

ANTI-SEISMIC BUILDING CODE DISSEMINATION (ABCD) PROJECT FOR HESI

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ABSTRACT:

The population living in urban areas is increasing rapidly and it is estimated that more than half of the world's human population will be living in towns and cities by 2008. In earthquake prone countries it's more challenging, as collapse of houses and buildings is the major cause for the loss of lives and property. Growing demand and rapid pace of development may lead to construction of unsafe house where thousands of people get trapped in the event of an earthquake. United Nations Centre for Regional Development (UNCRD) initiated Anti-seismic Building Code Dissemination (ABCD) project for Housing Earthquake Safety Initiative (HESI) in 2007. UNCRD conducted a survey in a number of disaster prone countries across the world. 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. 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.

KEYWORDS: Building code, dissemination, non-engineered, community-based, ABCD project

1. INTRODUCTION

The collapse of houses and buildings is the single largest cause of human deaths and economic losses resulting from earthquakes. It is obvious that regulations that ensure the structural safety of buildings play a key role in preventing these losses. The vulnerability and hence impact of earthquakes on livelihood of people can be reduced by measures such as adherence to earthquake resistant building design and construction standards, proper land use planning and education and training for risk evasion. However, the risk is ever increasing as rapid urbanization in developing countries is adding extra pressure on building construction and measures to reduce earthquake risks often get low priority.

Although developed countries also face risk from earthquakes, the problems in developed countries and developing countries are different in their scope and magnitude. Most developing countries have established a building control system, aiming to prevent loss of life and property in earthquakes. However, the system seldom functions effectively because of lack of awareness among communities, lack of capacity of implementing authorities and lack of regulatory mechanism for effective implementation, monitoring and reviewing. Many existing and new built houses in developing countries have structural deficiencies which render the buildings vulnerable to earthquake. Therefore, there is an urgent need to translate advancement in knowledge into practical initiatives, replicate good practices from anywhere to vulnerable areas everywhere and help build a resilient community against the disasters.

Against this background, United Nations Centre for Regional Development (UNCRD) Disaster Management Planning Hyogo Office initiated Housing Earthquake Safety Initiative (HESI) in four countries: Algeria, Indonesia, Nepal and Peru. HESI was launched with the main objective of identifying country specific problems and promoting the implementation of building safety regulation in four project target countries.

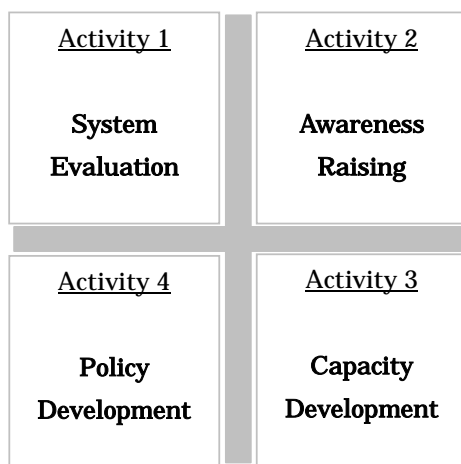
2. OBJECTIVES AND ACTIVITIES

2 - 1 Objectives

The main goal of HESI is to improve the structural safety of houses to prevent damage and safeguard people's lives, property and livelihood from earthquake through effective implementation of building safety regulations.

1. To raise awareness on the importance of implementing building safety regulations effectively to reduce risk of life and property losses caused by earthquakes.
2. To develop policy recommendations on improving the safety of houses, particularly that of traditional houses
3. To develop capacity of national and local government officials to implement building safety regulations effectively

2 - 2 Activities



The HESI project consists of four core activities: 1) system evaluation, 2) awareness raising, 3) policy development, and 4) capacity development (Fig. 2). The first activity aims to collect information relating to housing safety from the perspective of building code implementation. The second activity aims to raise awareness among stakeholders of housing safety, including officials from national governments and local governments, building professionals and house owners on the code as a tool to ensure the safety of house as well as the need to construct houses according to the code. The third activity aims to develop policies to disseminate building code more effectively within local governments, building professionals and communities. The fourth activity aims to develop capacity of government officials, engineers and technicians involved in housing construction in their roles to enforce the code.

Fig. 1 Four activities of HESI

Following the launch of the HESI project, UNCRD conducted a questionnaire survey in a number of earthquake prone countries across the world. The formatted questionnaire was sent to experts, professionals and persons responsible for implementation of building in different countries. Target persons were selected from personal list, from mailing list of professional organizations and mailing list of World Housing Encyclopedia. The objective was to collect information on building code and the status of its implementation in each country. So far, 26 responses have been received from national and local governments in 13 countries. The survey found that almost all of the respondents have a building code in force. At the same time, the differences were found in the process and requirements for obtaining building permits across countries. It also raised a number of implementation-related problems encountered in many of the responding countries. Some of the key issues found from the survey is summarized in the following Figures;

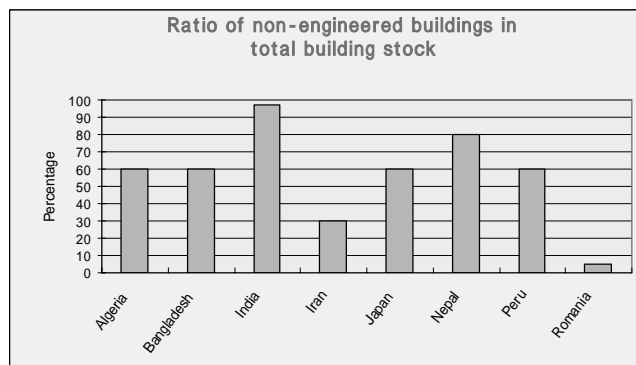


Fig. 2 Ratio of non-engineered buildings

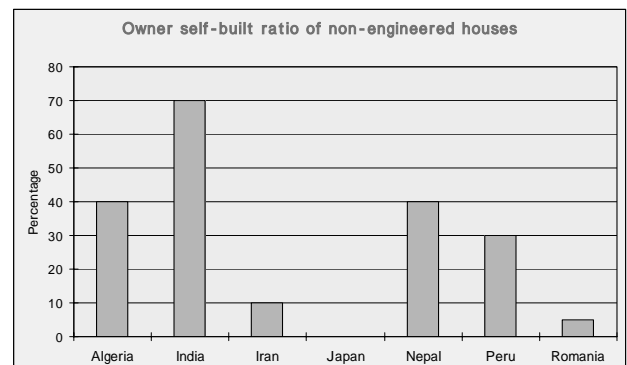


Fig. 3 Owner self-built ratio of non-engineered houses

3. FRAMEWORK OF BUILDING CODE IMPLEMENTATION IN NEPAL

UNCRD in partnership with MOLD, Department of Urban Development and Building Construction (DUDBC)/ Ministry of Physical Planning and Works (MPPW), and National Society for Earthquake Technology –Nepal (NSET) conducted a two–day workshop in Kathmandu on 2-3 August 2007. One of the objectives of the workshop was to find country specific problems in effective implementation of the Nepal National Building Code (NBC). The workshop, attended by senior officials and engineers from the Government of Nepal and municipalities all over the country, underscored the fact that capacity development of local authorities is necessary for effective implementation of the building code. A survey among the participants was conducted which showed that 91 percent of the participants were familiar with the building code before attending the workshop. The survey, however, showed that 53 percent of the attending municipalities do not have building bye-laws for implementation of building code and all of the municipalities expressed their desire to develop building control system in their municipalities. As the second step of the HESI project in Nepal, a training workshop on “Building Code Implementation” was organized on 19-23 May 2008 for engineers /planners/ architects from 25 municipalities all over the country. The workshop was organized by UNCRD in partnership with the DUDBC/ MPPW and NSET. (http://www.hyogo.uncrd.or.jp/hesi/nepal_ws08.htm)

3-1. National Level Training

The main objective of the training program was to prepare a framework for building code implementation in each participating municipality. It was also designed to enable participants to:

- Become familiarized with various requirements of building codes, building regulations, building/planning bye-laws for ensuring safe building construction and proper city development;
- Become familiarized with the building control system (building permit process) to ensure the safe construction of buildings being carried out in several cities of Nepal and other countries and to review such practices by field visits; and
- Guide/facilitate in developing a general broad framework for implementation of the building control system suitable for large, medium, small municipalities of Nepal based on the current and potential institutional arrangements and capacity, and suggest an action plan.

After five days of lectures, field visits and group discussions, the municipalities were asked to draft actions which are most essential in their municipalities to implement the building code. The municipalities were divided according to their size, population and number of constructions per year into large (Group A), medium (Group B) and small (Group C). The municipalities recommended series of actions in 5 different aspects of building code implementation: Design aspect, municipal laws and bye-laws, field inspection and monitoring, quality control and capacity building and awareness raising. They further discussed within the groups and came up with priorities of action for building code implementation in large, medium and small sized municipalities. The recommendation is shown in Table 1.

Table 1: Action priority suggested by Large (Group A), Medium (Group B) and Small (Group C) municipalities in Nepal

Priority	Group A	Group B	Group C
1	Preparation of implementation process guidelines	Training to Municipal technical staff for NBC codes	Initiation for preparing/upgrading municipal laws/by laws, approval from board, council and bringing it to action
2	Training to the technical staffs and consultant overseers	International exposure visit to municipal technical staff	Conducting training workshop for municipal technical staffs, consultants, local contractors, masons about MRT/NBC, field inspection and quality control

Priority	Group A	Group B	Group C
3	Computer based structural designing training to designers	Public meeting on earthquake disaster management and NBC	Dissemination of MRT, building code through school, media and publications
4	Establishment of Monitoring cell Preparation of check list for field inspection	Training to Mason, bar benders, plumbers, electricians, carpenter, shuttering fixer	Publication of guidelines, MRT in simple Nepali language
5	Widening of the scope of MRT	Awareness program from local FM, TV, posters, brochure	Establishment of separate section for building permit with sufficient numbers of technical staffs.
6	Incorporate the code in the housing loan system	Awareness program to school teachers, students, health workers, TLO, Police and others	
7	Trainings to new masons, contractors and technicians	Preparation of checklist for field inspection	
8	Field supervision made compulsory to the public and Class A buildings	Updating of municipal building by-laws	

The priorities are almost similar in the sense that they give first priority to capacity building. However, it is important to note that small sized municipalities focus more on implementation of Mandatory Rules of Thumb (MRT). MRT is developed as a part of the building code which has recommended provisions for small and regular types of buildings. As majority of the constructions in small and medium sized municipalities are of this nature, implementation of MRT alone can improve the safety of new constructions significantly. Even the large municipalities are looking for expansion of scope of MRT so that it encompasses the typical construction types prevalent in large cities.

The conclusions arrived from the two events, problem identification workshop in 2007 and training workshop in 2008, are very important in order to understand the process of building code implementation in developing countries. Some of the general conclusions from the two workshops are summarized below:

(http://www.hyogo.uncrd.or.jp/hesi/nepal_ws.htm)

- Mandatory Rules of Thumb can help much for enhancing seismic safety of buildings in urban Nepal
- Checklist for Class B buildings for capable municipalities, for others support to check design will be provided
- Capacity Building appears to be priority one action required for building code implementation.
- In order to incorporate building permit process in the Building Code existing system can be modified and clearer legal provisions can be devised.
- Political and social acceptability of the urgency to implement BC and the roles of municipal, DUDBC, Engineering Council, Professional associations, academia in its implementation needs to be enhanced.
- Awareness raising programs creates demand and in turn can help channel political will for effective implementation of the code.
- Municipal engineering professionals have pivotal role in developing systems for effective implementation of BC by: 1) Creating Demand and 2) Establishing system for addressing the needs



Picture 1: Nepal National HESI Workshop in 2007

3-2. Framework for municipalities

A training workshop on "Building Code Implementation" was organized on 19-23 May 2008 for engineers/planners/architects from Municipalities all over the country. The workshop is organized by UNCRD in partnership with DUDBC/ Ministry of Physical Planning and Works and NSET. The main objective of the training program is to prepare a framework for building code implementation in each participating municipality. After the completion of the program, the participants are able to:

- Be familiarized with various requirements of building codes, building regulations, building/planning by-laws for ensuring safe building construction and proper city development;
- Be familiarized with building control system (building permit process) to ensure the safe construction of buildings being in practice in few cities of Nepal and other countries and to help review such practices by field visits; and
- Guide/facilitate in developing general broad framework for implementation of building control system (ensuring building code compliance) suitable for large, medium, small municipalities of Nepal based on the current and potential institutional system and capacity; and suggest action plan.

The training program was followed by a half-day National Symposium open to public on Building Codes and Control System and two programs on Training of Trainers and Masons Training. The training was conducted as interactive learning training. Participants were asked to present their framework (proposed or existing) on implementation of NBC. A sample document was sent to the participants in advance for consistent format from all the participants. The framework was discussed with experts' inputs during the training course and participants also benefited from experience of other municipalities like Lalitpur and Kathmandu in building code implementation along with experience of building control system in other countries. Participants were also provided with opportunities to visit Lalitpur municipality and observe the process there. Site visit to few construction sites is also a part of the training program. After the experience of site visit, lectures and information sharing, the participants then discussed in groups about what needs to be addressed immediately for effective implementation of the code. In this way it can be assured that the outcome represents the real ground situation and envisages an achievable target for the municipalities. The revised action plan for each participating municipality was the main outcome of the training.

3-3. Training of trainers (TOT)

It has been realized from long past and has been highlighted also in HESI workshop in Kathmandu (August 2007) that capacity building of technicians and masons is essential for effective implementation of Building Code. As Nepal has just started implementation of building code, there is urgent need of capacity development of masons throughout the country. In order to conduct masons training, engineers and architects have to be developed as trainers. As a pilot project, NSET conducted one Training of Trainers (ToT) and one Masons' Training in Nepal immediately after the Training Workshop starting from May 25, 2008. After completion of the training, NSET submitted training manuals, feedback of participants, review of the training and future action plan to UNCRD. Both the trainings are expected to be taken as pilot cases and shall be continued throughout the country

NSET conducted one Training of Trainers to Engineers/Architects from DUDBC and Municipalities in Nepal. The main objective of the Training of Trainers is to develop trainers capable of disseminating essential engineering know how and earthquake resistant construction technology to masons and local level technicians. A total of 25 technicians were trained as future instructors to conduct Masons' training. The total duration of the training is 5 days. Basics of earthquake-resistant construction and

required skills for training the masons were taught by NSET master instructors to the potential instructors (engineers, architects, junior engineers from DUDBC and municipalities).

The outline of the training program is as follows:

- Target Audience: Potential instructors i.e. engineers, architects, junior engineers
- Duration: 5 days
- No. of participants for a course: 20
- Contents
 - a. Cause and Effects of Earthquakes
 - b. Principles of Earthquake-Resistant Design and Construction
 - c. Considerations for design and construction of masonry houses (including low strength masonry and timber house)
 - d. Considerations for design and construction of RC frame houses
 - e. Repair and Strengthening of existing houses
 - f. Quality control and workmanship
 - g. Social and practical considerations for technology transfer
 - h. Introduction to mason training course, training course for self-builder and contractors
 - i. Exercise on training delivery (presentation)
- Mode of training: Lectures followed by exercises, presentation by participants
- Reference Materials: Participants Handbook, Manual for Mason Training Course
- Standard: passing score = 60% on all exercises and presentations

3-4. Training of masons

NSET conducted one Masons' Training as pilot training program which can be continued in country wide scale by local resources or other resources. The objective of this training is to provide Masons with earthquake resistant construction technology and know how. A total of 25 Masons from the city benefited from this training. The training has to be conducted in coordination with local municipal authorities and process has to be ensured to institutionalize the process. The total duration of training is 5 days.

Graduates of BTT conducted mason training courses under the supervision of NSET master instructors at the beginning and later they should be able to conduct similar trainings independently. Outline of the training is as follows:

- Target Audience: existing skilled construction workers – masons, bar-benders
- Duration: 5 days
- No. of participants for a course: 25
- Contents
 - a. Cause and Effects of Earthquakes
 - b. Earthquake-resistant construction of masonry houses (including low strength masonry and timber house)
 - c. Earthquake-resistant construction of RC frame houses
 - d. Repair and Strengthening of existing houses
 - e. Quality control and workmanship
 - f. Social and practical considerations for technology transfer
- Mode of training: Lectures followed by hands-on exercises of model construction
- Reference Materials: simple reading materials to participants (leaflet, handbook)

4. ABCD'S APPROACH

UNCRD held an expert meeting on Anti-seismic Building Code Dissemination (ABCD) project for Housing Earthquake Safety Initiative (HESI) in Kobe in January 2007. The representatives from India, Indonesia, Japan, Nepal and Peru joined it. The following are the key points raised at the meeting:

- Role of the private sector in building code implementation should be explored including the private sector in building permit process might make the process more efficient. Peer review can be useful if there aren't sufficient municipal engineers to examine all buildings.
- It is required to establish a strategy in order to enforce building code to existing buildings and not only to new constructions in developing and developed countries.
- There is a need for training and capacity development, including the strengthening of existing training institutions towards safer non-engineered housing.
- Guidelines will 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. They have to be readily understandable for people with no technical background.
- There is an immense need for awareness raising how to educate communities and technicians about the importance of making safer houses. Information hasn't tricked down to communities and individual house owners. Community-based activities are the key.
- There is an issue of setting policy priorities, governments tend to devote more resources for primary health, basic education and infrastructure development and pay little attention to earthquake resistance of non-engineered houses

During the ABCD/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. Disseminating building code is an effective tool to safeguard houses from earthquake disaster. The most important task for UNCRD is to define the process of disseminating building code effectively in each target country. To that end, community-based activities and engaging officials and experts in the target countries are essential for the successful enforcement.

5. INDONESIAN CASE



Fig. 6 Proposed measures to disseminate Indonesian building codes



6. CONCLUSIONS

The results and future direction of the HESI project are as follows; in case of Nepal, institutionalization of building code enforcement is expected to result in better coordination between the MPPW and municipalities that are responsible for code implementation. Institutionalization means more periodic and vigorous training activities for municipal engineers, which will have a direct impact on the effectiveness of building code implementation. The final results of HESI will be disseminated during in 2008 and 2009 through various international events including the next Global Platform.

The results and future direction of the HESI project are as follows; in case of Nepal, institutionalization of building code enforcement is expected to result in better coordination between the MPPW and municipalities that are responsible for code implementation. Institutionalization means more periodic and vigorous training activities for municipal engineers, which will have a direct impact on the effectiveness of building code implementation. The Executive Officer of Katmandu Metropolitan City committed to establish a new section for building code enforcement in the near future. Learning from public dissemination initiatives by other municipalities is expected to increase similar activities nationwide. In case of Peru, HESI is expected to contribute to safer housing involving a wide range of stakeholders in the presence of increased awareness of the need to make houses earthquake resistant following major earthquakes of 8 October 2005 in Pakistan, 27 May 2006 in Java of Indonesia, 15 August 2007 in Peru and 12 May 2008 in China. The final results of HESI will be disseminated during in 2008 and 2009 through various international events including the next Global Platform for Disaster Risk Reduction (GP/DRR) in 2009.

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