STATIC AND DYNAMIC ANALYSIS OF HIGH RISE STRUCTURE - REVIEW

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Abstract: *Durability, Endurance, Efficiency and Stability are the qualities that the millennial and the others look forward or to seek when the load acts on a structure. The reality of controlling the seismic scale's is still an abstract dream for the Science. Engineers have gone into ruptures to study the kind of designs that prove to be ground efficient. The behavior of structure is studied under both the moving and static forces so as to prevent their collapse. The diverse view of possibilities is being considered while designing. A number of channels are there to determine the designing of a structure but STAAD pro has been proven the most accurate, precise and efficient which provides point by point description of the structure for both the analytical and dynamical design in which the structure is a multistory venture.*

Index Terms **– STAAD Pro, Static Analysis, Dynamic Analysis, RCC Buildings.**

I. INTRODUCTION

When a structure is subjected to certain forces, it behaves in a certain way and the mode of action is studied under the guideline of auxillary systems. The forces that ensure an impact include snow load, house hold object etc. Evaluavation of the reacting load is examined to speed up its connection with respect to its structure. Relative acceleration of the structure with respect to its natural frequency should be adequate enough to make a differentiating impact between static and dynamic analysis when the load is applied. During the seismic movements the basic security of the solid structure is of prime concern especially highly vulnerable seismic zones. The structure should be such so as to provide maximum well being and less damage and vulnerabilities. Building can possibly "wave" to and fro during a tremors. This often referred to as the essential mode and is that the least recurrence of building reaction. Most structures, be that because it may, have higher methods of reaction, which are exceptionally actuated during seismic tremors. By and by, the primary and second modes will generally reason the foremost harm by and enormous.The results acquired from static analysis are compared with the results acquired from Response Spectrum analysis.

Response Spectrum Method:

Representation of the response of the structures to ground acceleration where the peak value of a response quantity such as acceleration, velocity or displacement of an SDOF system as a function of natural periods T_n of the system with the particular damping ratio is plotted which represents the average response spectra of several ground motions. The damping in the structural system reduces the response. The maximum relative displacement is of importance as the stains in the structure are related to displacement, while the maximum relative velocity provides a measure of elastic energy imparted to the system, and the maximum relative acceleration directly relates to the seismic forces. All real structures are neither perfectly rigid nor perfectly flexible and so the response to ground motion is between these two extremes.

Equivalent Static Analysis:

All seismic load designs have to believe in the dynamic nature of the load. Be that as it may, analyzing comparable linear static techniques is usually adequate for easy regular structures. It assumes that the building responds in its fundamental mode.In many codes of practice this is often permitted for normal, low to medium-ascension structures. The applicability of this method is extended in many building codes by applying factors to account for higher buildings with some higher modes, and for low levels of twisting. It begins with an estimation of the base shear load and its transmission on each storey, determined by using recipes given in the code.

II. REVIEW OF LITERATURE:

V.Varalakshmi: The research includes the arranging and analysis of multi-storeyed G+5 structure at Kukatpally, Hyderabad, India. The Examination incorporates plan and analysis of column, beams, footings and, slabs by utilizing archived designing programming named as STAAD.PRO. Test on safe bearing limit of soil was resolved.

Naveen. G.Metal. (2016) Using ETABS 2015 and IS Code 1893:2002 (part 1), performed seismic analysis of 10 storey RC frame building with normal & irregular plan form by response spectrum process. Three models were considered for analysis, with one regular & two irregular. All the models are shaped differently but have the same area. The comparison was made by taking into account parameters such as overall storey displacement, storey drift, storey stiffness, mode times and frequencies during earthquake.

This was concluded that the higher frequency is due to irregular shape construction. Compared to irregular buildings, storey drift is highest in regular form structures. If the buildings have greater duration in the direction of earthquake movement than more would be affected. Store shear in the irregular structure of the building is higher than regular structure.

Verma S.K., Srivastava S., Zain M. (2017) Comparative study of static and dynamic high-rise building analysis with and without open ground storey. A multi-storied frame structure of (G+14) venture was used in this analysis. The building used design size was 19.23 m X 42.23 m and floor height was 3.3 m. Medium soil Type-II was used, as per IS-1893. Materials used for reinforcement were M-30 grade concrete and Fe-415 steel.
It was concluded that the difference in displacement values between static and dynamic analysis remains negligible for lower stories but the difference has increased in higher stories and static analysis has provided higher values than dynamic analysis including response spectrum method. The results of comparable static analysis proved to be approximately inexpensive, as displacement values are higher than those obtained in dynamic analysis. Also from the findings for both equivalent static analysis and an analysis of the response spectrum, study found that the displacement of the storey and the drift of the storey will be more along shorter spans.

Anupam Rajmanietal. (2015) Using STAAD-Pro software, carried out seismic analysis and wind analysis of 15, 30 and 45 story buildings with circular, rectangular, square and triangular plan form. Circular shape and triangular form have been concluded to be most suitable for maximum earthquake and maximum wind load for 15 story structure respectively. Rectangular shape is most stable for maximum earthquake in case of 30 storied house. In the case of 45 storied building circular shape & rectangular shape is most stable, respectively for maximum earthquake and wind load.

Manchalwar Setal. (2016) conducted a comparative study on 3 storey RC frame seismic analysis. Structure analysis was performed using equivalent static method and response spectrum approach to assess seismic loads using SAP-2000. This research has shown that the equivalant static method is simpler than the response spectrum method. Results obtained using analogous static method and response spectrum method using SAP-2000 have given almost the same values. The authors concluded that the findings of the Response spectrum approach are more reliable than those of ESM. The static analysis suggested is therefore not appropriate for high-rise buildings and dynamic analysis is required.

Mahdi T; Bahreini V. (2013) carried out work in five, seven and ten stories on the seismic behavior of three concrete intermediate moment-resisting spatial frames of unsymmetrical planes. In each of these three cases the structure's design configurations contain re-entrant corners. Those structures were analyzed using nonlinear static and linear dynamic procedures. The non-linear dynamic analysis was used to test the precision of those two methods. While the discrepancies with the nonlinear dynamic approach between the results of these two approaches are relatively broad, the linear dynamic analysis has been concluded to produce marginally better results than nonlinear static analysis.

Kim H.S; D.G. Lee. (2001) the impact of basements on seismic analysis of high-rise buildings has been considered. The basement is not included in the analytical model, and the building is usually believed to be fixed at ground level. The two structures type A and type B were used to carry out the seismic response of high rise structure with basement. All the sample buildings had 20 floors above ground level and the structural behaviour was examined by varying storey number from 1 to 5. Equivalent static analysis, analysis of the Eigen values, analysis of the response spectrum and analysis of the time history were carried out on all structures of the example. When the number of stores in the basement increased, the lateral stiffness decreased and the lateral displacements increased. When the number of storeys in the basement increased, natural vibration time periods became longer. The effect of the basement on seismic in structures with shear walls turned out to be more important. It was also observed that lateral loads influenced not only the response of the super structure but also the base structure.

Yajdhani S; Gottala A. Kishore K.S.N. (2015) performed a comparative study of a multi-storeyed building's static and dynamic seismic performance. G+9 (Rigid standard joint frame) construction is analyzed by STADD PRO. Equivalent lateral force method is used for static analysis and response spectrum method is used for dynamic analysis. Authors have concluded that the values for moments are 35 to 45 percent higher for dynamic analysis that the valued obtained for static analysis.There is not much different in the values of axial forces as obtained by static and dynamic analysis of the RCC structure. Column displacement values for dynamic analysis are 40 to 45 per cent higher than the values obtained for static analysis. Subject to seismic excitation, nodal displacement and bending moments in beams and columns display much higher values when compared to static loads.

Rao S., Ramanujam I.V.R. (2015), conducted a comparative study focused on static and dynamic analysis of seismic forces as per IS 1893-2002. In study , two buildings each located in the seismic zone and somewhere were modeled as spatial frames, using earthquake loads as member weights. Equivalent method of lateral loading was used in static analysis, while method of response spectrum was used for dynamic analysis. The first building consists of Stilt Floor + 11 floors (total 12 floors) and is 42.25 m high, standing on the hard soil stratum of Zone II. The 2nd building consists of basement + Stilt Floor + 11 floors (Total 13 floors) and is 42.70 m high, sitting on the hard soil stratum situated in seismic zone III to it. Concluded that the storey moments are high in Static Analysis (Seismic Coefficient Method) compared with the storey moments in Dynamic Analysis (Spectrum Response Method). The response spectrum optimizes the design, as the dynamic analysis values are lower.

P. Jayachandran: It has been discussed that the arranging and analysis of multi-storeyed G+4 building at Salem, Tamil Nadu, India. The investigation incorporates plan and examination of footings, column, beam and slab by utilizing two programmings named as STAAD.PRO and RCC Design Suit.

Dr. S.Suresh Babu (2015) study, he performed straight static analysis and dynamic analysis on multi-storeyed structures with plan irregularities for the assurance of lateral loads, base shear, storey drift, storey shear. The paper additionally manages the impact of the variety of the structure plan on the basic reaction building. A dynamic reaction under noticeable quake, related with IS 1893–2002(part1).

Md. Mahmud Sazzad (2015) conducted the seismic & wind analysis of 6 storey building with three different plan shapes i.e. rectangular with hollow space, modified cross shaped& L-shaped by computer-aided use Analyse & National Building Code of Bangladesh (BNBC),2006. The distinction was made in the light of Parameters like shear base, displacement & drift storey. It was concluded that rectangular with hollow space model is safest provided that all building conditions and form have significant impact in minimizing building drift.

Rahila Thaskeen (2016) In this study both symmetrical and asymmetrical structures are compared with anomalies in the plan. In the present study 4 types of structures with the same outer perimeter area are considered and validated by the addition of shear wall cores to determine the torsional impact on the structures. For structures G+12 and G+17 a simple linear comparison is also performed based on eccentricity. Structures with asymmetric mass and stiffness distribution undergo torsional motions during earthquake. The efficiency of the structures is assessed in IS 1893:2002 and ASCE 7-05 as specified by the procedure. Study it became evident that although the external perimeters of the structures (rectangular, L-shaped and C-shaped) were similar, major variance was found in the parameters of torsion that considered the asymmetry of the plane and the addition of rigid components.

Misam (2012)suggested that, in order to reduce the soft story effect on structural seismic response, shear wall be added to the building in different arrangements. It was found that shear wall position and numbering serve as an significant factor to displace the soft story structures during earthquake. So it shows that the use of shear wall in earthquake excitation is effectively reduced soft story impact on structure response. The vulnerability level of multi-story buildings is evaluated by examining the various configurations of the shear wall on the building and can also be useful for retrofitting the structure with minimal specifications, taking into account the level of activity and protection.

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Ambika (2017) In this paper they studied the momentum resistant frame with and without shear wall for different seismic zones. It was concluded that story drift and base shear of structure increases as we go to higher seismic zone, storey drift & base shear increases as the number of bays increases for the same zone, story drift and base shear for frame with shear wall is less compared to frame with frame with shear walls.

Yajdhani S Kishore (2015) studied a (G+9) Structure for both statical and dynamical analysis using STAAD pro and found that due to seismic excitation the nodal displacements and Bending Moments are greater in beams and columns to that due to static loads. The nodal displacements in Z directions are 51% higher for dynamic analysis than those obtained for static analysis. The column displacements are 43% to 47% higher for dynamic analysis than the static analysis. The values of Moment are higher for dynamic analysis as compared to the values acquired for static analysis. The twist estimates of columns are negative for static analysis and positive to that of dynamic analysis.

Amin Alavi. (2013) made an attempt to realize the seismic response of the structures, having re-entrant corners on high seismic zones for different positions of shear walls on RC buildings. Researchers researched a five-story building with six separate shear wall positions, treating both negative and positive X and Y directions as unintended torsion. The findings showed that the structures are more unstable when they become more irregular, and that the eccentricity between the center of mass and the center of resistance is more important to the structures' torsional activity during an earthquake.

III. CONCLUSION

Various scholars and researchers investigated on concept of seismic effects on structures over past decades which reveals the performance of a building/structure that is generally evaluated on basis of various performance parameters. Almost all researchers have used either pushover procedure or non linear dynamic time history analysis for the evaluation of concept.The performance is affected by Geometry of structure, type of material, ductility parameters, loading types and zones of earthquake. The information as assembled utilizing the software for the static and dynamic analysis is looked at for changed classifications under determined loading conditions.The review paper evaluates the major areas and subareas where structure analysis has been deployed and software commonly adopted.

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