

## Disaster management education on earthquakes

M. Erdik

Bogazici University, Istanbul, Turkey

**ABSTRACT:** For any earthquake disaster management program the public awareness building, information dissemination and the training of personnel constitutes the fundamental ingredient of success. An effective education and training program for earthquake disaster management should: be participatory in design; be community specific; be based on a rational assessment of the information needed; be integrated with the existing response systems; include information on prevention; mitigation and recovery; be established as an on-going process; and include, as priority, the most vulnerable section of the population. The curriculum should include: the earthquake hazards; earthquake disaster scenarios; preparedness plans; mitigating impacts and the mid-disaster activities.

### 1 EARTHQUAKE DISASTERS: MANAGEMENT, PREPAREDNESS AND MITIGATION

The inevitability of the occurrence of earthquakes in earthquake prone countries makes it imperative that certain preparedness and emergency procedures should be prepared prior to and in the event of an earthquake disaster. A disaster, as defined by U.N. Ad Hoc Group of Experts, is a disruption of the human ecology which exceeds the capacity of the community to function normally, unless disaster preparedness and mitigation measures are in place. Thus the people, institutions and the other elements of life which, by nature, function during normal times, cannot necessarily function effectively during the abnormalities created by the disaster. The need for return to normalcy necessitates appropriate disaster response (disaster management) before it happens. In this context, earthquake disaster management becomes the process of anticipating and planning for damage that a major earthquake would eventually create. It is an unbroken chain of concerted actions involving: disaster, response, relief, rehabilitation, reconstruction, risk reduction, mitigation, preparedness and (if possible) warning. The earthquake disaster preparedness and the mitigation constitute the two of the important activities of the earthquake disaster manage-

ment. In general, earthquake preparedness measures encompass: the development of emergency response and recovery plans; the utilization of earthquake hazard and risk assessments; and the dissemination of vulnerability and risk information. Earthquake mitigation measures encompass: development of physical and societal impact and loss scenarios; adoption of seismic zonation and land use planning; and reducing the impact of the hazardous process through earthquake design and construction codes. In all of these activities the goal should be the achievement of long term socio-economic development rather than the short term political gains.

### 2 NEED FOR AWARENESS BUILDING, TRAINING AND EDUCATION

For any earthquake disaster management program the public awareness building, information dissemination and the training of personnel constitutes the fundamental ingredient of success. In fact, one of the four goals of the proposed International Decade for Natural Hazards Reduction (USNAS, 1987) reads as: "to implement these (i.e. disaster mitigation) measures through programs of ... education and training- all tailored to specific hazards and locations and evaluated for their effectiveness".

Major losses of life in the past earthquakes have occurred due to the collapse of buildings with insufficient earthquake resistance or with inappropriate siting considerations. Several developing countries spend about 2% of their Gross National Product (GNP) for post-earthquake reconstruction (Erdik, 1987) and, in some instances, the losses caused by earthquake disasters have completely cancelled out any growth in the GNP (Einhaus, 1987). In rural areas the problem lies in implementation of low-cost and socially acceptable earthquake resistant design and construction. In urban areas the problems associated with urban planning, infrastructures, lifeline systems and secondary hazards merit consideration. With varying degrees, the 1985 Mexico City, 1989 Armenia and 1990 Loma Prieta earthquakes provide evidences regarding the effectiveness of the public education programs on disaster preparedness. 1985 Mexico City earthquake demonstrated the consequences of inadequate preparedness planning (Krimgold and Gelman, 1989). While efforts had been made to develop disaster response planning at the government level, at the time of the earthquake there was no effective response plan in place. Inadequate reconnaissance and damage assessment led to serious delay in full mobilization and application of national and international response capability. During the several days in which the ad hoc management of the earthquake response was assembled, valuable time was lost in the search and rescue operation. Regarding the 1989 Armenian Earthquake, Wylie and Filson (1989) report that there was no evidence of any predisaster public education about the earthquake hazard or about what to do, before, during and after the earthquake. Few members of the public, if any, new of appropriate actions to take during and after the earthquake. There was also no evidence that any pre-disaster earthquake response plans for organizations and communities existed and in fact, officials reported than none existed. The lack of earthquake disaster response plans likely constrained both the efficiency and effectiveness of initial disaster response and certainly negatively affected the coordination of initial response to the earthquake. As stated by Lee (1990) the 1990 Loma Prieta earthquake and its aftermath underscored the importance of regional planning and preparedness. There have been communication, priority allocation, planning, service restoration delays, execution of mutual aid agreements and emergency protocols.

Most of these problems can be addressed through proper planning, microzonation, appropriate construction technologies and implementation of comprehensive training and education programs.

In earthquake disaster prone developing countries most of the resources are allocated to programs for development and the disaster issues and problems are given a rather modest priority level. Given the scarcity of resources a comprehensive training for disaster preparedness becomes essential to reduce the human and property costs of earthquake disasters, and the waste, delay and misoriented development at the recovery phase. Today, several relief and development agencies allocate substantial amount of resources to research and applications in fields related to the earthquake disaster preparedness and mitigation in the national and international scale. The return on these efforts will only be realizable if they are coupled with proper training and education at all levels of society.

### 3 TRAINING AND EDUCATION PROGRAMS: GENERAL CONSIDERATIONS

In recognition of the fact that knowledge alone makes no contribution to the reduction of earthquake losses if it is unknown by those who would need it, a continuous education project is needed to transfer information and technology to a wide variety of researchers, practitioners, and public officials at local, national and international levels. An effective education and training program for earthquake disaster management should: be participatory in design; be community specific; be based on a rational assessment of the information needed; be integrated with the existing response systems; include information on prevention; mitigation and recovery; be established as an on-going process; and include, as priority, the most vulnerable section of the population.

According to Hays (1990) the selection of education project should be based on criteria such as the following:

1. Increased knowledge for loss reduction and improved professional practices (Will the project produce gains in knowledge that will deepen scientific and/or engineering understanding and capability?)

2. Synergism (Does the project have objectives and resources that complement those of an existing project and, therefore, provide leverage?)

3. Catalyst (Will the project stimulate other projects?)

4. New Frontiers (Does the project provide access to new information, study areas, and institutional partnership that are usually not available? Does it advance the frontiers of knowledge?)

Furthermore, in establishing such training and education programs the objectives should be clear, practical and attainable (i.e. not necessarily ideal but realistic).

In general terms, knowledge can be disseminated through: public information, training and education. Public information activities are the best means for promoting the basic awareness for earthquake disaster impact and mitigation utilizing the public communication media. Training activities involve a more focused set of learning activities with the objectives of teaching individuals to carry out specific tasks based on an accepted methodology with available techniques. Education represent the most formal approach to learning disaster mitigation with the aim of bringing a person to an understanding of a subject to the level of forming independent opinions, establishing priorities and understanding relevant methodology (Scramm, 1984). An individuals involvement in an organized training for earthquake disaster management should lead to some sort of certification. This recognition of the accomplishment will result in greater motivation for others to take up such training.

For proper development of a training and education program, curricula and strategies for disaster preparedness the following fundamental questions need to be answered (Erdik, 1988): What needs to be learned? (Subject Matter), Who needs to learn it? (Target Audience), How can it be learned? (Learning Media).

#### 4 WHAT NEEDS TO BE LEARNED?

The subject matter for disaster management training and education depend on the rural and urban development levels and the socioeconomic structure of a country. A rational assessment

of the subject-matter for training and education may start with identification of the country-specific problems associated with the management of disasters. For example, the problems associated with the earthquake disaster management in Turkey have been identified (Ergnay and Erdik, 1984) as: ambiguities on government policies for disaster management; high vulnerability of rural structures; insufficient enforcement of design codes, construction quality and urban planning.

There exist substantial amount of literature on disaster management. Some of the internationally known training materials and agencies are outlined in (Parker, 1983). A general overview of earthquake education curricula for primary and high school students in the United States can be found in Ross (1989). The direct use of these sources by developing countries should be considered cautiously since, as it has also been pointed out in (Carter, 1983), the nations must work out their own training needs rather than copying ideas or proposals from other countries or from academic sources, which may result in an inadequate definition of what is required in training and/or the training may be incompatible with the country's own disaster management plans. The curriculum of the training and education in earthquake disaster management should, in general, include the following topics. The curriculum should be differentiated for the rural and urban applications and for the target audience.

1. Earthquake Physics (Geographical distribution; tectonics; causes; measurement methods and scales)

2. Earthquake Hazards (Strong earthquake ground motion; site response; tsunami, seiche, landslide, subsidence and liquefaction susceptibilities; primary and secondary earthquake hazards; probabilistic assessments; macro-and micro-zonation and hazard mapping; land-use management and siting considerations)

3. Earthquake Vulnerability and Risk (Earthquake vulnerability of human lives, structures and socio-economic systems; synthesis of vulnerability with hazard for the assessment of earthquake risk; deterministic and probabilistic approaches)

4. Earthquake Resistant Design, Construction and Retrofitting (Principles and codes for earthquake resistant design and construction of buildings, infra-structure, utilities and life-lines; evaluation, repair, strengthening and retrofitting of the same; earthquake

resistant construction of non-engineered and/or rural buildings)

5. Earthquake Disasters (Case studies of relevant earthquake disasters; earthquake disaster data base; effect of disasters on environment and systems)

6. Preparedness (Pre-disaster) Planning and Activities (Pre-disaster planning and management activities and techniques; disaster awareness, public information, education and training; creation and strengthening of programs and organizations for the prevention of earthquake disasters; hazardous material and building management; earthquake insurance; legislative and regulatory measures; response readiness; logistical support; resource management; mobile command and communication operations; public warning systems)

7. Emergency (Mid-disaster) Planning and Activities (Emergency rescue, evacuation, transportation and communication; damage assessment, condemnation, demolition, demarcation of dangerous buildings and zones; debris removal; emergency provision of health care, shelter, water, food and utilities; human response and information management; law enforcement; planning and co-ordination of disaster relief assistance)

8. Post-Disaster Planning and Activities (Assessment of socio-economic conditions, resources and needs; measures and policies for relief, resettlement, rehabilitation and redevelopment; re-establishment of government services; institutional framework, implementing agencies; hazard abatement; disaster accounting; planning and co-ordination of rehabilitation and reconstruction assistance)

## 5 WHO NEEDS TO BE TRAINED?

There exists several target audience groups to direct the training and education program in disaster preparedness. These groups include: the general public, operational professionals (e.g. engineers, craftsmen, farmers, health workers, planners and insurers), private enterprise, government agencies, hazard specific endangered groups, and policy makers. Local governments and agencies are good sources of information for identifying priority target groups since they should be most familiar with the country specific demographic profile.

The general public needs training for awareness; masons and carpenters need training

for hazard resistant house construction; civil engineers need to understand earthquake resistant design codes and the socio-economic consequences of disasters; and the policy makers need to know how their decisions and actions will effect the vulnerability and the risk associated with earthquakes.

## 6. HOW CAN IT BE LEARNED?

Since the ultimate responsibility for the consequences of earthquake disaster rests on the government, there is merit in using the government sources (e.g. earthquake disaster management institutions) for the organization of the training. If needed, specialists or consultants can be acquired as trainers from other national institutions (universities), from regional institutions and from specialized UN agencies, such as UNDRO, WHO, UNESCO, UNIDO, UNEP, UNCHS, IISEE etc. The voluntary agencies, such as the Red Cross and the Red Crescent, can also have an important role. As outlined in (Parker, 1983) there exist several centers that can provide training in several aspects of the earthquake disaster management.

The teaching media traditionally encompasses printed materials (books, posters etc.), graphic materials, safety kits, audio-visual library, reference documents and data bases. One of the best learning media to this end is obviously the disaster itself. Thus the full documentation on the past disasters should be made available during the learning process. Teaching approaches should include: knowledge and skill building for problem solving with emphasis on teamwork; adjustment to prevailing conditions and constraints; exercises, gaming simulations and audio-visual presentations.

## 7 PUBLIC EDUCATION PROGRAMS

The target audience consists of specific sections of the community exposed to earthquakes. The training encompasses public awareness programs to develop and/or to maintain a desired level of awareness and earthquake disaster preparedness. There are several areas which could be used as objectives for program planning in public education (Nigg, 1983):

1. To heighten awareness of the earthquake threat,
2. To inform about possible, pre-earthquake preparedness measures,

3. To inform about adaptive behaviors during an earthquake,

4. To inform about adaptive post-earthquake behaviors,

5. To encourage the implementation of personal or organizational preparedness plans and actions.

From the psychological point of view (Hartsough, 1983) attempts to orient the general public toward appropriate actions before an earthquake should overcome the palliative defenses such as denial and avoidance (e.g.: the earthquake will not happen, and even if it happens the individual actions are useless). The subject matter should be at a readily understandable level and should aim to answer: what the disaster will do?; what is the best action to take personally, family wise and by the community?; what are the organizations programs of the government or non-governmental sector for relief and rehabilitation?; how to utilize these services most efficiently?; how to best support the local disaster operations?.

Training can be given through several channels that has direct links with the public. These include health organizations, religious service establishments, police, Red Cross or Crescent, radio and television services. Information can also be conveyed via elementary school programs, community gatherings, radio and television talks, posters and other special demonstrations.

#### 8 PROFESSIONAL LEVEL EDUCATION PROGRAMS

Professional people are the operational professionals involved in several aspects of earthquake disaster management, such as land-use planning, construction, relief and rehabilitation. Professional operating in earthquake disaster related fields include engineers, architects, builders, craftsmen, health workers and planners. Specific target audience can be identified by the individual countries for priority training. The training and education at this level can have an immediate effect on the earthquake disaster preparedness. In addition to these target audience the private voluntary organizations (PVO) or non-governmental organizations (NGO) constitute a parallel audience in need of training for earthquake disaster management. The training should be targeted to their senior personnel and field staff. The subject

matter of training will be substantially technical and should include: the physics of earthquake disasters; disaster problems, effects and impacts; current organizations, plans and programs for earthquake disaster preparedness and mitigation measures; earthquake hazard study; structural vulnerability; earthquake resistant design principles and codes; evaluation and restrengthening of existing structures and facilities; legislation governing land use, development and construction; earthquake insurance; and emergency phase planning including evacuation, recovery, medical care and restoration.

The operational professional level earthquake disaster management training can take forms of short courses and field training. Especially under the circumstances of disaster operations a series of courses can be given to the field staff while they are involved with on-going disaster program activities. Simulation exercises can provide an immediacy of experience. Past earthquake disaster reviews are also valuable training tools. Regional seminars and conferences will be of great importance for the comparison of plans, programs and activities in a regional arena encompassing countries of similar cultural and socio-economic background and prone to the similar disaster exposure.

#### 9 POLICY MAKER LEVEL EDUCATION (SENSITIZATION) PROGRAMS

Policy makers include top level government officials and political decision makers located at the top of the learning pyramid. The training should be tailored the key executive personnel to keep them periodically informed about policies, plans, organizations and programs of earthquake disaster management. Training should include critical post-disaster analysis of disaster operations with constructive retrofit proposals. The training can be given in the form of short seminars, round table meetings and similar discussion groups. Post-disaster review of the disaster plan and programs also provides substantial learning benefit.

#### 10 CONCLUSIONS

An effective awareness building, training and education program for disaster management

should: be participatory in design, be community specific, be based on a rational assessment of the information needed, be integrated with the existing disaster warning and response systems, include information on prevention, mitigation and recovery, be established as an on-going process, include as priority the most vulnerable section of the population.

In general terms, knowledge can be disseminated through: public information, training and education. Public information activities are the best means for promoting the basic awareness for earthquake disaster impact and mitigation utilizing the public communication media. Training activities involve a more focused set of learning activities with the objectives of teaching individuals to carry out specific tasks based on an accepted methodology with available techniques. Education represent the most formal approach to learning earthquake disaster mitigation with the aim of bringing a person to a level of forming independent opinions.

For proper development of a training and education program, curricula and strategies for earthquake disaster management the following fundamental questions need to be answered: what needs to be learned?, who needs to learn it? and how can it be learned?.

Knowing what will take place, how to be prepared and how to respond to an earthquake disaster are key ingredients of management. Disseminating this knowledge should be a noble responsibility of the educators and trainers.

#### REFERENCES

- Carter, W.H. (1983), Counter Disaster Training in Developing Countries, Disasters, v.7, pp.34-37.
- Scramm, D. (1984), Learning Disaster mitigation, Proc. Int. Conf. on Disaster Mitigation Program Implementation, Ocho Rios, Jamaica.
- Einhaus, H. (1988), Emergency Planning and Management for Disaster Mitigation, Regional Development Dialogue, v.9, No.1, pp.1-13, UNCRD, Japan.
- Erdik, M. (1987), Training and Education for Disaster Preparedness, Regional Development Dialogue, v.9, No.1, pp.36-48, UNCRD, Nagoya, Japan.
- Ergnay, O. and M.. Erdik (1984), Disaster Mitigation Program in Turkey, Proc. International Conference on Disaster Mitigation Program Implementation, Ocho Rios, Jamaica, 12-16 November, 1984.
- Hartsough D.M.(1983), A Targeted Program for Public Education: A Psychological Perspective, Proc., Workshop on "Continuing Actions to Reduce Losses from Earthquakes in the Mississippi Valley Area", USGS Open File Report No. 83-157, Reston, Virginia.
- Hays, W.W. (1990), Perspectives on the International Decade for Natural Disaster Reduction, Earthquake Spectra, v.6, No.1, Earthquake Engineering Research Institute, 90-01.
- Krimgold, F. and O. Gelman (1989), Working Group Conclusions on Lifelines and Disaster Response/Mitigation in Lessons Learned from the 1985 Mexico Earthquake, Ed. by V.V. Bertero, Earthquake Engineering Research Institute, 89-02.
- Lee, B. (Technical Editor) (1990), Loma Prieta Earthquake Reconnaissance Report- Supplement to Earthquake Spectra v.6, Earthquake Engineering Research Institute, 90-01.
- Nigg, J.M.(1983), A Targeted Planning Approach for Public Education Programs, Proc., Workshop on "Continuing Actions to Reduce Losses from Earthquakes in the Mississippi Valley Area", USGS Open File Report No. 83-157, Reston, Virginia.
- Parker, J.W (1983), Training Materials and Agencies, Disasters, v.7, pp.61-63.
- Ross, E.K.K. (1989), What Currently Exists in Earthquake Curricula, Proc., Conference on Disaster Preparedness- The Place of Earthquake Education in our Schools, NCEER Technical Report, 89-0017, Buffalo, NY.
- U.S.National Academy of Sciences (1987), Proposal for the International Decade for Natural Hazards Reduction, Washington, D.C., May, 1987.
- Wylie, L.A. and J.R.Filson (1989), Societal Impact and Emergency Response, in Armenia Earthquake Reconnaissance Report- Special Supplement to Earthquake Spectra, Earthquake Engineering Research Institute, 89-01.