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Comparative Analysis of Different RC Building for Different Bracing System X, V, K Bracing [G+10] for SESMIC and Wind Loads

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Abstract
Despite being a high-rise public building or residential building, the inclusion of a bracing system in an RCC structure is extremely uncommon in India. When constructing a structure in a seismically active region, this feature is extremely desirable. This study offers a solution for holding the structure under the bracing system and using other strengthening systems to reduce or eliminate the effects of earthquakes brought on by variation in load path and stiffness. This feature is helpful for creating an open floor plan on the ground floor or first floor and getting rid of internal columns that prevent open space. Different kinds of steel or RCC bracing systems are provided for the building to resist the lateral load. Higher stiffness and stability are two potential benefits of using RCC bracing over other bracings. The goal of this study was to compare normal buildings and high-rise buildings with different RCC bracing systems for seismic behavior. The bracing system that was provided around the building. ETABS is used to analyze the frame models in accordance with IS:7893-2000. Base shear and storey displacement will be taken into account in this paper to compare building seismic effects. When compared to moment resisting frames and V-braced frames, the results of the problem demonstrated that X-braced frames are safer and more effective during an earthquake frames

1. Introduction

Generally, the purposes ofhigh –rise buildings is to transfer the primary gravity load safely. The common gravity loads are dead load, live load. Also, the structure should withstand the lateral loads caused by earthquake, blasting, and wind depending on terrain category. The lateral loads reduce stability of structure by earthquake, blasting, and wind depending on terrain category. The lateral loads reduce stability of structure by producing sway moments and induce high stresses. So, in such casas stiffness is more important than strength to resist lateral loads.

There are various ways of providing bracings to improve seismic performance of buildings. The different bracing configurations typically used are: Diagonal bracing, cross bracing [X] and V –bracing configurations has its own merits and demerits as compared to other.

To find out seismic response of both the models by using is ETABS software.

To find out effects on various parameters of RC buildings under seismic events due to

presence of bracing system.
To determine which structure is superior to another in higher earthquake zones.
To determine which bracing system is superior to another in higher earthquake zones.
To increase the base shear at bottom of building during earth quake.
To reduce the storey drift and storey displacement during earth quake.
As steel bracing is economical, easy to setup, occupies minimum space and also have flexibility in nature to design for meeting the required strength and stiffness. Braced framed structures are usually considered to resist the lateral forces and also earthquake loads. Braced systems provide due to their strength, stiffness to the structures. They provide more stiffness against the horizontal shear because the diagonal member elements work in axial stress

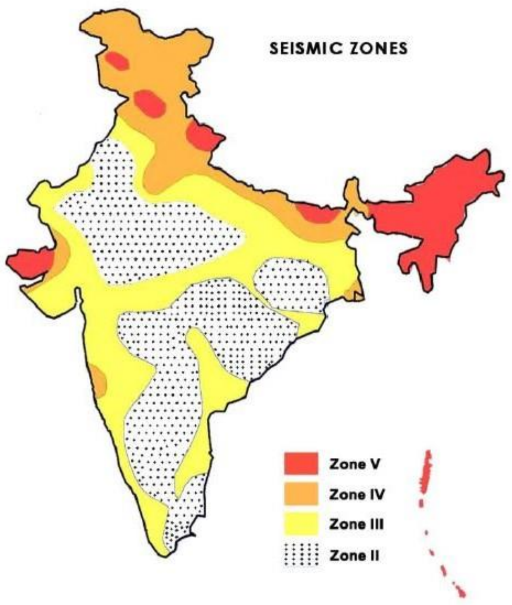

Fig.1 Seismic zone

2. Literature Review

The relevant literature on lateral load resisting systems used in high rise building was reviewed and presented here.
Abhinav, V., et al. [1] analysed 10-storey RCC building stiffened with shear walls using E TABS software. The location of shear walls was main objective. The present study concluded that shear wall along the periphery of the structure is much more efficient than other models in seismic zone V.
Jagdish, J. S., and Doshi, T. D., [2] studied high rise steel structures with bracing G+10 building was analysed with same configuration and different bracing systems such a Single-Diagonal, X bracing, Double X bracing ,K bracing ,V bracing. It was concluded that bracing reduce the storey displacement, and also K and V bracing results in irregularity of the structure.
Kirtan, T., et al. [3] performed comparative study on 10-storey RCC frame stiffened with shear walls and Hexagrid system using ETABs V 13. The base shear and displacement were

taken as criterion for analysis of frame. The present study concluded that in case of RCC frame base shear is least and the storey displacement is maximum as compared to RCC frame with shear wall and Hexagrid system.

Partani, P., and John , R., [4] analysed RCC framed structure stiffened with crescent shaped bracing in ground soft storey under seismic load of zone III. The reduction of 12 to 14 percent in storey displacements was observed. Storey drift was also reduced by 20%.

Azad M. S., et al.[5] studied RCC high rise building with shear walls and bracing system using ETABS 9.7 software. Six models as per different location of shear wall have been prepared for comparative study. It has been concluded from the results that model having shear wall at middle portion was safest among all.

Chandurkar, P.P., et al[6] studied effect of shear wall location in multi-storeybuilding. He analysed four different models for seismic zones II,III,IV and V using ETABS v 9.5.0. It was observed that the shear wall is economical and effective in high rise building when placed in short span at corner of the structure.

Soni, P., et al.[7] have analysed multi-storey building of different shear wall locations and heights using E TABS. The three building models Viz, G+10 were taken into consideration for comparative study.

Kevadhkar, M. D., and Kodag, P.B., [8] studied RCC building with three models as MRF, different shear wall systems and different bracings systems and they found that X type of steel braced system increases the stiffness and reduces the inter storey drift, lateral displacement and performance point than shear wall system.

Numsan, M., and Nazurl, I., [9] performed analysis on braced and un-braced structure subjected to wind loads. The authors concluded from their study the maximum displacement of the structure decreases after applications of X-braced system as compared to different types of steel system. Also by application of steel bracing is faster to execute.

Atif, M., et al.(2015)[10] have performed comparative study on seismic analysis of G+10 storey building stiffened with bracing and shear wall. The performance of the building is analysed in Zone II, Zone III, Zone IV and Zone V. The analysedstructure is symmetrical,G+10, ordinary RC moment resting frame(OMRF)

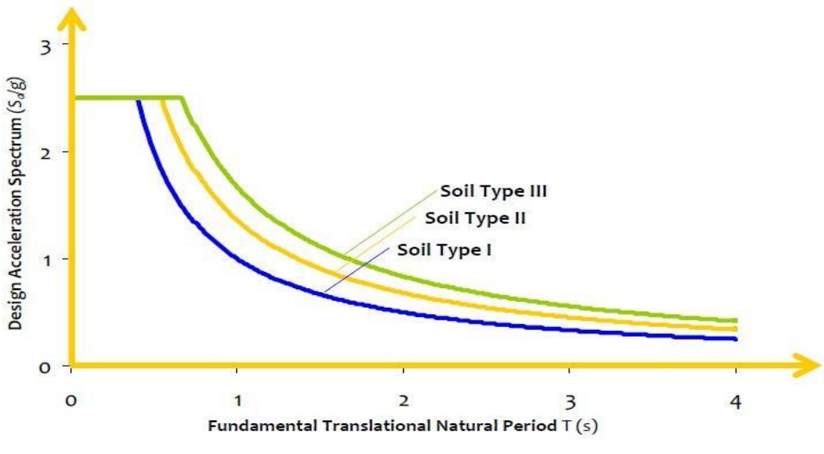

Fig.2 Design Acceleration Spectrum

3. Proposed System

The aim of design is to decide the size of the member and amount of reinforcement required, so that the structure will perform satisfactorily during its life period with minimum cost. The following three methods have been developed for the design of reinforced concrete structures.

a) Working stress method

b) Ultimate load method

c) Limit state method

1.Working Stress Method:

Working stress method is based on elastic theory assuming reinforced concrete as elastic material. The stress strain curve of concrete is assumed as linear from zero at the neutral axis to a maximum value at the extreme fiber.

This method adopts permissible stresses which are obtained by dividing ultimate stress by a factor known as factor of safety. For concrete a factor of safety of 3.0 is used and for steel it is 1.78. This factor of safety accounts for any uncertainties in estimation of working loads and variation in material properties. In working stress method, the structural members are designed for working loads such that the stresses developed are within the allowable stresses. Hence, the failure criterion is the stress. This method is simple and reasonably reliable.

The drawbacks of this method are

a) Stress strain curve for concrete is assumed as linear, which is not true.

b) Factor of safety doesn't predict the true margin of safety.

c) The failure criteria assumed is stress but strain criteria is the reliable.

d) The effect of creep and shrinkage of concrete is ignored.

e) This method gives uneconomical sections.

This method has been deleted in IS: 456-2000, but the concept of this method is retained for checking the serviceability states of deflections and cracking. Hence, the knowledge of this method is essential and IS: 456-2000 gives it in the appendix.

2. Ultimate Load Method:

In ultimate load method, structural elements are designed for ultimate loads which are obtained by multiplying the working loads with factor known as load factor. Hence, the designer can able to predict the excess load the structure can carry beyond the working loads without collapse. Hence this method gives the true margin of safety. This method considers the actual stress strain curve of concrete and the failure criteria is assumed as ultimate strain.

This method gives very economical sections. However it leads to excessive deformations and cracking. Thus, this method is failed to satisfy the serviceability and durability requirements. To overcome these drawbacks, the limit state method has been developed to take care of both strength and serviceability requirements.

3. Limit State Method:

In the limit state method, the structural element are designed for ultimate load and checked for serviceability (deflection, cracking etc.) at working loads so that the structure is fit for use

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throughout its life period. The details of this method are given in article 1.9.

4.2 Philosophy of Limit State Design:

A structure may become unfit for use not only when it collapses but when it violates the serviceability requirements such as deflections, cracking etc. The philosophy of limit state method of design is to see that the structure remains fit for use throughout its life period by assuring safety against strength and serviceability requirements i.e. the structure will not reach the limit state in its life time. The acceptable limit for safety against strength and serviceability required before failure occurs is called limit state. All the relevant limit states have to be considering in design. The loads and strength of the material s are to be considered in the design. The loads and strength of materials are to be estimated by probabilistic approach (characteristic values). The design loads and strengths are derived from the characteristic values through the use of partial safety factors.

4.3 Limit States:

The various limit states to be considered in the design are

1. Limit sate of collapse.
2. Limit state of serviceability.

4.3.1limit State of Collapse:

It is the limit state at which the structure is likely to collapse. The structure may collapse due to rupture of one or more critical sections or loss of overall stability due to buckling or overturning. This limit state may correspond to

a) Flexure
b) Compression
c) Shear
d) Torsion

4.3.2limit State of Serviceability:

Limit state of serviceability relate to the performance of the structure at working loads. It is the limit state at which the structure undergone excessive deflection, which adversely affect the finishes causing discomfort to the users and excessive cracking which effects the efficiency or appearance of the structure.

This limit state may correspond to

A) Deflection
b) Cracking
c) Other limit states (Vibrations, Fire resistance, Durability)

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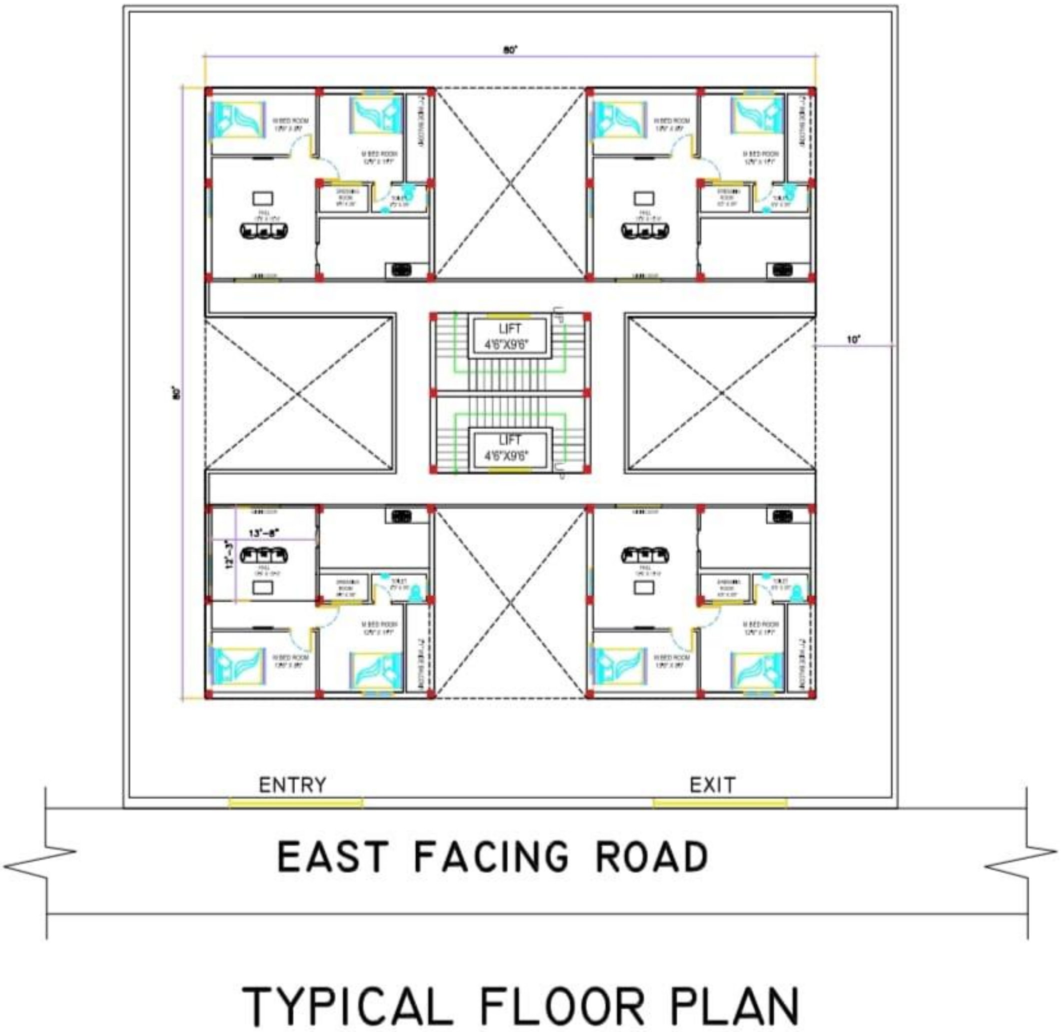

Fig.3 Proposed Method

4. Conclusion

Frame analysis was done by Etabs. Slab and beams were designed as per IS Code 456-2000.The properties such as shear, deflection, development, torsions are with the IS Code provisions. Designs of columns has been done as per IS Code 456-2000 along with SP-16 design charts. The shear load carrying capacity etc., are within the IS Code 456-2000.

Design of footing is also done as per IS Code 456 – 2000 .The checks like one way shear. Two way shear are within the IS Code limits. Frame analysis, columns & beams were designed by using Etabs, Computer Software

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References

1. Akiyama H., Goto S. and Nakazawa A. (1996) Shear Strength of Large Reinforced Concrete Circular Slabs under Uniformly Distributed Load, Proceedings of the Japan Concrete Institute, Vol. 18, No. 2, pp. 1097-1102 (in Japanese)

2. Iguro M., Shioya T., Nojiri Y. and Akiyama H. (1985) Experimental Studies on Shear Strength of Large Reinforced Concrete Beams under Uniformly Distributed Load, JSCE, Concrete Library International, No. 5, August, pp. 137-154

3. Iwaki R., Akiyama H., Okada T. and Shioya T. (1985) Shear Strength of Reinforced Concrete Circular Slabs, Proceedings of JSCE, No. 360N-3, August, pp. 155-164

4. JSCE (1991) Standard Specification for Design and Construction of Concrete Structures. Part 1 (Design)

5. Nakano M., Goto S., Nakazawa A. and Kuroda M. (1996) Water pressure test of actual bottom slabs of 140,000kl LNG under-ground tanks, JSCE Animal Convention, Vol. 6, pp. 528-529 (in Japanese)

6. Okamura H. and Higai T. (1980) Proposed Design Equation for Shear Strength of Reinforced Concrete Beams without Web Reinforcement, Proceedings of JSCE, No. 300, pp. 131- 141.

7. Sejima A., Nakano M., Kawamura Y., Sugino F. and Fukuda Y. (1996) Water pressure test of actual bottom slabs of 200,000kl LNG in ground tanks, JSCE Annual Convention, Vol. 6, pp. 530-531 (in Japanese)