



Review of Earthquake Resistant Structure in India

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ABSTRACT

Earthquake is one of the most destructive natural disasters. They are the intuitions of changes in the earth's crust. They not only destroy the areas where it occurs but they affect the overall economic stability of the country. It affects the society at large. It needs time to look for a solution to keep our structures safe from such disasters. No such technique is developed till now to have 100 % protection against earthquakes. But with the aid of the Earthquake Resisting structure, it is possible to minimize the loss. This paper aims to review the design considerations in earthquake-resistant structures.

Keywords: Natural Disaster, Earthquake Resistant Structure

1. Introduction

Natural Disaster is undesired happenings and it affects human life adversely. Remedial actions are also taken to mitigate the disasters. The disasters are of several types like drought, floods, storms, tsunami earthquake, etc. Among these natural disasters earthquake is very common. Around the world, more than 1 million such incidents take place in a year. It majorly affects urban areas. Because of this millions of deaths occurred in the whole world. The increase in urbanization in the seismic area and the increase in population leads to such disasters. Not only earthquakes but unsafe structures are a major threat to human life. With the view of major loss of human life, properties, and structure, lots of studies are going on throughout the world in the domain of earthquake-resistant structures.

1.1 Earthquake

An Earthquake is a series of shaking at the earth's surface produced due to the sudden release of energy by movement along a fault. Figure 1 illustrated the types of earthquakes. Fig. 2 illustrates a seismic map of India.

The other factors responsible for earthquake generation are as follows:

- Major Explosions
- Landslides
- Volcano's etc

The earthquake is classified as:

- Collapse Earthquake
- Explosive Earthquake
- Volcanic Earthquake
- Tectonic Earthquake

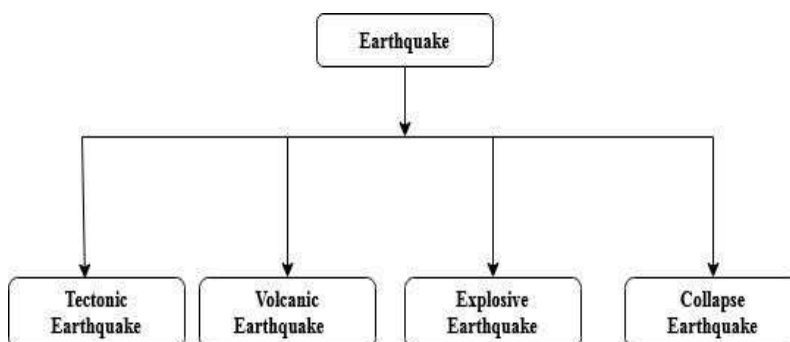


Fig. 1 – Types of Earthquakes.



Fig. 2 – Seismic Map of India.[3]

2. Literature Review

Akshay R Kohli et. al (2017) presented a STADD Pro software model for earthquake-resistant structures. Live Load, Dead load, and wind load analysis are presented. Both static & dynamic analysis is presented for concern structure. This software base model can be implemented in practical design consideration. [4]

Aman Kumar et. al (2017) discussed a critical review of 2 techniques of retrofitting i.e. base isolation method, tuned damper mass method, etc. Through results, it is expressed that, TMD structures are more efficient. [5]

G.B. Ramesh Kumar et. al (2018) discussed the basics of earthquake-resistant structures & intensity-wise analysis of earthquakes occurs so far. Several load types are also discussed. At last importance of Indian design standards and software applications in such type of design is presented.[6]

Katta Venkataramana et. al (2018) discussed the necessity of earthquake-resistant structures followed by building typologies and earthquake-resisting construction practices. At last future trends are discussed.[7]

Deepesh Panchal et. al. (2019) highlights the importance of earthquake-resistant building through a global-level review of test & findings done by researchers & suggest solutions to get rid of such disasters. [8]

Pooja Lonare et. al. (2019) represented the applications of various software like STAAD PRO, E-TABS, AutoCAD, etc in the design & planning of earthquake-resistant buildings.[9]

Dinesh Kumar et. al (2019) represented the latest trends in earthquake-resistant construction. They also discussed new structural systems & materials for earthquake-resistant structures. At last, they highlight the importance of an active control system. [10]

Sanjivan Mahadik et. al (2020) highlight the different techniques for increasing the resistance of seismic structures. Such techniques incorporate the usage of base isolation, shear walls, etc. In the end, they conclude that if we collaborate with these technologies the damage due to earthquakes can be reduced. [11]

Gauri Kolhapuren et. al. (2021) presented a study of the seismic analysis of medium rise structure for static and dynamic analysis in ordinary moment resisting frame (OMRF) and special moment resisting frame (SMRF). They presented a study of residential buildings & conclude the importance of resisting frame structure. [12]

Ruchi, Kusum Choudhary et. al. (2022) presented a review of a few earthquake-resistant structures of the seismic zone. They also presented the various techniques to protect buildings from such disasters. [13]

Shobhit Kumar et. al (2022) briefly about the fundamentals of the earthquake-resistant building along with materials & methodology of construction. They also discussed the case study of the earthquake of 26.Jan.2001 in Bhuj India. [14]

3. Earthquake Resistant Structure

An earthquake Resistant structure is a kind of structure designed to keep structures protected to some limit from an earthquake. It is not feasible to protect the whole structure from damage through earthquakes. But through this methodology of construction damages can be minimized by following the standard codes.

Based on the literature review following considerations is to be taken while constructing Earthquake Resisting Structures:

- The construction of structures is to be in such a manner that it should be tough enough & shouldn't be brittle.
- The use of resisting elements is recommended throughout the whole structure with the aid of shear walls, bracing, etc.
- Structures are constructed in such a manner that joints should be tight enough during vibrations due to earthquakes and act as one unit so that separation of parts would not take place. [16]
- The proposed structure must be constructed with a solid, strong & well foundation. Soft soil is to be strictly avoided.
- There should be a special provision for the reinforcement of highly loaded critical sections.
- The use of shock absorbers is recommended.[17]
- The techniques like base isolation systems or tuned mass dampers can be incorporated.
- Use of seismic-resistant concrete in construction.

4. Conclusion

In the past few years, our country India is faced many serious earthquakes, and as a result that thousands of people killed. With technological advancements, it is possible to minimize the losses that occur due to earthquakes. Government authorities must take strict follow-up for implementation of defined guidelines in high-rise structures construction towards earthquake-resistant construction. It is a need for time to move toward earthquake-resisting structures. If defined guidelines are followed for structure design this loss to human life can be minimized.

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