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Seismic Analysis and Comparison Of Is 1893:2002(Part-1) and Is 1893:2016(Part-1)

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Abstract- This study as a whole makes an effort to evaluate the effect of plan irregularity on RC buildings using IS 1893:2002 and IS 1893:2016 in terms of dynamic characteristics. Considerable improvement in earthquake resistant design has been observed in recent past. As a result, Indian Seismic code IS 1893 has also been revised in year 2016, after a gap of 14 years. This paper presents seismic load estimation for multi-storey buildings as per IS:1893-2002 and IS:1893-2016 recommendation. The scope behind presenting the project is to learn relevant Indian standard codes are used for design of various building elements such as beam, column, slab, foundation, and staircase using software STAAD-PRO.

Keywords- Seismic Analysis, STAAD-PRO, Comparison between IS 1893:2002 & 2016

Objective :

1. **To study IS 1893 – 2002 and IS 1893 – 2016 for the difference introduced in new code.**
2. **To design and analyse G+10 building structure by using IS 1893-2002 and IS 1893-2016**

To compare analysis result of 1893-2002 and IS 1893-2016.

I. INTRODUCTION

During an earthquake, failure of structure starts at points of weakness. This weakness arises due to discontinuity in mass ,stiffness and geometry of structure. The structures having this discount inuity are termed as Irregular structures. But nowadays need and demand of the latest generation and growing population has made the architects or engineers inevitable towards planning of irregular configurations. Hence earthquake engineering has developed the key issues in understanding the role of building configurations.For the design of any structure, we have to consider the earthquake load for structural safety during major earthquakes. In recent earthquakes so many reinforced concrete structures are damaged, it indicates the assessment of the seismic behavior of structures is how important. So everyone must have to design a satisfactory level of safety is a concern.

The main objectives of this study are the seismic performance of RC frame building. Also, conduct static analysis and dynamic analysis has been surveyed. A structural frame modeled as (G+10) storied residential building frame. The storey plan changes for regular and irregular building in floors. The models are to be analyzed in both static and dynamic methods based on IS codes: The storey displacements, base shear, and frequency, Time period in the response spectrum analysis are compared. The study on 6 storied RC frame building model and is analyzed using the software STAAD-PRO.2016. The static analysis is then performed for the modeled RC frame building using the computer software STAAD-PRO.2016. Five mockups are generated with this plan of the building by presenting different variation and displacement, story drift, base shear and story shear are the various considerations1. The study which involves earthquake analysis of RC frame (ten stories) building with different models that include a bare frame ,incomplete frame and open first storey frame. The parameters such as base shear, time period, natural frequency, storey drift and bending moments are studied, the building model was analyzed using STAAD-PRO.2016.

II.METHODOLOGY

1. Adopt the equivalent static and response spectrum technique to analyse the model for study and observe lateral displacement in various zones.
2. The (G+10) storey building is modeled frame. The performance equivalent static and response spectrum method in ZONE-III and base shear, lateral displacement are compared in both methods.
3. Forces and displacement due to each horizontal component of ground motion are separately determined by analysis of idealized building having one lateral degree of freedom per floor in the direction of ground motion component being considered.
4. Such analysis can be carried out by equivalent static procedure(Static method) or response spectrum analysis procedure (Dynamic method).
5. Both procedure leads directly to component The significant difference between linear static and linear

dynamic analysis is level of force and their distribution along height of structure.

6. For this study, seismic analysis is carried out by linear static analysis and response spectrum analysis.

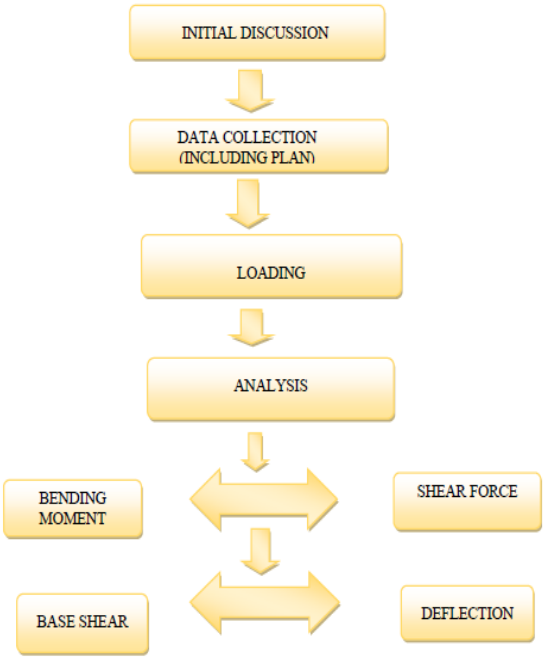


Fig. 1 Flow Chart of Methodology.

In seismology, a seismic zone or seismic belt is an area of seismicity potentially sharing a common cause. It may also be a region on a map for which a common areal rate of seismicity is assumed for the purpose of calculating probabilistic ground motions. An obsolete definition is a region on a map in which a common level of seismic design is required. Seismic zones in Indian subcontinent is divided into four seismic zones (II, III, IV, and V) based on scientific inputs relating to seismicity, earthquakes occurred in the past and tectonic setup of the region.

Previously, earthquake zones divided into five zones with respect to the severity of the earthquakes, but Bureau of Indian Standards [IS 1893 (Part I):2002], has grouped the country into four seismic zones.; the first and second seismic zones were unified.

The bureau of Indian standards is the official agency for publishing the seismic hazard maps and codes. It has brought out versions of seismic zoning map: a six zone map in 1962, a seven zone map in 1966, and a five zone map 1970/1984.

1. Seismic Zone II

Area with minor damage (i.e., causing damages to structures with fundamentally periods greater than 1.0 second) earthquakes corresponding to intensities V to VI of **MM** scale (MM - Modified Mercalli Intensity scale). It covers the areas which are not covered by other three seismic zones discussed below.

2. Seismic Zone III

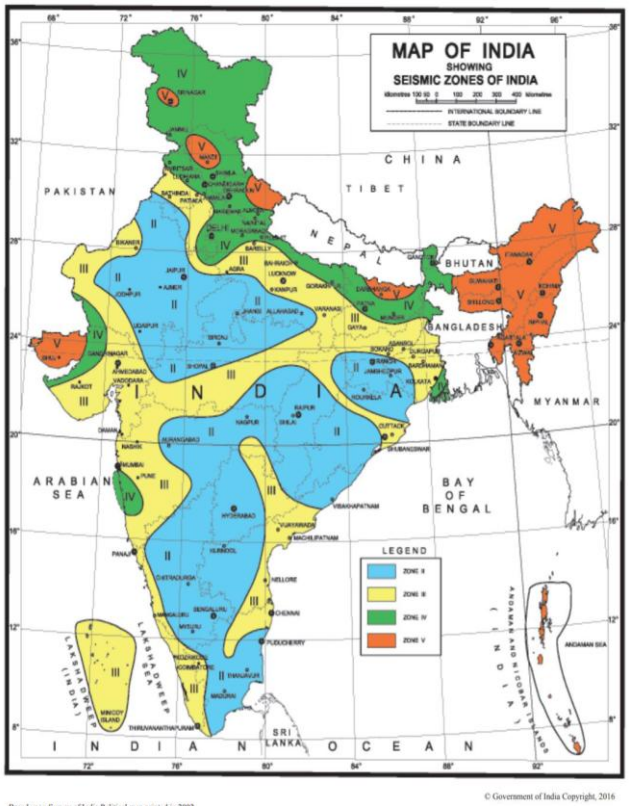
Moderate damage corresponding to intensity VII of **MM** scale. It comprises Kerala, Goa, Lakshadweep islands, remaining parts of Uttar Pradesh, Gujarat and West Bengal, Parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Orissa, Andhra Pradesh, Tamilnadu and Karnataka.

3. Seismic Zone IV

Major damage corresponding to intensity VII and higher of **MM** scale. It covers remaining parts of Jammu and Kashmir and Himachal Pradesh, National Capital Territory (NCT) of Delhi, Sikkim, Northern Parts of Uttar Pradesh, Bihar and West Bengal, parts of Gujarat and small portions of Maharashtra near the west coast and Rajasthan.

4. Seismic Zone V

Area determines by pro seismically of certain major fault systems. It is seismically the most active region, and comprises entire northeastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Rann of Kutch in Gujarat, part of North Bihar and Andaman & Nicobar Islands. Earthquake zone V is the most vulnerable to earthquakes, where historically some of the country's most powerful shock have occurred. Earthquakes with magnitudes in excess of 7.0 have occured in these areas, and have had intensities higher than IX.



Comparison of IS : 1893-2002 & IS : 1893-2016 :

	IS 1893:2002	IS 1893: 2016
1	Importance Factor(I)(C.I 6.4.2) Importance factor 1.5 was for Important structure and 1.0for all other building	Importance Factor(I):(C.I 7.2.3) For Residential or commercial buildings, with occupancy more than200 person importance factor 1.2 has been assigned in new code
2	Moment of Inertia(I): Clause regarding moment of inertia is not mentioned in old code. Thus analysis is made considering full moment i.e is un cracked section is considered	Moment of Inertia(I):(C.I 6.4.3.1) The moment of Inertia for structural analysis shall be taken as given below For RC and Masonary Structure: Ireq=70% for column. Ireq=30% for beam
3	Torsion irregularity:(C.I .7.1) Table-4 torsional irregularity As per old code is $\Delta 2>1.2(\Delta 1+\Delta 2)/2$	Torsion irregularity:(C.I .7.1) Table-5 torsional irregularity As per new code is $\Delta max>1.5\Delta min.$ when $\Delta max>(1.5\text{-}2.0)\Delta min.$ configuration shall be revised.
4	Soft story(C.I.4.20) A soft story is defined as the story in which the lateral stiffness is less than 70% of that in the story above,or less than 80%of the average lateral stiffness of the three storey above.	Soft story(C.I.4.20) A soft story is defined as the storey in which the lateral stiffness is less than that in the storey above.
5	Weak story(C.I.4.25) As per old IS1893(part-1)2002,a weak storey is defined as the storey in which the lateral strength is -less than `80% of that in the storey above.	Weak story(C.I.4.20.2) As per new IS1893(part-1)2016,a weak story is defined as the storey in which the lateral strength is less than that in the storey above.
6	Dynamic Analysis Require(C.I.7.8.1) For regular building : zone-IV,V-height>40m zone-II,III-height>90m For irregular building : zone-IV,V-height>12m zone-II,III-height>40m	Dynamic Analysis Require(C.I.7.7.1) Equivalent static analysis shall be applicable for regular building with height <15m in seismic zone II[C.I.7.6 and C.I.7.7.1] Equivalent static method should be used for regular building structure with approximate natural period is less than 0.4sec.[C.I.6.4.3]
7	Increase in allowable soil pressure cI.6.3.5.2 when earthquake forces are considered , increase in allowable pressure in soil for different types of soil (Type-I,II,III)and different types of foundation ,etc. was given in table-1 from 25%-50%.	Increase in net pressure on soil in design of foundation C.I.6.3.5.2. New code IS1893(part-1)2016,gives percentage increase in net bearing pressure and skin pressure for soil types A,B,and C as 50%,25%and 0% respectively in table -1. For soft soil no increase in bearing pressure shall be applied because , settlement can not be restricted by increase bearing pressure.

III.CONCLUSION

1. Study concludes that seismic analysis as per guidelines of IS 1893:2016 shows higher value of base shear than as per IS 1893:2002
2. Also maximum lateral displacement in horizontal direction shows large value by response spectrum method as per IS 1893:2016.

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