

Earthquakes

The disintegration of buildings during the earthquake involves following two factors of the building:

- 1) mass of the structure
- 2) stiffness of the structure
- 3) other physical factors including soil type

Now every material in the world, has a natural frequency and over a lot of research it has been found that the probability of a building's collapse during an earthquake is linked to the natural frequency of the structure.

The natural frequency is directly proportional to the stiffness of structure and inversely proportional to the mass of structure, it has also been observed that the buildings tend to have more mass add the bottom part and as the height increases the amount of mass decreases which makes the center of mass of the building situated closer to the surface of earth, these factors combined to determine whether a building will fall under an earthquake or not (Source – Ted)

A working solution for making the buildings earthquake proof is installation of seismic isolation devices, these devices decrease the base shear and displacement but increase the floor acceleration and drift, they are placed between the foundation and the building and thus prevent damage. (Source : https://www.researchgate.net/publication/328601090_Seismic_Isolation_Devices)

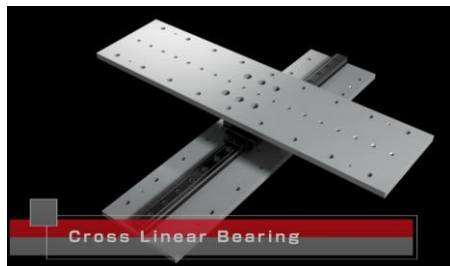
They are of two types:

- 1) Elastomer bearing
- 2) friction pendulum

THK of Japan is the first company which has commercialized this technology of seismic isolation system and brought it into the market, they have implemented this technology in a lot of structures all across Japan and their system has been tested when the great Hanshin earthquake struck Japan in 2011 where in most of the buildings with seismic isolation system survived the earthquake safely while others perished.

how does it work?

As per THK's technology cross linear bearing is the main component of the seismic make isolation system, this special type of bearing involves two linear motions simultaneously in a cross fashion and this enables all types of horizontal shaking during an earthquake.



These are supported by linear motion guides which are set of ballbearing based devices which enable the linear bearing to handle heavy loads of buildings and houses (note - cross linear bearings themselves can accommodate upto 11 tons of load)



finally these ball bearings along with the cross linear bearings are placed where the foundation meets the building and are supplemented with rubber materials (elastomers) which work as shock absorbers and help to return the building to its original shape once it has moved in an earthquake

[T H K Seismic Isolation System Introduction](#)

Detailed Description of each type:

https://www.researchgate.net/profile/Ionut-Ealangi/publication/210109277_EARTHQUAKE_PROTECTION_OF_BUILDINGS_BY_SEISMIC_ISOLATION_DEVICES_AND_CONCEPTS/links/0631c2ddb454740e6857d088/EARTHQUAKE-PROTECTION-OF-BUILDINGS-BY-SEISMIC-ISOLATION-DEVICES-AND-CONCEPTS.pdf