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Analysis of A Tall Structure Considering Shear Wall : A Review

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ABSTRACT

Earthquake is a form of disaster which occurs due to Natural or Man-made errors resulting in extreme damages to human civilization and any form of structure created by us. Recent example of such a disastrous earthquake was seen in our neighbouring country Nepal, resulting in massive destruction to the entire country destroying its economy and placing a setback of more than 10 years. It was such an unusual disaster, that it is extremely vital for survival to ensure the strength of the structures against seismic forces. In this way, there is persistent research work going on around the world, rotating around the advancement of new and better methods that can be consolidated in structures for better seismic execution. Structures designed considering exceptional methods to resist such forces and seismic forces have a considerably higher cost of development than ordinary structures, yet for prosperity against tension on the structure under seismic forces, it is fundamental.

In this study we are presenting literature review of publications related to lateral load resisting systems.

Keywords : Shear Wall, Lateral Forces, Tall Structure, Forces, Displacement, Cost.

I. INTRODUCTION

An Earthquake can be defined as vibration on the earth surface due to sudden release of energy from the Earth core resulting in formation of seismic waves. Brutal seismic forces are capable enough to destroy entire urban communities and cause tremendous loss to life and property. The seismicity alludes to the size, type and recurrence of earthquakes experienced over some stretch of time.

Seismometers are used to measure the earthquakes. Earthquakes smaller than magnitude 5 reported by national seismological observatories are measured generally on the local magnitude scale, also known as the Richter magnitude scale where-as the moment magnitude scale is commonly used for earthquakes larger than 5 are reported in the world.

II. LITERATURE SURVEY

We are presenting literature survey of researches related to seismic analysis, lateral load resisting members, shear walls and dynamic analysis methods.

Mahendra Kumar (2018) the objective behind this research work was to model and analyze shear wall frame structures with different thickness and shear wall placement along the structure and even presented various effects of soft storey along with openings in shear wall. Author modelled a 5 storey structure with height of 3.5m in each storey in a regular plan and the designe was done using the "ETABS" as per the Indian Code of Practice for Seismic Resistant Design of Buildings. These models were analyzed on seismic zone V on the parameters lateral displacement, base shear and storey acceleration in X and Y direction.

Shahid Ul Islam et. al. (2018) This study observed the combined performance of shear wall and RCC bracing system, and also the effect of their relative position in high rise commercial building (G+10). The shear walls provide the stiffness to restrain lateral loads and also help in distribution of gravity loads whereas the RCC bracing results in higher stiffness and stability as a potential advantage over other bracings. The study also aimed the comparison of performance of shear wall & RCC bracing system in high rise commercial buildings under seismic loading. The total of 6 structural configurations viz., Moment resisting frame (Model 1), MRF stiffened with RCC bracing system (Model 2), MRF stiffened with shear wall system (Model 3), MRF stiffened with both shear wall and RCC bracing system (Model 4A, Model 4B, & Model 4C) were modelled and then analysed. Analysis has been done in accordance with 1893:2002 using STAAD Pro V8i software. The seismic parameters taken into consideration are base shear and storey displacement.

Rahul T. Pardeshi (2017) A study on an irregular highrise building with shear wall and without shear wall has been carried out to understand the lateral loads, displacement shear effects. It is relevant that high rise building are increasing day by day hence its study is necessary for development point of view. So we thought to use Staad Pro V8i to analyse the certain irregular high rise building by changing the location of shear walls. The usefulness of shear walls in the structural planning of multistorey buildings has long been recognized. When walls are situated in advantageous positions in a building, they can be very efficient in resisting lateral loads originating from earthquakes. A study on an irregular high-rise building with shear walls and without shear wall has been conducted to understand the effect on stability of building and other factors as displacement, bending moment, axial force.

Reinforced concrete framed buildings are adequate for resisting both vertical and horizontal loads acting on them. Extensive research has been done in the design and analysis of shear wall highrise buildings. However, significance of shear wall location in highrise irregular structures is not much discussed in literature. A study on an irregular highrise building with shear wall and without shear wall has to be studied to understand the lateral loads, bending moment and shear effects.

Vinay Agrawal et. al. (2017) here the author considered a unsymmetrical G+19 storey building business building [L>3.6 least horizontal elements of the structure], H> 3.3 least sidelong element of structure and was demonstrated with the various placement of shear dividers and examination led for joint uprooting, Storey float, Storey firmness and Base shear force. These models were modelled using analytical application "ETABS" for static examination according to IS 1893 - 2002.

The experimental results concluded that the dependability of the structure is administered by the position and % zone of strong shear walls, the exposed frame model was less steady than different models when investigated for horizontal joint

displacement, storey float, storey firmness, storey shear forces, base shear forces and the axial column forces. As the objective behind the paper was to compare the conduct of the unsymmetrical structure for storey float, joint displacement, storey solidness, storey shear forces, axial forces in sections and base shear force under the distinctive situation of shear walls.

A.P.Nagendra Babu and Sk.Jain Shahab (2017) the primary focus of this research work was to determine the appropriate placement of shear walls In a multi storey structure while comparing seismic analysis of a Model G+10 storey structure from seismic zone II till zone V. "STAAD.Pro" was used for the modelling and analysis of the structure, where time period was retrieved in all the directions from the software according to IS IS 1893(part 1):2002. The conclusion stated that core shear walls presented more stiffness in comparison to Core shear walls, Time periods of building automatically increases as soon as shear walls are placed on the edges. Low horizontal firmness prompts huge deformations and strains, harm to the non-structural segment, inconvenience to the inhabitant. Structures with shear walls at the centre demonstrate to be a superior option for working in the earthquake inclined region. Dynamic investigation decreases storey shear, storey relocation, storey float and so forth; this demonstrates dynamic examination gave an improved gauge of forcess and along these lines examination of the building become highly accurate and quite economical.

PR.D. Prasad et al (2016) this paper dealt with an analytical parameter study for the structural shear walls with varying height for different models while considering load combinations as per IS 1893 (Part-1):2002. Analysis of even two reinforced concrete structure building with different zones locations of shear walls situated in seismic zone III and zone V was done. "Staad.Pro V8i" was used for design and analysis of the structure.

The analytical results lead to the conclusion that displacement reduces drastically in building with shear walls in comparison to building without shear walls, shear walls provide structural strength to resist seismic waves. No variations were found when compared structure with and without shear walls in wind analysis. There was a minor difference from bending moment and axial force for with and without a shear divider. The node displacement was more for Zone V contrasted with Zone III for seismic load. The Axial force diminished with expanding structural height for all models.

R.Resmi et. al. (2016) The authors paper compiled assessment of seismic performance of shear walls on such factors which influence execution of shear wall such as its placement, shear walls arrangement and the various types of materials.

Paper suggested parameters as right placement of shear wall at appropriate location of the structure while considering base shear and displacement. Shear walls with openings experienced a decrease in terms of strength. Diagonal shear wall was found to be effective for structures located in earthquake prone areas with no condition to raise shear wall to the extent of height of structure as shear walls are sufficient enough to the extent of mid of the structure. Author discussed four different models here lifeway's "a structure without a shear wall", "a structure with shear wall in L type", "structure with shear wall along periphery" and "a structure with cross type shear wall section". Results proved that when shear walls are placed along with the periphery of the structure, it is able to provide maximum efficiency.

Kiran Tidke et. al. (2016) this paper exhibited the impact of seismic loading on the position of the shear

divider in the structure at an alternate elective area. Adequacy of shear divider has been contemplated with the assistance of five distinct models. Model one was an uncovered edge auxiliary framework and other four models have various game plans of the shear divider. Reaction range and time historey technique were utilized for investigation in SAP2000 programming and structure were thought to be arranged in zone II. From the examination, some parameter was resolved like base shear, storey float and relocation of a structure.

Reaction range and time historey examination were performed for G+7 RC casing structure with shear divider outline at their diverse area.

RC outline with the shear divider was having a higher estimation of base shear than the uncovered edge. The nearness of shear divider could influence the seismic conduct of casing structure to a huge degree, and the shear divider expands the quality of solidness of the structure. The maximum. storey float of shear divider diminishes 0.0074% to 0.0303% when contrasted with the uncovered casing. The relocation of the shear divider for the middle shear divider, Core with parallel side shear divider, Corner shear divider and Periphery shear divider is 0.1029%, 0.1232%, 0.4623% and 0.0991% individually less contrasted with the uncovered edge. From the all unique area of the shear divider, the shear divider at the corner in the structure gave a superior outcome. It displayed more prominent base shear, less storey float and uprooting when contrasted with other shear divider area.

Mallika.K and Nagesh Kumar (2016) this paper presented modelling of a 20 storey unsymmetrical building with the use of analytical application “Etabs”. This research included seismic vulnerability of RC structure without use of shear walls, or when shear walls placed at the corners or when shear walls are placed towards the boundaries and lastly when placed in the interior dimension. Equivalent Lateral force procedure on moderate and extreme seismic zone for soft and hard soil conditions was used to analyze the models according to earthquake load IS 1893(PART1):2002.

While comparing the load combinations, it was found that shear walls at the corners of the structure were found quite efficient with least displacements figures in moderate zone for hard soil conditions. The arrangement of shear walls position in a suitable area is profitable and the structure performs better for an existing or new structure.

Gangisetty et. al. (2015) A Residential Building with 19 stories is examined with and without shear dividers for wind and tremor loads. The Building comprises of four pads for each floor and goes under zone 2. Shear dividers were taken at lift and stair and corners of the structure as L shape. Vertical burdens, Moments, Lateral forcess, Torsional minutes were thought about for the two cases at each floor during the examination part. Advancement strategies are utilized to take care of basic building issues where the most unpredictable skyscraper structures utilizing plan enhancement, including both size and topological streamlining, is comprehended by thinking about security, wellbeing, reaction to an alternate kind of loadings. Divider edge structure streamlining is a piece of the venture. For this arrangement of divider and centers, they were checked for dislodging, Internal Stresses and Intensities when exposed to different loadings.

The conclusion from the examination expressed that Bending Moments of sections in the two bearings were decreased at each floor level by utilizing shear dividers for a structure. Parallel Forces were expanded toward the path in which shear dividers were developed at each floor level and diminished the

other way contrasted with the structure without shear dividers. Variety in-floor shrewd segment minutes is less toward the path in which shear dividers were given practically identical to floor savvy minutes in the structure without shear dividers. Storey floats were decreased by giving shear dividers to the structure. The decrease in bending moment for sections with shear dividers is progressively practically identical to segments from shear dividers. Torsional Moments were decreased by utilizing shear dividers for a structure.

Mahdi Hosseini et al (2014) this paper analyzed the performance of the structure of framed building and analyzed it by the use of shear wall. Shear walls are concerned to resist seismic and wind loads, besides the various effects of shear walls were analyzed on a conventional frame structure. The improvement in the seismic performance of the structure with edge framework by utilizing shear divider was studied. Author analysied a symmetric G+20 structures on the parameters namely Shear force, Moment, Torsion and Storey Drify. The analytical results stated that value of storey drift reduces with the addition of several shear walls. Storey Drift with combinational load "DL+LL+WLx " in the direction X&Y presented similar performance on the structure. In view of the investigation, a shear was especially reasonable for opposing seismic investigation lateral forces in multistoried basic frameworks when contrasted with multistoried structural frameworks without the use of shear walls. They can be made to act in a ductile way by receiving legitimate enumerating systems. The vertical support that is consistently appropriated in the shear wall be similar to reinforcement horizontally. This arrangement is especially for squat dividers (for example Stature to-width proportion is about 1.0). For dividers with a stature to-width proportion under 1.0, a significant piece of the shear forces is opposed by the vertical reinforcement. Henceforth, sufficient vertical support ought to be accommodated on such shear walls.

Varsha Patil and Devikrishna.P.M (2014) this research paper proposed the background of shear walls presenting direct relevance of shear wall on High-rise Structures. This paper even discussed review on direct concept and the utility of shear wall, various effects of earthquake and design aspects in regards to architecture. This paper stated shear wall is the most economic, simple, efficient and long lasting in dissipating earthquake energy in comparison to other methods.

Ravikanth Chittiprolu and Ramancharla Pradeep Kumar (2014) this paper specified a study on an irregular high rise structure along with shear walls or without any shear walls so as to analyze the lateral loads, Storey drifts and torsion effects.

It was observed that with the addition of shear walls there a linear reduction in lateral load over the structure when placed on the right location with least lateral loads. This ultimately defined that shear walls are capable enough to make a structure highly resistant towards lateral loads in the case study as an irregular structure besides, shear walls are even evident in reduction of torsion effects.

Satpute S G and D B Kulkarni (2013) here the author analyzed seismic response of a ten storey structure using RC shear wall either using shear wall or without opening. Created numerical displaying and investigated the concrete reinforced shear walls working by utilizing diverse nonlinear strategies namely time history and pushover technique). These techniques contrast concerning clearness, limpidness and clearness of theoretical backgrounds which were mention in the past. Non-direct static systems were created to beat the inadequacy and constraints of straight strategies, while simultaneously keeping up a generally straightforward application. All techniques

fuse execution based ideas giving more consideration to control and form of damage. The examination is done by utilizing standard bundle SAP2000. The examination of these models for various parameters like uprooting, storey float and base shear has been displayed by RC shear wall working with and without opening.

Results demonstrated the values of seismic response generated in concern to base shear, storey displacement and storey drift was found to increase with rise in seismic zones. The conveyance of the storey float proportion over the height of stature progresses becoming non-uniform with the increment in the height of the frame for both the strategies. The storey drifts proportions for various damage conditions of a class of structures planned according to IS1893-2002.

Hamdy H. A. Abd-el-Rahim and Ahmed Abd El-Raheem Farghaly(2010) the primary objective of this research paper was to investigate numerically the stand of edge shear walls and raft foundation projection out of the boundary of building in the seismic resistant. The analytical tool SAP 2000 was used to run various three-dimension models which was developed for the further analysis including the subgrade modulus as a variable. The loading was viewed as utilizing speeding up time historey with a pinnacle ground acceleration of 0.25g as per the new Egyptian code (ECOL2008)[2] for seismic loads on structures. The outcomes reason that the slim elevated structures furnished with edge shear walls and pontoon projection assure critical improvement in the prompted base shear and inside forces in the pontoon establishment. The examination introduced the enormous estimations of base shear in the corner segments under seismic loads in an anticipated raft establishment building. The outcomes gave a wide vision that could be utilized as an eid to the designer for managing such slender structures.

The derived results stated that Viability of the shear walls was accomplished by diminishing considerably the base shears incited in the segments. The base shear lessens by half when thought about with the slender elevated structure without shear dividers. Execution of raft establishment projection lessens the inside forces in the pontoon, however on the opposite side the projection produces gigantic base shear in the corner segments and this merits more consideration and ought to be incorporated into the plan of these segments. The shear walls and projections of rafts demonstrated to be profoundly favourable of utilization in the slender tall structures laying on weak soil.

Wen-I Liao et al (2004) this paper proposed the use steel bars in the particular management of high seismic response shear walls so as to improve the ductility of low rise shear walls when applied to low rise buildings. The stature, length, and width of the structured shear dividers for the shake table tests are 0.7 m, 1.4 m and 0.085 m, separately. The tallness, length, and width of the planned shear dividers for the turned around cyclic tests are 1.4 m, 2.8 m and 0.12 m, In brief results in the analysis stated, the tried elite shear walls have more prominent pliability than that of customary shear walls. the tried elite shear walls have more prominent flexibility than that of ordinary shear walls.

III. Conclusion

In this study we reviewed publications and journals related to lateral load resisting techniques.

Here we observed that lateral load resisting systems helps in utilizing displacement of structure to control it within permissible limit.

It can be said that in past authors performed seismic analysis of tall structures but none of them perform analysis considering different positions of shear wall

also none of them perform analysis of a plus shaped tall structure.

Following observations are made in this review are as follows:

- In researches authors considered mid-rise or high rise structure for study.
- In past researches authors considered general loading conditions and linear analysis method.
- In past researches authors compared shear-wall structure with other type of lateral load resisting members.
- In review it is observed that most commonly authors concluded result in terms of forces, moment and displacement.

Future Scope:

Future scope of the study can be consider as follows

- In future study analysis of a tall structure can be perfume.
- In future position of shear forces can be compare for more stability of the structure.
- In future one can perform study using advance analysis tool.
- In future one can conclude results considering base shear, drift also.

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