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A REVIEW ON A COMPARATIVE STUDY OF TYPICAL R.C. BUILDING USING IS-1893:2002 AND IS-1893:2016

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Abstract— The sixth revision of IS 1893 (part 1) : 2016, "Criteria for Earthquake Resistant Design of Structures" have been published by bureau of Indian standards. In reinforced concrete building, frames are considered as main structural elements, which resist shear, moment, and torsion effectively. The frames are subjected to various loads, where lateral loads are always predominant. The study focuses on the comparison of various clauses of new IS 1893 (part 1) : 2016 with respect to old IS 1893 (part 1) : 2002. The study helps in understanding main contributing factors, which lead to poor performance of structure during the earthquake. So as to achieve their safe behaviour under earthquake in future. An attempt is made to compare both standards using structural software.

Keywords— Earthquake resistant design ,IS 1893, comparison, structural software, lateral load

I. INTRODUCTION

Natural disaster such as Earthquakes, Tsunamis, Landslides, Floods etc. causes severe damages and suffering to human being by collapsing many structures, killing persons, animal hazards etc. Such natural disasters are big challenges to the progress of development. Civil engineers plays an important role in minimizing the damages by proper designing the structures or by proper construction procedure or taking other useful decisions.

India is prone to strong earthquake shaking, and hence it is necessary to design earthquake resistance structure. The Engineers do not attempt to make an earthquake proof buildings that will not damaged even during strong earthquake. Such buildings will be too strong and also to expensive. Earthquakes are defined as a vibration of the earth's surface that occurs after a release of energy in the earth's crust. The purpose of earthquake resistance design is to erect structure that perform better during seismic activity. 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 adsorb and dissipate energy.

II. LITERATURE REVIEW

[A] Mehul J. Bhavsar, Kavita N. Choksi, Sejal K. Bhatt, and Shrenik K. shah, "Comparative study of typical R.C. building using INDIAN STANDARDS and EURO STANDARDS under seismic forces", International Journal of Scientific and Research Publications (IJSRP), December-2014

Mehul J. Bhavsar, Kavita N. Choksi, Sejal K. Bhatt, and Shrenik K. shah, studied on comparison of typical R.C. building Using IS codes and EURO codes under seismic loads. In that they compared the different parameters or clauses of both the codes such as response reduction factor, drift, time period, base shear etc. This paper represents the performance of a multistoried building under lateral loading using INDIAN and EURO standards by means of computer tools.

This paper adopts two Indian standards and two Euro codes which are as follows:

Indian standards	Euro codes
1) IS 456:2000 - "code of practice for plain and reinforced concrete"	1) EURO CODE 2 (EC 2): Design of concrete structure
2) IS 1893 (part 1):2002- "Criteria for Earthquake Resistant Design of Structure"	2) EURO CODE 8 (EC 8): Design of structures for Earthquake Resistant

The comparison of such parameters such as response reduction factor, drift, time period, base shear etc. are carried out by using both standards under gravity loading as well as seismic loading. For comparison, a residential building of G+7 storey is taken as a reference. Important factor is taken as 1 which is same specified in both codes. Modelling, analysis and design of structure is done on ETABS software.

They observed that the variations in values of different parameters is dependent on the load combinations of both codes. And concluded that the design base shear as per IS 1893 is lower as compared to EUROCODE 8 because of higher value of response reduction factor. The allowable storey drift as per EUROCODE 8 is 1.5% while as per IS 1893 is 0.4%. Due to this maximum storey drift as per EUROCODE 8 is higher than IS 1893.

[B] Vinit Dhanvijay, Deepa Telang, and Vikrant Nair, "Comparative Study of Different Codes in Seismic Assessment", International Research Journal of Engineering and Technology (IRJET), July-2015

Vinit Dhanvijay, Deepa Telang and Vikrant Nair described the comparison of International standards. They chose the Eurocode, IBC (American Society of Civil Engineers) and Indian code i.e. IS 1893:2002 for the comparison. For comparison the structure of G+10 storey Special RC Moment-Resisting Frame (SMRF) is taken as a reference. The manual calculations are carried out and then Modelling of structure is done as per staad pro. V8i software. A comparative analysis is performed in terms of Base shear, Displacement, Axial load etc. for selected columns.
The purpose of this paper is to bring out the main contributing factors which lead to poor performance of multistoried building during the earthquake and to achieve adequate safe behaviour under future earthquakes. At the end, they concluded that, the calculated Base shear in X- direction, compared to Indian code, IBC shows 5.53% less base shear and Eurocode shown 38.52% more base shear. Displacement as per Indian code is maximum compared to other codes, displacement as per IBC is 42.44% less and Eurocode is 23.1% less value than Indian code. And axial force as per Indian code is maximum compared to other codes, Axial force as per IBC is less by 14.3% and axial force as per Eurocode is less by 8.52% as compared to Indian code.

[C] Sajid Ali khan, and R.V.R.K. Prasad, "A Comparative Study of Seismic behaviour on Multistoreyed RC Buildings by the Provisions Made in Indian and other International Building Codes", International Journal of Engineering Development and Research (IJEDR), 2016

Sajid Ali khan, and R.V.R.K. Prasad presented a paper on comparative study of the seismic provisions of Indian, American and Australian code. The structure being a Regular RCC framed building with Ground + Five Floors. The building is a residential building. The live load is taken as 2 KN/m^2. The dimension of building is 25.76 m X 16.63 m in plan (as shown in figure) and height is 18 m. The RCC frame is OMRF (Ordinary Moment Resisting Frame). They considered various seismic parameters for analysis. The analysis is done using Equivalent Static Method of analysis (ESM) in STAAD PRO software.

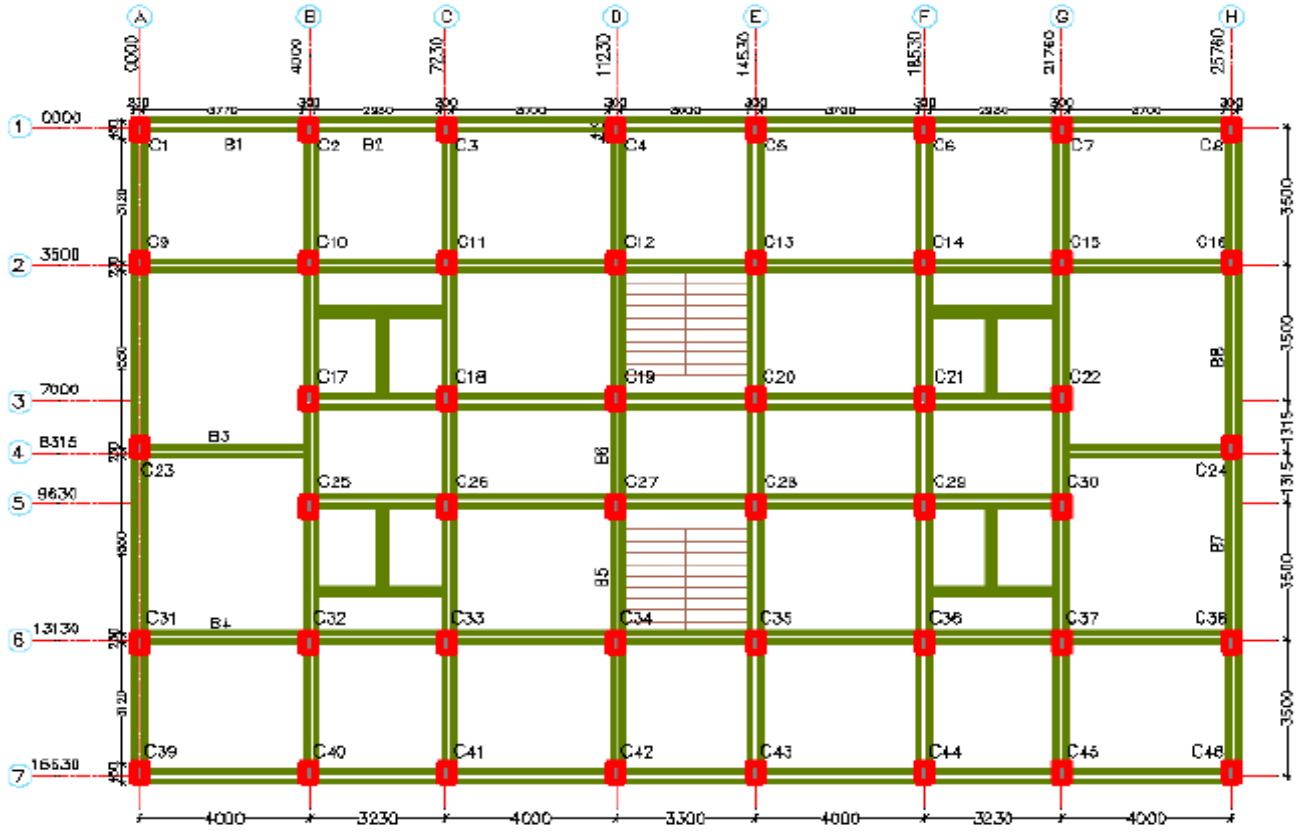

Figure 1 Typical layout of building

The values of Base Shear, Column's moments & axial forces, Beam's moments Lateral displacements and Storey drifts coming out from the analysis are compared for IS1893-2002, IBC-2006 & AS 1170-2007. From the analysis they concluded that, the value of base shear for IBC code is more than IS 1893 and AS 1170. Its value for IBC code is nearly double than that of IS 1893 and its value for AS 1170 is 70% than that of IS 1893, the values of Column moments for IBC code are nearly 150% for below plinth & Ground Floor, 130% for 2nd floor and 110% for top floor than that of IS 1893 and for AS 1170 its values are nearly 80 - 85% than that of IS 1893, the values of Axial Loads on Columns for IBC code are nearly 95% than that of IS 1893 and for AS 1170 its values are nearly 83% than that of IS 1893, the values of Beam moments for IBC code are nearly 125% than that of IS 1893 and for AS 1170 its values are nearly 80% than that of IS 1893, the values of Beam shear forces for IBC code are nearly 120% than that of IS 1893 and for AS 1170 its values are nearly 80% than that of IS 1893, the Lateral displacement and storey drift values are more in IBC code, the building design using IBC code would be more conservative than that of IS 1893 and AS 1170 codes, the area of steel required for the RCC members for IBC code would be more than that of IS 1893 and AS 1170 codes.

[D] Anupkumar S Karadi, B S Suresh Chandra, " ANALYSIS AND COMPARISON OF TALL BUILDING USING INDIAN AND EURO CODE OF STANDARDS", International Research Journal of Engineering and Technology (IRJET), August-2017

Anupkumar S Karadi, and B S Suresh Chandra carried out the detailed study on the comparison of Indian and EURO code of standards. They considered IS 456:2000 and IS 1893(part 1):2002 as an Indian standards and EC2 and EC8 as an European standards. They performed their research work by using ETABS 2016 software, the analysis work is done under static and dynamic loads on structure using Indian and Euro code of standards for a 30 storey building.
The site conditions are as follows: Soil profile: Medium-Soil, Location-Bengaluru, Seismic Zone-II, Zone factor-0.1, Wind Speed-33 m/s.

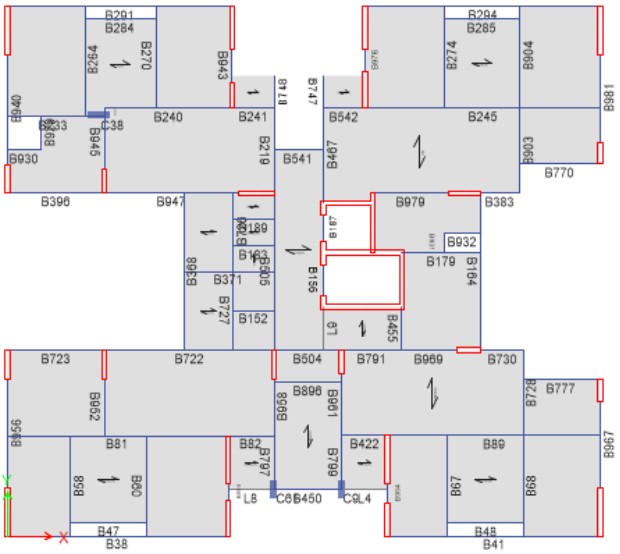

Figure 2 Typical layout of building

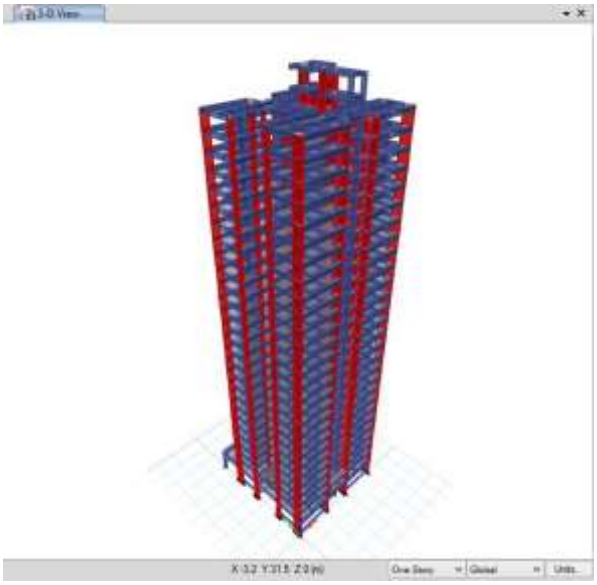

Figure 3: 3- D view of building

After done analysis on ETABS software they concluded that, In static analysis Bending moment, Shear force, Axial forces and Base design are reduced in Euro code based design values by 8-13% , Storey displacement is decreased by 22.5%. and in dynamic analysis, Design base shear calculated according to EC 8 is higher than IS 1893 by up to 60% on account of high values of response reduction factors specified by IS code. Due to higher design base shear, the storey displacement at top and storey drifts are high for Euro code based design, but these parameters are within the safe confinements specified by the codes. Percentage of steel for column as per Euro standards is relatively lower. It's because of higher values of modulus of elasticity of concrete specified by Euro code2 due to this the ductility of columns are enhanced by the concrete and axial force is less comparing to IS values because of low partial factor of safety for the dead loads. The minimum and maximum percentage of reinforcement for columns as per IS is 0.8% and 6% respectively, where as per EC 2 is 0.2 % and 4%. So, this also makes impact while giving minimum reinforcement.

III. CONCLUSIONS

From the study of above research paper it can be concluded that,

- Variations in values of different parameters such as response reduction factor, Base shear, axial force etc. are dependent on the load combinations of different codes.
- The lateral displacement and storey drift values are more in IBC code.
- The axial force is maximum as per Indian code as compared to the other codes.

IV. Scope of work

In this review paper, the various Indian codes compared with different countries codes for the analysis and design of R.C.C multi-storeyed building under seismic forces. The study of comparison of IS 1893:2002 and IS 1893:2016 can also made for the analysis and design of R.C.C multi-storey building under seismic load.

V. References

[1] Mehul J. Bhavsar, Kavita N. Choksi, Sejal K. Bhatt, and Shrenik K. shah, "Comparative study of typical R.C. building using INDIAN STANDARDS and EURO STANDARDS under seismic forces", International Journal of Scientific and Research Publications (IJSRP), December-2014

[2] Vinit Dhanvijay, Deepa Telang, and Vikrant Nair, "Comparative Study of Different Codes in Seismic Assessment", International Research Journal of Engineering and Technology (IRJET), July-2015

[3] Sajid Ali khan, and R.V.R.K. Prasad, "A Comparative Study of Seismic behaviour on Multistoreyed RC Buildings by the Provisions Made in Indian and other International Building Codes", International Journal of Engineering Development and Research (IJEDR), 2016

[4] Anupkumar S Karadi, B S Suresh Chandra, " ANALYSIS AND COMPARISON OF TALL BUILDING USING INDIAN AND EURO CODE OF STANDARDS", International Research Journal of Engineering and Technology (IRJET), August-2017

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