



ENHANCING EARTHQUAKE SAFETY OF SCHOOLS: LESSON LEARNED FROM NEPAL

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Abstract

Schools in Nepal, especially public schools, both their buildings and their occupants, face extreme risk from earthquakes. High vulnerability of schools was evidenced during the 1988 Udayapur earthquake (M 6.6 Richter), Sikkim/Nepal border earthquake of September 18, 2011. Many schools in Eastern Nepal were damaged. Furthermore, The Gorkha earthquake of 2015 stands as just one example, which struck Central and East Nepal, a non-school day. As school was not in session, the subsequent damage and destruction of nearly 9000 schools fulfilled only a fraction of its devastating potential. Had the earthquake hit on a school day, over one million children would have been affected. All this recent damage information suggests that the school buildings in Nepal are at high risk of damage during an earthquake event.

Realising an urgent need to establish a program in schools that could provide knowledge and awareness regarding disasters, especially earthquake as Nepal is a country highly prone to earthquakes, National Society for Earthquake Technology-Nepal (NSET) has been implementing School Earthquake Safety Program (SESP) in Nepal since 1997. The effort has demonstrated the technical, economic, political and socio-cultural feasibilities of enhancing earthquake performance of public schools. Many changes have been noticed both in community and implementation sectors.

After continuous efforts through SESP, it is understood that any effort in raising awareness and demonstration of risk reduction always pays. It pays more if the effort is pervasive from the central to the local level. From the survey and assessment to 160 retrofitted buildings after the 2015 earthquake it was found that the 25 April earthquake was like a laboratory test for the retrofitted schools in Nepal. It was a very big achievement that all the buildings retrofitted were found structurally sound during damage assessment. All the retrofitted buildings were used as safe shelter by the community immediately after the earthquake. Community felt safe sheltering in the retrofitted school as they were directly involved in retrofitting and were confident on what and how retrofitting was done. Classes in the retrofitted buildings were operated without fear. Schools with retrofitted buildings demanded for less number of temporary class room. Technical Committee formed under SESP is functional and Department of Education (Government Authority) has adopted the system of review of designs through technical committee.

Keywords: Earthquake, School Earthquake Safety Program, Retrofitting, Communities, Lesson Learned



1. Introduction

Education is one of the most important drivers of the development of individuals and societies. Parents all over the world know this to be true and school enrollment in developing countries continues to rise. While this is a positive movement, effort is still needed to ensure all children have access to a safe space to learn without fear. Schools should provide an enabling environment to allow children to reach their full potential and become active citizens who contribute to the growth of their country. To achieve this, multiple factors need to be considered beyond traditional education programming.

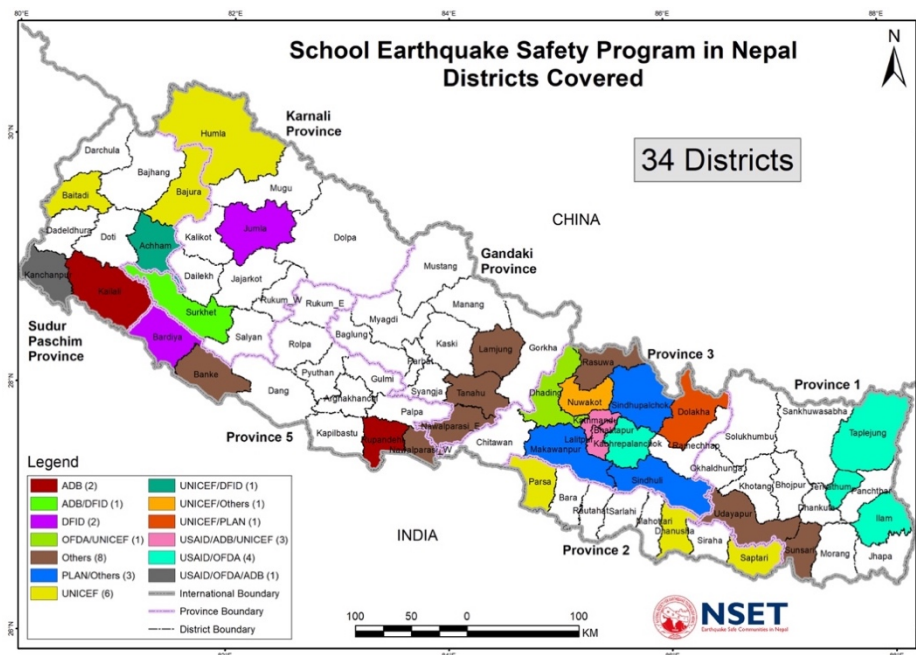


Fig.1 Geographical Coverage of SESP implemented by NSET

Schools in Nepal, especially public schools, both their buildings and their occupants, face extreme risk from earthquakes. This is due to the fact that the majority of the school buildings are generally constructed in very informal way without the involvement of trained engineers in design and construction. As management of the public schools is largely the responsibility of the local community, they have very less budget and low level of awareness on the hazard and risk lies in their areas. There is usually very little budget allocated for physical infrastructures and risk mitigation but not any for preparedness works. This situation increases the likelihood that poor quality materials and poor workmanship are used in the construction of the school buildings making them structurally more vulnerable to earthquakes. In Nepal, this means investment in safer learning facilities which consider disaster resilience, disaster preparedness and more resilient education. Nepal is subject to a wide range of disaster risks and impacts, inclusive of earthquakes, floods, droughts and landslides, which can have devastating effects on the country. The Gorkha earthquake of 2015 stands as just one example, which struck Central and East Nepal at 11:56 on a Saturday, a non-school day. As school was not in session, the subsequent damage and destruction of nearly 7000 schools fulfilled only a fraction of its devastating potential. Had the earthquake hit on a school day, over one million children would have been affected. The scale of damages indicates that schools in Nepal are at high risk during an earthquake event.

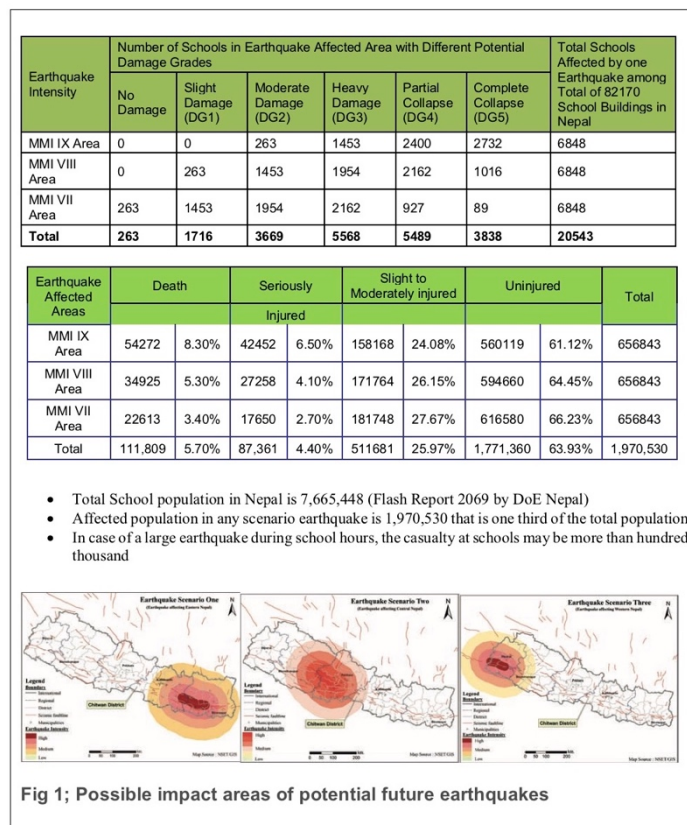
Similarly, schools are considered the most effective hub to reach and disseminate knowledge and skills of community resiliency. The concept, knowledge and skills of earthquake safety can trickle down from students,



teachers to the community so that it helps to prepare and educate school children and teachers for disasters. However, providing knowledge and skills of earthquake safety should be a continuous effort and it needed to be covered all the schools which are still inadequate in Nepal.

Realizing the urgent need to work on school safety, National Society for Earthquake Technology-Nepal (NSET) has been implementing School Earthquake Safety Program (SESP) throughout the country and the region aiming at mitigating this very problem of school safety and preparedness. Building earthquake-safe communities through intervention at schools are at the core of SESP. It is a holistic approach taken by NSET to improve the earthquake safety of communities by intervening in schools. This program concept has been very successful in terms of developing appropriate technical methodologies and a procedure for community-based implementation.

Besides this, all the school buildings (although number is very low) that were designed and constructed recently in compliance with National Building Code are safe and no significant damages observed during the post-



earthquake damage assessment after the April 25, 2015 Gorkha Earthquake. Similarly, school buildings retrofitted prior to the earthquake are also structurally intact and were used as emergency shelter by the community immediately after the earthquake. At the same time by applying the systematic approach on school reconstruction, now it is the highest reconstruction rate among all other sectors in ongoing reconstruction efforts. Almost 80% of Schools reconstruction has been already completed so far.



2. Earthquake Risks of Schools in Nepal

From 2008-2010, NSET conducted survey of all school buildings in Lamjung and Nawalparasi districts of Nepal. Earlier, in 1998, NSET conducted similar surveys of schools in the entire Kathmandu Valley. By extrapolating the observations and findings of these surveys to the entire country, NSET has estimated a country wide earthquake risk scenario for Nepal as shown in Fig 1. This considers that one third of the area of the country would be affected during a large earthquake event anywhere in Nepal. Considering these three scenarios of earthquake risks and based on the results of the school survey, the seismic performance of about 75% school buildings in Nepal must be enhanced [1]

After April 25, 2015 Gorkha Earthquake, World Bank carried out a detailed Structural Integrity and Damage Assessment (SIDA) of education facilities located in the 14 most-affected districts. Over 5,000 schools comprising over 18,000 buildings were surveyed. The data collected revealed that 30 percent of the buildings were completely destroyed, another 30 percent suffered major damages and were recommended for retrofitting, while the remaining were either recommended for minor repairs or were found to be intact.

The school's vulnerability assessment results before April 25, 2015 Gorkha Earthquake and SIDA information after the 2015 Gorkha earthquake evidenced the high vulnerability of school buildings with more than 60% are at high risk of damage during an earthquake event.

3. School Earthquake Safety initiatives in Nepal

Considering the results of the school survey, the seismic performance of about 75% school buildings in Nepal must be enhanced. Considering this fact, NSET has been implementing School Earthquake Safety Program (SESP) in Nepal since 1997. This program concept has been very successful in terms of developing appropriate technical methodologies and a procedure for community-based implementation. The effort has demonstrated the technical, economic, political and socio-cultural feasibilities of enhancing earthquake performance of schools. However, there are 34,000 schools with more than 84,000 buildings and the challenge is scaling up the process of enhancing earthquake safety of all schools in Nepal.

SESP is a holistic approach taken by NSET to improve the earthquake safety of communities by intervening in schools. SESP assists to make schools safer against earthquakes through the seismic strengthening of school buildings, trainings, schoolteachers, students and parents on earthquake safety and enhancing earthquake preparedness of schools. The targeted beneficiaries are students, teachers and the surrounding community of the selected schools.

Approach of SESP

- Community Based Approach
- Awareness raising on risk and risk reduction measures
- Multi-stakeholders Collaboration (Government, Civil Society Organizations, Private sector)
- Disseminate and replicate best practices that works in the context of Nepal
- Assist community to manage, implement and own the project
- Develop/ adapt appropriate, cost effective, replicable technology
- Emphasis on the use of local materials and resources
- Education and empowerment



School Earthquake Safety Program (SESP) evolved slowly and reached to the current stage which is a part of the Global movement under Comprehensive School Safety Framework to have a safe learning environment in Schools. In Nepal, school earthquake safety initiatives can be categorised in three main stages before 2015 Gorkha Earthquake;

Construction of earthquake resistant school buildings, capacities building of local masons in earthquake-resistant construction technology; training and orientation to students, teachers and the communities on earthquake safety; enhancing the earthquake preparedness of schools, involvement of the education authorities and Institutionalization of the process.

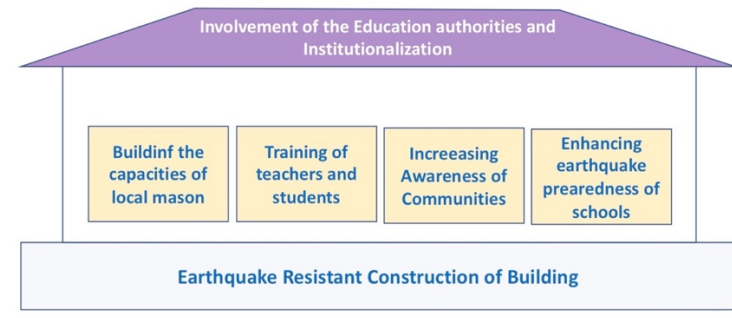


Fig 2. Components of School Earthquake Safety Program

3.1 Conceptualizing of School Earthquake Safety Program (SESP); Initial Dilemma

In 1997, under the 'Kathmandu Valley Earthquake Risk Management Project' (KVERMP), a vulnerability assessment was conducted in Kathmandu valley amongst 643 schools which revealed that over 60% of public schools were unsafe. The findings led NSET to focus attention on ways to make school buildings safer and founded the School Earthquake Safety Program (SESP) in 1999.

After the assessment of schools, retrofitting was found as the only solution to increase earthquake resilience for existing vulnerable school buildings. However, there were four questions raised, which were:

- Is it technically feasible to retrofit Nepali schools with brick and mud or other types?
- Is retrofitting economically affordable?
- Is it culturally acceptable?
- Will our local construction industry including contractors and masons be able to do it?
- Will it be sustainable?

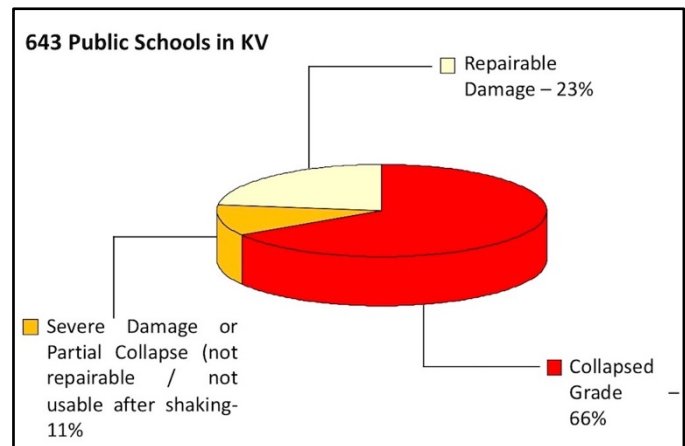


Fig. 3 Potential Damage of School Buildings in KV (IX MMI shaking)

Considering the high risk of an earthquake in Nepal, NSET initiated seismic retrofitting of school buildings in 1998 in Nepal. As this was a start of something completely new, a lot of questions were raised, firstly by the masons as they wanted to know why was retrofitting necessary, their questions led to the start of mason trainings. Through the mason trainings, the masons were convinced about the importance of retrofitting and they also suggested that all this information about disaster preparedness should be passed on to the community

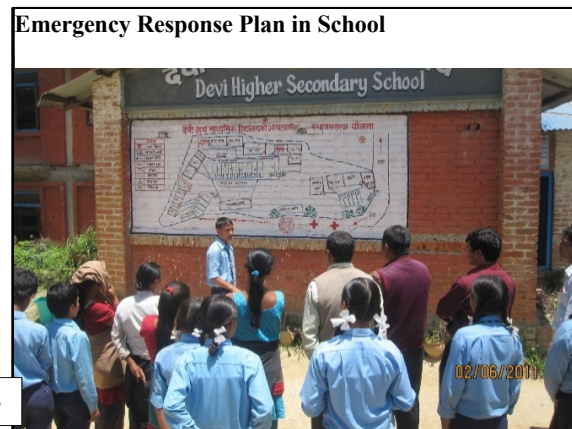
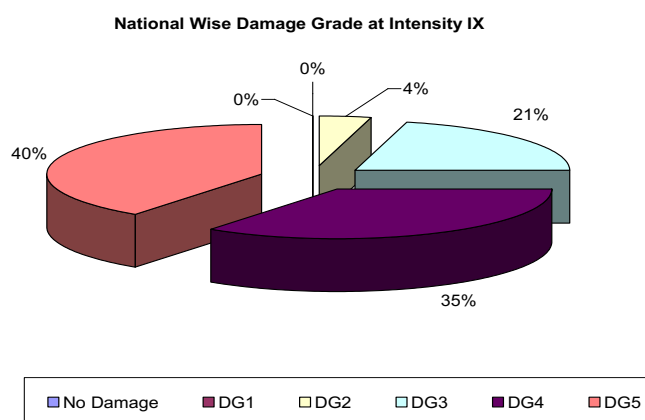


members as well. This is how the awareness activities began. Eventually, the students, teachers and parents all came together and developed the disaster education concept including preparedness and response plan. It took almost eight years (1997-2005) to evolve SESP a comprehensive program on school safety and able to answer all above five major questions raised at starting phase by successfully demonstrated in the field.

3.2 National strategy for Improving Seismic Safety of Schools in Nepal (SSS-Nepal)

The World Conference on Disaster Reduction was held from 18 to 22 January 2005 in Kobe, Hyogo, Japan, and adopted the Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. The Priority 3 of the Hyogo Framework for Action (HFA) 2005-2015 was: “Use knowledge, innovation and education to build a culture of safety and resilience at all levels”; and schools are the best venues for forging durable collective values; therefore they are suitable for building a culture of prevention and disaster resilience. In line with this Priority 3 of the HFA, the World Disaster Reduction Campaign 2006-2007 was launched in Paris in June 2006 by UN/ISDR secretariat and UNESCO, with support from the French Government. Its theme is: “Disaster Risk Reduction Begins at School”. This theme was chosen because it is in line with the world campaign focuses on promoting the safety of school buildings and the mainstreaming of disaster risk reduction (DRR) into school curricula or at least school activities. In other words, the World Campaign seeks to promote disaster resilience in schools and through schools.

After this global initiative on school safety, NSET collaborated with many organizations like Lutheran World Federation (LWF)-Nepal, Action Aid Nepal, Nepal Red Cross Society, Save the Children, , Plan-International, UNICEF- Nepal, UNISDR, UNCRD with the funding support from USAID, OFDA, World Bank, DFID,



JICA, American Red Cross (ARC) in implementing the School earthquake safety program. Keeping in view of need of earthquake preparedness at schools, these collaborations notably raised the awareness and enhance the capacity of school teachers on earthquake risk and preparedness.

At the same time, the National Society for Earthquake Technology – Nepal (NSET) implemented the program during September 2008 to October 2010 under Track II of the Global Fund for Disaster Reduction and Response (GFDRR) of the World Bank (WB) with the aim of “**Developing a Strategy for Improving Seismic Safety of Schools in Nepal (SSS-Nepal)**”. GFDRR and NSET conceptualized SSS-Nepal to build on a 10-year experience of NSET in improving seismic performance of both school buildings and the school system of public schools mostly in Nepal. The idea was on one hand to explore replicable potential of the methodologies and experience to the entire country by piloting the program in two districts, and to develop a strategy for improving seismic safety of the entire school population of the country. Thus this was a pilot project implemented in two districts of Lamjung and Nawalparasi; the territorial spread of the two districts covers almost the entire physiographic regions of Nepal, and hence represents the physical, cultural, socio-



economic and other variations that have their implications in the establishment and operation of public and private schools in Nepal.

3.3 Implementation of National Strategy on Seismic Safety of Schools in Nepal (SSS-Nepal)

An International Consortium of ADB, IFRC, UNDP, UNOCHA, UNISDR, and World Bank was formed in May 2009 to support the Government of Nepal in developing a long term disaster risk reduction action plan for implementing some important strategic actions suggested in the National Strategy for Disaster Risk Management (NSDRM). In addition, 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.

The Government of Nepal incorporated SESP: in the regular annual program of the Department of Education (DOE) and implemented a pilot program in 15 schools in 2010 with the technical support from ADB through NSET. The program was then being scaled up in the valley and implemented in 50 more schools in 2011/2012 as a piloting. Accordingly, program for implementing SESP in more schools further developed and the funding sources were also identified.



Fig.5 Retrofit option adopted to strengthen the vulnerable school buildings

ADB and NSET carried out snapshot study of the schools of the valley and recommend detail plans of action to reduce seismic vulnerability of all the schools of the Valley. Incorporating the lessons and experiences of piloting the program in 65 schools of the Valley, the DOE has developed a 5-6 years plan to strengthen existing 900 school buildings of the valley and calculated approximate cost of US\$ 30 million. The plan was DOE through the support from the ADB retrofit 260 school buildings by 2014 but only 165 schools retrofitting was completed so far when the country was shocked by April 25, 2015 Gorkha Earthquake.

3.4 Impact of April 25, 2015 Gorkha Earthquake in Education Sector

The devastating 2015 Gorkha earthquake made adverse impact on the school education sector in Nepal. The earthquake affected more over 9353 schools of 55 districts with the total loss of US\$ 313 million which demands recovery/ rebuilding cost of US\$ 397 million for the sector (PDNA, 2015 and PDRF, 2016). Almost



1.2 million children of worst affected 14 districts were out of school for more than two months due to traumatic aftershocks, lack of classrooms and educational materials. The earthquakes destroyed more than 35,000 classrooms, damaged a further 10,000 classrooms and destroyed or damaged many school toilets, boundary walls and water supply and sanitation facilities in 59 districts (CSSMP, 2017).

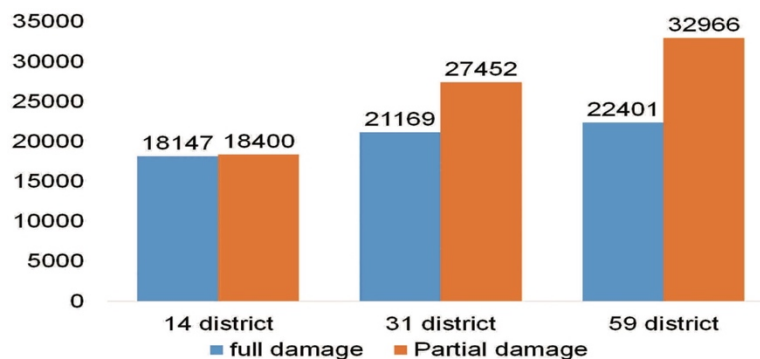


Fig.6 Damages of school buildings during 2015 Gorkha Earthquake

3.5 Retrofitted schools didn't suffer structural damage by 2015 earthquake

Under the School Safety Action Plan-2012, Design for retrofitting of 260 school building was done, out of which 165 school retrofitting was completed and work one 10 building retrofitting was on-going and design of other 84 buildings was completed and were in the final process of implementation when April 25 and May 12, 2015 earthquake quaked the Country.

After the earthquake, the initial rapid damage assessment of school buildings was carried out under the leadership of former Department of Education (Centre for Education and Human Resource Development, CEHRD). It was conducted to identify the status of schools building either to occupy the building or build temporary classrooms until detail damage assessment is accomplished. However, the country felt lucky as the earthquake occurred on Saturday while there were no children in the schools/classrooms. Had it occurred



during school hours, the human loss and damage could have been unconceivable. The initial rapid damage assessment found that about 60% of the existing school buildings in earthquake affected districts were identified unsafe for immediate occupancy. Again, after large aftershock on 12th May re-verification of visual assessment was done at critical sites. Re-verification to the existing retrofit designs was done after rapid visual damage assessment. During re-verification, some of the designed but not implemented buildings suggested for demolition and some changes suggested in some of the buildings. Out of designed but not implemented 84 buildings 20 buildings were found not in a position to retrofit and need to rebuild. However, the retrofitted schools didn't suffer any major structural damage during the earthquake [2,3]. Most of the retrofitted schools were used as immediate community shelter, field hospital and relief centres [4]. The findings have shown a clear direction for structural vulnerability reduction and enhancing disaster preparedness. It has demonstrated the feasibility and cost effectiveness for improving school safety through locally available resources.

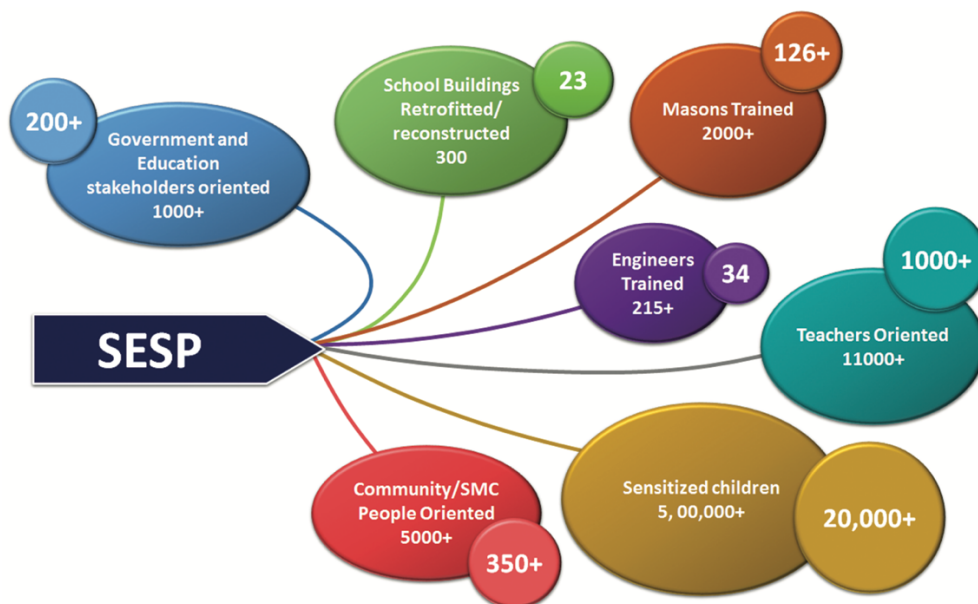


Fig. 7 Glimpses of Progress on school safety efforts in Nepal

3.6 School Safety after 2015 Gorkha Earthquake

The Government of Nepal has developed the School Sector Development Plan (SSDP) for the July 2016 to July 2023 period to continue its efforts to ensure equitable access to quality education for all. The SSDP is designed to address two major contemporary challenges. It supports 'building back better' after the earthquakes of April and May 2015 and improving disaster risk reduction in the aftermaths of the damage to the school infrastructure and the lessons learned on school safety. It also sets the scene for the reforms demanded by the move to a federal system of government. The main drivers of the plan's content are the achievements, lessons learned and unfinished agenda of the Education for All programme (EFA) (2004-2009) and the School Sector Reform Plan (SSRP) (2009-2016) under the Education for All National Plan of Action (2001-2015).

The focus of DRR under the SSDP programme is the safe reconstruction, repair and maintenance of schools in earthquake-affected areas and the safe construction and retrofitting of schools in non-affected areas. The concept of safe schools covers all three pillars of the comprehensive school safety framework of (i) safe learning facilities, ii) strengthened disaster risk management and (iii) strengthened resilience in communities and among stakeholders. In order to ensure access for all children to a safe enabling learning environment, comprehensive disaster risk ensure access for



all children to a safe enabling learning environment, comprehensive disaster risk reduction and school safety programmes are envisioned in all schools. So far Comprehensive School Safety Master Plan (CSSMP, 2017) under which 16 key activities are identified to ensure the minimum safety for safe learning environment at schools and standardized as a Comprehensive School Safety minimum package (CSSMP, 2018) under the leadership of Ministry of Education, Science and Technology (MOEST). Similarly, Comprehensive School Safety Implementation Guideline and communication strategy drafted and endorsed by MOEST in 2019. All these policies streamline the school safety single approach to all actors working in School Safety in Nepal.



Fig. 8 Comprehensive School Safety Minimum Packages (CSSMP) Dissemination flyer

3.6 Students Summit on Comprehensive School Safety-2019

The Government of Nepal, Ministry of Education, Science and Technology (MoEST), Centre for Education and Human Resource Development (CEHRD) in association with USAID, UKAID, UNICEF, UNOPS, NDRRC, Save the Children, PLAN International, Nepal Red Cross Society, WVI, NSSP, SAFER, EPSRC, Maiko High Schools Japan, CityNet, Teach for Nepal, and National Society for Earthquake Technology-Nepal (NSET) organized “Students’ Summit on Comprehensive, School Safety” previously known as “Students’ Summit on Earthquake Safety” during August 25 - 26, 2019 in Surkhet of Karnali Province.

With the view to contribute on School safety and safety of children and teacher due to disasters, Student Summit is being organized since 2002 jointly by various education cluster member organizations in Nepal. The theme of recent summit was “Students’ Summit on Comprehensive Earthquake Safety, 2019”. The two-day summit was actively participated by a total of 144 participants including 95 Students and Teachers (65 students and 30 teachers including 14 teachers and Students from Maiko High Schools from Kobe, Japan) from 34 schools of 19 districts of Nepal and Japan and 49 experts from the field of Disaster Risk Reduction in Nepal. The main objectives of the summit were:

- Raising awareness and sensitizing the school students and teachers on comprehensive school safety;



- Learn from rich knowledge and experience of other countries;
- Inter-school exchange of knowledge and experiences;
- Provide opportunity to set common goals and objectives on school safety and preparedness;

Recognizing the success and outcome of the past Student's Summits and the recommendations received from the participants, the "Students' Summit on Comprehensive School Safety" 2019 was organized. The summit focused on sharing lessons and experiences of 2015 earthquake and the recent initiatives taken by the Government of Nepal on disaster risk reduction and school safety; best practices and case studies along with identification of key actions to promote and institutionalize comprehensive school safety in Nepal. It helped educate and motivate the students and teachers on earthquake/disaster safety issues in the schools. At the same time, it also shared lessons learned from response, recovery and reconstruction efforts from the 2015 Gorkha Earthquake. Furthermore, it disseminated the newly formulated master plan, minimum package and guideline on Comprehensive School Safety in the context of changed government system from unitary to federal in Nepal.

Summit Declaration from the students as their commitment

The Student Summit 2019 has become successful in terms of raising awareness and in-depth understanding of the participants about the sensitivity of the issue of School Safety in Nepal. It has also able to leave good and positive impression on the mind of 144 participants that the Safety of the Students and teachers is one of the important issues which cannot be overlooked by the all level of government including local government, School Management Committee, Community, School Administration as well as teachers and students. The commitments made by the participants as part of Summit Declaration will definitely contribute on making school and teaching learning activities safe and thereby making Nepal resilient to disasters. It is because the commitment came from children who are now became the ambassadors to their community and schools and moreover confident of implementing the lessons on how to make their future safe against earthquakes and other kind of disaster. All in all, the Students Summit 2019 proved a great sharing platform to the students to discuss on school earthquake safety issues.

4. Lesson Learned

After implementing SESP in the selected districts, some lessons have also been learned. It is understood that any effort in raising earthquake awareness always pays but it is a slow process no radical change is possible. It pays more if the effort is pervasive from the central to the local level. From the survey and analysis, it was found that a majority of the school buildings are vulnerable and schools face extreme seismic disaster risk. Unless there is a nationwide comprehensive earthquake safety program for school safety and its timely implementation, there will be a huge casualty and destruction. It was also realized that the country is largely starved of skilled manpower for earthquake-resistant construction. Although a number of engineering colleges, polytechnics, and vocational schools exist, training on earthquake-resistant construction is still viewed not as an integral part of long-term earthquake mitigation strategies. Even many professional engineers are unaware of the potential hazard and earthquake mitigation measures. Similarly, construction masons do not get any formal training. Their skills are inherited or learnt from other masters. local masons do not have adequate

Students' Summit 2019: Surkhet Declarations

"Together with 144 national and international participants of the summit gathered from 34 Nepalese schools, representing 19 districts with disaster experts from different institution, and students and teachers from Japan, declare our commitments for enhancing school safety by re-assuring our earlier commitments of past student summits and establishing "Comprehensive School Safety Club" in our schools."



capacity to implement designs of earthquake-resistant buildings as provided by the DOE. Unless the capacity and skills of local masons is enhanced, the desired quality and safety of construction cannot be achieved. It was also understood that the funding provided by the government to the schools for construction is insufficient to complete the construction in desired quality and time. Hence, it further contributes to increased vulnerability of school buildings. Moreover, there is limited capacity of engineers and technicians on building assessment, design and implementation of retrofitting work. It is necessary to enhance their capacity through intensive as well as practical trainings. In many cases, the school family does not have an understanding of the importance of earthquake preparedness and emergency planning in schools. These things are new to them, but after an orientation program they were found to be very positive towards preparing plans and conducting drills once they were provided orientation.

5. Conclusion

School Earthquake Safety Program (SESP) has shown a clear direction for structural vulnerability reduction and enhancing disaster preparedness. It has demonstrated the feasibility and cost effectiveness means of improving school safety through locally available resources. Since there is a need to strengthen more than 60,000 school buildings, develop risk management plan and capacity of 35,000 schools and to disseminate safety message among more than 8 million children, Comprehensive School Safety Framework is to be institutionalize to all the schools.

The evidence of safe behaviour of retrofitted schools is to be disseminated to wider range so that there is good acceptance on the benefit. Working together with the Government, communities and Civil Society Organization is the need for current time.

6. Acknowledgements

This paper is an outcome of the last 27 years of work experience in the field of SESP and is based on the work done by NSET. All research staffs of NSET and funding partners are highly acknowledged for their support.

7. References

- [1] Amod Mani Dixit, Ryuichi Yatabe, Ranjan Kumar Dahal & Netra Prakash Bhandary (2014). Public School Earthquake Safety Program in Nepal, *Geomatics, Natural Hazards and Risk*, 5:4, 293-319, DOI: 10.1080/19475705.2013.806363.
- [2] Paci-Green, R., Pandey, B. (2016). School Construction as Catalysts for Community Change: Evidence from Safer School Construction Projects in Nepal, *International Journal of Mass Emergencies and Disasters*, Nepal Earthquake special issue, 34(3): 32-54.
- [3] Anwar N, Adhikari S, Shahid M, Shrestha S (2016): Making Schools Safer for Earthquake, Effectiveness of Retrofitting; A case study from Nepal, AIT Solutions, AIT.
- [4] Paci-Green, R., Pandey, B. Friedman R (2015). Safer Schools, Resilient Communities: A Comparative Assessment of School Safety after the 2015 Nepal (Gorkha) Earthquakes, Risk Reduction Education for Disasters (risk RED)