Know the Earthquake Risk in Your Building

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Generally the earthquake risk for a building depends on the magnitude of the earthquake that can be expected at that location, its topography and soil conditions and the structural capacity of the building to withstand the shaking. Out of these, it is only the third, "structural capacity", which is in our hands. This means that we can minimize risk to our life and property only by reducing the "seismic (earthquake) vulnerability of our buildings".

Seismic Vulnerability:

Structural assessment of buildings for earthquake risk is a highly specialized task and falls into the purview of advanced structural engineering. Nevertheless, based on the study of collapses during the past earthquakes, experts have been able to identify some "risk factors", which can be treated as "indicators of probable risk for earthquakes".

Risk Factors:

Some important risk factors and preferences for RCC framed structures, which are easy to understand, are listed below:

1. *Seismic Zone* … Higher the zone, higher the risk. Mumbai is in Seismic Zone III. Delhi is in Zone IV and Bhuj is in Zone V.
2. *Soil* … Softer the soil, higher the risk. If the soil is sandy and is saturated with ground water, there is a possibility if liquefaction during earthquake when the soil looses its firmness and behaves as a jelly.
3. *Importance of Structure* … Higher the importance, higher the criticality of damage. Emergency buildings such as hospitals, power & communication buildings, and fire stations are more critical than the assembly buildings such as prayer halls, malls. The assembly buildings are more critical than the residential and commercial buildings.
4. *Height of Building* … Taller the building, higher the risk. Further, if the height of each floor is large, the risk is more.
5. *Floor Plans & Symmetry* … The plan of building should be fairly symmetric. A square or rectangular plan is preferred over "L-shape", "T-shape" and irregular shapes. Preferably, floors should not have large openings such as chowks. Plans should not vary much from floor to floor. Preferably, lifts and staircases should be located symmetrically in the plan. The width of the building should not be too narrow as compared with its length.
6. *Stilts (open floors)* … If a building has stilts (for car parking etc) the risk is more.
7. *Cantilevers* … Large cantilevers (projections supported only on one side) especially at upper floors are undesirable.
8. *Floating Columns* … These are columns, which do not have their own foundations; but are supported on some intermediate beams in an indirect manner. These are sometimes provided especially when the building plans vary from floor to floor. These can prove to be very risky during earthquakes.
9. *Mass of Structure* … Sometimes we find a lot of external features such as double walls, dummy columns etc. This is undesirable since heavy mass would attract larger earthquake forces.
10. *Heavy Loads* … If there is a swimming pool or garden at the upper floors, the risk is more.
11. *Overhead water tanks* … Heavy tanks should be supported so that their load is directly carried down to the foundation.

12. *Connection between buildings* … As far as possible, buildings should not be physically connected with each other. Also, there should be adequate gap between buildings to avoid pounding on each other during an earthquake.
13. *Extensions/ Alterations* … If the building has suffered extensions or alterations, the risk is more.
14. *Age & Maintenance* … If the present condition of the building is bad, the risk is more.

Seismic Resistance:

The "Risk Factors" given above are rather easy to apply and can give you an idea about the earthquake risk to your building. They can also be applied to new buildings while buying a flat. However, it should be remembered that earthquake resistance of a building is a highly technical matter and the evaluation of a building based on the above factors should not be treated as conclusive. Moreover, there is a large amount of important technical data, which can be collected and interpreted only by structural engineers. Nevertheless, such a study would help you to understand the probable weaknesses in your building (so that you can consult a structural engineer, if necessary) and should not be a cause of panic.
