EARTHQUAKE AWARENESS DAY 2019

Are we prepared for an earthquake?

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TWO earthquakes had hit Haiti and Chile with a gap of over a month in 2010.

The 7.0-strong earthquake that rocked Haiti on January 12 claimed more than 300,000 lives with thousands of survivors displaced. Chile's earthquake was far stronger (8.8 magnitude) than Haiti's earthquake, yet the casualties and other damages in Chile were fewer than those in Haiti as the death toll in Chile stood at a little over 500.

What was the reason behind this?

"The reason behind the difference is better preparedness. After 1960's earthquake, the Chilean government took measures towards robust construction standards and that makes the difference," Mehedi Ahmed Ansari, a professor at the department of civil engineering of Buet, told *The Daily Star*.

He also said at least 90 percent of casualties can be prevented if the buildings are constructed properly.

Dhaka's situation is so bad that various studies have predicted that if a big earthquake hits Dhaka, the scenario will be beyond description.

Densely populated, Bangladesh sits at the juncture of three tectonic plates: the Indian plate to the west and southwest, the Tibet sub-plate to the north, and the Myanmar plate to the east.

Moreover, the plate boundary between India and Myanmar passes through Bangladesh and these tectonic blocks were responsible for many earthquakes in the past.

EARTHQUAKE VULNERABILITY

According to the Rajdhani Unnayan Kartripakkha (Rajuk), nine out of 10 buildings in key areas of Dhaka city have been constructed flouting their approved designs.

Rajuk surveyed at least 2.04 lakh buildings, which are three-storeyed or higher, on its 1,528 square km area jurisdiction.

A study titled "*Dhaka Profile and Earthquake Risk Atlas*" estimated that an earthquake with a magnitude of 8 along the Madhupur Fault may have the greatest impact on the city.

It said that the estimated losses will be worth USD 5.7 billion with more than 50,000 fatalities. Over 2,00,000 would be injured and 1,80,000 buildings damaged, the study said.

A comprehensive study titled "*Multi Hazard Risk and Vulnerability Assessment Modelling and Mapping*" conducted by the Department of Disaster Management in 2016 shows the Sylhet division is the most vulnerable followed by Chattogram and Rangpur divisions.

The report said Dhaka division is also in the moderate earthquake intensity zone.

Apart from this, a number of studies have made predictions based on different seismic models and geographical history that Dhaka city is at risk of a strong earthquake, measuring 7 or higher on the Richter scale.

GOVERNMENT'S INITIATIVE

The government has taken up a number of programmes to build earthquake response capacity.

A good amount of search-and-rescue equipment has been bought with support from bilateral and multilateral donors. The fire-fighting capacity of Bangladesh Fire Service and Civil Defence (FSCD) has also improved.

Besides, the government has prepared a contingency plan for all the stakeholders' concerns including fire service and civil defence and other utility services, according to officials of Department of Disaster Management.

It has also drafted the debris management plan and dead body management plan. Moreover, it is setting up a national emergency operation centre to coordinate the rescue and search operation in case of any emergency, they said.

"But the main challenge is implementation of building code," said Netai Chandra Dey Sarker, assistant director of Department of Disaster Management.

In the case of an earthquake, awareness and knowledge on earthquake are key. Therefore, people should be trained so that they know what to do in the event of such a disaster, he said.

Md Mohsin, additional secretary of the Ministry of Disaster Management and Relief, told *The Daily Star* that there will be good improvement when the building code is finalised.

"We have already purchased equipment worth Tk 150 crore. We have taken up another project of Tk 1,000 crore to procure more equipment. Apart from these, retrofitting of vulnerable buildings will start soon."

FSCD officials said any rescue operation carried out in Dhaka city will be difficult due to a lack of social awareness and inadequate road access.

Officials said although the FSCD is the designated authority for running rescue operations during disasters, it is not possible to carry out the operation smoothly without strong coordination among all related stakeholders.

"Now we are training volunteers. So far, we have trained 46,000 volunteers. We have a plan to provide training to 62,000 volunteers," said Brigadier General Md Sazzad Hussain, director general of FSCD.

He also said they regularly operate drills in different parts of the country to make people aware of earthquakes.

A major earthquake may cause massive destruction in the highly populated Dhaka city crammed with unplanned buildings like that seen in this picture taken at Mohammadpur. PHOTO: RASHED SUMON

'Quality of construction materials should be maintained to build earthquake-resilient structures'

Dr M Shamim Z Bosunia, *Professor and Managing Director, Abode of Consultants (Pvt) Ltd. and Former President, Institution of Engineers, Bangladesh*

THE fear of earthquakes—often referred to as "seismophobia"—is likely to increase with the expansion of construction projects and rapid urbanisation. Therefore, assessing earthquake risks before undertaking construction is of utmost importance.

While talking about safe construction practices in light of earthquakes, Professor Bosunia opined that earlier beliefs concerning earthquake were different than those of now. It was widely believed that the force of earthquakes is proportionally connected to the mass of buildings. However, scientific findings have now begun to reshape these beliefs from a rational point of view. According to him, the seismic zones are divided based on several variables, such as the soil condition, geographical formation of the land, regional fault, etc. Earthquake risks differ from zone to zone. For example, Sylhet falls in the zone of severe damage. Again, the earthquake risks in Dhaka are different than those of Khulna because of the zone difference.

Professor Bosunia asserted that there are no concrete design criteria to build an earthquake-resilient structure. However, BNBC has provided some recommendations for earthquake-resistant design. Earthquake-resistant design is required to protect a structure or a building from the effects of earthquakes. The structures must comply with some requirements related to things such as the thickness of the column, the thickness of the beam and slab systems.

Earthquake load, often known as dead load, refers to the intrinsic weights of the immovable structure of any building, such as column weight, beam weight, slab weight, partition wall, etc. Live load refers to the loads which depend on the occupancy type and change over time with situations, such as people moving around a building or the presence of movable objects in the buildings. Generally, in a 20-storey building, the dead load is around 80-85 percent while the live load is 15-20 percent, informed Dr Bosunia.

The effects of an earthquake hugely depend on the dead load. It is proposed in the code that a designer must comply with dead load, live load and wind load to design a building or a structure. The code offers some recommendations,

Dr M Shamim Z Bosunia

particularly on the thickness of column, beam and slabs. For instance, it is common practice to use 8 percent rods in the column during construction. But if one wants to design an earthquake-resistant building, one must reduce the use of rods to 6 percent in each column. The latter installation will enlarge the column. Simply put, the larger the column, the better it works for earthquake resistance.

Usually, the tremor jolts the ground when an earthquake takes place, and the seismic wave gradually transmits through a building vertically. The building starts to sway because of the transmission of the wave. Therefore, according to Professor Bosunia, for precautionary purposes, we should take the horizontal deflection of a building into account and calculate the measurement of sway. The extent to which a building can sway must be kept within the recommended guidelines for that particular building. It is also important to note that the transmission of seismic waves passes through the joints of columns, beams and slabs. Therefore, the proper construction of joint details of column, beam and slab is important to build an earthquake-resistant structure. Poor construction of joints makes buildings more vulnerable to earthquake damage.

The strength of concrete is also very important. The buildings in Dhaka city are constructed in such a way that the load on the column is shared between concrete and steel. 60 percent load is supported by concrete, whereas steel can support as much as 40 percent. Therefore, the quality of concrete should be a major concern. Concrete is the most widely used construction material all over the world; yet the most unpredictable one. In order to be earthquake-resistant, the strength of the concrete should be a minimum of 3000 PSI. Another point to note is that people with no training are often involved in concrete production. We should investigate this issue and ensure proper training to maintain the quality of concrete as much as possible.

To build an earthquake-resistant structure, Professor Bosunia pointed out three steps. First, the quality of the material should be ensured. Second, good designers should be assigned to design the buildings. Third, the practice of ductile detailing of concrete structures should be put in place. Ductile detailing is a process of providing reinforcement to concrete to sustain earthquakes.

If the beam column junction shakes because of the seismic wave, it may lead to a catastrophic outcome. Therefore, the material strength is of paramount importance when it comes to constructing a building. The structure should be designed by qualified designers as well. Follow-up strategies should be adopted to check whether the structure is built as per the design. Professor Bosunia emphasised that people with little or no knowledge should not be involved with construction. At the early stages of construction, we see engineers visiting the sites to monitor the process. However, when the construction turns into a multi-storey project, they no longer scrutinise the sites fully due to the absence of lift. This is a major problem and some solutions must be found to tackle it. The construction workers should also be trained properly to build earthquake-resilient structures.

Professor Bosunia concluded by highlighting the significance of the foundation during construction. Foundation can be vulnerable to seismic effects as well. Several factors come into play (soil interaction, wind, etc.) when we take earthquake load into consideration. For instance, sand affects the pile foundation through soil liquefaction, which may make the building sink into the mire. Experts should check the soil characteristics to prevent buildings from tilting. Also, pile foundation should not be installed anywhere close to water bodies.

The interview was taken by Maisha Zaman and Labiba Faiaz Bari of The Daily Star.