Everything you know about earthquake is wrong

By Reza Ghadim, GeoSIG marketing director

When someone asks me what I do for a living and I reply that I work for a company which produces instruments and sensors for monitoring earthquakes, the next question I am asked is whether we can predict an earthquake. My response tends to be different each time depending to whom I am speaking and the circumstances.

Preventing or predicting earthquakes

For example, recently in Greece a young teacher asked me the question. After I explained that I worked for a Swiss company making instruments for monitoring earthquakes, she really wanted to see how she could protect her pupils in the school with what the current technology allowed. She had heard that it was possible to predict earthquakes, and she even mentioned that some animals can sense an earthquake well in advance.

I always explain that I am not really a scientist nor a specialist in earthquakes. Working for a company who has many dealings with scientists and specialists in the field, you do get to know a thing or two about earthquakes. I started by stating the obvious: *that no technology can prevent earthquakes*, and considering the current limitations in predicting an earthquake the most important undertaking from anyone living in a seismic area is to ensure that their buildings are seismically strengthened and that they follow the basic rules when an earthquake takes place.

I asked if they followed a particular drill when earthquake strikes in their school. She wasn't sure if they had a procedure or practiced an earthquake drill. I suggested that she find out if their school was built to an earthquake-resistant building code or perhaps it was subsequently retrofitted for seismic safety. I explained that this is *preparedness* and it comes before anything to do with the technology.

Earthquake Engineering Research Institute (EERI) has a project called the School Earthquake Safety Initiative[1] (SESI), which offers tools for assessing seismic vulnerability of school buildings, as well as checklists for preparing for tsunami. There are a multitude of sources for earthquake preparedness drills such as www.ready.gov[2], which offers information sheets for what to do before, during and after an earthquake, as well as videos. Consideration should be taken into what can be done to secure items within the building, where students should shelter, what to do in the case of evacuation, and how to put together a communications plan for family members.

She was still interested to find out about the need for monitoring earthquakes. I explained that as a teacher she would appreciate that any solution to a problem can only come from understanding more about the problem. Over the years throughout the world there have been tens of thousands of sensors installed to purely monitor the earth's shaking. Such studies have enabled scientists to understand the major fault lines and perhaps more importantly understand the behaviour of earthquakes – foreshock, main shock, aftershock, etc. This data can help with determining seismic microzonation, and figuring earthquake hazard (seismic hazard) or earthquake risk (seismic risk).

Over the years many research studies have helped to at least identify which towns and cities are in imminent danger, and understand earthquake cycles and the intensity of earthquakes. Statistics gathered over time about earthquakes around the globe are often used to identify hot spots for earthquakes. Clearly, this is not an exact science, nevertheless it is one of a number of parameters which scientists consider in their ever expanding analysis. Data gathering and analysis is ongoing, and I have no doubt that at least insisting on earthquakerelated building codes come from such research. With earthquake early warning, accelerographs and recorders are used to get the earliest earthquake data, which is transmitted back and offers moments to take precautions before shaking reaches a destination.

Utilising structural monitoring

In another conversation with an elderly retired couple I met on a train journey to Rome, they were asking what else our instruments could be used for. I said that it was really simple: we could measure the effect of earth shaking on structures (which in effect is vibration). Whether it is a dam, a bridge or a building, we can measure the effect of the vibration on the monitored structure. From such information we can safely suggest if a building is damaged, and depending on the extent of the monitoring, one can pinpoint the damaged area. In a way we can monitor the structural health and safety of a given structure, which is a very valuable undertaking as after an earthquake, you need to be confident that despite the healthy appearance of your building it is safe to occupy or otherwise. The data is collected to determine the structural safety of a building, which can help with re-occupancy (occupancy resumption).

There are many applications for GeoSIG's products. In the HayWired Scenario[3], a recent publication by USGS, it was forecast that a 7.0 magnitude earthquake in the San Francisco Bay area of California could trap as many as 20,000 people in elevators and leave 400,000 people homeless. We have several products which can be used to stop a lift at the next floor as soon as there is significant shaking registered by a seismic switch installed in the lift, enabling passengers to evacuate safely.

I thought by this time they had heard enough and I had bored them enough to wish to change the subject. To my surprise, as earthquakes in Italy are very topical, they wanted to know more. They asked me about the bridge which had recently collapsed in Genoa and wanted to know if monitoring such a bridge would have prevented the tragic accident with the bridge. I said, in essence, yes. Generally speaking a monitored structure, whether it is a bridge, a tunnel, a dam or a building that is properly instrumented and monitored should be able to provide the necessary information to show changes in the behaviour of the structure. I said that I wasn't an expert in this field but we have all the necessary hardware and software to carry out structural health monitoring on structures not only for earthquakes but also for other causes such as defects or aging structures.

Clearly there are always exceptions, for example a catastrophic failure due to an explosion or some other sudden impact to the structure which could lead to its destruction can't be prevented by any monitoring. However such circumstances are very rare as structures are very alive and have an established behaviour, and changes in their normal behaviour can be detected, which can then allow civil engineers to look at the reasons for the observed changes.

Despite the common beliefs that one can predict earthquakes or that by monitoring you can prevent earthquake destruction, these are myths. It is possible in certain cases to create early warnings about the arrival of earthquake, be it only seconds in advance, and it is true that by monitoring structures we can observe the behaviour of the structure against its normal behaviour or designed limits… but the most important things people need to know is what is possible in strengthening their structures against earthquakes and to know how to behave during an earthquake. These are the actions that will make a difference.

Offering solutions

GeoSIG Ltd offers a variety of earthquake, seismic, structural, dynamic and static monitoring and measuring solutions. For more information on applications for our instruments, case studies, a catalog of our products, and a variety of presentations and papers available for download, you are welcome to visit our website at www.geosig.com. We are also available on social media for those who would like to get in touch.

Sources:

1. Retrieved from https://www.eeri.org/projects/schools/subcommittees/#education
2. Retrieved from https://www.ready.gov/earthquakes
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