Institutionalization of School Earthquake Safety Program in Nepal

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SUMMARY:
Making schools safer demands developing and implementing the technical, financial, management and governance curriculum with participation of all stakeholders in the high seismic prone countries like Nepal. The concept of school earthquake safety was initiated by NSET in 1999. As a result of a decade long effort of NSET in piloting School Earthquake Safety Program (SESP), in 2010, Government of Nepal and the development partners identified school DRR program as one of the five flagship programs of the Nepal Risk Reduction Consortium (NRRC). The school safety of flagship is led by the Ministry of Education (MOE) and the Asian Development Bank which focuses on the seismic vulnerability reduction of schools and institutional capacity building of different stakeholders of the MOE such as engineers, technicians, masons and teachers on earthquake vulnerability reduction and preparedness. MOE has planned to retrofit 900 school buildings of the Kathmandu Valley in next 5 years.

Keywords: Institutionalization, Earthquake risk, Earthquake safety, Vulnerability, Risk Reduction

1. EARTHQUAKE HAZARD AND RISK TO SCHOOLS IN NEPAL

Nepal is a hotspot for geophysical and climatic hazards as it sits astride the boundary between Indian and Tibetan tectonic plates along which a relative movement of about 3 cm per year has been estimated. Simple loss estimation studies for various settlements for intensity IX MMI level of earthquake shaking show potential death due to a scenario earthquake resulting in of about 2%-3% and injury at about 5-10% of population. Overall building damage is estimated at about 60%. The studies have shown that school-going children will constitute a significant proportion of the casualty. A study for Kathmandu Valley suggest a potential death of more than 29,000 children and teachers, and potential serious injury to an additional 43,000 persons in schools (18% of total) if the earthquake occurs during school hours.

An improvised vulnerability assessment of about 1100 buildings of public schools in Kathmandu Valley, undertaken by the Kathmandu Valley Earthquake Risk Management Project (KVERMP) during 1998, revealed that none of the surveyed school buildings complied with the requirements of the prevailing seismic code of Nepal. The school buildings have a variety of problems in terms of structural design, materials quality, poor construction methods, and also those due to old age. Opinions differed in terms of the possibility of improving seismic safety in public schools of Nepal: many opted for demolition and new construction. The National Society for Earthquake Technology-Nepal (NSET) opted for a comprehensive strategy that incorporated concepts of: a) incremental safety, b) seismic retrofitting using locally available materials and skills, c) community participation in safety improvement of public schools, d) capacity building, and e) awareness raising. Accordingly, NSET started in 1999 the School Earthquake Safety Program (SESP), which demonstrated the technical, social and cultural feasibility of structural intervention in existing public buildings for improving seismic performance. Since then, SESP has grown much in concept and contents, and is generally

regarded as one of the most successful earthquake risk reduction programs of Asia. SESP has already demonstrated its significance in more than 300 schools within Kathmandu Valley and out in districts located in all physiographic regions of Nepal from the High Himalayan settlements to the plains of the Terai in the south. During its implementation, a wide range of institutions from National to local level government authorities, development partners such as the USAID/OFDA, SNV, UN system and international institutions such as Room to Read, World Vision, Action Aid, The Asia Foundation, Global Fund for Children, GeoHazards International etc. have contributed their resources and partnered for the successful demonstration of the program. The SESP in Nepal has been very successful in terms of sensitizing national and international community to the need of school vulnerability reduction, developing appropriate technical methodologies and community-based implementation. However, there are more than 32,000 public and private schools in Nepal, and the challenge is to scale-up the process of enhancing earthquake safety of schools for which institutionalization of the concept of SESP is necessary.

2. NEPAL RISK REDUCTION CONSORTIUM- AN INNOVATIVE APPROACH FOR EARTHQUAKE RISK MANAGEMENT

The Nepal Risk Reduction Consortium (NRRC) was formed in May 2009 to support the Government of Nepal in developing a long term Disaster Risk Reduction Action Plan building on the National Strategy for Disaster Risk Management (NSDRM). The founding members of the Consortium are the Asian Development Bank (ADB), the International Federation of the Red Cross and Red Crescent Societies (IFRC), United Nations Development Program (UNDP), UN Office for the Coordination of Humanitarian Affairs (OCHA), UN International Strategy for Disaster Reduction (ISDR) and the World Bank.

Based on government priorities and discussions with multi stakeholder groups, the Consortium members and government identified five flagship areas of immediate action for disaster risk management in Nepal. The five flagship programs are:

1. School and hospital safety- structural and non-structural aspects of making schools and hospitals earthquake-resilient
2. Emergency preparedness and response capacity
3. Flood management in the Koshi river basin
4. Integrated community based disaster risk reduction/management
5. Policy/Institutional support for disaster risk management

The estimated total budget of the three-year Flagship programs is US $147.8 million.

The Consortium initiated a multi-stakeholder participatory process with the Government of Nepal and civil society organizations to identify short to medium term disaster risk reduction priorities that are both urgent and viable within the current institutional and policy arrangements in the country. In developing the program, the priorities outlined in the “Hyogo Framework of Action 2005-2015, Building the Resilience of Nations and Communities to Disasters”, and the Outcomes of the Global Platform for Disaster Risk Reduction (2009), which sets out specific targets for reducing losses from disasters, were taken into account. To date more than thirty organizations and Government of Nepal entities are contributing to the consortium work, including UN agencies, government departments, national and international NGOs. The US Government and the Humanitarian Aid Department of the European Commission (ECHO) also formally joined the consortium in 2011.

The Flagship 1, school safety focuses on structural and non structural vulnerability assessment, physical retrofitting and awareness rising on disaster safe construction. The school safety component addresses complete cycle of school earthquake safety program components from vulnerability assessment to vulnerability reduction, training and capacity enhancement, technology transfer mechanism and enhancing capacity of schools for preparing to respond to emergencies.

3. THE NEED FOR A FOCUS ON HAZARD SAFETY OF SCHOOLS IN NEPAL

3.1 Schools in Nepal

Public schools in Nepal, both their buildings and their occupants, face extreme risk from earthquakes. This is because of the fact that the majority of the school buildings, even those constructed in recent years are generally constructed without the input of trained engineers in design or construction supervision. Management of the public schools is largely the responsibility of the local community: the government provides the curriculum and a minimum financial support. The rest has to be managed by the community. Usually very low annual budget is available with the school management system. Such condition increases the likelihood that poor materials or workmanship are used in the construction of the school buildings making them structurally vulnerable to earthquakes. High vulnerability of schools was evidenced during the 1988 Udayapur earthquake (M6.6) in eastern Nepal; six thousand schools were destroyed in this event, which luckily took place during non-school hours. Such massive damage to the school infrastructure disrupted the affected community- approximately 300,000 children were not able to properly attend schools for several months after the event.

The main reasons to focus on schools for disaster risk reduction are based upon many facts. Public schools in Nepal are the centre of social and cultural life, especially in rural and sub-urban areas. Hence, there is a greater chance of propagating earthquake awareness from schools to the families, and from families to the communities. School-going children are also particularly vulnerable to natural disasters, especially the youngest children and are from middle to low-income groups who are also the highly vulnerable strata of the society. It is also true that the loss suffered by a community in the collapse of a school is psychologically much greater than the loss faced by collapses of other building types because schools house an entire generation and a community's future. The schools' structures are typically very simple and relatively small, unlike other critical facilities. Children can share the knowledge and skills with their parents and the community. For this reason, learning made by children in schools can also be the learning by the community.

3.2 Vulnerability Reduction to Earthquake

An alarming earthquake damage scenario including estimated losses in terms of casualty and damage to critical facilities has been provided for Kathmandu Valley to make a case on the need to focus on reducing disaster risks in schools. An account of the existing system and process of establishment of schools is discussed in detail.

An exploration has been made on the existing regulations and legal stipulations governing construction of school buildings and operation of school system. It is found that the National Building Code is the prescribed standard for the school buildings, however, like any other building; compliance to the National Building Code by the schools is a problem.

The results of a SWOT analysis (Strenght-Weakness-Opportunity-Threat) of school system shows demonstrated feasibility of improving seismic performance of school as the most visible strength, that raised earthquake awareness and increased interest of the population as the opportunity. Lack of proper policies, especially regulations that could promote and encourage disaster safety is the weakness, and political instability, geographical remoteness hindering scaling up of efforts uniformly in the country as the most important threats.

An exploration of the earthquake risk of existing school buildings of Nepal has been carried out by extrapolating the results obtained from NSET's work on School Earthquake Safety Program (SESP) in the past decade and results of the survey, design, retrofitting and earthquake-resistant construction of schools under the GFDRR-supported project recently implemented in two districts of Lamjung and Nawalparasi.

3.3 Earthquake Scenarios for Loss Estimation

The entire territory of Nepal lies in a very high seismic zone and any part of the country may encounter with MMI IX level of shaking at any time. However, it is not possible that all part of the country get affected by one big earthquake. So, it is estimated that about one third of the country is affected by a big earthquake event. Further, the level of shaking also differs in different distance from epicenter. So, it is assumed that about 25% of the total affected area falls in earthquake intensity MMI IX to MMI VI respectively. Potential damage to school buildings and associated casualties are estimated based on these earthquake scenarios.

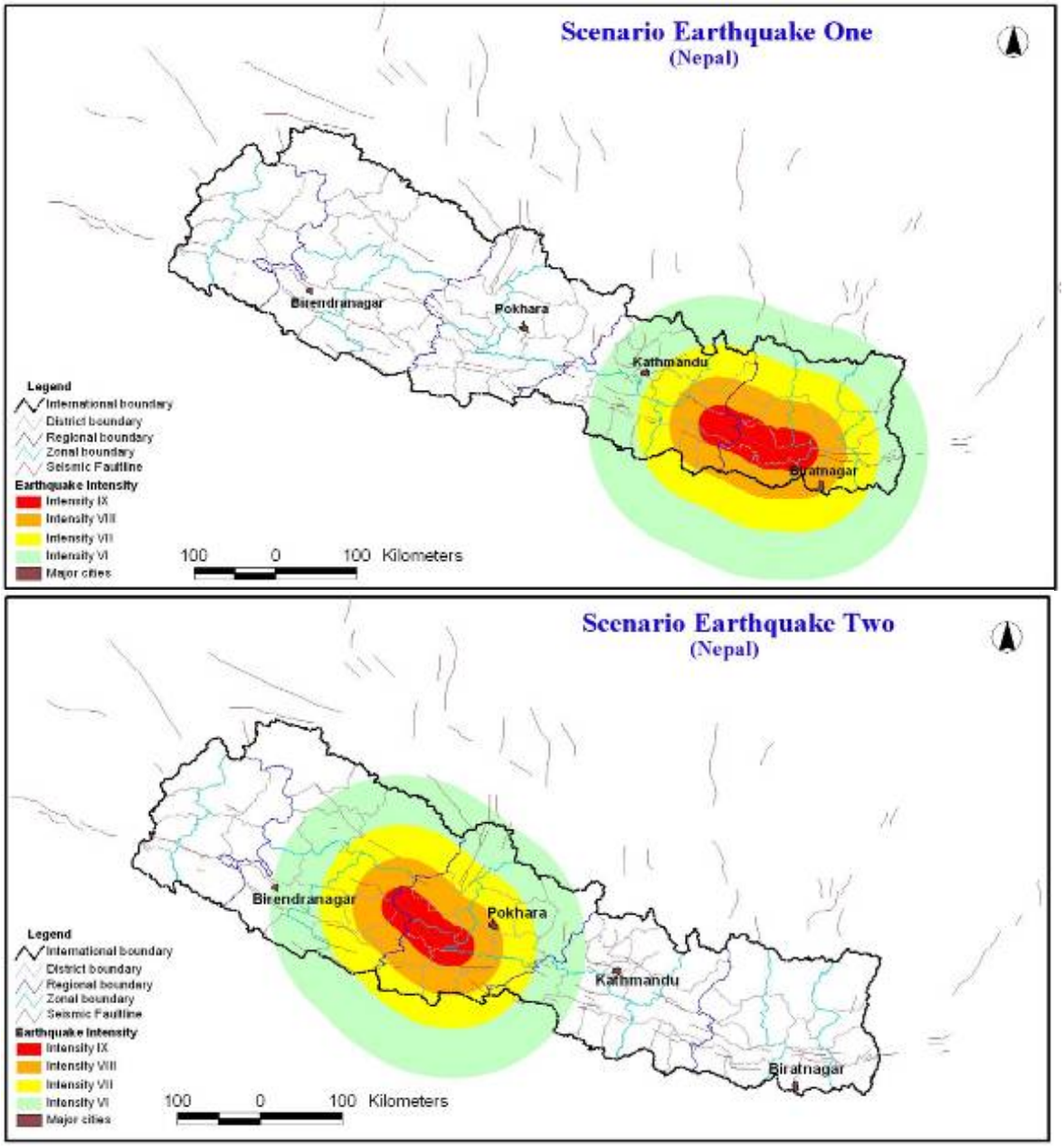

Figure 1: Earthquake Scenarios for Loss Estimation at National Level (earthquake occurring at different regions of the country)

3.3.1 Damage to school buildings due to scenario earthquakes

Earthquake damage scenario to school buildings is estimated based on the vulnerability analysis and loss estimation conducted for Lamjung district, Nawalparasi district, Kathmandu valley and some

school buildings from Humla district and the earthquake scenario considered as per above section. It is estimated that more than 9,000 school buildings, which is more than 10% of the total school buildings in Nepal, would suffer partial collapse and complete collapse resulting very high casualty.

Table 3.1. Potential numbers of school buildings affected by scenario earthquake

Earthquake Intensity	Number of Schools in Earthquake Affected Area with Different Potential Damage Grades						Total Schools Affected by one Earthquake among Total of 82170 School Buildings in Nepal
	No Damage	Slight Damage (DG1)	Moderate Damage (DG2)	Heavy Damage (DG3)	Partial Collapse (DG4)	Complete Collapse (DG5)	
MMI IX Area	0	0	263	1453	2400	2732	6848
MMI VIII Area	0	263	1453	1954	2162	1016	6848
MMI VII Area	263	1453	1954	2162	927	89	6848
Total	263	1716	3669	5568	5489	3838	20543

Further, if we consider potential reconstruction after an earthquake, about 12% of total school buildings in Nepal (Potential DG4 and DG5) Buildings need reconstruction even if we do not consider retrofitting of remaining schools, which is again required.

If all the buildings are judged for their safety for MMI IX, which is not realistic for scenario development, but required to consider if we develop the national level school intervention plan. This is because; it is not known where will be the next big earthquake location.

Table 3.2 gives the earthquake damage scenario if all the buildings get MMI IX (Only for planning purpose to estimate the total numbers of school buildings that need intervention)

Table 3.2. Distribution of Damage Grades of Schools for an Earthquake Episode Producing IX MMI intensity of shaking in the affected area

Earthquake Intensity	Number of Schools with Different Potential Damage Grades if MMI IX level Earthquake is considered						Total Schools Affected by one Earthquake among Total of 82170 School Buildings in Nepal
	No Damage	Slight Damage (DG1)	Moderate Damage (DG2)	Heavy Damage (DG3)	Partial Collapse (DG4)	Complete Collapse (DG5)	
MMI IX for all School Buildings	0	0	3154	17434	28798	32785	82170

Similar to the analysis above about 75% (DG4 and DG5 in table) of the schools need intervention. Among them, 60% require retrofitting and approximately 15% require demolition and reconstruction. From the above result, it can be estimated that out of about 82,170 school buildings, approximately 49,302 buildings need seismic retrofitting and approximately 12,326 school buildings require demolition and seismic safe reconstruction.

3.3.2 Casualty due to scenario earthquake at national level

Based on the realistic earthquake scenario and calculated potential damage to school buildings based on vulnerabilities study in selected districts of Nepal, the potential casualty at schools is calculated. If the scenario earthquake occurs at day time when the schools are open, there will be more than 110,000

deaths and about 600,000 serious to moderate injuries. Table below gives the detail of estimated casualty during scenario earthquake.

Table 3.3. Estimated Casualty at Schools during Scenario Earthquake

Earthquake Affected Areas	Death		Seriously Injured		Slight to Moderately injured		Uninjured		Total
MMI IX Area	54272	8.30%	42452	6.50%	158168	24.08%	560119	61.12%	656843
MMI VIII Area	34925	5.30%	27258	4.10%	171764	26.15%	594660	64.45%	656843
MMI VII Area	22613	3.40%	17650	2.70%	181748	27.67%	616580	66.23%	656843
Total	111,809	5.70%	87,361	4.40%	511681	25.97%	1,771,360	63.93%	1,970,530

3.3.3 Non–structural vulnerabilities

Non-structural vulnerabilities in schools of Nepal are basically more in the office room, library and laboratories which are due to unstable/ unanchored accessories. Some of the items need just relocation however some items such as cupboards, ceiling fans, etc. need to be restrained on the firm structural elements. In almost 90% of the schools, sitting arrangement need to be re-planned. There is a barrier for the movement due to fixture of desk and bench. Either this fixture need to be rectified as per accessibility or just rotated 180 degrees.

4. PRESENT STATUS OF EARTHQUAKE RISK REDUCTION

4.1 Development of concept for earthquake vulnerability reduction of schools in Kathmandu Valley

NSET in association with the Department of Education of the Government of Nepal and the Asian Development Bank, the leading institutions for school safety component of flagship 1 of NRRC, developed a concept to reduce seismic vulnerability of schools in Kathmandu Valley in 2010. The concept was developed analyzing existing school vulnerability, issues and gaps on school safety, capacity of the government, contribution and commitment of the development partners and opportunities for making schools safer. The concept highlights that out of 1,200 existing school buildings in the valley, about 900 school buildings require immediate intervention out of which 700 buildings need retrofitting and remaining 200 need demolition and reconstruction.

The concept also identified approximate cost of US$ 30 million over a period of 5 years for vulnerability assessment, design for retrofitting, implementation of seismic retrofitting and reconstruction, supervision, enhancement of emergency preparedness and response capacity of schools and capacity building of engineers, technicians, teachers and the school management committee. The concept along with the possible details of the proposed vulnerability reduction program was presented to a multi-stakeholder National Workshop that was organized in July 2010.

4.2 National Workshop on School Safety

A national workshop was organized to discuss the strategy and priority actions to implement earthquake safety program in schools in Kathmandu Valley. The workshop objectives were twofold, notably (i) raise awareness on the need for disaster risk reduction (DRR) in the schools; and (ii) invite all national and international stakeholders to consider the next steps in a proposed implementation program and to initiate discussions for co-funding. A concept paper with outline of a School Earthquake Safety Program was distributed to the workshop invitees prior to the workshop. It was subsequently modified based on the workshop outcome and recommendations.

Participants to the workshop included high level officials and senior representatives from the Ministries of Education, Home Affairs, Local Development, and Works and Transports and the departments; representatives of embassies, bilateral aid agencies, UN System, National and International Non Government Organizations, Academia, Schools, Engineering Association and Private Sectors.

Subsequently, participants discussed the program in-terms of its feasibilities under the themes a) likelihood of support to the program and its implementation potential, b) capacity and capabilities required for program implementation, c) ensuring sustainability of the program, and d) possible strategies for replicating the program to other areas of Nepal and making it multi hazard.

The following are outcomes and recommendations of the workshop:

a. Very positive statements made by senior officers of Ministries of Education, Home Affairs of the Government of Nepal were indicative of the government's commitment to enhancing disaster safety of schools in Nepal and possible close linkage of the proposed program with ongoing school construction component of the Education for All (EFA) Program. This also provides the basis to assume that the statement of commitments would be translated into actual implementation to develop policy, program guidance and approval including budgetary allocations for the project.
b. Successful experience in Nepal in disaster risk reduction in schools, implemented by a wide range of organizations in close cooperation with Department of Education, and the lesson learned can provide an excellent basis for the design and implementation of the proposed program.
c. Significant majority of the workshop participants expressed their intellectual support to the program and also the likelihood of their respective institutions and supporting it conceptually. However, they suggested to include a long-term vision into this pilot program with due consideration of cost reduction and sustainability of the effort.
d. While the workshop recognized the existence of technical capacities within a few both government and non-government organizations in Nepal, it acknowledged the existence of substantial gaps, and the need for capacity enhancement. The program should be implemented with key participation by the schools and communities around the schools. NGOs, CBOs, and community leaders should be another prime targets for capacity building.
e. Implementation modality: a suggested approach is to undertake a series of activities throughout the Kathmandu Valley in a sequential manner, in which assessment, implementation and evaluation are undertaken at the same time using a pilot project approach. The responsibility for program implementation lies across the actors; for example, the central government should focus on the program and create necessary policy and financial environment while the Department of Education and the district level authorities should provide technical and program coordination support respectively. The main responsibilities should lie at the local level with school management committee, school system, VDC or ward committees, local CBOS as the main implementing partners. A national technical organization with experience in design and implementation of school disaster safety programs should be given the responsibility of providing continuous technical backstopping and support for capacity building.
f. Replication outside Kathmandu Valley: The workshop strongly suggested extending the program with the above mentioned implementation modality to cover all areas of Nepal as soon as possible. It is also recommended include some schools of different region as demonstrate models even within the program.
g. Multi hazard approach: The workshop again expressed a conscious need to adopt a multi-hazard approach for vulnerability assessment and Design, implementation and maintenance of school buildings under the program.
h. The workshop gave ample basis to assume that all the statement of commitments by the government officials will be translated into actual implementation through policy, program guidance, and approval including budgetary allocations during the implementation of the proposed program under Flagship 1.

5. NATIONAL STRATEGY FOR IMPROVING SEISMIC SAFETY OF SCHOOLS

NSET and the GFDRR of the World Bank developed a national strategy in 2010 for improving seismic safety of schools of Nepal. The strategy has recommended different priority actions by analyzing issues and gaps in school safety, SWOT and factors contributing the vulnerability of schools. The strategy recommends, program detail, timeline, associated costs, technical possibilities, need and possibilities of capacity building, incorporation of disaster safety education in formal and informal education system and roles and responsibilities of different stakeholders for the implementation. A long term plan for 12 to 15 years has been planned with the vision of making all the schools of Nepal safer from earthquake by 2025. It has identified out of 83,000 existing school buildings; approximately 60,000 buildings need retrofitting and reconstruction which requires about US$ 1,850 million. The strategy also identified possible sources of funding for school safety during the period.

6. INCORPORATION OF SESP IN THE GOVERNMENT PLANS AND CONTRIBUTION OF DIFFERENT INSTITUTIONS

The Ministry of Education, Department of Education (DOE) incorporated SESP in its annual program in 2011. In first phase, the DOE allocated budgetary plan for retrofitting of 15 school buildings of the Kathmandu valley. The Asian Development Bank provided technical assistance through NSET for the implementation of the program which included vulnerability assessment, retrofit design, supervision and quality assurance and awareness raising programs in the target schools. The outcome of the first year program was a) seismic evaluation of 15 school buildings and design for retrofitting. b) Retrofitting of the buildings. c) Training to DOE engineers on detail assessment and retrofit design of buildings. d) Training to local masons on earthquake safe construction and seismic retrofitting. e) Training to teachers of 15 schools on earthquake preparedness. f) Preparation of emergency evacuation plans of the schools, and g) orientation to the students and conduction of earthquake drill. This program was also successful in raising awareness among school family including school management committee and parents on earthquake safety.

There was an involvement of different level of government and local level institutions. The ADB and NSET provided technical assistance while the DOE contributed the funds required for retrofitting and provided coordination and monitoring support. The District Education Office (DOE), the district level organization of the DOE implemented the program through the school management committee and the local community. The school and the local community managed the program at the local level including material, human resources and supervised the work continuously. NSET and DEO provided assistance to the school in supervision and quality assurance of the program. Women teachers association was involved in awareness rising activities in the schools.

As the program was completed successfully, the DOE has continued the program by allocating budget for retrofitting of another 50 school buildings in 2011/12 with the technical assistance from ADB through NSET. The program is being implemented in a same approach. Different non-governmental organizations are also involved in awareness raising activities while the DOE has planned to involve private sector in assessment and design for the purpose of enhancing technical capacity of related stakeholders to scale up of the program in coming years.

Based on the concept paper and workshop recommendations, ADB and AusAid have committed to support the government's initiation for retrofitting of 260 school buildings by 2014. They have already allocated approximately US$ 8.5 million for the retrofitting and technical assistance to the DOE.
Furthermore institutions are coming up with their commitment to contribute in the program. The World Bank, Japan Government and USAID are also approaching the DOE to partner in the program.

7. CONCLUSIONS

Making all 83,000 buildings of 33,000 schools buildings safer against multi hazard demands a long term strategy, clear commitment from the Government, contribution from the development partners, UN system, national and international institutions, private sector, academia, expert community and the local people. As NSET and the GFDRR has already developed national strategy for school safety, there need a strong multi stakeholder partnership to receive the goal of all schools of Nepal safer from hazards by 2025.

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