adpc

Asian Disaster Preparedness Center

School earthquake safety program Nepal

Asian Urban Disaster Mitigation Program

Safer Cities 4

Case studies on mitigating disasters in Asia and the Pacific

The School Earthquake Safety Program in Kathmandu Valley

Building safer communities through schools

Imagine, the earth shakes for no more than a minute, but "many schools which did not prepare for an earthquake are now suffering. Many school buildings are heavily damaged with children trapped inside of them. The children who are safe are crying from fear . . . Many parents are worried and angry because their children have not returned home, nor are they in school, nor can they be seen on the road."

The Kathmandu Valley's Earthquake Scenario (a product developed by the Kathmandu Valley Earthquake Risk Management Project or KVERMP) sketched this chilling picture against the background of an earthquake with a magnitude close to 8.3 on the Richter scale – similar in degree to the catastrophic earthquake that struck Nepal in 1934.

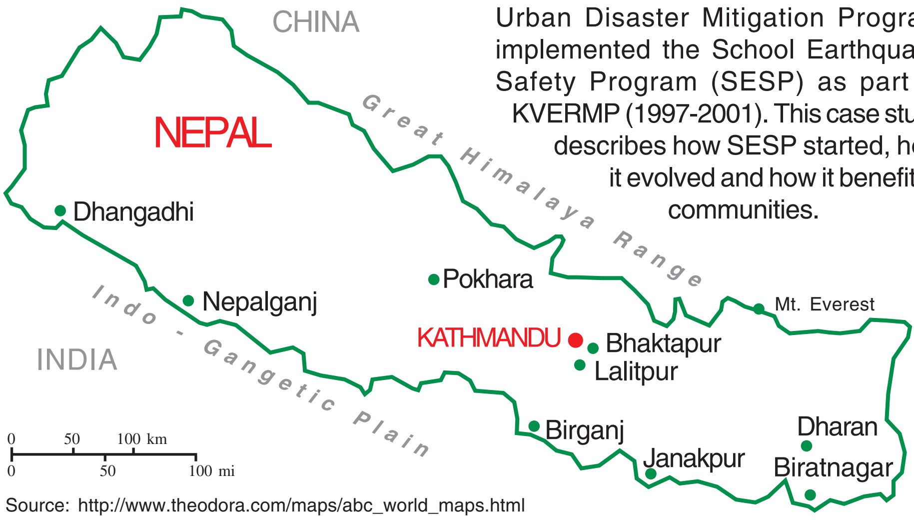
Introduction

Schools in Nepal pose extreme earthquake risks. School buildings, even those built recently, are generally constructed without the input of engineers trained in earthquake-resistant design or construction. Low budgets for the school management system increase the likelihood that poor materials or workmanship are used. The vulnerability of schools is illustrated by the 1998 Udayapur earthquake in eastern Nepal, where approximately 6,000 school buildings were destroyed, luckily during non-school hours.

After an earthquake, standing and safe schools play a crucial role in rehabilitating the community. Since schools are typically well distributed throughout the communities, they can be used as temporary shelters for the homeless, medical clinics and for other emergency functions.

Before an earthquake, schools can play a role in educating the children and their parents, relatives and friends in earthquake preparedness and mitigation.

In view of the above, the Asian Disaster Preparedness Center's (ADPC) Asian Urban Disaster Mitigation Program implemented the School Earthquake Safety Program (SESP) as part of KVERMP (1997-2001). This case study describes how SESP started, how it evolved and how it benefited communities.



Source: http://www.theodora.com/maps/abc_world_maps.html

Abstract

The School Earthquake Safety Program (SESP) is one of the priority initiatives under the Kathmandu Valley Earthquake Risk Management Project (1997-2001). The program evolved from a simple school retrofit activity to a comprehensive program of earth-quake safety involving the whole community. This case study explains the rationale for focusing on schools and the comprehensive process of developing and implementing SESP in Kathmandu Valley including details of: a survey and vulnerability assessment of public school buildings through school headmasters; retrofitting and reconstruction of schools; local masons' training on earthquake-resistant construction; a participatory community-based approach to earthquake mitigation; awareness raising and education on earthquake safety for teachers, school children and parents; empowerment of communities and general improvement of safety and livelihood; and institutionalizing SESP in local government.

The inside story

January 2003

Three reasons to focus on safer schools

- Schools house the community's future.
- Schools that are still standing and are safe can be used as refuge after a disaster.
- Schools can promote earthquake preparedness and mitigation in the community.

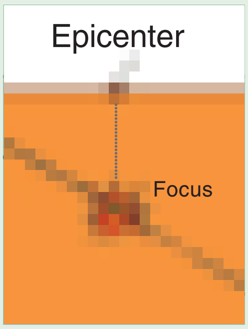
Issues to consider when implementing a school earthquake safety program

? questions to ask

- How do we get communities interested in strengthening schools?
- How do we build local capacities?
- How do we mobilize resources?
- How do we sustain the program?

What is an earthquake?

factfile



An earthquake is a sudden shaking or rupture in the earth caused by the release of accumulated stresses in the crust. The point within the earth where the rupture starts is known as the focus. Directly above it on the surface of the earth is a point called the epicenter. Earthquakes are measured according to these scales:

Modified Mercalli scale: Seismic *intensity* is an indicator of the effects of an earthquake at a particular point. Every earthquake has many intensities, the strongest usually being at the epicenter. Intensities decrease with farther distance from the epicenter. Intensities are quantified using the Modified Mercalli scale, which has numerical values ranging from I (detected only by seismic instruments) to XII (causing total destruction of most buildings).

Richter scale: The *magnitude* of an earthquake rates an earthquake as a whole, independent of the effects at any particular point. It is measured on a logarithmic scale to the base 10 called the Richter scale. This means a magnitude 8 earthquake has an amplitude 10 times greater than a magnitude 7 earthquake, 100 times greater than a magnitude 6 earthquake, and so on. Earthquakes of magnitude 1 to 3 on the Richter scale are detected only by seismic instruments. An earthquake of magnitude 6 will damage poorly constructed buildings and other structures within tens of kilometers of its epicenter.

Source: http://earthquake.usgs.gov

A survey of Kathmandu Valley school buildings

NSET and communities check earthquake-resistance of schools

'Most schools will perish in a big quake'

Over 66 per cent of Kathmandu Valley's public schools were likely to collapse in an earthquake of intensity IX on the Modified Mercalli scale. This emerged from the NSET (National Society for Earthquake Technology) survey of the earthquake vulnerability of 643 *public* schools in the three administrative districts of Kathmandu Valley – Bhaktapur, Kathmandu and Lalitpur.

> **Over 66 per cent of Kathmandu Valley's public schools were likely to collapse in an earthquake of intensity IX on the Modified Mercalli scale.**

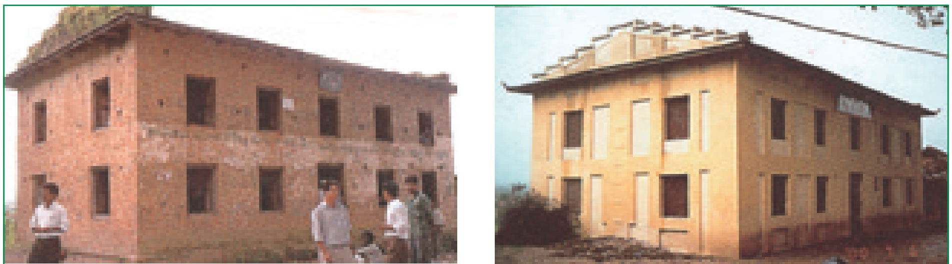
An earthquake of this intensity had been experienced in the valley once every 50 to 100 years over the past 900 years, the last time being in 1934. Such tremor during school hours could kill more than 29,000 students and teachers (12 per cent of total public school occupants) and injure 43,000 more (18 per cent of total public school occupants). The direct loss in terms of damaged buildings would be more than seven million US dollars (based on costs in the year 2000). Including the impact on students, teachers and buildings of *private* schools, the devastation would be phenomenal.

Approximately 60 per cent of the surveyed public school buildings were constructed using "traditional" materials such as adobe, stone rubble in mud mortar or brick in mud mortar – materials which were extremely vulnerable to earthquakes. Furthermore, 10 to 15 per cent of the buildings were in very poor condition. Many buildings had roofs that were on the verge of collapse or walls that could crumble at any time. These would be dangerous to occupy even in normal times.

Based on the school survey, SESP started as a program to retrofit and reconstruct vulnerable schools. In the process, it became clear that the initiative should be accompanied by *(1)* training of masons; and *(2)* training of teachers, parents and children on earthquake preparedness. A number of schools were then selected to pilot the SESP, starting with one site during 1999, then five sites in 2000 and four sites in 2001. A non-profit organization, Room to Read (formerly Books for Nepal), replicated KVERMP's SESP model in two communities outside Kathmandu Valley in 2001.

Communities participate in school survey

In consultation with headmasters, engineers and international experts, a school survey format was designed to gather data on sizes and shapes of buildings, dates of construction, construction materials, density of students, extent of engineers' involvement in building design and construction, and so on. Upon finalization of a survey format, headmasters and the school management



Bhuwaneshwory Lower Secondary School in Nangkhel, Bhaktapur, before and after retrofitting for earthquake safety

committee members from every school in the valley, together with authorities from district and regional education offices, were invited to participate in seminars that promoted awareness of earthquake risk in Kathmandu Valley. At the seminars, the headmasters were requested to assist in completing the school survey. A total of 17 one-day seminars were conducted with participation from 65 per cent of the valley's headmasters. These seminars took place in school premises and opened to the public to maximize the exposure of teachers, students and other community groups to earthquake risks.

After several months, 630 out of 643 survey forms were completed, although technicians were hired to aid some headmasters in completing the survey forms. A structural engineer visited 20 per cent of these schools to verify that the information collected in the survey forms were accurate and consistent. During these visits, engineers also began investigating potential methods and costs for retrofitting and reconstructing existing buildings.

The involvement of headmasters in the school survey not only shortened the survey collection time, but also raised people's awareness of the earthquake risks in their community.

The total cost of conducting this survey, excluding management costs and technical inputs was less than USD15,000. The involvement of headmasters in the school survey not only shortened the survey collection time, but also raised people's awareness of the earthquake risks in their community.

Following the completion of the survey, NSET classified buildings according to their construction materials and structural systems, conducted a vulnerability assessment and identified structural mitigation measures such as retrofitting as well as non-structural options such as preparedness planning in schools.

Response to survey: retrofit or reconstruct?

NSET weighs options for improving seismic resistance of schools

There were two options available for seismic improvement of school buildings: *(1)* to demolish and reconstruct and *(2)* to implement seismic retrofitting.

Retrofitting was cheaper. Depending on the structural type and condition of the school, it would cost USD30–50 per square meter to retrofit a school in Kathmandu Valley. For a typical brick in mud mortar school serving 200 children, a retrofit would cost USD8,000. This included seismic retrofitting, repair and maintenance, management and improvement of existing facilities. An example of the latter was reducing the steepness of the staircase in Bal Bikash Secondary School in Alapot, Kathmandu, or adjusting the swing of classroom doors in Bhuwaneshwory Lower Secondary School in Nangkhel, Bhaktapur, to enhance evacuation safety during a disastrous event. To demolish and reconstruct a brick in mud mortar school of similar size would more than double the cost.

Guidelines: to retrofit or to reconstruct?

? questions to ask

- What is the state of the building?
- How much is the available budget?
- What is the technical capability?
- What is the time frame allowed?

However, there was a limit to which old and poorly maintained buildings could be retrofitted. Buildings with weak materials would benefit less from retrofitting as compared to newer buildings with good construction materials of cement and steel. Obviously, a combination of the two options was required.

NSET decided to pilot the SESP with a retrofit program in 1999. At that time retrofitting was a new concept and its introduction generated much interest and willingness to learn among local masons and other community members. Retrofitting could be done in approximately four months while reconstruction would take more than one year. Aside from the costs, the scale and duration of disturbance to existing school functions would also be very high with the reconstruction option. Overall, it was believed that the option of retrofitting for suitable school buildings

Schools that participated in the School Earthquake Safety Program

SESP 1999

Retrofit: Bhuwaneshwory Lower Secondary School, Nangkhel, Bhaktapur *(photo on page 2)*

SESP 2000

Retrofit: Bal Bikash Secondary School, Alapot, Kathmandu

Retrofit: Gadgade Primary School, Nagarkot, Bhaktapur

Retrofit: Upayogi Primary School, Sirutar, Bhaktapur

Retrofit: Vaishnavi Secondary School, Kirtipur, Kathmandu

Reconstruction: Bhuwaneshwory Lower Secondary School, Nangkhel, Bhaktapur (building no. 2)

SESP 2001

Reconstruction: Himalaya Primary School, Thimi, Bhaktapur

Reconstruction: Kavresthali Lower Secondary School, Kavresthali, Kathmandu

Reconstruction: Nateshwory Primary School, Chhaling, Bhaktapur

Reconstruction: Gorakhali Primary School, Gorkha District of Prithvinagar

Safer Cities

Safer Cities *is a series of case studies that illustrate how people, communities, cities, governments and businesses have been able to make cities safer before disasters strike. The series presents strategies and approaches to urban disaster mitigation derived from analyses of real-life experiences, good practices and lessons learned in Asia and the Pacific. This user-friendly resource is designed to provide decision-makers, planners, city and community leaders and trainers with an array of proven ideas, tools, policy options and strategies for urban disaster mitigation. The key principles emphasized throughout Safer Cities are broad-based participation, partnerships, sustainability and replication of success stories.*

would increase the community's acceptability of earthquake safety.

NSET selects schools to retrofit and reconstruct

Following the assessment of the building stock of public schools in Kathmandu Valley, schools were selected and prioritized for SESP based on a set of selection criteria (*right*).

Selection criteria for the School Earthquake Safety Program

- ✓ The school is rated highly vulnerable.
- ✓ The school headmaster had attended the Headmasters' Seminar.
- ✓ The School Management Committee shows interest in introducing seismically resistant features to the school.
- ✓ Local masons in the vicinity are available.
- ✓ The communities in the school's vicinity are committed to participate and provide contributions (in cash or in kind).
- ✓ The school building is of moderate size with simple structures.
- ✓ The school is out of the city core but with good road accessibility.
- ✓ Construction materials are obtainable in the area.
- ✓ The school is willing to make arrangements to hold classes in an alternative site.
- ✓ The school has no dispute on land and building ownership.

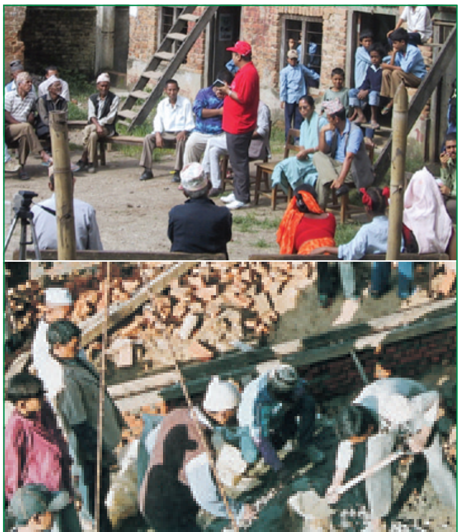
Masons: key to safer buildings

Masons trained in earthquake-safe construction

The lesson from SESP is not simply that a school could be retrofitted. The retrofitting or reconstruction process could generate awareness-raising opportunities. For an additional USD2,000, twenty local masons in Kathmandu Valley could be trained while retrofitting or reconstructing a school, and community members could achieve raised awareness on earthquake-related issues at the same time.

Communities relied heavily upon masons for construction and technical guidance, even though the masons had no formal training. If the masons were convinced of the feasibility of earthquake-resistant constructions and were motivated to obtain the required skills, then seismic performance of existing and new buildings could be improved. Therefore, NSET conducted practical on-the-job training programs on earthquake-resistant design and retrofitting methods for masons. Since many of the masons were illiterate, hands-on demonstrations were emphasized.

The training courses helped to convince local masons of the affordability and possibilities of constructing earthquake-resistant buildings using slight improvements in locally employed methods of construction. One retrofitted or reconstructed school translated to about 20 masons trained on earthquake-resistant technology. This created a multiplier effect in which masons were able to convince owners to construct earthquake-resistant houses. Following the retrofit of a school in Nangkhel, two houses were constructed with seismic considerations within a few months. Similarly in Alapot, two seismically resistant houses were constructed by trained masons using the owner's own funds. In Kavresthali, the community library was constructed with earthquake-resistant features. If each mason built ten houses a year, 20 masons could reduce the vulnerability of 200 families.



SESP includes a combination of public meetings and hands-on demonstration

Masons training curriculum

Module 1: Theory of Earthquakes

- What is an earthquake
- How earthquakes occur
- Why earthquakes concern us
- In what ways earthquakes damage buildings

Module 2: Earthquake Risk of Buildings

- Differences between earthquake force and normal force
- Critical structural components of building in earthquake
- Structural response of building to earthquake
- Weak aspects of Nepal's building stock
- Consequences of structural failure

Module 3: Earthquake-Resistant Construction Techniques

- Retrofitting masonry building
- Earthquake-resistant construction of masonry building
- Earthquake-resistant construction of framed building
- Quality control in construction

The cost of earthquake resistance factfile

The use of seismically resistant techniques **increases** construction costs by only **4%–8% in masonry buildings** (buildings with brick in cement mortar, reinforced concrete floor and roof slab) **and 6%–10% in reinforced concrete frame buildings** (up to three stories).

Community empowerment

Community participation improves safety, awareness, livelihood and outreach

People participate in decision-making

From the start, the SESP had actively incorporated community participation as a critical element of the process.

Periodic public meetings were called to review work progress, to present a financial update and collect views and suggestions from villagers. These provided a forum for active participation in decision-making and, at the same time, raised people's awareness of earthquake safety.

KVERMP activities promote safety awareness and outreach

Other activities initiated under KVERMP complemented SESP in raising awareness and encouraging people's participation in promoting earthquake safety. One such

Examples of community participation in SESP

- School headmasters assisted in completing the school building survey.
- The criteria for school selection emphasized good community solidarity and the community's willingness to contribute in kind and in cash to the strengthening of the school building.
- The masons identified for training were in the community or its vicinity.
- Masons training was set up as informal community gatherings during evenings.
- Community members observed hands-on demonstration of retrofitting and reconstruction techniques.
- The community provided about one fourth of the cost of labor.
- The communities themselves, with some support from NSET, generated funds and acquisition of materials for SESP.
- The SESP committee managed the funds and implementation of SESP.

activity was the Earthquake Safety Day (ESD). This had been an annual event held every 15 January since 1999, in memory of the devastating earthquake that struck Kathmandu Valley on 15 January 1934. The commemoration of this day comprised a range of awareness-raising activities over a one-week period. Each year, activities were organized by the ESD National Committee instituted by the Royal Government of Nepal and chaired by the Minister of Science and Technology. Activities included international symposiums, high-level meetings, exhibitions, rallies, art and essay competitions, street performances, special earthquake-related programs and interviews on radio and television, shake-table demonstrations and school hand-over ceremonies. The last two activities were particularly relevant to this case study.

The shake-table demonstration showed how different building types would react to a high-intensity earthquake like that of 1934. Local masons constructed 1:10 scale models of typical Nepali school buildings – with and without seismic reinforcements. These models were made at the school sites where school teachers, students and villagers could witness the process. The models were then placed on a shake-table that simulated a high-intensity earthquake. For those who had never experienced an earthquake, watching the collapse of the non-reinforced building created a lasting visual memory.

To celebrate the completion of a retrofitted or reconstructed school for the community, formal school hand-over ceremonies had been held since ESD 2000. All community members including students, parents, teachers, headmasters and masons were invited to the ceremony. Governmental institutions, non-governmental organizations and international agencies also participated in the ceremony. They included the Ministry of Education, District Education Offices (DEOs), District Development Committees (DDCs), Village Development Committees (VDCs), ADPC, Room to Read, GeoHazards International (GHI), UNDP, UNESCO and so on.

"Thank you for making my school safe. I suggest the next step should be to strengthen our homes," said Krishna Ghimire, a student of Kavresthali Lower Secondary School, when he delivered a speech at the hand-over ceremony of his newly reconstructed earthquake-resistant school during Earthquake Safety Day 2002. This is a good example of public education and awareness raising at the community level.

Stonecrete improves lives: a success story

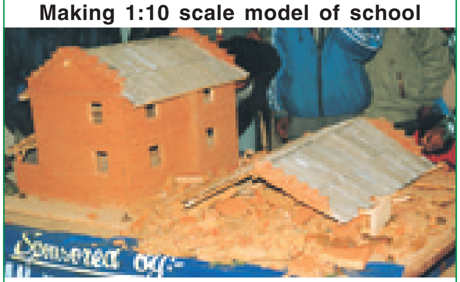
Kavresthali Lower Secondary School was made of stones and once demolished produced a large heap of stones. Instead of being dumped as useless waste, the dismantled stones were creatively transformed into something useful by villagers. They were broken into small pieces and filled into concrete blocks that could be easily molded by villagers themselves, creating a new and uniquely strong building material called "stonecrete."

According to laboratory tests, stonecrete blocks were stronger and cheaper than ordinary bricks. With the invention of stonecrete as an alternative building material, the community was able to reduce the cost of building construction. Furthermore, a new livelihood option was initiated – making stonecrete during periods of field fallow.

Masons receive graduation certificates at the hand-over ceremony of Kavresthali Lower Secondary School

Broken stones from demolished school buildings are filled into molds *(left)* to make stonecrete blocks *(right)*

Making 1:10 scale model of school



Shake-table demonstration

A breakthrough

The Honorable N.P. Saud, Minister of State for Education, was the chief guest at the School Hand-over Ceremony of Kavresthali Lower Secondary School on 12 January 2002. His participation attracted many high-level government officials to the event, raising the profile of the event.

The school lacked funds to complete reconstruction of its third floor. Following the School Management Committee's request for the completion of the school reconstruction, the Honorable Prem Lal Singh, Minister of Environment and Population, and Room to Read (formerly Books for Nepal), a non-profit organization, each promised to contribute NRs.150,000 (USD1959), raising 75 per cent of the funds required to complete the work.

Nepali masons rebuild lives in Gujarat

Advocates and practitioners of earthquake safety used the aftermath of the Gujarat Earthquake on 26 January 2001 as an opportunity for learning and awareness raising. In Patanka Village of Gujarat, the earthquake rendered 250 households homeless. To aid the reconstruction of Patanka, Nepali masons provided hands-on training on earthquake-resistant construction techniques to the local masons in Patanka. This technological exchange was made possible by the partnership between NSET and the Sustainable Environment and Ecological Development Society in India (SEEDS India) as part of the *Patanka Navjivan*

Nepali and Indian masons work together in Patanka, Gujarat

Yojana ("Patanka New Life Project") supported by NGOs in Kobe, GHI and the Disaster Management Planning Hyogo Office of the United Nations Center for Regional Development (UNCRD).

Houses in Patanka were typically 4x4 meters, with timber posts, 45-centimeter thick stone walls in mud mortar and clay tile roofs. As part of the technological exchange between India and Nepal, stonecrete was introduced in Patanka. This was especially relevant since stone masonry was a common practice.

Social acceptance of this new building technique took time. For example, Patanka villagers were accustomed to the thick stone walls of their houses. However, to make stonecrete cost-effective, the walls had to be thinner. Demonstrations had to be held regularly to convince local masons that the thinner stonecrete walls were stronger and more durable than the thick stonewalls.

Rather than simply providing completed houses like most rehabilitation projects, this project aimed to strengthen the community's capacity to help themselves, demonstrating a more developmental and sustainable approach.

This exchange was successful largely because of the similar culture in India and Nepal, plus some familiarity with the technology introduced. Some masons of Patanka even recalled the wisdom preached by their great-grandfathers on earthquake-resistant construction.

During Nepal's Earthquake Safety Day in 2002, Nepali masons had the opportunity to show Indian masons the schools they helped to retrofit through SESP in their hometowns of Nangkhel and Alapot in Kathmandu Valley. This two-way exchange between Nepal and India proved extremely valuable to local masons, families, children and teachers in the villages. Gujarati masons and engineers who visited NSET learned to construct a 1:10 building model and the shake-table. Subsequently, a shake-table demonstration was done in Bageshwor of Uttaranchal, India, by local masons in July 2002. This is an example of a successful South–South cooperation from which all could learn.

Insights from the School Earthquake Safety Program

lessons learned

- Involve the community right from the start.
- Transfer ownership of the program to beneficiary community as early as possible.
- Develop a transparent management structure.
- Convey scientific and technical know-how in simple terms.
- Transfer low-cost technology that is "accepted" by the community.
- Emphasize local capacity, local materials and local technology.
- Build local capacity through on-the-job training and hands-on demonstrations.
- Use earthquakes as learning opportunities.
- Never overlook the role of an individual in sparking behavior change.
- Use SESP as an awareness raising opportunity.
- Adopt a training-of-trainers approach to encourage a multiplier effect.
- Be patient. Promoting earthquake safety involves changing mindsets.

Institutionalizing SESP

Communities set up structures and links to sustain safety program

Communities organize themselves for effective implementation

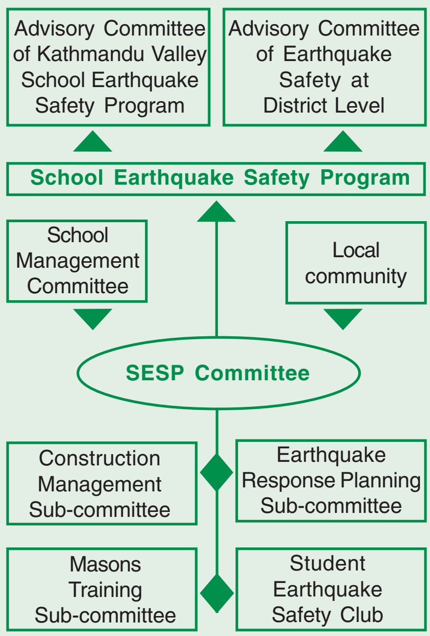
The objective of SESP was NOT to have school buildings retrofitted or reconstructed by outside sources, nor was it to provide a lump sum amount for communities to develop their schools. Commonly witnessed by community groups in Kathmandu Valley, these two approaches blocked transparency in the use of funds, which often ended up benefiting or were perceived to benefit only a privileged few, thus, generating conflict within a community. Moreover, these approaches did not contribute to the sustainable development of the community and instead led to a general distrust of outside assistance.

To ensure transparency and to win the community's trust for effective implementation of SESP, communities were given sole managerial responsibilities through the SESP Committees in each school. Each Committee was headed by the chairman of the School Management Committee, normally present in every public school in Nepal. The headmaster of the school, appointed as secretary of the committee, had the responsibility of managing all expenses incurred in the SESP. The rest of the committee members were elected by the community and included an NSET representative.

To manage the funds in a transparent manner, the Chairman of an SESP Committee and an NSET representative had to sign a Memorandum of Understanding (MOU) and open a joint bank account. The Chairman of the DDC had to approve the MOU.

The SESP Committees made all decisions while NSET's representatives assisted in the decision-making process when requested. This helped achieve transparency and optimized limited resources. NSET provided assistance in identifying the materials and equipment required. It also worked with the community to obtain funds for procurement or materials' donation from

Management structure of the School Earthquake Safety Program



within the community and outside, from DEOs, VDCs and DDCs.

Four sub-committees under the SESP Committee assisted in the decision-making and implementation processes.

The Construction Management and Masons Training Sub-committees developed a schedule of training and work in consultation with the community. The management of construction materials and masons was also the responsibility of the two sub-committees.

The Earthquake Response Planning Sub-committee worked with teachers and parents in developing an emergency response plan for the school. An Earthquake Kit was developed for training the teachers and parents on earthquake preparedness planning and establishment of evacuation and fire drills in schools.

The Student Earthquake Safety Club comprised of elected students who organized activities to promote earthquake safety in their school. For example, the first activity of a 13-member Student Earthquake Safety Club in Bal Bikash Secondary School, Alapot, was their participation in the United Nations' International Strategy for Disaster Reduction Year 2001 Risk Mapping Contest for children and local communities. The club received the first prize.

Advisory committees were formed at municipal and district levels. The Advisory Committee of Kathmandu Valley SESP, chaired by the Director of the Central Regional Education Directorate, and the Advisory Committee of District Level SESP, headed by the Chairman of the District Education Committee, provided guidance and direction to the overall SESP approach. Members of the committees included representatives of Kathmandu Metropolitan City, Bhaktapur Municipality, Lalitpur Sub-Metropolitan City, Thimi-Madhyapur Municipality, Kirtipur Municipality, DEOs, DDCs, VDCs, school management committees and NSET. The Advisory Committee also provided the necessary political support for SESP and helped to promote the SESP approach to other parts of Kathmandu Valley and Nepal.

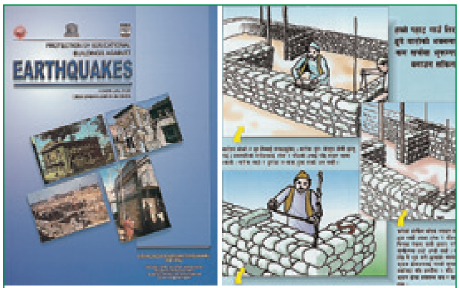
Organized community establishes linkages with city government

As indicated above, SESP was implemented with maximum participation of governmental institutions, DDCs, VDCs, school management systems, teachers, parents and students. The governmental agencies provided funds and policy guidance while the school management committees, with technical inputs and supervision from NSET, handled the actual implementation and construction. Such implementation scheme, together with the formation of municipal- and district-level advisory committees, considerably widened the outreach of the program and its ownership.

SESP generates educational products

The initial process to structurally strengthen school buildings developed into a comprehensive program including two significant outputs: *(1)* a manual entitled "Protection of Educational Buildings Against Earthquakes: A Manual for Designers and Builders," developed by NSET in collaboration with UNESCO; and *(2)* a curriculum for masons training on earthquake-resistant construction produced by NSET based on the curriculum developed by the Royal Nepal Government's Department of Housing and Building Construction. In addition, an Earthquake Kit was developed for training teachers and parents on earthquake preparedness planning.

Wider applications for SESP are envisioned to be institutionalized and managed at the national level and replicated throughout Nepal. The SESP management structure, training curriculum, manuals and toolkits and other resources developed under the SESP could be used and adopted in other communities, cities and countries.



Leaflets, booklets and manuals are some of the tools used in SESP

SESP replicated

Signs of replication had emerged. Organizations such as Room to Read had adopted the SESP approach and replicated similar initiatives in different parts of Nepal. An example above showed the stonecrete technology replicated in Patanka, India. The SESP approach was also endorsed and replicated by GHI, Japan International Cooperation Agency (JICA) and UNCRD in their programs. More importantly, the initiative of a community to adopt the SESP approach was a major achievement towards its replication. For example, Ward no. 8 of Gorkha District, Prithvinagar Municipality (in western Nepal), submitted a proposal to NSET for technical assistance in school reconstruction and implementing SESP in the aftermath of an earthquake (magnitude 5.1 on the Richter scale) that shook Gorkha on 16 July 2001. NSET did provide some technical support for school reconstruction. However, the community's desire to construct a model earthquake-resistant village could not be implemented due to lack of resources. To realize this vision, community organizing and resource mobilization are now underway.

Conclusions

Community participation – a step to sustainability

Construction of earthquake-resistant buildings is vital, but involving the community to do so is even more important to achieve sustainability. Participation enables people to understand the concept of earthquake safety and the need for earthquake-safe buildings. Consequently, they will be able to make informed decisions when it comes to the construction of their own houses and they will be asking masons to adopt earthquake-safe technologies for the whole community.

Safety programs can be channels for improved livelihood

The SESP in Kathmandu Valley demonstrated that recycling of salvaged materials during reconstruction or retrofitting could provide a livelihood option for the community.

Earthquake-safe technology is transferable

In India, Patanka Village (which suffered from the Gujarat Earthquake) was among the indirect beneficiaries of SESP. Masons from Nepal helped the local masons to reconstruct and rehabilitate the village using their acquired knowledge of quake-safe construction of buildings. Agencies committed to build safer communities facilitated this exchange and cooperation.

Further references

On KVERMP

ADPC Safer Cities 1: Community-Based Initiatives in Kathmandu Valley, January 2002.

The Kathmandu Valley Earthquake Risk Management Action Plan, January 1999.

Kathmandu Valley's Earthquake Scenario, 1998.

Room to Read
Friend's Colony, Thapathali
Kathmandu, Nepal
Tel: 97 71 246 381
Fax: 97 71 528 776
URL: www.roomtoread.org
E-mail: dinesh@roomtoread.org

SEEDS India
315 Tower I. Mount Kailash
New Delhi 110065, India
Tel: 91 11 626 2489
Fax: 91 11 625 0475
URL: www.seedsindia.org
E-mail: manu@seedsindia.org

On SESP

NSET-Nepal, 2001, Protection of Educational Buildings Against Earthquakes: A Manual for Designers and Builders.

NSET-Nepal, 2002, Report on Seismic Vulnerability of Public School Buildings of Kathmandu Valley and Methods for Reducing it.

Nathe, S. et. al., 1999, Public Education for Earthquake Hazards, Natural Hazards Informer (www.colorado.edu/hazards/informer/infrmr2/infrm2wb.htm).

FEMA, 1990, Guidebook for Developing School Earthquake Safety Program.

NSET-Nepal, Curriculum for Masons Training.

NSET-Nepal, Guidelines for Community Disaster Preparedness and Planning for Teachers, Students and Parents.

Other relevant Safer Cities case studies

ADPC Safer Cities: School Earthquake Safety Program in Indonesia.

Editorial Board

KVERMP

The Kathmndu Valley Earthquake Risk Mangement Project (KVERMP) in Nepal was launched in September 1997 under the Asian Urban Disaster Mitigation Program (AUDMP) of the Asian Disaster Preparedness Center (ADPC). The objective of this national demonstration project is to reduce earthquake vulnerability of Kathmandu Valley through four main elements: (1) loss estimation, scenario development and action planning; (2) a program for school earthquake safety; (3) public awareness promotion; (4) and capacity building. Through these elements, KVERMP seeks to promote long-term sustainable seismic vulnerability reduction mechanisms in and beyond Kathmandu Valley.

Project Partners

Implementation:

National Society for Earthquake Technology (NSET)
G.P.O. Box no. 13775, Kha-2-731
Mahadevsthan, Baneshwor
Kathmandu , Nepal
Tel: (977-1) 474-192
Fax: (977-1) 490-943
URL: http://www.nset.org.np
Contact: Mr. Amod Dixit
Secretary General
E-mail: adixit@nset.org.np

GeoHazards International (GHI), USA
200 Town & Country Village, Palo Alto
CA 94301, USA
Tel: (1-650) 614-9050
Fax: (1-650) 614-9051
URL: http://www.geohaz.org
Contact: Dr. Brian E. Tucker
President
E-mail: tucker@geohaz.org

Funding:

Office of Foreign Disaster Assistance (OFDA), U.S. Agency for International Development (USAID)

AUDMP

The Asian Urban Disaster Mitigation Program (AUDMP) is the first and largest regional program implemented by ADPC. The AUDMP started in 1995 with core funding from USAID's Office of Foreign Disaster Assistance (OFDA) until 2003. The program was developed with the recognition of increased disaster vulnerability of urban populations, infrastructure, critical facilities and shelter in Asian cities. In an environment where good governance and decentralization are high in most countries' political agenda, AUDMP aims to demonstrate the importance of and strategic approaches to urban disaster mitigation as part of the urban development planning process in targeted cities of Asia.

AUDMP supports this demonstration by building the capacity of local authorities, national governments, non-governmental organizations, businesses and others responsible for establishing public and private sector mechanisms for urban disaster mitigation as part of city management. AUDMP also facilitates knowledge sharing and dialogue between the key stakeholders to promote replication of the AUDMP approaches to other cities and countries worldwide. Currently, the AUDMP approaches have been introduced and sustained by national partner institutions in targeted cities of Bangladesh, Cambodia, India, Indonesia, Lao PDR, Nepal, Philippines, Sri Lanka, Thailand and Vietnam.

ADPC

The Asian Disaster Preparedness Center (ADPC) is a regional resource center dedicated to safer communities and sustainable development through disaster reduction in Asia and the Pacific. Established in 1986 in Bangkok, Thailand, ADPC is recognized as an important focal point for promoting disaster awareness and developing capabilities to foster institutionalized disaster management and mitigation policies.

For more information, please get in touch with us at:

Asian Disaster Preparedness Center
P.O. Box 4, Klong Luang
Pathumthani 12120
THAILAND
Contact: Information Scientist
E-mail: ambika@ait.ac.th

Tel: (66-2) 516-5900 to 10
Fax: (66-2) 524-5350
E-mail: adpc@ait.ac.th
URL: http://www.adpc.ait.ac.th