JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Analytical Study of RCC Multi-Storey Structures in Staad.Pro and Etabs: A Review

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Abstract : Seismic analysis for any multi-storey building is important for its safety and durability. The current paper presents a review of the previous research done on multi sotrey structures when subjected to seismic forces when analyzed in Staad.Pro or E-tabs. Previously, seismic analysis was performed as per the guidelines or IS: 1893-2002 but now, guidelines from the new seismic code i.e. IS: 1893-2016 are adopted.

Keywords **– Seismic Analysis, Multi Storey RCC Building, Staad.Pro, E-tabs.**

I. INTRODUCTION

Seismic analysis, a subdivision of structural analysis, is one of the key analyses for buildings or other structures, especially for high rise structures, located in an earthquake zone and is used to predict how they would react to an earthquake. It is a step in the structural design, earthquake or structural evaluation, and retrofit processes in seismically active areas. Shear barriers, one of the examples to resist seismic forces, were employed in the engineering process to prevent failures caused by such factors. In light of previous earthquake records, there is a rise in the need for earthquake-resistant buildings, which can be met by following the guidelines provided in Seismic analysis code IS: 1893-2016. The codes that were previously provided have been amended in light of recent significant earthquakes, and earthquake design of structures is now given more weight. When deciding on the best structural system for a project, the choice of a shear wall to withstand lateral pressures is of utmost importance. Structures are typically subjected to two different types of loads, static and dynamic. While dynamic loads change over time, static loads remain constant. Most calculations for civil structures only take into account static loads; because dynamic loads require more difficult calculations, they are rarely done. The sort of load that affects a structure during an earthquake is mostly dynamic in character, which is more devastating. Previously, numerous researchers have carried out their study in different analytical and designing software Staad.Pro or E-tabs by taking multistoried building with seismic analysis.

II. LITERATURE SURVEY

The various past research works on seismic analysis of multistorey building when analyzed in Staad.Pro and E-tabs software were studied which as discussed below:

Mandwe, et.al, (2021) investigated the behavior of 50 storied building with shear walls using Staad.pro software under seismic analysis. The total height, length and width of the building was 150m, 25m and 20m respectively. The fully understand the behavior of the structures, the results of axial forces, bending moments, displacement, shear forces etc were scrutinized and compared for the final conclusion of the study. It was noticed that with the presence of shear walls in high rise building, all the forces and moments were reduced drastically and staad.pro is versatile software for analyzing high rise structures.

Sreadha and Pany (2020) examined the behavior of multi storey building using floating column as the presence of such columns are column these days. Floating columns rest on beams instead of the foundation. The researcher used the designing software: Extended three dimensional analysis of building systems (ETABS), in which the analysis emphasized the significance of specifically detecting the presence of the floating column within the structure under static and dynamic seismic analysis and established its comparison with the building without floating columns. Different structural parameters such as maximum displacement, storey drift, base shear were studied and compared. For this purpose, three models were prepared: Model 1- G+5 building without floating column, G+5 with floating column on 1st floor and G+5 with floating column on 5th floor were modeled and analyzed for seismic zone 4. When compared to a structure without a floating column, the floating column-containing structure exhibits the higher value of displacement. Furthermore, the amount of lateral displacement increases when the floating column is moved towards higher floors.

Kumar and Sen (2020) studied the effect of seismic forces on G+10 storey building in ETABS software and for this purpose, the researcher took zone 3, 4 and 5 and analyzed the structure as per IS: 1893-2016. The comparison was made between the structures analyzed with response spectrum seismic analysis and Time History Analysis. To understand the behavior of the structure, different parameters were considered like displacement, shear force, bending moment, etc. The storey shear, lateral drift is more in zone 5 when compared to other zones.

Thakur and Singh (2019) studied the significance of single and double cross struts in RCC high rise buildings (16 storey and 20 storey buildings) when analyzed with Dynamic Seismic analysis as per IS: 1893-2016 in zone 5. The struts were introduced at the

center and corners of the building and parameters like displacement, forces and moments were compared with the building with struts. With the introduction of single and double cross struts in 16 storey and 20 storey building, it was concluded that the maximum displacement was reduced 50% to 60% approximately.

Jayakrishna, et.al, (2018) investigated the behavior of regular and irregular eight storey RCC structure while using STAAD.Pro software when analyzed with response spectrum seismic analysis. The researchers considered all the seismic zone for their investigational study and compared the results of base shear, node displacement, moments and forces to conclude the final outcome of the study. It has been found out that the lateral displacement of regular building is less than the lateral displacement of irregular buildings. However, the base shear for both the structures was approximately the same. Therefore, the behavior of different shapes of the structures is different and it should be analyzed as per the guidelines.

Malviya and Pahwa (2017) compared the seismic analysis of high rise buildings when analyzed with the guidelines of old (IS: 1893-2002) and new (IS: 1893-2016) seismic code. For this, response spectrum seismic analysis was considered and G+50 storey building was modeled with plan size of 45 x 45 m and seismic zone 5. The researchers compared the displacement, bending moment of the structures analyzed with old and new seismic code. In the end, it was noticed that the values of displacement, shear force and bending moments were less for the structure analyzed with new code than the old code.

Abhinav, et.al, (2016) analyzed the 11 storey building with shear walls at three different locations i.e. corner, along the building periphery and in the middle and observed their behavior in resisting lateral forces and moments using STAAD.Pro software. Seismic analysis was done as per IS: 1893-2002 with seismic zone 5. The study was conducted to evaluate the safety of the structure against earthquake with shear walls at different locations. From the results of the study, it was observed that the shear walls at periphery is the most efficient location from all the three locations.

Atif, et.al, (2015) compared the bracing system and shear wall system for 16 storey building and invested their behavior in resisting lateral forces generated from the earthquake in seismic zone 2, 3, 4 and 5. The seismic analysis was done as per the specifications of IS: 1893-2002. A comparative study in terms of base shear, axial forces, moments and shear forces in columns and beams was conducted. The bracing system and shear walls were introduced at corners as well as at the periphery of the buildings. It has been observed that the location of these bracings and shear walls plays a significant role in resisting lateral forces, however, shear walls are more efficient in resisting earthquake forces than bracing system.

Mundada et.al, (2014) investigated the behavior of the structure and the beams in the presence of floating column while applying seismic forces. For this investigation, existing 8 storey residential building was selected and load distribution pattern along with the various other effects on the building due to the introduction of floating columns and struts were studied. The model was prepared in STAAD.Pro software and analyzed with static seismic analysis while considering various seismic factors. The researcher adopted three cases for the study: Structure with normal columns, Structure with floating columns and Structure with Struts. Total 10 locations were chosen for the floating columns as well as for the struts and it was observed that with the introduction of floating columns, the forces and moments were greatly increased in nearby beams and columns. However, with the introduction of struts in structure having floating column reduced the values of forces and moments and gives stability.

Mahesh and Rao et.al, (2014) compared the seismic analysis of regular and irregular multi storey structure in different seismic zones and type of soil using both STAAD.Pro and ETABS. In this study, the researcher took 12 storey building with regular and irregular configuration and observed the building behavior in terms of storey drift, node displacement and base shear. It was observed that the building with regular configuration produced more base shear and storey drift than the building with irregular configuration.

III. Conclusion

Seismic analysis for the multi-storey building plays an impeccable role to understand the behavior of the structure while designing. The behavior of each building entailing different shape, loads, number of storeys etc under seismic forces has different reaction and mode shapes. Many researchers in the past have carried their study and studied the seismic behavior of many different kinds of structure in STAAD.Pro and E-tabs software and made their conclusions. This paper studied the literature of multi-storey building analyzed in Staad.Pro or E-tabs when subjected to seismic forces and represented their findings.

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