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SEISMIC ANALYSIS OF PYRAMID SHAPED BUILDING WITH AND WITHOUT BRACING

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Abstract - *Pyramid shape structures are one of the most applicable shapes that are used for designing of high rise buildings. Concrete braced frame is one of the structural systems used to resist earthquake loads in multistoried buildings. Many existing reinforced concrete buildings need retrofit to overcome deficiencies to resist seismic loads. The use of bracing systems for strengthening seismically inadequate reinforced concrete frames is a viable solution for enhancing earthquake resistance. Concrete bracing is economical, easy to erect, occupies less space and has flexibility to design for meeting the required strength and stiffness. In this study, the seismic analysis of reinforced concrete (RC) buildings with X bracing is studied. The bracing is provided for peripheral columns and any two parallel sides of building model. A seven-storey pyramid shaped building is analyzed for seismic zone III as per IS 1893: 2002 using ETAB software. In this paper, response spectrum analysis was executed. The results of the analysis on the axial forces, storey stiffness, storey drift and displacements are compared. The results are presented in tabular and graphical form. The results on the displacement are checked with serviceability conditions and are compared and presented in tabular form.*

Key Words: Seismic analysis, X Bracing, Inclined column

1. INTRODUCTION

Pyramid shaped high rise buildings have been increasingly used in new development zones. The structural components usually consist of beams and vertical columns in middle part and inclined columns in side faces of buildings. Multistoried buildings are designed for gravity loads as well as lateral loads and their combination. Is code providing these loading combination for which structure need to be analyzed and designed. In the analysis the internal forces in the component structures, displacements are found out. The designed structure must be safe for strength as well as serviceability ETABS is the present day leading design software in the market. Many design company's use this software for their project design purpose. So, this paper mainly deals with the comparative analysis of the results obtained from the analysis of a multi storied building structure when analyzed using ETABS software.

2. LITERATURE REVIEW

Mirghaderi, khafaf, imanpour, keshavarzi (2007) studied the lateral stiffness of pyramid shape buildings with inclined columns. In this paper numerous categories of pyramid buildings with different stories and slopes are selected, then analysis and design them. Symmetric and asymmetric pyramid building and regular building are considered for analysis. The result obtained is the lateral stiffness in symmetric and asymmetric pyramid building has much further value than regular structures.

ShahanaE, Aswathy S Kumar studied the comparative Study of Diagrid Structures with and without Corner Columns. Concrete diagrid structures with and without corner columns were modelled and analyzed using STAAD Pro and the results are compared. Due to inclined columns, lateral loads are resisted by axial action of the diagonal in diagrid structure compared to buckling of vertical columns. By comparing the analysis results they concluded that the behaviour of structure without corner column is more effective than with corner columns.

K.K.Sangle, K.M.Bajoria, V.Mhalungkar presented a study on seismic analysis of high rise steel frame with and without bracing .In this paper the linear time history analysis is carried out on high rise steel building with different pattern of bracing system for Northridge earthquake.

Mohd Atif, Prof. Laxmikant Vairagade , Vikrant Nair focuses on comparison of seismic analysis of G+15 building stiffened with bracings and shear wall. The performance of the building is analyzed in Zone II, Zone III, Zone IV, and Zone V.

Himanshu Bansal, Gagandeep studied the Seismic Analysis and Design of Vertically Irregular RC Building Frames. The objective of the paper is to carry out Response spectrum analysis (RSA) and Time history Analysis (THA) of vertically irregular RC building frames and to carry out the ductility based design using IS 13920 corresponding to Equivalent static analysis and Time history analysis.

3. AIM & OBJECTIVE

The aim of this project is to analyze pyramid shaped building using E-tabs.

Objectives: The main objectives of the project are:

- To check the seismic response of pyramid shaped building using Etabs.
- To make the building earthquake resistant against seismic effect.
- To analyse story drift, displacement, shear and story stiffness on different floor.

4. BUILDING DETAILS

Table 1. Details of building

SI NO	PARTICULAR	DIMENSION
1	Floor area of building	2520.56 m2
2	No of stories	G+7
3	Total height of building	27 m
4	Typical storey height	3m
5	Thickness of wall	230mm
6	Live load	3kN/m2
7	Wall load	2.3kN/m
8	Floor finishing	1kN/m2
9	Density of concrete	25 kN/m2
10	Density of brick	20kN/m2
11	Grade of concrete	M25
12	Grade of steel	HYSD415
13	Thickness of slab	120mm
14	Soil type	MEDIUM
15	Shear wall thickness	200mm
16	Beam size	230X450mm
17	Column size(Inclined)	230X600mm
18	Column size(vertical)	230X450mm

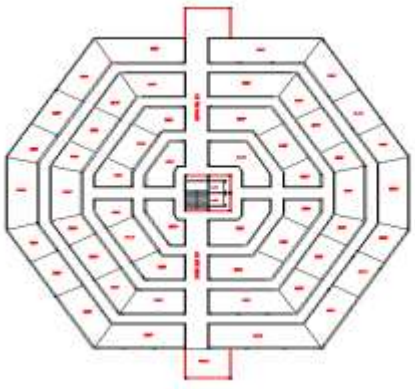

Fig 1: floor plan of building

4. MODELS

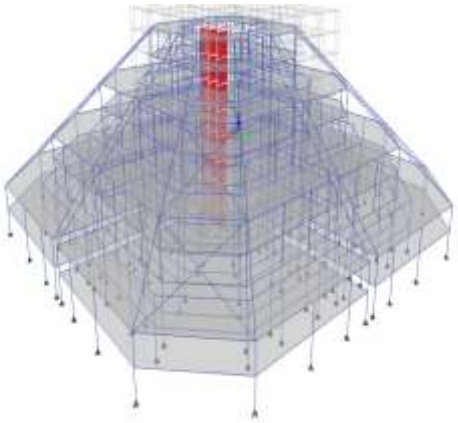

Fig 2: pyramid shaped building with bracing

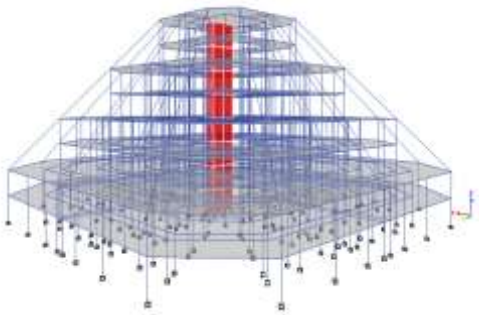

Fig 3: pyramid shaped building without bracing

Table 3. Seismic Parameters considered

Seismic zone	IV
Zone factor	0.24
Soil type	medium
Importance factor	1.5
Response reduction factor	5

5. RESULT

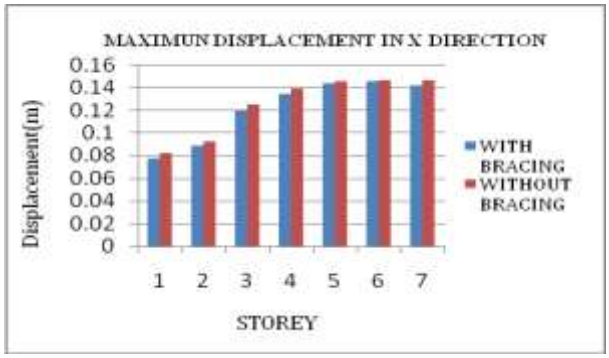

Fig 4 : Maximum displacement in X direction

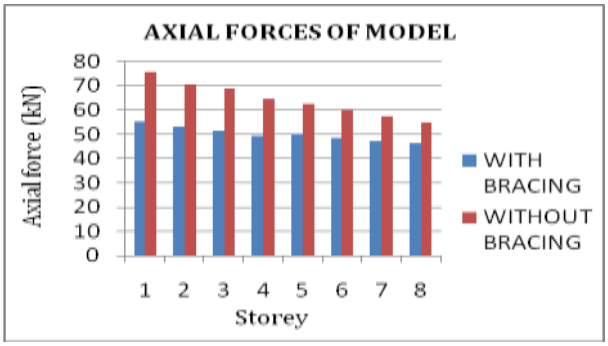

Fig 5: Axial forces of model

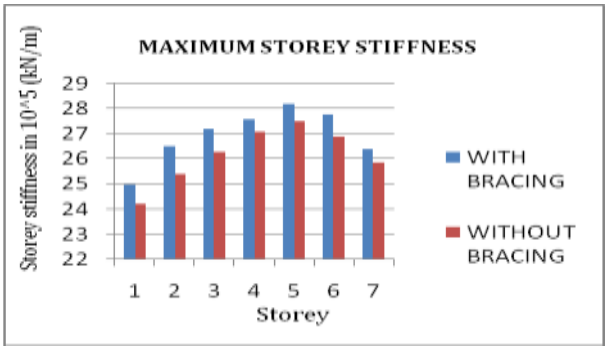

Fig 6 : Maximum storey stiffness

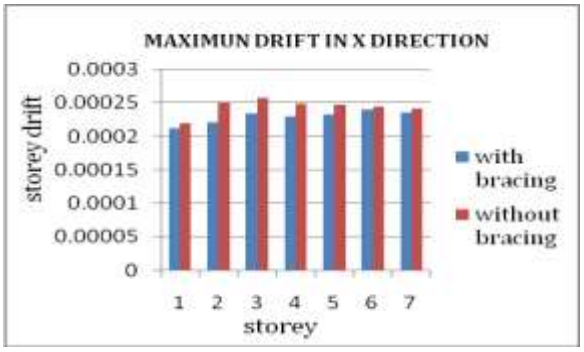

Fig 7 : Maximum drift in X direction

6. CONCLUSIONS

- The displacement is decreased in pyramid shaped building with x bracing as compared to pyramid shaped building without bracing.
- The story stiffness is more in pyramid building with x bracing than the pyramid building without bracing.
- The story drift is decreased in pyramid building with x bracing than the pyramid shaped building without bracing.
- The pyramid shaped building is suitable in earthquake prone area due to its higher stiffness & less displacement.
- The inclined columns of pyramid shaped building resist the lateral displacement effectively. So the % reduction of lateral displacement by the use of x bracing is 5% to 10%.
- The overall results suggested that building with inclined column is excellent seismic control for high-rise Buildings.

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