**A Review of Seismic Analysis of RC Structure using Different Countries Codes**

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**Abstract –**

The earthquake resistant structures will survive an earthquake with minimal damage to their structural components. To make a structure resistant to earthquakes, an engineer with sound knowledge of various seismic codes is required. Many academic and governmental researchers have worked and contributed their efforts for the evaluation of the various seismic codes.The analysis and design of various structures using the various codes was done by researchers. Seismic performance evaluation was performed by limiting parameters according to the provision of various codes.This article gives an overview of some articles published in international peer-reviewed journals around the world and gives a summary of articles found in the literature and articles comparing different international and national legislations.

**Literature review -**

**P.R.Bose and R Dubey et al. (1992)** In regards to earthquake provisions for RC framed structures, the counties had different approaches. The provisions compare are the Criteria for Seismic Resistant Design of Structures from 1981, NBC from 1985, and NZS 4203:1984 and 1988. The study compares the distribution of seismic shear along the height of buildings according to five different building code provisions.The results show that the seismic shear patterns obtained using dynamic analysis are similar among the five codes.

**F. Atique and Z.Wadud (2001**) Analysis of different regulations for seismic and wind analysis codes of different countries. 1993 (BNBC-93), Uniform Building Code, 1983 (NBCIndia-83). Bangladesh's location is in an active seismic zone. Established and validated building codes need to be updated to ensure the safety of structures and their occupants from natural disasters. Developed countries are increasing the safety factor against earthquakes by proposing higher base shear values. BNBC is the least conservative of our other norms and practices. Therefore, BNBC also needs to improve its domestic security.

**Dr. S.V. Itti and Abhishek Pathade (2002)** Analysis of the seismic design and analysis of the OMRF, IMRF, and SMRF in relation to the Indian Code (IS) and (IBC). The study compares the findings produced by the two codes, focusing on the variations in design base shear, lateral loads, drifts, and area of steel for structural members for all RC buildings. The findings of the comparison and analysis were then noted, along with any noteworthy differences. The study will be limited to RC buildings that were cast in one piece. Details of certain provisions are provided. The Indian and international building codes' provisions are noted. In SMRF IBC, the building's target deflection is accomplished with less lateral force. Less force and more deflection is the idea that is applied. In the Indian OMRF, IMRF, and SMRF

**Yuji Ishiyama andMarjan Faizian (2004)** It contrasts Iran, the International Building Code, and the BSLJ earthquake codes. Most seismic codes required designers to account for certain static lateral forces related to the structure and the area's seismicity. Formulas for base shear and the distribution of lateral pressures throughout a building's height are used to determine the fundamental natural period of the structure. Following the introduction, background information, and design process for the three codes, the base shear coefficient, seismic zoning, spectral content, fundamental period, behaviour coefficient, importance factor, and effect of soil profile are used in each code to calculate the seismic load. The variations have been described. After determining the seismic force, the distribution strategies over the building's height, as well as the torsion and Although these three codes differ in details, they have a lot of common features which can be compared. This comparison shows that the Iranian seismic code is very similar to the Americans but the Japanese code is considerably different from the other two codes.

**Adem Dogangunand Ramazan Livaoglu (2006)** In this design spectrum, the Eurocode 8, Uniform Construction Code, International Building Code, and Turkish Code are all compared. According to the report, earthquake codes now include improved ground motion, structure, and soil representations. Currently, changes are occurring more frequently than in recent years. One of the most significant adjustments made to seismic regulations is the layout spectrum. In order to examine and look at special reasons employing dynamic assessment and seismic verification of buildings, the unique code has been applied in several web sites. The short descriptions of the elastic or inelastic spectra provided by the code are shown in the fig. and table. This parameter, which is evaluated along with base shears, lateral displacements, intervals, and inner Storey driftsThe elastic or inelastic spectra described in short by the code by illustrated in fig and table. This parameter like base shears, lateral displacements, intervals and inner Storey drifts for analyzed business homes for defined soil type are relatively provided.

**Vijay Namdev and Khose (2010)** The ultimate goal of seismic or any design rules is to give instructions to designers and the minimum requirements for designs while maintaining safety and economy. Recent and prior earthquakes have shown that, because findings are often cleared up after an earthquake, buildings built to seismic design requirements are not always safe. As a result, it is required to periodically update the codes. The most recent state of the art, structural engineers' comprehension of it, and national building practises are all taken into account while amending codes. In comparison to other countries' seismic design codes, the Indian seismic design codes IS 1893 (Part 1): 2002 and 13920: 1994 are traditional and out-of-date in many respects.. This paper shows the limitations of the present IS design code and proposes some topics for updating according to the current condition and requirements.

**Imashi and Massumi (2011)** examined the earthquake forces determined in accordance with each (IBC 2003) and inside the Iranian Seismic Code utilising the linear static analysis approach (IS 2800-05). Both codes were used to determine the vertical distribution of base shear at the storey stage and the layout base shear of a building using a combination system (special moment metal frames + eccentric bracings) in 4 specific soil types. The results demonstrated that the two codes differed significantly from one another. For all types of soil profiles and seismically active locations, shear pressure values were higher in IS 2800-05 than in IBC 2003. Lateral force distribution within the constructing peak confirmed that distribution sample changed into distinctive most of the codes. According to IS 2800-05, the pressure distribution at the peak was linear for all systems and all durations, but a further force was applied to the top floor of long-term houses. For all systems with a length longer than 0.5 seconds, the vertical force distribution in IBC 2003 became parabolic because no additional force was taken into account. The Storey go with the flow issue according to structural device kind and important thing cost was supported by the IBC2003. The Storey waft barrier in IS 2800-05 was only designed for the primary era of the form. As a result, there is a desire to examine IS 2800-05 and develop more suited relationships while looking for beneficial and profitable goals.

**Landingin J and Rodrigues (2012)** a review of earthquake regulations. Comparisons are made between the American, Euro, and Philippine codes. the typical residential building sizes for regular occupancy. For four-story building types, regular and irregular reinforced concrete frames were examined and contrasted. The NSCP 2010 seismic characteristics and response spectrum were taken into account. However, the horizontal load actions using various load combinations have been completed. However, the horizontal load actions using various load combinations have been completed. Using the SAP2000 software package, response spectrum analysis and comparable lateral force analysis were carried out. For each RC frame structure, five representative columns were examined. In comparison to NSCP 2010 and 2009 IBC, EC8 was deemed to be cautious based on the results of the column axial load. The conclusion is that EC8 requirements were deemed to be safer for the design and analysis of typical RC residential buildings with some irregularity.

**S.H.C.Santos and Carmen Bucur et al. (2013)** comparison research seismic norms based on European and American codes. This standard is used to analyse typical buildings and is described in the paper. The study primarily focuses on a few important issues It outlines each input needed to determine the recurrence period, seismic zone, form of the design response spectrum for a given soil condition, and seismic force resisting system modification coefficients. For the purpose of comparing different regulations, a model for a typical reinforced concrete building that includes both residential and commercial space has been created. The building has been modeled with two different software SAP2000 and SOFISTIK. This model subjected to seismic input according to the several seismic codes.

**BariandDas(2014)** conducted a comparison between (BNBC), (NBC-India 2005), and (ASCE 7-05). This analysis provides information on the need for earthquake protection. When the various parameters of BNBC 2010 were compared to those of BNBC 1993, NBC-India 2005, and ASCE 7-05 from research, it became clear that BNBC 1993 had the least base shear of all the codes. For modest upward push homes, the bottom shear as per (BNBC 2010) was shown to have significantly improved over that of (BNBC 1993). However, BNBC 2010 is somewhat closer to NBC-India 2005 and has a substantially lower base shear price for low-story dwellings than (ASCE 7 05). Therefore, the more important concern of earthquake protection provided by BNBC

**Pamela Jennifer J P and Jegidha K J (2015)** research of earthquake-related seismic design behaviour. It focuses on the structural elements' yielding and inelastic behaviour, which is specifically described to display such behaviour during earthquakes. In order for the building to respond elastically to earthquakes, it is constructed with moderate strength. Ground motion is produced during earthquakes, and to withstand that motion The multistory RC building has undergone seismic design. An engineer needs to be well-versed in the different seismic design regulations in order to eliminate the additional risks that can arise during an earthquake in order to build an earthquake-resistant construction. In this essay, the literature from diverse study projects was examined. These publications provide greater details regarding the static and dynamic analyses performed on different kinds of structures. The time required for seismic analysis and the number of mistakes made in the structure's study and design will both decrease with the usage of software. The seismic performance of the structure was assessed by the researchers using codes from different nations. This article looked at a number of characteristics, including displacement, base shear, storey drift, duration, axial force, and bending moment. The seismic design of multi-story buildings employing different codes has attracted interest as a way to determine whether codal provision provides a very effective design to perform well during earthquakes.

**Dhanvijay and Telang et al. (2015)** When examining the poor performance of construction at some point in an earthquake, the standards of (Eurocode8), (IBC (American Society of Civil Engineers), and (IS 1893:2002) were taken into consideration. The STAAD Pro. V8i programme transformed the geometry into a G+10specialRC moment-resting frame, and laterally seismic forces were manually calculated in accordance with certain codes. For columns as well as for displacement, shear Y, torsion, and second Z of beams on each floor, a comparative evaluation was accomplished in terms of (base shear), (displacement), (axial load), and (moments in Y and Z) path. The inference was made that base shear in the X direction was 5.53 percent less and 38.5 percent more in accordance with IBC and Eurocode8, respectively, than Indian code, while in the Z direction, IBC validated a 5.8 percent lessening.

**Karthiga and Titus et al. (2015)** used four international building standards—IS1893, Euro Code 8, ASCE7-10, and the British Codes—to assess and design a residential structure (Ground+10) for seismic effects. STAADProV8i was used for the construction comparisons. then created in accordance with the needed codes. Pushover analysis in SAP2000 was used to assess the building's seismic performance. The base shear was excellent and in accordance with Indian law. British requirements had 12.25% less base shear than Indian requirements, American requirements had 11.10% less base shear, and Euro requirements had 3.05 percent less base shear. The displacement happened when what was once in line with Indian standards was no longer as in line with other codes. This study suggests that the Indian layout was less expensive than the Euro requirements.

**Khan and Prasad (2016)** considered residential structure G+ 5 storey as a reference and compared the seismic behaviour of multistory RC building employing regulations made in Indian code, IS 1893 2002, American code, IBC 2006, and Australian code, AS 1170 2007. In particular, the design base slip, lateral loads, drifts, and area of steel for structural parts of Reinforcements structures are discussed in this paper as being distinct in the results obtained utilising three codes. STAAD Pro software was used to model the common moment-resisting frame and run an equivalent static method analysis. According to the IBC code, the design base shear was more than that of IS 1893 and AS 1170. Its AS1170 value was 70% of IS 1893, and its IBC code value was around twice that of IS 1893. When compared to IS 1893, the Column moments for IBC code were over 150% higher for below plinth and ground level, 130% higher for second story, and 10% higher for top floor, while for AS 1170, the values were nearly 80-85% higher. IBC code and AS 1170 had lower axial loads on columns than IS 1893. For the IBC code, the beam moments and beam shear forces were almost 120% of IS 1893, but for AS 1170, they were roughly 80% of IS 1893. The parameters for storey drift and lateral displacement were more in line with IBC standards. It also showed that utilising the IBC code will make building design more efficient.

**Indumathi and Saravanan (2020)** examined the performance of a G+9 RC frame structure that was severely affected by seismic forces. The RC structure was created in accordance with IS 1893: 2002, and seismic lateral loading was then examined using ETABS 2013 in accordance with IS 1893: 2002, ASCE 7-10, NZS 1170-2004, and EUROCODE 8-2004. Maximum storey displacement in 3D frame structure for Indian, American, New-Zealand, and European Standards loads, stiffen columns in soft first storey, and infill wall at corners of soft first storey, respectively. Similar findings were obtained in a 2D frame using maximum storey displacement and maximum storey drift. Therefore, using infill walls at the corners of the first storey's soft floor provides strong lateral resistance. In addition, Base Shear data for Indian, American, New Zealand, and European Standards were compared.

**Kamaldeep Kaur and Jaspal Singh (2021)** A comparison between the variant designs codes provided by various studies was done. They evaluated the building's seismic resistance and used numerous codes to create it. Different methods for analysing seismic forces, including the RS method, pushover analysis, equivalent static analysis, etc. using various codes, produced a variety of results. This comparative study aids in evaluating the code used for seismic design and structural analysis that is both affordable and trustworthy. Previous researchers used a different code to compare the displacement, shearY1, axial load, and moments in the Y and Z directions for columns as well as the displacement, shearY1, torsion, and moment Z of beams on each floor. The structure was created with consideration for Euro code C.

 **Conclusion**

# According to a review of the literature, numerous research comparing different types of codes, such as OSC, 1997 UBC, 2006 IBC, AS1170, IBC 2006, Eurocode8, and Indian code 1893:2002, have been conducted. However, utilising the Etabs 2103 programme, differential analysis and modelling of three different size RC frame structures with various standards, including IS1893-2002, ASCE-7-2002, and NZS1170.2004, have not been carried out. Therefore, with the aid of ETAB 2013, it may be analysed and represented in the form of a graph and table. A small number of surviving works are also examined using the time history method together with combined earthquake, wind, and snow loading.

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