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HOW TO REDUCE EARTHQUAKE EFFECT ON BUILDING

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Abstract – *Today in this era, in the field of engineering of designing and construction everybody wants the structure to with stand for longer period resisting all the forces coming on the building. So, the engineers give their best out come to construct a building which with stands for a longer period. One of the forces that impacts on building is earthquake forces. The regions that are prone to earthquake, effectively the engineers construct Earthquake resistant structures. India's most famous building Taj Mahal, which is considered as one of the safest building in terms of earthquake. In my paper I am going to discuss about how to reduce the effect of earthquake on a building and general guidelines.*

Keywords- *Earthquake resistant, resisting, construction, earthquake forces and prone.*

I. INTRODUCTION

Disasters are the unexpected events that happen informing no time and place. Natural disasters are very dangerous and leave its impact by destroying the building, causing deaths, effecting human life etc. In order to reduce the impact of disaster on a building, various designing codes have been published in order to make earthquake proof buildings. The results of such impacts are very encouraging in developed countries but unfortunately in developing countries the effect of such impact is very disastrous and miserably poor. An example of disastrous earthquake in INDIA are-

1. Nepal Earthquake, 2015 killing around 9000 people injured 22,000.
2. Gujarat Earthquake, 2001 killing around 20,000 people.
3. Bihar Earthquake, 1934.
4. Maharashtra earthquake, 1993.
5. Uttarkashi Earthquake, 1991.

Earthquakes are natural hazards that is un-controllable which cannot be controlled but its effect of disaster can be reduced on buildings by designing the building as per guide lines. However, it is not only the earthquake that effects the life and property, it is the unsafe buildings which are constructed and are not able to resist the forces that are coming from earthquake. Keeping in view the huge loss of life and property lot of research is going on worldwide, in order to construct seismic structures and has become a hot topic of research too. The developed countries like USA, Japan etc has their buildings that are Earthquake resistant structures and are able to withstand against the forces. By constructing seismic structures the loss of life and property can be reduced.

II. REDUCE EARTHQUAKE EFFECT ON BUILDING

As we know we cannot control the earthquake but its effect on damage to the property can be controlled to some extent so that there is not much damage to life and property. Special criteria's are used to design the earth quake resistant structures so that they remain undamaged after the earthquake. The following technologies that can be used to reduce the effect of earthquake

1. Base isolation-The concept of base isolation can be explained suppose a building standing on a frictionless roller. When the ground will be subjected to earthquake the rollers will freely move with the motion of ground but the building will be remain standing because no force is transferred to the building, thus the building experience no earthquake.
2. Flexible Pads-Flexible pads are also called as base isolators. If the flexible pads are properly chosen, the effect of ground shaking experienced to the building can be reduced to much extent. The main feature of base isolation is that it provides flexibility to the structure. In this a careful study is required in order to decide which device is suitable depending on the type of building. Thus, base isolation is not suitable for all type of buildings. Base isolation is suitable for buildings resting on hard soil, underneath but buildings that are tall and resting on soft soil in that case base isolation is not suitable.
3. Seismic isolation- This technology is relatively new and evolving worldwide. This innovation has lead to decrease the effect of earthquake on a building and is evaluated internationally. It has been increased use since 1980's and has been evaluated and reviewed internationally. This technology is now been used in many countries like USA, Japan,

Italy, Newzealand etc. For retrofitting buildings like (hospital, complexes, historic buildings etc) the base isolation concept can be used. As per the analysis done over 1000 of buildings are equipped with the concept of base isolation,worldwide.In INDIA base isolation technique was first demonstrated after the Killari Earthquake, Maharashtra1993. Application of base isolation technique in India in newly located Killari town. In this Base isolators are used in shopping complex and school. Another example of use of this technique is in Gujarat, after 2001 Bhuj earthquake the four storey hospital building was built with base isolation technique.

4. Seismic Dampers-Seismic dampers are the device that is used to control the seismic effect on a building. When the seismic waves get transmitted towards the base of a building the seismic dampers can decrease the effect of damage and improve the seismic performance of a building. This is the approach to improve the seismic performance of a building. Dampers act like shock absorbers, when the waves get transmitted these dampers absorb the shock and reduce the effect on a building and thus the structure remains safe. These dampers can also be used in place of structural elements like diagonal braces.

III. GENERAL CHARACTERISTICS OF A BUILDING

1. Seismic structural configuration- Good seismic structural configuration can be assured if we follow some parameters that are to be used while designing and construction of building. The parameters are- a) geometry, shape and size of building) location and size of structural elements, c) location and size of non-structural elements. In this category the main aim of a architecture and civil engineer is to give simple shape of a building which gives aesthetic appearance also. The simple geometrical shapes have more ability to resist the loads rather than complex geometrical shapes. The structural configuration of a building can be categorized as simple and complex. The simple shapes like rectangle have more ability to resist the inertia forces because there is no bend in the geometry. So, this type of simple structures is good to construct and these buildings live for longer period of time, fighting against all the forces effectively. The components that are involved in seismic structural configuration are geometry, structural elements (example moment resisting frames and structural walls) and non structural elements (example façade glass).
2. Lateral Stiffness- Lateral stiffness means the initial stiffness, in this case lateral stiffness must be provided in the plan of a building so that there is no damage to the components of building. In this parameter the lateral stiffness decreases with the increase load or damage on a building.
3. Lateral Strength-Lateral strength refers to the capacity to resist the load during the ground shaking. Lateral strength should be provided in both the directions of plan uniformly distributed.
4. Ductility- The structure should have good overall ductility of a building. The structure should follow the mechanism behavior of earthquake.

IV. BASIC CONCEPTS TO DESIGN THE EARTHQUAKE RESISTANT STRUCTURE

1. To follow the earthquake design codes introduced by BIS(Bureau of Indian Standards)
2. Mass of a building should be so designed that is able to resist seismic forces, because earthquake produces inertia forces which are proportional to the mass of building.
3. Use of horizontal members must be provided because it provides strength.
4. Moment resisting frames and shear walls can be used during the construction of a building because they are very significant and useful to fight against inertia forces.
5. Vertical reinforcement should be provided at important locations such as corners, internal and external wall junctions as per code.

V. CONCLUSION

Today the nations are so developed that have devices, strategies, plans, design codes, equipments, good engineers, architects, to construct such type of structures that are able to resist the earthquake forces. As an engineer when has to understand the concept of earthquake and then is able to come out with solutions and techniques. The engineers have done very good job and has made marvellous, unique structures which are standing till now and are able to resist the forces coming from wind, earthquake etc. The example of earthquake resistant structures like Burj Khalifa, Sabiha Gökçen International Airport, in Istanbul Turkey, Transamerica Pyramid etc. The techniques that are used in order to make earthquake resistant structure have shown marvellous results and have decrease the loss of life and property. In India also there are some structures that are earthquake resistant but not all the structures.

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