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ANALYSIS OF RC BRACED FRAME FOR EFFECTIVELY RESISTING EARTHQUAKE IN DIFFERENT SEISMIC ZONES OF INDIA"

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Abstract - *The occurrence of Earth tremors over edifice makes us help to understand that if the building frame is not sufficiently stiff and strong against the seismic loads then the forces may result in the collapse of the edifice. The current research study is conducted on the seismic analysis of an edifice with x bracing by the equivalent static load method having G+14 storey. The loads applied over the structure are dead, live, and seismic load as per IS875 part-1, part-2 and IS1893 respectively. To ensure that the skyscraper having adequate safety against the lateral forces that acted upon them it is necessary that we study the seismic performance of earthquake resistance structures which resist the past tremors and find out the faults which may lead them to collapse so that we can generate a more safe design for the structure to withstand against future tremors. All the analyses conducted with the help of Staad.pro and the analyses results are shown by evaluating storey displacement, max bending moment, shear force, axial force are. The prototype model of building generated with area 25m2, the height of the building is 46 m. The conditions developed to analyze the structure are the zones III and V with soft and hard soil for each zone and the structure is SMRF type.*

Key Words: ESL method, static analysis, seismic evaluation, X bracing, high rise edifice.

INTRODUCTION

Occurrence of earth tremors lead an edifice to dynamic motion, the reason by which the edifice undergoes in dynamic motion is due to inertia force opposite to the direction of acceleration on which earthquake excites. Sudden tremble resulting ground vibration and elastic energy unleashes. Other than gravity loads, a preceding lateral experiences by the edifice which is of substantial magnitude at the time of earthquake shaking. It is compulsory to evaluate lateral loads for edifice design sketch out. The edifice ductility is the principal patron which the seismic performance is mainly based. The past observation shows that the detailed design of an RC edifice with X bracing act very well during seismic activity. To cope up with such a catastrophe is very strenuous so the need of edifice sketches out so that they can withstand these lateral forces. This paper shows the analysis of the edifice with x bracing using one of the software and the results which are obtained from the scrutiny of an edifice. The software tool which we used over here for analysis is Staad.pro. The performance study based on the determination and analysis of seismic forces on edifice calculated as per the IS: 1893:2002 part 1.

LITERATURE REVIEW

Prof. Prakash Sangave et. al. (2015) presented their research work based on a comparison between the three-dimensional models of steel & RCC edifice which are analyzed by using the seismic analysis equivalent static load method provided in IS 1893: (2002) with the help of software ETABS. They also done designing and cost estimation which is carried out using MS-Excel programming for all edifices. They analyzed a typical plan of building of RCC and steel structure having plan dimensions 22.5m X 12m with G+6 and G+10 storey height. They analyzed the seismic forces in zone V with hard soil condition having importance factor 1.

Mohd Atif et. al. (2015) researched on comparison of earthquake analysis of G+15 building provided with bracings and shear wall. The building is analyzed in all the seismic zones define as IS 1893-2002. The analyzed edifice is of same in geometry in along length and width and is of G+15 storeys, Ordinary RC moment-resting frame (OMRF). The structure is modeled in tool STAAD .Pro V8i software. Time period of the structure in both the direction is retrieving as per IS 1893(part 1):2002 seismic analysis has undergone. The Lateral seismic forces over the RC frame are carried out using a linear equivalent static method as per IS 1893(part 1): 2002 for different earthquake zones. The objective of present research work is to understand that the edifice needs to have suitable Earthquake resisting features to safely resist large seismic forces that are generated on them during an Earthquake. Shear walls are quite efficient in terms of cost construction and in reducing distortion due to an earthquake in the edifice. It is also been observed that the braced frames can dissipate a great degree of energy exerted by an earthquake. The performance results and the analysis of the prototype are then graphically shown and also the data in tabular form and then it is used for comparison for determining the best performance of edifice against the seismic forces.

Jana k Kumar M. Mehta et.al.,(2017) presented a comparative study on tall structures of (G+17) storey building was analyzed with different shear-wall configuration. They modeled to examine the effect of seismic parameters like base shear, lateral displacements, lateral drifts and model time period on the edifice for the zone-V in

medium soil as specified in IS:1893-2002. The plan is for the building is 25m x 25m with a total of 18 storeys having typical storey height of 3.5m. They provided the shear wall at a different location on the structure and compared them. Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

OBJECTIVES:

[1]. The main objective of this study is to determine the behaviour RC frame with steel X bracing.
[2]. To determine the statics of forces due to the use of X bracing over an edifice under the effect of seismic forces.
[3]. To understand the variable action of forces and their effects on different seismic zones.

METHODOLOGY:

STEP-1. In the present research four models prototype generated having a geometrical plan of square shape (25m X 25m) withG+14 storey of 3-D frame shown in Fig-3.1.
STEP-2. Four different cases of braced frame edifice modelled to compare of selected geometry& property in the software analysis tool STAAD.pro. Creation of an RC braced frame in zone III and zone V with soil conditions soft and hard for comparison.
STEP-3. The design criteria for earthquake resistant edifice is applied as per IS- 1893(part I) -2002.
STEP-4. The selected condition is analyzed in the software and obtained the results and plot them on the graph.

TABLE-1 GEOMETRY & LOAD CONSIDERATION

Description	Values
Number of storey	15
Number of bays in X direction	Five
Number of bays in Z direction	Five
Height of ground storey	4.0
Height of each storey	3.0 m
Bay width in X direction	5 m
Bay width in Z direction	5 m
Size of beam in zone III	400 x 400 mm
Size of column in zone III	1000 x 1000 mm
Size of beam in zone V	500 x 500 mm
Size of column in zone V	1200 x 1200 mm
Thickness of R.C.C. slab	150 mm
Steel section	Angle section based on optimization

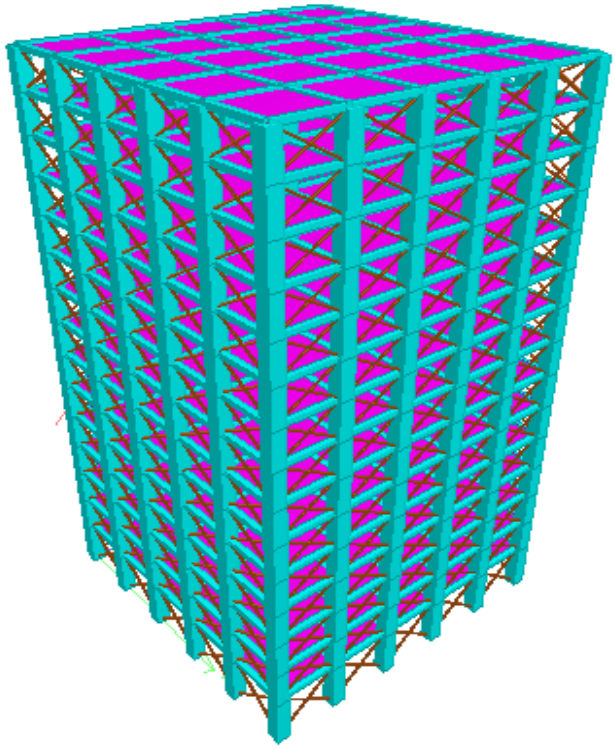

Fig 1:3-D Model outline of braced frame provided in all zones

Details of all the conditions are given in below table with respective model no.

Table 2 Detailed of model

MODEL CREATION DATA		
S.NO	CONDITION	MODEL NO.
1	ZONE III WITH SOFT SOIL	MODEL 1
2	ZONE III WITH HARD SOIL	MODEL 2
3	ZONE V WITH SOFT SOIL	MODEL 3
4	ZONE V WITH HARD SOIL	MODEL 4

RESULTS & ANALYSIS:

The results for different conditions of analysis are shown below in terms of max bending moment, shear force, axial force and storey displacement.

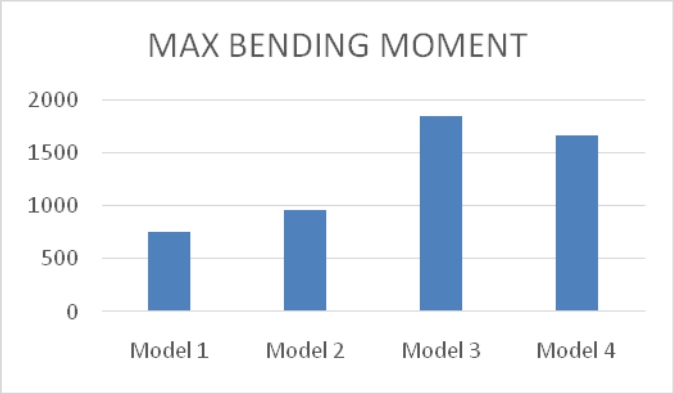

Fig 2: bending moment

The bending moment analysis is present in the graph for frames in different situations.

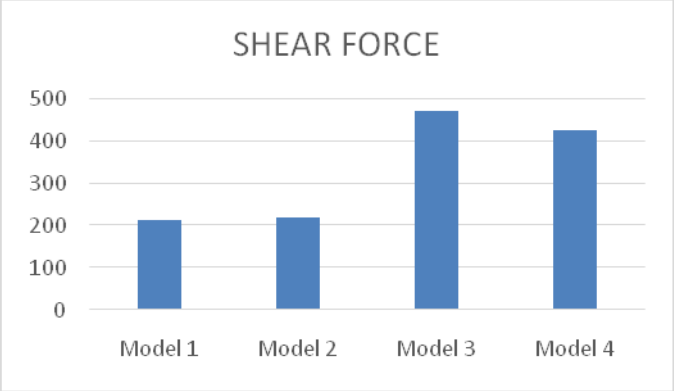

Fig.3 Shear force

The shear forces all the respective cases stabilizing the lateral forces are shown in the above the graph.

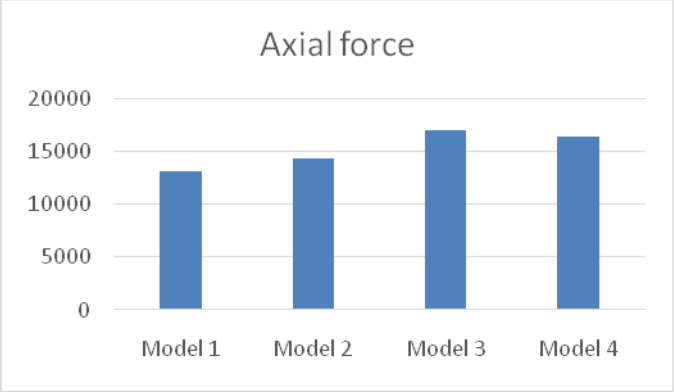

Fig 4: axial force comparison

Values of axial force generated over the structure as shown in graph.

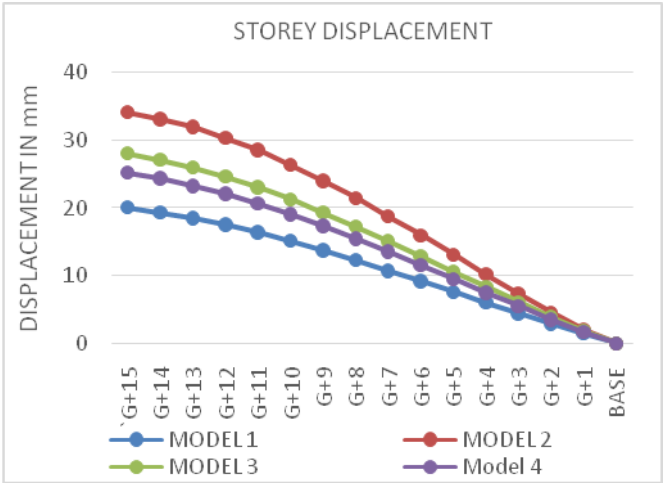

Fig 5: axial force comparison

The storey displacement results for all the frames are depicted in the above graph.

CONCLUSION:

The research work shows the behaviour of a bare frame edifice with X braced at the outer periphery of an edifice which is analyzed by using Staad.pro software. The results which are getting from the research enable to understand the shear force, bending moment, axial forces, and storey displacement. Model 1 & 2 is placed in zone III with soft & hard soil condition respectively similarly the model 3 & 4 are placed in the zone V with soft and hard soil condition respectively. All the forces analysis over the structure are shown in the above graphs for the bending moment, shear force, Axial force and storey displacement.

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