Reducing Vulnerability of School Children to Earthquakes

United Nations Centre for Regional Development (UNCRD)

School Earthquake Safety Initiative (SESI)

United Nations

2009

Reducing Vulnerability of School Children to Earthquakes

A project of School Earthquake Safety Initiative (SESI)

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UNCRD

Mission Statement of UN / DESA

The Department of Economic and Social Affairs (UN/DESA) is a vital interface between global policies in the economic, social and environmental spheres and national action. The Department works in three main interlinked area: (a) it compiles, generates and analyses a wide range of economic, social and environmental data and information on which States Members of the United Nations draw to review common problems and to take stock of policy options; (b) it facilitates the negotiations of Member States in many intergovernmental bodies on joint courses of action to address ongoing or emerging global challenges; and (c) it advises interested Governments on the ways and means of translating policy frameworks developed in United Nations conferences and summits into programmes at the country level and through technical assistance, helps build national capacities.

Foreword

One of the five priorities for action underscored in the Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters, adopted by 168 countries at the World Conference on Disaster Reduction 2005 in Kobe, is using knowledge, innovation and education to build a culture of safety and resilience at all levels (HFA Priority 3). HFA recognizes the central role of school in building resilience of communities to disasters. The World Disaster Reduction Campaign for 2006-2007 by the UN International Strategy for Disaster Reduction (UNISDR) was carried out together with various partner organizations under the theme of "Disaster Risk Reduction Begins at School." Various initiatives were taken during the campaign and they are instrumental in creating a global synergy for safe schools. Though the campaign ended in 2007 with many noteworthy achievements, the task for school safety and building resilience of communities has not ended; in fact, it has just started and needs dedicated efforts to make disaster resilience a component of sustainable development.

UNCRD has been playing an active role in realizing the message of school safety and building resilience of communities through schools for last many years. The project on "Reducing Vulnerability of School Children to Earthquake" under the School Earthquake Safety Initiative (SESI) is an example of how different stakeholders can be involved in implementing this message. The experience is unique in two aspects: First, the project is comprehensive and includes components of school retrofitting, disaster education, capacity building of communities and dissemination. Secondly, the implementing partners in each country represented various backgrounds; Government agency in Fiji, NPO in India, academic institute in Indonesia and semi-public agency in Uzbekistan, and multi-stakeholders collaboration ensured in its implementation, all stages from conceptualization of the project to realization in the field, involving local governments.

This publication, entitled “Reducing Vulnerability of School Children to Earthquakes”, not only summarizes the good practices and lessons learned from the project countries and but also highlights the task ahead to up-scale from model projects to countrywide activities on school safety.

It is hoped that this publication will be useful in creating further momentum in the campaign for disaster risk reduction in school and through schools.

Salvano Briceño
Director
UNISDR Secretariat

Foreword

Safer schools are necessary to prevent lives of children during disasters. The concept of school safety, however, is not limited to preventing the collapse of school buildings in disasters, and safety of teachers and students, but rather extends to meet the broader goal "disaster risk management". This is because today's children are tomorrow's adult citizens. What they learn about safety today significantly contributes towards development of "disaster risk resilient communities" for long run. Here lies the importance of disaster education under school safety.

Further, we can use the opportunity of this intervention to disseminate the disaster safety concept, the way of approach and the tools, to surrounding communities through students, teachers and parents, and also, through masons who are involved in safe construction of schools. The School Earthquake Safety Initiative (SESI) of UNCRD has successfully implemented this approach in the project countries.

The current project on "Reducing Vulnerability of School Children to Earthquakes" was in four countries – Uzbekistan, Fiji, India and Indonesia. The project aims to ensure that school children living in seismic regions have earthquake resilient schools and that local communities build capacities to cope with earthquake disasters. The project has the following key components: School retrofitting; Disaster education, Capacity building and Raising awareness.

I would like to take this opportunity to thank the counterparts and stakeholders in the project countries without whose continuous support the project wouldn't have come this far. I would also like to thank UN OCHA for supporting the project through UN Trust Fund for Human Security.

This publication compiles experience of implementation of the project in the four project countries along with experience of Japan in successfully implementing school retrofitting at country level. It is hoped that the publication will be instrumental in developing strategies for future school safety initiatives and up-scaling model from model projects to country-wide interventions.

Kazunobu Onogawa
Director
UNCRD

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1.1 Importance of School Safety

Earthquake damages residential buildings and infrastructures alike. The damages witnessed in the past tell a compelling story that among the damages caused to infrastructures, damages to school facilities are disproportionately high. Many schools in the earthquake prone regions are vulnerable to earthquakes and are susceptible to severe damages often killing the students and teachers during an earthquake. In addition to the already existing vulnerable schools, many schools are being constructed without proper compliance to earthquake safety standards. The Millennium Development Goals (MDGs) envisage education for all by 2015. In order to achieve this target, there is a large pressure to build thousands of class rooms in many of the developing countries and non-compliance to the safety standards means vulnerable schools are increasing. As witnessed in the past, the school buildings which are supposed to provide education to children are also the cause of death in many disasters.

Recently in May 2008, Wenchuan Earthquake in Sichuan, China killed about 7,000 students trapped in damaged school buildings. When an earthquake hit Spitak area of Northern Armenia during school hours in 1988, many children lost their lives due to collapse of school buildings. For example, 285 children out of 302 in total died at one school. This resulted in almost 2/3 of total deaths of 25,000 were children and adolescents. In the 1999 Chi-Chi Earthquake, Taiwan 43 schools in Nantou and Taichung area were completely destroyed and a total of 700 schools nationwide were damaged to different extent. The 2001 Gujarat Earthquake in India caused damages to over 11,600 schools (World Bank 2001). Another case is 2005 Kashmir earthquake. The earthquake occurred as the school day was beginning and led to death of 18,000 children trapped in damaged schools. The Kashmir earthquake resulted in collapse of 6,700 schools in North-West Frontier Province and 1,300 in Pakistan-administered Kashmir.

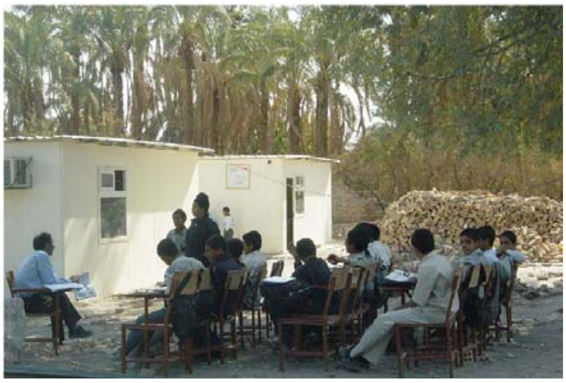


Figure 1.1 Class being conducted in an open space (2003 Bam Earthquake, Kerman, Iran)

Recognizing that school age children spend majority of their waking hours at school, there is always a high possibility that an earthquake struck while they are at school. Therefore, school buildings need to be protected from disasters as they save life of children and they can also help to work as shelter in post disaster scenario. Moreover, resilient schools are effective medium for disseminating disaster risk reduction awareness in the communities, can act as center of learning, can be instrumental in transfer of technology to the communities and have significant role to build disaster resilient communities. The activities like retrofitting of school and new construction with safety measures can spread message to the community of the importance of resilient buildings to reduce disaster impact. Realizing the importance of schools in disaster risk reduction, UNISDR campaigned for two years from 2006 to 2007 with the main theme as "Disaster Risk Reduction Begins at Schools." The campaign has been instrumental in mainstreaming school safety in disaster risk reduction initiatives in many countries and has resulted in many global initiatives such as Thematic Platform on Knowledge and Education by ISDR and Coalition on Global School Safety (COGSS) Initiatives.

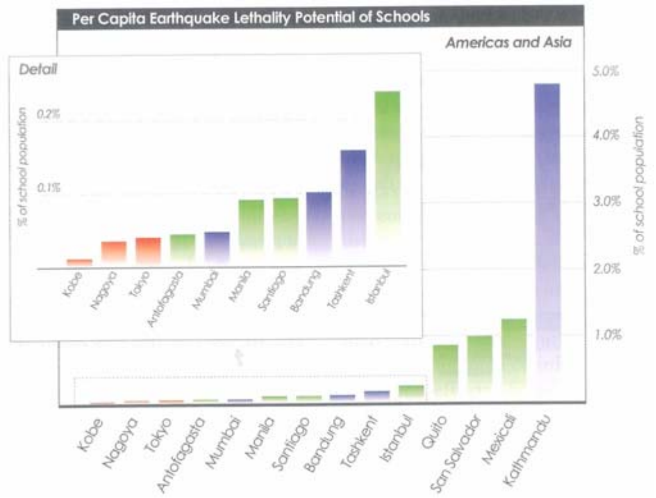


Figure 1.2
Comparison of the per capita school earthquake lethality potential of the GESI pilot cities (Source: Global Earthquake Safety Initiative, UNCRD, 2001)

1.2 UNCRD's School Safety Initiatives

Since its establishment in 1971, United Nations Centre for Regional Development (UNCRD) has been engaged in research and training to promote regional development particularly in the filed of human security, environment and disaster management. The UNCRD Disaster Management Planning Hyogo Office (Hyogo Office) was established in 1999 in Kobe to reflect the experiences from the Great Hanshin-Awaji Earthquake of 1995 and disseminate culture of safety to other parts of the world.

Box 1.1 Main Approaches of UNCRD disaster management programs

A: To incorporate and integrate disaster management into regional development plans and programs through:

- strategies to reduce vulnerability for promoting rapid urbanization;
- prioritizing the disaster resiliency of major urban facilities such as schools and hospitals;
- regional risk assessment utilizing micro-zoning (hazard map); and
- introduction of risk assessment and disaster prevention systems into planning processes.

B: To develop and transfer regional disaster management planning and technologies through:

- establishment of disaster data bases and management systems;
- providing guidelines for pre-, mid-, and post large-scale disasters;
- technology transfer, including economic efficiency and casualty evaluation; and
- development of educational and training programs on disaster management and raising awareness for the general public such as local residents and communities.

The first disaster management program of UNCRD started in 1985 based on the main approaches indicated in the Box 1.1. There were in total 8 approaches and the second approach of A: Prioritizing the disaster resiliency of major urban facilities such as schools and hospitals, focuses on the importance of school facility, even in the 1980's. UNCRD initiated the School Earthquake Safety Initiative (SESI) since 1999 immediately after the establishment of the Hyogo Office and disaster management section moved from Nagoya to Kobe. The first programs of SESI in early 2000's include an exchange program for school children between Kobe and Kathmandu on disaster management and school retrofitting projects in India and Iran under the Hyogo Friendship Funds that were created to assist recovery of disaster affected areas in Gujarat in India, Bam in Iran and Pakistan as indicated in the latter part of the 1.2.3 "School Earthquake Safety Initiatives". The original concept of "Reducing Vulnerability of School Children to Earthquakes" project funded by the UN Trust Fund for Human Security (TFHS) was also formulated in early 2000's after several experiences of SESI of UNCRD Hyogo Office.

1.2.1 Human Security and MDG

Earthquakes are the most lethal among natural disasters, inflicting huge losses on life and property and damaging the affected area's economy, social organization, and cultural heritage. While earthquakes comprise 15 per cent of the total number of disasters, they cause casualties amounting to around 50 per cent of the world total. Poorly constructed buildings, low levels of awareness in the community, and poor disaster preparedness of the responsible agencies aggravate vulnerability to the devastation caused by earthquakes. The risk in developing countries is growing steadily, due to rapid urbanization and migration from the rural to urban areas. Earthquakes cannot be predicted, and therefore the effective way to reduce earthquake risks is through preparedness and mitigation. An appropriately educated and prepared community is better able to cope with natural disasters and is thereby more disaster resilient.

Disasters caused by earthquakes severely undermine countries' efforts to achieve the MDGs. With respect to poverty reduction, an earthquake pushes the poor into graver poverty through destruction of their homes. Because the poor are not able to afford houses that are earthquake resistant, their houses are more vulnerable to earthquakes. To make matters worse, the poor have less savings, insurance and access to credit that will enable them to finance reconstruction costs. The achievement of universal primary education can also be hampered because household asset depletion makes schooling less affordable. Children and women are more likely to be pressured to contribute to household work, exacerbating gender inequality. The concept of human security is best defined as removal or reduction of vulnerability to economic, environmental, cultural, social, and political risks, including natural disasters such as earthquakes. Therefore, reducing vulnerability to the destruction caused by earthquakes is essential to ensuring human security.

1.2.2 Community Empowerment and Schools

Schools play a vital role in every community and region. The extent and nature of the contribution of schools go beyond traditional forms of education to school children. Their contribution to the regional development varies from cultural to economical, informational to environmental and vice versa. Recognizing the importance role of schools in regional development, each region and community needs to strive to improve quality of education and facilities. Capacity building of human resources and securing financial basis to provide adequate education and facilities must be considered in the process of formulating education policy at regional level.

Past experience has indicated that the basic problems related to disaster mitigation and preparedness in developing countries can be attributed to lack of capacity, awareness, education, and self-reliance within the communities. An appropriately educated and self-trained community is much more capable of coping successfully with natural disasters, and of reducing their impacts. The SESI project aims to promote culture of mitigation through community participation and the empowerment process tailored to residents with specific needs will complement, enlarge, and sustain the ongoing efforts. As disaster risk reduction is also a key for sustainable regional development, concept of disaster risk reduction should be integrated into school curricula and school facility management.

1.2.3 School Earthquake Safety Initiatives

Schools have been found to be the key element for community involvement in Japan and other countries world-wide. Schools not only provide education, they can provide emergency shelters immediately after earthquakes. Through this school-strengthening program, a community program has been formulated to spread the technologies rooted in culture and heritage. HFA also prioritizes use of knowledge, innovation and education to build a culture of safety and resilience at all levels. Furthermore, HFA also emphasizes on structural strengthening of critical facilities including schools. SESI is aimed at promoting self-help and education for disaster mitigation by building resilient and sustainable communities. The participatory approach to community development and capacity building among the local people is the key focus area of the initiative.

Figure 1.3 Damaged school building in Sichuan (June 2008)

Figure 1.4 Approach of UNCRD's School Earthquake Safety Initiative

Hyogo – Kathmandu Collaboration on Earthquake School Safety (2001 -)

As a part of the SESI, UNCRD Hyogo Office contributed to start an exchange program between schools in Kathmandu and Kobe in collaboration with National Society of Earthquake Technology-Nepal (NSET), Nepal based NGO. Recognizing the importance of education for disaster risk reduction especially after the experience of Kobe Earthquake of January 17, Maiko High School, located in Kobe started Environment and Disaster Mitigation course in April 2002 with a purpose to promote culture of disaster mitigation to young generations.

In Nepal, NSET-Nepal started an initiative to raise Earthquake Awareness in Nepal focusing on retrofitting vulnerable school buildings in the Kathmandu Valley, and Bal Vikas Secondary School was selected for this purpose. The retrofitting work of the school started in 2002 through mason-training program, with resources from parents and local villages. The activities aimed not only to protect lives of children, but also to empower communities by providing safer construction practices. While Maiko High School promotes the disaster education curriculum, Bal Vikas Secondary School attempts to raise awareness for disaster education through the retrofitting activity. Therefore, UNCRD Hyogo Office and NSET-Nepal linked up two activities to exchange information, culture, and learn from each other. Students are expected to be the ambassadors for disaster mitigation in the future. As of 2008, this exchange program between Maiko High School and Bal Vikas Secondary School still continues.

Figure 1.5 School Retrofitting in Nepal (2002): before - during - after (NSET)
Discussion and observation of work were carried out during retrofitting.

Hyogo Gujarat Friendship Fund (2001-2004)

Hyogo prefecture, Japan was devastated by the Kobe Earthquake (Great Hanshin-Awaji Earthquake) in 1995. The people of Hyogo resolved to do something about rehabilitation in other earthquake affected areas and decided on more concrete, long-term commitment - setting up a task specific fund for a rehabilitation project involving school children.

After the devastating Gujarat Earthquake of 2001, UNCRD Hyogo Office assisted them to initiate a project to utilize the fund by giving expert advice and coordinating stakeholders. The basic concept is to establish a resilient and sustainable community through self-help, cooperation and education. The overall objective is to conduct the comprehensive earthquake disaster mitigation training-cum-capacity building program for community development and long-term sustainability with special focus on the school system and the non-engineered construction procedures in the affected areas. The scope of work included construction of one training cum dissemination center in Gujarat, retrofitting of schools, construction of new school cum community centers, and conducting trainings to local masons in the process of construction and retrofitting work.

Figure 1.6 School rehabilitation in Gujarat (left) and exchange program in Nepal

Hyogo Kerman Friendship Fund (2004-2008)

After the Great Southeast Iran Earthquake 2003, which badly hit Bam city center areas and surroundings in Kerman, Iran, the Hyogo Government, Japan has promoted the friendship with Kerman province in the context that both have similar experiences of severe disasters. Looking at its own experience of the Great Hansin-Awaji Earthquake (Kobe-earthquake) and acknowledging the fact that stock of unsafe houses was the main cause of huge loss of life in Bam, the collected donation fund was offered to implement seismic retrofitting of schools in Kerman province aiming to support the children who assume the future of the disaster hit area. The project finished in late 2008 with supports from both UNCRD and SNS, a Japan based NGO.

Figure 1.7 School retrofitting in Jiroft (left) and Bam (right), Kerman, Iran (2007)

Hyogo Pakistan Friendship Fund (2006-2011) / Yogyakarta Friendship (2007-)

Hyogo Government is also implementing a friendship program in Pakistan, after the 2005 Pakistan Earthquake to rehabilitate a higher secondary school in Mansehra, Pakistan. The project is being implemented to reconstruct a damaged school building with cooperation of UNCRD Hyogo Office. The project will be completed by 2011. In addition, UNCRD is cooperating with Hyogo Yogyakarta Friendship Fund since 2007 to reconstruct and retrofit schools in 2006 Java Earthquake affected area.

CHAPTER 2

Reducing Vulnerability of School Children

UNCRD is implementing a project on "Reducing Vulnerability of School Children to Earthquakes" in Asia-Pacific region under project execution by UN Department of Economic and Social Affairs (UN-DESA) and funded by UN Trust Fund for Human Security (UNTFHS) of UN OCHA since April 2005.
The project aims to ensure that school children living in seismic regions have earthquake resilient schools and that local communities build capacities to cope with earthquake disasters. The project includes retrofitting of some school buildings in a participatory way with the involvement of local communities, local governments and resource institutions, trainings on safer construction practices to technicians, and disaster education in school and communities. These activities are carried out in Fiji Islands, India, Indonesia and Uzbekistan as demonstration cases which are being disseminated throughout the respective geographical regions through regional and international workshops.

2.1 Approach of SESI

This project focuses on (1) developing and transferring earthquake-protective technology to school buildings, (2) promoting education related to earthquake disasters. The first is physical and concerned with transferring earthquake-safer construction technology to the community, while the second provides education to students, teachers, and communities on disaster preparedness in order to raise awareness and self-reliant capacities. An additional purpose of the project is to ensure that the outputs of the project are also made available to other countries that experience similar natural disasters. The schools can be used as relief and rehabilitation shelters after earthquakes. Moreover, the strong leadership of teachers has been proven to be very effective in dealing with emergency situations in disaster-prone countries such as Japan. Schools play a crucial role in community training and building social capital among various community groups. Moreover, by raising awareness among children, the message can reach their families, and a culture of mitigation can be spread through the community.

The project facilitates the on-site implementation of training and capacity-building program for earthquake disaster mitigation, ensures the safety of school children, reduces damage caused by earthquakes, and thus leads to sustainable development. Promotion of sustainable development is in accordance with the overall goal of UN DESA and the mandate of UNCRD. The aims of the project are fully consistent with the commitments of the World Summit for Social Development (Copenhagen, 1995) and the World Summit on Sustainable Development (Johannesburg, 2002). These objectives are echoed in the UN Millennium Development Goals (MDGs), especially the ones dealing with poverty reduction.

2.2 Goal and Objectives

The goal of the project is to ensure that future generations living in seismically vulnerable areas have access to earthquake-resilient schools, and that local communities build the necessary capacities, through education and training, to cope with earthquake disasters.

The goal is achieved by demonstrating how schools can be used as community centers for earthquake disaster prevention and mitigation. This includes physical retrofitting of the schools, training of the local communities, and preparation and dissemination of educational materials on earthquake disasters. Locally applicable and affordable earthquake-safer construction technology is being transferred to these communities. This contributes towards the creation of earthquake-resilient communities, thereby enhancing their human security.

Objectives

To achieve the above-mentioned goal, the objectives of this project are as follows:

- To assess seismic vulnerability and enhance seismic safety by retrofitting selected schools as model cases;
- To demonstrate earthquake-safer construction practices, and enhance the capacity of masons and engineers;
- To raise awareness among students and communities through disaster education, and
- To disseminate case study experiences widely throughout the target countries and their respective regions.

2.3 Four Major Activities

2.3.1 Objective 1:

Assess seismic vulnerability and enhance seismic safety by retrofitting schools as model demonstration cases

This includes selection of around 10 schools in each case study city, seismic analysis of the selected schools, design of retrofit recommendations, and the retrofitting of 10 model schools (two in Tashkent and Bandung and three each in Suva and Shimla). This produced retrofit guidelines and manuals, which can be applicable to the regions. One national consultant (with a civil engineering background) conducted the seismic analysis and the retrofit design with the help of an international consultant.

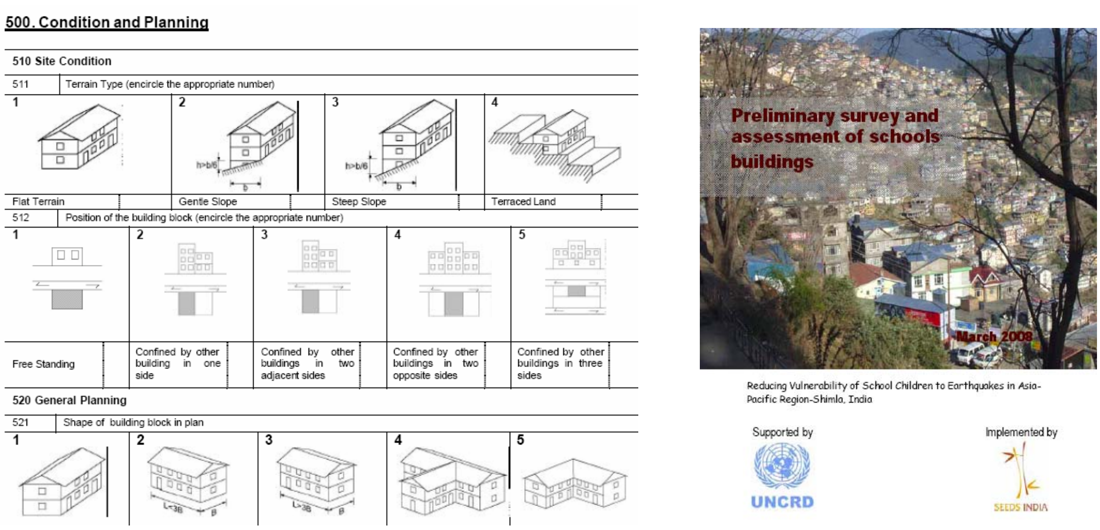


Figure 2.1: Assessment Guideline for School Buildings (India)

2.3.2 Objective 2:

Demonstrate earthquake-safer construction practices, and enhance the capacity of masons and engineers

The aim is to provide earthquake-safer construction practices to the communities through local training programs. Schools are used as the models for demonstrating the retrofitting technology. Training manuals have been developed targeting the masons and engineers. One training specialist was employed as a national consultant in each city.

Figure 2.2 A School Building in Tashkent during and after retrofitting

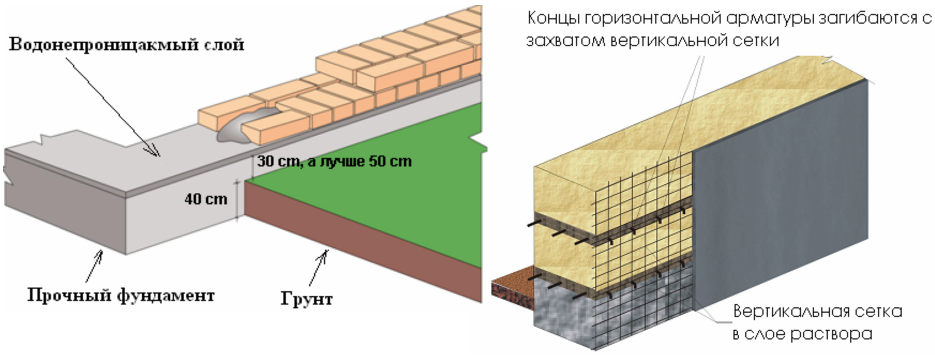


Figure 2.3 Retrofitting manual for experts in Uzbekistan

Figure 2.4 Retrofitting of a school in Indonesia

2.3.3 Objective 3:

Raise awareness of students and communities through disaster education

Educational materials have been developed, and used for training and awareness-raising programs. The educational materials consist of booklets and posters for the schoolchildren, and a CD-Rom. The CD-Rom contains general information on earthquake and educational software for risk assessment of houses and communities. One international consultant was employed for the development of the educational software. Two national consultants were employed, one as an education specialist, and the other as a communication specialist.

Figure2.5
Community people watching model demonstration of non-structural disaster mitigation in Shimla (India)

Figure2.6 Teachers' Manual in Fiji (left) and Uzbekistan (right)

Figure2.7 Students' Drill for evacuation (Indonesia)

2.3.4 Objective 4:

Disseminate the case study experiences widely throughout the target countries and their respective regions

National and regional training programs were conducted, involving the representatives of each region. An international workshop has been arranged to disseminate the experience globally. The results are being published.

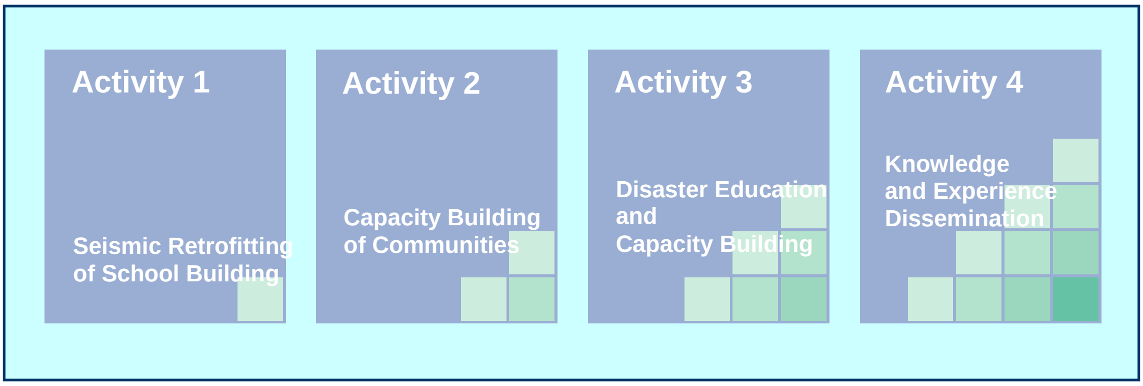


Figure 2.8 Activities of Reducing Vulnerability of School Children to Earthquakes

2.4 Outcomes and Outputs

Overall, a national consultant was appointed as a project manager. On-site field inspection and monitoring was carried out by UNCRD. An independent evaluation is being made at the end of the project by an international consultant. The activities in support of the program are:

- Appointment of a national consultant in each city (project manager) by UNCRD
- Appointment of one locally-recruited individual (project assistant) to be stationed at UNCRD in Japan
- Monitoring missions during the training programs by UNCRD staff
- Preparation of periodic progress reports and six-monthly reports by the national consultant
- Appointment of an international consultant (project evaluation)

Complementary Project Outputs

In addition to the schools retrofitted with safer construction technology, trained masons and engineers, and educated children and communities, the following materials were produced.

At the city level:

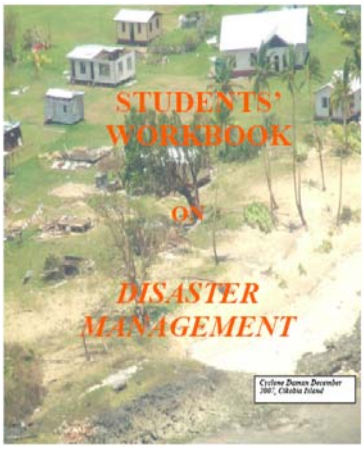
1. Guidelines for selection of vulnerable schools
2. Retrofit manuals
3. Educational booklets
4. Educational posters
5. Final report of each city

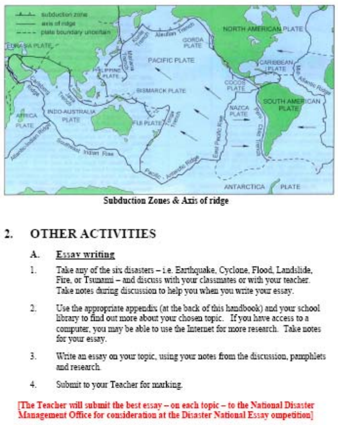
At the national and regional level:

1. Proceedings of the national and regional workshops

At the <u>international level</u>:

1. Proceedings of the international workshop
2. Final Report with CD-Rom, which includes:
   a. The final reports from each city,
   b. Retrofit manuals
   c. Educational booklets and posters (produced in each city), and educational software
3. Reproduction of educational software in different languages





(Report on Seminar, India) (Students' Workbook and its content, Fiji)

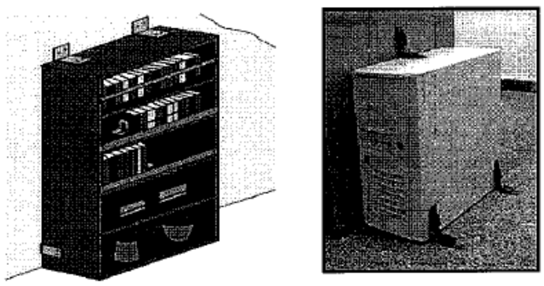


Рис.6 Примеры закрепления мебели и оборудования

(Educational material, Indonesia) (Educational material, Uzbekistan)

Figure 2.9 Manuals, guidelines, reports and educational materials

2.5 Implementation Modality

The project has been executed by the United Nations Department of Economic and Social Affairs (UNDESA). UNDESA is responsible for the financial administration and overall direction of the project. UNCRD Hyogo Office implemented the project. It coordinates all projects activities, and has been responsible for monitoring and contacts with local counterparts. The counterparts for the case studies have been the local governments, which own and operate the public schools. A local committee has been formed in each city to carry out the project in the country.

UNCRD has appointed three national consultants in each country: one project manager, one civil engineer (for retrofitting), one training, education, and/or communication specialist. These three national consultants has been a part of the project team, and are responsible for conducting the project activities in each country. Retrofitting of schools has been carried out by the local counterpart, in close cooperation with the local committee and the project team. The fund for retrofitting has been provided from the project budget through a contract to the local counterpart. The project scope, activities, and cost estimates were formulated through consultations with the local governments. International consultants have been appointed by UNDESA/UNCRD for:
1 review seismic retrofitting, 2 development of educational software, and 3 independent evaluation of implementation of the project.

2.6 Beneficiaries of the project

The beneficiaries of the project are primarily school children studying at the schools targeted for retrofitting. Since the average life period of a retrofitted building is 25 to 30 years, beneficiaries also include the students of the retrofitted schools for the next 25 - 30 years. The immediate beneficiaries from training for earthquake-resistant design and construction include masons and technicians in the cities of project implementation. From the activities related to disaster education and schools safety plan, teachers are also benefited. The beneficiaries include community people in project cities as the disseminations of technology and community seminars are to building their capacity to manage the earthquake risk. Institutionalization of the school earthquake safety will befit local and national governments which are supposed to upscale the activities with the community based approach. At the regional level, training workshops are planned to involve experts and government officers in the related filed. This ultimately benefits those countries for seismic risk management with particular focus on school earthquake safety.

Box 2.1: Reducing Vulnerability of School Children to Earthquakes: Project Activities in Summary

Seismic Retrofitting of School Buildings

The project includes seismic vulnerability analysis of about 10 selected schools in the project city in each country and the retrofitting of some of them which incorporate prominent construction typologies of the region. This leads to the development of country-specific guidelines on earthquake safe construction which incorporates solutions to the practical problems experienced during school retrofitting. Following stepwise approach is adopted for retrofitting of school buildings:

(1) Criteria Development for School Selection
(2) Guideline Development for Preliminary Assessment / Evaluation
(3) School Selection
(4) Preliminary Evaluation of School Buildings
(5) Detail Seismic Analysis and Retrofit Design of Selected Schools
(6) Retrofitting of School Buildings
(7) Retrofitting Guideline Development

Capacity Building of Communities

Retrofitting of schools in local communities can act as a demonstration of proper local earthquake technology to residents. Masons in these communities get on-the job training during the retrofitting of schools. In addition, technicians in each project city get training on earthquake design and construction of houses. Consideration is given to local practices, material availability, indigenous knowledge, and affordability of earthquake technology during trainings.

Disaster Education and Raising Awareness

The project includes the development and wide distribution of educational booklets, posters and guidebooks on teachers' training and students' drills for earthquake disaster preparedness and response. The guidebooks gain verification and are updated through training and mock drills.

In order to integrate disaster risk reduction (DRR) education into school curricula, current curriculum has been assessed. Integration modality and plan will be developed for the improvement of school curricula to take the DRR measures into account. The project also develops an interactive educational tool for awareness-raising on earthquake disasters and simple seismic risk assessment of buildings aiming to motivate householders to plan the seismic upgrading of their houses.

Knowledge and Experience Dissemination

Regional and international workshops on school seismic safety were held to disseminate lessons from the project cities to a wider audience. It is expected that distribution of guidelines on safe construction, training manuals for technicians, and education and awareness booklets will help to generate a sustainable demand for the seismic safety of schools and buildings. Educational interactive software on general awareness and risk assessment at the household level will be published in local languages to facilitate their application and distribution in 2009.

CHAPTER 3

Implementation in Project Countries

The project is being carried out with active participation of different stakeholders in each country. The counterparts and collaborating partners are basically national and local government agencies in association with, and support from, academic, and civil society organizations. The list of major partners in each project country is as follows:

Table 3.1 Major Partners in each Country

Fiji	National Disaster Management Office (NDMO)	Counterpart agency
	Fiji Institute of Technology (FIT) and Fiji Institute of Engineers (FIE)	Collaborating partners
	South Pacific Islands Applied Geo-science Commission (SOPAC)	
	Public Works Department (PWD)	
	Centre for Appropriate Technology and Development (CATD)	
	Fiji Social Service Council (FSSC)	
India	Sustainable Environment and Ecological Development Society (SEEDS)	Counterpart agency
	Ministry of Home Affiars, Government of India	Collaborating partners
	Himachal State Government	
	Education Directorate of Himachal State	
	Simla District Commissionar's Office	
	United Nations Development Programme (UNDP), India	
Indonesia	Research Centre for Disaster Mitigation, Institute of Technology Bandung (CDM/ITB)	Counterpart agency
	National Department of Education (DOE)	Collaborating partners
	Department of Education, Bandung / Yogyakarta, Java	
	Banda Reconstruction and Rehabilitation Agency (BRR)	
	Nangroe Aceh Darussalam (NAD) Provincial Government	
Uzbekistan	Uzbek Research Institute for Typical and Experimental Building (UzLITTI)	Counterpart agency
	Tashkent City Office	Collaborating partners
	Ministry of Education, Government of Uzbekistan	
	NGO HAYOT	

3.1 Project Implementation: Fiji

The Republic of Fiji Islands, situated in the Pacific "Ring of Fire," has frequent small earthquakes. An earthquake of magnitude of 6.75 in 1953 caused considerable destruction of property and life. It is a growing concern now that next large earthquake close to Suva would result in more damages because of the increased vulnerability due to haphazard urbanization in the past decades. In order to cope with future earthquakes, several initiatives have been taken at national and local level in recent years. Fiji is also vulnerable to other natural disasters such as wind storms, floods and drought. Disaster data reveal that a wind storm hits the country every one and half years.

The project "Reducing Vulnerability of School Children to Earthquakes" is built on the past achievements of managing the earthquake risk in the country. Schools in and around Suva city are selected for the intervention of this project. The project maintains synergy with policy and programs of National Disaster Management Office (NDMO), a government focal point for disaster management, which carries out community based disaster management activities. The Ministry of Education has also placed high priority in staging the school safety program into national campaign for safe school.

Partnership

UNCRD in Fiji coordinates its activities along with its project counterpart, NDMO is a unit within the Ministry responsible for disaster management, wherein day to day functions of disaster management are conducted. NDMO deals with disaster management at the national level. It is the prime policy formulating body and is also responsible for disaster rehabilitation. One of its core activities includes disaster management training and public education on par with its coordinating requirements with other governmental departments.

UNCRD-NDMO partnership is focused both at the policy advocacy level as well as at the community level in the field of disaster preparedness with special focus on schools. UNCRD recognizes the importance of working with the government on par with the local NGOs and the Civil Society Organizations in order to make the interventions replicable and sustainable. The efforts of UNCRD Hyogo Office in making schools a safer place for learning are realized with the active participation of its partners and the involvement of the community.

UNCRD also involves the expertise of local scientific institutions such as the Fiji Institute of Technology (FIT), the Centre for Appropriate Technology and Development (CATD) and the Fiji Institute of Engineers (FIE). In order to mainstream earthquake preparedness as an integral part of education and for facilitating wider dissemination of information, UNCRD collaborates with the Fiji Social Service Council (FSSC) as well. The local government bodies such as the Public Works Department (PWD) are also involved for a greater accountability and implementation of the project at the community level.

Box: 3.1 Multi-stakeholders' involvement in Fiji

Involvement of country team

One of the best practices in Fiji is the involvement of a country expert team to carry out Fiji SESI project. As NDMO doesn't have capacity for whole components of the project, the project was launched with involvement of different agencies as the country expert team. This arrangement not only helped in supplementing capacity of the implementing agency i.e. NDMO, but also provided opportunity to link simultaneously with different stakeholders in one project. The project was instrumental in driving home the message that "Disaster risk reduction begins at schools" to many stakeholders through one model project.

Involved agencies

National Disaster Management Office (NDMO) – Chair/Secretariat
Ministry of Education, Fiji
Fiji Institute of Engineers
Ministry of Health, Fiji
South Pacific Applied Geo-science Commission (SOPAC)
Suva City Council representatives
Three Professional Consultants
Department of Mineral Resources
Public Works Department
(Other members are invited as and when required.)

Key features

Multi-stakeholders involvement in decision making
Supplementing capacity of NDMO in different aspects of project implementation
Plan to reach throughout the country through government agencies

Follow-up initiatives

Building upon the experience of SESI model project, NDMO Fiji is developing a proposal to be submitted to the Cabinet for up-scaling the school project throughout the countries. As the model project has already produced training manuals for carpenters and masons, education material for school children and training materials for teachers, NDMO is making arrangements to distribute it throughout the country. The training manuals for education are being prepared for verification before commissioning. The Permanent Secretary for Provincial Development for distribution to all the village and settlement heads in Fiji and the National Committee will coordinate training for rural carpenters on the use of the Manual. Plan is undergoing on conducting a training course in vocational schools for carpenters and masons.

Fiji

Table 3.2 Outcome summary in Fiji

Activity	Outcome	Numbers	Remarks
School retrofitting	Vulnerability assessment of schools in Suva, Fiji	6	See Annex 2
	Retrofitting of schools	3	-Suva Vocational School -St. Agnes Primary School -Nasinu Muslim School
Training and capacity Building	Training to local technicians	2	Total 50 participants
	Training to teachers	2	Total 40 participants
	School earthquake drills	2	Participated by students and teachers
Publications	Training manual for technicians		See Annex 3
	Disaster awareness posters and pamphlets		
	Guide to creating evacuation plan for School in the Fiji Islands		
	Disaster Management and Earthquake Preparedness: Teachers' Handbook		
	Disaster Management: Students' Workbook		

Box 3.2: What next? Future Strategy for School Safety in Fiji

(From Discussion on Country Strategic Planning, meeting in the Intl. Conference on School Earthquake Safety Initiatives, Nov. 05-07, 2008, Kobe, Japan)

The aim after this SESI pilot project will be to institutionalize and sustain the efforts. Engagement with government agencies will be a key part of this initiative. An increased engagement with the Ministry of Education will be targeted, and the work done on this issue by the NDMO will also be aimed for transfer to the Ministry of Education for greater ownership. Regarding structural issues, the target will be to work with Ministry of Provincial Development and Housing with rural areas and the ongoing development that needs to be influenced. The institutions will be encouraged to take steps and promote policy lessons learnt under the project.

The NDMO will continue to be responsible for the general awareness campaign targeting the general public. The lessons learnt from the pilot project will be fed into the overall campaign besides engagement with the Ministry of Education. The lessons from the SESI project will also be shared more widely so that neighboring countries can also benefit from the experience.

3.2 Project Implementation: India

Following the 2001 Gujarat earthquake, there has been concern over the need to promote earthquake safety in India. A majority of the states along the Himalayan belt are in highest seismic zones which includes Himanchal, Uttaranchal, Assam among others. The unique geographic setting at the northern-western fringe of the youngest mountain chain (The Himalayas) places Himachal Pradesh in the most active seismic zone (Zone V). Therefore, the project activities are to be carried out in Shimla district of Himachal Pradesh. Shimla city is commemorating the centenary of India's worst earthquakes till date – the 1905 Kangra Earthquake.

The project took momentum along with other initiatives by state and local governments in association with civil society. Sustainable Environment and Ecological Development Society (SEEDS) serves as local resource institution to implement the project. The program witnessed a very encouraging and positive response from government of India in not only providing permission to carry out the project but also in providing support throughout the implementation phase of the project. Government of Himachal Pradesh supported the entire project and they gave necessary permissions to carry out retrofitting in school buildings. Department of Education is one of the major partners in carry out work. They have also given letters for teachers training to be attended in various training programs conducted under SESI project.

During initial phase of the project, the implementation faced few challenges and it started late. However, SEEDS carried out the concept on its own and through local resource to create a very firm working platform when the project was formally launched in Shimla, Northern part of India. During the approval and clearance waiting, SEEDS carried out preparatory work and conducted status of disaster education in India, framework for training manuals and program for community awareness raising. SEEDS also completed vulnerability analysis survey on 6 school buildings in Shimla which served as base for selection of school for retrofitting for the project. As SEEDS was working in Shimla with schools on the School Earthquake Safety Initiative, supported by DG-ECHO through its disaster preparedness programme in partnership with Christian Aid, they had a very good working relationship with school authorities and other stakeholders which helped in mobilization of different stakeholders. As a result of engineers training program in which secretary of education department was chief guest, he and all engineers showed lots of interest to include retrofitting for old school buildings in Himachal Pradesh. Outcome of this project will be shared with different stakeholders who will ensure sustainability of efforts done under SESI project.

Under this project SEEDS school safety team carried out different programs in schools and they have prepared school disaster management plans for schools where we are doing retrofitting. Mock drills were being carried out in schools with formation and training of different task forces like first aid, search and rescue. SEEDS has also done community seminars for awareness about building safety in which they have used different local medium like drama so community can easily understand importance of earthquake safety in the area. All the stakeholders gave a very good response during different programs.

Box: 3.3 Lessons learned and way forward: India

Lessons learned

- There is an obvious need for promotion of building safety in schools in India
- Construction workers are major players in ensuring safety of buildings
- Need to organize and formal training of construction workers
- There is need for better awareness among technicians about retrofitting and more IEC (information, education and communication) materials should be developed

Way forward

- The model project of SESI is small but a firm step towards reduction of disaster risks due to earthquakes
- More such programs are needed for country like India
- Construction workers should be targeted and a certification program should be developed
- Education Department is very keen to take retrofitting of schools in Himachal Pradesh.

Table 3.3 Outcome summary in India

Activity	Outcome	No.	Remarks
School retrofitting	Vulnerability assessment of schools in Shimla, India	6	See Annex 2
	Retrofitting of schools	3	-Child Welfare School Parishad, Dhali, District of Shimla -Primary School Junga, Tehsil, -Secondary School Kufri, Tehsil,
Training, capacity Building / awareness	Training to local technicians	2	Total 50 participants
	Training to teachers	2	Total 40 participants
	School earthquake drills	2	Participated by students and teachers
	Community Seminar	2	Total 60 participants
Publications	Training manual to technician		See Annex 3
	Disaster awareness posters and pamphlets		
	Education booklet		

Box: 3.4 What next? Future Strategy for School Safety in India

(From Discussion on Country Strategic Planning, meeting in the Intl. Conference on School Earthquake Safety Initiatives, Nov. 05-07, 2008, Kobe, Japan)

Even before the current pilot project, the work on school safety in India has been going on for a few years. The work done in Himachal Pradesh under the project needs to be scaled up to influence policy levels in the government and other decision makers. The school safety lessons will also be fed into the state government level planning for disaster management. The training of masons is also very important, and a certification program for construction workers is also being planned. India is a large country, and with a fast growing economy. There are a large number of schools and there is extensive construction activity taking place, and the work will be used to influence across these. The national government is drafting the national policy on school safety, and efforts are being made to influence the policy planning process.

3.3 Project Implementation: Indonesia

Indonesia lies in a very seismically active region which is characterized by numbers of major earthquakes frequently occurring. This location makes Indonesia an earthquake prone country and has experienced more than twenty earthquakes of magnitude 6.5 or higher during the past five years. It was the most affected country by the great Sumatran Earthquake and Tsunami Disasters in 2004 and the following Earthquake 2005. Many schools collapsed or were damaged in these earthquakes due to an inappropriate design and construction. Many of these school buildings still remain damaged.

Realizing the importance of school safety, SESI project was implemented in Indonesia from 2005. Schools and communities for this project are from Bandung city, which was affected by an earthquake in February 2005. The concept of long term mitigation in this project, particularly towards resilient schools and communities, will influence the reconstruction process resulting in sustainable development. The Institute Bandung Technology Center of Disaster Mitigation (CDM/ITB) serves as local resource institution to implement the project with the support of Bandung City, Bandung District and Department of Education.

UNCRD and Center for Disaster Mitigation (CDM) /ITB conducted a collaborative project to reduce the vulnerability of existing school buildings in the corridor of the School Earthquake Safety Initiative (SESI) project. Two school buildings, SD Cirateun Kulon II and SD Padasuka II both in Bandung County, were selected for this project due to the dire needs of improvement and severe deficiencies of earthquake resistant systems. The project included retrofitting and strengthening of school buildings, and other activities to improve school community preparedness regarding earthquake.

Prior to conducting any physical work to the structure, the locations and building layouts were checked to ensure that the buildings could be retrofitted. The existing structures were investigated to determine the type and quality of materials used, as well as the existing lateral resisting system. Then, the retrofitting was designed based on the structural deficiencies/weak parts and their accessibilities, weighing in factors of retrofit on buildings' life time, earthquake resistance capacity, buildings' function, and appropriate retrofit strategy/techniques. The design of retrofit strategy also considered factors of continuation of normal function, availability of materials and skilled construction workers, needs of upgrades for non structural components, and total costs.


India


Indonesia

Box: 3.5: What next? Future strategy in Indonesia
(From Discussion on Country Strategic Planning, meeting in the Intl. Conference on School Earthquake Safety Initiatives, Nov. 05-07, 2008, Kobe, Japan)

ITB Bandung needs to share experiences and develop a critical mass of people working on school safety issues. It also needs to move ahead from the pilot projects and identify sectors and strategically target them so that we can reach out to maximum number of schools and teachers. Government and school teachers are important stakeholders for this. Assessment of school safety plans is also a strategic step that needs to be taken up for appropriate programming.
Indonesia Safety Building Culture for Disaster Risk Reduction – SBCRR, and consortium for disaster education are examples that can be built upon for scaling the initiative. The private sector also needs to be engaged with for making the work sustainable and have access to resources in the long term.

Table 3.4 Outcome summary in Indonesia

Activity	Outcome	Numbers	Remarks
School retrofitting	Vulnerability assessment of schools in Indonesia	4	See Annex 2
	Retrofitting of schools	2	-SD Cirateun Kulon II -SD Padasuka II
Training, capacity Building and awareness	Training to local technicians	2	Total 50 participants
	Training to teachers	2	Total 40 participants
	School earthquake drills	2	Participated by students & teachers
	Community Seminar	1	Total 40 participants
Publications	Training manual for masons		See Annex 3
	Disaster awareness posters and pamphlets		
	Education booklet		


Indonesia


Indonesia

3.4 Project Implementation: Uzbekistan

Uzbekistan is situated in a tectonically active region and exposed to high seismicity. Tashkent, the capital city, was hit by a strong earthquake in 1966 causing a huge loss of lives and properties. In the last decade, there have made several initiatives to contain the risk of earthquakes in Tashkent. The city was one of the case study cities for IDNDR RADIUS and the UNCRD Global Earthquake Safety Initiative (GESI).

The government of Uzbekistan recently initiated National Program for Improvement of Educational Facilities which includes improvement of school buildings among others. This program provides the basis for the current project.

The current UNCRD project is conducted in Tashkent, Uzbekistan where the Hokimiyat (municipal) office, a counterpart agency, is located. The Ministry of Education is taking part in the project to spread similar programs throughout the country. The Uzbek Research Institute for Experimental and Typical Building (UzLITTI) serves as a local resource institution to implement the project in Tashkent.

UzLITTI has been founded in 1963 in Tashkent as a scientific research institution on construction. Since its establishment, UzLITTI has contributed to technology and design development of earthquake resistant buildings in Central Asia. UzLITTI has been nominated by the Government of Uzbekistan as the leading organization in the republic for seismic resistant construction, design, rehabilitation and reinforcement of buildings and facilities. UNCRD sponsored a critical study for the school typology buildings in Tashkent in 2000. The survey permitted to prepare a study focused on the solving of the structural problems by school building typologies. Immediately after the survey, UNCRD started building partnership with local stakeholders such as Tashkent City Government and UzLITTI and conceptualized the project on “Reducing Vulnerability of School Children to Earthquakes” in Uzbekistan.

The UNCRD project was a welcome model as the government of Uzbekistan that has launched State National Program on Development of School Education of Uzbekistan 2004-08 under initiative of the president of Uzbekistan. The approach being followed in Uzbekistan for assessment of nearly 10,000 schools, risk reduction initiatives in prioritized schools and initiative to improve overall quality of education which emphasizes risk reduction as most important and urgent priority of President and the Government of Uzbekistan. One of the priorities of the program is to strengthen school facilities. Out of around 10,000 school buildings, preliminary assessment of 8476 schools (87%) has been completed. Of those, 325 schools need new construction, 313 need renovation, 3769 need structural strengthening and 2089 need maintenance. In approving the renewal of targeted local schools was drawn up a timetable for the transfer of students for construction and repair work in the nearby educational institutions. During 2004-2008, along with educational institutions included in the State nationwide program, funded by local Hokimiyats and sponsorship organizations have been built and put into operation 47 general schools. To meet this challenge was estimated seismic risk identified schools, produced the regulatory framework and model projects including retrofitting.

It is very encouraging to note that with the implementation of the State nationwide program coincided and time of the project UNCRD «Reducing vulnerability of school children to earthquakes» in Tashkent. The project leads the country with the participation of design and construction companies, much work on reconstruction and strengthening of school buildings in Tashkent. In doing so, stakeholders utilize the latest technology in design and construction work, and in the training schools and residents.

Box: 3.6: What next? Future strategy for Uzbekistan

(From Discussion on Country Strategic Planning, meeting in the Intl. Conference on School Earthquake Safety Initiatives, Nov. 05-07, 2008, Kobe, Japan)

The work so far has led to the derivation of a general philosophy and approach on school safety, with the three sectors of policy, education and training. In the context of policy we should develop a strategy to introduce the safety issue into the curriculum, and to influence the decision makers. Priority selection should be taken up with the stakeholders. The future projects should also include decision maker groups such as politicians. It should also involve a number of people such as philosophers and psychologists besides technical experts, teachers and government officials.

The fixing of responsibilities for planning of schools needs to be much higher than houses. The second level is designing and the designers. The third is the construction and the construction agencies and workers. The fourth level is of maintenance of the buildings. All these four factors are important for training and dissemination so that safe school buildings are constructed and maintained in an appropriate way. Simplification should be targeted, and codes should be made easier for construction workers to understand.

Children under 15 years of age should be targeted very specifically for basic education on disasters such as earthquakes and how to cope with them and behave when they strike. Older children should not be taught how to respond and behave in disasters, but how to reduce and mitigate them. Different levels require different education, starting from small children to older ones, and local people to governments.
Common standards and codes is the last thing that is very important for schools.

Uzbekistan

Table 3.5 Outcome summary in Uzbekistan

Activity	Outcome	No.	Remarks
School retrofitting	Vulnerability assessment of schools in Tashkent, Uzbekistan	3	See Annex 2, Many schools were assessed (State Program for School Up-gradation)
	Retrofitting of schools	2	-School No. 20 -School No. 116
Training, capacity Building and awareness	Training to local technicians	2	Total 50 participants
	Training to teachers	2	Total 40 participants
	School earthquake drills	2	Participated by students and teachers
	Community Seminar	2	Total 40 participants
Publications	Training manual on Earthquake Safe Construction		See Annex 3
	Education booklet on earthquake safety		
	Disaster awareness posters and pamphlets		
	Education booklet		
	Guidelines on seismic resistant building construction		

Box: 3.7 Project implementation by different stakeholders

SESI was implemented in the project countries through local counterparts. Although wider stakeholders involvement was ensured at all stages of the program in each of the project countries, stakeholder with different background were selected as leading counterpart in each country.
This variation from academic institute to government agency was instrumental in producing a rich experience from the SESI project. The partner agency worked with their background, their own expertise and under their own country specific conditions. UNCRD played a vital role in coordination, technical support and information exchange among the project countries.

Key Implementing partners in project countries

Country	Organization	Type
Fiji	National Disaster Management Office (NDMO)	Government
India	Sustainable Environment and Ecological Development Society (SEEDS)	NGO
Indonesia	Centre for disaster Mitigation, Institute of Technology Bandung (CDM/ITB)	Academic Institute
Uzbekistan	Uzbek Research Institute for Typical and Experimental Building (UzLITTI)	Semi-Public organization

CHAPTER 4

Highlights of the Project Outcomes

4.1 Project Outcomes: Fiji

4.1.1 Vulnerability Assessment and School Retrofitting

A methodology for assessing the seismic vulnerability of schools had first to be developed, as none existed prior to this. The Chief Structural Engineer, PWD Mr Sia Ansari and Mr Robert Pole representing the Fiji Institution of Engineers (FIE) developed the "Earthquake Evaluation Process" that has been piloted in five schools in the larger Suva area. A survey questionnaire "Field Measurements Required for Initial Earthquake Evaluation Process of Schools" was sent to ten schools in Suva whose response provided the initial basic information on which the Project Technical Team assessed the levels of exposure to gauge high risk building and whether a more detailed on site follow up was warranted.

Figure 4.1 Heavily damaged portion of a school building in Suva, Fiji

A follow up field visit was found necessary on all the schools that returned the completed survey questionnaire:- Adi Cakobau, Suva Muslim, Nasinu Muslim, St Annes, St Agnes, Ballantyne Memorial School, Mahatma Ghandi, Suva Vocational Schools.

The evaluation process provides a systematic and uniform approach for engineers and technicians to use in deciding the Structural Performance Score (SPS) of a building with an assigned Grading for Seismic Risk. An SPS score of less than 33 means the building fails to meet minimum earthquake safety standards;

Grade	**A+**	**A**	**B**	**C**	**D (Fail)**	**E (Fail)**
SPS	Greater than 100	100 – 81	80 – 51	50 – 34	33 – 20	Less than 20

Results

- The survey questionnaire for preliminary earthquake risk assessment was very well completed by all but one school that returned the forms
- In each school there was at least one building that needed further on site technical assessment
- All the buildings in which further on site technical assessment was done failed to meet earthquake safety standards with over 80% bracketed in the least and worst grade.

Discussion Issues

1. This small sample in Suva implies a potentially very dangerous national picture that our schools are not adequately safeguarded against earthquake risk hence we are potentially putting children's lives at risk in all schools. Earthquake disasters around the world have proven to be the most lethal among natural disasters, inflicting huge losses on life and property and damaging the affected area's economy, social organization, and cultural heritage. The NDMO is urged to liase with the Ministry of Education and undertake a national survey of schools using the survey questionnaire "Field Measurements Required for Initial Earthquake Evaluation Process of Schools".
2. A major fault found throughout is the lack of preparedness and other measures to mitigate fire hazards, particularly provision of adequate egress in double storey women's dormitory buildings. What exist are death traps.
3. The opportunity for this Project to work in closer cooperation with the EU Schools project should be seriously pursued with the MOE by the NDMO.
4. The Project needs input of funding and technical resources to successfully implement the activities during the project work and workshops.

Before retrofitting After Retrofitting

Figure 4.2 Example of retrofitting in Suva, Fiji

4.1.2 Education and Raising Awareness

Training Workshop for Teachers

Date: 2nd December 2007
Venue: Salvation Army Hall, Suva
Participants: school supervisors from Ministry of Education (MOE), education expert, selected school teachers in charge of the occupational health and hazard management unit, PWD and CATD.

Modules:

I. Hazard, vulnerability and risk of earthquake in the Fiji Islands in the context to safety of school system
II. Preliminary self assessment of school facility against potential earthquakes.
III. Rapid response to emergency situations
IV. Role of school administration, teachers and students in emergency management planning in the schools.
V. Preparedness and mitigation measures in schools
VI. The structure of drill exercise to be carried by teachers and students.

Earthquake drill

The Disaster Awareness Committee was formed after a Disaster Management Workshop by National Disaster Management Office, where the importance of disaster management was highlighted, and the need to have disaster management plan for each school.

As being felt with the full impact of tsunami waves, the schools along the coast line are under the greatest threat. MGM High School, which is one of the targeted school under the programme, falls in the coastal area where is designated as the danger zone by NDMO.

Table: 4.1 Activities list of earthquake drill in Suva, Fiji

	Activity	**Involved**
Activity 1	Setting Up Evacuation Plan - Hierarchy Chart and Roles and Responsibilities	Teachers Administrators
Activity 2	Checking Evacuation Procedure for Emergency Situations at School - - Fire Threat, Earthquake, Tsunami	Teachers Administrators Students
Activity 3	Conducting Earthquake Drill Immediate Threat and Moderate Threat	Teachers Administrators Students
Activity 4	Conducting Tsunami Drill - Tsunami Warning and Evacuation from School to nearest higher ground	Teachers Administrators Students Community
Activity 5	Checking Emergency Kit / First Aid Kit	Teachers Administrators Students Community

Educational Material Development

Three educational materials, "Teacher's Handbook for Disaster Management and Earthquake Preparedness", "Students' Workbook on Disaster Management", and " A Guide, To Creating Evacuation Plans for Schools in the Fiji Islands" has been developed by the Ms. Tauga, the educational expert of this project in collaboration with NDMO and Ministry of Education. The workbooks were reviewed at the National review workshop on school safety book in December 2007.

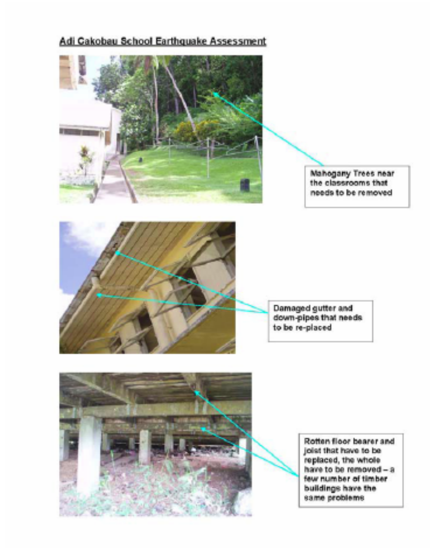


Figure 4.3 Educational manuals and Technical report developed in Fiji

4.1.3 Training and Capacity Building

One day Training workshop on safe housing and school construction was conducted using the draft manual of safe school construction as participant's handbook. The training program received the comments from the participants on the suitability of the content, presentation of the material and overall evaluation. Technicians from ministry of education urged to make the manual as the national guideline for school construction. Following was the program of the training.

Table 4.2: Brief glimpse of training program in Suva, Fiji

▪ Opening Remarks from NDMO, CATD, UNCRD and GRIPS
▪ **Introduction** of housing safety survey ▪ **Questionnaire** fill up on housing earthquake safety issue by trainee
▪ **Lecture: E**arthquakes, floods, cyclones in Fiji, ▪ **Discussion:** 1952 earthquake and tsunami and other past earthquakes
▪ **Lecture:** -How does building behave in earthquakes - Design and construction principles for earthquakes
Lecture: earthquake deficiencies of wooden, masonry sand RC building
▪ **Lecture:** Location of building site**,** Building plan for earthquakes, Architectural issues ▪ **Exercise :**DO's and Don't DO's
Lecture: Eq resistant Timber frame structure
Lecture: Eq resistant masonry and RC structure
Lecture: seismic retrofitting principle and method for wooden, masonry and RC houses
Lecture: repair and maintenance log and method
Exercice: Multiple choice question **Questionnaire:** Re-survey of carpenters on earthquake safety of houses **Feedback**: Guideline content and pressent
Closing Remarks - Representative of participant - NDMO, CATD, GRIPS and UNCRD

Training Manual Development

Training Manual for Technicians has been developed by Training Expert, Mr. Robert Pole and Mr. Josefani Bola, the director of CATD. The content of the training manual are:

1.0 Background
2.0 Earthquakes
- 2.1 Causes of Earthquakes
- 2.2 Earthquake Prone Areas
- 2.3 Damages Caused by Earthquakes
- 2.4 Structures at Risk
- 2.5 How to Minimize Effects of Earthquakes on Structures
- 2.6 Retrofitting School and Similar Public Buildings
  - a. Inspection and Assessment
  - b. Problems and Solutions
- 2.7 Safe Building Construction Practices
  - Timber Framed Buildings
  - Masonry Buildings

3.0 School Building Maintenance Programme
4.0 Institutional Arrangement

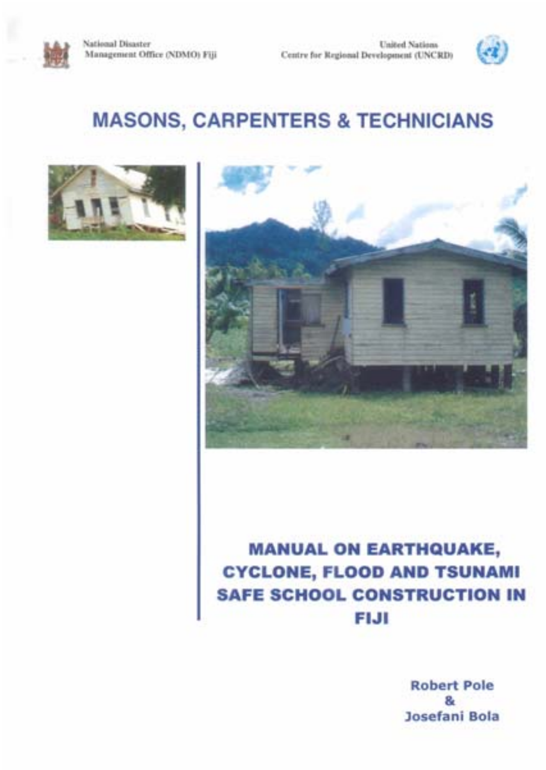


Figure 4.4 Guideline for Experts and Posters for the Public (Fiji)

4.2 Project Outcomes: India

4.2.1 School Retrofitting

Through the project detailed analysis, design and retrofitting of 3 schools were done. One of the schools retrofitted is Government school for differently abled children, Dhali. This school is run by the state government for deaf and blind children from Himachal Pradesh. This school is situated on top of the mountain in a remote area. This place is far away from the main market of Dhali. This place is located on the way from Shimla city to Kufri. It is surrounded by resort and small hotels because of the location of the school building.

There are 120 students in this school from nursery to 10th standard and 12 teachers are there for taking classes who are coming from near by area. In order to support differently abled children 8 people are there apart from teaching staff. This school is running by Himachal Pradesh state government. This school building is built during 1980s and because of weather and aging it have developed lots of defects. There are diagonal cracks around openings. There are lots of vertical cracks also on exterior wall of the building. Condition of the flooring is really deteriorated and students are facing lots of problems due to the same.

This building is not only lacking the proper earthquake resisting features but it also lacking the universal design for differently abled children. This will be good school building to choose for this project.

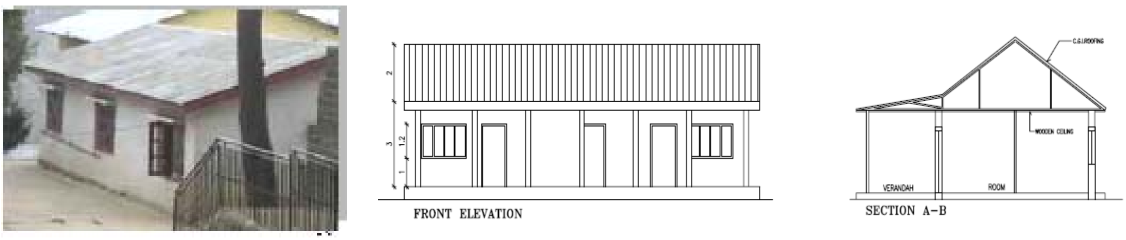
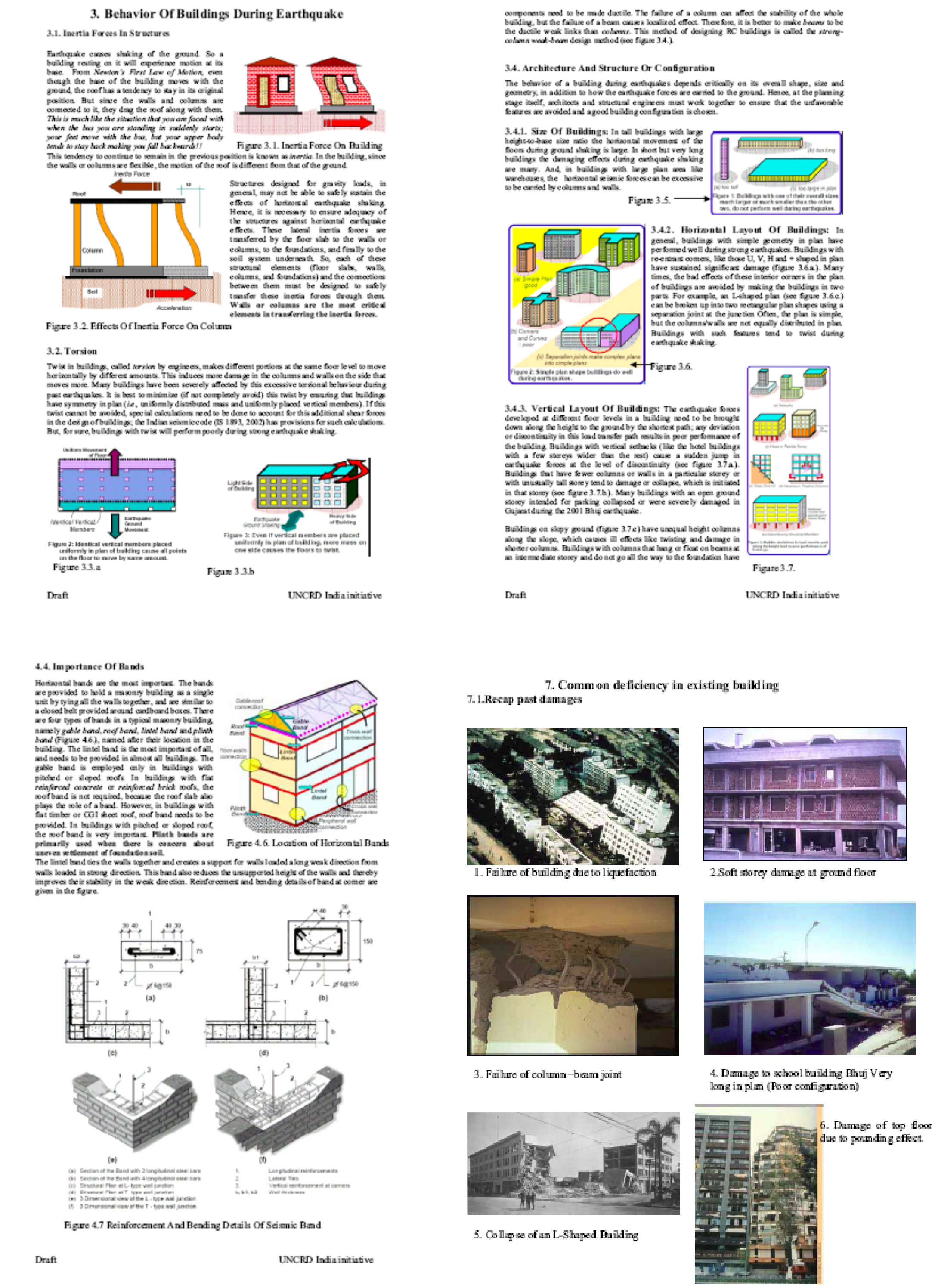


Figure 4.5 Government school for differently abled children, Dhali.

NOTES ON RESTORATION & RETROFITTING :

1. All decisions to arrive at the retrofitting measures for the vulnerable load bearing masonry structures are based on IS 13935, 2008, IS 4326 and IS 13928. These decisions are as follows.
2. This is Category "E" building.
3. Table 3A on page 16 of the IS 13935 dictates the requirement of various features.
4. In the walls where the requirements specified in Table 3A for the wall openings is not satisfied all the openings in the walls including the doors and windows are to be encased. This will be done on the inside face since in the upper storey it will minimize the work to be done on scaffolding
5. Built -in cupboards are also treated as openings. The encasement of the built in cupboards is done on the same face as the shutters of the cupboards.
6. Wall height in storey is less than 15 times the wall thickness which is 315mm. Hence, neither pilasters are required nor the increase in effective thickness.
7. Maximum wall length in store is less than 35 times the wall thickness which is 380mm. Hence, no pilasters are required.
8. Since the foundation is resting on soil that is not soft no plinth band is needed.
9. Lintle level Seismic Belt on both sides of the wall has to be provided on all walls, except where continuous RC lintel or sunshade (chajja) is present.
10. Sill level belt is required on both faces of every wall.
11. Vertical reinforcement is to be installed at every wall junction. It will consist of weld wire mesh or single reinforcing rod. The single rod in the "T" corner is to be installed on only one side. The selection between the two options depends upon the suitability for the given situation.
12. Since vertical bar at the jambs of windows and doors are not present the Seismic belts are provided all around the openings.
13. The in-plane shear strenghtof the wooden partition is to be increased by (a) additional vertical posts and diagonal bracings. In addition the connection of the vertical post to the foundation is strengthened to ensure proper shear transfer.

Figure 4.6
Salient points in restoration and retrofitting of non-engineered buildings



3. Behavior Of Buildings During Earthquake

3.1. Inertia Forces In Structures

Earthquake causes shaking of the ground. So a building resting on it will experience motion at its base. From *Newton's First Law of Motion*, even though the base of the building moves with the ground, the roof has a tendency to stay in its original position. But since the walls and columns are connected to it, they drag the roof along with them. *This is much like the situation that you are faced with when the bus you are standing in suddenly starts; your feet move with the bus, but your upper body tends to stay back making you fall backwards!!*

Figure 3.1. Inertia Force On Building

This tendency to continue to remain in the previous position is known as *inertia*. In the building, since the walls or columns are flexible, the motion of the roof is different from that of the ground.

Structures designed for gravity loads, in general, may not be able to safely sustain the effects of horizontal earthquake shaking. Hence, it is necessary to ensure adequacy of the structures against horizontal earthquake effects. These lateral inertia forces are transferred by the floor slab to the walls or columns, to the foundations, and finally to the soil system underneath. So, each of these structural elements (floor slabs, walls, columns, and foundations) and the connections between them must be designed to safely transfer these inertia forces through them. **Walls or columns are the most critical elements in transferring the inertia forces.**

Figure 3.2. Effects Of Inertia Force On Column

3.2. Torsion

Twist in buildings, called *torsion* by engineers, makes different portions at the same floor level to move horizontally by different amounts. This induces more damage in the columns and walls on the side that moves more. Many buildings have been severely affected by this excessive torsional behaviour during past earthquakes. It is best to minimize (if not completely avoid) this twist by ensuring that buildings have symmetry in plan (*i.e.*, uniformly distributed mass and uniformly placed vertical members). If this twist cannot be avoided, special calculations need to be done to account for this additional shear forces in the design of buildings; the Indian seismic code (IS 1893, 2002) has provisions for such calculations. But, for sure, buildings with twist will perform poorly during strong earthquake shaking.

Figure 3.3.a

Figure 3.3.b

Draft UNCRD India initiative

components need to be made ductile. The failure of a column can affect the stability of the whole building, but the failure of a beam causes localized effect. Therefore, it is better to make *beams* to be the ductile weak links than *columns*. This method of designing RC buildings is called the *strong-column weak-beam* design method (see figure 3.4.).

3.4. Architecture And Structure Or Configuration

The behavior of a building during earthquakes depends critically on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. Hence, at the planning stage itself, architects and structural engineers must work together to ensure that the unfavorable features are avoided and a good building configuration is chosen.

3.4.1. Size Of Buildings: In tall buildings with large height-to-base size ratio the horizontal movement of the floors during ground shaking is large. In short but very long buildings the damaging effects during earthquake shaking are many. And, in buildings with large plan area like warehouses, the horizontal seismic forces can be excessive to be carried by columns and walls.

Figure 3.5.

3.4.2. Horizontal Layout Of Buildings: In general, buildings with simple geometry in plan have performed well during strong earthquakes. Buildings with re-entrant corners, like those U, V, H and + shaped in plan have sustained significant damage (figure 3.6.a.). Many times, the bad effects of these interior corners in the plan of buildings are avoided by making the buildings in two parts. For example, an L-shaped plan (see figure 3.6.c.) can be broken up into two rectangular plan shapes using a separation joint at the junction Often, the plan is simple, but the columns/walls are not equally distributed in plan. Buildings with such features tend to twist during earthquake shaking.

Figure 3.6.

3.4.3. Vertical Layout Of Buildings: The earthquake forces developed at different floor levels in a building need to be brought down along the height to the ground by the shortest path; any deviation or discontinuity in this load transfer path results in poor performance of the building. Buildings with vertical setbacks (like the hotel buildings with a few storeys wider than the rest) cause a sudden jump in earthquake forces at the level of discontinuity (see figure 3.7.a.). Buildings that have fewer columns or walls in a particular storey or with unusually tall storey tend to damage or collapse, which is initiated in that storey (see figure 3.7.b.). Many buildings with an open ground storey intended for parking collapsed or were severely damaged in Gujarat during the 2001 Bhuj earthquake.

Buildings on slopy ground (figure 3.7.c) have unequal height columns along the slope, which causes ill effects like twisting and damage in shorter columns. Buildings with columns that hang or float on beams at an intermediate storey and do not go all the way to the foundation have

Figure 3.7.

Draft UNCRD India initiative

4.4. Importance Of Bands

Horizontal bands are the most important. The bands are provided to hold a masonry building as a single unit by tying all the walls together, and are similar to a closed belt provided around cardboard boxes. There are four types of bands in a typical masonry building, namely *gable band*, *roof band*, *lintel band* and *plinth band* (Figure 4.6.), named after their location in the building. The lintel band is the most important of all, and needs to be provided in almost all buildings. The gable band is employed only in buildings with pitched or sloped roofs. In buildings with flat *reinforced concrete* or *reinforced brick* roofs, the roof band is not required, because the roof slab also plays the role of a band. However, in buildings with flat timber or CGI sheet roof, roof band needs to be provided. In buildings with pitched or sloped roof, the roof band is very important. Plinth bands are primarily used when there is concern about uneven settlement of foundation soil.

Figure 4.6. Location of Horizontal Bands

The lintel band ties the walls together and creates a support for walls loaded along weak direction from walls loaded in strong direction. This band also reduces the unsupported height of the walls and thereby improves their stability in the weak direction. Reinforcement and bending details of band at corner are given in the figure.

Figure 4.7 Reinforcement And Bending Details Of Seismic Band

Draft UNCRD India initiative

7. Common deficiency in existing building

7.1.Recap past damages

1. Failure of building due to liquefaction

2.Soft storey damage at ground floor

3. Failure of column –beam joint

4. Damage to school building Bhuj Very long in plan (Poor configuration)

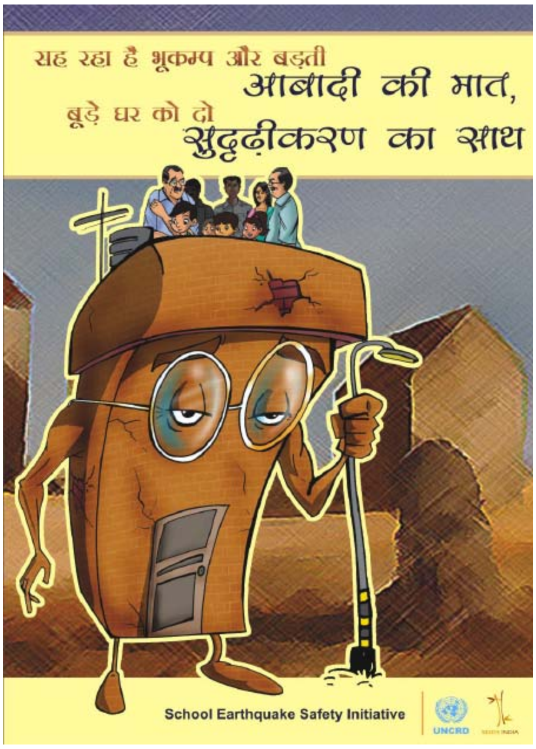
5. Collapse of an L-Shaped Building

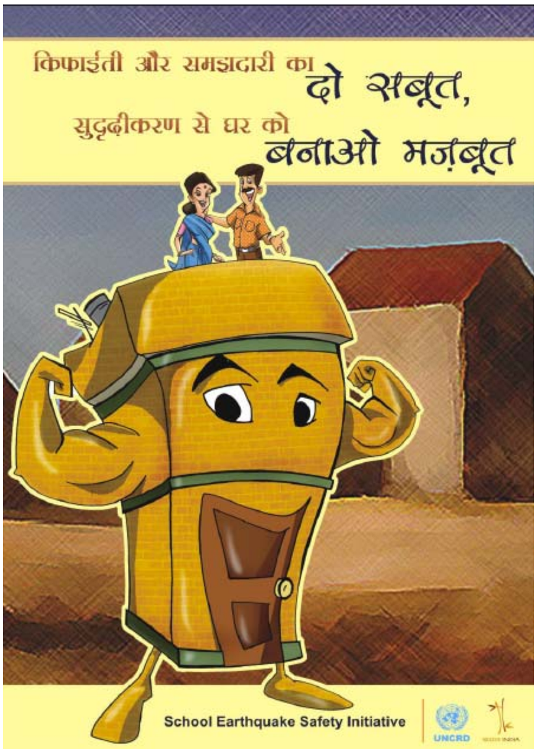
6. Damage of top floor due to pounding effect.

Figure 4.7 Training manual for experts developed by SESI project, India

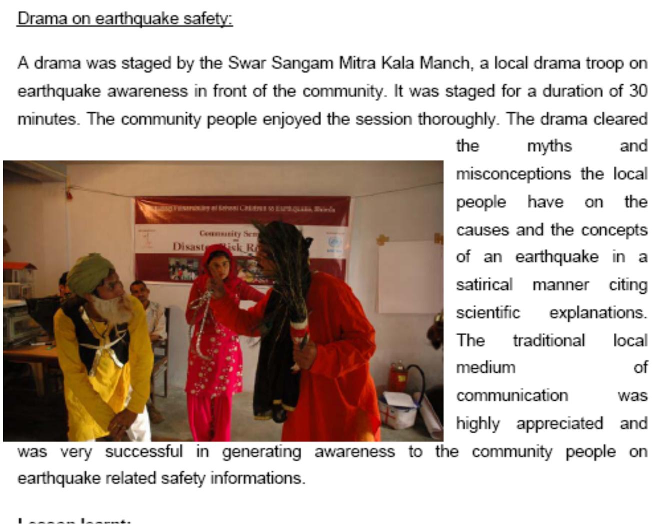
4.2.2 Education and Raising Awareness

Various activities on community awareness, education and training to community people have been completed through the project. Community seminar with activities such as Focused Group Discussion, Search and Rescue training and Drama were carried out.





Earthquake awareness posters (India)



Drama on earthquake safety:

A drama was staged by the Swar Sangam Mitra Kala Manch, a local drama troop on earthquake awareness in front of the community. It was staged for a duration of 30 minutes. The community people enjoyed the session thoroughly. The drama cleared the myths and misconceptions the local people have on the causes and the concepts of an earthquake in a satirical manner citing scientific explanations. The traditional local medium of communication was highly appreciated and was very successful in generating awareness to the community people on earthquake related safety informations.

Drama on earthquake awareness

First aid-training

Figure 4.8 Different education and awareness activities carried out in Shimla, India

4.2.3 Training and Capacity Building

Manual of Training for technicians

Content of the Training manual prepared for the Indian SESI project is as follows:

1. Earthquake
1.1. Earthquake Mechanism
1.1.1. Plate Tectonic
1.1.2. Seismic Waves
1.2. Earthquake Terminologies
1.2.1. Focus or Hypocenter
1.2.2. Epicenter
1.2.3. Epicenter Distance
1.2.4. Shallow Focus Earthquake
1.2.5. Deep Focus Earthquake
1.2.6. Fore Shocks
1.2.7. After Shocks
1.3. Measurement of Earthquake
1.3.1. Magnitude
1.3.2. Intensity
1.3.3. Magnitude versus Intensity

2. Indian Seismology and Himalayan Region
2.1. Seism Zoning of India
2.2 Tectonic Features of India

3. **Behavior of Buildings during Earthquake**
3.1 Inertia Force in Structures
3.2 Torsion
3.3 Ductility
3.4 Architecture and Structure (configuration)
3.4.1. Size of Buildings
3.4.2. Horizontal Layout of Buildings
3.4.3. Vertical Layout of Buildings

4. Seismic Construction of Masonry Buildings
4.1. Box type construction
4.2. Foundation
4.3. Walls
4.3.1. Wall in Stone Masonry
4.3.2. Wall in Brick Masonry
4.3.3. Openings in Wall
4.4. Importance of Bands
4.5. Floor
4.6. Roofs
4.7. Vertical Reinforcement

5. Seismic Construction of RC Buildings
5.1. Foundation
5.2. Beam-Column and Joints
5.2.1. Beam
5.2.2. Column
5.2.3. Beam Column Joints
5.3. Short Column
5.4. Open Storey or Soft Storey Problem
5.5. Building with Shear Wall
5.6. Staircase

6. Quality Workmanship
6.1. Care in Masonry Construction
6.2. Care in Reinforced Concrete Work

7. Common Deficiency in Existing Buildings
7.1. Recap of Past Damages
7.2. Deficiency in Masonry Buildings
7.2.1. Configuration
7.2.2. Connection
7.2.3. Corners and Joints
7.2.4. Floor/Roof
7.3. Deficiency in RC Buildings
7.3.1. Ductile Detailing
7.3.2. Short Column
7.3.3. Open Storey
7.3.4. Irregular Buildings
7.3.4.1. Plan Irregularity
7.3.4.2. Vertical Irregularity

8. Retrofitting
8.1. Assessment
8.2. Seismic Retrofitting
8.3. Retrofitting of Masonry buildings
8.4. Strengthening Reinforced Concrete Member

9. Indian Seismic Code
9.1. Importance of Seismic Code
9.2. Seismic Code Published By BIS

10. Earthquake technology dissemination
10.1. Dissemination to Common Public
10.2. Dissemination to Masons
10.3. Dissemination to Technician
10.4. Dissemination to Policymaker

4.3 Project Outcomes: Indonesia

4.3.1 School Retrofitting

The retrofitting project was first conducted at SD Cirateun Kulon II. The school buildings consisted of two buildings made of RC frames and masonry walls. Each building has four rooms, and the layout of the school buildings is presented in Figure 4.9. Based on results from survey and tests, structural analyses were performed on the existing structures using the actual material and structural components. Earthquake risks were introduced to the buildings by applying loads based on potential seismic risks and local soil conditions. The analysis showed that both buildings were considered likely to behave poorly under seismic loadings, thus required retrofitting. With the funding from Hanshin Department Store Labor Union of Japan, the physical works were then conducted to improve the structural quality and reduce the earthquake vulnerability.

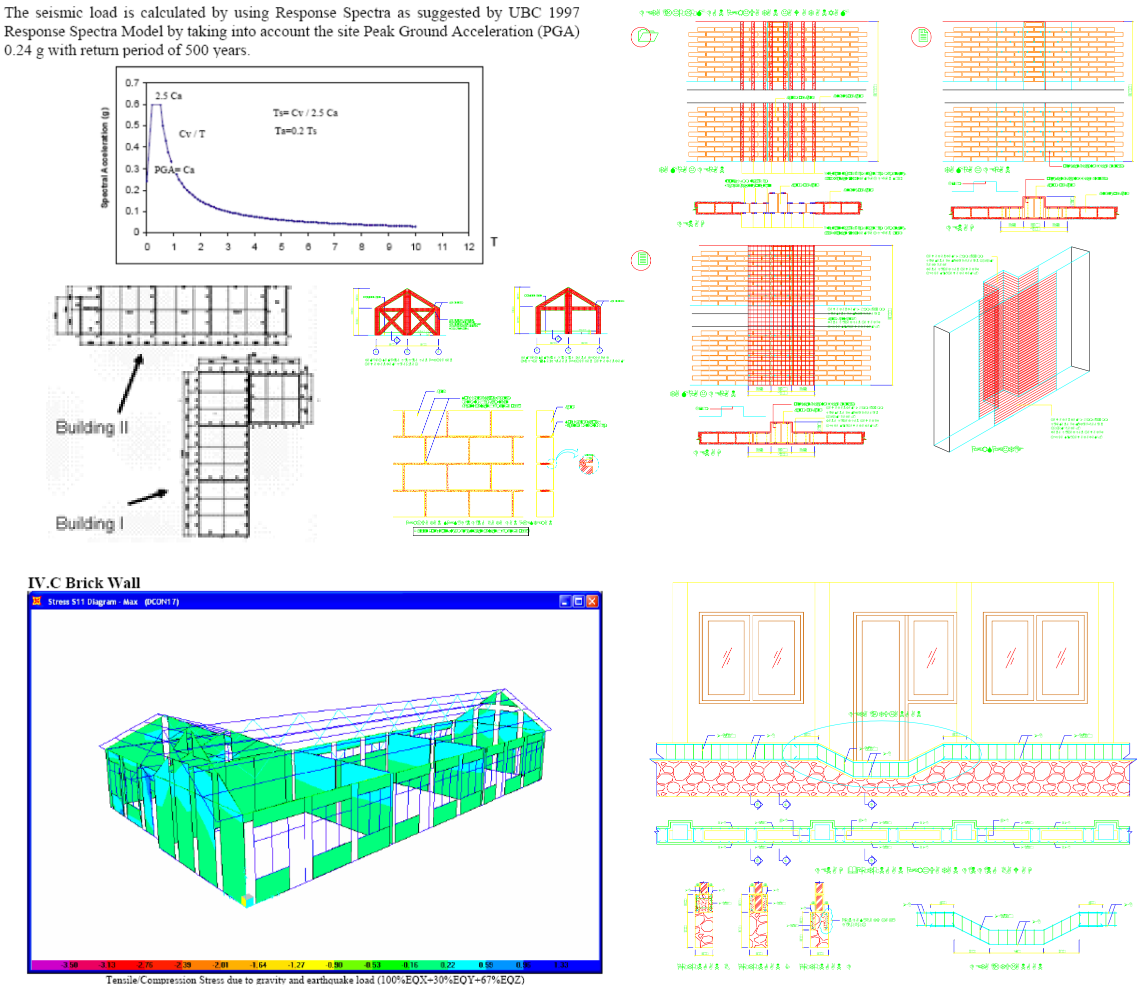
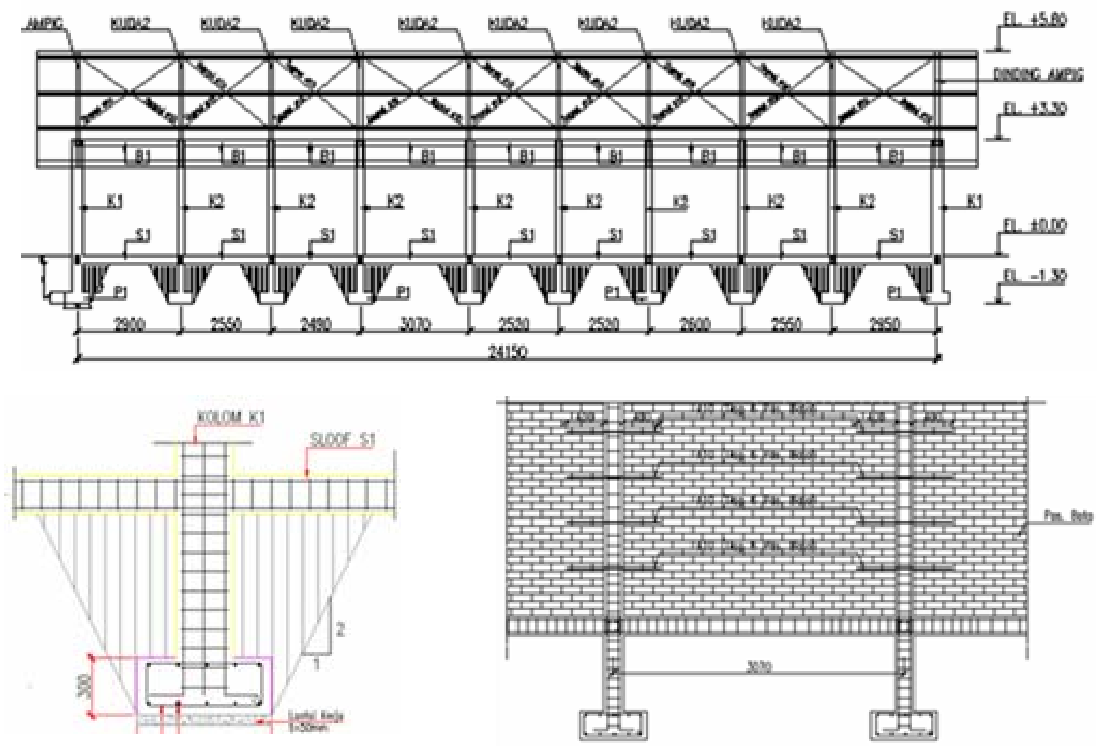


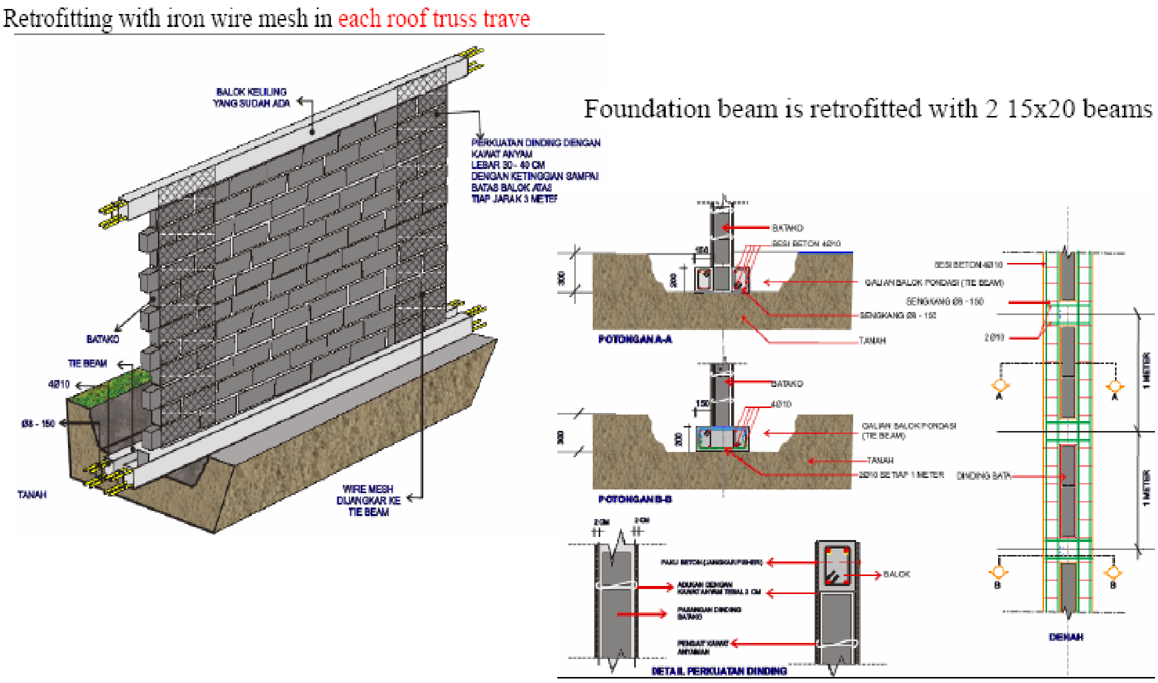
Figure 4.9 Layout, Analysis and Design of Schools in Bandung, Indonesia

Figure 4.10 Existing structural conditions

Two types of retrofitting strategies were applied to the structures due to different structural qualities, as well as needs and capabilities of the school communities. Figure 4.11 shows the different approaches for retrofitting strategies. Building I which was considered to have lower quality was retrofitted by adding adequate RC frames with mat footings. Anchorage was provided to connect walls with columns and beams. Building II which was in better condition was retrofitted using wire mesh for strengthening wall elements. Double tie beams were added adjacent to the existing one for better foundation system. For both structures, proper detailing was applied to roof truss systems, and repair was carried out for nonstructural elements such as doors/windows and ceilings. Finishing/cosmetic repair and improvement of sanitary facilities were also conducted for both structures. Figure 4.12 shows the various stages of the retrofitting work for SD Cirateun Kulon II and the finished projects.



(a) Retrofitting strategy for Building I



(b) Retrofitting strategy for Building II (courtesy of PT Teddy Boen Konsultan)

Figure 4.11: Design of retrofitting strategies

Figure 4.12 Retrofitting process

4.3.2 Education and Raising Awareness

CDM-ITB conducted Community Seminar at SD Cirateun Kulon. In this seminar, there were 3 main topics that were delivered to the participants. The topics were:

I. Basic education about human safety

This topic was delivered by Dr. Ir Krishna S. Pribadi. This topic discussed more on giving the basic knowledge of earthquake to the participants until giving the mitigation measures before earthquake, during earthquake and after earthquake.

II. Basic education about building safety construction

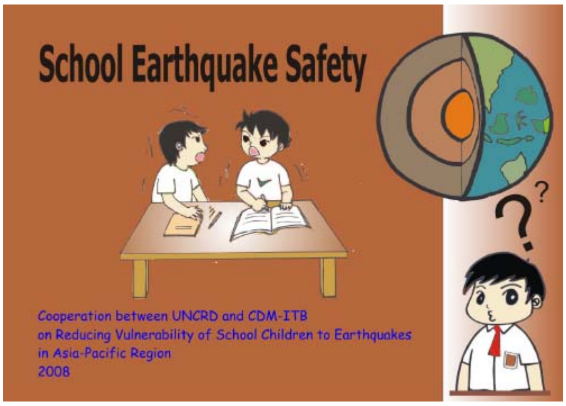
This topic was delivered by Dyah Kusumastuti, PhD. This topic discussed more on simple earthquake resistant building construction, such as determining the location and the layout of the building, determining a good quality material until the construction and the detailing of the structure.

III. Booklet using coaching.

This Coaching was delivered by Ms. Ayu Krishna. This coaching explained briefly on how to use the booklet. After each topic, the participants were allowed to ask few questions. There were four questions that were asked by the participants. From all of the questions, three question concerned about Building safety construction and one question concerned about human safety.

1. The first question related on how to build an earthquake resistant simple building and how to choose a good layout.
2. The second question related on the use of sliding door and the opening of the door (open into the room or outside the room) related to earthquake safety building.
3. The third question related on how to manage the panic that was happened in the society after earthquake.
4. The fourth question related on the causal factor of large deflection on the floor and the retrofitting measures to that problem.

Beside seminar, the students of SD Cirateun Kulon also practiced Earthquake Drill in front of the participants and it gave good impression to the participants. Overall, this seminar run successfully, and the participants were looked very enthusiastic in following this seminar.



Booklet

Poster

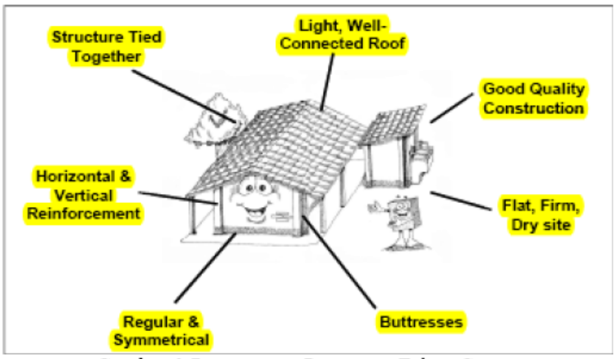
Figure 4.13 Publications on raising awareness for students

Figure 4.14 Earthquake drill for students

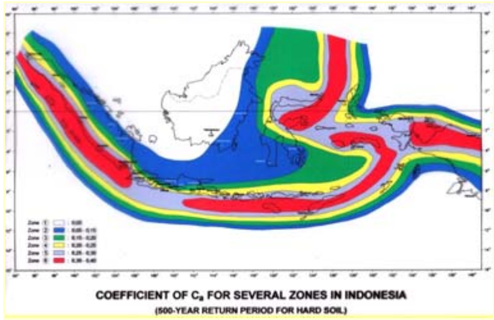
4.3.3 Training and Capacity Building

To further reduce the earthquake vulnerability of the school communities, the improvement of the structural quality of SD Cirateun Kulon II was accompanied by various activities in earthquake mitigation and earthquake preparedness. Before conducting the retrofitting work, hands-on training was conducted for masons and workers to improve their knowledge on how to build proper earthquake resistant structures. Next, manual/guideline on building construction was also developed for the masons, as well as for the teachers and parents. To complete the mitigation efforts, school communities (teachers, students, and parents) were also involved in the dissemination activities of earthquake mitigation strategy, which included earthquake drills.

Bengkulu, 2000 (Data: CDM/ITB)



Gambar 1 Persyaratan Bangunan Tahan Gempa



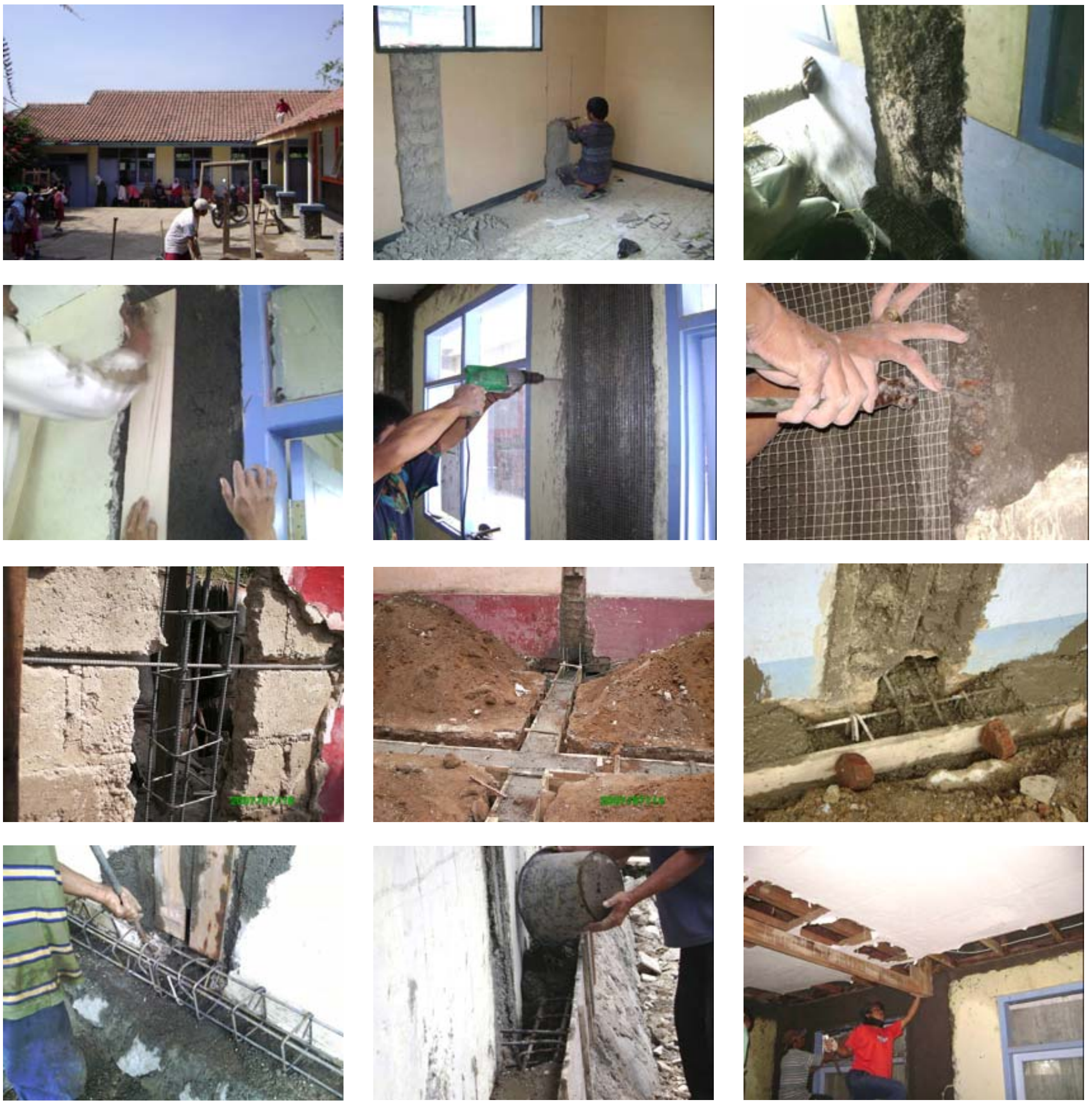


Figure 4.15 Figures and Photos demonstrating different parts of a school

4.4 Project Outcomes: Uzbekistan

4.4.1 School Retrofitting

School Structures Typology Survey and Damage

In Tashkent city, there are more than 360 schools. Nearly 20 % of school buildings have had deficiencies of different level at present. Preliminary analysis of seismic risk for Tashkent city showed that more than 25% of school buildings may be completely destroyed and 30% may be heavily damaged in case of design earthquake.

The buildings of schools and pre-school facilities in Tashkent are represented mainly by two constructive systems: bricks and RC frame-panel consisting major portion of school building stock and a few buildings made up of from adobe bricks. Nearly 35 % of school buildings were constructed before Tashkent earthquake of 1966 for design intensity 7 by MSK scale. Since 1966, half of school buildings were constructed using assembled RC frames of IIS-04, which are inherently weak in seismic resistance. The weakness of this construction typology had been revealed Spitak (1988) and Kairakkum earthquakes (1985) and also confirmed by through the engineering analysis of earthquake consequences. Many school buildings in Tashkent are located in the zone with slumping soils, and as a result many buildings, both brick walled and frame panel type are likely to be damaged. The survey showed that typical structures used for school building in Tashkent basically consist of brick works up to 4 storeys in old construction, and reinforced concrete frame-panel for the more recent buildings. Recurrent structure typologies for school buildings are categorized in the following three groups for the purpose of analysis in the work:

1. Mixed type of brickwork and reinforced concrete or wood reinforcing frame - residual buildings - year of construction ’40s;
2. Brickwork structures, frequent typology used until late ‘60s;
3. Frame-panel, widespread used in the modern construction.

In order to establish an effective and recognizable linkage to the local professional practice in the Central Asian region, and to follow the standard analysis procedure, it is ensured that the characterization is in compliance with the previous study on the Risk Assessment of Tashkent city in the framework of IDNDR RADIUS project.

Main technical parameters assessed during preliminary field survey are:

- Year of construction and building codes prevailed in the specific period
- Construction typology of structural elements of the building
- Existing seismic measures and adequacy against current building code requirements
- Design intensity
- Relative bearing capacity of the building main elements
- Soil conditions
- Existing damages


Figure 4.16: School building during retrofitting (Tashkent)

Basic elements of retrofitting of masonry buildings of schools

1. Implementation of anti-seismic belts with application of retrofitting bars or rolling profile steel as angle bars or channel bars.
2. For creation of a hard disk of ceiling replacement of wooden ceiling on monolithic reinforced-concrete.
3. Introduction of additional reinforced-concrete or metal frames for retrofitting of long walls (more than 9 meters) and supported in a perpendicular direction by walls.
4. Implementation of frames for window and doorways by angular steel or monolithic reinforced-concrete.
5. Retrofitting of walls (from one or two sides) for perception of the main stretching loads by means of retrofitting grids in a layer of high-strength mortar M 100.
6. If necessary retrofitting of the basements by reinforced concrete covering.
7. Creation of the irrigational network excluding watering of the basements and blind area around of building.

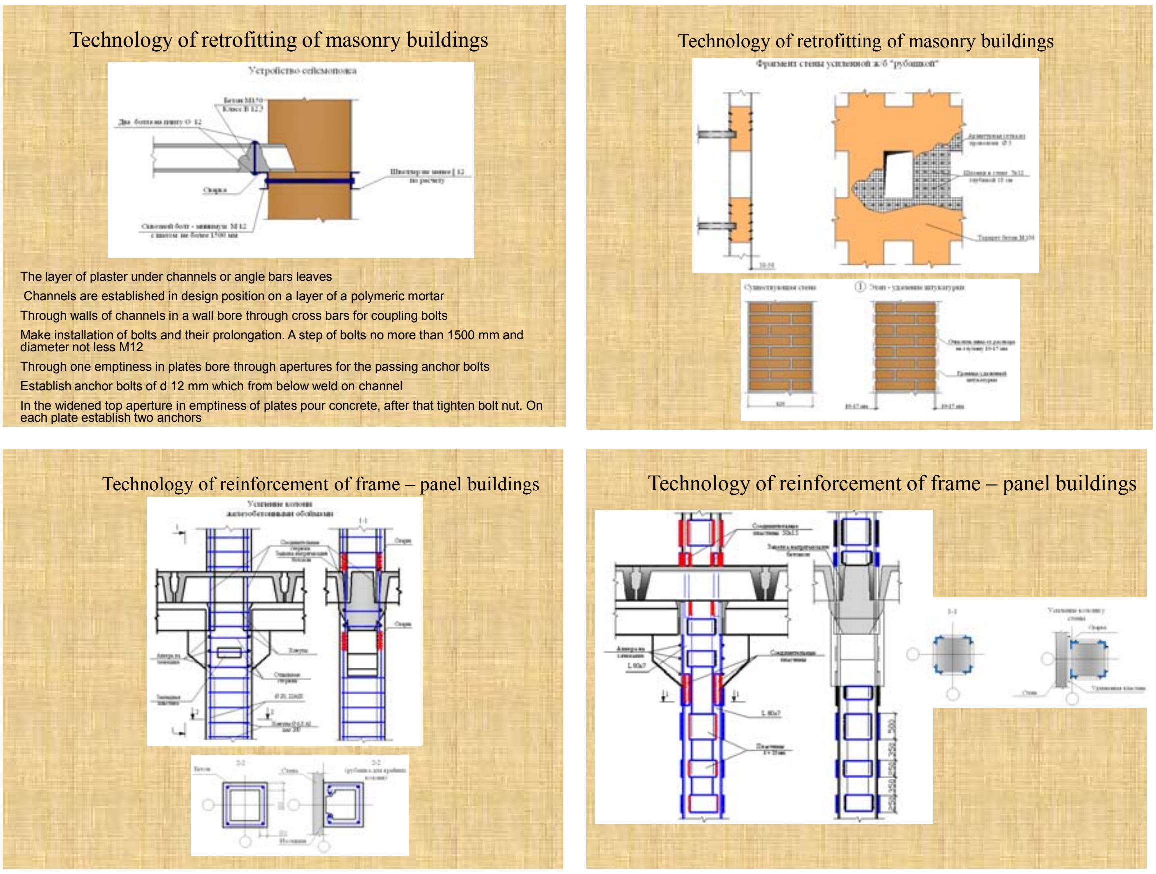


Figure 4.17 Technology of retrofitting of school buildings used in Tashkent

4.4.2 Education and Raising Awareness

Earthquake drill in N 20 School in Tashkent

In school N 20 of Tashkent earthquake drill was conducted where the personnel of school, school teachers and students participated. The members of makhalla (neighborhood) and members of parents committees also participated actively. The training was carried out with application of multimedia training programs and with demonstration of training films. The drill had information about response during the earthquake and evacuation immediately after the earthquake. After the training the participants have shown good skills of repeating the drill. It is necessary to note, that right after commands of the teacher, children were covered under school tables and began to count. This approach is widely applied in many countries, to sustainable preservation of mentality of children during display of forces of nature. Then the class quickly has gathered and children, having covered heads with portfolios from probable falling fragments of building on the part of bearing wall of corridor in which there are no windows, have quickly left building and were built for muster in the open, beforehand planned district.

Figure 4.18 Students and teachers being instructed during earthquake drill (N20 School in Tashkent)

4.4.3 Training and Capacity Building

Training program for technicians

A two day training workshop on earthquake resistant construction was held in Tashkent to impart knowledge to local technicians on earthquake resistant technology and also to receive feed back on use of guidelines for their refinements before going for publication.

Training Workshop

a) To impart knowledge and skill on earthquake safe construction procedure to technicians and masons in Tashkent. In particular, the aim of training workshop was to provide in-depth knowledge to technician/masons on following:

- Earthquake basics
- Building performance in earthquakes
- Planning and configuration
- Earthquake resistant construction for masonry and RC buildings
- Repair, maintenance, Workmanship
- Earthquake retrofitting
- Building code and construction

b) To receive feedback on the content and presentation of the material from the training participants so as to improve the training guidelines

c) To institutionalize the training and continuing education on earthquake safe construction in Uzbekistan through formal and informal sector organizations.

Training course module

Module I (Earthquake safety Basics)

- Earthquake hazard and risk- earthquake mechanism, magnitude and intensity
- How earthquake force affect buildings
- Earthquake Risk Mitigation/ reduction measures
- Structural Mitigation measures- Retrofit/ Re-construct the building
- Non-structural mitigation measures - Fix, Fasten, Anchor, Replace, Relocate, Rectify, manage, restore, reinsure

Module II (Building performance in earthquakes)
Module III (earthquake resistant construction of RC buildings)
Module IV (Case study) school retrofitting (Tashkent school no:116) by designer
Module V (Design of masonry buildings)
Module VI (Explanation of guidebook on earthquake resistant construction under SESI)

For builders technical seminar was held which is program on which the presentation of the Manual on technology of works on retrofitting of masonry and frame-panel buildings of schools was carried out.

Training program for technicians

Two training were conducted to train the technicians on earthquake safer construction technology. The content of the training is as given in Table 4.3.

Table 4.3: Brief outline of training program for technicians

Opening/ welcome remarks Introduction of participants and resource persons
Lecture: Basics of earthquake, Seismicity of India, measuring earthquakes and its impact **Lecture:** Basic Rules of Good Quality & Disaster Resistant Construction Location of building in hilly region, Building plan for earthquake vulnerable areas, Structural and non structural issues, Architectural issues
Typical damages observed in different types of buildings
Lecture: Basics of Earthquake Engineering for Masonry Structures How building behaves during an earthquake, Design and construction principles for earthquake
Lecture: Overview of Disaster Resisting Features for earthquake resistant masonry buildings **Exercise:** DO'S and DON'T
Lecture: Ductile detailing and construction for earthquake resistant system
Latur, Gujarat and Jammu & Kashmir
Showing different damaged observed in building without earthquake resistant features
Recap of the content delivered on the first day
Lecture: Different steps in evaluation of building, procedure for safety audits Vulnerability Assessment of Masonry Building
Lecture: Why retrofitting, advantage, damage vulnerability, basic process Difference between retrofitting and repairing, types of retrofitting, benefits of retrofitting against new construction
Lecture: Cautions in retrofitting, Retrofitable buildings Retrofitting of RCC Structures – Brief presentation
Field visit to school under retrofitting and explanation of different activities

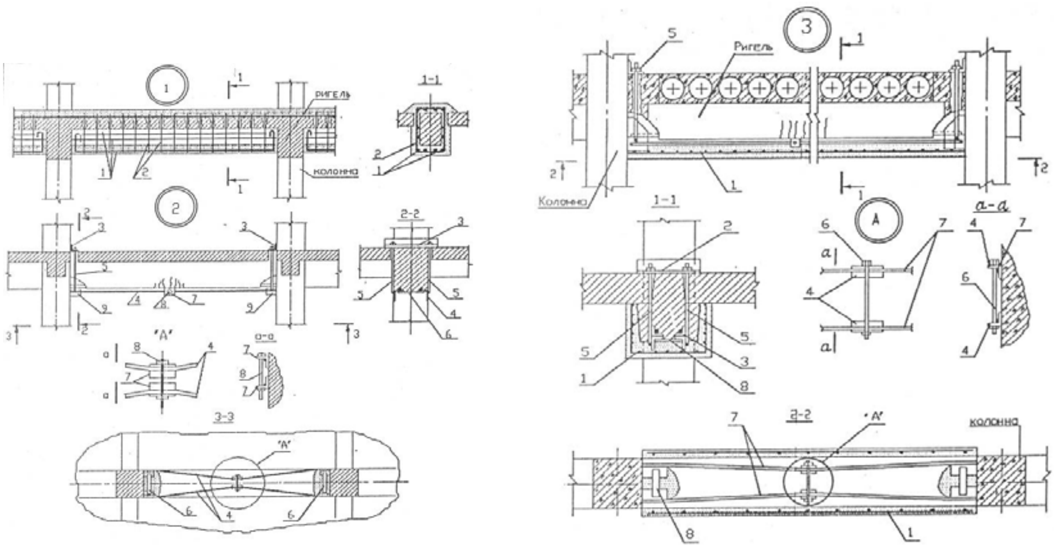


Figure 4.19 Retrofitting designs of RC frame panel schools in Uzbekistan

Basic design for retrofitting of RC frame panel schools in Uzbekistan

1. Retrofitting of joint connections of columns and crossbars.
2. Retrofitting of columns by the implementation of reinforced-concrete holder or metal structure.
3. Retrofitting of crossbars by escalating by metal structure.
4. Introduction of connections for increase of rigidity of building from reinforced-concrete diaphragm, transformation of masonry partitions by retrofitting in diaphragms, metal bracings.
5. Retrofitting of the basements by enlarging or introductions of diaphragm from reinforced-concrete.
6. Increase of rigidity of ceiling by an additional layer of the reinforced concrete.

On the chosen model schools, specified designs of retrofitting were applied: it is masonry school N20, 1939 years of construction and frame-panel school N 116 in Tashkent.

Figure 4.20: Retrofitting and Children, Uzbekistan

4.5 Project Outcomes: Dissemination

As part of the dissemination activity, national, regional and International events were organized by UNCRD in collaboration with UN agencies, International Organizations and local counterparts.

1. International Symposium on "Keeping School Safe from Earthquakes"

I. Date: 2006.01.18

An International symposium was held on January 18, 2006 in Kobe Japan on the main theme of Creating Safe Schools, Homes and Communities. One of the sub-themes of the symposium was "For Children: Earthquake Resistant Schools and Disaster Management Education." The symposium was organized with the objective of promoting a better understanding of Safe schools and disaster education. The symposium drew participation from wide range of interest groups and was an opportunity for academics, professionals and international agency representatives to interact with wider public.

Besides papers on schools and disasters, lessons from previous earthquakes on school safety, technical issues on earthquake vulnerability reduction of school children, the symposium was instrumental in bringing up issues for future intervention in the panel discussion. The panel discussion focused on three questions to find a general strategy for future intervention.

- What are the most appropriate themes of disaster risk knowledge?
- What sort of strategy is appropriate to include these contents in school education?
- How can we evaluate the effectiveness of such measures in light of lessons from recent past earthquakes of Sumatra and Pakistan?

The symposium was held in collaboration with Yomiuri Shimbun Osaka, 2006 Symposium Committee, Hyogo Prefecture, ADRC) JCA Hyogo, UN/OCHA Kobe, and others.

2. International Workshop on "Keeping School Safe from Earthquakes"

I. Date: 2006.06.01 - 2006.06.02

Fig. 4.21
Kathmandu 2006 Workshop on "Keeping School Safe from Earthquakes"

II. Venue

Kathmandu, Nepal (Shanker Hotel)

III. Organizers

United Nations Centre for Regional Development (UNCRD)
National Society for Earthquake Technology-Nepal (NSET)

In association with

Department of Education, Ministry of Education, Government of Nepal
UN Secretariat for International Strategy for Disaster Reduction (UN ISDR)
National Graduate Institute for Policy Studies, Tokyo, Japan
Kyoto University, Kyoto, Japan

VI. Purpose

The purpose of this International Workshop on 'Keeping schools safe from Earthquakes', is to provide a platform for exchanging information and experiences from different countries on school earthquake safety.

3. Asia-Pacific Regional Workshop on School Education and Disaster Risk Eeduction

8-10 October 2007, Bangkok Thailand

Jointly organized by UNESCO, UNICEF, UNESCAP, UNCRD, UNOCHA, IFRC, ASEAN, ADRC, ADPC, ASB and UNISDR Asia and Pacific

The Regional Workshop on Education for Disaster Risk Reduction has been an initiative developed by the Education Task Force as a first step to demonstrate the long term commitment of this partnership to integrate disaster risk reduction into the Education sector.

This three-day Regional Workshop initiated a longer-term regional strategy that aims at raising awareness on the need to integrate disaster risk reduction and school safety construction programs as part of education curricula. It brings together decision makers and practitioners from the field of disaster risk reduction, disaster management and education and built on past and existing in-country initiatives as well as key processes and bodies at the country and regional level that have placed education for disaster risk reduction and school safety as a top priority of their agenda (RCC, Asian Conferences on Disaster Reduction, ASEAN Committee for Disaster Management, UNCRD, IFRC among others). UNCRD took a role as a leading agency to host Session 4: Making School Buildings Safer from Disasters with ADPC.

Working Group Discussion 4

Following were discussed during the working group discussion.

Question 1: What sort of policy or program can address the issue of vulnerability reduction of schools?

Question 2: What are the benefits of having separate standards for the design and construction of school buildings (in addition to the national building code)? What timelines need to be prescribed?

Question 3: What about capacity building for safe construction and retrofitting?

Question 4: How can all schools (both public and private) be covered for retrofitting and rehabilitation? What funding mechanism is required for the intervention?

Question 5: Should be there any progress indicator in school safety in line with Hyogo Framework for Action?

Question 6: What are the concrete recommendations to ETF for regional initiatives to be undertaken for safe schools construction in hazard prone area?

4. International Conference on School Safety (A Golden Jubilee Initiative)

14-16 May 2008 Islamabad, Pakistan
Organized by Aga Khan Planning Building Service, Pakistan and Focus Humanitarian Assistance, Pakistan; UNCRD was also one of the partner organizers.

The Conference was held with aims to highlight global and regional understanding and objectives as set in various initiatives such as the Yokohama Strategy, the Hyogo Framework for Action (HFA) 2005-2015, the UN Decade on Education for Sustainable Development, Millennium Development Goals (MDG), the 2006-2007 World Campaign on Disaster Reduction entitled “Disaster Risk Reduction Begins at School”, and the Global Knowledge and Education Platform of Global Platform for DRR, etc.
UNCRD led the Session 2 on Technical Aspects of Seismically Safer Schools. The session evolved from input from experience of experts from a wide range of expertise in construction, strengthening and retrofitting of schools and also benefits from experience and expertise of involvement in houses and other infrastructures.
The objectives of the session were:

- To identify and disseminate good practices in building safe schools and retrofitting of school buildings to withstand hazards
- To create awareness at different levels to make schools as focal point for building culture of safety
- To highlight the role of safe schools as tool for community awareness and technology transfer
- To prepare future action plan for seismically safe schools

5. South-pacific Regional workshop on "Safe Schools and Disaster Risk Reduction", ,

Sept. 08-09, 2008, Suva, Fiji

UNCRD organized South-Pacific Regional Workshop on “Safe Schools and Disaster Risk Reduction” in collaboration with Government of Fiji and National Disaster Management Office (NDMO), Fiji on 9 and 10 September, in Fiji, Suva. As Fiji is one of the project countries for the project representing the South-Pacific region, the Regional Workshop was held as a platform to disseminate the lessons of the project, to exchange experiences in the region, and to develop regional strategy to promote school safety and disaster education.

The objectives of the South-Pacific Regional Workshop on SESI were 1. Share knowledge and experiences of school earthquake safety at the national and regional level, 2. Identify good practices in integrating disaster risk reduction in developing school safety programs, 3. Identify the policy issues for institutionalization of school safety into national development program, resource allocation for making safe school buildings and capacity building for dissemination and adaptation of appropriate technologies in the context of the South Pacific countries, and 4. Define the challenges, critical needs and opportunities in implementing the school earthquake safety in the South-Pacific countries. The workshop was held by about 60 participants included participants from 5 South Pacific countries.

6. Cenral-Asian Regional Conference on School Earthquake Safety

Sept 17-18, 2008, Tashkent, Uzbekistan

UNCRD has held a Central Asian Regional Workshop on "Safe Schools and Disaster Risk Reduction" in collaboration with State Committee of Uzbekistan republic on Architecture and Construction and UzLITTI.

As Uzbekistan is one of the project countries for the project representing the Central Asia region, the Regional Workshop provides platform to disseminate the lessons of the project, to exchange experiences in the region, and to develop regional level strategy to promote school safety and disaster education.

The objectives of the Central-Asia Regional Workshop are 1. Share knowledge and experiences of school earthquake safety at the national and regional level, 2. Identify good practices in integrating disaster risk reduction in developing school safety programs, 3. Identify the policy issues for institutionalization of school safety into national development program, resource allocation for making safe school buildings and capacity building for dissemination and adaptation of appropriate technologies in the context of the Central Asia countries, and 4. Define the challenges, critical needs and opportunities in implementing the school earthquake safety in the Central Asian countries.

The workshop was participated by about 60 participants including participants from four countries in the region.

Figure 4.22
Central Asia Regional Conference on SESI in Tashkent, Uzbekistan (Sept. 2008)

7. International Workshop on "School Earthquake Safety Initiative"

UNCRD Organized International Workshop on "School Earthquake Safety Initiatives (SESI)" in Kobe, Japan on 5-7 November 2008.

The objectives of the International Workshop were: (a) To disseminate experience of UNCRD's SESI project in four countries: Fiji, India, Indonesia and Uzbekistan; (b) To assess the achievements and challenges school earthquake safety initiative; (c) To define the challenges, critical needs and opportunities in implementing the school earthquake safety; (d) To identify the policy issues for institutionalization of school safety into national development program, resource allocation for making safe school buildings and capacity building for dissemination and adaptation of appropriate technologies in the global context; and (e) To recommend process of country strategic planning and its elements for school safety and disaster risk reduction.

The three day workshop was held by representatives from 4 project countries, international expert in school safety and disaster risk reduction along with experts from Japan. A half-day symposium open to public was organized as part of the workshop. Outline of the country presentation and future strategies are indicated in this document and detailed discussion will be presented in a proceedings of the International Workshop on SESI 2008.

Figure 4.23:
International Workshop on SESI in Kobe, Japan (Nov. 2008)

Figure 4.24:
Retrofitting Inauguration ceremony in Indonesia (Dec. 2007)

CHAPTER 5

From School to Communities

5.1 School Safety and Regional Development

Schools perform important roles to build and maintain a regional society. The function of schools embraces; 1) development of a cooperative relationship within the regional society, 2) long-term contribution to the capacity building and stabilization of the society and community, 3) function as a center in case of disaster emergency of the regional society, and 4) provisions of an opportunity as a model construction and retrofitting in the region.

Firstly, cooperative relationships would be created through the daily communication among the children at school, within the parents groups, and between the children and members of regional society including teachers and school support groups. In particular, elementary and secondary schools play larger roles if it is compared to the roles played by schools of higher level education. The second essential function implies that education at schools also encourages regional society to develop its capacity for improving economic activities and to promote social development through provision of motivation to members of the community. Thirdly, schools function as the core of regional society when an emergency occurs and continues. Surrounding residents evacuate to the school in case that the community faces a large disaster. People sheltered from danger can receive necessary information at the school once an emergency base is established. Many experiences show that the vulnerable groups such as children, physically challenged persons and citizens in advanced age are affected more severely from disasters and need to be provided extra attention. Schools can provide protective environment for them and they shelter and stay at schools as an emergency base during disasters. Moreover, especially in developing countries, education at school fosters the basement of the development. Resilient schools are the fundamental factor to achieve the Millennium Development Goals of the UN. And the last function is shown in the four target countries of the SESI project in this publication.

Therefore, regional development paradigm emphasizes the importance of improvement of school education and strengthening the school facilities. Capacity building of human resources for school education at regional level and financial basis for education and establishment of school building are the key policies. Relevant governments need to appropriate the budget for educational sector considering a comprehensive program for the regional development. Regional disaster management as a part of regional development program requires disaster education at school and disaster risk management in the school buildings particularly in the earthquake and other strong hazard prone regions. Under the recent decentralized governance conditions, educational authority and policy makers in the region need to cooperate in a well-organized manner to cope with regional issues. The regional society is expected to join and support the regional decisions on educational policies through processes of participation, involvement, and cooperation. Many cases and efforts indicate that there exist various issues and challenges to achieve such objectives. Development of appropriate curricula for disaster management and funding for construction and retrofitting of school buildings against disaster are remaining as challenging issues.

Many international agencies related to disaster risk reduction and education, have initiated programs on disaster education and resilient school buildings all over the world. UNESCO, ISDR, UNICEFF, UNDP, UNCRD and regional agencies continue the effort to develop the most suitable and applicable solutions for improvement of school facilities and disaster education in each region. International agencies and NGOs also carry out financial and knowledge supports in the same direction. After the establishment of the HFA 2005-2015, more initiatives started and concentrated into the disaster risk reduction at schools. The integrated program of UNCRD on school earthquake safety is implementing from the viewpoint of regional disaster management for sustainable development.

Box: 5.1: From School to Community: Case of Indonesia

In the aftermath of the Great Tsunami and Earthquake in 2004 December, The government of Indonesia has requested to implement the proposed activities in Banda Aceh area so that the reconstruction process can get best utilize the demonstration effect of the school project. Based on their demand, some initial project activities like kick-off meeting and community seminars were carried out in Banda Aceh. The Banda Reconstruction and Rehabilitation Agency (BRR) has requested to initiate the activities of school retrofitting in 2005 aiming to influence other agencies involved in reconstruction of schools and other infrastructures positively. The UNCRD counterpart institution, the Research Centre for Disaster Mitigation of Institute of Technology Bandung (CDM/ITB) had carried out building survey and other preliminary assessment of school buildings in Aceh region based on the understanding. Two community seminars were also organized in Aceh in collaboration with stakeholders. Considering the impact and potential hazard exposed by another earthquake in May 2006 in Yogyakarta, it was then suggested that this project would, in this context, be better in Java region. As per the advice, consultation works with local Department of Education in Java region is underway. With the Grant Agreement (GA) with ITB in place, the project activities can be started with immediate effect in Java.

In Indonesia, the UNCRD Hyogo office is carrying out two projects, namely: school earthquake safety project and the Housing Earthquake Safety Initiative (HESI) project. Both of the projects having goal as safety of community people in case of earthquake disaster, advantage was taken to compliment the activities from each to another. In Bandung, it has been supported the school project in dissemination of the earthquake safe retrofitting technology through schools in the community as a contribution from the HESI projects and its lessons.

In Bandung, school earthquake safety project is being implemented in partnership with ITB and local governments in Bandung city and Bandung Kabupaten. One of the components of the school project is to demonstrate the technology of school retrofitting so that the existing vulnerable school buildings can be improved and children in the schools are safe. At the same time it will disseminate the concept of safe building in the community. Under the school project framework, Hanshin Labor Union, Osaka Japan expressed willingness to contribute financially to the local government and a school in Bandung to get the school retrofitted. As UNCRD has been engaging local consultants and experts for the earthquake technology development and dissemination in Indonesia, the retrofitting work of school was found as the most appropriate way of disseminating it.

5.2 Housing Earthquake Safety Initiative (HESI)

In January 2007 UNCRD Disaster Management Planning Hyogo Office launched a project titled "Housing Earthquake Safety Initiative (HESI)". The project aims to improve the safety of houses and protect them from earthquake disaster through effective implementation of building code. The project is implemented in Algeria, Indonesia, Nepal and Peru. Although building code is only a part of large dialogue of building safety, it is important and key element. Under this initiative, UNCRD provides an international information exchange platform to share policy experiences as well as the cases of school safety project. The activities included perception and implementation gap analysis of target countries, raising awareness among the stakeholders, developing policy recommendations on improving safety of houses and developing capacity of national and local officials to implement building safety regulations effectively. One of the major activities envisaged in HESI is creation of platform for networking, information exchange, sharing of knowledge and sharing of good practices in mitigating earthquake risk throughout the world.

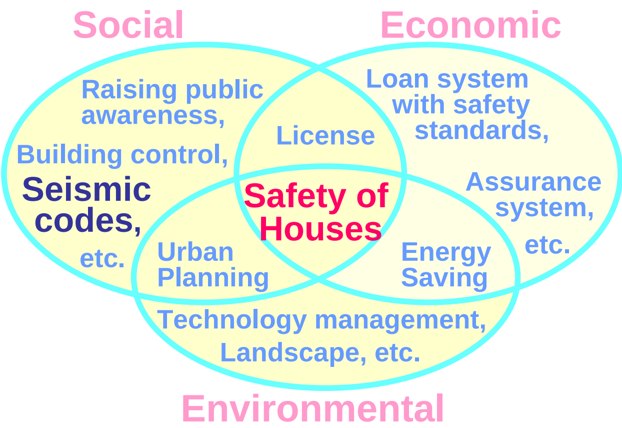


Figure 5.1
Different regimes of Housing Earthquake Safety Initiative

The project aims to improve structural safety of houses and other buildings to reduce impact of earthquakes in life and livelihood of people through effective implementation of building safety regulations. Because the collapse of buildings and houses is the single largest cause of human deaths and economic losses resulting from earthquakes, anti-seismic building code dissemination (ABCD) and effective enforcement of control systems can reduce the loss significantly. Though many earthquake prone countries now have building codes, there is serious challenge for effective implementation of the codes because of lack of awareness, lack of institutional mechanism for implementation and insufficient capacity of authorities.

There are several effective tools to reduce or prevent life and property losses during an earthquake. The experiences from past earthquakes show that effective implementation of earthquake resistant codes can reduce the losses significantly. This is because the collapse of houses is often the single largest cause of human deaths and economic losses resulting from earthquakes. However, there are many vulnerable houses with structural deficiencies in a number of developing countries situated in earthquake prone regions in the world. These vulnerable houses and buildings including schools are constructed using traditional techniques without the aid of an architect or engineer. The research seeks to tackle this situation and to protect vulnerable people from possible future disasters. The first challenge is to define the process that is appropriate for individual country contexts. The second challenge is to disseminate the code to communities. It is verified that effective building code implementation requires not only the capable national institutions for strict enforcement but also means to engage community people through disseminating the information and involving professionals for community consultations.

5.3 Importance of School and Housing Earthquake Safety

UNCRD held an expert meeting on Anti-seismic Building Code Dissemination (ABCD) project for the HESI in Kobe in January 2007 as the first step. The representatives from India, Indonesia, Japan, Nepal and Peru joined it. The followings are the key points for the HESI project;

- It is required to establish a strategy in order to enforce building code to existing buildings and not only to new constructions in many countries in the world.
- There is a need for training and capacity development, including the strengthening of existing training institutions towards resilient non-engineered housing.
- Guidelines suffice for non-engineered houses. Technical research should be done to set the minimum specifications such as size, width of walls and the use of columns.
- There is an immense need for raising awareness how to educate communities and technicians about the importance of making safer houses, and so on.

During the ABCD for HESI project, UNCRD conducted a survey in a number of disaster prone countries across the world. The objective was to collect information on building code and the status of its implementation in each country. Non-engineered houses are constructed using traditional techniques without the aid of an architect or engineer. A widespread presence of non-engineered houses, owner self-built among these in particular, are potentially more dangerous if they are built in crowded cities in the midst of rapid urbanization. This is also the case of school buildings in rural areas in many developing countries. Disseminating building code is an effective tool to safeguard houses from earthquake disaster. To that end, community-based activities and engaging officials and experts in the target countries are essential for the successful enforcement.

Urban environment or built-environment is mainly composed of individual buildings. Performance of buildings against hazards including earthquakes and strong wind plays important roles to build and maintain a regional society. The function of buildings including schools embraces; 1) to provide livelihoods and safe living environment for regional society, 2) to activate and provide economic activities for industries and office workers, 3) to formulate long-term contribution to the culture and stabilization of the society and community, and 4) to support social functions such as schools, hospitals and other facilities. Thus, most built-environment of urban area is covered with buildings. Therefore vulnerable buildings directly imply high urban risks in many cases including the case of China in 1976, Armenia in 1988, Iran in 1990, Kobe in 1995, Turkey in 1999, India in 2001, Bam, Iran in 2003, Pakistan in 2005, Java in 2006, Peru in 2007, and China 2008.

5.4 Dissemination Earthquake Safety to Communities and CBDM

Many experiences show that the vulnerable groups such as children, physically challenged persons and citizens in advanced age are affected more severely from disasters and need to be provided extra attention. Therefore, regional development paradigm emphasizes the importance of improvement of public building facilities and private ones including individual houses. Capacity building of human resources for building construction at regional level and financial basis for education and establishment of capacity building systems are the key policies. Relevant governments need to appropriate the budget for enforcement and/or retrofitting of public facilities considering a comprehensive program for the regional development. Regional disaster management as a part of regional development program requires disaster risk management in the school, hospital and other public buildings particularly in the earthquake and other strong hazard prone regions. Under the recent decentralized governance conditions, building control and public construction authority and policy makers in the region need to cooperate in a well-organized manner to cope with regional issues. The regional society is expected to join and support the regional decision through processes of participation, involvement, and cooperation. Many cases and efforts indicate that there are various issues and challenges to achieve such objectives.

Figure 5.2 Shake table demonstration for the public (CBDM in Bangladesh 2007)

Disseminating building code is an effective tool to safeguard houses from earthquake disaster. However, a number of challenges are expected as UNCRD implements the HESI project in Algeria, Indonesia, Nepal and Peru, though each country has diverse stakeholders of housing and school safety and the relationship among them might differ. The system always has a loophole unless people who pay for houses demand that their houses be made resilient. It is imperative to have a system of punishment for violators of the code, and the house owners and other community members can be part of the enforcement body. The role of governments, both national and local, is enormous given the fact that they have to be technically capable to enforce the code as well as to be able to convince and motivate professionals and the public to comply with the building regulation.

Moreover, UNCRD has been implementing series of the “Community Based Disaster Management (CBDM)” projects since 1999. Currently, CBDM projects are focused on gender perspective in the context of regional development and urbanization. The Figure 5.2 shows an event in Bangladesh to demonstrate how to reinforce houses under CBDM project in 2007. These programs have been closely connected with school earthquake safety in terms of its contents and community based activities.

CHAPTER 6

From Model Projects to Country-wide Intervention:

Experience of Japan

School Earthquake Safety Initiatives in Japan

Contributed by: Takayuki NAKAMURA, JAXA (former MEXT official)

6.1 Introduction

Earthquakes can occur anywhere and at any time in Japan. This is because Japan is located on the border between four large plates: the North America Plate, Pacific Plate, Eurasia Plate and Philippine Plate. The Great Hanshin-Awaji Earthquake (hereinafter, the Kobe Earthquake), which occurred in Kobe on January 17 in 1995, killed more than 6,400 people. School buildings were also severely damaged by the Kobe Earthquake. According to a report provided by the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT), approximately 4,500 educational facilities were structurally and/or non-structurally damaged, though there were fortunately no casualties resulted from damaged schools since the Kobe Earthquake occurred in early morning at 5:46 a.m.. After the strike of the Kobe Earthquake, 390 schools took the role for evacuation shelter and these schools accommodated approximately 180,000 evacuated people. Furthermore, at the time of recent major earthquakes such as Niigata-Chuetsu Earthquake in October 2004 and Iwate-Miyagi Nairiku Earthquake in June 2008, while many school buildings were damaged, non-damaged schools accommodated many evacuated people. On the basis of these experiences, it is critical to ensure that school students are safe and school facilities are fit to serve as evacuation shelters for local populations. In this paper, MEXT's policies and some examples on structural and nonstructural retrofitting of school buildings are introduced. Moreover, measures to improve the function for evacuation shelter and disaster risk education at school are described together with their examples.

6.2 Promotion of Earthquake-resistant School Building

6.2.1 Roles of School Building

Since school buildings have the following crucial roles, it is indispensable to assure the safety of school buildings against earthquakes.

A. Place for educating children: school buildings are the place where many children study and live most part of their days. It is, therefore, vital to keep school buildings in safer and healthier environment.

B. Place for cultural and sporting activities: school is a well-known building to the people who live near the school. School buildings are, therefore, often utilized for the cultural and sporting events for the local population.

C. Place for evacuation: school often becomes an evacuation shelter when a major natural disaster occurs. To this end, it is important that school buildings accommodate necessary functions for evacuation shelter.

6.2.2 Retrofitting of School Buildings

A. Revision of the Building Standard Law

The Building Standard Law of Japan was revised in 1981 and new seismic resistant design methods were adopted. According to the revised law, the buildings constructed based on the new design would have no damage in the case of middle class earthquakes (about JMA 5 upper scale). Moreover, there would be no casualties in these buildings and no severe collapse of these buildings even in the case of major earthquakes (about JMA 6 upper).

Table 6.1 Difference between New and Old Seismic Resistant Design

Type of Earthquake (JMA Scale)	**Medium Scale Earthquake (about 5 Upper)**	**Larger Scale Earthquake (over 6 Upper)**
Old Seismic Resistant Design (until 1981)	No major damage	Not verified
New Seismic Resistant Design (since 1981)	No major damage	Will not collapse

JMA Scale: A scale indicating the strength of seismic motion, which was formed by JMA (Japan Meteorology Agency)

5 Upper: Many people are considerably frightened and find it difficult to move

6 Upper: Impossible to keep standing and to move without crawling

B. Seismic Capacity Index of Structure (Is)

In order to evaluate the seismic capacity of an existing school building, the seismic capacity index of structure (Is) is used in Japan based on the regulation of the Law to Promote Seismic Rehabilitation. The law regulates that a building has low risk of collapsing if the Is of the building is more than 0.6. However, in consideration of the importance of school building, MEXT recommends that the Is of school building should surpass 0.7 after retrofitting.

Is (Seismic Capacity Index of Structure):

An index to define the seismic capacity of an existing reinforced concrete building

Is＝Eo×S×T

Eo : A basic structural seismic capacity index calculated by the elements of Strength index (C), Ductility index (F) and Story Index (St)

Eo= C×F×St

S: A reduction factor to modify Eo index, which is based on the structural balance in both plan and elevation

T: A reduction factor to modify Eo index, which is graded by time-dependent deterioration

Table 6.2 Evaluation of Seismic Capacity Index of Structure (Is)

Is ＜ 0.3	There is high risk of collapsing
0.3 ＜ Is ＜0.6	There is risk of collapsing
0.6 ＜ Is	There is low risk of collapsing

6.2.3 Guideline for promoting earthquake-resistant school building

A survey carried out by MEXT in April 2002 showed that public school buildings had not been satisfactorily retrofitted. It emerged from the survey that seismic diagnosis was carried out on only 30% of buildings built based on the pre-1981 Old Seismic Resistant Design, and only about 45% of public primary and junior high school buildings had been retrofitted.

In this connection, a council called “Co-operators’ Meeting for the Survey and Study of the Promotion of Earthquake-Resistant School Buildings” was established by MEXT in October 2002. The outcomes of the council’s discussions were submitted to MEXT in April 2003 in a report entitled the “Promotion of Earthquake-Resistant School Buildings”. Based on this report, the “Guidelines for the Promotion of Earthquake-Resistant School Buildings” was stipulated by MEXT in July 2003.

Chapter 1 of this guideline describes the basic concept of the “earthquake-resistant school building;” and Chapter 2 outlines the methods for devising earthquake-resistant promotion plans, the points to bear in mind, and the suggested methods for determining the urgency of earthquake resistance projects.
The basic principles pointed out in this guideline are: (1) to prioritize earthquake resistant measures for school buildings at high risk of collapse or severe damage; (2) to implement seismic resistant capacity evaluation promptly; (3) to develop a plan for promoting earthquake resistance promptly; (4) to disclose the results of the seismic resistant capacity evaluation and the plans for promoting earthquake resistance; and (5) to check and take measures for the earthquake resistance of non-structural elements.
(The web address: http://www.nier.go.jp/shisetsu/pdf/e-taishinsuishin.pdf)

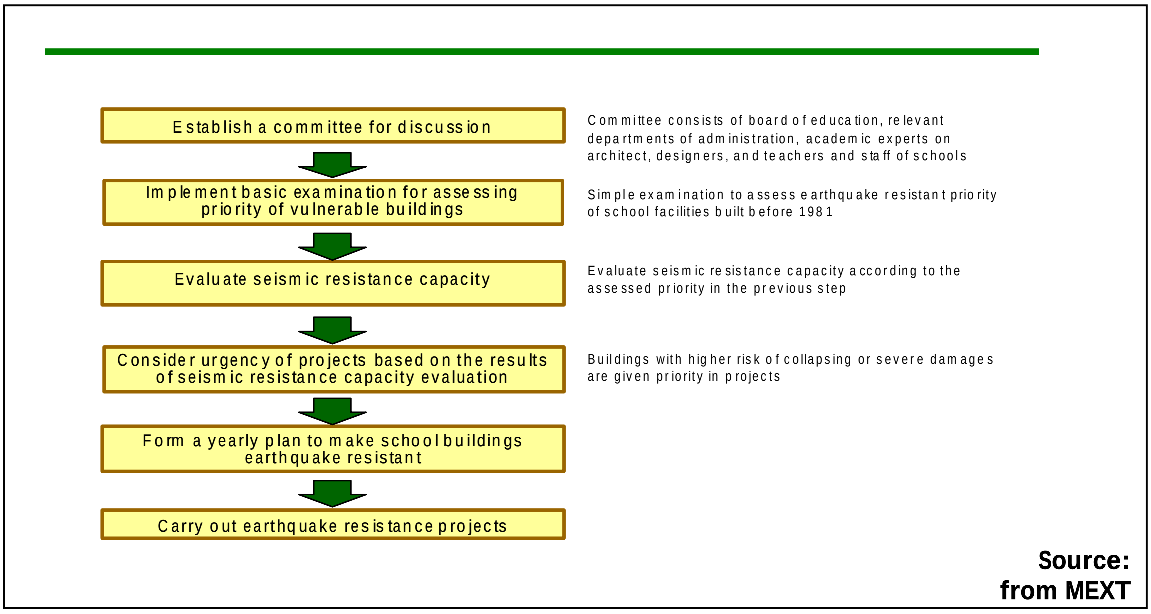


Figure 6.1 Procedure for Developing a Plan for Promoting Earthquake Resistance

6.2.4 Subsidy System

MEXT has been urging municipal governments, which are responsible for school buildings, to promote school building’s retrofitting based on the above-mentioned guideline. In addition, as the following figure shows, MEXT has a subsidy system regarding public school buildings. In line with the Sichuan Earthquake in China in May 2008, MEXT has raised the subsidy rate for vulnerable school buildings (Is<0.3) from a half to two thirds in June 2008.

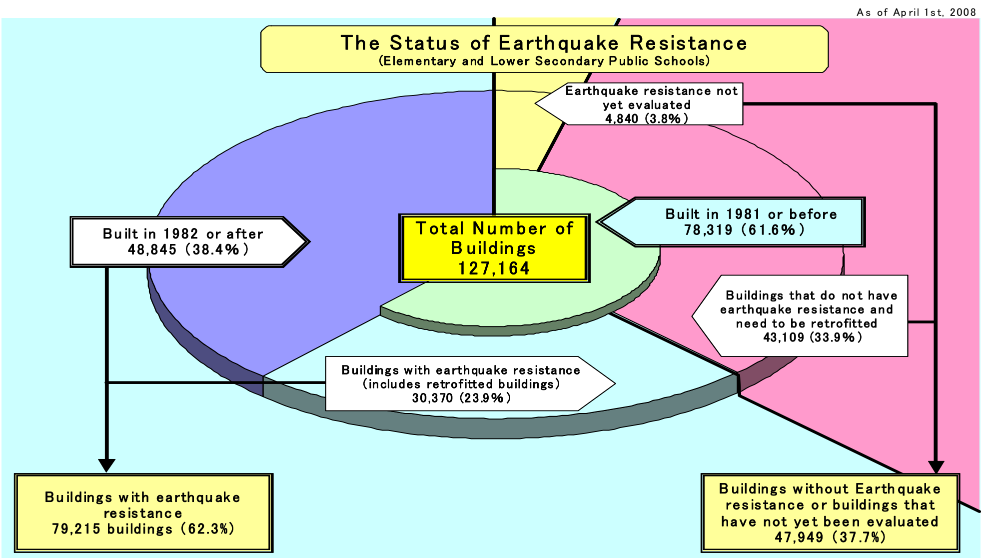
Table 6.3 Subsidy Rate for Public School Building

Type of Construction	Subsidy Rate from MEXT
New construction	1/2
Reconstruction	1/3, 1/2 (Is<0.3)
Renovation	1/3
Seismic Rehabilitation	1/3, 1/2 (Is<0.3)

□Budget of fiscal 2008: 229 billion JPY

6.2.5 Status of Earthquake Resistance

By utilizing the above-mentioned subsidy system, the retrofitting of school buildings has been implemented in Japan. The following pie chart shows the status of earthquake resistance on elementary and lower secondary public schools in Japan as of April 1 2008. As this pie chart shows, approximately 48,000 of school buildings, or 38% of school buildings were found lacking needed earthquake resistance or needed further assessment. Above all, 10,000 of these buildings were estimated to be at high risk of collapse in expected large scale earthquakes. A commitment was made to reinforce all of these buildings at high risk within 5 years. In addition, as mentioned, the subsidy rate for vulnerable school buildings has been raised in June 2008. Moreover, in order to accelerate the 5 years retrofitting program into 4 years, MEXT has added an additional national fund (114 billion JPY) to the regular budget of fiscal 2008 (115 billion JPY, total 229 billion JPY) in the supplementary budget of fiscal 2008 of Japanese government in October 2008.



Source: from MEXT

Figure 6.2 The Status of Earthquake Resistance

6.2.6 Earthquake-resistant Methods

In Japan, following methods are mainly utilized for retrofitting school buildings. Since each method has pros and cons, it is important to select an adequate method based on the consideration of the structural form of the building, the assigned budget and the needs from users.

Type	Steel Frame Brace	Reinforced Concrete Wall
Characteristics	・A construction method to attach steel frame braces to columns and beams ・Steel frame braces can be installed outside or inside the building ・Working at the construction site is comparatively easy ・Users can utilize the building even under construction	・A construction method to add reinforced concrete walls inside the building ・Construction period is comparatively longer ・Ventilation and lighting might be disturbed ・Construction cost is comparatively lower
Photo		

Figure 6.3 Earthquake-resistant Method

Type	Column Reinforcement by Steel Plate or Carbon Fiber	Out Frame
Characteristics	・A construction method to attach steel plate or carbon fiber to columns ・Construction cost is comparatively higher ・Ventilation and lighting are not disturbed	・A construction method to add reinforced components outside the building ・Ventilation and lighting are less-disturbed ・Construction inside the building is unnecessary ・Construction cost is comparatively higher
Photo		

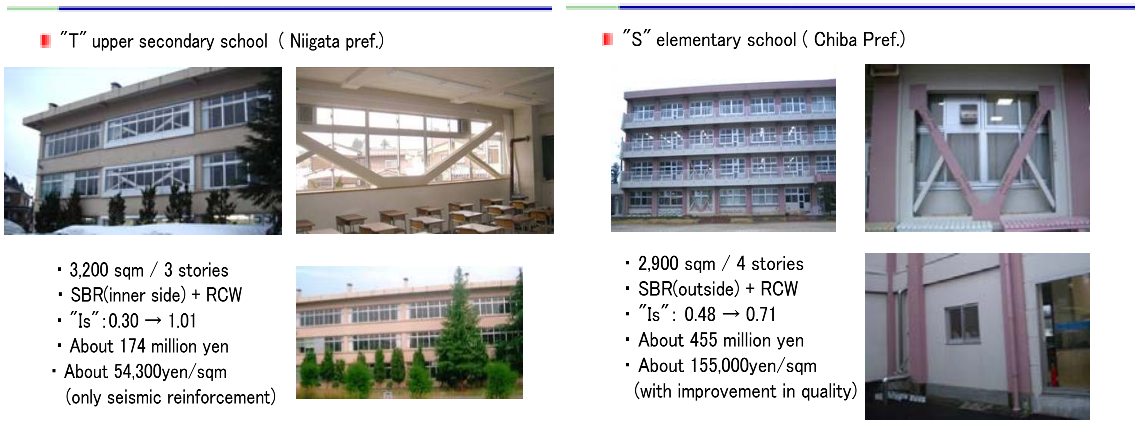
(Source: from NIER)

Figure 6.4 Earthquake-resistant Method

6.2.7 Recent Example of School Building Retrofitting

MEXT published a reference book for retrofitting school buildings in September 2006. The book includes many seismic retrofitting examples with various pictures, charts and plans. The following schools are some examples in this reference book.

(the web address: http://www.nier.go.jp/shisetsu/pdf/e-taishinjirei.pdf)



(Source: from MEXT)

Figure 6.5 Examples of School Building Retrofitting

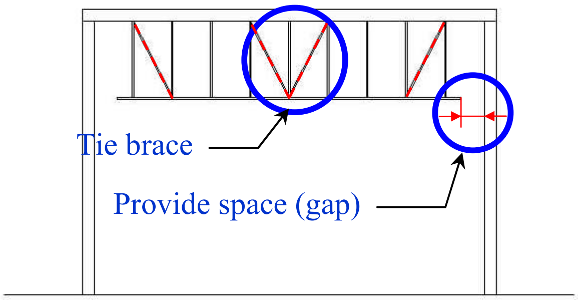
6.3 Non-structural Seismic Retrofitting

Even though structural parts of school buildings such as columns, beams and walls are enough retrofitted, if non-structural members such as ceiling materials, various fixtures and furniture are not sufficiently retrofitted, these non-structural members may fall or topple when a major earthquake occurs. Children and evacuated local people can be killed or injured by these vulnerable non-structural members. Therefore, the retrofitting of non-structural members of school building is extremely important.

In order to urge municipalities to implement non-structural seismic retrofitting of school buildings, the National Institute for Educational Policy Research of Japan (NIER) published a reference book on non-structural seismic retrofitting of school building in December 2005. The following case is an example in this reference book.

(Web address: http://www.nier.go.jp/shisetsu/pdf/e-jirei.pdf)

Figure 6.6 Example of Non-Structural Seismic Retrofitting

Item	Ceiling Material	
Damage	 Ceiling materials fell down in a special classroom at the 2004 Chuetsu Earthquake in Niigata Prefecture.	 Ceiling materials in an auditorium fell down at the 1993 Hokkaido Southwest Offshore Earthquake.
Retrofitting	 1. Daily inspection ・Confirm that tie braces are installed ・Confirm that the interval between hanging bolts is sufficient, and the bolts are tightened. ・Confirm that ceiling boards are not moved, cracked or deformed, and fasteners are not loosened or rusted. 2. Retrofitting ・Provide sufficient space between ceiling materials and wall or column. ・When hanging bolts are long (≥1500 mm) due to the wide space between the roof and the ceiling, horizontal and diagonal tie braces should be installed to prevent the ceiling from moving. (Source: from NIER)	

6.4 Improvement of the Function for Evacuation Shelter in School

6.4.1 Public building designated for disaster prevention base in Japan

In Japan, when major natural disasters occur, a public building is utilized for an evacuation shelter for the people who live near the building. As the following figure shows, the percentage of school building is 61% which is the highest in those buildings.

Table 6.4 Public Building designated for Disaster Prevention Base in Japan
(As of March 31, 2007)

Type of Building	Number of buildings	Percentage (%)
School building	117,228	60.8
Welfare building	24,452	12.7
Public hall	15,515	8.0
Government office	8,849	4.6
Fire station	6,149	3.2
Police office	5,772	3.0
Others	14,770	7.7
Total	192,735	100.0

(Source: Fire and Disaster Management Agency of Japan (FDMA))

Evacuated people at gymnasium

Drinking water distributed by water wagons

(Source: from NIER)

6.4.2 Research on the function for evacuation shelter in school

According to the above-mentioned survey, a school building is frequently utilized for an evacuation shelter in time of disaster. However, it is criticized that the school building has many inconveniences when it is used for an evacuation shelter. For instance, insufficient number of toilets, no heating and air-conditioning, no privacy, cramped space for evacuated people, no barrier-free design, difficult to manage as evacuation shelter, etc. In order to cope with these inconveniences, NIER started a research on the function for evacuation shelter in school in March 2006 with the cooperation of several ministries such as MEXT, FDMA, Cabinet Office (CAO), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Ministry of Health, Labour and Welfare (MHLW). Based on this research, NIER published a report in August 2007. A survey on the function of school building was conducted in this research. The following table shows how many schools have necessary facilities for evacuation shelter.

Emphasized points in this report are; (1) to retrofit school buildings, (2) to secure necessary functions for evacuation shelter, (3) to manage the evacuation shelter at school efficiently and (4) to resume the education at school earlier. Especially, necessary functions and management for evacuation shelter in school are underlined. Specifically, the following items are pointed out in terms of necessary functions. Moreover, it is very crucial to put these functions into a school planning at the stage of designing.

Table 6.5 Facility equipped in the School designated for Evacuation Shelter

Item	Number of equipped schools	Number of schools designated for evacuation shelter	Percentage (%)
Toilets at gymnasium	25,406	33,670	75.5
Outdoor toilets	20,336		60.4
Stock area	9,125		27.1
Water purification facility	9,087		27.0
Electric generator	4,615		13.7

(Source: from NIER)

Table 6.5 Necessary Function for Evacuation Shelter

Items	Examples
Toilets, Showers	flushing water, temporary toilets and showers, etc.
Electricity, Water, Gas	retrofitted pipelines, mobile generators, purification facilities, wells, etc.
Communication measures	telephones, facsimiles, radios, televisions, etc.
Indoor environment	heating, air-conditioning, ventilation, lightning, garbage, privacy, etc.
Barrier-free design	removing level difference of floors, western-style stools, multi-purpose toilet booths, using tatami-rooms, etc.
Stock for emergency materials	

(Source: from NIER)

In addition, important items shown in this report for the management of evacuation shelter at school are; (1) to make a plan for utilizing the school building for an evacuation shelter, (2) to cooperate with related organizations, (3) to create a manual for the management of evacuation shelter and (4) to resume education at school earlier.

6.5 Disaster Risk Education at School

In Japan, there is no independent subject as disaster risk education. However, curricula related to disaster risk education are slotted into the several subjects, the class activity, the school event and the club activity, as the following figure shows.

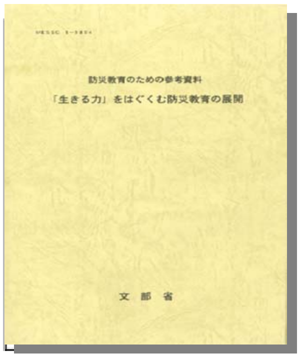
Moreover, MEXT started a pilot project for promoting disaster risk education at school and the community from fiscal 2008. The purposes of this project are; (1) to create materials for disaster risk education, (2) to develop training programs for teachers and staffs at school, (3) to develop practical programs for disaster risk education and (4) to support advanced or unique projects rooted in the community. Eight projects, for example Kamaishi City in Iwate Prefecture, were adopted for this pilot project in fiscal 2008.

Table 6.6 Disaster Risk Education at School

Stage	Example of Curriculum
Elementary School (age: 7-12)	**Life** (2nd grade): Public facilities and workers, for example, fire station and fire-fighters **Science** (5th grade): Work of running water **Science** (6th grade): Change of land influenced by volcanic eruptions, earthquakes and floods **Health and physical education** (5th grade): Prevention for injury **Home economics** (5th and 6th grade): Out-door cooking exercise
Lower Secondary School (age: 13-15)	**Science**: Characteristics of volcanic eruptions and earthquakes **Health and physical education**: Injury prevention and first-aid in time of disaster **Home economics**: Out-door cooking exercise
Upper Secondary School (age: 16-18)	**Health and physical education**: First-aid training in time of disaster **Ethics**: Dignity for life, Relationship with nature and science **Science**: Mechanism of volcanic eruptions and earthquakes **Home economics**: Cooking and living in time of disaster
Besides above, the drill for evacuation in time of disaster, the lecture on disaster prevention by experts, the science club activity, the volunteer activity in time of disaster, etc. are implemented as a class activity, a school event and a club activity.	

(Source: the author made this table based on the information from MEXT)

Furthermore, a reference book for teachers and some pamphlets for students on disaster risk education are published by MEXT.



For teachers

For students (Source: from MEXT)

Not only MEXT but also municipal governments are implementing various activities related to disaster risk education. For instance, the Education Board of Mie Prefecture is implementing the following diverse activities on disaster risk education.

- The Education Board published videos for disaster risk education in cooperation with the Department of Disaster Reduction. In addition, guidebooks and sub-textbooks are also published.
- Lessons and experiments by experts are conducted. In addition, the prefecture has special cars where students can experience the shock of earthquake.
- Town watching and mapping for disaster prevention are implemented at each school.

Guidebook (Source: from Mie Prefecture) | Lesson by an expert | Town watching

6.6 Conclusion

The importance of the retrofitting school buildings and the disaster risk education was emphasized in the Hyogo Framework for Action 2005-2015 (HFA), which was adopted in the United Nations World Conference on Disaster Reduction held in Kobe in January 2005. Furthermore, in order to implement the disaster risk education and the safer school facilities which are pointed out in the HFA, the United Nations International Strategy of Disaster Reduction (UNISDR) and its partners carried out a campaign entitled the "Disaster risk reduction begins at school (2006-2007)". As an action of this campaign, a workshop entitled the "Asia-Pacific Regional Workshop on School Education and Disaster Risk Reduction" was held in Bangkok in October 2007. The emphasized points in the "Bangkok Action Agenda" adopted at the workshop were, (1) to integrate disaster risk reduction into school education, (2) to strengthen disaster risk reduction education for community resilience, (3) to make schools safer, and (4) to empower children for disaster risk reduction. Not only UN but also OECD has been implementing the initiative on school safety. The OECD countries agreed that governments in earthquake-prone countries should take steps to reduce earthquake risks for school children. Based on this agreement, a recommendation entitled the "OECD Recommendation concerning Guidelines on Earthquake Safety in Schools" was approved by the OECD's governing council in July 2005.

Aforementioned Japanese school earthquake safety initiatives in this paper can be situated in the abovementioned worldwide stream regarding school safety. As shown earlier, 38% of school buildings are still vulnerable against major earthquakes in Japan as of April 1, 2008. In order to promote the retrofitting of school buildings under the circumstance of tight budget, it is indispensable for municipalities to prioritize the retrofitting of their schools. Furthermore, it is also critical for municipalities to publish the results of the seismic evaluation and secure the transparency toward the public. Saving children is everybody's business. Everybody should have the responsibility about this. It is too late to regret not having retrofitted school buildings after a major earthquake strikes our children's schools.

CHAPTER 7

Conclusions

The Hyogo Framework for Action (HFA) 2005-2015: "Building the Resilience of Nations and Communities to Disasters" adopted at the 2005 World Conference on Disaster Reduction in Kobe, has underscored use of knowledge, innovation and education to build a culture of safety and resilience at all levels as one of the priorities of action. Furthermore, realizing the central role of schools in building resilience of communities to disasters, the World Disaster Reduction Campaign for 2006-2007 by the UN International Strategy for Disaster Reduction (UNISDR) was carried out together with various partner organizations under the theme of "Disaster Risk Reduction Begins at School." The campaign not only underscored the importance of resilient schools to protect lives of children, but also emphasized the opportunity created by safer schools to spread the message of disaster risk reduction to communities.

Realizing importance of resilient schools, UNCRD Disaster Management Planning Hyogo Office initiated School Earthquake Safety Initiative (SESI) in 1999. SESI is aimed at promoting self-help and education for disaster mitigation by building resilient and sustainable communities. The participatory approach to community development and capacity-building among the local people is the key focus area of the initiative. SESI is based on the concept that intervention for resilient schools can be effective medium in building resilience of communities to disasters. The project on "Reducing Vulnerability of School Children to Earthquake" under SESI has been implemented by UNCRD in 4 project countries: Fiji, India, Indonesia and Uzbekistan. The project has successfully completed many vulnerability assessments of school buildings as pilot projects, retrofitting of selected model schools, training and raising awareness of engineers, technicians, teachers and community people, publication of guidelines, manuals and teachers' handbooks. The project has been instrumental in demonstrating success of the approach of integrating components structural safety and disaster awareness as part of the school safety program.

7.1 From Model Projects to Country-wide Intervention

The UNCRD project has been served as model projects in the four countries. In addition to the model project of UNCRD, there have been many other initiatives at local, regional and global level for resilient schools. Japan has been successfully promoting school safety and retrofitting of educational facilities. Japan strengthened school earthquake safety programs after 1995 Kobe Earthquake. Through the initiatives, many schools have been retrofitted. Japan has developed a national guideline for seismic retrofitting of school buildings. Experience of Japan can be instrumental in up-scaling from model projects to country-wide intervention.

Learning from the model projects and success stories of countries like Japan, there is an urgent need now to up-scale the school safety intervention from model project to country-wide intervention. The existing school buildings need to be strengthened, disaster education needs to be established in the regular school programs and the community-school interface needs to be institutionalized. Furthermore, the new school buildings being constructed need to comply with building standards.

The first step in country-wide intervention is a National Strategic Plan. The strategic plan should ensure the following key issues:

1. New construction for school buildings comply with building standards. The investment in making school buildings resilient against earthquakes should also reach to the communities for safer housing.

2. Strategy for retrofitting of existing schools has to be established. Because of necessity to build new schools in order to meet the education for all goals by 2015 and scarcity of resources, retrofitting of all school buildings is not achievable. A systematic approach to assess vulnerability of schools, their prioritization, detail investigation and design should has to be established. Empowering the local community for this and transparency of the process are key issues for strengthening existing schools.

3. School disaster management plan has to be established in close coordination with all other stakeholders. The school disaster management plan has to be an integral part of the school operation. The plan should include from regular disaster education to school maintenance program.

4. Regular disaster risk reduction activities and capacity building of teachers. In addition to the formal education on disaster risk reduction in school education, the strategic plan should promote non-formal education through different activities within the school and in coordination with other stakeholders including local community. Training of trainers and regular training to teachers on effective disaster risk reduction education should also be an integral part.

5. Establishment of the process community-school interface to disseminate the message of culture of safety from school to the communities and institutionalization of the process. The school based disaster risk reduction initiatives can be an effective tool for sustainability of community based disaster management.

6. Capacity building of technicians and development of process tools and guidelines. As the numbers of schools need to be intervened stands in thousands, capacity building of technicians is important starting point. As capacity building of technicians for earthquake safer constructions is directly related with housing earthquake safety, a wider stakeholder involvement in this process has to be guaranteed.

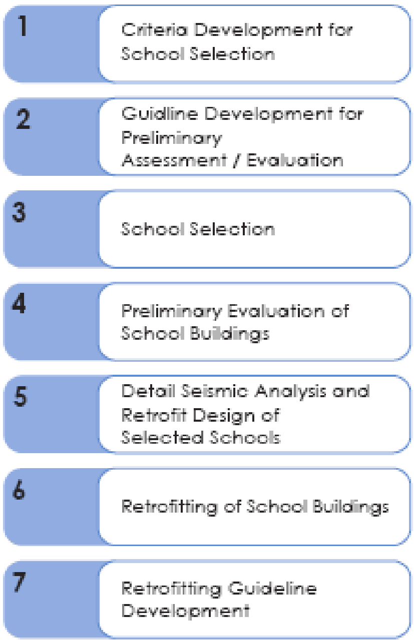


Figure 7.1 Flow chart of Retrofit

Uzbekistan

Indonesia

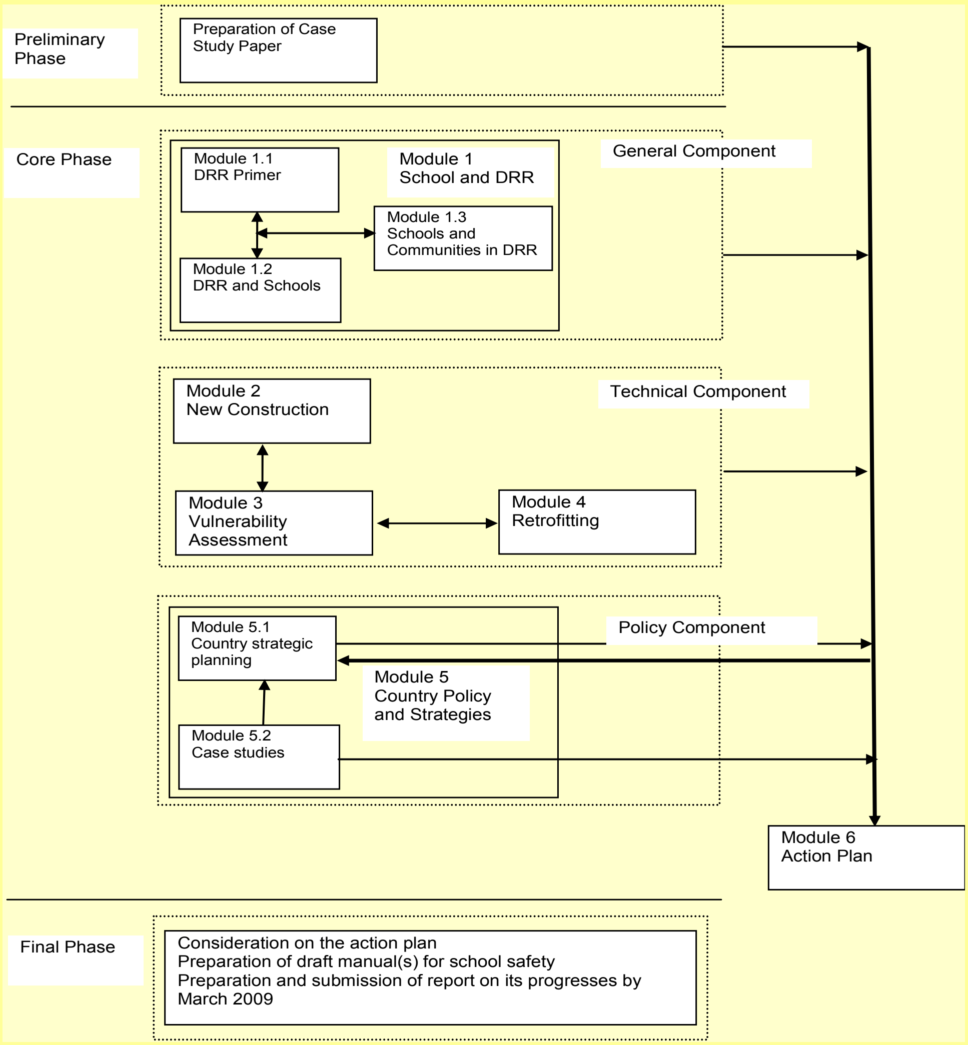
Figure 7.2 Seminar and Retrofit work

7.2 Training Program on Resilient Schools

As many earthquake prone countries will be accelerating efforts for resilient schools, a large number of technical manpower is needed. In order to disseminate the experience of the pilot projects of UNCRD and experience of Japan on School Safety, UNCRD has developed a training module on "Safer School against Disasters (Dissemination of Anti-Seismic Building for Communities)" which was conducted for the first time in Kobe, Japan in Oct-Nov., 2008 with support JICA. The training program is designed four weeks and is targeted for officials working in school construction and retrofitting. Japan, as one of the most earthquake prone countries in the world, has been taking lead in earthquake resistant technology development. In addition to technology development, national and local governments have developed guidelines and established building permit systems to ensure earthquake safety of school buildings nationwide. Based on a great deal of experience in technology development as well as in building administration, this program is designed to meet the needs of national and local government in less developed countries to build their capacity and to develop practical knowledge of earthquake resistant technology and related policy for earthquake resilient schools which can contribute to the dissemination of anti-seismic building for communities.

The training program aims to build capacity of government officials and engineers to develop action plan and implement school earthquake safety for their respective countries. This will contribute not only to ensure the safety of schools but also to build resilient communities. JICA, UNCRD and the KIC (Kobe International Center for Cooperation and Communication) will continue the training course for three years from 2008.

Box 7.1: Flow chart of training module on Safer Schools against Disasters



Supported by JICA Hyogo, UNCRD and KIC

7.3 National, Regional and Global Networking

There has already been a global movement towards safer schools and building resilience of communities to disasters through schools. Institutionalization of the achievements from UNCRD school safety project under SESI and expanding the activities by learning from the past can help in achieving the target in a greater pace.

Thematic Platform on Knowledge and Education (TPK) of UNISDR has been organized by participation of different organizations. The cluster, is aiming among other things, at strengthening networking, creating new partnerships, identifying gaps/sharing of members' priorities; identification of focus areas and collectively advancing the implementation towards concrete results for the benefit of countries in achieving the Hyogo Framework goals though knowledge and education. Coalition for Global School Safety and Disaster Prevention Education (COGSS-DPE) is an open group of organizations and individuals actively engaged in core working groups which partners with TPK in supporting implementation of priority 3 of the HFA. In order to better serve the goals of these global initiatives, networking and coordination at local and regional level is essential. These National/Regional Networks on resilient schools and disaster prevention education will be instrumental in linking with various sub-national and cross-sectoral initiatives. The national network will involve stakeholders from different sectors.

7.4 Future Actions

UNCRD Hyogo Office will finalize all activities under “Reducing Vulnerability of School Children to Earthquake” project of SESI by the end of the year 2009. However, the SESI programs will continue to develop new projects related to the safety of school buildings and disaster education for students, teachers and community people in earthquake prone areas. The achievements and outcomes of this project from 2005 till 2009 will be disseminated not only in four targeted countries, i.e. Fiji Islands, India, Indonesia and Uzbekistan, but also in other Asia and the Pacific regions vulnerable to earthquake disasters.

In order to implement further challenges such as assessment of vital regional facilities and all existing houses, retrofitting of most vulnerable facilities and houses, capacity building of national and local governmental officials and disseminate earthquake safer technologies to local experts and community people, UNCRD will pursue the earthquake safety measures in the context of regional development. The social, economic and environmental / physical aspects of regional development will be analyzed and practical measures will be developed to secure the safety of vital regional facilities including school, hospital, government offices and houses by utilizing the opportunity of the UNCRD HESI project that will end March 2012. Moreover, for the safety of communities, series of CBDM projects funded by the Hyogo Trust Fund will also continue to promote community based activities on safer culture and sustainable urban/rural development.

These programs should be implemented based on the considerations to the country and region specific conditions such as social consensus, policies, construction type, traditional technologies, available materials and workers. It is essential to collaborate and cooperate with many stakeholders such as governments, academies, teachers and community people to implement the SESI project currently and in the future.

Finally, UNCRD would like to collaborate with many relevant organizations and programs on school earthquake safety and disaster education in the world.

Box: 7.2 Key issues recommended in Country Strategic Planning Session in International Workshop on School Safety, Nov. 05-07, 2008, Kobe, Japan

- A wider stakeholders' linkage beyond engineers and teachers is necessary in possible future initiatives.
- Mass dissemination is an important issue and we need to work out how to spread the lessons and the work widely.
- Cross-ministerial links are very important, beyond the education ministries.
- Linking with other projects such as the European Commission initiatives is also important to ensure wider coverage and consistency.
- Need to create a pressure group for change that will continue to work beyond the current pilot project to disseminate and possibly extend and expand the current work.
- While the current pilot will soon be wound down, there is an emerging window of opportunity to hand over the process to be owned by the government for future scaling and sustenance.
- COGSS and the Thematic Group on Education of the ISDR are platforms that will be available for strategic lobbying.
- Forming a global strategy and coming together collectively will improve not just knowledge base for everyone, but will also create a greater global momentum and will also thereby improve resource availability and funding opportunities for future initiatives.
- Small pieces of work can also lead to great impacts in the long term. The small scale retrofitting of schools in Nepal has led to this level, and such sustained efforts will surely lead to much larger impacts in the future.
- A linkage with poverty reduction and such issues can be useful for giving a wider applicability to school safety. Social studies and such subjects can include disaster management. Impacts will take time to be visible, but in a few decades everybody will be knowledgeable on disaster issues.
- The achievements of SESI need to be recognized and made visible globally. UNCRD will do its bit to do dissemination, but all partners should make efforts to document, write papers, publish experiences and lessons, and disseminate widely at local, national as well as global level.
- The programme has created influence on other parts of the world, and programmes with similar themes and names are taking shape in other countries like Iran, Nepal and other places. The programmes are taking similar approach as SESI and adding value to it.
- The outcome of the project will be published in different languages such as Chinese and Russian. UNCRD already has a website with elaborate information on SESI and also on related issues. These can be accessed for use and dissemination.
- The partners and participants have highly appreciated and valued the support and contribution of UNCRD through SESI. Partners will continue to advocate the agenda with appropriate stakeholders at national level in their respective countries to take the initiative forward.
- There is a diverse range of practices, tools and material emerging from different parts of the world. This is a very positive trend and needs to be encouraged. At the same time, basic principles and definitions need to be clarified and agreed upon so that the framework within which everyone works is consistent.

ANNEX 1

Abbreviation

ABCD: Anti-seismic Building Code Dissemination
ADRC: Asian Disaster Reduction Center
ADPC: Asian Disaster Preparedness Center
ASB: Arbeiter Samariter Bund (NGO)
ASEAN: Association of South-East Asian Nations
BIS: Bureau of Indian Standards
BRI: Building Research Institute
BRR: Banda (Aceh) Reconstruction and Rehabilitation Agency
CAO: Cabinet Office
CATD: Centre for Appropriate Technology and Development
CBDM: Community Based Disaster Management
CDM: Center for Disaster Mitigation
COGSS: Coalition for Global School Safety
DESA: Department of Economic and Social Affaires
DOE: Department of Education
DPE: Disaster Prevention Education
DRR: Disaster Risk Reduction
FDMA: Fire and Disaster Management Agency
FIE: Fiji Institute of Engineers
FIT: Fiji Institute of Technology
FSSC: Fiji Social Service Council
GA: Grant Agreement
GESI: Global Earthquake Safety Initiative
GRIPS: National Graduate Institute for Policy Studies
GP/DRR: Global Platform for DRR
HESI: Housing Earthquake Safety Initiative
HFA: Hyogo Framework for Action
IDNDR: International Decade for Natural Disaster Reduction
IEC: Information, Education & Communication
IFRC: International Federation of Red Cross and Red Crescent Societies
IS: Seismic Capacity Index
ISDR: International Strategy for Disaster Reduction
ITB: Institute Technology Bandung
JICA: Japan International Cooperation Agency
JMA: Japan Meteorological Agency
JPY: Japanese Yen
KIC: Kobe International Center for Cooperation and Communication
MDG: Millennium Development Goals
MEXT: Ministry of Education, Culture, Sports, Science and Technology
MGM: Mary G. Montgomery
MHLW: Ministry of Health, Labor and Welfare
MLIT: Ministry of Land, Infrastructure, Transport and Tourism
MOE: Ministry of Education
MSK: Medvedev Sponheuer Karnik
NAD: Nangroe Aceh Darussalam
NDMO: National Disaster Management Office
NIER: National Institute for Educational Policy
NPO: Non Governmental Organization
NSET: National Society for Earthquake Technology - Nepal
OCHA: Office for Coordination of Humanitarian Affairs
OECD: Organization for Economic Cooperation and Development
PEB: Public Educational Buildings
PWD: Public Works Department
RADIUS: Risk Assessment Tool for Diagnosis of Urban areas against Seismic disasters
RC: Reinforced Concrete
SD: Sekolah Demokrasi
SEEDS: Sustainable Environment and Ecological Development Society
SESI: School Earthquake Safety Initiative
SOPAC: Pacific Islands Applied Geo-science Commission
SPS: Structural Performance Score
TFHS: Trust Fund for Human Security
TPK: Thematic Platform on Knowledge and Education / ISDR
UN: United Nations
UNCRD: UN Centre for Regional Development
UNDP: UN Development Programme
UNESCAP: UN Economic and Social Commission for Asia and the Pacific
UNESCO: UN Education, Science and Culture Organization
UNICEF: UN Children's Fund
UzLITTI: Uzbek Research Institute for Typical and Experimental Building

ANNEX 2

List of Assessed and Retrofitted Schools

Summary table of vulnerability Assessment and Retrofitting of Schools in project countries

Country	Assessed schools	Retrofitted schools
Fiji	1. Ballentine Memorial School – Methodist High School, Suva 2. Nasinu Muslim School – Muslim High School 3. Suva Muslim School – Muslim High School 4. Suva Vocational School – Christian Vocational School 5. St. Agnes Primary School – Catholic Primary School. Suva 6. Adi Cakobau School – Government all Girls Boarding High School.	1. Suva Vocational School – Christian Vocational School 2. St. Agnes Primary School – Catholic Primary School 3. Nasinu Muslim School – Muslim High School
India	1. Government Senior Secondary School, Mashobra, Shimla 2. Government Senior Secondary School, Kufri, Shimla 3. Government Primary School, Koti, Shimla 4. Government Primary School, Junga, Shimla 5. Government Secondary School for disabled Children, Dhali 6. Government Primary School, Mundaghat, Darbhog, Shimla	1. Government Secondary School for Disabled Children, Dhali 2. Government Senior Secondary School, Kufri, Shimla 3. Government Primary School, Junga, Shimla
Indonesia	1. SD Cirateun Kulon II, Bandung 2. SD Padasuka II, Bandung 3. SD Sukajadi, Bandung 4. SD Legok Jambu, Bandung	1. SD Cirateun Kulon II 2. SD Padasuka II, Bandung
Uzbekistan	1. School No. 116, Uchtepa district, Tashkent 2. School No. 123, Tashkent 3. School No. 20, Tashkent	1. School No.116, Uchtepa district, Tashkent 2. School No.20, Tashkent

ANNEX 3

List of Publications and Papers (Detailed data: Attached CD-ROM and UNCRD web-site: http://www.hyogo.uncrd.or.jp/school%20project/outcome/index.html)

AS: Assessment of Seismic Safety

Fiji	: Reducing Vulnerability of School Children to Earthquakes in Fiji Schools
India	: Preliminary survey and assessment of school buildings;
	: Earthquake Vulnerability Assessment of School Buildings, India
Indonesia	: Preliminary Survey of School Buildings to be retrofitted in Bandung;
	: Structural Analysis SD Padasuka II, Bandung;
	: Structural Analysis SD Cirateun Kulon 1 - 2, Bandung
Uzbekistan	: Preliminary Field Survey of School Buildings in Tashkent
	: Seismic Analysis of School Buildings in Tashkent, Uzbekistan

DS: Design for School Retrofit

Fiji	: Brief Technical Evaluation Report,
India	: Final School Retrofit Plans for Schools in Dhalli, Junga, and Kufri
Indonesia	: Retrofitting of SD Cirateun Kulon II and SD Padasuka II, Bandung
	: Final Report of Retrofitting
	: Case Study; Retrofitting of SD Cirateun Kulon II, Bandung, Indonesia
Uzbekistan	: Provision of School Earthquake Safety, Case Study of Uzbekistan;
	: Retrofitting of Masonry and Frame-panel School Buildings in Tashkent

EM: Educational Materials

Fiji	: Students' Workbook on Disaster Management
	: Information for teachers from Ministry of Education
India	: Community Seminar on Disaster Risk Reduction, Junga, Shimla, India;
Indonesia	: School Earthquake Safety (Education booklet)
	: Programs for Community Seminar, Students' Drill, Teachers' Training
Uzbekistan	: Training on Preparation to Disasters and Raising of Awareness;
	: (Russian educational material of Uzbekistan)

GE: Guideline for Experts

Fiji	: Technical Specification
	: Masons, Carpenters & Technicians; Manual on Earthquake, Cyclone,
India	: Manual for Training of Technicians (draft version);
	: Report on First Technician Training Programme, Shimla;
	: Schedule for Second Technicians' Training in Shimla
Indonesia	: (Indonesian guideline)
Uzbekistan	: Training workshop on Earthquake Resistant Construction, Tashkent;
	: Training workshop for Masons, Technicians, and Engineers, Uzbekistan;
	: Training Manual for Masons and Technicians (Russian)

GT: Guideline for Teachers

Fiji	: Teachers' Handbook; Disaster Management Earthquake Preparedness;
	: A Guide to Creating Evacuation Plans for Schools in Fiji
India	: Schedule for the First Teachers' Training in Shimla;
	: Schedule for the First School Earthquake Drill Programme;
	: Teachers Handbook on Disaster Risk Reduction (version 2);
	: A Report on Teachers' Training on Disaster Risk Reduction, India
Indonesia	: The Children's Earthquake Drills Report;
	: Final Report of Second Trainings in Indonesia
Uzbekistan	: Training workshop on Earthquake Safety Education in School, Tashkent;
	: Study guide on preparation of school children to emergency actions;
	: Report on School Children's Earthquake Drills, Tashkent;

JF: Japan and Final Reports

Fiji	: Fiji Islands Schools Retrofitting Project
India	: Disaster Education in India – A Status Report
Indonesia	: School Earthquake Safety Initiative in Indonesia, ITB
Uzbekistan	: Reducing Vulnerability of School Children to Earthquakes
Japan	: Guideline for Promotion of Earthquake-resistant School Building, MEXT;
	: Seismic rehabilitation of seismically vulnerable school buildings in Japan (Regional Development Dialogue Vol. 28 No. 2, Yoshiaki Nakano)
	: Quake Busters (Educational Software: Yamaguchi Univ. and UNCRD) English / Japanese / for Kids

PP: Posters and Site Pictures

Fiji	: Posters on Tsunami, Floods and Earthquakes
India	: Posters (Hindi) prepared by SEEDS in the project
	: Posters (Hindi) prepared by SEEDS before the project
Indonesia	: Pictures of Retrofitting works (SD Cirateun Kulon and SD Padasuka)
Uzbekistan	: Pictures of Retrofitting works and Disaster education/drills, Tashkent

Photos of Field Survey

- i) Earthquakes/Flood Damages
- ii) Earthquake Recovery
- iii) Traditional Construction
- iv) Children in Affected Areas

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UNCRD

Reducing Vulnerability of School Children to Earthquakes

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