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Seismic Analysis of RC Structure with Shear Wall and Bracing

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ABSTRACT: Earthquakes are one of the natural phenomena resulting in the collapse of infrastructure or building major damaging earthquakes have shown the vulnerability of building with soft storey. This paper focuses on the effect of soft storey. Severe structural damage suffered by several modern buildings during recent earthquakes illustrates the importance of avoiding sudden changes in lateral stiffness and durability. In order to improve the earthquake resistance of such RC building, the use of shear wall and bracing system are introduced in the structure. This structure considering (G+9) of which ground floor acts as soft storey. In this paper a model of building has created using STAAD.Pro software, with this model shear wall and bracings are provided, based on seismic analysis displacement and storey drift were calculated by using static method.

KEYWORDS: Soft Storey, Lateral Stiffness, Durability, Shear Wall, Bracings

I. INTRODUCTION

Earthquakes are one of the most feared natural phenomena that are relatively unexpected which results in the loss of life. In past occurrence of earthquake results in collapse of building which were not particularly engineered to be earthquake resistant. In view of this the structure has to be designed with seismic resistance. An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. It is also known as a quake, tremor or temblor. An earthquake is caused by a sudden slip on a fault. The tectonic plates are always slowly moving, but they get stuck at their edges due to friction. When the stress on the edge overcomes the friction, there is an earthquake that releases energy in waves that travel through the earth's crust and causes shaking. Due to Improper design of the structure without seismic resistance many buildings have collapsed and lives have lost.

Many analyses like Base Isolation, Damping Devices, shear wall and Bracing Systems have been carried out to overcome this need in-order to protect the structure and lives which does not improve the performance of the structure. Among these methods, shear wall and bracings has been chosen for this study. Shear walls should be located on each level of the structure including the crawl space. To form an effective box structure, equal length shear walls should be placed symmetrically on all four exterior walls of the building. Shear walls should be added to the building interior when the

Exterior walls cannot provide sufficient strength and stiffness or when the allowable span-width ratio for the floor or roof. For subfloors with conventional diagonal sheathing, the span-width ratio is 3:1. This means that a 25-foot wide building with this subfloor will not require interior shear walls until its length exceeds 75 feet unless the strength or stiffness of the exterior shear walls are inadequate. Shear walls are vertical elements of the horizontal force resisting system. They are typically wood frame stud walls covered with a structural sheathing material like plywood. When the sheathing is properly fastened to the stud wall framing, the shear wall can resist forces directed along the length of the wall. When shear walls are designed and constructed properly, they will have the strength and stiffness to resist the horizontal forces.

A bracing system serves to stabilize the main girders during construction, to contribute the distribution of load effects and to restrain the compression flanges or chords where they would otherwise be free to buckle laterally.

Bracing provides one or more of the following functions:

1. Control buckling of the main beams
2. Load distribution
3. Dimensional control.

Since bracing connects beams, it can be used to distribute the vertical bending effects between the main beams and to ensure that lateral effects such as wind loading and collision loading are shared between all the beams. This sharing is particularly important at lines of support, where the effects of the lateral loads are often resisted at one fixed or guided bearing.

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II. Objective And Scope

The main objective of this study is to identify an efficient retrofitting method for existing open ground story reinforced concrete frame buildings. The aim of this paper is to introduce Shear wall and Bracing on structure in order to resist the Earthquakes which have shown severe damage on buildings with soft story.

1. Avoid the loss of lives resulting from the collapse of infrastructure or a building in a major Earthquake.
2. Limit personal injury and building damage in moderate earthquakes. Infrastructure / building should be fully functional after a cleanup.
3. Minimize damage and disturbance to residents in moderate and minor earthquakes
4. Maintain the key function of the infrastructure / building
5. Protect the lives of those outside the building
6. Protect other property & the environment.

III. Parameter Details Of Model

Usually the most economical way to eliminate of soft story behaviour is by adding shear wall to soft stories. For investigation on effect of shear wall arrangement on building in seismic response of structure with soft story, models are designed G+9 storied regular buildings of shear walls along RC frame have been considered. Stories height is in 3.1m.

Depending on the location of shear walls model have been created. The dynamic analysis has been done using 3-D modelling in STAAD.pro software. These models consist of 6 bays with respective meter each in global X direction and 9 bays in global Z direction. The plan area of the building is 22.62 m ×25.63 m. The supports of the columns are assumed to be fixed.

Building dimensions:

Beam Cross-Sections:	
Floor Beam Size	: 300mm X 450mm
Column Cross-Sections	
Column Size	: 500mm x 300mm
Shear Wall Thickness	: 250mm
Thickness of slab	: 150mm
Floor to floor height	: 3.1mm
Number of story's	: G+9
External wall	: 230mm
Internal wall	: 150mm

Physical Properties Considered for Present:

Density of brick wall	= 20 KN/m3
'E' for reinforced concrete	= 2.24x10 7 KN/m2
Grade of steel	= Fe415
Density of concrete	= 25 KN/m3
Grade of concrete	=M20
Poisson's ratio of concrete	=0.17

Seismic Zone:

The behaviour of all the models is studied for Zone IV (Severe) of Seismic zones of India as per IS code for which zone factor (Z) is 0.24. Importance factor to modify the basic seismic Coefficient and seismic zone factor, here it is taken as 1, Response Reduction Factor as 5.

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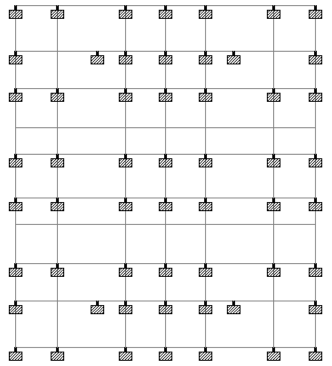

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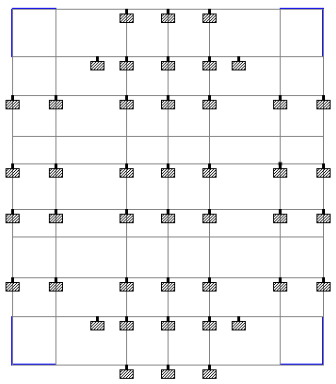

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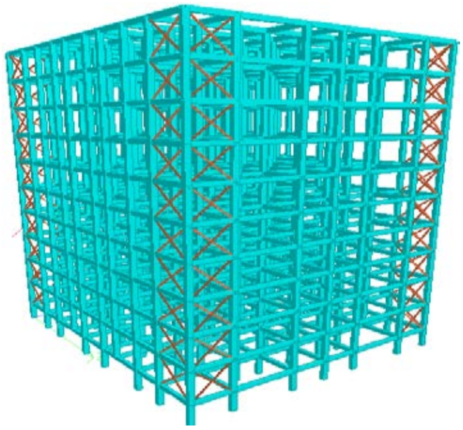

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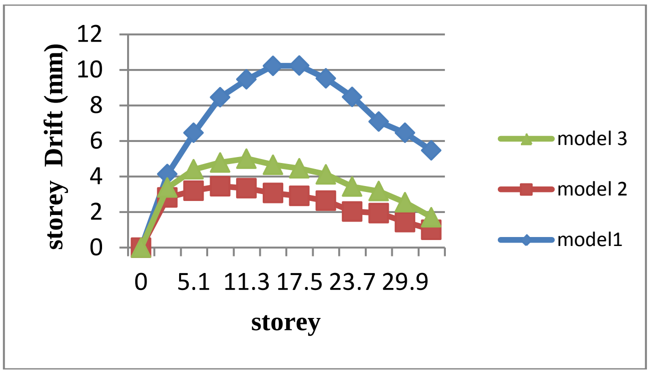
Fig.1 3-D modelling in STAAD.pro software. (a) model-1 without shear wall and bracing, (b) model-2 with shear wall in L-shape, (c) mode-3 with bracing with X type.

IV. Methods Of Analysis

Earthquake response analysis corresponds to simulate the behaviour of a structure subjected to earthquake ground motion by means of a mathematical model of the structure. A three dimensional model has independent displacements at each node and can simulate any type of behaviour. The present study undertaken deals with Linear Static Method of Analysis or Equivalent Static Method of Analysis of 3D frames that can be used for regular structure with limited height.

Seismic Zone: The behaviour of all the models is studied for Zone IV (Severe) of Seismic zones of India as per IS code for which zone factor (Z) is 0.24.Types of Primary Loads and Load Combinations are considered.



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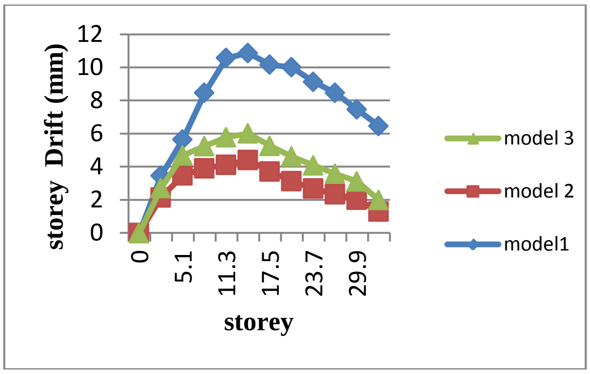

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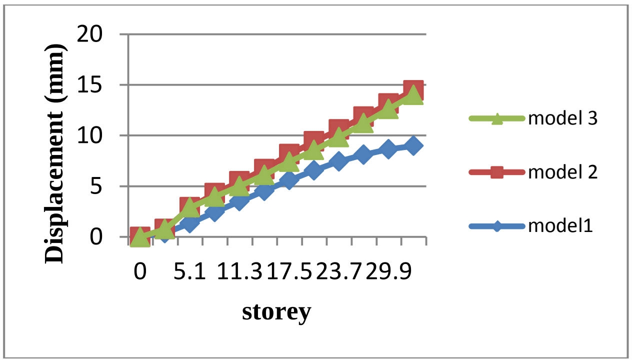

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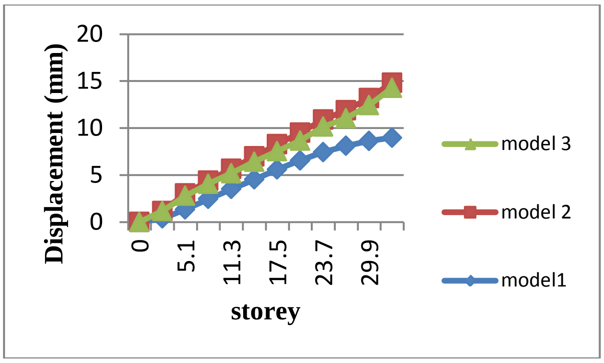

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Fig.1 Types of Primary Loads and Load Combinations are considered (a) storey drift along X direction, (b) storey drift along Z direction, (c) Displacement along X direction, (d) Displacement along Z direction.

V. RESULT AND DISCUSSION

The proposed method, for seismic analysis of plane RC frame of the building with open soft storey structure is generally acceptable and its result is approximately responding to more accurate relevant method. Lateral displacement is large in frame with soft storey. Minimum displacement for corner column is observed in the building in which a shear wall is introduced in X-direction as well in Z-direction. The over strength in a braced RC frame is due to the added strength of the brace system as well as an added strength in the RC frame due to stiffening effects of connections. The important parameter affecting the capacity interaction is recognised as the number of braced bays connections taken into consideration as a stiffness ratio. The seismic performance of structure without braced frames is weak. The result of the paper shows that, value of ductility is higher for structures with bracing than that of structures without bracing system.

VI. CONCLUSION

By using STAAD.Pro software model has been created. The displacement and storey drift were calculated by using static method of seismic analysis. Based on the result displacement vs storey level and storey drift vs storey level was compared graphically

REFERENCES

[1] Mohammad Eyni Kangavar Seismic Propensity of Knee Braced Frame (KBF) As Weighed Against Concentric Braced Frame (CBF) Utilizing ETABS and OPENSEES, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-5, pp 141-152, June-2012

[2] Alurwad Rajeshwarreddy R, Dr. Arshad Hashmi Seismic Behaviour of Reinforced Concrete Frame with Infill Walls, International Journal of Engineering Research and Applications (IJERA) Vol. 3, Issue 4, pp.1419-1423, Jul-Aug 2013.

[3] Arturo Tena-Colunga Review of the Soft First Story Irregularity Condition of Buildings for Seismic Design, The Open Civil Engineering Journal, Vol. 4, pp.1- 15, 2010.

[4] Amit V. Khandve Seismic Response of RC Frame Buildings with Soft Storeys, International Journal of Engineering Research and Applications (IJERA) Vol. 2, Issue 3, pp.2100-2108, May-Jun 2012.

[5] Takuya Nagae, Keiichiro Suita, Masayoshi Nakashima Performance Assessment for Reinforced Concrete Buildings with Soft First Stories, Annuals of Disas. Prev. Res. Inst., Kyoto University, No. 49 C, pp 189-196, 2006

[6] Dr. Saraswati Setia and Vineet Sharma Seismic Response of R.C.C Building with Soft Storey, International Journal of Applied Engineering Research, ISSN 0973-4562 Vol.7 No.1,2012.

[7] Dr. Kulkarni A. B. Mulgund G. V. Seismic assesement of rc frame buildings with brick masonry infills International Journal of advanced engineering sciences and technologies Vol no. 2, issue no. 2, 140 – 147, 2011.

[8] Mangulkar Madhuri.N., Misam.A Structural response of soft story-high rise buildingsunder different shear wall location International Journal of civil engineering and technology (ijciet) Volume 3, Issue 2, , pp. 169-180, July- December 2012.

[9] Sharany Haque, Khan Mahmud Amanat Seismic Vulnerability of Columns of RCFramed Buildings with Soft Ground Floor International Journal of Mathematical models and methods in applied sciences Issue 3, Volume 2, pp.364-371, 2008.

[10] IS 1893:2002 Indian standard criteria for earthquake resistant design of Structures Part 1: general provisions and buildings, Bureau of Indian Standards, New Delhi.

[11] IS 456:2000 Indian Standard codes of practice for plain and reinforced concrete, Bureau of Indian standards New Delhi.