Earthquake prediction: A wild guess

By A G CHACHADI

The geological community not only in India, but throughout the world was taken aback on 30 September 1993 when the killer fault at Latur gave way, killing at least 35,000 and incurring a loss of property worth crores of rupees.

The Deccan plateau in India and the shield areas of the world were once considered to be seismically dead, or showing feeble seismicity, therefore most of the studies so far on seismicity were concentrated on plate boundaries or highly seismic zones like the Himalayas. It is high time now that the geologists and seismologists should redefine their objectives and look on the so called stable platforms.

The utter silence of the premier apex earthquake engineering centre in the country which has not made any comment on the Latur quake is a barometer indicating how badly we lack data on these areas. But, for a few organisations nobody would have the requisite data to assess the seismicity in the Deccan. Whatever the data that has been already collected should be made use of, to arrive at a scientific conclusion, to redefine the stability of the stable land mass.

Koyna and Latur areas call for a comprehensive debate on the seismic zoning of the Indian continent, as a whole. The existing seismic zoning map of India should be scrapped and more meaningful seismic intensity map needs to be prepared to forewarn the public. There is a need to define the kind of buildings that need to be built and warning systems be set up in the high risk zones. The areas where the earthquakes that are likely to be induced by artificial means like dams and reservoirs should be considered, while preparing the seismic map. For example the upcoming Sardar Sarovar Project on Narmada has been a matter of debate and it is certain that the dam of this magnitude is certainly going to induce seismicity which may shake the entire sub continent. This because the dam is built on the faulted area. Koyna though very small compared to the Narmada dam, has made its presence felt in 1967, and we ought to learn a lot from it.

Earthquakes are the most unpredictable amongst the other natural disasters like floods, droughts, volcanoes, landslides, cyclones, cloudbursts, avalanches etc. This is because the parameters that make an earthquake are either rooted deep into the crust and/or instantaneous in nature. There is no direct way of forecasting this catastrophe. Only indirect means like gravity data measurement, observable ground movements, changes in ground water levels, temperature variation etc can be made use to tell that something is wrong at particular location, but never with confidence.

Some scientist based on gravitational data brought into force the high seismic zone of Latur long time back, but never said that the earthquake of 6.4 magnitude would take place on 30 September 1993 at 3.56 am. Therefore, the lacuna is time, location and magnitudes, of these three parameters.

Time and magnitude are very important for forecasting. Even if we cannot assign a quantitative number for magnitude, and if we can define whether the coming quake is low, moderate or high magnitude, and if time can be found accurately, the problem of forecasting will be solved. Can we do it?

One of the top brass in geophysics said "The current measuring instruments in India are not operated meticulously and are three generations behind the sophisticated digital instruments used abroad".

No doubt we lack sophistication, infact, there is a seismograph installed in USA which can measure 1 mm change in the distance between New York and Los Angles. But, can we predict quakes with this sophisticated instruments?

Latur had given ample information in advance of the impending earthquake which would have been a very good warning signal for a keen observer. For example, there was a dramatic rise in the ground water level in the wells before the earthquake, besides about 250 minor shocks recorded in the area for the last one year. A close look into these kind of aspects would certainly provide an insight into the forthcoming event.

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The forecast that Bombay is going to be rocked with a major earthquake comes from Dr Negi. His conclusion is based on the gravity observations which can tell about subsurface faults. His prediction is also based on the fact that the high-steep gravity anamoly locations have invariably sent the shocks in other part of India in the past. But, where are the high and steep gravity anamoly at Latur? The gravity maps show very gentle and negative (-80 milligals) gravity anamoly around that area, but still, the earthquake occurred.

Therefore, Bombayites should be contended on three grounds --

* Some of the high and steep gravity anamoly areas in India are yet to show seismicity.
* High and steep gravity anamoly alone is not the sole criterion for an earthquake and
* When a big city like San Francisco has been built and is being built in a most active San Andreas fault whose seismicity is well known, why should Bombay be upset about a prediction which may in all probability not turn into a reality. But, at the same time, they should be cautious and alert, rather than panicky and worried.

Geologists generally take it easy when the stress is released at frequent intervals. The ideas is simple there is a continuous build up of stress inside the active zones, and this stress is released as small earthquake shocks. It is therefore assumed that the building up of stress inside is minimum, and therefore, nothing to panic.

What happened at Latur is quite surprising. It is reported that more than 250 earthquake shocks were recorded in a period of one year preceding the major shock on 30 September. If you look into the earlier concept, it is but natural for a seismologist to assume that no build up of stress was taking place. But, this continuous release of stress in about 250 minor shocks has deceptive meaning. One would just imagine if the total stress of these 250 shocks were accumulated to be released at one instant, the magnitude would have been more dangerous. Therefore, the concept of microearthquakes, stress release should be reinterpreted.

The nuclear explosions are generally carried out in the shallow sub-surface, and many time these explosions are of such strength that they send shock waves equivalent to an earthquake of moderate magnitude. For example, the Nevada test site of USA has been frequently used for detonating nuclear explosions. Since it is one of the most secret sites, and the data concerning it is all classified, nobody knows its impact on San Andreas active fault. During an explosion, shock waves quite similar to earthquake are transmitted through earth to far off distances. During this time, vibrations of the ground are more intense because the explosions are in shallower regions of the earth. This will in turn induce activity in the less active seismic zones and may trigger off an earthquake.

China exploded a nuclear device just after the Latur quake, and this measured about 5.4 on the Richter scale, which was certainly detrimental to the alreadyshaken Indian subcontinent. The series of earthquakes at Koyna, Satara Ratnagiri, Gulbarga and around Latur are all interdependent, if one vibrates, the other responds.

The Gulbarga region was not active earlier, but because of Latur, it has become active and the showing up of hot steam fumes around that area, indicate the deep seated faults which may give up anytime. Similarly, the Koyna region may also respond in due course of time.

The most crucial and important aspect of natural disaster is the management. The only thing that is known by our experience of disaster management in the history is that we stretch our hands to beg only after the event takes place -meaning there is no pre-planning for the event. There should be pre, real time and post time disaster management plan, depending upon the need.

Goa, though does not show any active seismicity, will be influenced by the earthquakes in its active neighbouring areas such as Bombay Satara Koyna, Latur and Gulbaraga region. The extent of damages in Goa depends upon the distance of the epicenter of the earthquake, its magnitude, and more importantly, its dept of origin. Because the Latur earthquake magnitude was only 6.4 on the open ended Richter scale, the damage caused to life and property were uncomparable with earthquakes of same magnitude elsewhere, due to the fact that the focus (depth) of this earthquake was in the shallow depths.

Deeper the earthquake origins, more the dissipation of energy, and hence, less the damages. However, a detailed tectonic map of Goa state needs to be prepared, along with local gravity anamoly map, so that the likely weak zones can be marked and monitored for their seismicity.

As far as buildings are concerned, the load bearing structures are more stable than the framed structures, because there is a differential motion taking place between the filled walls and the frame during an earthquake in the framed structures, thereby making them more susceptible to cracks and collapses.

Essentially a load bearing structure built with shock absorbing pads one at ground level and other at door and window level, would greatly minimise the damages to buildings even during high magnitude earthquakes. Whether in high seismic area or outside, one should strictly adhere to building construction codes, particularly in the case of multistoryed buildings.

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