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REVIEW PAPER ON COMPARISON OF SEISMIC BEHAVIOUR OF SHEAR WALL AND BRACING SYSTEM IN RC FRAME STRUCTURE

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ABSTRACT

In medium to high rise building, shear wall and bracing system is used to provide stiffness, strength and energy dissipation to resist the lateral loads imposed by earthquake. This research work focus on review of comparison of shear wall and bracing system by response spectrum method with the help of STAAD -Pro V8i software. The structure which is to be analyzed is symmetrical G+10 residential building. Comparison of response of shear wall and bracing system of RC framed structure will have to be done in future scope of this research work. In order to minimize the damages due to earthquake, shear wall are efficient in terms of cost and effectiveness. On the other hand bracings can absorb great degree of energy which is exerted by earthquake. Structural performances of both system are significant, but their effect shows unequal variations and behavior against earthquake load.

Keywords: medium rise building, base shear, natural time period, storey drift, response spectrum

I. INTRODUCTION

Earthquake causes very tremendous damages as it is unexpected in nature. Disasters due to earthquake have become a great issue now-a-days. It frequently occurs all over the world. The prediction of location, the time of occurrence, intensity of earthquake is very difficult to understand. So it is very necessary to adopt the suitable assumptions before design by keeping in mind the dangerous seismic effects. Generally, structures are designed for dead load, live load, wind load, etc. which is not sufficient for taking earthquake load. It is not necessarily safe against seismic load. The design adopted in the Indian Code IS 1893(Part 1) :2002 "Criteria for Earthquake Resistant Design of Structure" to ensure that structure possess at least a minimum strength to withstands minor earthquake occurring frequently; resist moderate earthquakes without significant structural damages though some non structural damages may occur; and aims that structure withstand major earthquake without collapse. In order to dissipate energy of earthquake different areas, regions, countries have different provisions of providing such system.

Shear wall and bracing system are the most efficient system as they gains more plane stiffness, reduces lateral displacements and dissipate energy during strong motions. Damages due to earthquake can be prevented by

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adding such structural elements like shear wall and bracing systems. It is very important now-a-days to prevent such an unforeseen disaster by implementing such systems. It has been observed that, it is a need to adopt the structural systems, which can resists the lateral loads due to seismic effect in RC framed structures.

This paper is the review of study of the comparison of the responses of RC structures, with shear wall and bracings in multistoreyed residential building. In this paper, the analysis of the RC framed structure with position of shear wall and bracing system is studied.

II. SHEAR WALL

In general point of view, shear wall is the large reinforced concrete wall or large dimensioned column. Also, it increases the lateral stiffness of structural frames. Shear wall has better resistance and have more efficiency against lateral loads. To reduce the eccentricity and corresponding torsion moment, it is very important to minimize the distance between centre of mass and centre of rigidity. Construction of shear wall is mainly done from the foundation level. The thickness of shear wall is approximately 150-200mm or more is generally provided. Shear wall are provided in the building having maximum height by maintaining its thickness. Shear wall are also provided as a load bearing structure in case of heavy loaded structures. They are used to resist lateral forces due to earthquakes. The scope of present work is to study the review of effectiveness of RC shear wall in medium rise building.

III. BRACING SYSTEM:

Combining the bracing elements in frame to increase the energy absorption capacity of the structure is the most practical effective method of enhancing the seismic resistance. Braced frame can absorb the greater energy exerted by earthquakes. They are widely used to reduce lateral displacements and dissipate energy due to strong ground motions in the steel structural. Same concept is also applicable for concrete frames braced frame also increases capacity of structure. Concrete and steel bracing has flexibility, economical, occupy less space, easy to erect and also meets required strength and stiffness.

IV. LITERATURE REVIEW:

1) Mohd. Atif : In this paper, they have analyzed and compared G +15 building with shear wall and three different patterns of bracings with three different positioning of it, considering all the four zones for earthquake. Parameter like displacement, axial force, bending moments of columns and shear moment, torsion for beams are calculated. Graphical and tabular representation of data is discussed in this paper. They have adopted Linear Static Analysis method. They have concluded that shear wall elements are very efficient in reducing lateral displacement of frame than that induced in braced frame and plane frame. The lateral displacements of building studied are reduced by the using X-type bracing system.
2) Varsha R. Harne: Analysis of building has done using STAAD-Pro V8i. The models were prepared in the software by using different cross sections of RC shear wall i.e. Boxed type, L-type and Cross type shear wall and these are located at different locations such as along periphery ,at corner and at middle position. Amongst all the load combinations, the load combination of 1.5DL +1.5EQX is found to be more critical

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combination for all the models. Hence it can be said that building with shear wall along periphery is more efficient than all other types of shear wall.

3) Prof. Bhosale Ashwini Tanaji: They have used the various types of concrete bracings i.e. K-type, Diagonal, V-type and X-type of bracings and calculated the storey drift and displacement of building. The storey displacement of building reduced by the use of concrete bracings. X-type of bracing reduces maximum displacement. The storey drift of concrete braced system is less as compared to the unbraced building thus the overall response of the building decreases. The X-type of concrete bracing is found to be most efficient in terms of storey overturning.

4) MD. Samdhani Azad : This study focus the building behavior against seismic forces either SW or steel bracing. The analysis of both systems either shear wall or steel bracing systems using ETABS Software analyzed to determine the behavior and performance of each of models is done. According to their results, they have compare the maximum displacement and storey drift of models. They concluded that the model, shear wall at mid portion is the safest among the other models assessed in the research purpose.

5) Umesh R. Biradar : In this paper, they have analyzed seven models of different bracing systems for linear statics(ESA), linear dynamics, non linear static (Pushover analysis) and non linear dynamic analysis (time history analysis) by ETABS software. According to this paper, IS Code method does not gives suitable results as the natural time period for bare frame and braced frame is same and they have obtained the satisfactory results of time periods in ETABS by using ESA and RSA method. Natural time period are reduced by 15.49%, 12.87%, 11.32%, 11.17%, 11.17% and 4.83%. For X-bracings 12.87%; natural time period is reduced. Hence X-bracings are preferred in this project.

V. METHODOLOGY:

It needs to adopt the exact process to analyze a certain structural frame considering its corresponding characteristics related to earthquake as seismic analysis was very complicated portion in the field in structural engineering. The future scope of this paper is to study the comparison of response of RC frame structure having shear wall and bracing systems. Methods used for earthquake analysis are:

1. Static analysis:

It is known as equivalent static force method. In this method, the base shear is calculated from the weight of building. Earthquake forces are calculated in normalized way in this method. Live loads and dead loads are considered according to the norms and distributed along in each storey.

2. Dynamic analysis:

Sometimes, for the analysis purpose equivalent static force is not sufficient. Dynamic analysis can be performed by

i. Response Spectrum Method
ii. Time History Method
iii. Pushover Analysis

From the above literature review it is clear that they have adopted following methods for seismic analysis:

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i)Response Spectrum Method:

A **response spectrum** is simply a plot of the peak or steady-state response (displacement, velocity or acceleration) of a series of oscillators of varying natural frequency, that are forced into motion by the same base vibration or shock. The resulting plot can then be used to pick off the response of any linear system, given its natural frequency of oscillation. One such use is in assessing the peak response of buildings to earthquakes. The science of strong ground motion may use some values from the ground response spectrum (calculated from recordings of surface ground motion from seismographs) for correlation with seismic damage.

If the input used in calculating a response spectrum is steady-state periodic, then the steady-state result is recorded. Damping must be present, or else the response will be infinite. For transient input (such as seismic ground motion), the peak response is reported. Some level of damping is generally assumed, but a value will be obtained even with no damping.

ii)Equivalent static method:

The equivalent static method is based on the seismic coefficient which is obtained from natural time period of vibration of structure. Base shear is calculated from time period which is use for earthquake resistance design of the structures. This approach defines a series of forces acting on a building to represent the effect of earthquake.

VI. CONCLUSION

By studying the above review it is concluded that:

1) By using shear wall and bracing system, the lateral displacement and deflection of the building reduces.
2) SW construction will provide large stiffness to the building.
3) The system of using concrete bracings is more useful which can use to strengthen or retrofit the existing structure.
4) The lateral displacement of the building reduced by the use of X-type of bracing system.
5) The lateral deflection of column in the case of SW provided at center is much reduced as compared to other locations of the SW.
6) In medium high rise buildings (>10storeys) provision of SW is found to be effective in enhancing the overall seismic capacity characteristics of the structure.
7) The X- type of concrete bracing is found to be most efficient in terms of story displacement is provided on two parallel sides or all sides o building and also base shear increases. In terms of storey overturning moment X- bracing is found to be most efficient.
8) The reinforcement requirement in column is affected by the location and orientation of adjacent SW and columns.
9) The X-type of concrete bracing is found to be most efficient in reducing overall response of building (i.e. displacement, storey drift and deflection) as compare to other types of bracings.
10) ESA and RSA methods are more accurate than IS code method, as it reduces the natural time period.

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VII. FUTURE SCOPE OF WORK:

The volume of work undertaken in this study is limited to effective location and type of the most efficient shear wall and bracing system. The study could be extended by comparison of shear wall and bracing system analysis by the response spectrum method with the help of STAAD-Pro Software, as STAAD-Pro gives accurate and quick results.

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