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# REVIEW ON SEISMIC ANALYSIS OF HIGH RISE BUILDING WITH IS-16700-2017

Dhvani M. Kantharia[1], Ass. Prof. Gunvant Solanki[2], Ass. Prof. Dimple Desai [3]

*[1]P.G. Student, Department of Civil Engineering, CGPIT, Uka Tarsadia University,*
*[2]Ass. Professor, Department of Civil Engineering, CGPIT, Uka Tarsadia University,*
*[3]Ass. Professor, Department of Civil Engineering, CGPIT, Uka Tarsadia University,*

***Abstract: Tall buildings are emerging constructions in Indian cities due to urbanization. In comparison to low and mid-rise buildings the design criteria for tall buildings are different. National building code and other Indian standard codes are not sufficient to adequately address various issues related to tall building. Recently, BIS released the Code IS 16700: 2017 "Criteria for Structural Safety of Tall Concrete Buildings" under CED-38 committee. In the design of tall building other parameters that need attention are; wind load analysis using wind tunnel test, P-Δ effect, secondary effect like creep & shrinkage, and temperature. In analysis for seismic loads few changes in comparison to IS 1893 part 1: 2016 are also reported. Modelling of the tall building and changes in the design considerations are listed. Criteria for selection of foundations are specified. The importance of non-structural elements is also specified and design guidelines based on the sensitivity of the elements are provided. In this code has given response spectra for Equivalent Static Method and Response Spectrum method separately for 6.0 s periods. Expressions are given for calculating design acceleration coefficient (Sa/g), for Equivalent Static Method and Response Spectrum method separately for Rocky/hard soils, medium soils and soft soils.***

***Keywords: Tall concrete buildings, IS 16700: 2017, IS 1893-2016, Code provisions, Design criteria, Non-Structural Element, Building monitoring, Response spectrum.***

## I. INTRODUCTION

Shortage of land in cities to accommodate the huge population migrants due to rapid urbanization can be compensated by vertical developments of cities with tall buildings. Tall buildings are the emerging construction practise in the developing countries like India. The design criteria for the tall buildings are different in comparison to low and medium rise buildings. In general, wind load is not the governing criteria in most of the low rise buildings, but for tall buildings wind is the governing criteria in most of the cases, however, based on the geographical locations and other parameters. Main objective of the present study is to expose the reader to the latest tall building design Code IS 16700 "Criteria for Structural Safety of Tall Concrete Buildings" which is developed by BIS CED 38 committee and released in December 2017. India is prone to strong earthquake shaking, and hence earthquake resistant design is essential. The Engineers do not attempt to make earthquake proof buildings that will not get damaged even during the rare but strong earthquake. Such buildings will be too robust and also too expensive. Design of buildings wherein there is no damage during the strong but rare earthquake is called earthquake proof design. The engineers do not attempt to make earthquake proof buildings that will not get damaged even during the rare but strong earthquake. Such buildings will be too robust and also too expensive. The aim of the earthquake resistant design is to have structures that will behave elastically and survive without collapse under major earthquakes that might occur during the life of the structure. To avoid collapse during a major earthquake, structural members must be ductile enough to absorb and dissipate energy by post elastic deformation.

## II. LITERATURE REVIEW

Following few researches of previous works which are based on,

**Gangisetty Venkata Krishna and Ratnesh Kumar[(1)]** was carried The selection of structural system and plan dimension are specified based on structural configuration and seismic zone. In the design of tall building other parameters that need attention are; wind load analysis using wind tunnel test, P-Δ effect, secondary effect like creep & shrinkage, and temperature. During past earthquakes it was observed that performance of the NSEs are poor. In order to achieve operational or immediate occupancy seismic performance level it is important to appropriately design non-structural elements otherwise even minor disruption such as lack of water or power supply can compromise the functionality of the building. In the literature it is recommended that when NSEs significantly affects structural response of the building, they shall be considered in design and modelling of the building. Acceleration sensitive, deformation sensitive and acceleration-and-deformation sensitive. The proposed importance factor (Ip) values for acceleration sensitive NSEs are on higher side as compared with available literature. For 'flat slab + structural wall' and 'framed tube' systems, maximum height and slenderness ratio limits for various seismic zones are not provided.

**Narayan Malviya, Sumit Pahwa**[(2)] were presented concerned with the study of seismic analysis and design of high-rise building. The structural analysis of high rise multi-storey storey reinforced concrete symmetrical and asymmetrical frame building is done with SAP software The Response spectrum analysis (RSA) of regular RC building frames is compare with Response spectrum analysis of regular building and carry out the ductility based design. as per IS 1893:2002 and IS 1893:2016. In the Maximum deflection is get low value to compare old code. Shear force value and bending moment get low value to compare old code 1893-2002.

**Prakash Channappagoudar1, Vineetha Palankar, R. Shanthi Vengadeshwari, Rakesh Hiremath**[(3),] presented one such computation where a building in Pune is taken into consideration for analysis with respect to wind loads for different number of floors. Analysis is done for both codes of IS 875(Part 3):1987 and IS 875(Part 3):2015 for different parameters affecting the stability of building. This paper also includes important points of IS 16700:2017 which takes both the previous codes of Wind and Earthquake into consideration and specifies a new code of conduct for design of tall buildings ranging from 50 – 250 meters. Comparison of Lateral Forces for Dynamic Analysis for Wind code of 1987 and 2015 for 27floors and 39floors shows that the lateral forces in the along direction has reduced in code IS:875(Part 3)2015 when compared to earlier code ,the columns under consideration, steel requirement in IS:875(Part 3)2015 is higher compared to IS:875(Part 3)1987. steel requirement in IS:875(Part 3)2015 is higher compared to IS:875(Part 3)1987. Time period increases as there is increase in height of the structure for 27 floors and 39 floors. Acceleration has to be limited to certain value such as the human is perceptible to that certain limit at that height of the building. Earlier codes had no clear definition and limit regarding this peak acceleration whereas IS:16700 2017 code "Criteria for Tall Buildings" limits the value of this peak acceleration to 0.15m/s2 for residential buildings. Hence here on the buildings that are to be constructed, should have peak acceleration limited to 0.15m/s2. Base Reaction study in the code IS:875(Part 3)1987 should be less than that of code IS:875(Part 3)2015.

**Prof. Kavita K. Ghogare, Dr. Abhinandan R. Gupta, Prof. Aparna R. Nikumbh**[(4)] done for behaviour of non-structural elements during an earthquake. Non structural elements of a building are not a part of the main load resisting system. Therefore, these are neglected from the structural design point of view. Many damages occurs in non structural elements. By definition, non structural earthquake damage is damage to components that are not structural. For example, a partition, which is non load bearing is non structural, while load bearing wall is structural. Use dynamic analysis method as per the conditions.Mostly single-degree-offreedom SDOF System is used. Maximum damages are due to the highest seismic force.

**Khuzaim J. Sheikh, Krutarth S. Patel, Bijal Chaudhari**[(5)] present on the response of the various structural system used in the buildings and its comparison. Four different structural systems were investigated, which includes Structural Wall + Moment Resisting Frame, Structural Wall System, Core Structural Wall system and Outrigger Structural System (Belt Truss System). 39 storey building having typical height 3.65m was considered. Moreover, Response Spectrum analysis and Static wind analysis were also performed and comparison of different structural parameters such as Base Shear, Storey Drift, and Storey Displacement were accomplished. The Response of tall building under wind and earthquake loading is studied as per IS codes of practice. Seismic analysis with response spectrum method and wind load analysis are used for analysis of G+39 storey RCC building as per IS 1893(Part 1): 2016, IS 875 (Part 3): 2015, and IS 16700: 2017 codes respectively. The building with slenderness ratio of 8.55 for G+39 storey was studied, which is within limits of slenderness give in IS 16700: 2017.The building with aspect ratio 2.46, which is less than 5 limits specified by IS16700: 2017.Different structural systems like moment resisting frame + structural wall system, Structural wall system, Core structural wall system and outrigger structural system are studied.

## III. CONCLUSIONS

All the above review concluded that the maximum drift limit equations for deformation sensitive NSEs are not provided. Response spectrum results show that acceleration against time is higher in case of revised code.Bending moment and shear force obtained with old code is higher than revise code. the combined effect of lateral forces acting along and across the wind direction is higher, hence giving a higher requirement of steel. Lesser lateral forces less will be the displacement, increasing the stiffness of the structure. Various methods of analysis are there. IS Code provisions for non structural elements are most important. Effects of non structural elements – on natural period of structural system, unsymmetrical arrangement of non structural walls, position of column and many more. Outrigger system shows very less displacement and drift in. it can be used if there is larger irregularity, which creates larger displacement and drift. It is also been moving further higher, structural core system will also shows larger displacement and drift, where outrigger will be seen as performing better.

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