CHAPTER

15

IMPLEMENTING SCHOOL SEISMIC SAFETY PROGRAMMES IN DEVELOPING COUNTRIES

Sudhir K. Jain

Indian Institute of Technology, India

Abstract: This paper discusses some of the challenges of implementing successful seismic safety initiatives in developing countries. Two Indian initiatives are presented – the National Programme on Earthquake Engineering Education and licensing of engineers – that can provide lessons for planning school seismic safety programmes in developing countries. A number of strategy issues are discussed in the light of these programmes, which focus on the need for having realistic expectations, giving priority to areas and components that are likely to succeed, focusing on new buildings first and retrofitting later, considering the broader context of education provision and infrastructure, promoting effective communication and developing local leadership.

Introduction

It has long been recognised that schools require special attention with regard to seismic safety. Spectacular collapses of a number of school buildings in the 1933 Long Beach earthquake in California (M6.3, with a maximum MMI of IX) resulted in the implementation of the Field Act by the state of California, which required special seismic safety provisions in all new public schools. This law not only required good seismic design features, but also superior construction supervision (Steinbrugge, 1970).

During the 2001 Bhuj earthquake in India (M7.7, with a maximum MMI of X), 971 students and 31 teachers died, and 1 051 students and 95 teachers were injured. Fortunately, this earthquake occurred on the Republic Day holiday, when classrooms were empty. Another tragic event took place when about 300 schoolchildren marching in the Republic Day procession in a narrow lane in the town of Anjar were killed when buildings on both sides collapsed on them (Rai, Prasad and Jain, 2002).

In addition to protecting lives during damaging earthquakes, seismic safety of schools has two important post-earthquake implications:

- School buildings can be used to provide temporary shelter.
- To restore normalcy to the lives of the affected population, schools should be re-opened soon after an earthquake disaster.

Challenges for developing countries

What is a developing country? In the opinion of the author, the difference between a developed and developing country is not the availability of natural resources, but rather the quality of governance and utilisation of available resources. Thus, any seismic safety initiative has to factor in the issues of governance. The best-laid plans will not work without the consideration of the country's socio-political context.

In addition to issues of governance, developing countries offer several major challenges to any programme aimed at school safety. Some countries are still grappling with the task of sending every child to school. India, for example, recognises that basic education is the right of every child, but this goal is still far from being achieved; numerous schools have too few teachers, the building infrastructure of most publicly-owned schools leaves much

to be desired and many schools are run in temporary shelters. In such a scenario, how does one argue with a well-meaning administrator about the need for seismic retrofitting of schools when the administrator is frustrated at not being able to provide shelter for children from the rain?

Developing countries lack mechanisms to effectively ensure that new constructions comply with all safety regulations, not only those that are earthquake-related. India on the one hand has design and construction firms that can compete internationally; on the other hand the country has no system to control poor quality design and construction of ordinary buildings.

In India, awareness about seismic threat – even in seismically active areas – is poor. In a workshop in Ahmedabad several months ago, city officials in two cities in seismic zones IV and V (the highest zone is V) admitted publicly that prior to the workshop they were unaware of the seismic threat to their own cities. Finally, the professionals connected with the construction industry (structural engineers, architects, construction engineers, etc.) are generally not competent in the seismic safety-related aspects of their respective professions.

Two Indian experiences

This section describes two experiences in India that can provide some lessons for planning school seismic safety programmes in developing countries.

National Programme on Earthquake Engineering Education

After the 2001 earthquake, India's Ministry of Human Resource Development launched a comprehensive National Programme on Earthquake Engineering Education (NPEEE) (*www.nicee.org/npeee*). In the project, eight premier institutes of technology provide training for teachers from colleges of engineering, architecture and polytechnics. Components of the project include short-term (one to four weeks) and medium-term (one semester) training programmes for faculty members; international exposure for faculty members; development of resource materials and teaching aids; development of library and laboratory resources; and organisation of conferences and workshops. The programme is open to all recognised engineering colleges/polytechnics and schools of architecture – both public and private – with related academic degrees or diploma programmes.

The programme commenced in April 2003, initially for three years, with a budget of about INR 137.6 million (about USD 3 million). This amount does not include institutional overheads, salaries, buildings or other infrastructure as the eight premier institutes are publicly funded.

- About 13 short courses, each of one or two weeks duration, have been conducted for faculty member to date.
- A group of 17 faculty members from around the country have completed a one-semester certificate programme at IIT Kanpur in Earthquake Engineering, while another group of 22 faculty members are completing a similar programme at IIT Roorkee.

- Several workshops have been held to develop curriculum.
- Some progress has been made towards modifying curricula to include adequate coverage of earthquake engineering.

The programme, within its first year, has received tremendous support from administrators and others. The components that are the key to its success include:

- The entire project is totally transparent in terms of finances and activities. The Programme Implementation Plan (PIP) – which outlines budget and norms for various activities, checks and balances – is available on the Web site and has been distributed by e-mail and post to college teachers and others.
- All concerned colleges are included regardless of their source of funding.
- The programme is kept at a manageable size in terms of human resources and subject area. For example, it focuses on technical education, which does not include support for research or training programmes for professional engineers. No attempt is made to solve the entire problem in the short three-year period; it is expected that such a programme must operate for ten to 20 years to fully tackle the problem.
- The programme is managed by a young group of employees, who over the years have developed a good rapport and understanding.

Licensing of engineers

In the past, India has not had a system for competence-based licensing of structural and other engineers. In recent years, it has been understood that significant opportunities will be lost without a proper licensing system. The Engineering Council of India (ECI) was formed after the Gujarat earthquake as an umbrella organisation for a number of professional bodies. It aims to develop a comprehensive licensing system for different disciplines of engineering. However, efforts are being made to simultaneously license all engineering disciplines (civil, electrical, aerospace, etc.), although clearly, there is a greater need to license disciplines such as civil or structural engineering (aerospace and automobile industries have enough checks and balances to ensure competence of their engineers).

More recently, the All India Council for Technical Education (AICTE) declared its intention to initiate the licensing of engineers. The AICTE is primarily charged with regulating the technical education sector, but it is not clear if this is the appropriate body for licensing engineers. Moreover, it is a duplication of efforts as both the AICTE and the ECI try to achieve the same objective.

Strategy issues

In view of the above discussion, the following key issues of strategy emerge.

Having realistic expectations

Making schools earthquake safe is a lengthy process, and the problem cannot be eliminated in a short period of time. The school seismic safety effort in a developing country should be based on what can be achieved in the short and medium term, rather than what is needed in the long term. Small activities enable concerned stakeholders to gain confidence and to learn to work together for a common cause, in preparation for involvement in larger initiatives. When discussing a new initiative, an administrator tends to prefer that the entire problem be tackled at once. For an administrator, the effort is the same for managing a grant of USD 100 000 or USD 10 million; hence, there is pressure to develop a comprehensive package that includes everything, regardless of practicability, which leads to unrealistic expectations. The NPEEE was launched with a one-day workshop in April 2003 on "Earthquake Engineering Curriculum". A wide cross-section of participants attended, including more than 100 faculty members and professional engineers. Most speakers chose to address what needs to be done to ensure the safety of buildings and what should have been, and is not, included in this programme. It was clear that in an environment where everyone had been talking about the problem but nothing was being done, the participants saw a new hope in the form of this NPEEE project, and they expected it to solve the entire problem. In order to ensure that this project is not negatively affected by unduly large expectations, the project's goals should be commensurate with the available management and technical manpower capabilities.

Giving priority to regions and components that are likely to succeed

There is a wide variety of opinions and attitudes in different cities, regions, states or countries, depending on the individual or entity responsible for managing the earthquake safety project. Similarly, the manpower available for its implementation can vary greatly. This situation has two implications.

- A programme for a city, regions, state or country should ideally be tailor-made, bearing in mind what is likely to succeed. If the entire programme requires five components, and it appears that only three of them can be effectively implemented, it is best to omit the other two, even though they may be important. As the system successfully implements or starts to implement the three attainable components, capacity and motivation to take up the remaining two may improve and it may become possible to undertake them at a later stage.

- Choosing a city, region, state or country in which to implement a school safety programme should depend more on the attitude of leadership and the availability of resource manpower, than on the seismic risk. For example, the states in the north-eastern part of India are far more prone to earthquakes than most other parts of the country. However, if a state with lower risk can provide better opportunities for a successful programme, it may be better to give priority to that state. As experience and expertise is gained on

what works and what does not, it may be easier in future to start a programme in one or more of the north-eastern states. To take another example, in India, the Central Board of Secondary Education (CBSE) oversees a large number of schools in the country. It should be possible to put in place a system that will ensure that every new building in every CBSE school complies with seismic safety standards in letter and spirit.

Focusing first on new buildings, then on retrofitting

Retrofitting projects can be effective tools in drawing attention – both of the public and of decision-makers – to seismic safety; however every day, developing countries are constructing new but unsafe buildings, which will be candidates for future retrofitting. The resources available in terms of manpower, money and management skills are limited, but it is best to focus them first on setting up systems to ensure that all new constructions are seismically safe. Once there is a level of confidence in new constructions, efforts can be directed towards seismic retrofitting programmes. This is particularly important for school safety in developing countries, which as part of the development agenda, are currently investing heavily in new schools. For example, in April 1999 and December 2000, the government of Gujarat built about 6 000 new schools across the state using pre-cast technology; about three-quarters of these either collapsed or were seriously damaged during the 2001 earthquake (Rai, Prasad and Jain, 2002).

Considering education and construction issues

A school seismic safety programme must consider the overall school education environment and the construction scenario of the region.

Hence, it is important that some attention be paid to the issues of good education (*e.g.* "Are there teachers?", "Do schools have adequate classrooms and blackboards?") and to the entire construction industry (*e.g.* regulatory mechanisms, capacity building for professional engineers associated with schools, quality training for masons).

Improving communication

An effective communication system is essential to ensure the success of a school seismic safety programme. A programme should be transparent and complete details should be provided on the Internet, including financial provisions. While school safety initiatives have been undertaken in the last ten years in a number of developing countries, information and details of these initiatives are unfortunately disseminated only through presentations in international workshops. All resource materials developed for such initiatives should be placed on a common Web site, and public domain dissemination of information should be a requirement of funding agencies.

A good example of using the Internet effectively is the World Housing Encyclopaedia project of the Earthquake Engineering Research Institute (EERI) in the United States and of the International Association for Earthquake Engineering (IAEE) (*www.world-housing.net*). This Web site compiles information on different types of housing across the world. It has achieved a good amount of success with rather limited funds. It should be possible to develop a similar site for school safety programmes.

Developing local leadership

Outsiders are rarely able to effectively contribute single-handedly to safety programmes in developing countries. It is rare to find outside experts with a good understanding of the local situation who can work in developing countries for long periods of time. Hence, the best results are achieved when the problem is tackled by local experts, with outsiders providing a guiding role: developing local leadership is the key to success.

Closing remarks

Most of the remarks above could apply not only to school safety programmes but to any other seismic safety activities. However, since schools involve children – a hopeful, optimistic and enthusiastic community – this hope and enthusiasm is transferred to teachers. Students and teachers can have a strong influence over the seismic safety of their own schools. For example, if simple facts about earthquake risk and seismic safety are covered in the school curricula, more questions will be asked about the safety of the schools, putting pressure on the school management. Efforts are being made in this direction: recently, the Central Board for Secondary Education in India introduced the subject of natural disasters in class eight, and a textbook has been published.

Working in India for the last 20 years on capacity-building projects (*e.g.* Jain and Murty, 2003) has taught the author that grand plans do not often work, that it is best to embark on a project that can be managed with available resources, and that it is possible to increase the volume and size of operations only after the project has obtained credibility and confidence in the initial phase.

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