ANALYSIS OF G+30 HIGHRISE BUILDINGS BY USING ETABS FOR VARIOUS FRAME SECTIONS IN ZONE IV AND ZONE V

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Abstract

From the ancient time we know earthquake is a disaster causing occasion. Up to date days constructions are fitting increasingly narrow and extra inclined to sway and consequently detrimental within the earthquake. Researchers and engineers have worked out within the past to make the constructions as earthquake resistant. After many functional reports it has proven that use of lateral load resisting methods in the constructing configuration has drastically increased the performance of the structure in earthquake by using ETABS 9.7.4, the work has been carried out for the distinctive instances utilizing shear wall and bracings for the exceptional heights, and maximum top regarded for the reward gain knowledge of is 93.5m. The modeling is completed to examine the outcome of special circumstances along with specific heights on seismic parameters like base shear, lateral displacements and lateral drifts. The gain knowledge of has been implemented for the Zone IV and Zone V in Soil Type II (medium soils) as targeted in IS 1893-2002.

Keywords- Lateral Load Resisting techniques, Response Spectrum system, Lateral Displacements, Drifts, Time period, Base Shear, Seismic Zone, delicate soil

Introduction:

From a structural engineer's factor of view the tall constructing or high upward thrust constructing (HRB) may be outlined in concert that, with the aid of virtue of its top, is affected by lateral forces given that of wind or earthquake or each and every to an extent that they play an awfully major function inside the structural type. Tall constructions have involved grouping from the beginning of civilization. The Egyptian Pyramids, one of the crucial seven wonders of world, created in 2600 B.C. [1] Amongst such old tall structures. Such structures were made for safeguard and to indicate pleasure. The system of urbanization that began with the age of industrialization remains to be ongoing in setting up nations like India. Industrialization motives migration of contributors to urban centers wherever job opportunities are critical. Rising the structural techniques of tall structures will management their dynamic response. A tall building can be outlined as a constructing whose design is dominated via the lateral forces prompted given that of wind and earthquake. On the way's aspect ten experiences, the lateral flow begins dominant the seam, the stiffness rather of force turns into the dominant problem. [2] Fully distinctive structural forms of tall structures could also be accustomed strengthen the lateral stiffness and to decrease the waft index. Glide in constructing frames would be a result of flexural and shear mode contributions, given that of the column axial deformations and to the diagonal and beam deformations, severally.[3]-[5]

Many Lateral resisting systems (comparable to introduction of body-wall, framed tube, belt truss with stabilizer, tube in tube and bundled tube programs) may be accustomed withstand the lateral plenty functioning on the constitution. This be taught seeks to understand the more than a few lateral techniques that have emerged and its associated structural behavior for soil kind three (i.e., smooth soil form) all advised 4 zones. [6] The more than a few types of bracings discipline unit presented in RCC constructing mannequin at regular location to understand the suitableness of the programs with relevance the seismic motions whereas alternative properties of the structural individuals within the building are stay constants love the scale of the columns, beams, bracings and thickness of slabs. Analytical modeling is finished in ETABS 2013 application system. [7]

In India most of the people approached towards the concrete structure instead of steel as they find concrete as convenient and cost effective in nature. But as India is becoming worlds second most populous country and the area is just limited then vertical hike is in the building construction is very necessary. so, for construction of this multistoried building steel can be a truly effective material in all engineering aspect. The use of steel as a core construction material is not yet become prevalent in India as it is in other developing where maximum construction both commercial and residential high-rise structures are being built of steel. [8] it is very stiff and they possess high strength to weight ratio which shows great integrity against the seismic loading. Now,

availability of steel is deeply in favor of Indian consumers as India became third biggest steel producer with 101.4MT per annum. The advancement in building, Information, modeling has integrated design, detailing, and fabrication of steel which will result in high performance under earthquake loading. This paper emphasized to prefer steel frame over the RCC as it perform far better than RCC under the seismic loading. [9]

Practical knowledge is an essential skill required by an engineer. By industrial training, the practical knowledge can be super imposed to technical knowledge. Industrial training is an essential component in the development of the practical and professional skills required by an engineer. For understanding the engineering practice in general and sense of frequent and possible problems that may arise during construction and also necessary solution for these problems can be experienced and understood during industrial training. This exposure to the practical world is the main objective of industrial training.

In this modern era of 21st century, as urbanization increases the availability of land is becoming less due to high population and cost of land is becoming higher. To overcome this problem the only solution is to prefer high rise structures. A high-rise structure is to designed to resist all lateral load. A high-rise building is a structure whose architectural height is between. When it has a minimum of 14 to 45 floors whether or not the height is known it is classified as high-rise structure. By the study of past earthquakes occurred in multistoried building shows that if they are not well designed and constructed with adequate strength it leads to the complete collapse of the structure. So, to acquire safety against additional deformations there is need to study of detailed considerations to design earthquake resistance structures. Generally structural engineers traditionally use linear static analysis to compute design forces moments and displacements of a structure resulting from loads acting on it. In wind design the building is subjected to a pressure on its exposed surface area, where as in earthquake design the building is subject to random motion of the ground at its base. Design for wind forces and earthquake effects are different. My present work is to study the behavior of a multi storied R C building subjected to earthquake and wind effects with and without P-delta effects. The building models in the study has sixteen storey's , twenty four and thirty two stories with constant storey height of 3m. Three models are used to analyze with different zone factors and wind effects. [10]

Dynamic actions are caused on buildings by both wind and earthquakes. But, design for wind forces and for earthquake effects are distinctly different. The intuitive philosophy of structural design uses force as the basis, which is consistent in wind design, wherein the building is subjected to a pressure on its exposed surface area; this is force type loading. However, in earthquake design, the building is subjected to random motion of the ground at its base, which induces inertia forces in the building that in turn cause stresses; this is displacement-type loading. Another way of expressing this difference is through the load deformation curve of the building – the demand on the building is force (i.e., vertical axis) in force-type loading imposed by wind pressure, and displacement (i.e., horizontal axis) in displacement type loading imposed by earthquake shaking. Wind force on the building has a non-zero mean component superposed with a relatively small oscillating component. Thus, under wind forces, the building may experience small fluctuations in the stress field, but reversal of stresses occurs only when the direction of wind reverses, which happens only over a large duration of time. On the other hand, the motion of the ground during the earthquake is cyclic about the neutral position of the structure. Thus, the stresses in the building due to seismic actions undergo many complete reversals and that to over the small duration of earthquake.

The increase in population by which land deficit occurs and to overcome that, high-rise buildings are opted. These types of high-rise buildings are affected by the natural calamities. Calamities like earthquakes are the most dangerous by means of the damage and chaos caused to the structural components and they cannot be controlled. These natural calamities caused property damage and interruptions in development of the normal lifecycle.

Methodology:

In the present study, analysis of G+30 multi-story building in all seismic zones for wind and earthquake forces is carried out.3D model is prepared for G+30 multi-story building using ETABS.

The present comparative study deals with equivalent static method for seismic analysis of G+30 frame structure for both RCC and Steel building. The analysis of both the building models is run in software ETABS2015. For the analysis the parameters like Story Stiffness, Time Period, Frequency, Base Shear, Lateral forces and Seismic weight are studied significantly for the loading. Seismic codes vary with every region across the country. In India standard criteria for earthquake resistant design of structures IS 1893(PART- 1):2002 is the main code which gives the idea about the seismic design force according to the various zones.

Methods of analysis of structure:

The seismic analysis should be carried out for the buildings that have lack of resistance to earthquake forces. Seismic analysis will consider seismic effects hence the exact analysis sometimes become complex.
However, for simple regular structures equivalent linear static analysis is sufficient one. This type of analysis will be carried out for regular and low-rise buildings and this method will give good results for this type of buildings. Dynamic analysis will be carried out for the building as specified by code IS 1893-2002 (part1). Dynamic analysis will be carried out either by Response spectrum method or site-specific Time history method. Following methods are adopted to carry out the analysis procedure.

- Equivalent Static Analysis
- Linear Dynamic Analysis
- Response Spectrum Method
- Time History Analysis
- Pushover Analysis
- Non Linear Static Analysis
- Non Linear Dynamic Analysis

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a. Equivalent Static Analysis
b. Response Spectrum Method
c. Time History Analysis.

Results:

The methods to be discussed are the response spectrum method and the linear time-historical past analysis. The first one is generally used because it applies to the predominant part of a seismic analysis fundamental for design reason. As soon as the structural mannequin has been selected, it's possible to perform evaluation to examine the seismically brought about forces within the structures. There are unique ways of analysis which provide special levels of accuracy. One of the largest earthquakes of the sector has passed off in India and the earthquake engineering tendencies within the country began rather early. After the 1897 Assam earthquake a new earthquake resistant type of housing was developed which continues to be typical in the northeast India. Seismic analyses of many of the buildings are still carried out on the groundwork of lateral (horizontal drive assumed to be equivalent to the precise (dynamic) loading. The bottom shear which is the whole horizontal force on the constitution is calculated on the basis of constitution mass and essential interval of vibration and corresponding mode form.
For every seismic zone the software gives six possible seismic load cases and two combination load cases i.e., maximum and minimum. The six possible load cases depend upon the loads acting on the structure.**:**

Table 1: BASE SHEAR

ZONES	BASE SHEAR (KN)
ZONE IV	1926
ZONE V	2889

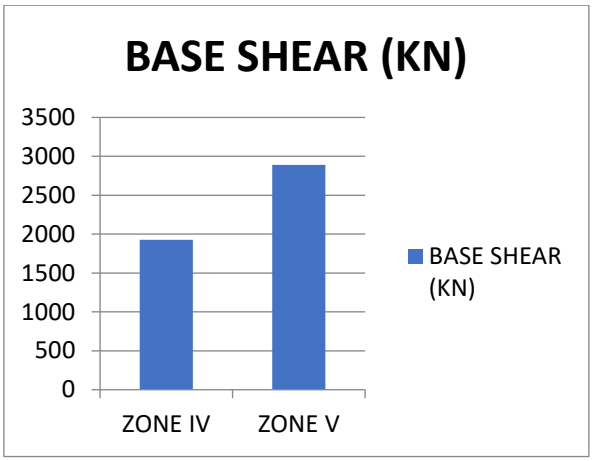

Figure 1: Graph for Variation of Base shear values For Different Zones of IV and V of INDIA

ZONE 5 RESULTS:

Table 2: STORY DRIFT IN X DIRECTION FOR TOP 10 FLOORS

STORY	LOAD CASE/COMBO	DIRECTION	DRIFT
Story 30	Seismic	x	0.000515
Story 29	Seismic	x	0.000681
Story 28	Seismic	x	0.000850
Story 27	Seismic	x	0.001008
Story 26	Seismic	x	0.001155
Story 25	Seismic	x	0.001290
Story 24	Seismic	x	0.001414
Story 23	Seismic	x	0.001528
Story 22	Seismic	x	0.001630
Story 21	Seismic	x	0.001723

Table 3: STORY DRIFT IN Y DIRECTION FOR TOP 10 FLOORS

STORY	LOAD CASE/COMBO	DIRECTION	DRIFT
Story30	seismic	y	0.000647
Story29	seismic	y	0.000835
Story28	seismic	y	0.001025
Story27	seismic	y	0.001008
Story26	seismic	y	0.001366
Story25	seismic	y	0.001516
Story24	seismic	y	0.001655
Story23	seismic	y	0.001780
Story22	seismic	y	0.001894
Story21	seismic	y	0.001997

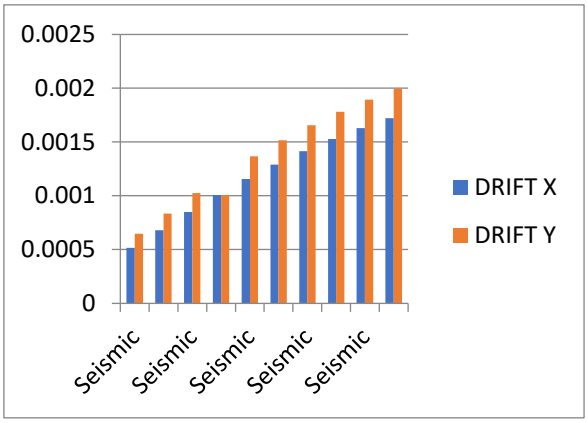

Figure 2: Comparison of drifts x and y of the structure in zone 5

ZONE 4 RESULTS

Table 3: STORY DRIFT IN X DIRECTION FOR TOP 10 FLOORS

STORY	LOAD CASE/COMBO	DIRECTION	DRIFT
Story30	seismic	x	0.000343
Story29	seismic	x	0.000454
Story28	seismic	x	0.000566
Story27	seismic	x	0.000672
Story26	seismic	x	0.000770
Story25	seismic	x	0.000860
Story24	seismic	x	0.000943
Story23	seismic	x	0.001018
Story22	seismic	x	0.001087
Story21	seismic	x	0.001149

Table 4: STORY DRIFT IN Y DIRECTION FOR TOP 10 FLOORS

STORY	LOAD CASE/COMBO	DIRECTION	DRIFT
Story30	seismic	y	0.000432
Story29	seismic	y	0.000557
Story28	seismic	y	0.000683
Story27	seismic	y	0.000801
Story26	seismic	y	0.000910
Story25	seismic	y	0.001011
Story24	seismic	y	0.001103
Story23	seismic	y	0.001187
Story22	seismic	y	0.001263
Story21	seismic	y	0.001331

BASE REACTIONS

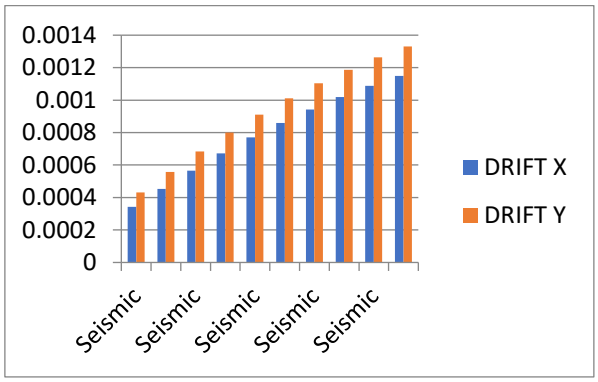

Figure 4: comparison of drifts x and y in zone 4

Conclusion:

In this paper we got the results from mathematical model for models. The graph clearly shows the story drift, story shear, support reactions. It is also observed that the results are more conservative in Static analysis as compared to the dynamic method resulting uneconomical structure in both zone4 and zone5.

i. The story drift increases from top story to bottom story in both zone4 and zone5 at story 31 the drift is maximum as compared to other stories.

ii. The zone5 has higher value of drift as we compared the drift values in zone4 and zone5.

iii. The story shear is maximum for the moments as we compared with the forces in all stories for zone4 and zone5. In zone5 has higher value of shear as we compared with zone4.

iv. The Z direction force for support reactions has maximum value as we compared with X direction and Y direction support reactions in zone4 and zone5.

v. The X direction moment for support reactions has maximum value as we compared with Y direction moment and Z direction moment in zone4 and zone5.

vi. The maximum value is occurs in zone5 than zone4 for forces and moments in support reactions

vii. Designing by Software's like ETABS reduces ton of your time in design work.

viii. Details of each and every member will be obtained by ETABS.

ix. All the List of unsuccessful beams will be obtained and conjointly higher Section is given by the software.

x. Accuracy is improved by using software.

References

1. Smith, R. and Will ford, M. (2007). The damped outrigger concept for tall buildings. The Structural Design of Tall and Special Buildings 16:4, 501-517

2. Will ford, M., Smith, R., Scott, D., and Jackson, M. (2008). Viscous dampers come of age. Structure Magazine, 6, 15-18.

3. Yang, J. N., Agrawal, A. K., Samali, B., and Wu, J. C. (2004). Benchmark problem for response control of wind-excited tall buildings. Journal of Engineering Mechanics, 130:4, 437-446.

4. Ramallo, J. C., Johnson, A. M., and Spencer, B. F., Jr. (2002). "Smart" base isolation systems. Journal of Engineering Mechanics, 128:10, 1088-1100.

5. Smith, B. S. and Salim, I. (1981). Parameter study of outrigger-braced tall building structures. Journal of Structural Division,

6, 2001-2014. 6. Smith, R. J. and Will ford, M. R. (2007). The damped outrigger concept for tall buildings. The Structural Design of Tall and Special Buildings, 16, 501-517.

7. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures" PHI Learning Private Limited, New Delhi, 2010.

8. Taranath B.S., "Structural Analysis and Design of Tall Buildings" McGraw-Hill Book Company, 1988.

9. Taranath B.S., “Wind and Earthquake Resistant Buildings Structural Analysis and Design” Marcel Dekker, New York, 2005. 10. ETABS 9.5, “Documentation and Training Manuals”.
10. IS 1893 (part 1): (2002), “Criteria for Earthquake Resistant Design of Structures Part General Provisions and Buildings”, Bureau of Indian Standards.