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Review on Evaluation and Study of Parametric Characteristics of Structural Components of High Rise Building

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Abstract: ***Shear wall are most commonly used to resist lateral forces like seismic load, wind loads etc. It has very high strength and stiffness which provides stability to structure. But the volume of concrete required for shear wall is high and also dead weight of structure also increases. Scope of nowadays work is to study earthquake (seismic) responses of building by avoiding shear wall and adding some extra beams at different places in dead wall to create more stable and more economical structure and It should be carried out by considering different seismic zones. Generally different bracings systems are used to design high-rise stable and more economical building. In this paper different literature surveys are carried out and also various methods are studied to design more economical and stable structure. For further analysis various parameters such as lateral displacement, base shear, Moment in different direction and axial force on different column can be studied.***
Keywords: Shear wall replacement, base shear comparison, high rise buildings with horizontal bracings, seismic analysis.

I. INTRODUCTION

The race towards high-rise, architecture and more stable structure has been challenges. When the building increases in height, the stiffness of the structure becomes more and more important. Reinforced Concrete Buildings are adequate for resisting both the vertical and horizontal load. High-rise have continued to upward higher and higher facing, strange loading effects and very high loading values due to dominating lateral loads.

In buildings built in region likely to experienced earthquake of high intensity or high lateral force then more suitably advisable shear wall structure. The design of these walls for seismic forces requires special consideration as they should be safe under various loads. The design of building 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. The resistance to the lateral loads from wind or from an earthquake is the reason for the evolution of various structural systems. Bracing system is one such structural system which forms an integral part of the frame. Such a structure has to be analyzed before arriving at the best type or effective arrangement of bracing. This project is about replacing of shear wall and adding additional beams at different level of column height.

II. SCOPE AND OBJECTIVE

A. To replace shear wall with horizontal RC beams.
B. To enhance the structural strength of member.
C. To avoid different bracings and to provide horizontal beams instead of shear wall
D. To reduce volume of concrete.

III. LITERATURE REVIEW

A. Kiran Tidke (2006), Seismic Analysis of Building with and Without Shear Wall, in this paper researcher concluded that the RC frame with shear wall is having higher value of base shear than bare frame. The presence of shear wall can affect the seismic behavior of frame structure to large extent, and the shear wall increases the strength of stiffness of structure. And From the all different location of shear wall, shear wall at corner in building gives better result. It shows greater base shear, less story drift and displacement as compared to other shear wall location.[1]

B. Kanchan Rana, Vikas Mehta (2017), Seismic Analysis of RCC Building with Shear Wall at Different Locations Using STAAD Pro., In this paper they have concluded that the shear wall can be provided at different location. For stability of structure

location of shear wall generally used are as on the periphery of structure. Researchers concluded in their paper that if shear wall will be provided at the center of the outer periphery of the structure that will give much better result. Researchers studied different parameter of the structure to find best result, they compare about base shear, story drift, peak story shear.[2]

C. Gaikwad Ujwala Vithal (2017), Effect of Shear Wall on Seismic Behavior of Unsymmetrical Reinforced Concrete Structure, in this paper researcher studied about g+11 story building with various location and thickness of shear wall. Shear wall with 150mm, 200mm, 300mm and 400mm were used where length kept constant. In this paper they concluded that increasing thickness of shear wall doesn't give much strength n resulting in uneconomical design in all five cases. Top floor displacement is much less in all cases compared to without shear wall, but it is less when shear walls are provided at corners than other places of shear wall. Storey drift is maximum for shear wall parallel to Y direction and minimum in parallel to X direction for EQX and EQY. In all shear walls placed at the corners of structure base shear due to EQX & EQY is minimum, so as Torsion.[3]

D. Vipin V. Halde, Aditi H. Deshmukh (2015), Review on behavior of soft storey in building, in this paper researcher concluded that when the effect of soft storey is considered then the deflection has increase at that particular floor. RC frame buildings with open first storeys are known to perform poorly during in strong earthquake shaking. The measures should take to improve capacities of the columns in the soft first storey. Since the behavior of the soft storey is different during a quake, the structural member undergoes damage and to provide member to withstand that additional forces due to soft storey heavy or bulky member need to be provided. This increase financial input. Thus proper care, expert design and detailing are needed in soft storey buildings.[4]

E. Rakshith K L, Smitha (2017), Effect of Bracings on Multistoried RCC Frame Structure under Dynamic Loading, research is carried out by Response Spectrum method. in this paper researchers concluded that In RCC frame building the displacement and storey drift decreases for different types of bracing system used compared to RCC frame building without bracings and the base shear increases for different types of bracings system used compared to unbraced frame structures. In regular and irregular RCC frame structure X- bracing gives minimum displacement and storey drift and base shear is increased. In regular and irregular RCC frame structure. The performance of X-bracing gives better results compared other bracing system. From the result the regular RCC frame is having much more stiffness compared to vertical irregular RCC frame structure. Steel bracing are generally used to strengthen or retrofit the existing structure.[5]

F. Nicka Keipour, Elyar Zafarkhah & Masood Mofid (2012), Effect of Height of Buildings and Arrangement of Braces On RC Buildings Retrofitted with Steel Knee Braces Based on Incremental Dynamic Analysis (IDA), in this paper researcher concluded that improvement of seismic performance of buildings due to retrofitting with knee braces, has a reverse relation with the height of structures. So, for short-rise or mid-rise structures this kind of retrofitting is logical, but, in high-rise buildings, knee brace cannot improve seismic performance of structures very well and using them is not economical.[6]

G. Sagar R Padol, Rajashekhar S. Talikoti (2015), Review paper on seismic responses of multistoried rcc building with mass irregularity, in this paper researcher concluded that the Many of the studies have shown seismic analysis of the RCC structures with different irregularities such as mass irregularity, stiffness and vertical geometry irregularity. Whenever a structure having different irregularity, it is necessary to analyze the building in various earthquake zones. From many past studies it is clear that effect of earthquake on structure can be minimize by providing shear wall, base isolation etc.[7]

H. Jibi Abraham, Reshma C (2018), Seismic analysis of pyramid shaped building with and without bracing, in this paper researcher concluded that Pyramid shape structures are one of the most applicable shapes that are used for the designing of high rise buildings. Concrete braced frame is one of the structural systems used to resist earthquake loading in multistoried buildings. Different 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 of structure. 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.[8]

I. Pachchigar Foram N., Patel Falguni R., Patel Minal H., Vaghasiya Nidhi C (2016), Development of Multi-Storeyed RCC Building Model with Soft Storey in STAAD PRO, in this paper researcher concluded that over estimations are of displacements for all of the models and deformation levels by uniform lateral load pattern. When increase in height of storey nonlinear time history analysis required. The displacement estimation for multi-storey building linearly varies from bottom to top.[9]

J. Rajat Bongilwar, V R Harne and Aditya Chopade (2018), Significance of Shear Wall in Multi-Storey Structure with Seismic Analysis, in this paper researcher concluded that In multi-storey buildings, provision of shear walls is found to be effective in increasing the overall seismic response and characteristics of the structure. Shear walls are considered for analysis of RC frame in which equivalent static method can be effectively used. Shear wall ultimately increases the stiffness and strength of the structure and affect the seismic behavior of the structure. From the analytical result, it is observed that base shear increases in the model with shear wall when compared to the model without shear wall. This is due to increase in stiffness of building. The considerable reduction in lateral displacement is observed in the shear wall model when compared the model without shear wall. The reduction of displacement of storey is due to increase in stiffness of structure. For better seismic performance, a building should have proper lateral stiffness. Low lateral stiffness leads to large deformation and strains, damage to nonstructural elements.[10]

K. Adithya. M. (2015), Study on Effective Bracing Systems for High Rise Steel Structures, in this paper researcher concluded that the concept of using steel bracing is one of the advantageous concepts which can be used to strengthen or retrofit the existing structures.

The lateral storey displacements of the building are greatly reduced by the use of single diagonal bracings arranged as diamond shape in 3rd and 4th bay in comparison to concentric (X) bracing and eccentric (V) bracing system.[11]

IV. CONCLUSION

As per the literature review studied it can be concluded that the shear wall gives the better stiffness and strength to the structure. Location of shear wall gives best result when provided at the center of periphery of building. As for more stability additional bracings are added which also increase the cost of the structure. These all parameter indirectly increase the dead weight. To reduce such dead weight of structure additional beams can be incorporate at particular location of which can balance lateral forces coming from earthquake and also reduce dead load.

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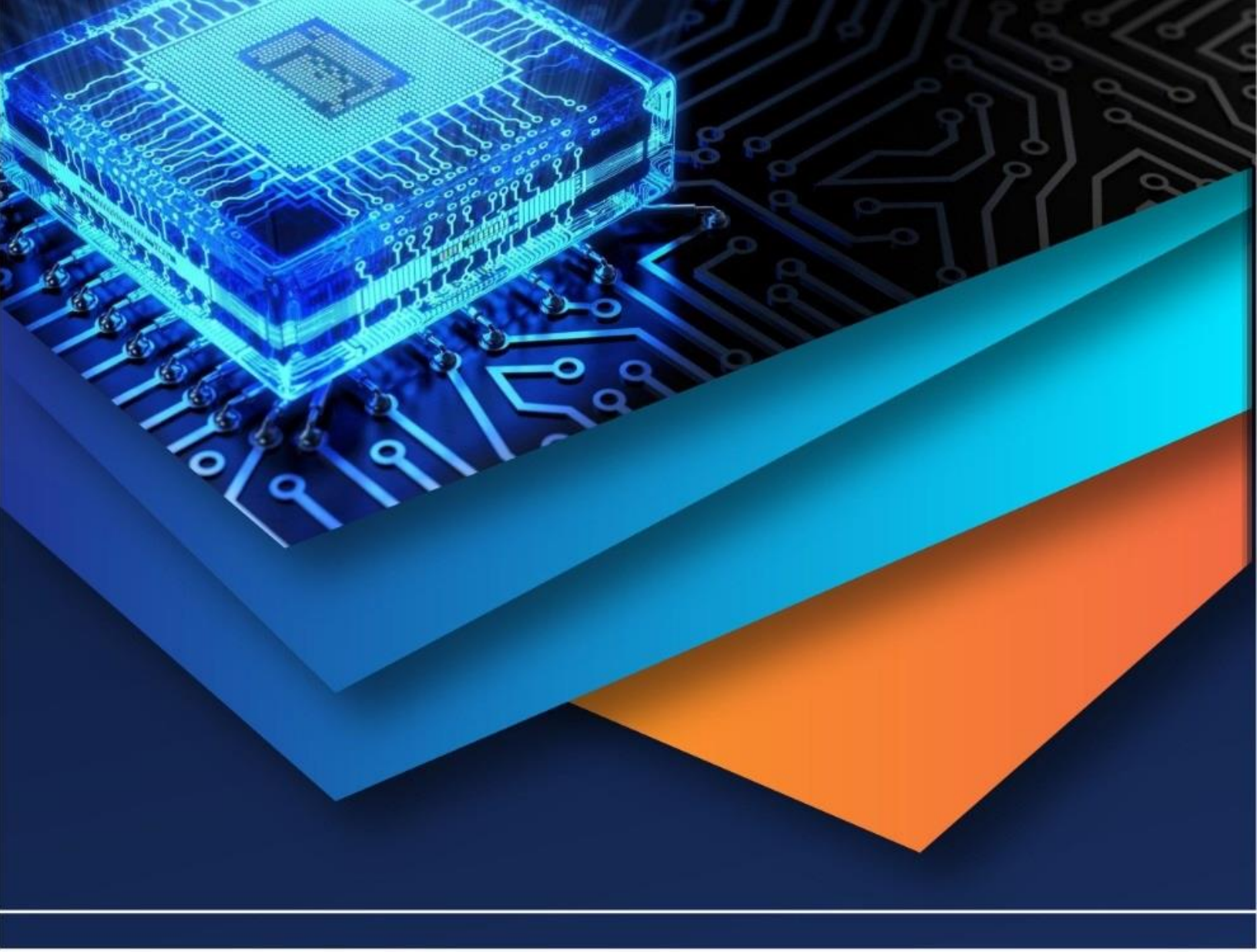

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