Are we prepared for the next earthquake ?

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BANGLADESH is situated in the Delta region of the Bay of Bengal. The main Andaman fault in the region is becoming active day by day. According to seismologists the slip rate of the fault is 63 mm/year. This fault has crossed Bangladesh and met Himalayan fault through India. Minor earthquakes of magnitude ranging 3 to 4 on the Richter scale are common phenomena in Bangladesh. There are records of strong motion earthquakes in the region.

Unlike other natural disasters like floods and hurricanes earthquakes occur for a few seconds only, and it is not possible to precisely predict the occurrence.

In order to understand the seismicity of the country, Bangladesh is divided into three zones. Roughly it may be stated that the northeastern part of the country is more prone to earthquake shocks than the south-eastern part. This does not mean in any way that strong earthquakes are ruled out in the south-eastern part or, for that matter, the south-western part. In fact, nearly the total area of Bangladesh falls in the active seismic zone.

The issue now is, how can we use what we have learned in Turkey and India to address similar problems in Bangladesh before the next earthquake hits? No matter how well we can mitigate these types of tragedies, we still have a considerable number of things to study and learn from these earthquakes.

Role of Planners, Architects and Civil Engineers

In Bangladesh the role of structural engineer has overshadowed that of architect in seismic design. The causes of this are two **:** structural engineers have maintained strongly that seismic design is an engineering problem, and architects have, by default, been willing to accept this position. In consequence, seismic design tends to be delegated by the architect to the structural engineer. In recent years it has become clear that architectural configuration, the size and shape of a building, makes a major contribution to the success or failure of the building's seismic performance.

In order to achieve reliable earthquake resistance a building's structural configuration should be decided from consideration of the following factors:

Simplicity and Symmetry: Earthquake repeatedly demonstrates that the simplest structures have the greatest chance of survival. There are three main reasons for this. First, our ability to understand the overall behaviour of simple structure is markedly greater than it is for a complex one, e.g. torsion effects are particularly hard to predict on an irregular structure. Second, our ability to understand simple structural details is considerably greater than it is for complicated ones. Third, simple structures are likely to be more build-able than complex ones.

Symmetry is desirable for much the same reasons. It is worth pointing out that symmetry is important in both directions in plan and helps in elevations as well. Lack of symmetry produces torsion effects, which are sometimes difficult to assess, and can be very destructive. The introduction of deep re-entrant angles into the facades of buildings introduces complexities into the analysis, which makes them potentially less reliable than simple forms. Buildings of H, L, T and Y-shape in plan have often been severely damaged in earthquakes as we have seen at Hamzarbagh, Chittagong in 1997. Such plan forms should only be adopted if an appropriate three-dimensional earthquake analysis is used in the design. External lifts and stair walls provide similar dangers, and should be used with appropriate attention to analysis and design.

Length in Plan: Structures which are long in plan naturally experience greater variations in ground movement and soil conditions over their length than short ones. These variations may be due to out-of-phase effects or due to differences in geological conditions.

Shape in Elevation: Very slender structures and those with sudden changes in width should be avoided in strong earthquake areas. Very slender buildings have high column forces and foundation stability may be difficult to achieve. Height/width ratios in excess of about 4 lead to increasingly uneconomical structures and require dynamic analysis for proper evaluation of seismic responses. Sudden changes in width of a building, such as SEATBACKS in the facades of buildings, generally imply a step in the dynamic response characteristics of the building at that height, and new earthquake codes have special requirements for them. If such a shape is required in a building it is best designed using dynamic earthquake analysis, in order to determine the stress concentrations at the notch and shear transfer through the horizontal girder below the notch.

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It's total destruction of life and property all over and around Bhuj : The Indian experience.

Uniform and Continuous Distribution of Strength and Stiffness: A building will have the maximum chance of surviving an earthquake if**:**

a) the load bearing members are uniformly distributed;

b) all columns and walls are continuous and without offset from roof to foundation;

c) all beams are free of offsets;

d) columns and beams are coaxial;

e) reinforced concrete columns and beams are nearly of the same width;

f) no principal members change section suddenly;

g) the structure is as continuous and monolithic as possible.

In qualification of the above recommendations it can be said that while they are not mandatory they are well proven, and the less they are followed the more vulnerable and expensive the building will become.

Earthquake Resistant Design Codes of Practice: There is, at present, no specific code of practices on the design and construction of earthquake resistant building and engineering structures, in details, for the engineers, but only a few clauses are available as detailing requirements in the Bangladesh National Building Code-1993. These clauses are at all not sufficient for all types of engineering structures, which are needed to be formulated immediately by the academic, research and professional institutions. The following codes of practices are thus needed to be formulated:

1) Standard Criteria for Earthquake Resistant Design of Structures.

2) Standard Code of Practice for Earthquake ResistantDesign and Construction of Buildings.

3) Standard Guidelines for Improving Earthquake Resistance of Earthen Buildings.

4) Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings.

5) Standard Code of Practice for Ductile Detailing of RC Structures Subjected to Seismic forces.

6) Standard Guidelines for Repair and Seismic Strengthening of Building and Engineering Structures.

Pre-earthquake measures and activities

The following pre-earthquake measures may be undertaken by the departments concerned of the Government**:**

1) Studies on seismicity of the region considering instrumental and historical data of occurred earthquakes.

2) Elaboration of a seismotectonic map for the country.

3) Elaboration of seismic hazard maps of the country for planning, design and construction.

4) Elaboration of codes, instruction manuals for anti-seismic design of different types of structures such as Dams, Industries, Life Line Systems (Gas, Electricity, Water Supply and Sanitation), Port, Offshore structures etc.

5) Elaboration of seismic micro zoning maps considering seismic hazard for significant urban areas.

6) Providing the above data for land use planning to the departments concerned.

7) Elaboration of laws and regulations for implementation of seismic codes of practices.

8) Development and installation of strong motion networks and computerized systems for rapid collection analysis of earthquake data.

9) To make engineers, planners, architects to understand and follow the seismic code provisions for future building constructions.

Immediate steps to be undertaken by the department concerned of the Government:

· Microzonation of each city/district considering earthquake hazard.

· Survey and investigation on the **usable**, **damageable**, and **collapsible** buildings within each city/district.

· Communicating the above information database to the respective authority to advise the owner of the building to perform the following within a specified time**:**

§ To strengthen the demarcated vulnerable buildings to sustain future strong earthquakes.

§ To repair/strengthen or to demolish the demarcated collapsible buildings.

§ To force the occupants of the damageable buildings to vacate for the purpose of immediate protection of human lives.

Immediate attention to be given to the following structures to assess their structural strength to sustain future earthquakes:

· Hospital buildings

· Mosques, Madrasa, School, College, University buildings

· Supermarkets, Seaports, Airports, High-rise apartments

· Dams, Electricity generation plant, Gas supply system

· Water treatment and supply system

· Highway and Railway bridges

· Petrochemical industries

Post-earthquake measures and activities

· Establishment of centers, which will carry out emergency protection measures in each city, village and institution.

· Extinguishing of fires in the first stages by volunteers and protection against fire by professional staff.

· Emergency rescuing of people.

·Evacuation from densely populated and dangerous places.

· Establishment of centers for food supply and organization of other emergency activities.

· Organization of temporary housing, medical centers, schools and other public utilities based on the immediate needs.

· Removal of ruins, demolishing and clearing out of structures or parts of buildings posing a direct or indirect danger to the population.

Rapid Actions to be taken now

·The departments concerned (CDA, RAJUK, KDA, RDA) of the Government should take immediate initiative to set up a **Monitoring Cell** headed by an expert on Earthquake Engineering for the verification of design and construction of new structures and implementation of their recommendations for protection from future earthquakes.

The departments concerned (Facilities Department, LGED, R&H, PWD, PDB, CDA, RAJUK, KDA, RDA) of the Government should take immediate steps to identify the damaged vulnerable structures (Schools, College, University, Hospital, Mosque, Dams, Bridges, Highways) and strengthen those to protect mass human lives.

· The Government should establish **Earthquake Disaster Management Cell** to overcome the after effects of earthquake with necessary instruments or machinery.

· The Government should instruct the local administration of each city/district to conduct thorough investigation by the experts to identify the risky buildings and make necessary arrangements to force the owner of the building to demolish/strengthen that using appropriate technology, for future, earthquake.

· Keeping the above in mind, a proposal had already been submitted to BIT, Chittagong to set up a "**Centre for Research and Training on Earthquake Engineering**" for the research and training of engineers, planners and architects.

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All health information to keep you up to date

Know your medicines

Injection solutions: Solutions for injections are sterile (germfree) preparations of a drug dissolved or suspended in a liquid. Other agents, (anti-oxidants), are often added o preserve the stability of the drug or to regulate the acidity or alkalinity of the solution. Most injectable drugs used now are packaged in sterile, disposable syringes. This reduces chances of contamination. Certain drugs are still available in multiple-dose vials, and a chemical bactericide is added to prevent the growth of bacteria when the needle is reinserted through the rubber seal.

Eye drops: A sterile drug solution (or suspension) dropped behind the eyelid to produce an effect on the eye.

Ear drops: A solution (or suspension) containing a drug introduced into the ear by dropper. Ear drops are usually given to produce an effect on the outer-ear canal.

Nasal drops/spray: A solution of a drug, usually in water, for introduction into the nose to produce a local effect.

Do's and Dont's

DO

* Check the dose on the label carefully before giving medicines to children.
* Make sure some common preparations you give to children for viral infections.
* Make sure that your medication will not make you drowsy or otherwise affect your ability before you drive or perform difficult or dangerous tasks.
* Read the label and follow the instructions carefully. This is equally important with all types of drugs-creams and lotions as well as drugs taken by mouth.
* Finish the drug treatment your doctor prescribes for you.
* Consult your doctor for advice if you experience side effects.

DON'T

* Pretend to children that medicinal preparations are sweets or soft drinks.
* Give any medicines to children under the age of five, except on the advice of your doctor.

Next: Tips on peptic ulcer