GeoHazards International

Kathmandu Initiative

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Kathmandu Action Plan and Initiative

Implemented by:

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Summary

The Kathmandu Valley project had four main objectives:

1. evaluate Kathmandu Valley's earthquake risk and prescribe an action plan for managing that risk;
2. reduce earthquake vulnerability in public schools;
3. raise awareness about the Kathmandu Valley's earthquake risk among the public, government officials, international community resident in the Kathmandu Valley, and international organizations; and
4. build local institutions that can sustain the work launched in this project.

Like many urban areas in developing countries, Kathmandu Valley's risk has increased significantly since the last major earthquake. The Valley has a burgeoning population of almost 1.5 million people, uncontrolled development, and a construction practice that has actually degraded over this century. Nepal is among the poorest and least developed countries in the world with a per capita GDP of US$ 145. Approximately 14% of the GDP (US$ 400 million) is derived from foreign development aid. A weak economy and abundant poverty result in a lack of government funds to support earthquake hazard mitigation programs (including ratification of a building code), inexpensive and poorly constructed dwellings that often fail even in the absence of earthquakes, and a tendency in the general population to ignore the earthquake hazard because of more immediate needs. The Kathmandu Valley has an urban growth rate of 6.5% and one of the highest urban densities in the world.

Currently, Nepal has no official building code and nearly all construction is built without the input of an engineer and without seismic force consideration. The technical information about earthquake risk in the Kathmandu Valley is incomplete and scattered among several governmental agencies. However, a more important contributor to the region's lack of earthquake preparedness is that the synthesized and available technical information has not been applied to the infrastructure of the modern day Kathmandu Valley and has not been presented in a form comprehensible to the public and government officials.

It is clear that a large earthquake near the Kathmandu Valley today would cause significantly greater human loss, physical damage, and economic crisis than in past earthquakes. The Kathmandu Valley Earthquake Risk Management Project aimed to improve this situation and start a process towards managing the earthquake risk in the Valley.

Nepal and Earthquakes

Nepal is located within the Himalayan mountain range, a product of the continental collision of the Eurasian and Indian plates, initiated about 40-55 million years ago. The collision was followed by subduction of the Indian plate underneath Tibet, which continues today at an estimated rate of about 3 cm per year. The subduction results in tectonic stresses along the Himalayan Frontal Fault System (HFF), the Main Boundary Thrust Fault System (MBT), the Main Central Thrust Fault System (MCT), and the Indus Suture Zone (ISZ), all parallel to the Himalayan arc. Numerous earthquakes have occurred in this region, including four major earthquakes of magnitude greater than M8 within the last 100 years (Seeber et al., 1981; Molnar, 1984; and Chandra, 1992). Table 1 shows the frequency of earthquakes instrumentally recorded since 1911 within 150 km of Nepal's border.

In this century alone, over 11,000 people have lost their lives due to earthquakes in Nepal. The 1934 AD Bihar-Nepal Earthquake produced strong shaking in the Kathmandu Valley, Nepal's political, economic and cultural capital, destroying 20 percent and damaging 40 percent of the Valley's building stock. In Kathmandu itself, one quarter of all homes was destroyed along with several historic sites. This earthquake was not an isolated event. Three earthquakes of similar size occurred in the Kathmandu Valley in the 19th Century: in 1810, 1833, and 1866 AD. The seismic record of the region, which extends back to 1255 AD, suggests that earthquakes of this size occur approximately every 75 years, indicating that a devastating earthquake is inevitable in the long term.

Institution Building

An important part of this project was to institutionalize the earthquake risk management processes started during its course. Continuation of these processes is a key component to reducing the Kathmandu Valley's earthquake risk. The project's institutionalization efforts have focused on two areas: first, establishing NSET-Nepal as a neutral seismic safety advocate for the country; second, to incorporate earthquake and other disaster risk management activities into local government.

The project has given NSET-Nepal an opportunity to establish an office, train its staff, gain experience in earthquake risk management, and develop a positive reputation through its actions. It has also provided an opportunity, through the development of the Earthquake Risk Management Action Plan Initiatives and other activities, for NSET-Nepal to plan its long-term strategy in tackling the Kathmandu Valley's earthquake risk.

Progress has been made in establishing local government earthquake risk management institutions as well. The Kathmandu Metropolis created a Disaster Management Unit as part of the city government, which has been included in project activities and was trained in organizing disaster management activities by a KVERMP consultant. Other municipalities in the Valley have also considered establishing Disaster Management Units and are working with NSET-Nepal to get the process started. NSET-Nepal

has also been active in educating ward-level officials (a ward is a subset of a municipality, the legal equivalent of a neighborhood), and at this time two wards have created their own Disaster Management Committees comprised of neighborhood residents and community-based organizations.

NSET Description

The National Society for Earthquake Technology - Nepal (NSET) is a multidisciplinary professional society whose main goal is to promote awareness of earthquake risk and implementation of seismic risk reduction projects in Nepal. NSET is a non-governmental, not for profit organization located in Kathmandu whose members come from various professional fields. Its activities include working with Kathmandu's key facilities managers to Strengthen the City Infrastructure and to create an Earthquake Action Plan, conducting public events such as the January 1998 Earthquake Awareness Day and increasing the Safety of Public Schools in the Valley. NSET is a national member of the International Association of Earthquake Engineering and has developed close working relationships with several international professional and academic institutions in order to better achieve its goals.

GeoHazards International helped NSET to establish its office and works closely with the organization, providing support and training on many of NSET's projects. USAID provides funding for much of the project, and funding is managed by ADPC/AUDMP. NSET is also working to implement the RADIUS project in the Kathmandu Valley in association with the United Nations International Decade for Natural Disaster Reduction (UN-IDNDR). The project examines seismic risk in over 70 cities worldwide. In addition, NSET's work has been used as a model by the RADIUS project for in-depth case studies in nine cities around the world. NSET is a member of the Nepal National Committee for the IDNDR and has worked actively with numerous national and local government institutions. NSET's national and international relationships are an important resource in its ability to develop and implement this plan.

Schools Overview

The project included a vulnerability assessment of the Kathmandu Valley's public schools to serve as an example of how to conduct earthquake risk mitigation projects in Nepal. The purpose of this assessment is not to identify the vulnerability of individual schools, but to quantify the risk faced by the entire system. First, the project team created a questionnaire to be filled out by school headmasters. The survey was comprised of questions that included school building size, density of student population, year(s) of construction, etc. Additionally, simple questions were asked about structural characteristics presented through illustrations and descriptions. The project conducted 16 seminars to teach school masters from 65% of the 645 schools in the Valley about earthquake risk and the necessity of planning for earthquake disasters in their schools. It also gave them guidelines to help them complete the questionnaire. Subsequently, the survey was conducted by the headmasters and data on 430 schools were returned to the project.

Following completion of the surveys by the headmasters, engineers visited approximately 20% of all the schools in the survey sample to assess reliability of the data collected and complete any unfinished portions of the survey. Investigations into potential methods for and costs of retrofitting these existing

buildings were made. Since 1999, several schools have been retrofitted as a result of these measures, including Bhuwaneshwori, Kaavresthal, Nateshowri and Himalaya Primary School.

Scenario Overview

A simple loss estimation study was conducted for a repeat of the 1934 earthquake in the modern day Kathmandu Valley. The location and vulnerability of the Kathmandu Valley's infrastructure was determined through interviews with approximately 30 institutions. The information collected in these interviews was combined with previously conducted studies, then a loss estimation study was conducted using simple, order-of-magnitude methods. Loss estimates were conducted for the road, water, electricity and telephone systems and for typicial structures. In addition, possible death and injury figures were determined by looking at statistics from previous comparable earthquakes from around the world.

The Earthquake Scenario

A scenario document that explains the results of the earthquake loss estimation study in layman's terms has been written and published in English and Nepali languages (NSET-1, 1999). This document includes a description of possible damages to various vital systems in Kathmandu and an explanation of the repercussions of this damage on life in the Kathmandu Valley. It also presents the story of one common man, Bhaicha, for an entire year after the scenario earthquake, illustrating how this character's life is impacted. This document is being widely distributed along with information on earthquake preparation methods and means of obtaining additional earthquake safety information. It is expected that this document will provide emotional understanding of the earthquake phenomenon to complement the technical information included in the loss estimation study.

Loss Estimation of the Bihar-Nepal Earthquake

The 1934 Bihar-Nepal earthquake produced shaking of intensity X, IX and VIII (Modified Mercalli Intensity scale) within the Kathmandu Valley. It is believed that this shaking was primarily due to amplification of the local soil, lacustrine sediments several hundred meters thick. Therefore, a similar distribution of shaking can be expected from all major, distant earthquakes affecting the Valley. In addition, there is a high probability of liquefication in many of the Valley's urban areas, particularly near rivers.

A brief summary of the loss estimates for a possible repeat of the 1934 level of shaking follows:

- As many as 60 percent of all buildings in the Kathmandu Valley are likely to experience heavy damage, many beyond repair.
- Almost half of the bridges in the Valley could be impassible, and ten percent of all paved roads will have moderate damage, such as deep cracks or subsidence. The country's only international airport may be inaccessible. The prevalence of extremely narrow roads, which could easily be blocked by debris, will exacerbate the problem.

- Approximately 90 percent of water pipes and 50 percent of other water system components (pumping stations, treatment plants, etc.) could be seriously damaged. Almost all telephone exchange buildings and 60 percent of telephone lines are likely to be damaged, requiring significant to moderate repair to operate. Approximately 40 percent of electric lines and all electric substations are likely to be damaged.
- Simply applying the percentage of the population killed or injured in the 1934 earthquake to the population of the Valley today results in an estimate of 22,000 deaths and 25,000 injuries requiring hospitalization. Applying more recent earthquake casualty figures from cities comparable to the Kathmandu Valley results in an estimate of 40,000 deaths and 95,000 injuries in the Kathmandu Valley's next major earthquake.

Action Plan

As a response to the extreme risk identified in the Kathmandu Valley, the project worked with over 80 government and non-government institutions to develop a plan (NSET-2, 1999) to systematically reduce the risk over time. The Prime Minister of Nepal officially released and endorsed this plan in January, 1999 at the Earthquake Safety Day.

The purpose of the plan is to assist His Majesty's Government of Nepal, concerned agencies and the municipalities of the Kathmandu Valley to reduce the region's earthquake risk over time by coordinating and focusing risk management activities. The specific objectives that this plan will focus on in order to achieve that purpose are: improving emergency response planning and capability, improving awareness of issues relating to earthquake risk, integrating seismic resistance into new construction processes, improving safety in school buildings, improving the seismic performance of existing structures, improving the seismic performance of utility and transportation systems, increasing experts' knowledge of the earthquake phenomenon, vulnerability, consequences and mitigation techniques, and preparing for long-term community recovery following damaging earthquakes.

Ten specific intiatives were defined as urgent for implementation in the next two years. NSET will actively aid and promote the implementation of the following objectives:

- NSET will request HMG/N Government to (1) constitute the National Disaster Management Council headed by the Prime Minister; and (2) direct the NDMC to define an integrated national disaster management system.
- Once constituted, the National Disaster Management Council should (1) provide guidance for the preparation of new (or revision of existing) integrated emergency response plans and (2) direct those organizations to prepare plans.
- NSET will work with the Ministry of Science and Technology to develop a comprehensive program to raise awareness about earthquake risk and mitigation options.

- NSET will work with the municipalities and districts in the Valley to create Disaster Management Committees and design a program of activites, including public awareness programs, for these committees.
- The Ministry of Housing and Physical Planning, per NSET's request, will constitute the Building Council and direct it to draft the rulse and procedures for implementing and enforcing the building code, formally adopting requirements to implement and enforce the code.
- NSET will work with the Ministry of Housing and Physical Planning and others to prepare training materials and provide training for building inspectors, masons and engineers on applied aspects of design and construction of buildings to conform to the Building Code.
- NSET will manage and coordinate the "School Earthquake Safety Project," which will (1) inform selected communities about the vulerability of their schools and what can be done to reduce the risk; (2) prepare school-specific plans for improvements in seismic safety; and (3) mobilize support to improve the safety of the school buildings. Non-structural hazards and mitigation methods will be explained through informational products produced by NSET.
- NSET will encourage the Nepal Telecommunicatios Corporation to assess the vulnerability of its system to earthquakes, identify the most vulnerable elements, and develop a program to improve its performance after earthquakes.
- NSET will encourage engineering institutes to develop and offer short courses for practicing engineers on earthquake engineering principles and procedures.