

EDUCATION FOR EARTHQUAKE AWARENESS AND DISASTER MITIGATION

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ABSTRACT

Earthquakes are unavoidable and unpredictable natural events causing untold human misery and tremendous socio-economic problems. While the country is still under development an earthquake disaster puts the country at a great economic loss and slows down the development. Such disasters can be greatly minimised by preparedness, planning and education. A logical approach to implement disaster mitigation program is through education and training at various levels. It is necessary to educate masses to create awareness. Education of policy makers and administrators would enable them in organisation and preparation of disaster prevention programs and relief measures. It is necessary to educate engineers and architects who could ensure incorporation of earthquake resistant features in the design of structures. It is necessary to educate artisans who actually implement the features in the construction of structures. Education and training at different levels is indeed an effective method of minimising the disastrous effect of future earthquakes.

INTRODUCTION

India has witnessed sufficient number of damaging earthquakes in this century. This has created awareness of earthquake induced problems in some areas such as Dharmshala, North Eastern India, Bihar, Jammu & Kashmir and Koyna (Maharashtra). There are many other areas in the country which are earthquake prone. In general there is a lack of awareness about the earthquake disasters and the available mitigation measures. In case of an earthquake of magnitude around 7 thousands of houses are sometimes damaged beyond repair and great number of people are killed or injured. The magnitude of problem is greater when earthquake occurs in densely populated region. The majority of population in India lives in villages, most of the people have bad social and economic conditions and are more or less ignorant of earthquakes and their impacts. The village houses are usually constructed of weaker

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materials, without engineering knowledge and supervision. These houses suffer much greater damage in earthquakes as compared to urban houses. There are many simple methods available for earthquake resistant construction, for example, use of light weight construction like timber, use of better quality of binding material, provision of bands etc. There is a lack of awareness of these methods and it is more so in rural areas. It is utmost important that scientific approach should be adopted to protect human life and man made structures during severe earthquakes. Through the researches conducted at the Department of Earthquake Engineering and elsewhere in the world it is possible to make most of the construction earthquake resistant at little extra cost.

There is a wide-spread ignorance about earthquakes, its occurrence, causes, duration, periodicity, magnitude, damagability and prediction. The disaster caused by earthquakes cannot be completely avoided but can be greatly minimized by using the technical knowledge. The translation of technical knowledge into effective public safety programs is difficult, complex and sometimes controversial process involving dissemination and implementation of knowledge throughout the society. The best way to implement disaster mitigation programs is through education and training at different levels of population. The objective of this paper is to bring out the structure of education and training program that is necessary for implementation of earthquake disaster mitigation programs.

EARTHQUAKE DISASTER MITIGATION

Earthquake Disaster : The disaster caused due to earthquakes is well known. Earthquake in itself is not a disaster, it is merely shaking of the ground. The disaster is primarily caused due to failure of man made structures. The structures are damaged because they are not designed and constructed to withstand the forces developed in them due to earthquake motion. Earthquake motion has a most terrifying character against which human being has the feeling of high degree of weakness and unsafety. Earthquake is an unavoidable natural phenomenon. Earthquakes cause more disaster in the populated areas. Human societies may stay away from this phenomenon by not making houses in the earthquake regions. Such a proposition is not practicable. The settlements exist and will exist in earthquake regions.

Disaster Mitigation :

The earthquake disaster mitigation is the only means to protect human life and structures. The earthquake disaster mitigation can be broadly divided into two categories,

- (a) Prediction of earthquake
- (b) Disaster prevention programs

(a) Prediction of Earthquake :

The earthquakes are not predictable at present. The reliable forewarning is therefore not possible. The knowledge of prediction could be useful in the protection of human life but it may not be so much useful in the protection of man made structures.

(b) Disaster Prevention Programs :

These methods are the only practical way of dealing with reduction of earthquake hazard. The disaster prevention measures include preparation of zoning map, education of public, preparedness and planning for disaster, installation of strong motion network, reinforcing and renewing of structures, demolishing of buildings that have outlived their life and using the concept of earthquake resistant design and construction of structures. The organised education and training programmes at various levels is essential to implement the different aspects of disaster prevention program into practice.

MAN MADE STRUCTURES

The man made structures suffer maximum damage in earthquake causing economic losses to individuals, community and Government. The structures that are liable to damage can be classified into two broad categories (ref 1).

Engineered Constructions :

The bridges, dams, tall reinforced concrete buildings, hydro, thermal and nuclear power plants, life line systems, refinery structures, major industrial structures, etc. are classed as engineered constructions. These structures are formally designed by established engineering procedures and constructed following the national codes of practice.

Non-Engineered Constructions :

The buildings made in brick, stone, wood or clay and a combination of these materials, that may or may not be governed by building bye-laws fall in this category. These structures are usually constructed traditionally through masons and carpenters without technical supervision. No consideration is usually given at any stage of their construction about their vulnerability during future earthquakes. The earthquake damage occurs relatively more in Non-Engineered construction. The general principles of earthquake resistant design for both types of construction are available. There is a need to communicate this knowledge to the concerned people to construct safe and economic structures capable of resisting earthquake effects.

EARTHQUAKE EDUCATION

Professor A.S. Arya (1981) in his key note paper identified following three types of earthquake education to effectively mitigate the earthquake disaster,

- (a) General education at mass level
- (b) School education
- (c) Engineering education

The details of various components are described in the reference 1 and 2. The salient features are presented here.

General Education for Masses :

Most of the people are ignorant of earthquakes and their impact on human life. The objective of this education should be to create awareness and remove fear, so as to improve their reaction to earthquake, they should then help to save not only their own lives but of others too. The following aspects should be included,

- (a) Earthquake phenomenon
- (b) Removal of ignorance, superstition and associated stories
- (c) Do's and Dont's
- (d) Knowledge of simple earthquake resistant features
- (e) Whom to contact for advise and help for safety and repairs of building.

General Education for Policy Makers and Administrators :

The administrators and policy makers have to organise the disaster relief operations and plan post earthquake programs involving reconstruction, rehabilitation and land-use planning. The objective of the education should be to create awareness and exposure to earthquake induced problems to human life and man made structures, so that they could organise and plan disaster prevention programs and disaster relief operations on a large scale. The following aspects should be included in the education program,

- (a) Earthquake Phenomenon : Causes and effects, Richter magnitude, M.M. Intensity, duration, periodicity, seismic zones, past history.
- (b) Effect of earthquake on ground, foundation, liquefaction, buildings/structures and human life.
- (c) Stability of damaged structures.
- (d) Post earthquake repair, restoration and reconstruction.
- (e) Earthquake resistant design and construction features of buildings, basic planning considerations.
- (f) Disaster preparedness, emergency evacuation and relief.
- (g) Disaster Insurance.
- (h) Disaster education and training programs.
- (i) National bodies dealing in earthquake disaster mitigation
Role of I.M.D., G.S.I., B.I.S., D.E.Q., I.S.E.T.
- (j) Seismological investigations, Instrument data collection and its purpose.
- (k) Code and byelaws for earthquake disaster mitigation

General Education for Educated Citizens: It is necessary to create awareness to educated masses. They can take larger responsibilities of looking after the safety of their own buildings after earthquake and assist in disaster relief operations. The educational program would cover aspects similar to above except that organisational portion of the training is not necessary for them.

Education Program for School Children The best way to impart earthquake education for future protection of life and property is to educate school children. The objective of children education

should be to create awareness and exposure to earthquake disaster problems. The following aspects should be included in this program.

- (a) Earthquake Phenomenon
- (b) Earthquake hazard reduction
- (c) Do's and Dont's
- (d) Engineering methods of disaster mitigation
- (e) Engineering and scientific institutions in the country dealing in seismic problems
- (f) Inclusion of popular stories/articles in text books, posters.

Technical Education : The technical education should be imparted to engineering and diploma students. The technical training should also be given to artisans. The civil engineering, architecture and town planning students need this education most because they are directly involved in planning, design and construction of man made structures. The objective of this education should be to provide upto date know-how in the earthquake resistant design procedures and constructions, relevant codes and byelaws, so that they can actually implement these features in new constructions. The following steps are necessary in this direction.

(a) Introducing a special elective course at postgraduate level in Structural Engineering, Geotechnical Engineering, Bridge and Dam Engineering, Mechanical and Industrial Engineering, Electrical Engineering etc., so as to cover basic concepts of earthquake resistant design of structures, systems and equipments.

(b) A one and half year M.E. program in Structural dynamics and soil dynamics is already existing for Civil Engineering graduates at Department of Earthquake Engineering, University of Roorkee, Roorkee. In addition, one and half year P.G. Diploma course in Earthquake Engineering is available for sponsored engineers. These courses deal in detail the engineering aspects of disaster mitigation and earthquake resistant design and construction practices.

(c) Introducing a course on Earthquake Engineering at undergraduate level, Indian Society of Earthquake Technology has prepared a syllabus of such a course and circulated to all Engineering Colleges in the country. It would be desirable to introduce elementary knowledge about earthquake resistant construction at Diploma level too.

(d) There is a need to prepare model byelaws for earthquake resistant features in buildings for introducing in the Municipal byelaws.

(e) Seminars, workshops, symposium and short term courses are necessary for education and training of engineers and architects in basic principles, design and construction of earthquake resistant structures.

(f) A short term training program is necessary for masons and carpenters for educating them earthquake resistant construction features in traditional construction of different regions.

(g) Some standard models/charts displaying the construction details for earthquake safety should be prepared. These can be displayed in display centres and mobile exhibition for education purposes.

IMPLEMENTATION OF EDUCATION PROGRAMS

There is a great deficiency of technical literature on Earthquake Engineering in the form of books. In order to propagate earthquake education faster there is a pressing need for books on various engineering aspects, socio-economic aspects, repair, restoration and strengthening, planning, preparedness and management of earthquake disaster mitigation. The professionals dealing in earthquake problems have an important role to play in future in this direction. The long term education programs should be undertaken at different levels. The following methods can be employed for implementation of earthquake programs,

(a) Education by radio and television.

(b) Publication of simple hand books.

(c) Publication of popular articles in newspapers/magazines.

(d) Preparation of posters.

(e) Organisation of short term courses.

(f) Education by conferences, workshops, practical training, seminars, informal meetings, lectures by experts on earthquake engineering topics.

(g) Educational movies.

INTERNATIONAL SCENERIO IN EDUCATION PROGRAMS

Earthquakes have caused disasters in many seismic countries of the world, Japan, U.S.A., Newzealand, China, U.S.S.R. etc. There is an increasing awareness in various seismic countries to introduce education programs for seismic problems. In order to derive benefit of experience of various countries, there is a continuing need for international co-operation in education programs also. International Association of Earthquake Engineering (IAEE) is playing an active role by organising four yearly World Conference on Earthquake Engineering. A set of proceedings published on this occasion provide a useful literature on all aspects of earthquake engineering. There is a continued thinking in Japan on various aspects such as urban planning for disaster, establishing anti-disaster measures for cities and disaster prevention programs. Some projects undertaken in this direction are summarised below;

- (a) Long term education project on earthquake and earthquake resistant design. This was started in 1973 by Earthquake Research Institute, Turkey.
- (b) Disaster prevention school in Japan for citizens has operated since 1978.
- (c) Earthquake preparedness education of Los Angeles city employees. This education program is prepared for work place and home environment.

CONCLUSION

There is lack of awareness in the area of earthquake disaster mitigation. The education and training of masses and personnel at different levels is necessary to create exposure to earthquake induced problems and various aspects of disaster mitigation. Education to masses can be imparted through books, radio, television, educational movies, posters, popular articles and exhibitions. The technical education in disaster mitigation can be imparted through seminars, workshops, conferences and short term courses. The educational programs at different levels is indeed an effective method of minimising the disastrous effect of future earthquake.

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