International Journal of Engineering, Management & Technology (IJEMT)
www.ijemt.com, Volume 1 Issue X, December 2022, PP 1-7, ISSN (Online): 2583 – 4517

EARTHQUAKE RESISTANT BUILDING CONSTRUCTION : REVIEW

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ABSTRACT : *Earthquake is a natural phenomenon occurring with all uncertainties.It. It is Very serious problem since they affect human life in various ways. Now a days to prevent the buildings there are several techniques and methods to resist earthquake effects such as ; Base isolation, seismic Dampers, steel plate shear walls ,Hollow foundation. These ground motions cause structures to vibrate and induce inertia forces in the structural elements. In the absence of seismic design, the building may fail,leading to a catastrophe. The seismic design philosophy aims to primarily ensure life safety and secures the functionality of the building. In conjunction with the design philosophy, it is essential to adopt earthquake-safe construction practices for the efficient seismic performance of a building. This paper is a review on various researches carried out by various researchers and engineers on such systems.*

KEYWORDS - *Earthquake, Advanced Techniques, Effective Designs Process, Ideal Resistant Ratio, Structure Failure.*

I.INTRODUCTION

An earthquake is earth's shaking or in other word release of energy due the movement of tectonic plates. It is not the earthquake which kills the people but it is the unsafe buildings, which is responsible for the wide spread devastation. Keeping in view the huge loss of life and property in recent earthquake it has become a hot topic word wide and lot of research is going on to understand the reasons of such failures and learning useful lessons to mitigate the repetition of such devastation., it cannot be stopped but all those humans can do is construction of safe structures to mitigate the death toll and damage.

II.SOME CONCEPTS ON EARTHQUAKE RESISTANT CONSTRUCTION

A. Losses Due to Earthquake:

Following are the five recent earthquake data of India.

Date	Location	Depth (km)	Magnitude	Deaths
04/28/2021	Assam	34	6.0	2
07/24/2019	Maharashtra	10	3.8	1
09/12/2018	West Bengal	10	5.3	1
09/18/2011	Sikkim	51	6.9	1011
01/26/2001	Gujarat	40	7.7	20005

The above data shows that loss of life due to earthquake is all about the collapse of buildings. Thus, the earthquake resistant construction and design does not aim to achieve a structure that will not get damaged in a

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Published online on www.ijemt.com : December 5, 2022

strong earthquake having low probability of occurrence; it aims to have a structure that will perform appropriately and without collapse in the event of such a shaking.

B. During Earthquake Failure of Buildings:

1) Soil failure (liquefaction)

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. Liquefaction and related phenomena have been responsible for tremendous amounts of damage in historical earthquakes around the world.

When liquefaction occurs, the strength of the soil decreases and, the ability of a soil deposit to support foundations for buildings is reduced as seen in the photo (SC) of the overturned apartment complex buildings in Niigata in 1964.

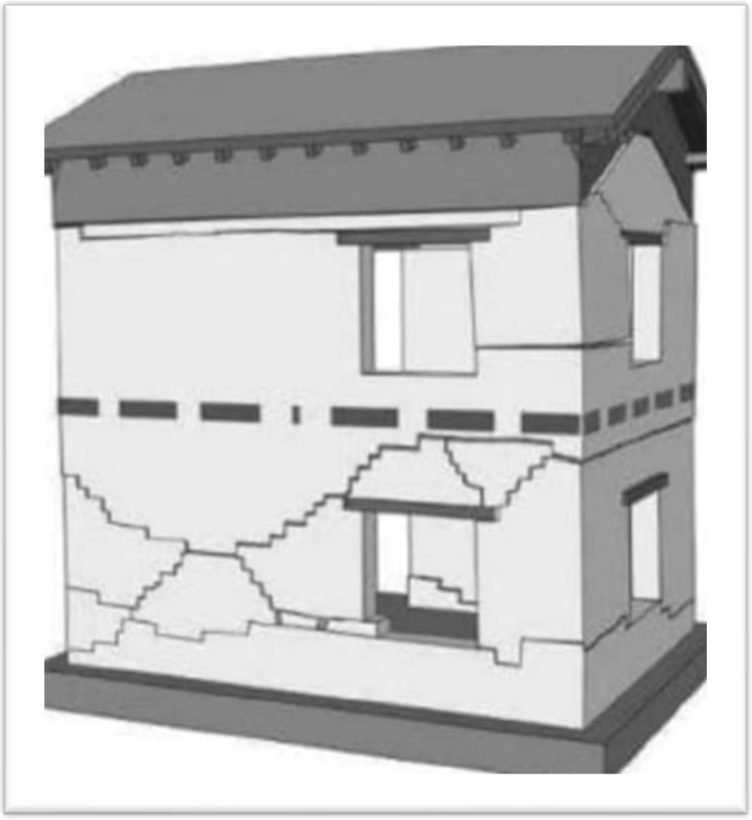
2) Foundation failure:

The building's foundations vibrate in the same way as the surrounding ground when the ground shakes at the building site. The building reaction to an earthquake movement occurs over a few seconds.

The design of earthquake-resistant base and foundation includes a solid reinforced concrete foundation slab with crisscross strips, freely supported on an intermediate sandy cushion, which separates the soils from the foundation slab, and the channels around the foundation.

3) Insufficient base shear capacity

The use of low-quality mortar such as mud between wall bricks decrease the cracking strength and base shear capacity of the wall. As a result, wall blocks were separated from each other under very small shear forces. Heavy Roofing Heavy and stiff buildings is among the factors that results in the failure of masonry structure due to earthquake forces. This is because heavy and stiff buildings attracting large seismic inertia forces.

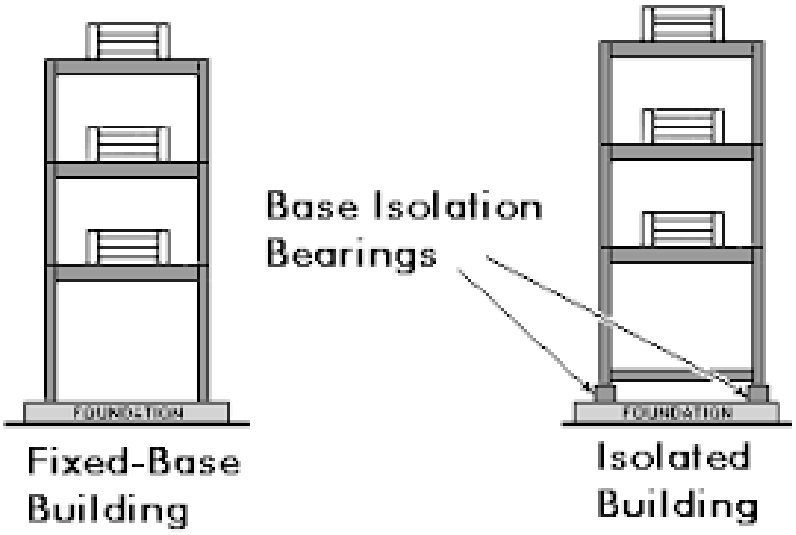


III. VARIOUS TYPES OF METHODOLOGIES TO RESIST EARTHQUAKE IN BUILDINGS

1. Base isolation:

Base isolation, also known as seismic base isolation or base isolation system, is one of the most popular means of protecting a structure against earthquake forces. It is a collection of structural elements which should substantially decouple a superstructure from its substructure resting on a shaking ground thus protecting a building or non-building structure's integrity. Base isolation is one of the most powerful tools of earthquake engineering pertaining to the passive structural vibration control technologies. It is

meant to enable a building or non-building structure to survive a potentially devastating seismic impact through a proper initial design or subsequent modifications.



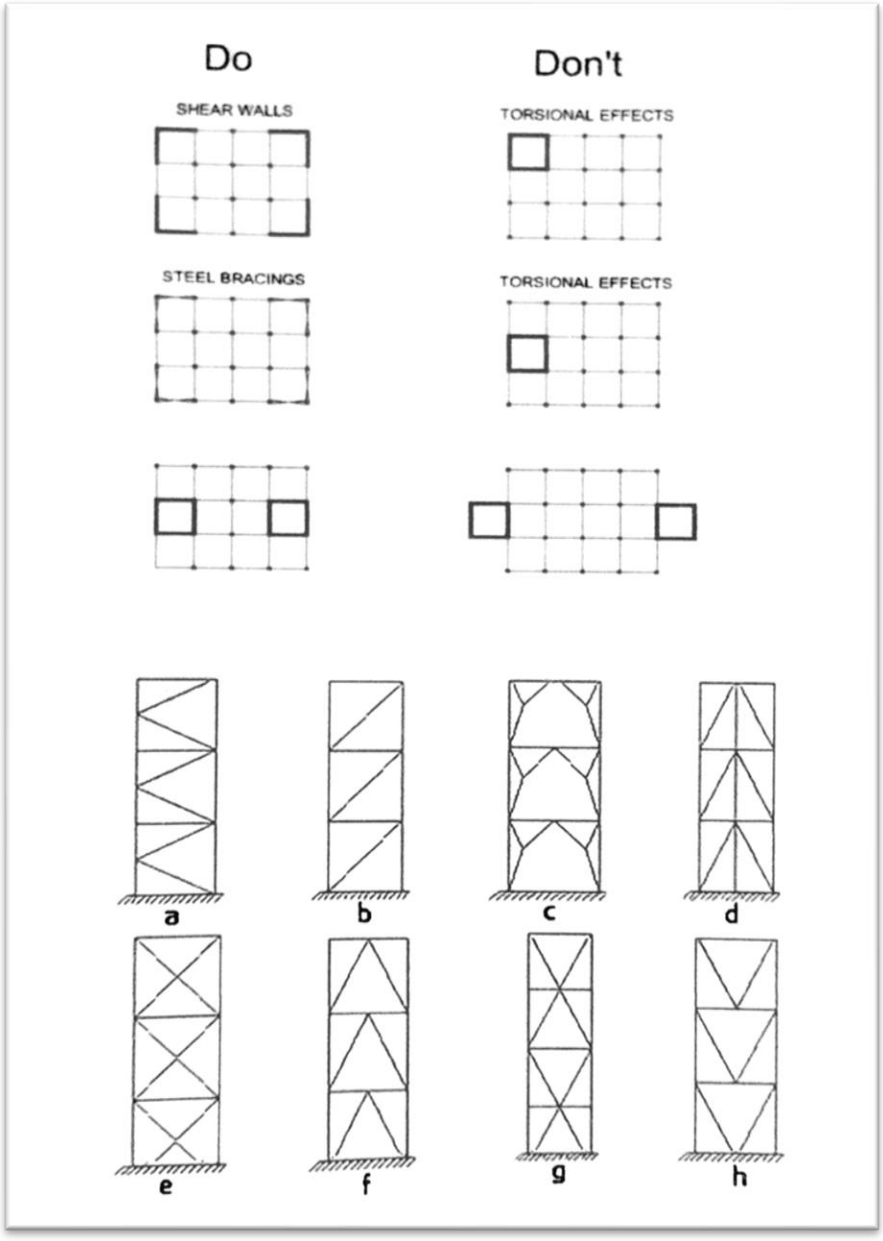
2. **Active Mass Damping:**

A tuned mass damper, also known as a harmonic absorber, is a device mounted in structures to reduce the amplitude of mechanical vibrations. Their application can prevent discomfort, damage, or outright structural failure. They are frequently used in power transmission, automobiles, and buildings.

3. **Cross Bracing and Shear Walls:**

Cross-bracing, which uses two diagonal members in an X-shape, is a popular way to build wall trusses. Instead of braced frames or in addition to them, engineers may use.

Shear Walls - vertical walls that stiffen the structural frame of a building and help resist rocking forces.



IV. GUIDELINES FOR EARTHQUAKE RESISTANT CONSTRUCTION

Addition to the main earthquake design code 1893 the BIS (Bureau of Indian Standards) relevant earthquake design codes for earthquake resistant construction

Masonry structures (IS-13828 1993):

- Horizontal bands should be provided at Plinth, Lintel and Roof levels as per code
- Providing vertical reinforcement at important locations such as comers, internal and external wall junctions as per code.
- Irregular shapes should be avoided both in plan and vertical configuration.

- Grade of mortar should be as per codes specified for different earthquake zones.
- Beam and column should be of equal width.
- Structure should have uniform floor height.
- Shear walls should be provided for increasing stiffness.
- Building should be light in weight and avoid unnecessary masses.

CONCLUSION

The gap between the main structure and base foundation system is composed of lead rubber bearings (LRB) which are a flexible arrangement of materials with high energy dissipation properties. This allows the base and foundation system to freely move with the force of the earthquake. While the top structure remains stationary. This is truly an amazing earthquake engineering Techniques. The builders and constructors should adopt the codal provisions in all the future construction, as prevention is better than cure. On the light of avoiding the risk, this may not be an impossible task as earthquake resistant measures in building involves only 2%- 6% additional cost depending on the type of building. Simple base isolation system in low rise structure performs better and gives better outcome which means there is no need to modify the characteristics of superstructure as modification might not have a positive impact on performance of isolators. Going through all these research paper we conclude that earthquake vulnerability can be greatly reduced by application of earthquake resistant techniques thereby providing safe living conditions and safer environment too. The success of such techniques is largely attributed to the development of such devices and proper planning

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