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ANALYTICAL STUDY OF FRAME STRUCTURE IN DIFFERENT SIESMIC ZONE

Adarsh Hardaha*1, Dr. Rajiv Chandak*2, Ajay Kumar*3

*1CE, Jabalpur Engineering College, Jabalpur, MP, India.

*2RGPV, CE, Jabalpur Engineering College Jabalpur, MP, India.

*3Professor & Head, Department Of Civil Engineering, Jabalpur Engineering College Jabalpur, MP, India.

ABSTRACT

This study focuses on analyzing a reinforced concrete (RC) framed structure on medium soil across different seismic zones. In this study, eight models of reinforced concrete (RC) framed structures (G+4 and G+5, with heights of 15m and 18m) were analyzed to assess the seismic behavior across various zones. These models are analyzed using STAAD Pro (V8i, Series 6) according to the guidelines of IS 1893-2002/2005 for seismic zones II, III, IV, and V. The structure uses a Special Moment Resisting Frame (SMRF) design. The objective of this work is to analyze the behavior of the RC framed structure under various seismic conditions and determine the maximum axial forces (in kN) in the columns for medium soil in each seismic zone.

Keywords: SMRF, Framed Structures, Maximum Axial Force, IS 18932002/2005, STAAD PRO.(V8i) Series 6.

I. INTRODUCTION

Multistorey structures are popular in urban areas. Building codes in many cities permit the construction of ground plus three-story buildings without requiring an elevator. Such buildings are made possible by using rigidly interconnected beams and columns. These rigidly connected beams and columns in multi-bay, multistorey buildings form what is known as a framed structure.

When loads from walls and floors are transferred to the beams, the beams experience rotation. Since the beams are rigidly connected to the columns, the columns also rotate. This creates a system in which any load applied at any point in the building is distributed across the entire network of beams and columns. This interconnected framework enhances the building's stability and load-bearing capacity, making it a practical choice for urban multistorey construction.

LOADS ON STRUCTURE

The type of loading determines the type of analysis required for a structure. Loads are typically divided into two main categories:

Static Loads: These are loads that change slowly over time, where the load's acceleration is less than the natural frequency of the structure. Examples include dead loads, like the weight of building materials, and live loads, such as occupants and furniture.

Dynamic Loads: These are loads that vary relatively quickly over time, compared to the structure's natural frequency. Common examples include seismic loads and wind loads, which require special considerations as they impose rapidly changing forces on the structure.

SEISMIC METHODS

EQUIVALENT LATERAL FORCE: Seismic investigation of the vast majority of the structure are still completed based on sidelong (level) constrain thought to be identical to real (dynamic) stacking. The base shear which is the all out flat power on the structure is determined based on structure mass and key time of vibration and comparing mode shape. The base shear is dispersed along the tallness of structure. This technique is normally traditionalist for low to medium stature working with an ordinary adaptation.

RESPONSE SPECTRUM ANALYSIS : This technique is material for those structures where modes other then the crucial one influence essentially the reaction of the structure. In this strategy the reaction of multi level of opportunity framework is communicated as the superposition of modular reaction. Every modular reaction being resolved from the otherworldly investigation of single level of opportunity framework which are then joined to register the complete reaction? The technique is normally utilized related to a reaction range.

ELASTIC TIME HISTORY ANALYSIS: A straight time history investigation conquers every one of the weaknesses of model reaction range examination gave non liner conduct isn't included. This technique requires more prominent computational exertion for figuring the reaction at discrete occasions. One intriguing preferred standpoint of such method is that the general indications of reaction amounts are saved in the reaction chronicles. This is essential when communication impacts are considered in plan among pressure resultants.

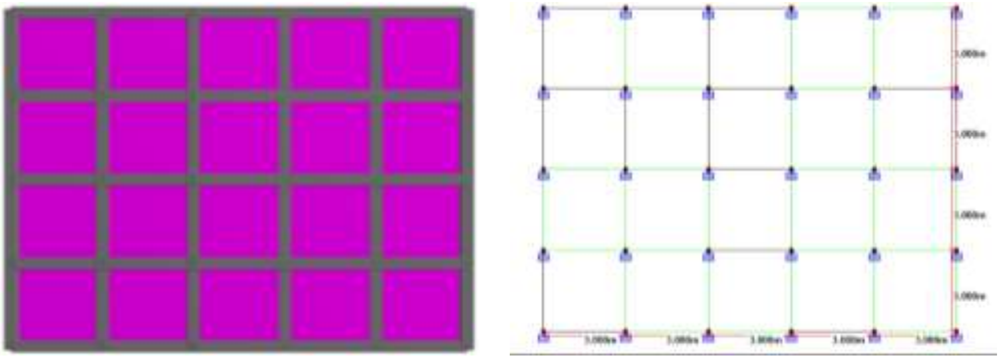
Figure 1:

II. METHODOLOGY

The structure consists of symmetrical, reinforced concrete frames with five bays in the direction of x and four bays in the z horizontal directions, modeled and analyzed using STAAD.Pro V8i (Series 6). Each story has a height of 3 meters, and the horizontal spacing between bays is 3 meters in x direction and 3 meters in z directions.

THE PRELIMINARY DATA

Column Size	600 mm * 400 mm
Beam Size	400 mm * 400 mm
Thickness Of Wall	230 mm
Slab Depth	150 mm
Heights Of Frames	15 m
Height of each floor	3.0 m
Concrete and steel grade	M-30 and Fe-415
Support Condition	Fixed
Brick Walls (outer & inner)	230 mm &125 mm
Seismic Zones	II, III, IV & V
Soil Types	Medium Soil
Model	G+4 & G+5



Plan in 3-D rendering Plan with Bay Width

Figure 2:

LOAD CASES

S.NO.	TYPE OF LOAD	LOAD CASE
1	Seismic Load	EQ +X
		EQ +Z
2	Wind Load	W +X & -X
		W +X & -X
3	Dead Load	Member Weight + Floor Weight
4	Live Load	Floor Weight
5	Combination of Load	Mentioned below

LOAD DISTRIBUTION

WIND LOAD DISTRIBUTION

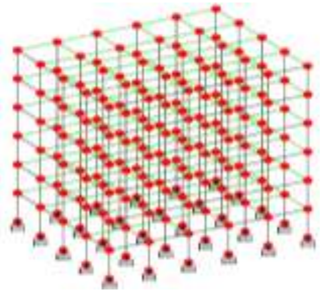


Figure 3: Wind Load Distribution

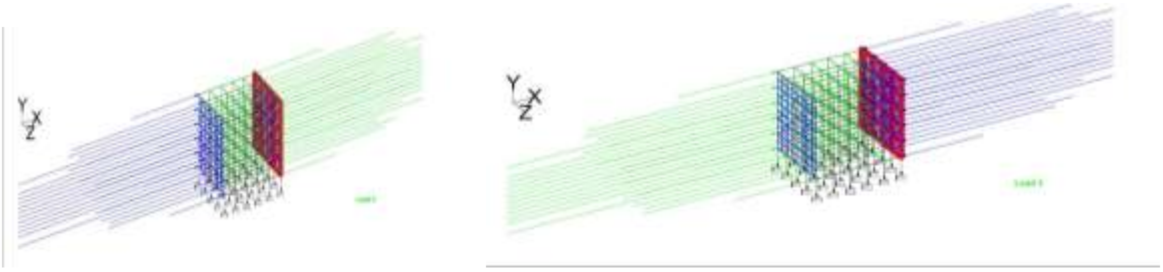


Figure 4: Wind load distribution in +x AND -x direction

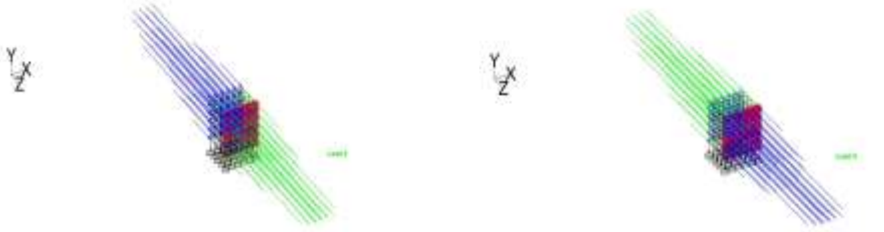


Figure 5: Wind Load Distribution In +Z And -Z Direction

SIESMIC LOAD DISTRIBUTION

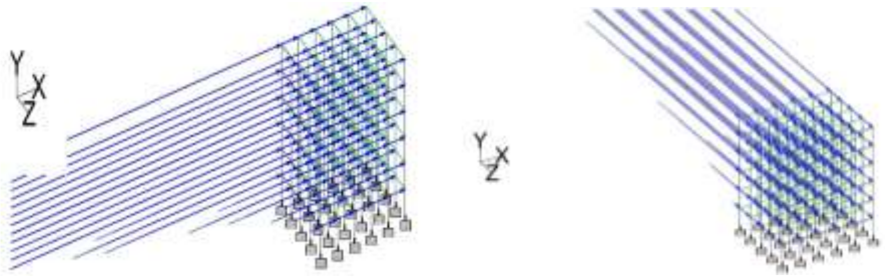


Figure 6: Siesmic Load Distribution In +X Direction

DEAD LOAD DISTRIBUTION:

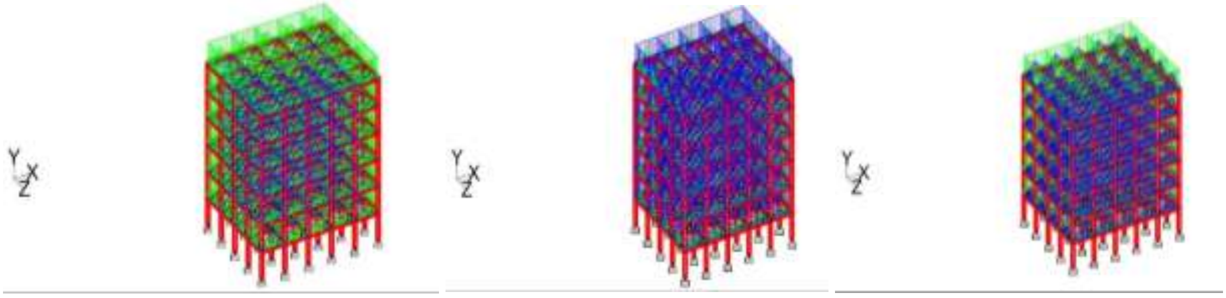


Figure 7: Dead Load Distribution

LIVE LOAD DISTRIBUTION:

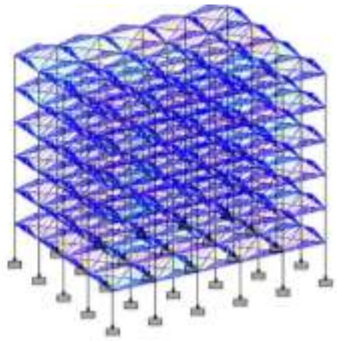


Figure 8: Live Weight Distribution

III. MODELING AND ANALYSIS

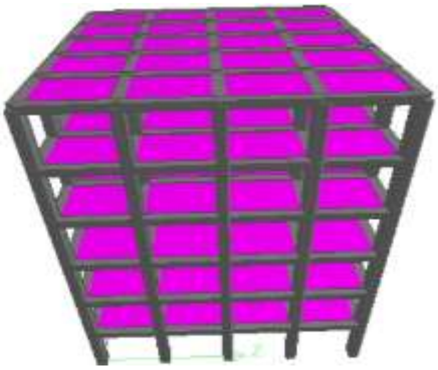


Figure 9: 3D view of building.

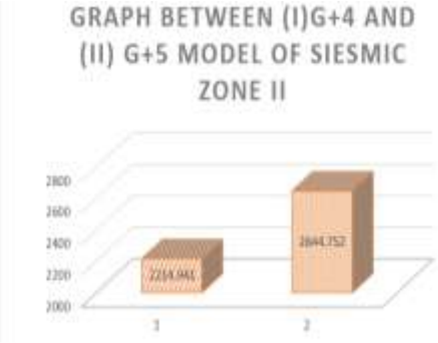
IV. RESULTS AND DISCUSSION

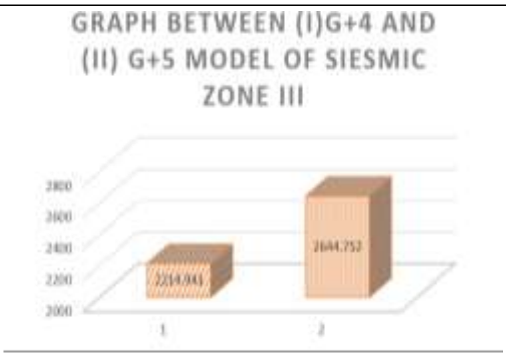
The results of this work in terms of maximum Axial force in columns is compared and the conclusion for the same is given below as:

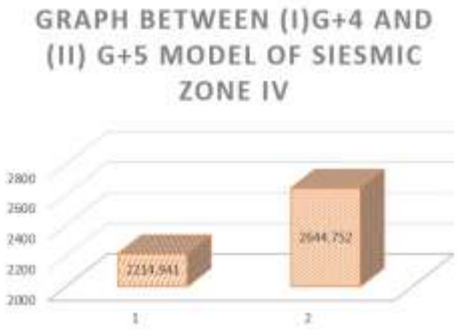
1 As the height of the building frame is increases the values of maximum axial force in column are also increases.

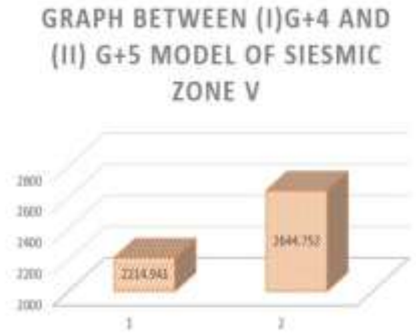
2 For maximum axial force, Seismic Zone-II, Seismic Zone -III & Seismic Zone -IV shows almost same variation.

S.NO	SEISMIC ZONE	AXIAL FORCE IN COLUMN IN KN FOR **G+4 MODEL**	AXIAL FORCE IN COLUMN IN KN FOR **G+5 MODEL**
1	II	2214.941	2644.752
2	III	2214.941	2644.752
3	IV	2214.941	2644.752
4	V	2214.941	2644.752


GRAPH BETWEEN (I)G+4 AND (II) G+5 MODEL OF SIESMIC ZONE II


GRAPH BETWEEN (I)G+4 AND (II) G+5 MODEL OF SIESMIC ZONE III


GRAPH BETWEEN (I)G+4 AND (II) G+5 MODEL OF SIESMIC ZONE IV


GRAPH BETWEEN (I)G+4 AND (II) G+5 MODEL OF SIESMIC ZONE V

V. CONCLUSION

The results of this work in terms of maximum Axial force in columns is compared and the conclusion for the same is given below as:

- As the height of the building frame is increases the values of maximum axial force in column are also increases.
- For maximum axial force, Seismic Zone-II, Seismic Zone -III & Seismic Zone -IV shows almost same variation.

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