5.5 CASE STUDY OF EARTHQUAKE RESISTANT STRUCTURE

An earthquake is the sudden shaking of the surface of the earth caused by the passage of seismic waves through the earth's crust. During the earthquake, vibrations occur in all directions radiating from the epicenter. The sudden release of energy cause structure to vibrate and inertia forces are acting on them. Most of the earthquakes are result from tectonic events, primarily movements on the faults, and remaining related to the manmade. The lack of earthquake knowledge and its incorporation in the building design and execution leads to the failure of structures.

Some of the reasons behind building failures are

- Vertical and horizontal movement and the inertia of buildings cause frequent changes in buildings' weight.
- Use of poor-quality material.
- Massive structure (greater the mass of the structure, more the lateral force is exerted on the building).
- More the height of building, lesser its stability.

There are 9 severe earthquakes has witnessed by India in the last 3 decades between 1990 to 2020 and reports claim the number of causalities approx. 30500. Although, certain parts of the country are more prone to earthquakes (seismic zone V of IS 1893(Part 1)-2016) than the others [4]. No region can be considered free from earthquakes. In the Indian scenario, minor earthquakes are reported near the seduction zone (Himalayan belt) on a daily basis, whereas in the interpolate region (Deccan plateau) few major earthquakes have been observed over the years. The performance of the built environment during the past earthquakes has shown its brittle nature and has created an itch among the engineers and architects to move towards seismically efficient buildings.

- Analysis of earthquake resistant Design structures against natural earthquakes he said that buildings can effectively protect against earthquake using multiple design options[3].Load factors of earthquake designing structures where a number of options, details for earthquake types can be found[9].

- About 60 % of the Indian landmass, is susceptible to moderate to very severe earthquakes. A great earthquake in an unoccupied area may produce minimum damage when compared to a moderate earthquake in a densely populated area. All the field survey studies conducted after a major earthquake suggested that the maximum casualties reported were caused by structure collapse.The seismic performance of a building during an earthquake depends on its shape, size, geometry, and the nature of the load path. The aim of seismic design philosophy is to ensure the safety of structural components and human life. Design philosophies state that the load-bearing structural elements must suffer no damage in the case of a minor shaking, sustain repairable damage in the case of moderate shaking and sustain severe damage without collapse under strong shaking.

OBJECTIVE

The main aim of a structural engineer is to prevent the structural damages that are caused due to earthquakes.

So, the main objective of this paper is to fulfil the following.

- To increase the stability of structures against inertial forces using modern techniques
- To know about new and advanced methods for earthquake-resistant structures.
- To prevent deflection of structure which causes failure by using new and advanced methods.

METHODOLOGY

Since it is clear that our main reason for this research is to make the public aware and improve towards this ruinous phenomenon that is Earthquake matter. We have decided to research new technologies for the construction of earthquake-resistant structures, starting with local On the other hand, up to more percentage of housing reserves in rural areas, the urban population grew rapidly during last decade. The growth of the urban population in building projects, and then discovered and cited new approaches that the world is still using right now.

Thus, the methodology process is given below

- Creating idea
- Evaluation for its necessity
- Supervising projects
- Researching website
- Collecting information
- Conclusion

NECESSITY FOR EARTHQUAKE-RESISTANT CONSTRUCTION

As per census 2011 India, there are more than 330 million dwelling units in the country, two-thirds out of which are rural households. According to India's geological survey, the country has been classified into four seismic zones having different seismic capabilities the Indian census by 32% has increased from 286 million in 2001 to 377 million in 2011.

About 30% constitute residential units of seismic zone IV and V.These rural building units are mainly made by the use of locally available materials like mud and unburnt bricks, stone walls, or walls made of burnt bricks, all these are very poor in construction and maintenance. Besides a large percentage of housing facilities in rural areas, the urban population has increased rapidly during the last decade. The growth of the urban population in the Indian census by 32% has increased from 286 million in 2001 to 377 million in 2011. The urban population is estimated to be around 590 million by the end of 2030.As per the statistics, 50% of the demand for construction work in India comes from infrastructure. Sector, the rest comes from industrial activities, residential and commercial development, etc [1][6]. Due to this rapid urbanization, demand for infrastructure, essential infrastructure, residential layout, and community development has increased.

The occurrence of earthquakes in (day time or night time) plays a major role as they have a direct impact on the occupancy of buildings. for example. The Latur earthquake (1993) took place in the early hours around 3:53 AM most people were sleeping in the affected area. On the contrary, the Bhuj earthquake (2001) occurred around 8.46 AM, in which most people woke up and there was minimal interference in the building. The two

earthquakes showed poor performance of non - engineered building units such as random rubble masonry in mud mortar with heavy roofs as well as modern multi-story RC framed buildings (Figure 2).

Figure. 2: Apartment collapse in Bhuj

The Last seismic experience shows that modern residential buildings lack seismic designs. Further, the importance of incorporating seismic principles in the structural design of the building to function as a single unit during the earthquake has become clear. Empowering rural communities to ensure seismic safety of building stock by generating awareness about earthquakes and the significance of earthquake-resistant buildings. The environment built in urban areas should be planned and has to be carefully prepared in the initial stages so that the constructing layout is suited for seismic performance.

BUILDING TYPOLOGIES

The classification of the building is based on the material used in the building such as

- Type of mortar used
- Concrete used in the structure
- Reinforcement
- Wooden structures

A. Classification of masonry units -

Stonemasonry - doing stonework

Wooden masonry - doing wooden work

Reinforcement masonry - doing steelwork

Brick masonry - doing brickwork

B. Classification of load-bearing units in structures-

Reinforced walls - the walls can be made load bearable

Trusses- H shaped girders made of steel

Braces- made of steel

Columns - vertical reinforced concrete bars

Beams - horizontal reinforced concrete.