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Study On Residential Building of Constant Area and Different Shape Using ETABS : 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 publication available on citations in which lateral load resisting techniques are utilized.

Keywords : Area, Analysis, ETABS, Earthquake, Forces, Moment, Cost, Displacement.

I. INTRODUCTION

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.

II. LITERATURE REVIEW

Shriram et. al. (2018) Here author illustrate that earthquake play an important role in designing structures. Lot of work has been done by many researchers who worked to study the effect of earthquake on different shape. Being inspired from the work contributed in the study on effects of earthquake on different shaped building in plan,

Author presents effects of four shape configuration i.e., RECTANGULAR, SQUARE, TRIANGULAR, CIRCULAR with same area. Buildings with different shape geometry react differently against earthquake. The effect of different shape of structure have been carried out by using SAP2000 software. SAP 2000 software is a software for designing a mathematical model of and mechanically analyzing civil structure like everything ranging from cable-stayed bridges to concrete walls. There are several factors which affect the behavior of building from which base shear and lateral displacement play an important role in understanding the behavior of structure. Results are expressed in form of tables, bar charts. It has been observed from the result that Triangular shape is best for base shear as compared to rectangular, square, circular shape.

Deepesh et. al. (2017) Seismic analysis of a multi-story Reinforced concrete frame is analyzed under moderate earthquake loads as an application of seismic hazard and in accordance with the seismic provisions proposed in IS: 1893-2002 to analyze the performance of existing buildings if exposed to seismic loads. The frame was analyzed using the response spectrum method to calculate the seismic displacements and stresses.
The behavior of Multi-story building of regular and irregular plan configuration under earthquake is complex and it varies of wind loads are assumed to act simultaneously with earthquake loads. The study of this research mainly emphasize the structural behavior of multi-storey building for different plan configuration such as regular building along with L- shape and I- shape. In this modeling of G+ 24 storey RCC framed building is studied for earthquake load using STAAD-PRO V8i. Assuming that material property is linear static and dynamic analysis is performed. These analyses are carried out by considering different seismic zones (III and V) and for each zone the behavior is assessed by taking three different types of soils namely Hard, Medium and Soft. Post analysis of the structure, lateral displacements, story drift, base shear, maximum bending moment and design results are computed and then compared for all the analyzed cases. Designs of these structures in all cases are also done to obtain the most economic structure above all the cases.

Ramchandani et. al. (2016) Here Authors describes the analysis process for non-linear static and dynamic analysis of structures have been developed in recent years. In this paper, the response spectrum analysis is performed on two different shapes *i.e.* regular and irregular shape of structure by using STAAD PRO. And the comparison results are studied and compared accounting for the earthquake characteristics and the structure dynamic characteristics. As the results show that the earthquake response peak values and the main response frequencies are very close and comparable. It can be referred to by the engineering applications.

Mohammad and Peera (2015) here authors elaborated that Extinct earthquakes events demonstrate that, buildings with irregularity is vulnerable to earthquake damages. So as it's essential to spot the seismal response of the structure even in high seismic zones to cut back the seismic damages in buildings. Objective: The most important objective of this study is to grasp the behaviour of the structure in high seismic zone and also to evaluate Storey overturning moment, Storey Drift, Displacement, Design lateral forces. During this purpose a 15 storey-high building on four totally different shapes like Rectangular, L-shape, H-shape, and C-shape are used as a comparison. The complete models were analysed with the assistance of ETABS 9.7.1 version. In the present study, Comparative Dynamic Analysis for all four cases have been investigated to evaluate the deformation of the structure. Results & Conclusion: The results indicates that, building with severe irregularity produces more deformation than those with less irregularity particularly in high seismic zones. And conjointly the storey overturning moment varies inversely with height of the storey. The storey base shear for regular building is highest compare to irregular shape buildings.

Lu liu and Xiaoqing (2014) Studied that as there are increasing numbers of digital documents for education purpose, we realize that there is not a retrieval application for mathematic plane geometry images. In this paper, we propose a method for retrieving plane geometry figures (PGFs), which often appear in geometry books and digital documents. First, detecting algorithms are applied to detect common basic geometry shapes from a PGF image. Based on all basic shapes, we analyze the structural relationships between two basic shapes and combine some of them to a compound shape to build the PGF descriptor. Afterwards, we apply matching function to retrieve candidate PGF images with ranking. The great contribution of the paper is that we propose a structure analysis method to better describe the spatial relationships in such image composed of many overlapped shapes. Experimental results demonstrate that our analysis method and shape descriptor can obtain good retrieval results with relatively high effectiveness and efficiency.

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.

Mario De Stefano and Barbara Pintucchi (2008) presented an overview of the progress inresearch regarding seismic response of plan and vertically irregular building structures. Three areas of research are surveyed. Firstly, the study of the effects of plan-irregularity by means of single-storey and multi-storey building models. The second area encompasses passive control as a strategy to mitigate torsional effects, by means of base isolation and other types of devices. Lastly, the third area concerns vertically irregular structures and setback buildings. They clarified that discontinuities of mass, stiffness or strength along the height, considered by current seismic codes as irregularities in elevation do not necessarily result in actual increases in plastic demands and moreover results in poor seismic behaviour.

Raul Gonzalez Herrera and Consuelo Gomez Soberon (2008) studied the damages caused bydifferent plan irregularities during seismic events of different magnitudes. The work describes to the geometric forms that are repeated more in the urban areas in México (squared, rectangular, section U, section L and section T), as well as its variations from plants observed with extracted aerial photography of Google Earth. These architectonic plants were modelled in SAP2000 considering one, two and four levels to determine the effect of the geometric form in the seismic behaviour of structures with elastic analyses. Also, effects of different irregularities are analyzed based on the variation of displacements, with respect

to regular systems. They concluded that irregularities in plan are vulnerable to construction. [5]

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 elite shear walls have more prominent flexibility than that of ordinary shear walls.

MN Aydınoğlu (June 2004) studied an improved pushover procedure of Incremental Response Spectrum Analysis (IRSA) works directly with smoothed elastic response spectrum and makes use of the well-known equal displacement rule to scale modal displacement increments at each piecewise linear step of an incremental application of linear Response Spectrum Analysis (RSA). IRSA can be readily applied to plan-symmetric as well as asymmetric multi-story buildings and irregular bridges involving multi-mode response at each piecewise linear step. Practical implementation of the procedure including P-delta effects is very simple and transparent.

It is inferred from above study that typical building frames with generalized bending model including all the nonlinear effects will yield results which are realistic and physically reasonable. For the cases studied in this paper concluded that use of these complex and irregular models does not seem justified.

ShunsukeOtani (1980) studied nonlinear behavior of reinforced concrete plane structures using analytical methods. Columns of a framed structure must resist lateral forces in two horizontal directions. It is inferred from the above study that the stiffness is reduced significantly under biaxial lateral load reversals. The measured maximum first-level displacement was approximately one-twentieth of the story height. The measured maximum base shears were approximately 1.7 times the base shear calculated for the collapse mechanism (load at each level proportional to height, no strain hardening). The measured maximum base shear was approximately 1.3 times the calculated base shear assuming yield moments at the top and the bottom of the first-story columns (clear height). The measured maximum base (overturning) moments were approximately 1.8 times the base moment calculated for the collapse mechanism. Due to this large base moment, the first-story column developed net tensile stress, which was not calculated for the collapse mechanism.

Tarek S. Aziz (1976) studied the nonlinear dynamic behavior of building frames. The study covered basic points associated with inelastic dynamic analysis procedures. Two types of nonlinearities are studied: those due to material behavior and those due to geometry changes. The importance of each nonlinear effect is studied separately and those effects which might be more important than others are pointed out. Among the different effects studied are the P- and stability effects, the presence of gravity loads, axial deformations in the columns, joint size and nonlinear joint behaviour, damping, and nonlinear soil-structure interaction. Comparisons are made between different complex, intermediate and simple models for inelastic dynamic analysis.

III. CONCLUSION

Based on literature review in these detailed study on shape use and orientation of residential building of same area with different shape for proposed area and related technique has been done in past researches were conducted on different materials, lateral load resisting techniques including RCC, flyash cement concrete and panels however information on techno-economic feasibility of shapes of building structures is not defined properly

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