

EARTHQUAKE DISASTER

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The word disaster is a small word, but has a great impact upon community. In general we can name many natural disasters such as Topological Accidents and Tectonic Disasters. The topic of my discussion is the earthquake disaster.

Earthquake is one of the most destructive hazards, if not to human life itself, most certainly to the work of mankind. The strong earthquake always causes the collapse of buildings and leaves behind many structural damages and losses of life.

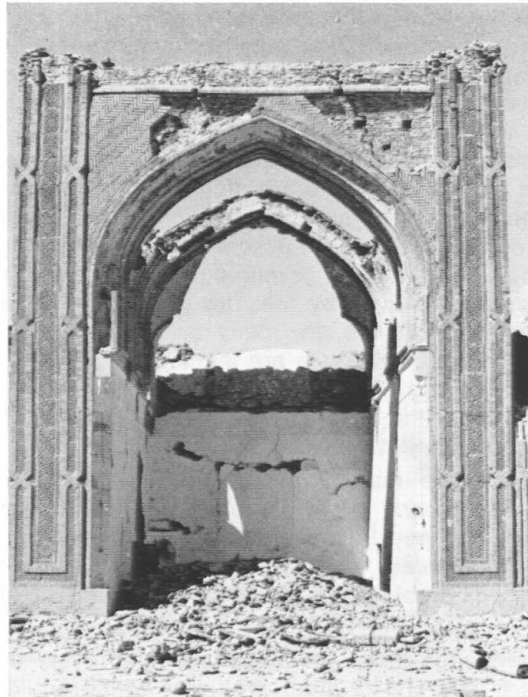
What is an earthquake? Earthquake consists of a sudden release of stored energy in the ground. It consists of horizontal and vertical ground vibrations. The horizontal motion usually has much greater effects upon the structure than the vertical. The most destructive force is caused by horizontal earth motion in which the ground underneath a structure is moving suddenly to one side, and a building due to its inertia force tends to remain on its original position. In case of catastrophic earthquake the pattern of day to day life is disrupted, people are plunged into helplessness and need medical care, shelter, clothing and many other necessities of every day life. There is fear of epidemic disease, either in humans or in domestic animals, looting is spread and people need psychological and sociological relief. Most often earthquakes are followed by fire; fire prevention is very important in earthquake prone areas. There are many evidences which show that the fatalities of fire after an earthquake are much more greater than the earthquake itself. The shaking of the earth is not the greatest problem to be faced during the days and weeks after the initial event, it is rather the matter of human adjustment and human need.

In general there are many topics which can be mentioned in this discussion such as : general behaviour of people, panic, restlessness, fear, rescue operations, and psychological behaviour of people, and immediate necessities, blankets, tents, potable water, fuel, sanitary facilities, food, medical care, blood, problems of burial of dead bodies and issuance of death certificates.

The above mentioned problems are common in every earthquake disaster, but there are also lots of other problems which could be mentioned, if the earthquake will occur in metropolitan areas, or large cities.



Collapse of typical building in earthquake of August 31, 1968 in Dashte-Bayaz earthquake.



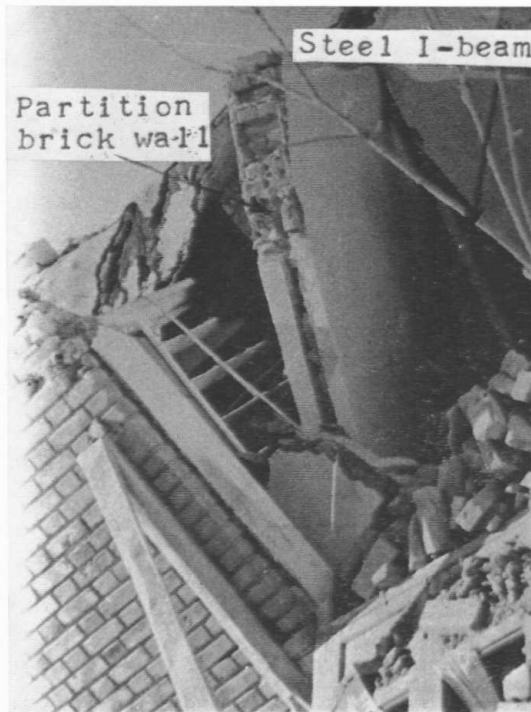
Behaviour of old building in earthquake of 1968 in Ferdous (Iran) September 1968.



Collapse of medical center in Ghir (Iran) earthquake of April, 10, 1972.



Behaviour of traditional buildings in earthquake of April, 10, 1972 in Ghir (Iran).



Collapse of dispensary due to earthquake of September, 1st, 1962 in Buin-Zahra (Iran).



Collapse of dispensary due to earthquake of September, 1st, 1962 in Buin-Zahra (Iran).



Collapse of roof of dispensary of Buin-Zahra (Buin-Zahra Earthquake of September, 1st, 1962 — Iran).



Damages to high rise building in Skopje (Yugoslavia) earthquake of July 26, 1973.



Collapse of six stores reinforced concrete social security building in Managua earthquake of December 23, 1972.

Iran is a country which is located in a highly seismic zone, and we have experienced major destructive earthquakes from time to time, but these earthquakes mostly occurred in scarcely populated area, where there were no important buildings and no major structures; if the earthquake will occur in a large city : there will be a big catastrophe. The massive constructions and high rise buildings in Tehran (the capital of the country) are rapidly increasing, the population of Tehran is now about four million. Therefore it is appalling to even think what a destructive earthquake could do to this city. Tehran is a rather new city which developed rapidly, with no experience of a major earthquake, but the adjacent city to Tehran is the city of Rey which historical records show that in the years 856, 864, 1130 and 1176, this city was destroyed by violent earthquakes, therefore attention should be paid to the possibility of earthquake occurrence in Tehran. Tehran besides being heavily populated, it also serves as a center for economy and administration of the entire country. Therefore the continual function of the country depends on the capital and if a destructive earthquake will occur in Tehran, there will be a big catastrophe not only on local, but also on national and international scale.

The painful lessons learned in Managua due to earthquake of December 1972 are useful as a guide for the policy and pre-planning in similar cities. In Managua as a consequence of the earthquake, the economy and administration of the entire country were severely disrupted, and the government had to solve a multitude of new problems. After the earthquake most of Managua was evacuated and a 2 meters high fence was erected around the city to keep out looters, and secure it from vandals. As the result of the earthquake, the power of the city was disrupted, many public buildings including hospitals, schools, commercial buildings and governmental offices collapsed or were seriously damaged, all four hospitals in the city with a total of 1,500 beds collapsed, fire fighting equipment all over the city was immobilized. Fire raged uncontrolled for days. Breaks in water pipe lines cut the water distribution system of the city. The government could not control the situation during the first few days after the earthquake. Managua earthquake of December 23, 1972 is a good example for the necessity of pre-planning of earthquake disasters, and this case shows that with consideration of the important effects which are associated with earthquake occurrence, a program for reducing risk and mitigating losses should be prepared in advance. The risk of damages, loss of life and social problems depend upon the effectiveness of a program which must be pre-planned. Pre-planning should not always be considered only as a rescue operation or to take immediate steps or towards reconstruction of the area. One important aspect of it is the readiness of the country to face a disaster and the problems associated with it.

Medical care plays a very important role in this readiness. In case of an earthquake the spread of epidemic disease by human source or by farm animals is important. Virus being carried by domestic animals, such as cats, dogs, and other sources, it is better to remove such animals right after the earthquake in order to prevent polluting the region. Sociological arrangement of some sort and social activities in order to reduce the people's grief and give them some kind of psychological relief is very important. Setting up temporary schools and play grounds to gather the

children will effect to reduce their grief. This procedure was adopted in Ghir earthquake of 1970 in Iran and schools were set up immediately after the earthquake under the tents, and this tactic showed a very good result.

Generally speaking a person which has lost everything needs some other sort of psychological and sociological relief, than food. I am not saying that food and medical care are not important, but what I mean is that pre-planning should be done in all aspects of facing a disaster.

I believe in any disaster someone from outside the region should be responsible to handle the rescue operations. A man who has lost all his family and beloved persons is in such psychological shock that he is not able to control any rescue operation.

Since the forecasting of an earthquake event is in elementary stage, and if this could be done there are many problems associated with it; the only way to face the earthquake disaster for the time being, is to build better constructions. The preparation of a safety code and regulations and als the implementation of the code have a very important role in reducing the earthquake hazards. Special attention should be paid to construction of public buildings such as hospitals, schools, theaters, and so on to resist to severe earthquake. Above mentioned facts being important, the hospital especially should not only be built earthquake resistant, but should also remain operational after a severe earthquake. I strongly believe that all the time the hospitals should be prepared to face any disaster.

Public education has a very important role in case of earthquake disaster. People should be trained ahead of time and practice to face a disaster bravely, and be some kind of help in case of disaster to the local government.

In general I could summarize my speech by concluding that the only way to face an earthquake disaster is to build better constructions, use better materials, follow the safety code and to train and educate people in advance and be pre-planned to face such a disaster.

DISCUSSION

M. F. Lechat : As you mentioned, there is no, or not yet, reliable forecast for earthquakes. Yet, we can make some kind of prevention. We can promote the traditional type of building, this is a set back. Or we can use antiseismic technology. But since clearly you cannot restrict your anti-seismic buildings to the area of the next earthquake, you have to do it in the whole earthquake exposed area. Do you have any idea of the cost involved ? What is increased cost of building using antiseismic technology ? Also you can turn to educate people, or to make regulations forbidding poor building techniques. What is in your experience the most feasible approach ?

A. A. Mointar : First of all about the increase of cost of the building. This is a very difficult question, because many buildings which are existing all over the world are not adequately built for human living. These types of building regardless of how much you spend to become earthquake resistant are not worth the effort and money, so that these types of buildings should be removed. But there are many other building which are

suitable for living, therefore I think according to the type of construction it may vary from 15 per cent to 20 per cent extra cost to make them earthquake resistant.

I think preparation of a code of practice and regulation for the country is a very easy task. You can call on some specialists and ask for their advice, but this is not important. The implementation of the code is much more important, how you can implement that code for the country. I believe educating the people to use the code is very important; if you have suitable education for the people they can accept the regulations that you give them, otherwise it is non-sense. You can force using the code, but the people may not be listening to these regulations.

In my opinion for reconstruction of rural areas, with consideration of economical and educational handicaps, we should not depend only on enforcement of code and regulations, the best way is to use the self-help system, by giving the farmers technical services and safe skeleton of buildings and let them finish the rest.

In general most fatalities due to earthquakes are caused by distraction of the skeleton of the buildings; by giving them earthquake resistant skeletons we have reduced this fatality considerably. We should pay more attention to the skeleton of buildings, even if we have to introduce some new materials and new techniques to the villagers. If we give to the farmer a roof with suitable columns and ask him to finish the building himself with any material that he wants, he can purely do this. Suppose after the earthquake some of this finished work may be demolished and may have caused a few human injuries or losses of life but these may not create a catastrophe. It is just an economical problem, which has to be balanced whether to build a very strong building that will not be effected by an earthquake, or whether to have a building that resists some forces, but not completely collapses.

A. Fain : Can you tell me how many major earthquakes you have had in Iran these last twenty years. Secondly, with the new techniques in seismography, I think it is now possible to predict the occurrence of earthquakes some time in advance, have you applied these observations in your country ?

A. A. Moinfar : Every five years we have an earthquake of about magnitude 7., every two years we have an earthquake with magnitude 5.5 and 6. Smaller earthquakes we have frequently. The earthquakes of magnitude 7 and 7.5 had a fatality of 10,000 in 1962 and of 10,000 again in 1968. In average every year we have about 3,000 deaths due to earthquakes.

About the prediction of earthquakes, there is some work being done, but still it is in elementary stage. For example right before an earthquake the ratio of P wave velocity to S wave velocity drops, or there is a variation of percentage of contained gases in the natural mineral water, or variation in the ground water table, or a sudden change in the magnetic field of the ground, and many other phenomena, which scientists at the present time are working on. One indication is fault movement. As long as there is some movement on existing active geological faults, the energy is being gradually released. If the rate of this movement is changed, there is indication

of energy accumulation along the fault and we may expect an earthquake. Most of these cases are being studied at the present time at laboratory scale, and so far there has been good progress in the U. S. A., U. S. S. R. and in Japan in forecasting small earthquakes. All those things still are at an initial stage and not yet in practical application. Although they can predict some of the smaller earthquakes, the large earthquakes are not predicted yet, but we are very hopeful for the future.