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A Review Paper on Comparison of IS 1893 (part-1)2002 and IS 1893 (part-1) 2016

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Abstract - In India, Indian Standard Criteria for Earthquake Resistant Design of Structures (IS 1893 Part 1) provides the required clauses to structural designers for designing earthquake resistant buildings. Considerable improvement in earthquake resistant design has been observed in recent past. As a result of continuous research in earthquake engineering, gained knowledge & experiences, the IS 1893 Part 1 has been revised in year 2016 ,after a gap of 14 years. Previously its was revised in year 2002.This paper includes study on literature made on comparision of the mentioned IS codes.

Key Words: Analysis, Force, Earthquake, Earthquakes resistant structure ETABS, revised clauses, sesmic zones.

1.INTRODUCTION

Earthquakes are caused by tectonic movements in the Earth's crust. The main cause is that when tectonic plates collide, one over the other , causing earthquakes. Earthquakes are in form of waves i.e. seismic waves which spread outward in all direction from the source.

In order to prevent such damage of structures and to minimize the human hazard , seismic codes are prepared with consideration of seismology of country, accepted level of seismic risk, properties of construction materials, construction methods, and structure typologies etc. the provisions given in seismic codes are based on the observations, experiments & analytical case studies made during past earthquakes in particular region .In Indian practice IS 1893 (Part1) gives various criterias, provisions for Earthquake Resistant Design of Structures, so this is used as code of practice for analysis & designing of earthquake resistant buildings.

In the last decade, the detailed & advanced research, damage survey was carried out by the Earthquake Engineering Sectional Committee of Bureau of Indian Standards. As a result, the huge data regarding behaviour of various types of structures during earthquake was collected which gained the knowledge. This continuous effort has resulted in revision of IS 1893 (Part 1): 2002 . Hence the sixth revision of IS 1893 (Part 1) was published in 2016.

2. LITERATURE REVIEW

Many scholars and researchers had researched on the comparision on IS codes of privious version and on seismic analysis.An attempt had been made to study these literatures and conclude over this topic.

Azhar Bagadia et.al.[1] compared the response of industrial structure as per IS 1893-1984 with IS 1893 Part 4 -2005. The model of composite structure of RC framed building with steel roof truss was analysed in STAAD Pro software as per both mentioned codal provisions. The results showed that the displacement & base shear values given by analysis as per IS 1893 part 4-2005 are much less than that given by analysis as per IS 1893-1984.

Anil K. Chopra et.al.[2] this book includes the theory of structural dynamics and application of this theory to earthquake analysis, response and design of structures. This book concerned with the earthquake response and design of the multi-story building with dynamic analysis.

Dhiman Basu and Sudhir et.al.[3] studied and gave the seismic analysis of Asymmetric Buildings with flexible floor diaphragms, In this paper, the definition of center of rigidity for rigid floor diaphragm buildings has been extended to unsymmetrical buildings with flexible floors. A superposition-based analysis procedure is proposed to implement code-specified torsional provisions for buildings with flexible floor diaphragms. using the provision for the diaphragms provided in IS 1893:2002 .

Dr. H. Sudarsana Rao et.al [4] compared lateral forces calculated as per the provisions of IS 1893- 1984 & IS 1893-2002 for two buildings, one is of 12 stories in area which was in zone I but later on upgraded to zone II, & another building is of 11 stories situated in zone II. The STAAD Pro software was used for analysis of both case studies. Author concluded that the forces calculated as per IS 1893-2002 gave higher values than the previous version of building in zone I upgraded to zone II. The observation made that the base shear value as per revised IS 1893-2002 is higher for structures in zone II.

Inchara K P, Ashwini G[5] this includes study of the performance and variation in steel percentage and quantities concrete in R.C framed irregularbuilding in gravity load and

different seismic zones. And to know the comparison of steel reinforcement percentage and quantities of concrete when the building is designed as per IS 456:2000 for gravity loads and when the building is designed as per IS 1893(Part 1):2002for earthquake forces in different seismic zones. In this study five (G+4) models were considered. All four models were modeled and analyzed for gravity loads and earthquake forces in different seismic zones. ETABS software was used for the analysis of the models. According to their research, it can be inferred that support reactions tended to increase as the zone varied fromII to V, which in turn increased volume of concrete and weight of steel reinforcement in footings and in case of beams, percentage of steel reinforcement increased through zones II to V

K. Rama Raju, A. Cinitha & Nagesh R. Iyer [6]carried out a non linear seismic analysis of 6 storey building frame in SAP 2000. The building was constructed as per past code of practice. The four load cases given in IS 456 & IS 1893 were used for pushover analysis. The study of distribution of lateral forces for each load case, comparison of base shear & roof displacement is carried out. Authors observed a significant variation in base shear capacities and hinge formation mechanisms for four design cases.

Kalyan Chowdary Kodali et.al.[7] performed analysis of conventional beam slab and flat slab models. G+30 storey building model with shear walls are considered, which are subjected for different load condition. The seismic zone considered is Zone V. they concluded that, the time period of conventional beam slab is more when compared to flat slab. They found that storey drift of flat slab model is high when compared to beam slab model. Due to the higher drift ratios in flat slabs additional moments will develop. In such case the columns should be designed considering additional moments. in beam slab model base shear is more when compared to flat slab building.

Manu K V et.al.[8] done the study of characteristic seismic behavior of conventional RC frame building and flat slab buildings. They carried out the analysis using ETABS V9.7.4. They found out that lateral displacement is minimum at plinth level and maximum at terrace level, as number of stories increases lateral displacement also increases. Storey drift is minimum at plinth and top stories and maximum at middle stories, thus extra stiffness of column requires at middle stories compared to other stories. The natural period increases as number of stories increases. The base shear value is maximum at plinth level and minimum at terrace level, as total number of stories increases base shear increases.

Mohana H.S et.al.[9] **,** conducted the work of analysis of a both commercial multistoried building with flat slab and conventional slab for G+5. They compared the results for the parameters like base shear, storey drift, axial force, and displacement in all seismic zones of India. They got the results as storey shear of 5% more when compared to conventional slab type, the axial forces was found to be 6% more in flat slab. They also found out that storey displacement was differing approximately 4mm in each floor and for both flat slab and conventional slab structure.

Sumit Pahwa et.al.[10] carried out the study of flat slab with two way slab for comparative behavior values of various parameters using Staad Pro 2006. They created models for two-way slabs and flat slab without shear wall for each plan size of 16X24 m and 15X25m. They considered the models in the seismic Zones III, IV and V with the varying height of the above models such as 21m, 27m, 33m and 39m. After the modeling and analysis on the basis of results they concluded that the model of flat slab increases drift value in shorter plans and decreases drift in larger plans which is in the range of 0.5mm – 3mm.

Steven L. Kramer[11] deals with the initial basic concept of earthquake engineering, geotechnical engineering, seismology, and structural engineering. This book deals with the type of damage done by earthquake, measurement of ground motion, hazard analysis and methods for analyzing the ground response during an earthquake.

S.K. Ahirwar, S.K. Jain & M.M. Pande[12] studied a comparative study of seismic loads on four multi-storey RC framed buildings (3 storey, 5 storey, 7 storey & 9 storey) as per IS 1893- 1984 & IS 1893- 2002 codal recommendations. In this paper seismic coefficient, response spectrum & modal analysis methods were adopted to compute the seismic forces on these buildings. The conclusion includes comparison of lateral load & base shear for each building calculated as per both mentioned IS codes.

3.. CONCLUSION

From the above lieterature review study it can be concluded that, different scholars, researchers had studied IS codes of previous versions and comparative study also be done.Seismic anaysis done by different softwares such as STAAD. Pro, ETABS etc. Which are also combined with manual studies. Future opportunities of studying this type of research work is an of this review paper .

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