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Lessons from Bhuj earthquake

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A severe earthquake occurred on the morning of 26th January, 2001 with its epicentre near Bhuj and the entire surrounding area was devastated entailing a huge loss of life and property. The Bhuj area in Gujarat falls in earthquake zone V which is the most severe earthquake zone in the country. Other areas of similar severity fall in Jammu and Kashmir, upper Garhwal in Uttaranchal, Assam and other north-east areas. Earthquake activity is not new in the Bhuj area, but this time the earthquake effect was on a mammoth scale. Further, economic activity and population in the area has increased in recent years so that damage to life and property is more visible and painful than before.

The electronic and print media have brought this incident very vividly before the notice of the general public all over India. The public is now rightly worried about the safety of buildings not only in Gujarat but elsewhere too and the role of building contractors, architects and structural engineers is under severe scrutiny. All these professionals including the owners of buildings have to learn a few lessons from this earthquake.

Buildings which are properly planned, designed and constructed have a good capacity to withstand earthquakes. The Bureau of Indian Standards (BIS), New Delhi, has published a few codes: IS 1893 : 1984, *Earthquake resistant design of structure;* IS 4326 : 1993, *Criteria for earthquake resistant construction*; IS 13920:1993. *Code of practice for detailing of reinforced concrete structures subjected to seismic forces* and SP: 22 (S&T) - 1982, *Explanatory handbook on earthquake engineering*. Structural engineers are duty-bound to follow these useful publications and past experience has shown that buildings designed in accordance with these IS codes have withstood earthquakes well. The design philosophy of earthquake resistant design is that buildings should not collapse thereby saving lives of residents, but these may crack to a limited extent so that the cost of repairs to damaged buildings is reasonable and bearable.

Earthquake-resistant design of buildings costs money. The owners of buildings should understand this aspect and give up old habits of saving money at all costs. The immediate effect of earthquake-resistant design is the increase in the quantity of steel reinforcement in buildings. About 25 to 30 percent more steel is required to be consumed when a building is designed for earthquake forces. This means that the total cost of building may be increased by 4 to 5 percent on this account. The owners of buildings should bear this in mind and be mentally prepared for this extra cost.

Further, soil investigation of the building site is essential. This is a regular practice nowadays and the cost of this exercise is not much and it pays itself by effecting savings in the foundation design. In earthquake-resistant design, soil quality plays an important role and a suitable factor has to be assumed depending on the quality of soil. Buildings on hard soil, in general, are likely to withstand earthquake forces well, entailing less damage.

Architects need to plan symmetrical buildings with lesser projecting parts as these parts are susceptible to damage during earthquakes. Further, square columns are very efficient in resisting earthquakes and architects should not insist on columns of 230-mm width, concealing them within 230-mm thick brick walls. The column sizes work out too large in earthquake-resistant design and these columns will protrude out of the adjoining brick walls. Beam sizes too are affected by earthquake forces and architects should not insist on lesser depth for beams. Beams of limited depth require more steel consumption in buildings. In areas of severe earthquake zone, symmetry in building plans should be insisted upon. Asymmetrical buildings should be provided with expansion joints in order to divide these buildings into different parts, each of which needs to be symmetrical in plan.

Both owners and architects of buildings are required to co-operate with structural engineers so that buildings are properly designed to withstand earthquakes successfully. Structural engineers should play their professional role and follow the BIS codes strictly. If a well-designed building bears earthquake forces well, the credit goes to the concerned structural engineer, architect and contractor.

Building contractors should remain true to their function and they should never compromise with the quality of construction materials and practices. An earthquake is an acid test of all professionals involved in the building industry .

Public are well advised to go in for insurance of their buildings against hazards due to earthquake. Many insurance companies offer substantial rebate in premium amounts if buildings are designed for earthquake forces. The recent earthquakes have shown that nearly 60 to 70 percent area of the country falls under moderate to severe intensity of earthquake.

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