zones are safe. The required reinforcement for same structure for different zones are different like in zone 4 required more reinforcement than zone 2. Further by design aspect get the bending moment in beam 1 as a 312.89 KN-m in zone 4 and 301.48 KN-m in zone 2. They get percentage difference 3.65% percent by staad –pro. But bending moment in beam 1 by manually as a 337.5 KN-m in zone 4 and 309.79 KN-m in zone 2, they get percentages difference of 8.2 %percent.

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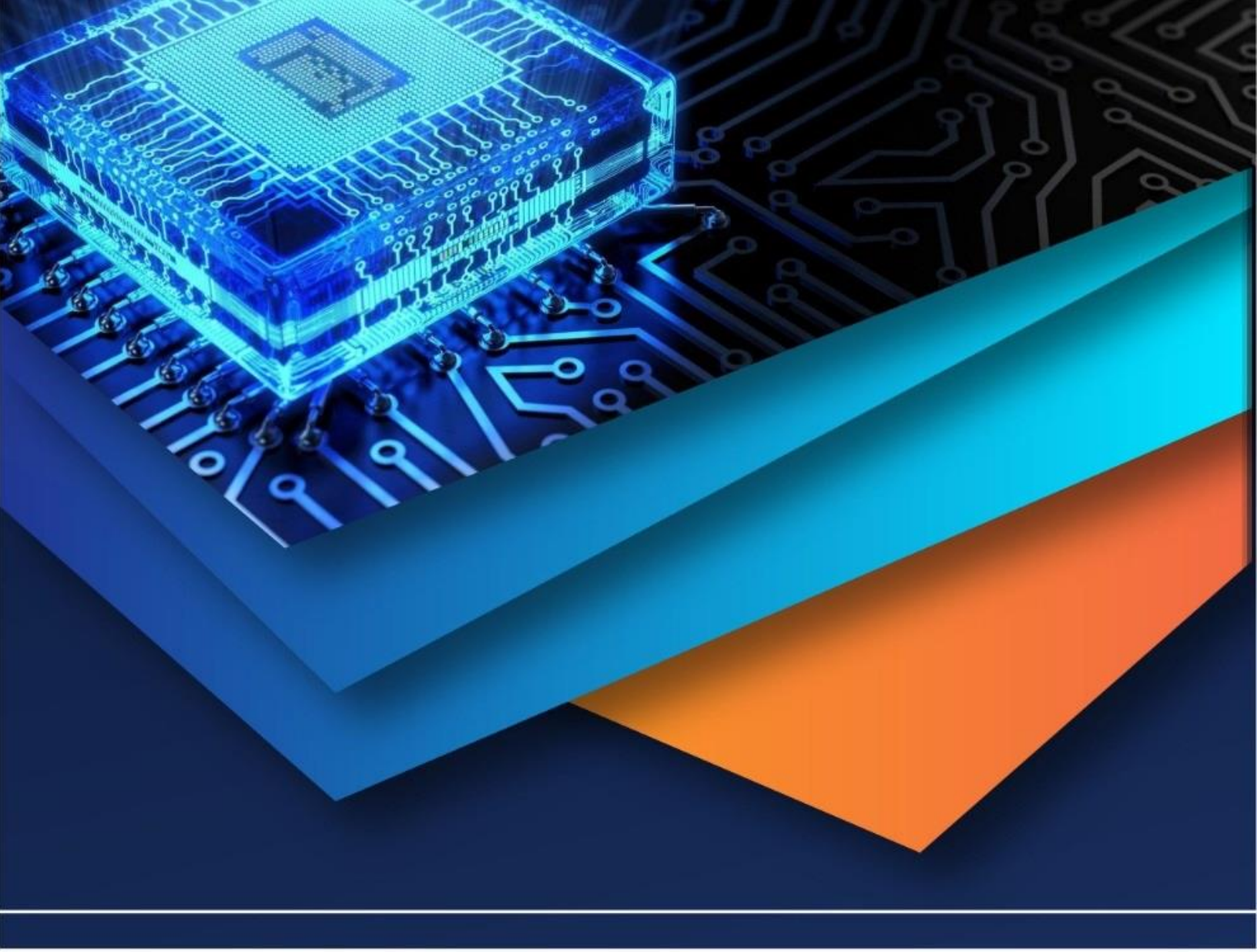

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