GUIDELINES FOR THE IMPLEMENTATION OF EARTHQUAKE RISK MANAGEMENT PROJECTS

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ACKNOWLEDGMENTS

The methodology for the implementation of risk management projects described in these Guidelines was developed by GeoHazards International (GHI) in the last decade, and implemented, we think successfully, in several cities in developing countries around the world. Many people collaborated in the development and application of this methodology. GHI is especially indebted to the many people of the cities where the methodology has been utilized. They have helped us to adapt techniques, that in many cases were developed for industrialized countries, to local conditions. Most importantly, they have helped us to understand and respect local values and priorities. Without that understanding and that respect, any initiative would become just another academic or theoretical exercise.

We would like to thank the body of advisors to GHI. They are a group of world-renowned experts in various disciplines who have generously contributed their time and advice to help GHI's projects be effective and useful in collaborating with vulnerable communities around the world to improve their preparedness for natural disasters. The input of GHI's advisors is reflected in the methodology presented in this document.

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PART I: INTRODUCTION

Background

The RADIUS project was launched by the IDNDR Secretariat to promote worldwide activities for reduction of seismic disasters in urban areas, particularly in developing countries. One of the main objectives of the project was to develop practical tools for urban risk management. One of these tools is a set of Guidelines for the implementation of risk management projects that describes the methodology employed by the RADIUS initiative. The Guidelines include the lessons learned during the implementation of case-study projects in nine cities selected worldwide.

The 18-month long case studies were implemented following the methodology developed by GeoHazards International (GHI) for risk management projects in developing countries. This methodology has been developed and applied by GHI through actual projects in such cities as Quito, Ecuador, and Kathmandu, Nepal.

Purpose of the Guidelines

The Guidelines for the implementation of RADIUS-type risk management projects should be used to:

- Explain the philosophy and methodology adopted by the RADIUS risk management projects
- Assist in the reading, understanding, and interpretation of the reports prepared for the case-study projects
- Provide general guidelines on how RADIUS-type risk management projects could be implemented in other cities

Philosophy behind RADIUS risk management projects

The process of managing the earthquake risk of a city includes three stages: evaluation, planning, and implementation in order to be realistic and effective. The evaluation stage involves understanding the underlying problem and its magnitude. The planning stage delineates, based on the problem's evaluation, the actions that need to be taken to solve it. Finally, the implementation stage realizes the proposed actions. Although the three stages are all crucial within the problem-solving process, it is clear that the implementation stage is most important because anything accomplished in the first two stages depends on the third in order to be carried out.

The implementation of the risk management process (and its stages) requires the participation of members of a community. For risk management purposes, the members of a community can be divided into three groups: the technical community (geologists, seismologists, engineers), the authorities (local government, leaders), and the rest of the community. Figure 1 tries to schematically explain the ideal level of participation of each of these groups in each of the stages of the earthquake risk management process. The size of the circles represents the relative level of participation of a given group at a certain stage of the process.

While the technical community plays a vital role in the evaluation process (which is, basically, the main activity of this sector of the community), technical people generally have a much less important role in the planning stage, where social, economic and political issues are the factors that usually decide the policies and measures to be adopted. Furthermore, the participation of the technical community is almost zero in the

implementation stage since financial, legal, political and social aspects usually guide the implementation processes.

The role of local authorities in the city's activities is clearly important. During the evaluation stage, authorities usually provide funding and the necessary information for the technical people to carry out the assessment. However, the role of the authorities is especially important during the planning stage, when authorities coordinate the risk management plans with all the other plans and policies of the city, and during the implementation process, when authorities provide the legal, political, and financial frameworks for the realization of the plans that have been prepared for the city.

The role of the community is also crucial in the effective implementation of any city programme or activity. Demands put forth by the community aid in applying the necessary pressure on authorities to take required actions, and the active collaboration and involvement of the community are a must for the success of any initiative that has a direct impact on the lives of all the members of the society. The role of the community is especially important during the implementation stage of the risk management process, when the support and collaboration of the people will allow the establishment of long-term efforts to put into practice the plans and programmes developed to reduce the urban risk. Most importantly, the active involvement of the community will stop, or at least reduce, the creation of new risk due to poor decisions made by an ill-informed community (informal construction, ignorance of building and land use regulations, lack of emergency response preparedness, etc.).

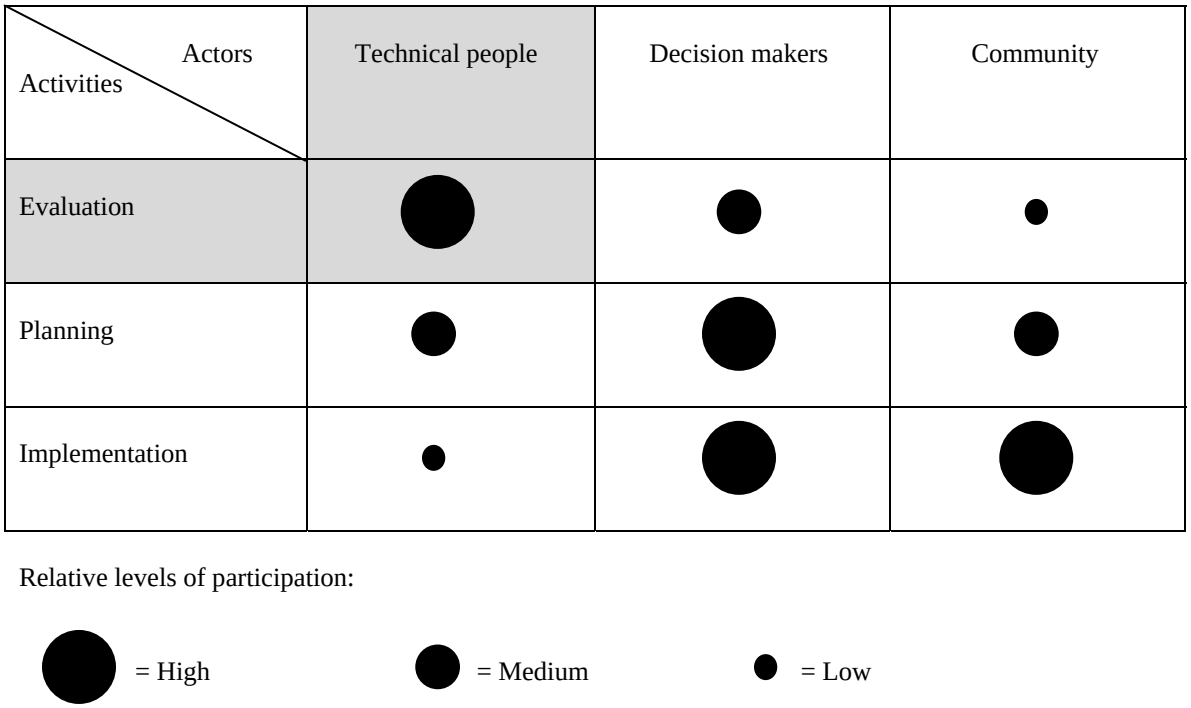

Figure 1. Ideal relative levels of participation of different groups of the community in seismic risk management.

Unfortunately, a large majority of the earthquake risk-related activities in most of the world's communities have focused on the evaluation of the risk (in many cases, on the hazard only) carried out by the technical community, as shown by the shaded area in figure 1. Most of the efforts and resources have been used in studies to produce reports, maps, papers and conferences that have not been utilized by the whole community. Very few concrete actions have resulted from those studies, and there has been almost no progress in the incorporation of the community in the risk-reduction process. There is a general and wrong perception in the community that earthquakes (and other natural disasters) are "technical" problems that

have to be dealt with by technical people. In the meantime, earthquake risk has been increasingly steadily, especially in the communities of so-called "developing" countries.

Based on these considerations, the methodology described by these Guidelines has the main objectives of raising awareness in the community of the seismic risk and the actions that could be taken to manage it, and of incorporating all the members of the community in the risk management process. The final goal is to establish long-term, sustainable initiatives to manage the earthquake risk of a city. By adopting this methodology, RADIUS practised this philosophy in the case-studies that were implemented in nine cities worldwide.

The methodology adopted by RADIUS

Urban seismic risk is steadily increasing worldwide, especially in developing countries. There are many reasons for this increase, among which are the urbanization process that is taking place worldwide, the lack of planning and resources of the cities to accommodate this very fast urban growth, the lack of appropriate building and land-use codes or the lack of mechanisms to enforce them, and, most importantly, the lack of awareness of the community and its leaders. This lack of awareness has kept members and institutions of the community from participating in or supporting risk management initiatives. In most cases, due to the lack of awareness and information, members of the society contribute to the increase of the risk by making uninformed decisions.

Most of the existing risk management techniques and methodologies have been developed in industrialized countries and, as such, cannot be transferred directly to developing countries. There must be an adaptation process of the existing methodologies to the conditions found in countries and cities of the so-called "third world." For this adaptation process to be successful, there must be an active involvement and participation of the local people, those who know most about the local social, economic, political and cultural conditions.

Another characteristic of risk management efforts implemented so far, both in developed and developing countries, is that they have put emphasis in preparing very accurate estimates of the potential losses and effects that a natural disaster could cause in a city. However, there have been only few examples in which the results of these studies have been actually utilized by the leaders and members of the community to reduce their risk. Most studies are not even known about by members of the community that could benefit from them. Due to this lack of familiarity with on-going or past studies, there are many instances in which efforts have been duplicated and resources have been spent without producing any tangible improvement.

With all of these considerations in mind, GeoHazards International (GHI), a non-profit organization dedicated to the reduction of the deaths and suffering caused by natural disasters in vulnerable communities in the world, has developed a methodology for the implementation of risk management projects in developing countries. Among the main characteristics of this methodology, the following can be highlighted:

- Optimization of the time and resources necessary to prepare damage estimates and realistic risk management plans
- Production of sound damage estimates that identify only the main, not all, factors that contribute to the earthquake risk of a city
- Best possible use of already existing information, as well as of the local scientists' expertise and their familiarity with the region
- Incorporation of representatives of the various sectors of the society throughout the project
- Set up of the conditions that will allow the immediate start of the implementation of the prepared risk management plans

GeoHazards International has applied this methodology to actual risk management projects implemented in cities like Quito, the capital of Ecuador (GeoHazards International, 1994); and Kathmandu, the capital of

Nepal (GeoHazards International, NSET; 1998 and 1999). The Guidelines presented in this document describe this methodology and how to use it to implement risk management projects in cities in developing countries.

Contents and organization of these guidelines

This document is divided into three main parts:

Part I: Introduction presents the basic concepts and philosophy behind the risk management projects that may be implemented by following these Guidelines. The methodology that was adopted by RADIUS, as well as the history of the development of the methodology, are also presented in Part I. A description of the contents of these Guidelines is presented to facilitate their understanding and use by readers.

Part II: Guidelines presents a detailed explanation of each one of the activities that should to be carried out to implement risk management projects following the methodology adopted by RADIUS. The methodology includes the phases of project preparation, earthquake risk assessment, planning, and setting up of the conditions for the implementation of the plans prepared by the project. The Guidelines describe each of the activities included in the above-mentioned phases presenting, for each activity, the following information:

- *Objectives:* A description of the objectives to be achieved by the implementation of the activity
- *Required information:* A detailed list of all the information that has to be prepared before the activity can be started
- *Process:* A description of the various steps to be followed for the implementation of the activity
- *Intermediate products:* A description of the products that result from the implementation of the activity and that, although not the final products expected from the activity, can be utilized in other activities of the project implementation
- *Participants:* A list of all the participants who need to be involved in the activity in order to ensure its successful implementation
- *Products:* A description of the final products that the activity is expected to furnish
- *Examples:* A presentation of real life examples of how the activity has been carried out within a risk management project previously implemented by a RADIUS city or within another city where this methodology has been applied
- *Observations:* A presentation of general recommendations, comments, and remarks

Part III: Annexes present examples of final products of risk management projects which were implemented using the methodology described in these Guidelines. A complete earthquake scenario and an action plan are presented. Both the scenario and the plan are examples of actual results produced in cities where this methodology has already been applied. These examples are expected to provide potential users of these Guidelines with a clear idea of what a risk management project could produce for their cities. Additionally, examples of publications, press articles, and pamphlets that have been prepared in different cities to inform the community about the results and achievements of the project are also included.

PART II: GUIDELINES

Objectives of risk management projects

A RADIUS-type risk management project is designed with the specific objective of initiating long-term risk management processes in the cities where the project is implemented. For that purpose, the risk management project should have three main tasks:

- Assess the city's seismic risk and develop an earthquake scenario that describes the effects of a probable earthquake on the city
- Prepare an action plan describing activities that, if implemented, would reduce the city's seismic risk. The action plan is prepared based on the results of the risk assessment
- Set up the conditions that will facilitate the institutionalization of risk management activities in the city

In order to produce realistic results and raise awareness of the community on the seismic risk, representatives of the various sectors of the society must be actively involved throughout the project. Additionally, through coordinated work with the local mass media, the general public must be consistently informed about the progress of the activities and the project's achievements.

DESCRIPTION OF THE METHODOLOGY

Reducing urban earthquake risk should follow three stages: evaluation, planning, and implementation. In the evaluation stage, the earthquake risk of a city is assessed and the factors that contribute to it are identified. For the evaluation to be useful, it must have certain characteristics. First, the evaluation must be realistic by reflecting the local conditions. A very elaborate evaluation that lacks the characteristics of the city itself will not be of much use. Second, the evaluation must be comprehensive by including all the factors that contribute to the city's earthquake risk. An oversimplified or incomplete evaluation will not produce meaningful results either.

The planning stage involves formulating effective alternatives or solutions presented as an action plan. An effective action plan must be feasible, reflect priorities, and be accepted by the community. In order to be feasible, the action plan should properly consider the local economic, social, and cultural realities. In setting priorities, the action plan must reflect results of cost/benefit analyses since there are very limited resources to meet the high needs and demands characteristic of urban areas that have grown very rapidly with very little or no consideration of the risk in their urban planning. Additionally, in order for the action plan to be accepted by the community, representatives of all the sectors of the society should be actively involved in its preparation.

The last stage, the implementation process, applies the results of the evaluation and planning processes. To be effective, however, the implementation process must have long-term continuity, and have the support and involvement of the community. Risk management efforts must be institutionalized, that is, financial, legal, political, and cultural conditions need to be created that will ensure the continuity of the work.

The risk management projects described by these Guidelines are designed to be implemented in 18 months and to be carried out in two phases. The first one, the evaluation phase, is comprised of the seismic risk assessment for the city. In this phase, an earthquake scenario is constructed and agreed on. This is done through the collection of existing data and the estimation of the potential damage caused by a hypothetical earthquake. The second phase is that of planning. In this phase, an action plan is constructed that, if implemented, will reduce the earthquake risk of the city. The action plan is prepared using the results of the risk assessment phase.

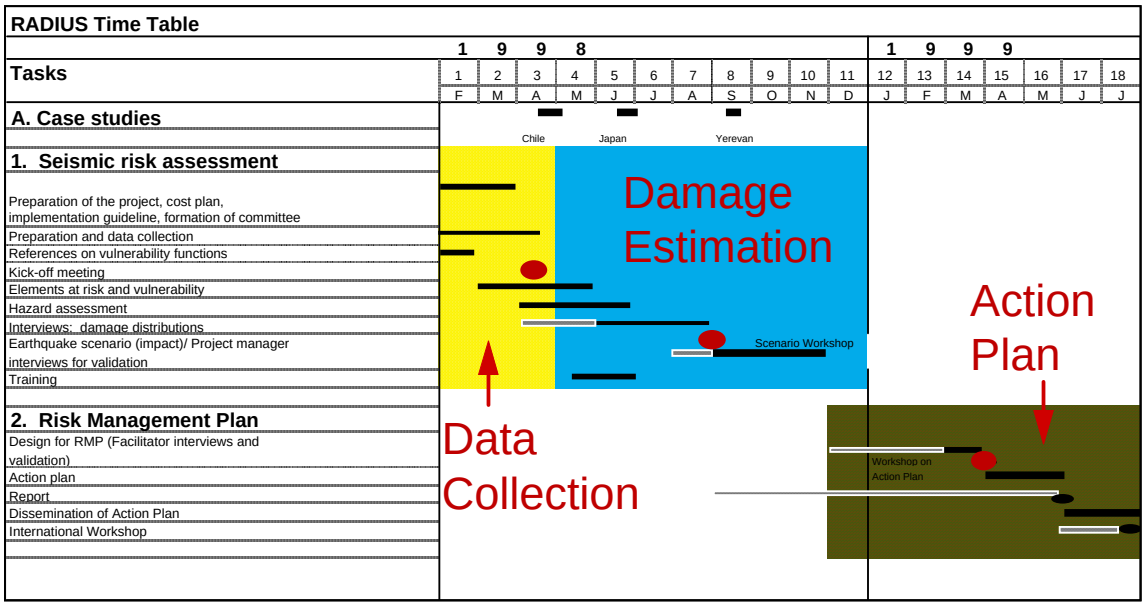

Figure 2. Programme of activities for an earthquake risk management project.

A detailed program of activities for an earthquake risk management project is presented in figure 2. This figure shows that the main activities included in the implementation of the project are collection of existing data, estimation of the potential damage, and preparation of the action plan. Since the involvement and active participation of the community is crucial to the project's success, the programme of activities includes meetings throughout the project (represented by the big dots) in which key representatives of the community are first informed about the advances of the project and then asked to provide feedback.

These Guidelines present a detailed explanation of each one of the activities included in the methodology described above. These activities are grouped into four project phases:

- Project preparation
- Earthquake risk assessment
- Planning
- Preparation of the plan implementation

The Guidelines provide the following information for each activity included in the above-mentioned phases:

- *Objectives:* A description of the objectives to be achieved by the implementation of the activity
- *Required information:* A detailed list of all the information that has to be prepared before the activity can be started
- *Process:* A description of the various steps to be followed for the implementation of the activity
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- *Observations:* A presentation of general recommendations, comments, and remarks

PHASE I: PROJECT PREPARATION

PROJECT SET UP

1. Objectives

The objectives of the set up of the project are to:

- Establish the project by agreeing on scope, schedule, costs, and funding sources

In order to decide what can realistically be achieved through the project, it is important to identify, at the very beginning, what has been done so far to manage the city's seismic risk, what information is available, and what resources can be counted on. The institutions and persons that need to be involved have to be identified and incorporated in the project's preparation. Realistic schedules and cost plans have to be developed and agreed on. Potential funding sources have to be identified and approached in order to obtain their involvement.

While the situation may change from city to city, it is recommended that the project be led jointly by the city authorities and a locally respected technical institution. While the latter provides the technical knowledge required to carry out the project, the representatives of the local government provide the political and institutional support needed for the successful completion of the work.

2. Required information

- Knowledge of previous efforts
- Knowledge of institutional capability and interest
- Identification of key people and institutions
- Knowledge of available funds, legal procedures

3. Process

- Review reports on similar efforts carried out by other cities around the world and adopt what seems appropriate to the local conditions
- Local authorities and technical institution should agree on project specifications
- Local authorities should nominate individuals to participate as members of the Steering Committee
- The Steering Committee should be in charge of setting up the project
- Establish a local advisory committee consisting of representatives from the various sectors of the community. This committee provides the project with overall guidance and advice on long-term project planning. It also provides links with local and international agencies and businesses concerned with managing earthquake risk.

4. Intermediate products

5. Participants

- Representatives of local government
- Representatives of a local, respected technical institution
- International advisers, if necessary and possible

6. Products

- Cost plan
- Schedule

- Steering Committee
- Administrative procedures that are clear and accepted by all the people involved
- Legal contracts among coordinating institutions
- Established local advisory committee
- Sufficient funding

7. Observations

- International advisers and a professional journalist may be useful to the project. A journalist could help keep the local community informed.
- The Steering Committee must be representative of the entire community, it should maintain a balance of technical, social and political interests among its members

8. Examples

Example of a Steering Committee

STEERING COMMITTEE OF THE RADIUS-GUAYAQUIL RISK MANAGEMENT PROJECT

NAME	RESPONSIBILITY	ADDRESS
Dr. Carlos Villacís	International Co-Director of RADIUS	GeoHazards International
Mr. Guillermo Arguello	Local Co-Director of RADIUS, and Director of the Office of Urban Development Plan of the Municipality of Guayaquil (DPLAN-G)	Municipality of Guayaquil
Dr. Rosalba Medina	Technical Adviser of Habitat-UN. For Project ECU-94-005: "Support to Municipio of Guayaquil".	Municipality of Guayaquil
Mr. Walter Mera	Dean of the School of Engineering of Universidad Católica de Santiago de Guayaquil and member of RADIUS project	Faculty of Engineering - Universidad Católica de Guayaquil
Ms. Gloria Gallardo	Director of Civic Promotion, Press and Publicity of Municipio of Guayaquil	Municipality of Guayaquil
Mr. Pedro Triviño	Director of Computer Systems Department of Municipio of Guayaquil	Municipality of Guayaquil
Mr. José Navarrete	Staff Member, Office of Urban Development Plan of the Municipality of Guayaquil (DPLAN-G) and member of RADIUS project	Municipality of Guayaquil
Ms. Mara Vieira	Staff member, Office of Urban Development Plan of the Municipality of Guayaquil (DPLAN-G) and member of RADIUS project	Municipality of Guayaquil
Ms. Nastenka Calle	Staff member, Office of Environment and member of RADIUS project	Municipality of Guayaquil
Mr. Jaime Argudo	Director of the Research and Development Institute of the School of Engineering (IIFIUC) and Scientist Responsible of RADIUS project	Faculty of Engineering- Universidad Católica de Guayaquil

Example of a cost plan

PROJECTED LOCAL BUDGET: RADIUS-TIJUANA FULL CASE STUDY
Management (for 22 months, in US dollars)

	Municipality	RADIUS	Total municipality	Total RADIUS	GRAND TOTAL
Personnel costs					
Coordinator	22 000				
Technical coordinator	22 000				
Social writer	5 000				
Interviewer	5 000				
GIS operator	15 400				
			69 400		
Seismologist		8 000			
Assistant		4 000			
Seismologist		8 000			
Assistant		4 000			
Geologist		4 000			
Geotechnical Engineer		4 000			
Facilitator		3 000			
				35 000	
Operational costs					
Communications	2 000				
Materials	4 000				
Gasoline	5 000				
Others	2 000				
			13,000		
Communications		2 000			
Materials		2 000			
Gasoline		1 000			
Others		1 000			
				6 000	
Equipment					
3 Personal Computers	8 000				
1 Vehicle (existent)					
Data Back-up	2 000				
2 printers	4 000				
1 Lap-Top	3 000				
			17 000		
GIS tools		9 000			
				9 000	
Advisory Committee Meetings (2)	4 000				
Project Kick-Off Meeting	3 000				
			7 000		
			106 400	**50 000**	
GRAND TOTAL					**156 400**

PHASE II: EARTHQUAKE RISK ASSESSMENT

The estimation of the potential damage of an adopted hypothetical earthquake is carried out in two steps: theoretical and non-theoretical. The theoretical estimation is performed by combining the seismic intensity distribution that is estimated for the adopted earthquake with the inventory of the structures and infrastructure of the city. This combination is performed using vulnerability functions (See figure 3) that are developed to reflect the seismic behaviour of the structures and infrastructure found in the city.

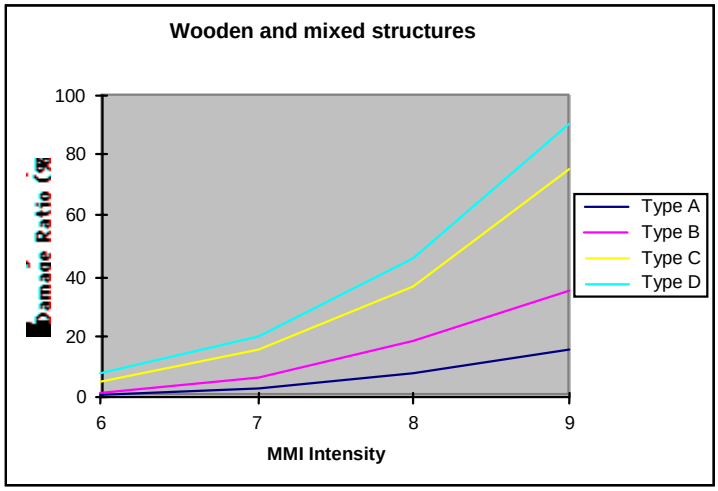


Figure 3. Example of vulnerability functions for the estimation of building damage.

The non-theoretical estimation is performed through a series of interviews (See figure 4) with the people in charge of the systems and services of the city. The information collected in these interviews allowed for the actual characteristics of the city systems to be included in the damage estimation.

The results of the damage estimation are used to prepare a preliminary earthquake scenario that is presented and discussed by representatives of the various sectors of the community during the scenario workshop (See figure 5). The information produced in the workshop is then used to prepare the final version of the Earthquake Scenario that is published and distributed to the community.

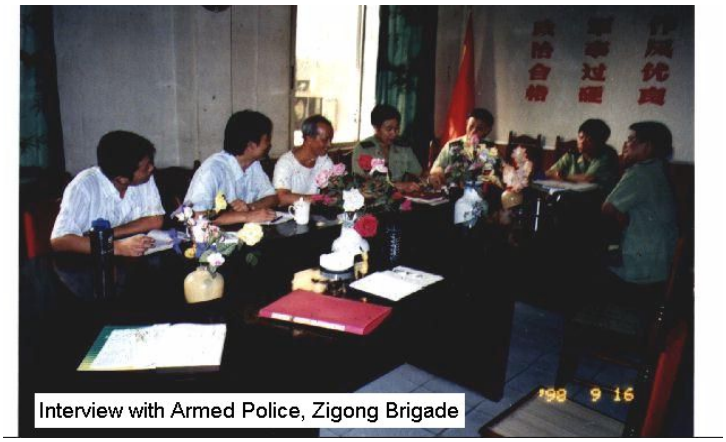


Figure 4. Example of an interview with people in charge of city services.

Figure 5. Some of the participants in the scenario workshop in Guayaquil.

The earthquake risk assessment process includes the following activities:

- Preparation and collection of data
- Kick-off meeting to officially introduce the project to the community
- Hazard assessment
- Vulnerability assessment
- Damage estimation (theoretical)
- Damage estimation (non-theoretical)
- Preparation of the earthquake scenario
- Implementation of the scenario workshop
- Publication and dissemination of the earthquake scenario

PREPARATION AND COLLECTION OF DATA

1. Objectives

The objectives of the preparation and collection of data are first to identify the information required to carry out the assessment as well as possible sources that could supply this information. Local institutions or universities, for example, may be considered and the information that is found to be already in existence should be identified. Once identified, this information should be collected and any missing information should be obtained through additional studies or alternate sources. As the necessary information is collected, it should be analyzed, classified and prepared in a systematic and uniform format in order to facilitate its use in the project. Finally, any necessary agreements between institutions should be negotiated and signed to allow for efficient exchange of information.

Necessary data for damage estimation

1. Intensity distribution
2. City limit or boundary
3. Existing soil types
4. Population density
5. Lifeline information

Water System Network
- map and location of main network
- material of pipes and joints
- location of wells, stations, treatment plants
- areas serviced by lines

Electricity System Network
- map and location of stations and lines
- areas serviced by lines

Sewage System Network
- map and location of main sewage network
- material of pipes and joints
- location of treatment plants
- areas serviced by lines

Roadways
- map and location of main railroads, highways

Bridges
- map and location of main bridges
- length of bridge
- type of bridge, e.g., single or multiple span

Telecommunications System Network
- map and location of main communication lines
- areas serviced by lines
- critical points of cellular system

Dams
- location and type of dam – e.g., concrete or earthfill

Tunnels
- type of tunnels – e.g., alluvium, rock or cut and cover

6. Existing structures
7. Building inventory - e.g., location, type and height
8. Critical facilities

Schools
- location and name
- number of students
- if available, type and height of building

Hospitals
- location and name
- number of hospital beds and physicians
- if available, type and height of building

Fire Stations
- location of stations
- number of personnel and fire trucks per station

Police stations
- location of stations
- number of personnel per station

Airport
- location and location of runways
- general conditions and information (structural observations, size of aeroplanes that can be accommodated)

Any other critical facilities
- gasoline stations, government buildings, industries – especially those handling hazardous material, etc.

9. Collateral hazard potential

- landslide potential
- liquefaction potential
- tsunami potential

Fig. 6 Table of data necessary to carry out the damage estimation.

2. Required information

- List of data necessary for damage estimation. Figure 6 shows a list which may be expanded on, or adapted as necessary, depending on the particular characteristics of a city
- Knowledge of which institutions might be in possession of necessary data, or may have the ability to collect it
- Knowledge of experts and advisers that could contribute to the collection of data

3. Process

In order to carry out the preparation and collection of data it is recommended that the following preliminary steps be taken to minimize duplication of efforts and ensure the cooperation of the city system representatives:

- First, any previous damage estimation studies should be reviewed and adapted as necessary.
- Second, it would be prudent to meet with the heads of the city's institutions and with experts that may be in possession of the necessary data, in order to discuss any legal issues regarding property rights
- Next, any necessary agreements between institutions that will provide data to the project should be drafted and signed
- In the meantime, the project's data handler(s) should decide on the most efficient database
- The location of the database should also be decided on, since many different organizations and institutions will be contributing data and it is more feasible to keep the gathered data in one, accessible location. In many cases, databases have been established at the municipal headquarters in order to guarantee access to the project data by all the institutions involved in the project
- Furthermore, a standard format for the data should be agreed on, as well as the types of information managing tools and applications that will be used. If possible, it is recommended that a Geographical Information System (GIS) be used since it facilitates efficient and effective handling of the data and representation of results
- After obtaining the collected information, its reliability should be checked. For example, how current or accurate the information collected is should be assessed. Also, the reliability of the source should be considered when collecting the data.

4. Intermediate products

There are several intermediate products that are obtained through the preparation and collection of data. They include the following:

- Legal agreements between institutions to share information and collaborate
- A better understanding of the existing data formats and the most efficient format for use in the project
- A computer system that will store data in a systematic and uniform format
- Data management software -- specifically, a GIS is recommended

5. Participants

- Steering committee
- Technical institution
- Local authorities
- City institutions, departments handling system data (i.e., technical departments of these institutions)
- Computer expert(s), or project data handler(s)

6. Final products

After completing the preparation and collection of data, several products will have been obtained. First, all of the information required for the project will be available in a user-friendly and efficient database. After

its inspection, the data will be reliable. Moreover, its incorporation will require that all data be translated into a standard format.

Through the interaction of institutions in order to assess existing and necessary information, the identification of key people to the project will be made possible. This identification will facilitate the formation of the project's active working groups. Furthermore, all the institutions involved will have a better understanding of the city's comprehensive characteristics; the importance of involving the city's various sectors will be recognized, since all sectors contribute to a city's risk and should be involved in its mitigation. Finally, the institutions that are approached at this stage of the project will become familiar with its goals and objectives and, hopefully, become involved.

7. Observations

- Make sure city's institutions realize the benefit of providing information to the project. For example, when speaking to representatives of the institutions, be sure to highlight the fact that participation in this project will grant them the opportunity to gain a better understanding of their system and its risk, as well as a better understanding of the information provided by other institutions. In cases where city systems and institutions depend on each other, this type of information is very valuable
- It is recommended that it be agreed that the established database be held at a venue which would ensure the database could be open to the public (e.g., the municipal headquarters). Agree on a user accessible and user friendly database
- Computer expert should design an efficient database and suggest appropriate information management tools (GIS) and applications
- A GIS is recommended and useful because it allows for handling, management and presentation of a large amount of information. A GIS could be fed information and present results in map form or other graphic outputs that are easy to understand
- Use of collected data needs to be very clearly discussed and agreed upon with each institution

8. Examples

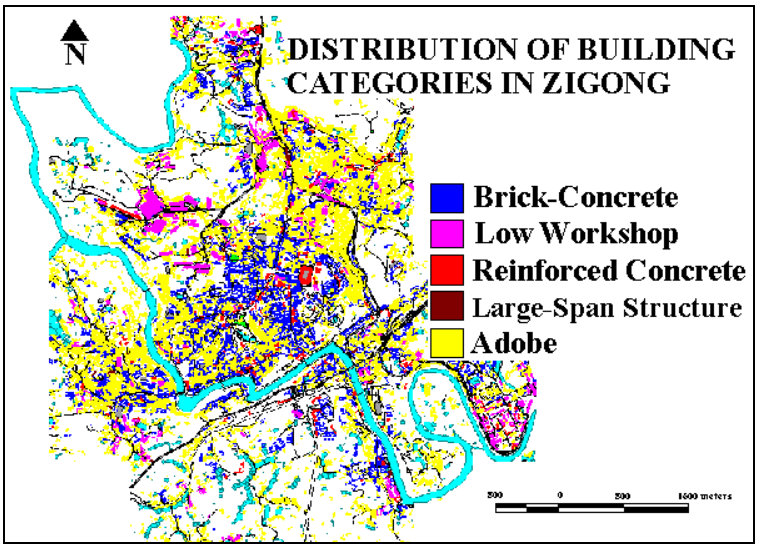


Figure 7. Building distribution map for Zigong, China, based on the city's building inventory.

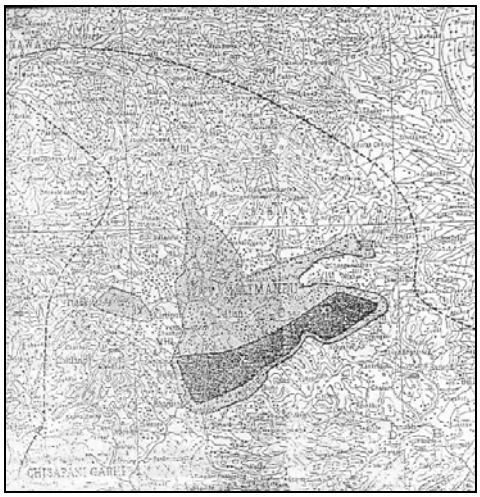


Figure 8. Example of existing intensity distribution map for the earthquake adopted in the Kathmandu Valley earthquake risk management project. This map needed to be digitized and scaled for use in the project.

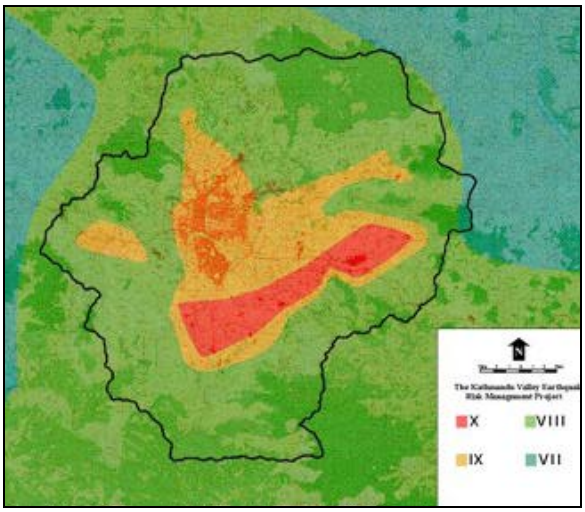


Figure 9. Example of digitized intensity map and Kathmandu Valley boundary area used in the project.

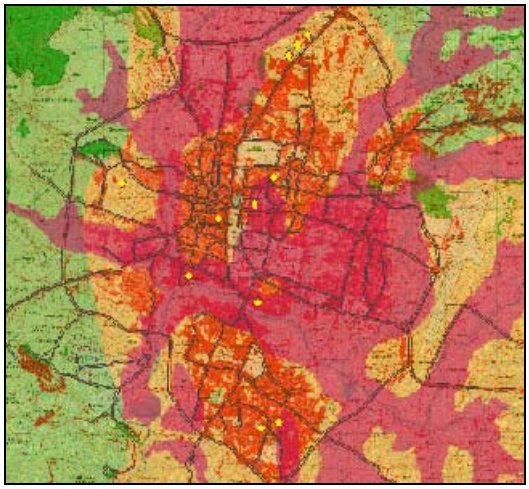


Figure 10. Example of intensity distribution, liquefaction potential and hospital location information for Kathmandu City which needed to be made uniform in order to be combined.

KICK-OFF MEETING

1. Objectives

The objectives of the Kick-off Meeting have to do, mainly, with raising the awareness of the community of the city's earthquake risk and how the proposed risk management project may aid in taking the necessary steps to mitigate that risk. During the meeting, the need for the project due to the city's risk, should first be explained. Then, the project can be introduced to the community -- the proposed scope, schedule and coordinating bodies (i.e., the Steering Committee and local advisory committee) should be introduced. During the meeting, it is extremely important to request the involvement and collaboration of all the sectors of the community.

2. Required information

- Historical seismicity
- Historic growth of the city
- Recent earthquake disasters (local, national, and international)
- Basic information of project: schedule, cost, working groups, administration, organization
- Information on potential funding sources, people and institutions in charge
- A list of key people and institutions

3. Process

In order to carry out an effective and successful Kick-off Meeting, project coordinators must ensure it is well attended by representatives of the city's various sectors and covered by the mass media. Therefore, the following steps are recommended:

- A programme and invitations should be prepared
- All the institutions which should be present at the Kick-off Meeting should be visited in order to inform key representatives about the event; project coordinators may wish to take this opportunity to request any additional necessary collaboration from the institution
- Additional key people and institutions (e.g., local/regional/national/international representatives, potential funders) should be identified and invitations should be sent accordingly
- Attendance to the event by each institution should be followed up and confirmed by coordinators
- In order to aid in the mass dissemination of the event, risk and project, a press release should be prepared and disseminated to the mass media
- Representatives of the mass media should also be invited to attend the meeting. Some cities have taken the opportunity to follow the Kick-off Meeting with a press conference, which further ensures coverage of the topics at hand and the dissemination of information to the general public
- During the meeting, it is important to ask for and take note of any feedback offered by the participants that would help to improve the project
- Also, the collaboration of key institutions, which up to this point may not be fully involved, should be requested

4. Intermediate products

Some intermediate products of the Kick-off Meeting include the following:

- Collection of important data on city's risk, which will be presented to help demonstrate the need for the project
- Examples of already collected information, which will help motivate other representatives of key sectors and institutions to participate in the project.

5. Participants

- Local authorities
- Representatives of different city sectors (lifelines, education, health, etc.) and institutions
- Local experts
- Local and international potential funders
- Press and mass media representatives
- International expert(s)

6. Final products

Through the realization of the Kick-off Meeting, many important products will be attained. These include the following:

- Awareness and acceptance of the project by the community, commitment and involvement of institutions and authorities
- Awareness of community of the city's risk
- Participant feedback and subsequent improved design of the project

7. Observations

In carrying out the Kick-off Meeting, there are several important points to keep in mind:

- It is crucial to not only demonstrate the existence of risk but also, perhaps more importantly, demonstrate the project's practicality and effectiveness in contributing to a solution. Furthermore, care should be taken to present this risk in a manner which will not cause panic, but rather reflect the real circumstances of the city which need to be addressed
- Because risk management projects often have manifold effects on the societies which carry them out, benefits to the whole community and to its development through the implementation of the project should also be highlighted. For example, through a risk management project, a city may find that one of its priorities is the need to set up and implement land-use planning codes, which will not only help mitigate earthquake risk, but also aid in the overall development of the city

8. Examples

Sample risk information presented during Kick-off Meeting:

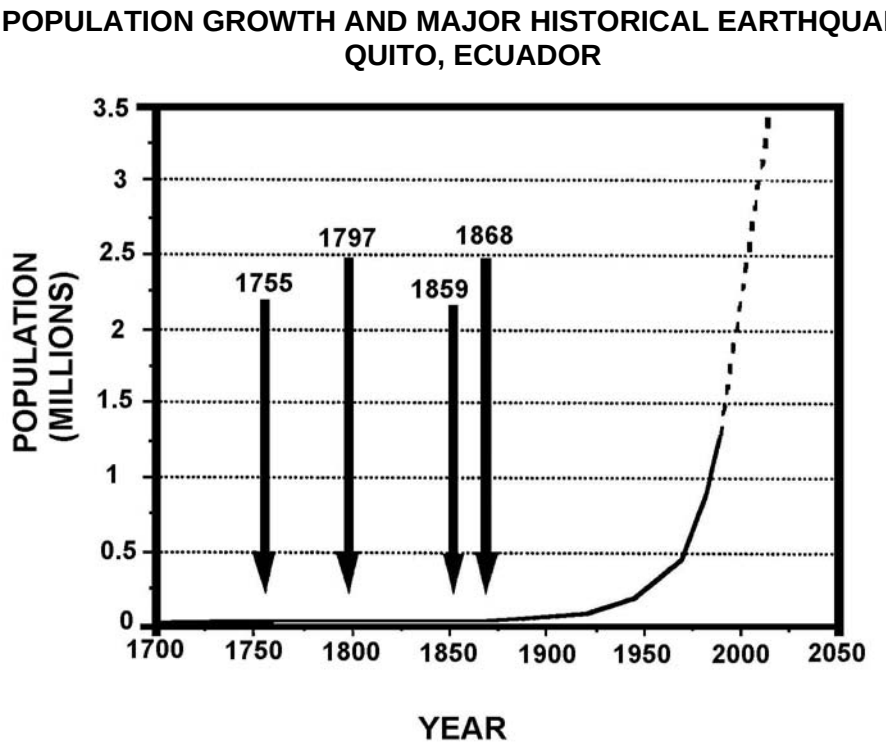


Figure 11. This population growth vs. historical earthquake data shows Quito's population growth since 1700. Arrows indicate major earthquakes in that time period and, along with other data obtained, suggest a devastating earthquake is likely in the near future.

Examples of typical vulnerable construction in Bandung, Indonesia (left) and Guayaquil, Ecuador (right):

CRONICA

EL MERCURIO 5
MIERCOLES 6 DE MAYO DE 1998

Proyecto Radius de Naciones Unidas -inaugurado en la UCN- menciona a Antofagasta

Determinan zonas de alto riesgo sísmico

El terremoto del 30 de julio de 1995 en Antofagasta dejó en evidencia algunas áreas urbanas de riesgos sísmico, cuya determinación exacta servirá para prevenir daños y elaborar planes de evacuación, en caso de ocurrir otro sismo de gran envergadura con epicentro en esta zona.

Las Naciones Unidas, a través del proyecto Radius, inició diversos estudios de riesgos sísmicos en Antofagasta -para culminar en un plan de respuesta a grandes terremotos-, bajo la asistencia del secretariado de International Decade for Nature Disaster Reducion (IDNDR), Intendencia Regional y Universidad Católica del Norte (UCN).

La sigla Radius viene del concepto "Risk Assessment Tools for Diagnosis of Urban Areas against seisminc Disasters", que traducido significa "Herramientas de evaluación de riesgo para el diagnóstico de áreas urbanas con desastres sísmicos", con aplicación en distintas partes del orbe.

El proyecto fue puesto en marcha ayer con una sesión de conferencias especializadas en la UCN. En ella intervinieron los expertos Kenji Okazaki (IDNDR) y Carlos Villacis, además de los académicos Walter Roldán y Mario Pereira, para concluir con un diagnóstico del director de la Oficina Regional de Emergencia (Oremi), Mario Carvajal.

En la UC del Norte fue puesto en marcha el proyecto Radius. El experto Walter Roldán se dirige a los asistentes.

PREVENIR

El director del departamento de Ingeniería Civil de la UCN, Walter Roldán, quien expuso sobre la sismicidad en el norte grande, expresó que el terremoto de 1995 -con 7.3 grados en la escala de Richter- puede considerarse moderado dentro de otros sismos ocurridos en esta zona.

Agregó que cualquier terremoto dejará secuelas, por ello resulta necesario tomar medidas preventivas, sobre todo a nivel de las construcciones que se realizan dentro de áreas de riesgo sísmico.

"Este evento no se percibió igual en toda la ciudad, y todas estas diferencias ya han sido evaluadas, pero queda otras fases por analizar en profundidad", acotó.

ANALISIS DE EFECTOS

El experto Carlos Villacis -perteneciente a la consultora Geohazard International- destacó que el proyecto Radius avaluará los riesgos sísmicos de Antofagasta, para luego analizar sus efectos a nivel de infraestructura, sociales y económicos.

Expresó que con todos estos antecedentes, se procederá a la elaboración de un plan de acción para mitigar las consecuencias de un terremoto en esta ciudad. "Para ello vamos a necesitar la ayuda de la comunidad, servicios públicos y sector privado, para avanzar en el proyectos y sus acciones inmediatas", aclaró.

Antofagasta está dentro del circuito de nueve ciudades seleccionadas para aplicar en 1998 el proyecto Radius, que también incluye a Addis Abeba (Etiopía), Bandung (Indonesia), Guayaquil (Ecuador), Izmir (Turquía), Skopje (Macedonia), Tashkent (Uzbekistán), Tijuana (México) y Zigong (China).

El director de Oremi, Mario Carvajal, destacó que toda estas evaluaciones servirán para reforzar la planificación adelantada desde el Gobierno Regional en caso de catástrofes, sobre en caso de aluviones y sismos de consideración.

ILUSTRE MUNICIPALIDAD DE TALTAL

LICITACION PUBLICA INTERNACIONAL

Llámese a Propuesta Pública para ejecución de las siguientes Obras:

Figure 12. Example of a press article covering the Kick-off Meeting in Antofagasta, Chile

Актуально

ВЫЙТИ ЗА "РАДИУС" БЕДЫ

Сегодня в Ташкенте внимание общественности сосредоточено на работе симпозиума, проводимого в рамках Международного проекта "Радиус" и осуществляемого под эгидой секретариата международной декады (десятилетия) по уменьшению ущерба от стихийных бедствий IDNDR ООН.

Поднимаемая на нем проблема по снижению сейсмического риска для столицы Узбекистана, понятно, имеет актуальное значение для ее жителей. Хотя вектор ее действия явно направлен куда как на больший масштаб, охватывая и не самые близлежащие к городу районы. Ведь границы очерченной опасной зоны бывают весьма расплывчаты и условны. Природные бедствия не признают никаких административно-территориальных рубежей и установленных кордонов.

На нынешнем форуме с участием экспертов из Японии, Индии, Австралии рассматриваются результаты полугодовой деятельности специалистов, привлеченных к осуществлению данного проекта, по сути начавшегося разворачиваться с мая нынешнего года. С памятного для многих совещания в Ташкентском хокимияте на первой конференции, посвященной "Радиусу". Силы на реализацию намеченной программы подключились немалые. Диапазон выполнения поставленной задачи распространился на институты сейсмологии, геологии и физики, механики и сейсмостойкости сооружений, АО УзЛИТТИ Госкомархитектстроя, ТашНИИ ПИ Генплан, Главное архитектурно-планировочное управление и другие, уменьшив его последствия, сведя к минимуму возможный ущерб.

Потому так важна для всех нас оценка специалистов сейсмической опасности территории города, уязвимости его строений и элементов жизнеобеспечения. Однако чтобы дело ученых довести до логического конца, дать ему конкретное воплощение, нужны внимание к проблеме и участие в ее решении каждого из нас, не говоря уже о государственных и общественных организациях, возможно, и зарубежных фирм. Борьба с землетрясениями имеет не только общенациональный, но и международный характер. Методы противостояния стихийному бедствию многогранны, и включают в себя оценку и снижение их последствий, строительство только сейсмоустойчивых зданий и укрепление существующих, наконец, обучение людей действиям, которые им помогли бы в условиях сотрясений земной коры.

И город Ташкент, для которого предстоит впервые выполнить оценку сейсмического риска, вправе рассчитывать на международную консолидацию сил, опыта, финансовую поддержку со стороны различных структур, да что там — всей общественности. Ибо опыт, полученный в результате реализации целей и задач Международной программы "Радиус", подкрепленной грантом в 50 тысяч долларов на начальный ее этап, будет достижением не только для Ташкента, но и многих других городов, расположенных в сейсмоопасных зонах всех континентов земли.

Figure 13. Press coverage for Tashkent, Uzbekistan

HAZARD ASSESSMENT

1. Objectives

The main objectives of hazard assessment are the following:

- To select the hypothetical earthquake to be adopted for use in the project
- To estimate the distribution of seismic intensities for the adopted earthquake
- To estimate the effects of collateral hazards

These estimates will form the basis of the damage estimations.

2. Required information

- Historical seismicity
- Damage reports from past earthquakes
- Information on main seismic sources
- Soil conditions
- Topography
- Previous hazard assessment studies
- Landslide potential
- Liquefaction potential
- Tsunami potential
- Flood potential (e.g., failure of vulnerable dams)
- Additional collateral hazard potential (e.g., nuclear power plant failure)

3. Process

The descriptions of two possible hazard assessment processes are presented below. The first is the adoption of a recent past earthquake. If this first option is not possible or acceptable, the second option involves adopting an earthquake using the city or region's seismic information.

Option 1

If feasible/acceptable:

- Adopt a recent (having occurred this century) earthquake that is well documented and caused significant damage to the city
- Validate the observed intensities reported for the past earthquake by using available information on soils and collateral hazards
- Add in the effect of collateral hazards on currently populated areas that were not populated at the time of the earthquake and, therefore, were not considered in the reported damage

Option 2

If adopting a past earthquake is not feasible or acceptable (for example, if your city has not experienced a significant seismic event in the past century):

- Adopt an earthquake using historical seismicity and seismic source information
- Adopt appropriate attenuation relations in order to produce a distribution of intensities
- Consider the effect of local soil conditions
- Add in the effects of collateral hazards

4. Intermediate products

Some intermediate products of hazard assessment, which may have many potential important uses, include GIS maps of:

- Seismic sources
- Soil conditions
- Collateral hazards
- Observed intensity distributions for past earthquakes

5. Participants

- Technical people
    - Seismologists
    - Geologists
    - Geotechnical engineers
    - Oceanographers (tsunami)
    - Civil engineers
    - Computer expert/ GIS operator

6. Final products

After carrying out hazard assessment, the following final products can be expected:

- Development of an intensity distribution map for the adopted or hypothetical earthquake. This intensity distribution map will be used in damage estimation (see next section for comments on selecting appropriate hypothetical events).
- Collateral hazard information will also have been compiled and incorporated for use in the next phase of the project.

7. Observations

When carrying out hazard assessment, it is important to keep in mind several important observations:

- The adoption of the hypothetical earthquake needs to consider the various local conditions, from soil conditions to economic. In other words, while the event should be a feasible one, the adopted earthquake needs to be an earthquake for which a city can prepare. It does not need to be the maximum possible earthquake for a city since, due to the potential damage a maximum possible earthquake may inflict upon the community, it may be unrealistic to fully prepare against such an earthquake
- Due to the fact that existing economic and social factors need to be considered, decision-makers and local advisory committee members must be included in the process of selecting the hypothetical earthquake
- Use of an actual past earthquake has several advantages. First, the amount of necessary calculations is reduced when using an actual past event for which information on intensity distribution is already available. Second, the intensity distribution map is realistic since intensities were actually observed, and, third, people may more easily identify with or may remember an actual past event than a hypothetical one

8. Examples

Samples of mapped hazard data:

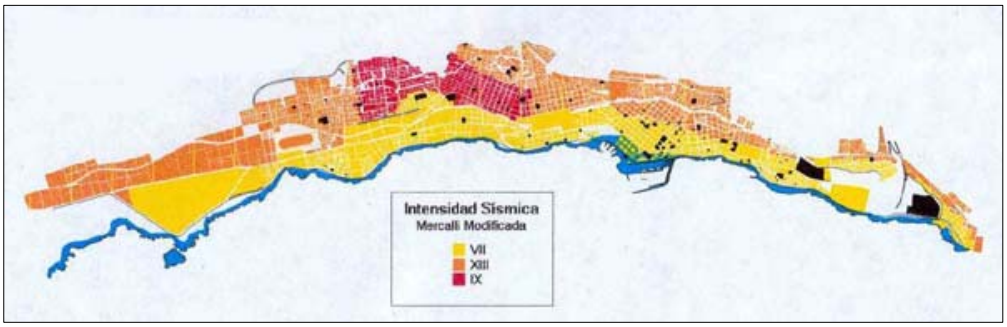


Figure 14. Example of potential tsunami inundation areas (blue) and schools (black dots) in Antofagasta, Chile. Information is superimposed on a map of the distribution of intensities for the adopted earthquake.

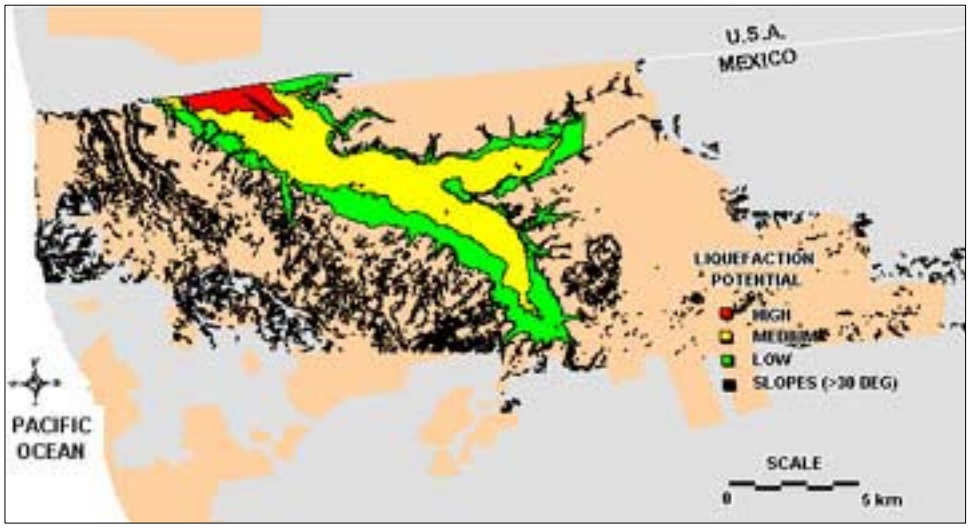


Figure 15. Map of potential liquefaction and landslide areas for Tijuana, Mexico.

VULNERABILITY ASSESSMENT

1. Objectives

The objective of the vulnerability assessment is to prepare vulnerability functions and recovery functions that are applicable to local conditions.

2. Required information

- Previous vulnerability studies
- Characteristics of local structures
- Characteristics of local infrastructure
- Examples of vulnerability functions developed for other cities, regions, or countries
- Data on the human and economic impacts of past earthquakes
- Data on the recovery processes of the city, of other cities, countries or regions after an earthquake or other disaster occurred

3. Process

The recommended process of vulnerability assessment is to first identify all the existing structural and infrastructural types of the city and then select representative ones. Next, existing vulnerability functions for the selected types should be calibrated using data of past observed damage as well as the opinions and/or studies of local experts. For important and critical facilities, individual vulnerability studies should be carried out.

In addition to the vulnerability assessment of the physical environment of the city, a vulnerability assessment of the human environment and recovery processes should be conducted. To achieve this, statistical analyses of past human and economic impacts should be performed in order to develop appropriate and applicable human and economic impact estimations. Finally, appropriate and applicable recovery functions should be developed.

4. Intermediate products

Intermediate products achieved throughout vulnerability assessment include the identification of typical structural types, the development of vulnerability functions for traditional construction and potentially useful laboratory tests.

5. Participants

- Technical people
    - Civil engineers
    - Architects

6. Final products

The final product of vulnerability assessment is the development of sound vulnerability and recovery functions, which are applicable to local conditions.

7. Observations

It is very important that the following observations be considered while carrying out Vulnerability Assessment in a city:

- Essential buildings and facilities require individual evaluations (airport, hospitals, important bridges, government buildings, historical monuments, harbours, army bases). The vulnerability assessment of

these structures cannot be considered through the use of vulnerability functions, which are used to obtain a general, average description of damage

- Human and economic impacts should also be considered. For example, impact studies have been conducted by international institutions or agencies, such as the United Nations. These studies describe the average impact disasters such as earthquakes could have in developing countries. These studies can be used to aid in the human and economic impact estimations in the project
- Information or human impact data from other cities in the region with similar conditions can also be utilized
- Data on other disasters in the city, region, or in cities with similar conditions may provide the city with useful recovery information

8. Examples

The first two following examples were taken from *The Quito, Ecuador Earthquake Risk Management Project: A Compilation of Methods, Data and Findings*, published by Escuela Politecnica Nacional, GeoHazards International, Ilustre Municipio de Quito, ORSTOM-Quito, and OYO Corporation.

Example of calibrated damage matrix:

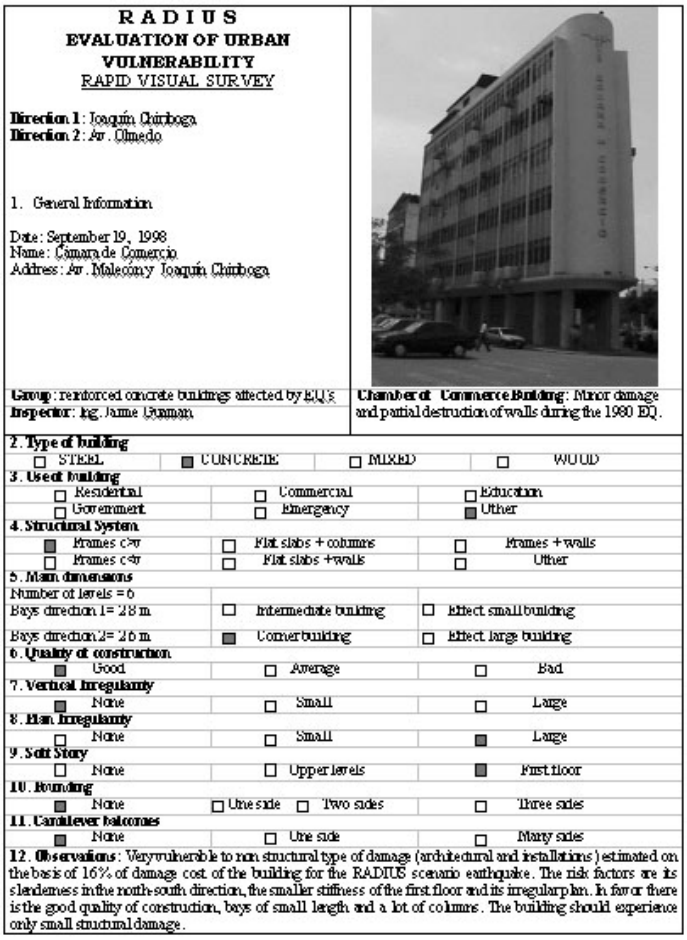
POWER SUPPLY
TRANSMISSION LINES

	Modified Mercali Intensity				
Damage Ratio	**VI**	**VII**	**VIII**	**IX**	**X**
0.00	93.60	7.30	1.80	0.00	0.00
0.50	6.40	72.10	50.90	7.50	0.30
5.00	0.00	20.60	47.30	92.20	72.50
20.00	0.00	0.00	0.00	0.30	27.20
45.00	0.00	0.00	0.00	0.00	0.00
80.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	0.00	0.00	0.00
%	0.03	1.39	2.62	4.71	9.07

Excerpt from vulnerability report written for one of Quito's critical facilities, the Mariscal Sucre Airport Traffic Control Tower:

The control tower in the *Mariscal Sucre* airport in Quito is a 4-storey RC structure, one bay in each direction, with an approximate span length of 4.2 m and storey height of 2.5 m. The other half is a thin solid slab. The four vertical elements are 40 by 40 cm columns. Horizontally, there are beams in all four bays, about 30 by 70 cm in size. The vertical loading is rather light, since only electronic instrumentation is present. Therefore, moving mass is light too.

Most probably, all cross sections and proportioning are sufficient to resist lateral forces from an earthquake that may induce linear elastic response of the structure. However, for a very severe earthquake, when global ductility is needed, the structure may not be safe enough, since the beams' flexural capacity seems to be much larger than that of the columns.



RADIUS
EVALUATION OF URBAN VULNERABILITY
RAPID VISUAL SURVEY

Direction 1: Joaquín Chiriboga
Direction 2: Av. Olmedo

1. General Information

Date: September 19, 1998
Name: Camara de Comercio
Address: Av. Malecon y Joaquín Chiriboga

Group: reinforced concrete buildings affected by EQ's
Inspector: Ing. Jaime Guzman

Chamber of Commerce Building: Minor damage and partial destruction of walls during the 1980 EQ.

2. Type of building
☐ STEEL ■ CONCRETE ☐ MIXED ☐ WOOD

3. Used building
☐ Residential ☐ Commercial ☐ Education
☐ Government ☐ Emergency ■ Other

4. Structural System
■ Frames c/w ☐ Flat slabs + columns ☐ Frames + walls
☐ Frames c/o ☐ Flat slabs + walls ☐ Other

5. Main dimensions
Number of levels = 6
Bays direction 1= 28 m ☐ Intermediate building ☐ Effect small building
Bays direction 2= 26 m ■ Corner building ☐ Effect large building

6. Quality of construction
■ Good ☐ Average ☐ Bad

7. Vertical Irregularity
■ None ☐ Small ☐ Large

8. Plan Irregularity
☐ None ☐ Small ■ Large

9. Soft Story
☐ None ☐ Upper levels ■ First floor

10. Pounding
■ None ☐ One side ☐ Two sides ☐ Three sides

11. Cantilever balconies
■ None ☐ One side ☐ Many sides

12. Observations: Very vulnerable to non structural type of damage (architectural and installations) estimated on the basis of 16% of damage cost of the building for the RADIUS scenario earthquake. The risk factors are its slenderness in the north-south direction, the smaller stiffness of the first floor and its irregular plan. In favor there is the good quality of construction, bays of small length and a lot of columns. The building should experience only small structural damage.

Figure 16. Building evaluation forms used in vulnerability assessment in Guayaquil, Ecuador.

DAMAGE ESTIMATION (THEORETICAL)

1. Objectives

The objective of the theoretical damage estimation is to estimate the theoretical potential damage caused by the adopted earthquake.

2. Required information

- Inventory of buildings (using GIS in order to include location of buildings)
- Inventory of infrastructure
- Population information
- Intensity distribution (including collateral hazard effects)
- Vulnerability functions for buildings, infrastructure, and human and economic impact

3. Process

In carrying out the theoretical damage estimation, there are several steps which should be followed:

- The date and time of the earthquake should be decided on since they will determine weather conditions and building occupancy
- The area unit for which the damage will be estimated (e.g., urban block or neighborhood) should be decided
- Hazard and vulnerability data should be combined in order to estimate potential damage and impact. This combination can be performed efficiently using GIS
- Estimated damage should be mapped for efficient presentation
- Recovery times for the city's services and human and economic impacts should be estimated using the recovery functions that have been prepared

4. Intermediate products

There are several potentially useful intermediate products that will result as part of the theoretical damage estimation. These include maps of the superposition of the following and the estimated hazard:

- City structures
- City infrastructures
- Population distribution
- Economic activities

These maps can be used effectively to demonstrate the existence and features of the city’s risk to the community.

5. Participants

- Technical people
    - Computer expert

6. Final products

The final products of the theoretical damage estimation include the following:

- Preliminary theoretical estimates of structural and infrastructural damage and human and economic impact caused by the adopted earthquake
- Recovery time estimates for the city's main systems from the damage caused by the adopted earthquake

7. Observations

It should be perfectly clear that the results are purely theoretical, using average damage functions that do not include particular characteristics of local systems. These particular characteristics are considered in the non-theoretical damage estimation (see next section).

It may be helpful to note that once all required information is in GIS or standard format, it is very easy to estimate damage for different earthquakes since only the intensity distribution changes. The city, then, could conduct investigations as to how several hypothetical events could affect it.

8. Examples

Sample damage, human impact and recovery time estimates:

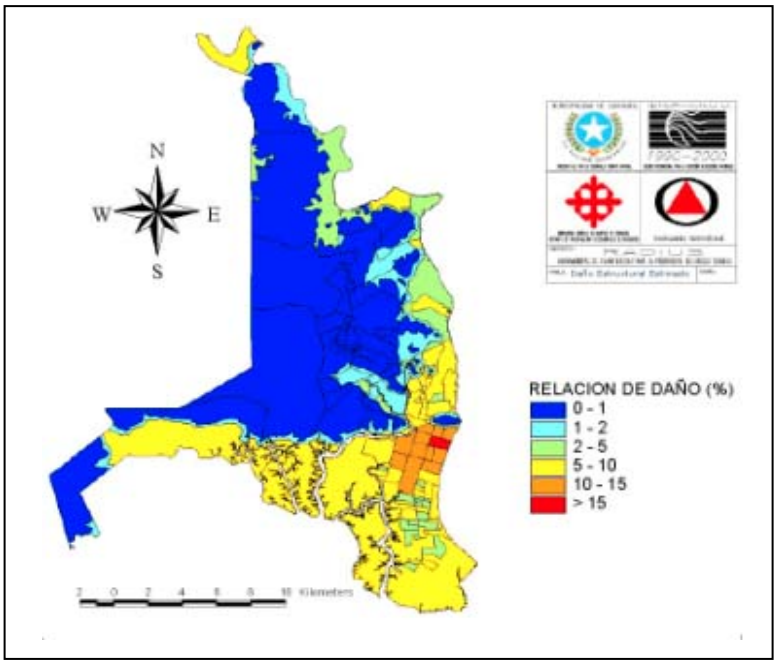


Figure 17. Building damage estimates for Guayaquil, Ecuador.

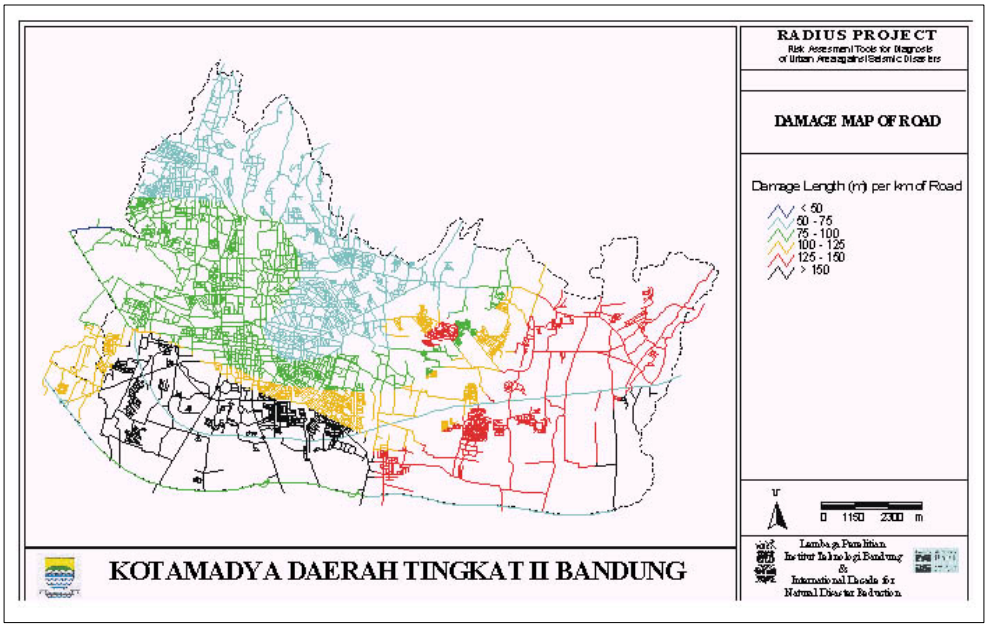


Figure 18. Road damage estimates for Bandung, Indonesia.

HUMAN IMPACT ESTIMATES			
CURRENT POPULATION (millions)	**ESTIMATED DEATHS (thousands)**	**ESTIMATED SERIOUS INJURIES (thousands)**	**ESTIMATED HOMELESS PEOPLE (thousands)**
1.3	18	37	130

Figure 19. Human impact figures based on the scenario earthquake for Tijuana, Mexico.

WATER SUPPLY RECOVERY ESTIMATES		
30% OF PRE-EARTHQUAKE CAPACITY	**60% OF PRE-EARTHQUAKE CAPACITY**	**100% OF PRE-EARTHQUAKE CAPACITY**
1 month	1.5 months	2 months

Figure 20. Recovery figures for Tijuana's water supply system, based on the scenario earthquake.

DAMAGE ESTIMATION (NON-THEORETICAL)

1. Objectives

The objectives of non-theoretical damage estimation are to:

- Review and, if necessary, revise theoretical estimated damage and recovery process
- Incorporate the particular or unique characteristics of each city system (vulnerable or critical elements)
- Learn the disaster preparedness level of each city system. For example, learn whether any emergency plans, training, special equipment, or spare parts inventory exist for each city system
- Understand the actual impact of the estimated damage on each city system's activities and functional capability
- Learn what the expected recovery capacity of each city system is if the event were to occur today
- Raise awareness among city system managers or administrators
- Learn the previous disaster experience of each city system. For example, learn how the system has responded to past earthquakes, floods, landslides, etc.
- Learn the dependency of the system on other city systems

2. Required information

- Intensity distribution maps, including effects of collateral hazard
- System facility maps (superimposed on expected intensities)
- Theoretical damage estimates (preliminary results)
- Examples of damage from past, actual earthquakes in cities with similar conditions to help system administrators consider potential damage
- Identification of key people and departments for each system

3. Process

In order to carry out the non-theoretical damage estimation, a series of interviews are conducted with the people in charge of the city's systems. The following steps are recommended:

- Customize interview materials:
    - Edit interview process and questions to make them compatible with local conditions and specific project goals
    - Identify photographs and damage descriptions that work best with local conditions and will complement any maps that will be used in interviews
    - Select organizations to interview:
    - Edit the following list of suggested organizations to interview to fit the goals of the project:

Local government	Army	Traffic
Hospitals/ health care	Telephone	National government
Schools	Airport	Financial industry
Water	Railways	Religious/cultural groups
Sewer	Tourism	Aid organization
Power	Historical monuments	City planning
Roads and bridges	Fuel	
Police	Housing	
Fire	Industry representatives	
	Insurance	

- Make appointments:
  - Make initial appointments with high-level officials in the selected organizations
  - Prepare a short project summary to send along with the request for an appointment
  - Emphasize neutrality of project, that this is not an investigation but an opportunity to improve the city
- Conduct first interview:
  - In general, limit interview to two hours in duration, unless interviewee is obviously willing to continue the discussion
  - Before the interview, prioritize questions to suit each different interviewee. Determine if the focus of the interview will be technical, political, or otherwise and select the appropriate questions to discuss
  - Use draft maps and drawings to complete the explanations of the project and theoretical damage estimation
  - Identify any necessary information that could not be collected during the interview, and ask that the information be collected and submitted later
  - During the first interview, determine additional people in the organization who need to be interviewed in order to collect all of the necessary information. Find out how to contact these people
- Make and conduct secondary appointments:
  - Before these appointments, especially if they concern technical information, send a list of requested information so that the interviewee can prepare
  - Documentation:
  - Record each interview on audio tape
  - If it is convenient, take notes on the interview in question form
  - Transcribe key points of each interview shortly afterwards, while it is still fresh in the memory. This is most easily done by someone who attended the interview
- Follow-up on interviews:
  - After each interview, send organization a summary of the discussions and technical information that was collected
  - Get comments and corrections on the summaries
  - Collect any other pending information
- Organize collected information:
  - Write a short (one to two pages) summary of the information that was learned from each organization
  - Organize all collected information so that it can be used during the scenario and action plan design process

4. Intermediate products

There are several intermediate products that will result as part of the non-theoretical damage estimation. They include revised damage estimates, validated recovery times, corrected and complete information on each city system, emergency response plans of each city system (if existing), and familiarity with each city system's administration (e.g., set-up or procedures). This familiarity will aid in the design of risk management activities for that system.

5. Participants

- Technical people
- Local authorities to arrange appointments (i.e., facilitate interviews with appropriate representatives)
- Journalist (to aid in the interviewing process)
- Representatives of the technical/operative departments of each city system to be interviewed

6. Final products

After completing the non-theoretical damage estimation, the final products attained include the following:

- More complete knowledge and understanding of each city system
- Corrected data and maps
- Better understanding of each system's level of preparedness; a realistic estimate of the impact an earthquake would have on each system
- Better understanding of each system's recovery capacity; a realistic estimate of each system's recovery times
- Better understanding of the dependency city systems have on one another; a better understanding of the impact each system's failure would have on other systems
- Increased awareness

7. Observations

There are several observations that are worth noting with respect to the non-theoretical damage estimation. They are as follows:

- It is extremely important to understand and communicate to the representatives and administrators of each institution that the results of the damage estimation will not be used to place blame. The objective of the project is to provide the city with a diagnostic, not an audit or judgement. Furthermore, the current state of a city is often the product of many, many years of planning (or lack of) and, in general, not solely the product of any present-day actions
- When developing interview questions and conducting each interview, remember to consider the characteristics and time of the adopted earthquake (e.g., though the physical damage would be comparable, a devastating earthquake occurring mid-morning may have different human impacts on the educational sector than one occurring at midnight since, presumably, the number of people in the buildings at times would not be the same)
- Ensure that the questionnaire is as clear and easy to understand as possible. If possible, review the questions with an expert of the institution to be interviewed before conducting the actual interview in order to ensure that the questions are applicable to the system and clearly stated
- Recording interviews on audio tape is very useful for transcribing purposes, but this may create fear or make interviewees nervous. Be sensitive to any concerns, and always ask for permission before recording a conversation with someone. Video cameras are not recommended because they require more set-up time and could, potentially, be very distracting
- If necessary, schedule a second meeting to complete the interview

8. Examples

Proposed topics to be covered during interviews:

General Introduction
1. *Describe project*
2. *Provide basic earthquake information*
3. *Explain goals of interview*

Overview of system and system's vulnerability
1. *Explain preliminary damage estimation maps*
   Inquire about the following:
2. *Accuracy of details of system*
3. *Normal operating problems*
4. *Effects on system from any recent earthquakes*
5. *Vulnerable points of system*
6. *System redundancy*
7. *Dependence on other systems*
8. *Existing or planned regulations*

9. *Ask about future developments*

Emergency response
Inquire about the following:
1. *Emergency planning*
2. *Emergency dependence on other systems*
3. *Recovery ability*
4. *Recovery time estimates*
5. *Recovery funding*

Mitigation potential
Inquire about the following:
1. *Previous work*
2. *Feasibility of mitigation*
3. *Political control*

Conclusion
1. *Obtain feedback on the selected facilitator*
2. *Request any additional interviews*
3. *Describe the next steps of the project*

Photos of sample interviews:

Figure 21. Interview held with a public institution in Quito, Ecuador.

Figure 22. Interview held with representatives of the Public Health Sector, Tijuana, Mexico.

Figure 23. Interview held with members of the Armed Police, Zigong, China Brigade

CREATION OF EARTHQUAKE SCENARIO

1. Objectives

The objective of the creation of the earthquake scenario is to describe the results of the damage estimation in a comprehensive and easy to understand manner.

2. Required information

- Results of theoretical damage estimation reviewed and corrected by city system managers
- Results of all information collected through interviews
- Examples of scenarios prepared for other cities

3. Process

In developing the earthquake scenario, the following process is recommended:

- Combine theoretical and non theoretical damage estimates
- Map results of combination and summarize main findings
- Send mapped results and summary to city system managers for their review, ask them to submit promptly any necessary revisions
- Prepare final version of preliminary damage estimates and mapped results (checking consistency) to be presented to the community during the earthquake scenario workshop. To facilitate the audience's understanding, a journalist should write the preliminary scenario results in non-technical terms

4. Intermediate products

Many potentially useful intermediate products will be obtained through the Creation of the Earthquake Scenario. These include the following:

- Preliminary estimates of the city's damage, losses and impacts due to the adopted earthquake
- Preliminary estimates of the city's emergency response capacity
- Preliminary estimates of the city's recovery capability and process
- Damage estimates and information available in uniform and efficient format (preferably GIS)

5. Participants

- Technical people
- Working group (drawers, technicians, etc.)
- Representative(s) of the technical department of each institution
- Journalist
- Computer expert/ GIS operator

6. Final products

The final products of the creation of the earthquake scenario include realistic and corrected descriptions of the damage and impact that the adopted earthquake will have on the city, as well as realistic and corrected estimates of the recovery capability of the city.

7. Observations

Several important observations should be kept in mind when creating the earthquake scenario. These include the following:

- More important than describing physical damage is describing the actual impact this damage will have on the city's activities. For example, how many people will be affected by breaks in the city's water lines is more intuitive and convincing to general audiences than how many total breaks have been estimated
- Description of the earthquake damage scenario should not be limited to the time immediately after the earthquake. Try to describe the situation at several times. Descriptions of the situation after the following time periods are suggested:
    - After 1, 2, 5 and 8 hours
    - After 1 and 2 days
    - After 1 week
    - After 1, 3 and 6 months
    - After 1 year

  In the scenario, be sure to include descriptions of damage as well as emergency response and recovery activities
- Estimates should be considered as preliminary. You may want to include a phrase indicating so on the maps sent out for review or presented at the workshop
- Preliminary estimates will be presented to the community for discussion during the earthquake scenario workshop (after which, they can be finalized). Therefore, it is important to prepare the main results in the most comprehensive and easy to understand manner possible. A journalist can be very helpful and useful in this respect

8. Examples

Sample damage, human impact and recovery estimations:

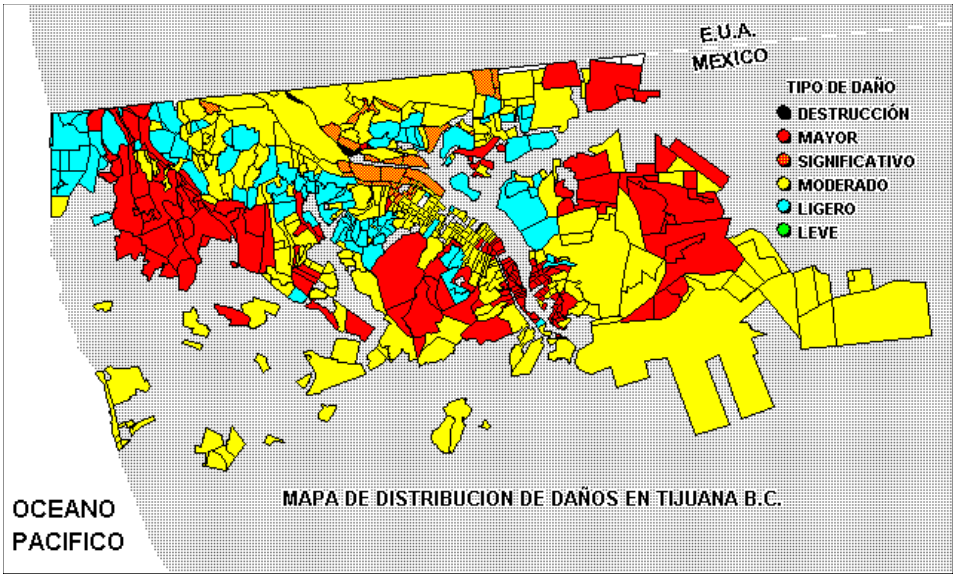


Figure 24. Building damage estimates for Tijuana, Mexico.

Figure 25. Electricity system damage estimates for Antofagasta, Chile, based on scenario earthquake.

ANTOFAGASTA, CHILE HUMAN IMPACT ESTIMATES			
CURRENT POPULATION (thousands)	**ESTIMATED DEATHS (thousands)**	**ESTIMATED SERIOUS INJURIES (thousands)**	**ESTIMATED HOMELESS PEOPLE (thousands)**
220	3.4	7	43

Figure 26. Human impact figures based on the scenario earthquake for Antofagasta, Chile.

KATHMANDU VALLEY, NEPAL DEBRIS REMOVAL ESTIMATES		
DEBRIS REMOVAL BEGINS	**DEMOLITION BEGINS**	**DEBRIS CLEARANCE ENDS**
2 weeks	1 month	1 year

Figure 27. Debris removal estimates for Kathmandu Valley, based on the scenario earthquake.

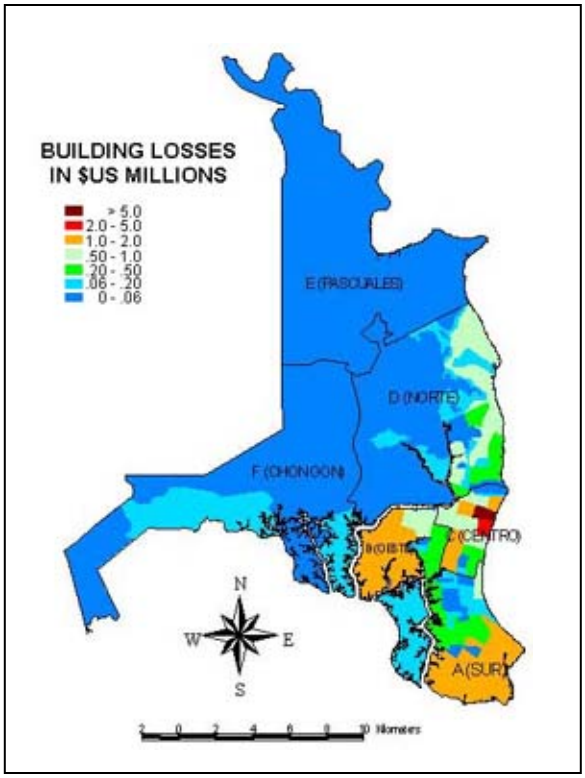


Figure 28. Economic building damage losses for Guayaquil, Ecuador, based on the scenario earthquake.

SCENARIO WORKSHOP

1. Objectives

The objectives of the scenario workshop are to:

- Present the results of the seismic damage estimates to the community and request their feedback
- Estimate the impact of the estimated damage on the city activities
- Produce ideas for actions that, if implemented, would reduce the impact of an earthquake on the city's activities
- Discuss the conditions necessary to institutionalize the risk-management activities in the city

2. Required information

- Preliminary earthquake scenario
- Identification of key people and institutions that should attend
- Necessary handouts to collect feedback

3. Process

In developing the earthquake scenario workshop, the following process is recommended:

- Prepare a workshop program and the necessary materials
- Choose a venue that ensures active and efficient participation from attendees
- Send out invitations, including project background information and the preliminary written earthquake scenario to the appropriate representatives of all of the city systems
- Hire a facilitator who will lead and moderate the discussions
- Prepare a press release and send invitations to representatives of the mass media
- Publicize appropriately in order to raise awareness and get support
- If possible, ask that invited outside experts arrive prior to the workshop date in order to give them a city tour. This will ensure they have a better understanding of the city's present condition. You may also consider taking this opportunity to have outside experts meet with appropriate city authorities. However, consideration of the experts' travel schedule is highly recommended before scheduling any appointments
- Carry out the workshop. Include in the scheduled programme 1/2 day for an orientation to the project and workshop, 1 day for the presentation of the scenario, and 1 day for the discussion by and feedback from the workshop participants
- During the workshop, divide the participants into working groups for the discussion
- After the workshop, prepare a report on the workshop results, and send this report to the representatives of the participating institutions for their review
- Prepare a final report on the workshop results

4. Intermediate products

Several useful intermediate products can be obtained when carrying out the earthquake scenario workshop. They include the following:

- Corrected earthquake scenario
- Better understanding of the impact an earthquake would have on the city, based on the interactions of different institutions and city systems
- General ideas about potential risk management activities that can be formulated after imagining the problems that could be faced
- Additional information/data that had not been previously obtained

5. Participants

- Steering Committee
- Invited experts
- City authorities
- Facilitator
- City sector representatives
- Invited international organizations
- Potential donors
- Mass media

6. Final products

The final products of the earthquake scenario workshop include the following:

- Corrected, revised and accepted earthquake scenario (including damage, impact and recovery process)
- Collection of risk management activity ideas that are proposed locally and based on the presented damage estimates
- Establishment of a multidisciplinary working group that will continue working for the remainder of the project
- Raised awareness on the potential earthquake risk to the city and its systems among the participants and the institutions they represent
- Ideas on and suggestions for the institution that should be in charge of implementing the action plan (produced later in the project)

7. Observations

- The representatives of the various city sectors are the participants and main actors of the workshop. Organizers and technical people should keep a low profile. If possible, seating arrangements should be followed that would help to ensure this interaction (see floor plan included in next section, examples)
- Representatives of the various city sectors will, perhaps for the first time, have the opportunity to talk and interact with each other. The opportunity to have so many representatives of various institutions discussing the city's earthquake risk should be taken full advantage of. Therefore, organizers should ensure that participants are active contributors, not passive observers or listeners
- Facilitator should be someone who is independent, trusted, respected, experienced and accepted by the participants of the workshop. The facilitator does not necessarily need to have a technical background. In fact, the less the facilitator knows about earthquakes specifically, the more impartial (s)he can be and the better this person can lead the discussion
- Working groups can be heterogeneously or homogeneously formed. Homogeneous groups are made up of representatives of different institutions of the same sector. For example, representatives of different lifeline institutions may form a group. Heterogeneous groups, on the other hand, are made up of representatives of different institutions and sectors. Each group type has its advantages and disadvantages:

  Homogeneous group advantages:
  A) Members can more easily focus on the effects of the disaster, which may be common or similar to group members;
  B) Members' institutions, being from the same city sector, may interact on a regular basis outside of the project and, therefore, it may be easier for members to work together. The results of this cooperation may be more productive;
  C) Emergency response and recovery processes are similar for institutions of the same sector.

Homogeneous group disadvantages:
The working group's similar characteristics may contribute to a lack of consideration of factors and activities outside the sector represented by the working group.

Heterogeneous group advantages:
Because group members have different experiences and characteristics to offer during the discussion, broader, more comprehensive discussions or analyses of the problem may be possible.

Heterogeneous group disadvantages:
A variety of problems and situations due to the differences of the working group members may arise and slow down the working process, consequently affecting the discussions, and perhaps the results of the project.

- The venue should be comfortable and suitable for the workshop set-up (see floor plan). If possible, the venue should be equipped with necessary technical equipment (overhead projectors, screens, etc.). Also, the venue should be somewhat isolated, so people can concentrate on the workshop proceedings.

8. Examples

Sample earthquake scenario workshop schedule:

Day 1

16:30	Arrival and check-in of participants
17:30	**Opening ceremony**
	Welcome
	Opening address
	Orientation
	Overview
	Questions and comments
	Introductions of participants and observers
18:30	An introduction to earthquake-caused damage
19:30	**Reception and dinner**

Day 2

7:30	Breakfast
	The scenario earthquake
8:30	The earthquake strikes!
8:45	The earthquake's characteristics
	Task A: Reviewing the damage caused by the scenario earthquake
9:00	Instructions for discussion
9:05	1. Water, Electric power, Telephone
10:00	Break
10:30	2. Roads, bridges, airport
11:15	3. Buildings, hospitals, housing
12:00	4. Rebuilding issues
12:30	Lunch

Task B: Describing the effects of damage caused by the scenario earthquake

14:00 Instructions for group work sessions
14:30 Group work sessions
15:45 Break
16:00 Plenary session - Presentations by groups
17:00 Open forum - Comments by participants and observers
18:00 Adjourn

Day 3

7:30 Breakfast

Task C: Formulating earthquake risk reduction actions

8:30 Earthquake risk reduction action plans
9:30 Instructions for group work sessions
10:00 Break
10:30 Group work sessions
12:30 Lunch
13:30 Group work sessions (continued)
14:00 Plenary session - Presentations by groups
15:30 Break
16:00 Open forum - Comments by participants and observers
16:30 Workshop evaluation
16:45 The next steps
17:15 Closing remarks
17:30 Adjourn and depart

Participants of the Scenario Workshop, City Hall of Tashkent, 11 November, 1998

Figure 29. Participants at the earthquake scenario workshop in Tashkent, Uzbekistan.

Earthquake scenario workshop - Sample of participating sectors:

Emergency response

- Police
- Army
- Fire
- Civil protection
- Municipalities
- Red Cross

Lifelines

- Water
- Electricity
- Telephone
- Gas
- Roads
- Airport
- Seaport
- Nuclear energy

Health care

- Hospitals
- Clinics

Shelters

- Housing
- Buildings
- Schools
- Archeology
- Churches

Business

- Finance
- Economics
- Insurance

***Sample of earthquake scenario workshop handout*:**

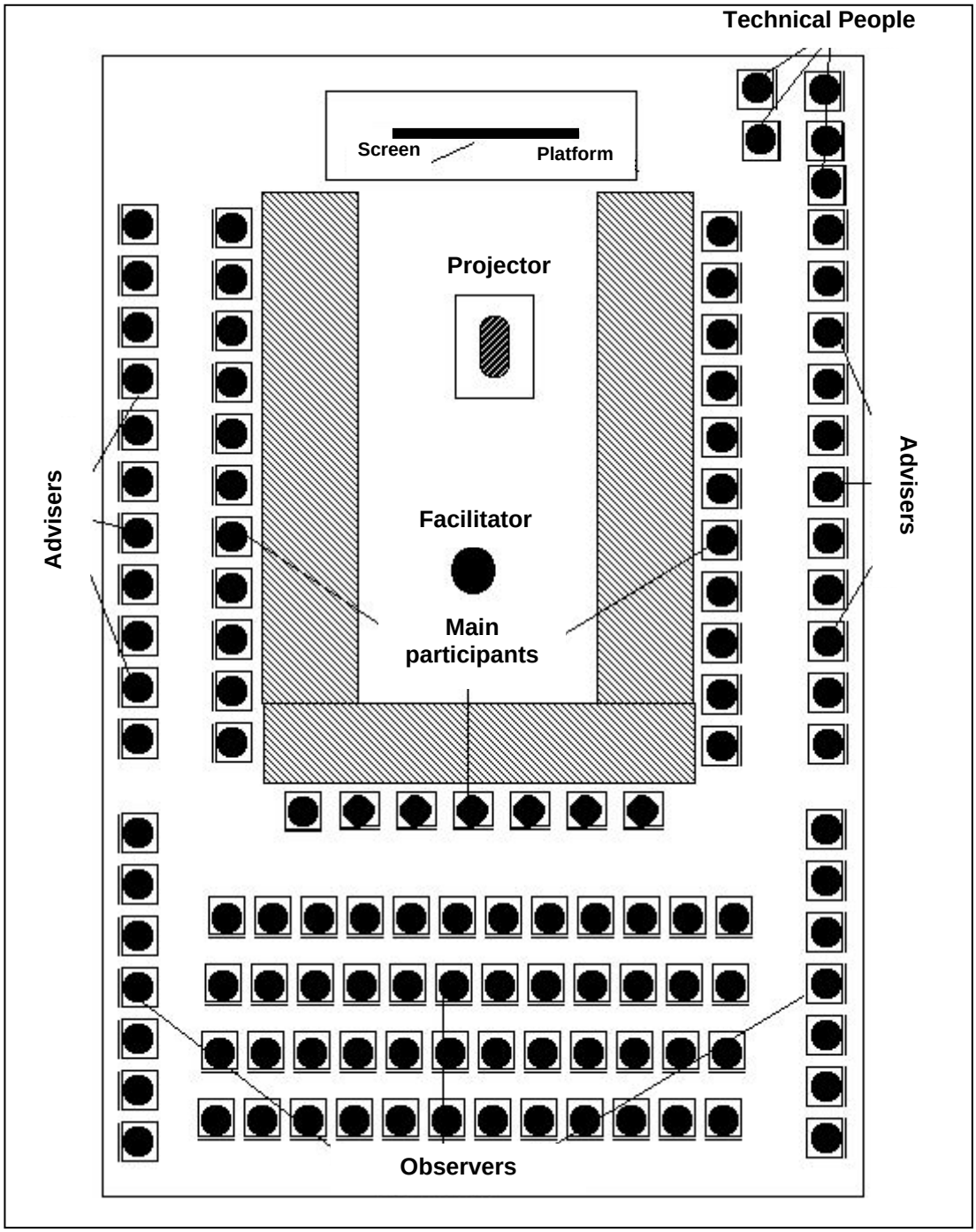
Handout A1: Water, electric power, telephone

Task A: Reviewing the damage caused by the scenario earthquake

Do you wish to modify, add to, or improve on the descriptions of expected damage? If so, express your opinions in the spaces below, and either mention them in the following plenary session, or hand them to the facilitator for inclusion in the final report of the workshop.

Name of your organization:_____

Sample of earthquake scenario floor plan:



PUBLICATION AND DISSEMINATION OF THE EARTHQUAKE SCENARIO

1. Objectives

The objectives of the publication and dissemination of the earthquake scenario are to:

- Communicate the results of the city's risk assessment locally, nationally, and internationally
- Raise awareness locally, nationally, and internationally
- Motivate and generate new ideas for potential risk management activities

2. Required information

- Reviewed and corrected earthquake scenario
- Feedback from the community obtained from the handouts collected during the earthquake scenario workshop
- Examples of published scenarios produced for other cities

3. Process

In publishing and disseminating the earthquake scenario, the following methodology is recommended:

- Analyse feedback from project participants obtained from handouts collected during the scenario workshop
- Analyse the workshop results, taking into account the participants' feedback
- Prepare the final version of the scenario incorporating all analyses
- Send the final version of the scenario to all the participating institutions for their final comments
- Prepare a non-technical version of the scenario for mass dissemination
- Prepare press releases
- Schedule a ceremony to hand over the scenario to the city's authorities
- Disseminate scenario in collaboration with the mass media. For example, the scenario can be printed in the city's newspapers and/or disseminated through public institutions such as libraries, etc.

4. Intermediate products

Some useful intermediate products include the following:

- Material for television and radio documentaries
- Short brochures which can be utilized for mass distribution
- Opportunity to present findings through seminars and conferences

5. Participants

- Steering committee
- Journalist
- Mass media
- Local authorities

6. Final products

The final products obtained from the dissemination of the scenario include the following:

- Publication and dissemination of the earthquake scenario
- Raised awareness

7. Observations

When publishing and disseminating the earthquake scenario, the following comments should be kept in mind:

- The scenario publication needs to be attractive. The publication should be easy to read, not too long or too short, but interesting. The publication should include graphics and helpful maps
- The project journalist is crucial to the publication and dissemination of the scenario. As a professional communicator, the journalist knows what is interesting to people. (S)he will also guarantee the clarity of the publication. If the journalist understands the information being transmitted, then the general public will understand it as well
- In publishing and disseminating it is important to convey a positive message in addition to just pointing out the problems of the city. For example, it is important to promote, encourage and motivate the work being done to solve the problem. Avoid creating panic, scaring the public is not the objective of the scenario

8. Examples

The following description is an excerpt from the earthquake scenario from *The Quito, Ecuador Earthquake Risk Management Project: A Compilation of Methods, Data and Findings*, published by Escuela Politecnica Nacional, GeoHazards International, Ilustre Municipio de Quito, ORSTOM-Quito, and OYO Corporation. The entire scenario can be found in annex 1 of this report.

A MONTH IN QUITO FOLLOWING A FUTURE EARTHQUAKE

[EXCERPT]

The Earthquake Strikes

It is just after 9:00 P.M. An afternoon of heavy rain has soaked the city; the streets are still wet. Residents of Quito are relaxing with family and friends, having dinner, watching television, or sitting and talking . . .

Suddenly there is a slight jolt, then heavier shaking. Dishes quiver on dinner tables, and windows rattle in their casings. The city trembles as the ground shakes violently. People are initially confused by the commotion, but then realize that Quito is experiencing a major earthquake. . .

Shaking in the Centro Historico is not as severe as in the north, but still very strong. The abundance of the vulnerable adobe and unreinforced masonry buildings leaves the area heavily damaged. Some adobe structures collapse, especially those already damaged in past earthquakes and not properly repaired, trapping and killing those inside . . . frantic people search in the wreckage for loved ones .

. . . Forty seconds after the start of the earthquake, the shaking stops.

One Hour Later

One hour after the earthquake struck, uninjured citizens are removing rubble by hand and with makeshift tools to free victims from underneath collapsed buildings, despite fear of aftershocks. People try to locate family members and

apply first aid, with only the light from car headlights. Rescue of those trapped underneath collapsed buildings is hampered by darkness. The injured start to make their own way toward hospitals and private clinics . . .

The First Day

During the first day after the earthquake, citizens realize that roads are blocked, and hence help may not come from rescue organizations in the near future; they begin to organize groups to search buildings for the injured and dead. Rescue operations are hampered by a shortage of heavy equipment to move rubble . . .

Looting continues in unprotected shops and homes. Businesses and banks are not open; people become frustrated and angry as they try unsuccessfully to withdraw money from automatic teller machines for their immediate needs . . .

The city's 10-hour water reserve is exhausted. The only water available in the most affected areas is that remaining in household water tanks. In some areas, available water is polluted by sewage. EMAP-Q personnel begin manually shutting off functioning water service for inspection and to prevent further water loss from damaged pipes. Officials realize that in the coming week water will need to be trucked in from neighboring regions. More than three-quarters of the city still is without power; damage to several subnetworks and system overload severely restrict telephone communication. Because of a lack of earthquake preparedness plans, utility repairs are slow and poorly coordinated . . .

Two Days Later

Two days after the earthquake, thousands of people are homeless; makeshift shelters are not able to accommodate them. Response workers are still attempting to rescue missing persons from beneath the rubble of collapsed buildings. A strong aftershock heightens anxiety and keeps most from returning to their homes. The aftershock causes the collapse of a few buildings damaged in the main earthquake, injuring or killing those taking refuge inside. Nonetheless, a few sleep in their damaged homes or on the street nearby to guard against looters, and some seek divine protection in churches. Many sleep in the parks, risking exposure and sickness from the rain and cold. Some with relatives, friends, or homes in other provinces leave the city, depriving Quito of badly needed emergency response and recovery professionals . . .

One Week Later

One week after the earthquake, collapsed buildings—responsible for most of the deaths—are still being searched for bodies. Many people are still hoping that missing relatives or friends will be found alive. Emergency workers remove the remaining victims. Undamaged public school buildings and other temporary shelters are full, and many people are living on the streets and in parks. Undamaged private schools resume classes . . .

One Month Later

One month after the earthquake, panic has subsided, and residents no longer fear aftershocks. Most residences remain damaged, and virtually none of the collapsed buildings are being rebuilt. Shelters are still full, and many people are still living in small tent cities in plazas, parks, and playing fields. For many, the only improvement they have seen in their living condition is that the plastic, cardboard, or plywood tents they built themselves have now been replaced with canvas tents provided by international agencies. Health officials are concerned about a significant rise in respiratory ailments resulting from the large numbers of people living in crowded temporary quarters.

PHASE III: PLANNING

The results of the damage estimation as well as the ideas for risk management activities produced during the scenario workshop are used as the basis for the preparation of an Action Plan that, if implemented, would reduce the city's seismic risk. Regular meetings are carried out with the city institutions in charge of implementing risk management activities in order to define the objectives, tasks, schedules and budgets of the activities that would be included in the Plan.

The proposed activities address the three stages of the disaster cycle: a) before the disaster, when preparedness and mitigation are important; b) immediately after the disaster, when the emergency response capacity is needed; and c) after the disaster, when the city's capacity to recover quickly from the disaster is most important. A preliminary action plan is prepared that is presented to the community during the Action Plan workshop. The results of the workshop are then used to prepare the final version of the Action Plan that is submitted to the city authorities. Summaries of the plan are also prepared and published for distribution to the community.

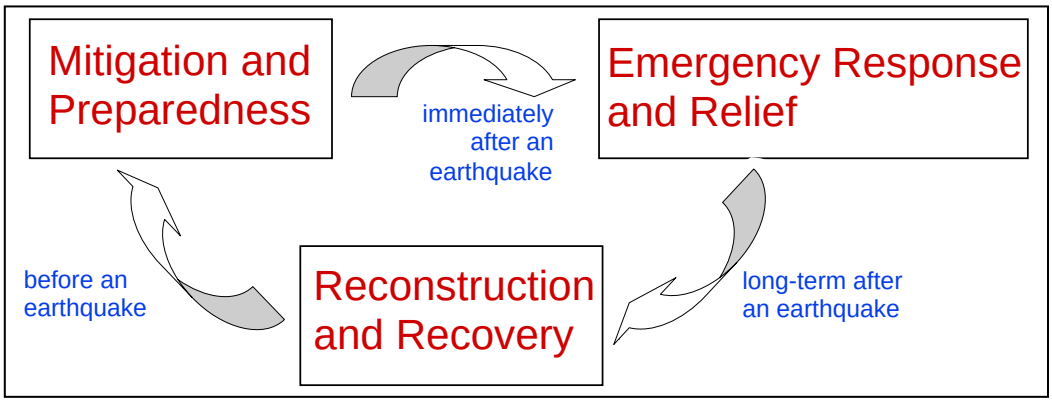


Figure 30. The planning phase considers all the stages of the "disaster cycle".

Preparation of a city's risk management plan includes the following activities:

- Assessment of the city's current level of risk management preparedness
- Formulation of risk management activities
- Definition of the institution that should implement the plan
- Formulation of a strategy for implementation
- Implementation of the Action Plan workshop
- Preparation, publication, and dissemination of the Action Plan

ASSESSMENT OF CURRENT RISK MANAGEMENT PREPAREDNESS OF THE CITY

1. Objectives

The objectives of the assessment of the current risk management preparedness of the city are to:

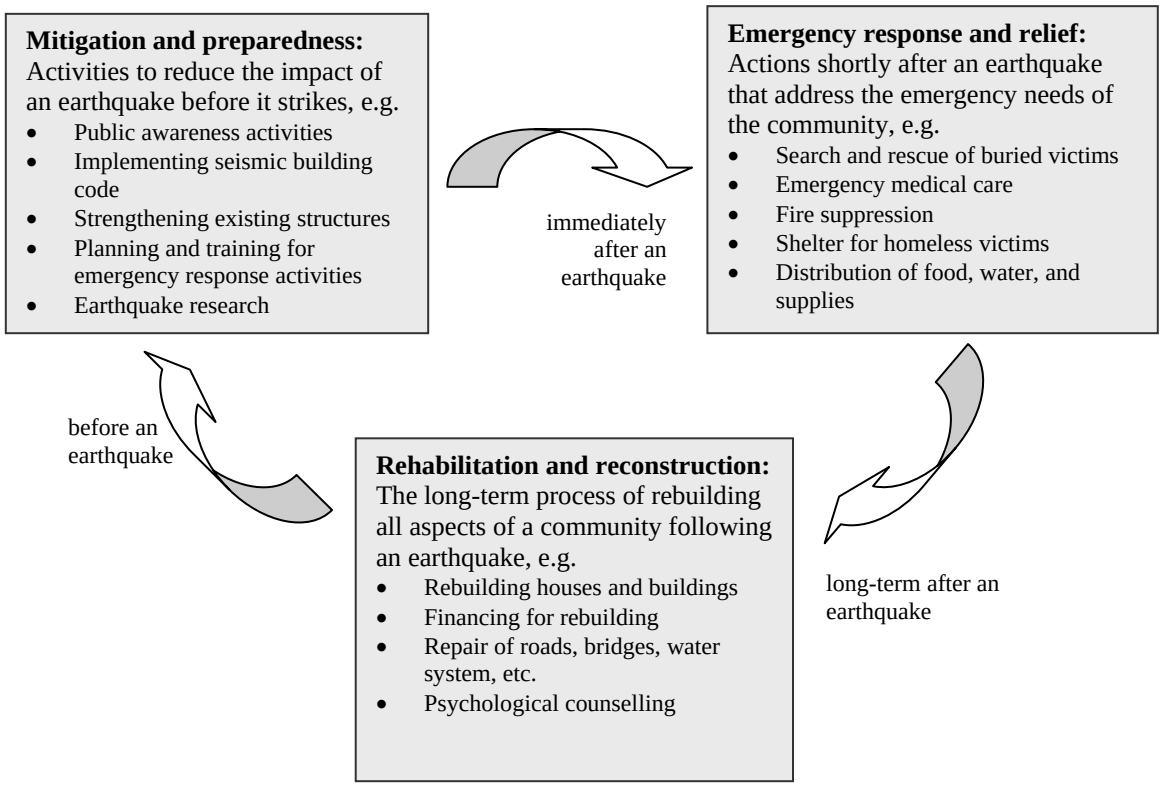
- Identify what has and has not been done so far
- Identify the institutions that are or should be involved in risk management activities, and what they have so far done
- Generate ideas on what should be done
- Raise awareness of the possible lack of preparedness

2. Required Information

- Information on the institutions in charge of risk management activities and what they have done so far
- Information on previous efforts to coordinate risk management
- Examples of risk management plans that have worked for other cities

3. Process

- Consider the three phases of the disaster cycle (before, immediately after, and long-term after an earthquake)



- List the activities that a city should implement within each phase to be prepared for the next disaster. Prepare a table (see example in section 8) to be filled out using local information
- Fill out the table based on collected information
- Send completed table to experts and institutions for their review
- Prepare report

4. Intermediate products

- Identification of lacking or duplicated /overlapping efforts or work
- Assessment of preparedness of individual institutions
- Identification of existing coordinated activities (already working)
- Raised awareness

5. Participants

- Steering Committee
- Institutions involved in risk management activities. They should include institutions involved in the three phases of the disaster, that is, institutions involved in mitigation and preparedness, institutions involved in emergency response and relief, and institutions involved in reconstruction and recovery
- Local authorities and experts

6. Final products

- Assessment of the city's preparedness level
- Identification of actions/activities that can and should be taken to reduce risk
- Raised awareness

7. Observations

- The disaster cycle figure illustrates what is important in each phase of a disaster. However, currently, most efforts undertaken in cities address only the emergency response immediately after the disaster. In general, there are very few efforts and institutions addressing and working on the other phases, that is, preparedness activities or recovery efforts

8. Examples

- Table prepared and completed to assess the current risk management preparedness of the city of Kathmandu, Nepal (taken from the Kathmandu Valley Earthquake Risk Management Action Plan Report prepared by GeoHazards International and the National Society for Earthquake Technology, 1999)

Mitigation and Preparedness Actions	Responsible Organization(s): Responsibility may be actual or presumed	Status of programmes and activities
Planning for emergency response activities, such as search and rescue, fire suppression, emergency communication, etc.	SDU[1] of MOH	No comprehensive planning currently exists
Planning for comprehensive earthquake risk management for Kathmandu Valley	NSET	Planning is ongoing under KVERMP
Planning for emergency relief activities, such as establishing shelters, collecting and distributing supplies, etc.	SDU, RNA, NP, NRCS	Currently there is no specific planning except by NRCS
Planning for long-term recovery after an earthquake, such as rebuilding infrastructure, limiting economic losses, etc.	No clearly responsible organizations	
Recommending policy matters relating to disaster management to His Majesty's Government Nepal (HMGN)	IDNDR National Committee	The IDNDR National Committee has so far prepared the National Action Plan for Disaster Management, which has been endorsed by HMGN in principle
Establishing and equipping an emergency operations centre in an earthquake resistant building	No clearly responsible organizations	
Training emergency response personnel	No clearly responsible organizations	
Training professional builders, scientists, engineers, and planners	No clearly responsible organizations	
Stockpiling emergency supplies, such as tents, non-perishable foods, etc.	NRCS, NFC	NRCS has some relief materials stored for 40,000 people
Raising awareness of decision-makers about earthquakes	No clearly responsible organizations	Some work has begun by NSET, LWS, UMN, and DMU of KMC
Raising awareness of entire community about earthquakes	No clearly responsible organizations	
Establishing and enforcing the seismic building code	NBC	NBC is yet to be formed by the MHPP
Constructing new residences in a seismically resistant fashion	Individual homeowners, builders	Currently there are no resources to help homeowners and builders do this
Constructing new government buildings in a seismically resistant fashion	HMGN, builders	
Constructing new lifelines in a seismically resistant fashion	Individual lifelines	
Assessing vulnerability of existing residences and retrofitting the most vulnerable	Individual home owners	
Assessing vulnerability of existing schools and retrofitting the most vulnerable	No clearly responsible organizations	

[1] All acronyms used in these charts are listed and defined at the end of this section.

Assessing vulnerability of existing government buildings and hospitals and retrofitting the most vulnerable	No clearly responsible organizations	
Assessing vulnerability of existing lifelines and retrofitting the most vulnerable	Individual lifelines	No comprehensive earthquake risk assessments have been made
Researching the earthquake phenomenon	DMG, MHPP	DMG responsible for isoseismal mapping, seismological study, etc. MHPP responsible for developing damage assessment techniques and other research related to the built environment
Monitoring seismic activity in Nepal	DMG	Currently there is a 17-station microseismic network that uniformly monitors M>= 2 Richter throughout the country. There are also two strong motion seismographs

Emergency Response and Relief Actions	Responsible Organization(s): Responsibility may be actual or presumed	Status of programmes and activities
Conducting search and rescue activities	RNA, NP	No specialized search and rescue capabilities currently exist. The need for training is urgent
Suppressing fires that occur after an earthquake	KFB	KFB has very poor institutional capability. Urgent attention is required
Providing emergency medical treatment	Individual government hospitals	Existing capabilities are much less than potential requirements
Investigating and containing hazardous materials spills, such as oil, toxic waste, etc.	No clearly responsible organizations	
Coordinating emergency response efforts of all involved agencies	CDRC, DDRC	The DDRC contains representatives of many local public sector groups. It is responsible for coordinating all aspects of the emergency response. The CDRC is made up of national representatives and provides guidance to the DDRC according to the need
Coordinating foreign aid and supplies	UNDP	UNDP has been requested by HMGN for assistance in coordinating foreign aid and supplies in national scale disasters
Establishing emergency shelters for homeless families	MOH, NRCS	
Collecting and distributing relief supplies (e.g. food, water, blankets, medical equipment)	NRCS, MOH, DO	MOH and DO provide monetary support in case of deaths and large disasters
Conducting emergency repairs to lifelines needed for the emergency response effort, such as telephones, electricity, roads, etc.	Individual lifelines	This activity depends on availability of funds. There is a strong dependence on donor agencies. In-house planning and preparedness is non-existent
Clearing debris that is hindering emergency response efforts	No clearly responsible organizations	

Informing the public about what to do and where to go, such as locations of emergency shelters and the status of relief supplies	No clearly responsible organizations	
Identifying the deceased and informing relatives.	NP	
Identifying and restricting use of and access to unsafe areas	No clearly responsible organizations	
Supplying and managing cremation timber	NTC	Timber supply, transport systems and cremation facilities are inadequate for the needs after a major disaster. Tradition inhibits other forms of funerals
Collecting and compiling information about amount and locations of damage	NP	In past disasters, Nepal police have collected information such as deaths, injuries, and damage to houses. There is currently no comprehensive damage assessment system

Rehabilitation and Reconstruction Actions	Responsible Organization(s): Responsibility may be actual or presumed	Status of programmes and activities
Deciding which buildings are safe to reoccupy, which need repair, and which need to be demolished	No clearly responsible organizations	
Establishing long-term temporary locations for homeless families, schools, government offices, etc. during the rebuilding or repair process	No clearly responsible organizations	
Clearing all debris	No clearly responsible organizations	
Planning and coordinating rebuilding efforts in a seismically safe way	No clearly responsible organizations	
Addressing planning issues such as widening streets, changing city layout, relocating families, etc.	No clearly responsible organizations	KMC is implementing municipal infrastructure development works, but earthquake risk is not considered
Rebuilding or repairing damaged houses	Individual home owners	After the 1988 Bihar-Nepal earthquake, most rebuilding of private homes occurred without consideration of seismic forces
Rebuilding or repairing damaged lifelines, such as water, electricity, telephone, and roads	Individual lifelines	This activity depends on availability of funds. There is a strong dependence on donor agencies. In-house planning and preparedness is non-existent
Rebuilding or repairing damaged government hospitals	Individual hospitals	This activity depends on availability of funds. There is a strong dependence on donor agencies. In-house planning and preparedness is non-existent
Rebuilding or repairing damaged schools	No clearly responsible organizations	A separate World Bank project was implemented to rebuild schools damaged by the 1988 Bihar-Nepal earthquake

Rebuilding or repairing damaged cultural and religious sites	DOA	In-house planning and preparedness is non-existent with the DOA
Making available and distributing financial aid to affected citizens	No clearly responsible organizations	

Acronyms:

CDRC: Central Disaster Relief Committee
DDRC: District Disaster Relief Committee
DMG: Department of Mines and Geology
DMU of KMC: Disaster Management Unit of Kathmandu Metropolitan City
DO: District Offices
DOA: Department of Archaeology
HMGN: His Majesty's Government, Nepal
IDNDR: United Nations International Decade for Natural Disaster Reduction
KFB: Kathmandu Fire Brigade
KMC: Kathmandu Metropolitan City
LWF: Lutheran World Federation
MHPP: Ministry of Housing and Physical Planning
MOH: Ministry of Home
NBC: National Building Council
NFC: Nepal Food Corporation
NP: Nepal Police
NRCS: Nepal Red Cross Society
NSET: National Society of Earthquake Technology – Nepal
NTC: Nepal Timber Corporation
RNA: Royal Nepal Army
SDU: Special Disaster Unit of the Ministry of Home
UMN: United Mission to Nepal
UNDP: United Nations Development Programme, Kathmandu Office

FORMULATION OF RISK MANAGEMENT ACTIVITIES

1. Objectives

The objectives of the formulation of risk management activities are to:

- Generate and define realistic, feasible risk management activities that solve the problems identified in the risk assessment phase
- Get the commitment of the institutions that will be in charge of implementing those activities
- Raise awareness among institutions on the need and feasibility of the implementation of those risk management activities

2. Required information

- Results of the assessment of the city's preparedness level. It is crucial to summarize and analyse the results of the scenario workshop, in which the community revised the damage estimates and proposed preliminary ideas of activities that could reduce the city's risk
- Information on the institutions that could implement activities that increase the city's level of preparedness. Most of these institutions may have already been involved in the project during the risk assessment phase and, therefore, may already be familiar with the most important problems that cause the city's vulnerability
- Examples of risk management activities implemented in other cities (not only the idea, but also the method, cost, scope, etc.).

3. Process

- Generate ideas of possible actions. The first stage of this occurs in the scenario workshop when the participants break into groups to consider actions that their organizations could conduct. The list from the workshop can be supplemented by actions from previously existing natural disaster risk management plans for the city or for other cities of similar characteristics. Also, important first steps and easy actions that were missing can be added by the project team
- Get the cooperation of organizations necessary to implement actions and work with them on the definition (objectives, tasks, schedules, budgets, etc.) of the proposed risk management actions. It may be possible to have meetings of the working groups established during the scenario workshops to further define risk management activities. Since the people of those working groups have already worked together in the assessment of the city's risk, their joint work should be very effective in defining realistic risk management activities
- Identify and visit critical institutions to work on the definition of the risk management and get the support of the institution
- After working with the related institutions on the definition of risk management actions, prepare a report or summary of the developed ideas and send them to institutions for revision
- Help institutions to identify potential sources of funding, if necessary
- Prepare a preliminary risk management plan with all the defined activities (ensure that all phases of the disaster cycle are considered). The proposed activities should be grouped considering the objectives that the plan has for reducing the risk faced by the city. Although these objectives could vary from city to city, the following is a list of eight long-term objectives that a comprehensive plan should consider. These objectives incorporate the wide array of needs faced by an earthquake threatened city and recognize the importance of addressing all major aspects of risk:

A) Improve emergency response planning and capability;
B) Improve awareness of issues related to earthquake risk;
C) Integrate seismic resistance into the process of new construction;
D) Increase the safety of school children and school buildings;
E) Improve the seismic performance of existing buildings;
F) Improve the seismic performance of utility and transportation systems;

G) Increase local experts' knowledge of the earthquake phenomena, vulnerability, consequences and mitigation techniques;
H) Improve long-term community recovery following damaging earthquakes.

4. Intermediate products

- Potential partnerships for implementation of complementary risk management activities. Through their joint work, several institutions that need to be involved in the implementation of a given activity may start preparing collaborative programs and plans
- Preliminary definition of the priorities of the proposed risk management activities
- Improvement of existing plans, programmes or activities resulting from the better understanding of the city's problems and the collaborative work of several related institutions

5. Participants

- Steering Committee
- Working groups created during the scenario workshop
- Related institutions

6. Final products

- List of feasible, realistic, well-defined risk management activities
- Commitment of institutions to implement the activities they have prepared
- Raised awareness
- Preliminary risk management plan covering all the phases of the disaster cycle

7. Observations

- Since city organizations are not accustomed to being told what to do, the goal should be to make them feel they are integral players in developing the plan, and that the plan represents their interests, not just the interests of the project
- It is very important for local institutions to decide what they can and will do -- that gives the institutions a feeling of ownership of the generated plan and creates commitment. It also guarantees feasibility and effectiveness of proposed activities
- It is also crucial to identify those organizations whose cooperation seems critical for the success of the plan and who seemed willing to consider the idea of implementing earthquake risk mitigation actions. These organizations should be visited in person to discuss directly the contents of the information
- The institutions will commit to carry out the activities, but meetings are necessary to coordinate and inform the rest of the community
- There are limited resources and many actions and needs to be met; therefore, not all the proposed activities can be implemented simultaneously or immediately. The generated list will be presented and discussed in a workshop to assign/determine priorities

8. Examples

Getting the collaboration of related institutions

It is important to get the cooperation of organizations necessary to implement actions. The success of the action plan requires cooperation from organizations such as the National Planning Commission or the Telecommunications Corporation, for example. Below is an example of an information "packet" that was sent to the heads of several institutions in Kathmandu, Nepal, asking them to cooperate in the development of an Action Plan to manage the seismic risk in Kathmandu Valley. The packet describes earthquake risk (risk is considered to be the overall seismic risk of a city, not just a series of specific problems) in Kathmandu Valley, explains why a plan is needed, explains how the plan will operate, and explains how each organization should participate in developing the plan. Each packet contained a list with potential

projects that an organization could conduct to reduce Kathmandu Valley's earthquake risk (this page was different for each packet). At the end of the packet, a form was included and each organization was requested to fill it out in order to describe in detail the action(s) that they were most interested in conducting. These packets were sent to about 50 or 60 institutions. Below is the packet that was sent to the Nepal Water Supply Corporation:

The General Manager
Nepal Water Supply Corporation
Tripureshwor, Kathmandu

SUBJECT: Kathmandu Valley Earthquake Risk Management Project Action Plan

Dear Sir,

If the 1934 earthquake shaking were to recur today, tens of thousands of deaths, ten times that many injuries, and crippling social disruption would be expected. That does not need to be true – if Kathmandu Valley begins implementing earthquake mitigation measures now, many lives can be saved. This letter describes how your organization can be involved in an effort to save lives, and prevent injuries and social, political, and economic disruption in Kathmandu Valley following an earthquake.

The National Society for Earthquake Technology – Nepal (NSET) was formed to address this problem, and is currently undertaking the Kathmandu Valley Earthquake Risk Management Project (KVERMP) with GeoHazards International as the first step. As part of this project, NSET is helping responsible organizations in Kathmandu Valley create the Kathmandu Valley Earthquake Risk Management Action Plan, a list of the most urgent earthquake risk reduction activities for Kathmandu Valley. The concept of the Action Plan was introduced at the KVERMP workshop in February of 1998. Now, we are returning to the organizations which participated in that workshop and asking the critical organizations, like yours, in Kathmandu Valley to seriously consider implementing earthquake mitigation projects.

NSET is requesting your organization to provide an earthquake risk mitigation idea for consideration in the Kathmandu Valley Earthquake Risk Management Action Plan. For each activity on the Kathmandu Valley Earthquake Risk Management Action Plan, NSET will work with your organization to make the project implementation a success.

The following packet provides more information about:

- Kathmandu Valley's earthquake risk
- The Kathmandu Valley Earthquake Risk Management Action Plan
- How your organization can be involved

Please read through this information and a KVERMP member will be contacting you to discuss the material.

Sincerely,

_____
Amod M. Dixit
Project Co-Director

Kathmandu Valley is at Extreme Risk from Earthquakes

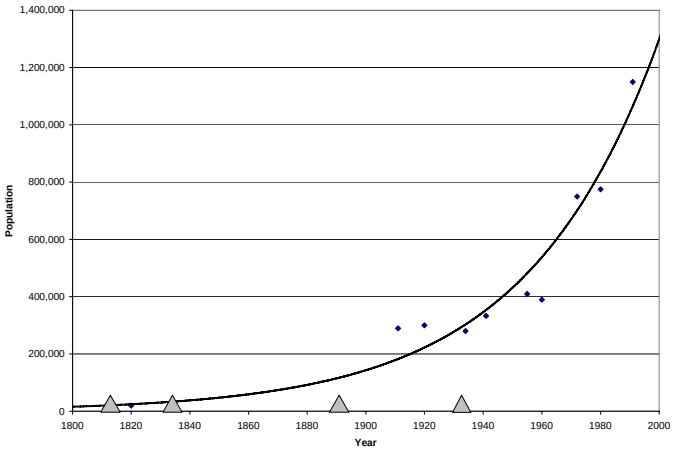


Chart showing Kathmandu Valley's population growth since 1800. The triangles indicate major earthquakes in that time period.

- Kathmandu Valley has averaged two major earthquakes per century for the last 800 years.
- There has only been one major earthquake affecting Kathmandu Valley this century (1934 AD). Another earthquake could strike at any time.
- Scientists *cannot* predict precisely when or where an earthquake will occur.

Since the earthquake in 1934, Kathmandu Valley's population has increased by 400%. Kathmandu Valley's risk from earthquakes has increased even faster than its population. After the quake in 1934, residents gathered in open spaces which, today, have nearly all been filled in by buildings. In 1934, most homes were a maximum of two stories. Today, homes are routinely built by untrained masons up to heights of five and six stories, making them much more vulnerable to earthquakes. Estimates have been made of the damage that would occur if the shaking of the 1934 earthquake were to occur again today. These estimates are based on experiences in other earthquakes around the world.

People: 40 thousand deaths; 95 thousand injuries; 600 thousand or more homeless.
Buildings: 60% of buildings in valley damaged heavily. Residences are the most vulnerable structures.
Infrastructure: 10% roads damaged; 55% bridges damaged; 40% water system damaged; 65% electricity system damaged; 15% of urban areas expected to remain without water service for more than 6 months.

The next major earthquake to affect Kathmandu Valley will be an unprecedented disaster if no mitigation efforts are made now.

Simple Actions Can Be Taken to Reduce Kathmandu Valley's Risk

Earthquakes alone do not kill people. The collapse of man-made structures do. Although people cannot control the occurrence of earthquakes, people can definitely control the quality of man-made structures.

There are many simple actions that can be taken now to reduce the deaths, suffering, and impoverishment that will be caused by the next earthquake in Kathmandu Valley.

What Is the Kathmandu Valley Earthquake Risk Management Action Plan?

- The Kathmandu Valley Earthquake Risk Management Action Plan is a list of critical activities that should be taken to reduce Kathmandu Valley's earthquake risk.

- These actions will be implemented by organizations such as yours. NSET will help all of the organizations with actions on the list to successfully implement the projects. NSET will conduct activities such as presenting the project to potential funders, and arranging earthquake-related technical support, if requested.

- NSET will review progress of each activity on the list. Each year, NSET will publicize the successes of each project, and will identify reasons if progress has been slower than expected.

- The actions that constitute the list will be selected by a diverse panel of Kathmandu Valley citizens, representatives of critical organizations, and the management committee of NSET. There will be a KVERMP workshop in October in which NSET will seek the opinion of you, and others like you, to determine which issues you think are important for the plan. Following this, the decision committee will select the items for the plan. The audience will be allowed to observe the entire decision making process.

- We want your organization to submit an idea to be considered for selection for the Kathmandu Valley Earthquake Risk Management Action Plan. This idea can be small or large, short-term or long-term, as long as it addresses some critical aspect of earthquake risk.

What Can You do?

- In October, KVERMP will conduct a workshop to select the activities that will make up the Kathmandu Valley Earthquake Risk Management Action Plan. We would like your organization to submit an action for consideration.

- In the following pages, we list some actions that your organization could undertake to reduce Kathmandu Valley's earthquake risk. These actions come from sources:

1. The representative of your organization who attended KVERMP's Kathmandu Valley Earthquake Risk Management Project Workshop, February 21 – 22, 1998 in Dhulikhel.
2. The National Action Plan on Disaster Management in Nepal, developed by the Nepal National Committee for the International Decade for Natural Disaster Reduction (IDNDR) and endorsed by the Ministry of Home.
3. The activities that similar organizations in other cities of the world have conducted to reduce their earthquake risk.

- Please select the action that seems like the best candidate for the Action Plan. If you can think of an idea that does not appear on the list which is more appropriate for your organization, that should also be considered.

- For the idea that you select, please complete the form at the end of the packet.

- NSET will contact you shortly to discuss these ideas.

Nepal Water Supply Corporation Activities

Please identify the action that seems to be the best candidate for your organization to submit to the NSET Action Plan.

Activities suggested by the Nepal Water Supply Corporation Representative at KVERMP Dhulikhel workshop (please see pages at end of packet)

- Rehabilitate Balaju Reservoir.
- Rehabilitate Bansbari Reservoir, Bhaktapur.
- Conduct Melamchi project considering effects of earthquakes.

Activities from National Action Plan on Disaster Management in Nepal

- Store polythene pipes in necessary numbers at local level.
- Store bleach powder for sterilizing water in temporary settlements.

Activities conducted by similar organizations in other cities

- Assess vulnerability of water supply system to earthquakes.
- Ensure that future construction on the water supply network will be earthquake-resistant.
- Make an emergency response plan for water supply network.
- Train staff to respond appropriately after an earthquake disaster.
- Assess vulnerability of sewer system to earthquakes.
- Ensure that future construction on the sewer system will be earthquake-resistant.
- Make an emergency response plan for the sewer.

You may also consider ideas that do not appear on this list.

Example Activity

Name of Organization: *Your Organization*

Name of Person: *Highest available authority*
Telephone: *977-1-abc-xyz*
Fax: *977-1-abc-xyz*
Email (if available): *you@xxx.com.np*

Title of action: *Train all employees in how to act in the event of an earthquake.*

Problem being addressed: *Employees currently know nothing about earthquake safety and will panic if an earthquake occurs.*

Estimated resources required

Funds: *Earthquake safety pamphlet printing costs = NRs xyz*
Administrative costs = NRs xyz
Training expenses = NRs xyz
TOTAL = NRs xyz

Expertise, equipment, etc: *Need NSET to help us identify a trainer and pamphlets that we can reprint.*

Availability of funds

Funds for the proposed action available within your organization:
No funds currently available.

Funds not available:
all

If funds not available currently, are you willing to include the proposed action(s) in the programme for the next fiscal year?
Yes. Will include in next year's programme

Funds required from external sources:
None should be required.

Estimated schedule

Year to start: *1999*
Year to complete: *2000*

Description and major steps to conduct action:

1. *NSET identifies expert to conduct training.*
2. *Organize an hour-long training event for the entire staff.*
3. *NSET identifies pamphlet that explains earthquake risk.*
4. *Translate (if necessary) and reprint enough copies of pamphlet for entire staff.*
5. *Conduct training.*

Earthquake Risk Mitigation Activity

Name of organization:

Name of person:

Telephone:

Fax:

Email (if available):

Title of action:

Problem being addressed:

Estimated resources required

Funds:

Expertise, equipment, etc. (optional):

Availability of funds

Funds for the proposed action available within your organization:

Funds not available:

If funds not available currently, are you willing to include the proposed action(s) in the programme for next fiscal year?

Funds required from external sources:

Estimated schedule

Year to start:

Year to complete:

Major steps to conduct action:

Example of a risk management action proposed for Quito, Ecuador

Establish a proper insurance tariff with underwriting guidelines

A proper insurance tariff with insurance underwriting guidelines considering earthquake hazards would encourage responsible, earthquake-resistant design and construction. Under this project, the Superintendencia de Bancos y Seguros, in collaboration with Asociación de Compañías de Seguros del Ecuador, Asociación Nacional de Agencias Colocadoras de Seguros del Ecuador, and international reinsurers, would establish fair rating guidelines, which would make earthquake insurance available to residents of Quito. The insurance tariff and underwriting guidelines would be based on soil properties, estimated ground shaking intensities and subsequent geological hazards, damage distribution estimates, and structural design and construction. Rating discounts would then be available for structures with appropriate earthquake-resistant design and construction. A proper insurance tariff and underwriting guidelines could also ensure that earthquake insurance is feasible for existing structures, especially residential buildings.

Auxiliary tasks:

- Evaluate sufficiency of client earthquake coverage
- Train insurance company staff to advise clients on earthquake risk management actions
- Train insurance company staff to monitor clients' adherence to building codes

Possible resources:

Sources of information for this project include the system of tariffs used in Mexico, and CRESTA, the international working group of insurance and reinsurance companies.

Responsible agencies:

- Superintendencia de Bancos y Seguros (National Superintendent of Banks and Insurance)
- Asociación de Compañías de Seguros del Ecuador (Association of Insurance Companies of Ecuador)
- Asociación Nacional de Agencias Colocadoras de Seguros del Ecuador (National Association of Brokers of Ecuador)
- Reinsurers
- Insurance companies, agents, and brokers

DEFINITION OF THE INSTITUTION THAT SHOULD IMPLEMENT THE PLAN

1. Objectives

The main objective is to identify and reach consensus on the institution that will be in charge of implementing the Action Plan developed by the project. This may be an already existing institution or a new one, a public or a non-governmental organization. Given a set of required characteristics, the community will agree on the institution that is best prepared to carry out a successful implementation of the recommendations and plans produced by the project.

2. Required information

- Clear definition of the functions of the institution
- List of required characteristics of the institution
- Summary and analysis of the results of the scenario workshop during which the representatives of the community discussed which institution should implement the risk management plan produced by the project
- Identification of the institutions that, potentially, could be in charge of implementing the plan

3. Process

- Define the functions of the institution. In general, the institution will not be directly in charge of executing the risk management activities included in the plan. Instead, the main objective of the institution will be to ensure that the prepared plan is successfully implemented. It will conduct activities that increase the likelihood of success of the specific initiatives included in the plan. For this purpose, the institution should have the following functions:
  A) Promote risk management activities at every level of the community;
  B) Raise awareness of the community on the city's seismic risk and the feasibility of its management;
  C) Coordinate risk management efforts of both individuals and institutions;
  D) Monitor the progress (or the lack of it) of the plan's implementation and report findings;
  E) Periodically review and update the risk management plan.

- Prepare a set of required characteristics of the institution. Although this may change from city to city, the basic characteristics of the institution in charge of implementing the risk management plan produced by the project are that the institution be:
  A) Representative. All sectors of the community should feel represented by the institution and all their interests should be considered;
  B) Politically independent. Political and administrative changes may interrupt the long-term implementation of the risk management activities. The institution and its functions should not be affected by these changes;
  C) Technically and administratively capable of carrying out the implementation of the plan produced by the project;
  D) Accepted and supported by the whole community. In this sense, transparency and efficiency are critical.

- Prepare a report on the recommendations produced in the scenario workshop regarding the institution that should be in charge of the plan's implementation, add the lists of functions and required characteristics of the institution, and send the report to members of the Local Advisory Committee (LAC) for their review
- Incorporate feedback of the LAC and prepare a report that should be presented, discussed, and agreed on during the Action Plan workshop
- If the institution is identified at an early stage of the project, that institution should be provided with training, visibility, and a leading role to prepare it for the implementation phase of the risk management process

4. Intermediate products

- Well-defined functions for the institution in charge of the plan's implementation
- A set of characteristics the potential institution should possess that has been discussed and agreed on
- A report on the recommendations for the institution that should be discussed during the Action Plan workshop

5. Participants

- Steering Committee
- Local advisory committee
- Related institutions

6. Products

- A well-defined proposal for the institution that should be in charge of the implementation of the project results. This proposal should be presented to the community at the Action Plan workshop for its discussion, revision, and approval

7. Observations

- While the situation may differ from city to city, it seems that a non-profit, non-governmental organization (NGO) is the best qualified institution to be in charge of the implementation of the risk management plan. The characteristics of a typical NGO may guarantee independence from political influence and avoid conflicts of interests

8. Examples

The institution in charge of implementing the risk management plan developed for Kathmandu, Nepal

The National Society for Earthquake Technology – Nepal (NSET) has taken responsibility for creating and implementing this plan. NSET, a multidisciplinary professional society, promotes awareness of earthquake risk and implementation of seismic risk reduction projects in Nepal. NSET is the national member of the International Association of Earthquake Engineering and has developed close working relationships with several international professional and academic institutions. NSET is associated with the United Nations International Decade for Natural Disaster Reduction as the implementer of the RADIUS project in Kathmandu Valley, a project examining seismic risk in over 70 cities around the world. 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.

NSET's non-governmental, non-profit status as a professional organization is an asset in managing earthquake risk. Organizations similar to NSET have successfully coordinated earthquake risk management in other countries. This role for NSET is in accordance with the declared policy of His Majesty's Government, Nepal (HMGN) to develop collaboration between governmental and non-governmental organizations in the area of disaster management. NSET has no political alliances and is able to provide the long-term stability and focus that is necessary to manage a long-term problem such as earthquake risk. As a non-profit organization, NSET is pledged to publicize its financial dealings related to this plan. NSET will not benefit financially from money raised to support the projects of other institutions included in this plan. As a professional organization, NSET's management committee and members include many of Nepal's foremost experts in earthquakes, in disciplines ranging from earth science to engineering to public information. All of these factors place NSET in a uniquely qualified and objective position to coordinate Kathmandu Valley's earthquake risk management efforts.

FORMULATION OF A STRATEGY FOR IMPLEMENTATION

Reducing a city's earthquake risk is a multi-faceted task. It requires many organizations to implement specific activities directed towards earthquake disaster preparedness and risk management. This section describes the specific activities to be conducted by the institution in charge of the plan implementation for its role in this process. Since these activities may be different for the institution of a given city depending on the local conditions, the activities designed for the National Society for Earthquake Technology - Nepal (NSET) to implement the risk management plan developed for Kathmandu are presented here as an example. This material is taken from the Kathmandu Valley Earthquake Risk Management Action Plan report published by NSET and GeoHazards International.

The activities that NSET should conduct range from building support for earthquake mitigation activities in general, to providing guidance for specific risk management initiatives. These activities are classified into three groups: a) Building support for the plan and earthquake risk management in general, b) Supporting individual initiatives; and c) Keeping the plan going.

Building Support for the Plan and Earthquake Risk Management in General

Any activities that increase the community's motivation to address earthquake risk, or which raise trust in the plan or in NSET, will help the plan to achieve its objectives. Therefore, part of the strategy of the plan is to build support in these areas.

Using Transparent and Inclusive Processes

The decision making for the risk management plan has been done and will continue to be done in an open, public manner, not behind closed doors. NSET will ensure that the process remains open to build the understanding and trust of the Kathmandu Valley community in this plan. Efforts were made to inform and involve all "key players" in the development of the plan, in particular those people who are responsible for implementation of the initiatives, and experts from relevant professions and agencies. All interested parties, including the press, are welcome to observe the plan decision making process and comments from all parties are valued. In future editions of the plan, efforts to be transparent and inclusive will continue and expand.

Making Decisions Rationally

All decisions that were made for the plan can be justified rationally and were based on the advice of Nepalese technical experts. Although some of decisions were subjective, the decision making process and the information used to influence those decisions are documented and available for review.

Using Open Financial Policies

NSET is a not-for-profit organization and it will remain neutral so that decisions are being made solely considering the best interests of Kathmandu Valley. NSET and its members will not benefit financially from money raised to support the projects of other institutions. NSET will only benefit financially from the plan if money is raised specifically to support projects to be implemented by NSET which are described in the plan. NSET will annually make publicly available its financial activities related to the plan.

Building Relationships with Other Groups

NSET will build relationships with a variety of groups present in Kathmandu Valley, such as businesses, government organizations, other NGO's, professional societies, and international groups. These relationships will focus on building the ability to work together and building trust. It is expected that these relationships will help strengthen the plan, even if the interaction has no relation to the plan. In addition, NSET will present the Action Plan as a whole, and particularly the "Initiatives to Implement Now" section (see Appendix 2), to various groups as the opportunity arises. This will keep groups aware of the plan and its progress.

Raising General Awareness

Awareness of earthquakes in Kathmandu Valley is growing, but it is still low. It is important that people at all levels of society understand what the earthquake threat is, and understand how the plan can help in reducing that risk. When possible, NSET will conduct awareness raising activities, and it is expected that these will increase understanding of why the plan is required, and will therefore increase support for it.

Educating Decision Makers Through Awareness Efforts

NSET may offer study tours for government officials and professional leaders. These tours would consist of two types:

- *Examination of earthquake disasters striking other nations.* Visits to communities ravaged by earthquakes would increase the understanding of why Kathmandu Valley needs to address this problem. It will increase their motivation and commitment to work in this area.
- *Exposure to government and professional practices developed in other countries to address earthquake risks*. Examining how other societies manage earthquakes would educate leaders about how Kathmandu Valley can benefit and learn from other communities.

Conducting Regular Public Hearings

NSET will hold regular hearings to allow parties responsible for initiatives contained in the plan to report on progress, to investigate interesting topics and to educate the NSET management committee and staff. These meetings will provide an opportunity for the NSET management committee to keep in touch on a regular basis, as well as providing an opportunity for the management committee to share information with others. The press will be encouraged to report on these hearings.

Formally Presenting Plan to Government Agencies

NSET will present the plan to the Council of Ministers, the National Planning Commission, and national and local government agencies. NSET will recommend that they adopt the plan as their official guide to managing earthquake risk and that they support the initiatives in the plan.

Informing the International Community in Kathmandu Valley About the Plan

Kathmandu Valley's international community is potentially a valuable asset in helping to reduce Kathmandu Valley's risk. NSET will present the plan to foreign embassies, missions, and other international groups present in the valley.

Supporting the Individual Initiatives

The individual initiatives are important for reducing future losses. This is the most tangible area of the plan in which success can be measured and change can be monitored. For the plan to be successful, the initiatives need to be successful. To that end, NSET proposes to aid each initiative in the "Initiatives to Implement Now" section (see Appendix 2) in a variety of ways which are explained below.

Coordinating Initiatives

It is important that all mitigation work be done in an efficient and effective manner. For this to occur, there needs to be a great amount of coordination to make sure that work is not repeated, knowledge is shared, and that plans of various different institutions fit together smoothly. As an example, there are many different types of emergency relief supplies that need to be stockpiled before a disaster. There are also many different government and private organizations that are storing or could potentially store these supplies. It is important that these organizations coordinate with each other to make sure that there are not surpluses of one type of supply and shortages of another. NSET will act as a link, as needed, between these organizations and a catalyst to get them working together. NSET will not be involved, unless requested, in implementing projects that are the responsibilities of other organizations.

Planning Initiatives

Upon request, NSET will work with organizations to help them determine which initiatives are most urgent, cost-effective, and feasible for them to implement. NSET will help organizations to analyze the

costs and the benefits of the various earthquake risk mitigation options that face them. If it is helpful, NSET will collaborate with institutions to define a realistic scope of work, milestones, and schedule for initiatives that they will undertake.

Arranging Technical Support

NSET will arrange technical support for activities in the "Initiatives to Implement Now" section (see Appendix 2) of the plan in the form of publications or consultants. In most cases, NSET will not directly provide technical information or consultation, but will act as a referral service.

Conducting Peer Review of Initiatives

In some situations, expert guidance and support can increase an initiative's effectiveness and efficiency. Peer review is a process where expert professionals without an interest in a specific project are asked to review the concepts and methods at various critical stages of implementation and to discuss their observations with the professionals responsible for implementing the project. This process adds expertise to the project, builds the skills and confidence of professionals, and helps to assure that goals will be met. Peer review is a voluntary, structured approach to including expert technical input in a project. NSET can arrange for peer review by Nepalese and foreign experts for selected projects in the "Initiatives to Implement Now" section.

Seeking External Funding for Respective Agencies

NSET will present the Action Plan as a whole to a variety of groups that may be interested in funding earthquake risk mitigation projects. NSET cannot be responsible for raising money for any specific project, but will work to increase the awareness of funding groups of the plan and the need for money to support the individual projects in the plan. NSET will not receive or administer any of the funds received through this process for initiatives to be implemented by other institutions. NSET will annually make available its financial activities related to this plan.

Publicizing Successful Initiatives

NSET will publicize successful initiatives and the responsible organizations to public groups and the press. This will be accomplished through workshops, lectures, press conferences, and future editions of this plan. NSET, as a neutral player in the plan, can credibly publicize the actions of institutions that have made a difference in Kathmandu Valley's earthquake safety.

Keeping the Plan Going

For the plan to be useful, it needs to be up-to-date and applicable to Kathmandu Valley as the community changes. Not only will the particular initiatives need to be monitored for their progress and then updated accordingly, but the goals and strategies of the plan will need to be continually reviewed to see if they are functioning as intended.

Monitoring the Initiatives Annually

The progress of each initiative which is listed in the section "Initiatives to Implement Now" will be monitored annually. The purpose of this process is both to identify which institutions deserve public praise, and to learn why some initiatives are more successful than others. The process will be conducted openly and will be summarized in the next edition of the plan.

Evaluating the Objectives and Strategies Periodically

The plan will be evaluated periodically. The plan development team recommends that this evaluation occurs every two years. The plan objectives will be thoroughly reviewed to make sure they remain appropriate. The plan strategy should be thoroughly reviewed to determine if it has been effective. This process will result in recommendations to be used in creating the next edition of the plan.

Creating a New Edition of the Plan Periodically

A revised plan will be assembled, published and distributed at the same interval as the plan evaluation. The new version of the plan will be developed in an open fashion, allowing opportunities for all interested parties to comment on proposed initiatives, objectives, and strategies. The lessons from monitoring and evaluating the plan will be incorporated. Later versions of the plan will include reports on past successes and failures of the plan.

IMPLEMENTATION OF THE ACTION PLAN WORKSHOP

1. Objectives

The objectives of this workshop are:

- To present to the community the preliminary action plan that has been developed and to obtain their feedback
- To reach consensus on the activities that should be incorporated in the plan and define their priorities
- To prepare recommendations on the institution that should be in charge of implementing the plan and on a strategy that would ensure its implementation

2. Required information

- Comprehensive list of institutions and people who should attend the workshop
- Invitation packages to be sent to the institutions attending the workshop. These should include relevant information and an explanation of the institution's expected participation
- Results of the assessment of the city's current level of risk management preparedness
- Preliminary action plan developed in collaboration with city institutions
- Proposal of the institution that should be in charge of implementing the plan including its functions, required characteristics, and a list of potential candidate institutions
- Proposal of a strategy that would ensure the successful implementation of the plan
- A set of handouts to be distributed during the workshop to inform the participants about the topics to be discussed and to collect their feedback

3. Process

- Prepare workshop programme and materials (handouts)
- Send invitations including background information, preliminary action plan, the proposals for the institution that should be in charge of the plan's implementation and the proposals for the strategy that would ensure a successful implementation process
- Find a venue that ensures the active and efficient participation from attendees (comfortable, suitable, equipped, and, if possible, isolated so people can concentrate on the workshop proceedings)
- Hire and train a facilitator who will lead/moderate the discussions. It would be very useful to hire the same person who facilitated the discussions at the scenario workshop
- Prepare press release and carry out the appropriate publicizing to raise awareness and get support
- Send an invitation to the mass media
- Implement the workshop. To achieve the workshop objectives, three half-day sessions are suggested to be prepared. In the first session, the local steering committee presents the background information needed for the workshop. It includes a short revision of the methodology of the project, a summary of the estimated damage to the city in a hypothetical earthquake, an evaluation of the present level of preparedness of the city, and a description of the basic elements of the plan that is being prepared along with the strategy that is being proposed for its implementation. In the second session, representatives of the institutions that have been working on the development of the plan present the activities that have been proposed to reduce the city’s seismic risk. The activities are divided into several categories considering the different aspects that need to be improved to increase the level of preparedness of the city for seismic disasters. Finally, the third session is used by the participants to discuss the preliminary action plan that has been presented, agree on the priorities that are to be assigned to the proposed activities, and make recommendations on a process that would ensure the implementation of the plan and the institutionalization of the risk management efforts
- Analyse the workshop results and prepare a report that is sent to the institutions for their review
- Prepare a final report incorporating feedback, comments and suggestions sent by the various institutions

4. Intermediate products

- New ideas of risk management activities that can be developed and included in the final plan
- New ideas on the functions and characteristics of the institution that should be in charge of implementing the plan
- New ideas to improve the strategy that should be adopted to ensure successful implementation of the plan
- Stronger relations and potential partnerships among the institutions participating in the workshop
- Raised awareness

5. Participants

- Steering Committee
- Invited local and, if possible, international experts
- City authorities
- Facilitator
- Representatives of the various community sectors and of the relevant institutions
- Invited local and international funding organizations as well as other potential donors
- Mass media

6. Products

- Improved risk management plan that includes feedback from workshop participants
- A better understanding of the priorities for the plan implementation. The workshop participants discussed and assigned priorities to the activities that are to be included in the final plan
- A better understanding by the institutions of the proposed plan and, therefore, stronger support for it
- A concrete proposal of the institution that should be in charge of implementing the plan
- A well-defined strategy to be adopted for the implementation of the plan
- Public commitment of the institutions to support the plan and its implementation
- Raised awareness

7. Observations

- Once again, the facilitator plays a critical role in helping the workshop participants reach consensus on such sensitive and important issues as the priorities of the risk management activities, the institution that should be in charge of the implementation of the plan, and the strategy that would ensure successful implementation of the plan. Special care should be taken when selecting the facilitator and when training him/her. The facilitator must have a clear understanding of the project and the workshop goals
- When presenting the background information at the beginning of the workshop, the presentation of the summary of the estimated damage caused by the hypothetical earthquake and of the assessment of the city's current level of preparedness is very important. While the damage estimates will tell the participants that there is a real problem that has been well documented, the assessment of the city preparedness will demonstrate that the community is not ready to survive that threat. When this is understood, it will be easier for the participants to understand the solutions proposed by the plan and realize the importance of its implementation
- Every possible effort should be made to have active and enthusiastic participation of the people and institutions attending the workshop. The main goal should be to make them feel they are integral players in developing the plan, and that the plan represents their interests, not just the interests of the project

8. Examples

Example of action plan workshop's agenda

Day 1

9:00 to 10:00
- Workshop inauguration

10:00 to 10:15
- Break

10:15 to 11:00 Background information
- Introduce workshop purpose and agenda
- Overview of the project and its implementation so far
- Overview of loss estimates

11:00 to 1:00 Basic information on the proposed plan
- Overview of city's current level of preparedness for seismic disasters
- Introduction to plan and plan concept
- Clarify and discuss plan objectives
- Introduction to proposed plan strategy

1:00 to 2:00
- Lunch

2:00 to 5:00 Presentation of the preliminary plan developed with the institutions
- Present initiatives to appear in plan by category:
  A) Improve emergency response planning and capability;
  B) Improve awareness of issues relating to earthquake risk;
  C) Integrate seismic resistance into the process of new construction;
  D) Improve the safety of school children and school buildings;
  E) Improve the seismic performance of existing buildings;
  F) Improve the seismic performance of existing non-essential utility and transportation systems;
  G) Increase experts' knowledge of the earthquake phenomenon, vulnerability, consequences and mitigation techniques;
  H) Prepare for long-term community recovery following damaging earthquakes.

5:00
- Adjourn

Day 2

Using the information provided on Day 1, the objective on Day 2 is to reach consensus on the activities that should be included in the plan, on the priorities assigned to those activities, on the strategy to be adopted for the implementation of the plan, and on the institution that should be in charge of leading the implementation process.

9:00 - 9:30

- Introduce Day 2 purpose and agenda
- Report on Day 1's activities

9:30 - 10:00

- Present and discuss criteria to assign priorities (see example below)

10:00 - 10:15 Break

10:15 - 11:30 Assigning priorities

- Analyse and define the priorities of the risk management activities included in each category
- Discuss

11:30 - 13:00 Implementation strategy

- Discuss the proposed implementation strategy
- Make recommendations on the institution that should be in charge of the plan implementation
- Reach consensus on how to start the implementation process

13:00 -13:30 Workshop evaluation and closing ceremony

13:30
- Adjourn

Example of criteria used to select activities for inclusion in the plan

- Does the initiative appeal to common sense? Does it obviously reduce earthquake risk?
- Is the initiative supported by the organization required for its implementation?
- Is the initiative easy to implement?
- Does the initiative appear to be cost-effective?
- Is the initiative politically realistic to implement?
- Is the initiative technically practical to implement?

Example of criteria used to assign priorities

- Which of all the actions in a category, in my judgement, seems to have higher priority?
- Which action has the best cost-benefit relationship?
- Are there the necessary funds to implement this action?
- Is it probable that this action will be successfully implemented?
- What level of support to this activity can be expected from the community?
- What level of participation is required from the community for its implementation?
- What other activities would be generated or implemented if a given activity is implemented first?
- Which activities cannot be implemented if a given activity is not implemented first?
- Will the activity generate a long-term process that effectively contributes to reduce the city's risk?

Example of handout used during the action plan workshop in Kathmandu, Nepal

Category: Improve awareness of issues relating to earthquake risk

Action	Who could conduct action
• Conduct programmes to raise awareness about earthquakes and earthquake risk • Colloquium of HMGN ministers and Members of Parliament • Hospital administrators • Engineers and building construction professionals • Public safety employees and emergency response officials • NGOs and CBOs • Annual Earthquake Day	• Ministry of Science and Technology • Ministry of Home • Disaster Management Units • Nepal Red Cross Society • NGOs, INGOs • IDNDR National Committee • Department of Mines and Geology

Action	Who could conduct action
• Establish Disaster Management Units in key organizations to assess earthquake risk, raise awareness about earthquakes, and plan for disaster management	• Lalitpur, Madhyapur, Bhaktapur, Kirtipur, Wards • Hospitals • Nepal Telecommunications Corp., Nepal Water Supply Corp., Nepal Electricity Authority • Department of Roads, Tribhuvan Int'l Airport

Action	Who could conduct action
• Educate staff about earthquake preparedness and how to behave during an earthquake	• All departments and ministries • Municipalities • Private businesses, other groups

Action	Who could conduct action
• Educate businesses about how to prepare for an earthquake • Create incentives for businesses to increase their earthquake safety	• Ministry of Industry • Federation of Nepal Chamber of Commerce and Industry • Ministry of Labour • Ministry of Commerce • Private industries

Figure 31. Working group meeting during action plan workshop in Tijuana, Mexico.

PREPARATION, PUBLICATION AND DISSEMINATION OF THE ACTION PLAN

1. Objectives

The objectives are to:

- Prepare the final version of the risk management action plan
- Submit the plan to the city authorities
- Prepare and publish an overview of the plan to be distributed to the community

2. Required information

- Corrected and revised risk management action plan
- Feedback of the community contained in handouts collected during the action plan workshop
- Examples of published action plans produced for other cities

3. Process

- Analyse the handouts and workshop results.
- Prepare the final version of the action plan describing the objectives, strategy, and history of the plan. Each of the actions included in the plan should be analysed in a three-step process. The initiatives which meet the criteria of all three steps should be included in the plan and should be actively assisted by the institution in charge of implementing the plan

Step 1:
The first step for selecting the initiatives is to examine how well each potential initiative meets the following subjective criteria:

- Does the initiative appeal to common sense? Does it obviously reduce earthquake risk?
- Is the initiative supported by the organization required for its implementation?
- Is the initiative easy to implement?
- Does the initiative appear to be cost-effective?
- Is the initiative politically realistic to implement?
- Is the initiative technically practical to implement?

This analysis is carried out using the feedback provided by the community during the action plan workshop.

Step 2:
Initiatives that satisfy most or all of the above criteria are then analysed to determine how they relate to the plan's objectives. For example, the objectives established for the action plan in Kathmandu, Nepal are as follows:

- Improve emergency response planning and capability
- Improve awareness of issues relating to earthquake risk
- Integrate seismic resistance into the process of new construction
- Improve the safety of school children and school buildings
- Improve the seismic performance of existing buildings
- Improve the seismic performance of existing non-essential utility and transportation systems
- Increase experts' knowledge of the earthquake phenomenon, vulnerability, consequences and mitigation techniques
- Prepare for long-term community recovery following damaging earthquakes

Step 3:
Initiatives are then examined to determine how effective they are as a group to begin a comprehensive, lasting process of earthquake risk management in the city. Attention should be also given to keeping the list of initiatives as a whole short and achievable.

- Send final version of the action plan to the institutions for final revision
- Prepare a simplified version for mass dissemination
- Prepare press release
- Organize a ceremony to submit officially the Risk Management Action Plan to the city authorities
- Disseminate the plan widely in collaboration with the mass media (e.g., have action plan printed in newspaper) and through public institutions (libraries, etc.)

4. Intermediate products

- Documentaries for televison and radio
- Short brochures
- Seminars and conferences

5. Participants

- Steering Committee
- Journalist
- Mass media
- Local authorities

6. Final products

- Risk management action plan submitted to the city authorities
- Simplified version of the action plan widely disseminated
- Raised awareness on the feasibility of managing the city's risk

7. Observations

- Publication has to be attractive (i.e. easy to read , not too long/short, and interesting). Should include graphics and helpful maps
- Journalist is crucial - as a professional communicator, (s)he knows what is interesting to the people. (S)he will also guarantee the clarity of the publication - if (s)he understands the information being transmitted, then the general public will understand it as well
- It is important to give proper credit to all the institutions and individuals that participated in the preparation of the action plan. It must be made clear that the proposed plan is the result of the joint efforts of many institutions and that the interests of all the community sectors are being considered. Besides, it is important to promote feelings of ownership in the various institutions of the city in order to ensure their active involvement in the implementation process of the plan
- It is important to make the ceremony, in which the action plan is submitted to the authorities, as visible and publicized as possible. In the ceremony, the local authorities will commit publicly to support and implement the action plan that the project has prepared for the city. This will give the plan the political support that is required for the plan's successful implementation

8. Examples

Example of initiatives included in the risk management action plan prepared for Kathmandu, Nepal

Note: This material is taken from the Kathmandu Valley Earthquake Risk Management Action Plan published by the National Society for Earthquake Technology - Nepal (NSET) and GeoHazards International (GHI). The full version of this plan is included in annex 2.

OBJECTIVE: IMPROVE EMERGENCY RESPONSE PLANNING AND CAPABILITY

INITIATIVE 1:
NSET will request HMGN to (1) constitute the National Disaster Management Council (NDMC) headed by the Prime Minister; and (2) direct the NDMC to define an integrated national disaster management system that describes the roles and reporting relationships for each involved agency at the national, district, municipal or village, and ward levels of government. NSET will work with the Prime Minister's office and other concerned authorities to see that these steps are taken and to provide technical advice and assistance upon request.

Schedule:
By the end of the first year the NDMC will be created and the national disaster management system will be defined.

Cost:
The cost of forming the NDMC can be absorbed by government institutions. Defining an integrated national disaster management system will require outside funds to support the participation of an expert in emergency management and to cover the costs of a workshop or several meetings.

Preliminary estimate: NR 500,000 (US$ 7,000)

INITIATIVE 2:
Once constituted, the National Disaster Management Council should (1) provide guidance for the preparation of new (or revision of existing) integrated emergency response plans that identify internal and external relationships for every responsible organization including government and non government agencies, public and private utilities, hospitals and schools; and (2) direct these organizations to prepare plans according to the guidance and to assess communications equipment, facilities and training needed to execute the plans during an earthquake disaster. NSET will work with the Prime Minister's office and other concerned authorities to see that these steps are taken and provide technical advice and assistance upon request.

Schedule:
By the end of the first year the NDMC should issue the planning guidance to every responsible organization. Integrated plans and reports on equipment, facility and training needs will be submitted to the Prime Minister at the end of the second year.

Cost:
Expert assistance is required to provide guidance and a training session on preparing emergency response plans and to aid each responsible organization in preparing these plans.

Preliminary estimate: NR 1,000,000 (US$ 5,000)

PHASE IV: PREPARATION OF THE PLAN IMPLEMENTATION

All the efforts and time invested in evaluating the earthquake risk of a city and defining action plans to manage that risk will be wasted if nothing is actually implemented. Throughout the risk management project, several activities have to be carried out to set up the political, legal, financial, and cultural conditions that will facilitate the implementation of the plans and programmes prepared by the project and, most importantly, promote the institutionalization of earthquake risk management in the city. Among these activities are the following:

- Incorporation of all the community sectors in the project: representatives of the institutions and sectors of the community should have an active participation throughout the project
- Proper information and dissemination of results: effective collaboration with the mass media throughout the project should be promoted so that the whole community is properly informed about what the project is doing for the city and what the project results are
- Search for funding: strong efforts to generate funds, especially local funds, have to be made by approaching the industrial, commercial and financial sectors of the community as well as international aid organizations with offices in the country
- Creation of an organization to coordinate risk management activities: an organization must be selected (or created if a suitable one does not exist) to coordinate, monitor, and advocate risk management efforts in the city

INCORPORATION OF THE COMMUNITY

- Local advisory committee and workshops, joint work with people and institutions throughout the project for both the evaluation of risk and planning

DISSEMINATION OF INFORMATION

- Working with mass media
- Incorporating journalist in Steering Committee
- Publishing results in layman's terms

FUNDRAISING

- Using seed money to generate local funding. This is important not only in the implementation of activities, but also in the creation of feelings of ownership
- Incorporating the private, financial, commercial and industrial sectors. Demonstrating to them the benefits of protecting their investments. Approaching potential local and international funders, e.g., Lions Clubs, Diplomatic Missions, United Nations, Red Cross, etc.

ESTABLISHMENT AND STRENGTHENING OF RISK MANAGEMENT INSTITUTION

- Once the institution which should be in charge of carrying out and monitoring the action plan is identified, it should be provided with appropriate training, experience through the implementation of the project, and general directions on how to establish an organization of this type. Using examples of organizations that have been successfully established in other places, work plans and necessary staffing, for example, should be defined
- The goal is to have the institution gain visibility and credibility and have the community accept this institution as that which should be in charge of implementing the plan

PART III: ANNEXES

ANNEX 1: EXAMPLE OF AN EARTHQUAKE SCENARIO

Note: This material is taken from the publication "The Quito, Ecuador, Earthquake Risk Management Project - A Compilation of Methods, Data, and Findings" published by Escuela Politecnica Nacional, GeoHazards International, Ilustre Municipio de Quito, ORSTOM-Quito, and OYO Corporation.

A MONTH IN QUITO FOLLOWING A FUTURE EARTHQUAKE

The technical analysis of this project, while providing detailed estimates of damage from potential earthquakes, does not communicate the impact of such disasters. The purpose of this phase of the project was to describe life in Quito during the month following one of these earthquakes. This description can help government officials, emergency service planners, business leaders, and the general public to visualize the consequences of a future major earthquake, and provide the motivation and understanding required to act.

The following description is based on the technical analysis of the local earthquake and the vulnerability study of Quito's city services, public buildings, and infrastructure.

CAUTION

The following section describes possible impacts of the potential local earthquake in Quito. Other earthquakes not evaluated in this study would produce different consequences. This is not a prediction of a specific earthquake, earthquake damage, or consequences. This description is intended only for use in planning and preparedness exercises and in raising awareness of Quito's earthquake risk. The authors, advisors, and other contributors to this report are not responsible for use beyond these purposes.

The Earthquake Strikes

It is just after 9:00 P.M. An afternoon of heavy rain has soaked the city; the streets are still wet. Residents of Quito are relaxing with family and friends, having dinner, watching television, or sitting and talking. Older children are studying for the next day of school while the younger ones are asleep in bed.

Suddenly there is a slight jolt, then heavier shaking. Dishes quiver on dinner tables, and windows rattle in their casings. The city trembles as the ground shakes violently. People are initially confused by the commotion, but then realize that Quito is experiencing a major earthquake.

Some people lose their balance; others are thrown to the floor. Cabinet doors swing open, ejecting pots, pans, and dishes onto the floor in a terrible din. Pets run about, frightened. Pictures, lamps, and televisions fall to the floor, causing injury to some people as they try to run from their homes to escape danger. Some doors get stuck in their frames, trapping people inside.

Northern Quito experiences the strongest shaking because of its proximity to the earthquake source. The shaking is so strong that it becomes difficult to stand and nearly impossible to walk. Many bookcases, refrigerators, stoves, and other heavy objects overturn, pinning or crushing some people beneath them. Self-built homes are devastated. Cracks form in walls of many reinforced concrete homes, severely damaging some.

Shaking in the Centro Historico is not as severe as in the north, but still very strong. The abundance of the vulnerable adobe and unreinforced masonry buildings leaves the area heavily damaged. Some adobe structures collapse, especially those already damaged in past earthquakes and not properly repaired, trapping and killing those inside. Some unreinforced masonry church facades, cupolas, interior walls, and towers crack and collapse. Heavy, tile roofs collapse into homes. Narrow streets become clogged with rubble; frantic people search in the wreckage for loved ones.

Modern buildings between the Centro Historico and the airport escape serious damage. Structures in the vicinity of the airport, however, suffer moderate to severe damage, as do self-built structures on the eastern and western slopes of the southern part of the city. In southern Quito, the shaking is the least intense, but still strong enough to crack brick and cement block walls and destroy chimneys. Practically all unreinforced masonry school buildings in Quito, and several reinforced concrete school buildings with short columns, collapse or are badly damaged.

Landslides block Via Oriental and Via Occidental, especially in lanes next to cut slopes. Northern access to the city is interrupted by landslides on Panamericana Norte, the road to the Mitad del Mundo, and the road through Calacali to the coast. Several large landslides and rocks fall on the Tabacundo Highway and Via Interoceanica, making

them impassable. A bridge on the Panamericana Norte is heavily damaged, rendering it, too, unusable. Several secondary streets in northern Quito suffer cracking. Northwestern neighborhoods such as Jaime Roldos, Pisuli, and Comite del Pueblo 2 become isolated. Some roads in the northeast are partially blocked; slope failure at the Zambiza garbage dump cuts the only access to that area. Several main north-south avenues are blocked by damaged overpasses. Some motorists, unable to proceed, abandon their cars in the middle of the street. More than a hundred obstructions in the roads of Quito make transit within the city and between northern, central, and southern Quito almost impossible.

Figure 32. Self-built structures on steep slopes.

The airport suffers only minor damage and remains operational, but is difficult to access, especially from the south. Police stations and the Civil Defense building suffer localized damage; fire stations suffer more severe damage. In some cases, emergency response equipment is damaged or trapped, thwarting timely response. Medicines in hospitals and clinics fall from shelves and spill onto the floor, and medical equipment is severely damaged. Some hospital staff and patients are injured by falling equipment. Two unreinforced masonry hospitals, and older unreinforced masonry wings of newer hospitals, suffer heavy damage and become inoperable. Many factories and warehouses made of steel are damaged when poorly anchored masonry walls collapse. Some industrial buildings suffer heavy damage and a few collapse, in some cases releasing hazardous materials.

Figure 33. Slopes susceptible to landslides along Vía Oriental.

Water pipes throughout Quito break, especially at their rigid joints and in places where they cross filled quebradas. Landslides block the open canal that brings drinking water to the Puengasi water treatment plant. Some main sewer collectors—in particular, those located on the western slopes of the city—rupture, damaging buildings and streets above. Landslides along the Machangara River block sewage outlets. Structural damage to the central telephone building results in partial loss of telephone communication within Quito and to the outside world. Power poles fall throughout the city, and more than 500 transformers are damaged. Several distribution substations and transmission cables, especially those in the northern part of the city, are seriously damaged, plunging most of the city into darkness. Forty seconds after the start of the earthquake, the shaking stops.

One Hour Later

One hour after the earthquake struck, uninjured citizens are removing rubble by hand and with makeshift tools to free victims from underneath collapsed buildings, despite fear of aftershocks. People try to locate family members and apply first aid, with only the light from car headlights. Rescue of those trapped underneath collapsed buildings is hampered by darkness. The injured start to make their own way toward hospitals and private clinics. Because of fear of aftershocks and the unknown structural condition of their homes, many people who are uninjured and have no missing family members head toward open areas such as La Carolina, El Ejido, La Alameda, and Fundeporte parks. A few seek refuge in undamaged churches and convents, despite the danger of aftershocks. Some, taking advantage of the destruction and confusion, loot unprotected homes and businesses.

In several older homes, electrical wiring short-circuits, and fire rapidly consumes old, dry wood. Residents extinguish some fires; thick adobe walls impede other fires from spreading widely. The fire department cannot attend to most fires because of poor communication, blocked roads, heavy traffic, lack of personnel, and lack of water—many

water pipes have ruptured, cutting off supply, and many fire hydrants were out of service even before the earthquake. The darkness of night is punctuated by scattered flames.

The few operating commercial radio stations broadcast information to the public. The broadcasters have limited knowledge of earthquake disaster recovery, and incite confusion and panic with erroneous information, including false rumors that a larger earthquake will come in the next few days, that the Pichincha volcano is going to erupt, and that high government officials died in the earthquake.

Hospital hallways are crowded with patients, staff, and fallen equipment. Doctors and nurses attempt to check the safety of previously admitted patients while administering first aid to new arrivals. In the southern part of the city, damage is less severe and fewer people are injured. Access to medical care is limited, however, because there is only one major hospital in that area.

As there are no automatic shutoff valves within the water supply system, large quantities of water are lost. Quito's water supply is cut off. Water and sewage flood the lower parts of the city and damage some streets. Portions of the telephone system in operation are saturated by calls from people trying to reach relatives, friends, hospitals, and other public services.

No statement about the severity of earthquake damage has been made by government officials, as they are still gathering information. Aftershocks come frequently, threatening damaged structures with further collapse. People of Quito wait in anguish for dawn.

The First Day

During the first day after the earthquake, citizens realize that roads are blocked, and hence help may not come from rescue organizations in the near future; they begin to organize groups to search buildings for the injured and dead. Rescue operations are hampered by a shortage of heavy equipment to move rubble.

Since the city has no official agency or plan to inspect and evaluate the safety of buildings, several professionals volunteer to determine the amount of damage; no one, however, is authorized to make decisions on the further use of the buildings. Some residents cautiously reenter damaged buildings to search for missing persons or retrieve personal belongings; most, however, do not for fear of aftershocks, and will spend ensuing nights outdoors in the cold weather until temporary shelter can be found. A light rain worsens their situation.

Looting continues in unprotected shops and homes. Businesses and banks are not open; people become frustrated and angry as they try unsuccessfully to withdraw money from automatic teller machines for their immediate needs.

With the help of radio amateurs, emergency response agencies organize rescue units, focusing attention on the devastated northern

areas and the Centro Historico. Civil Defense officials are able to broadcast general instructions to the population.

Several roads cave into underlying sewers and quebradas. The city attempts to locate heavy equipment to open blocked and damaged roads. Driving throughout the city is nearly impossible. Within neighborhoods, public transportation is nonexistent with the exception of taxis, which charge many times more than standard rates. Because of damage to the power supply system, traffic lights are out of service, resulting in confusion and increased traffic congestion. Broken sewers flood many vital underpasses.

Relief doctors and nurses cannot reach the hospitals because of road conditions and personal and family injuries, and hospital staffs become fatigued. Many patients with minor injuries are asked to leave in order to free space for the more seriously injured. Medical care is particularly difficult in hospitals without reserve water supplies and backup electrical generators. Undamaged public schools and military quarters are transformed into makeshift emergency health centers to accommodate the large number of injured.

The city's 10-hour water reserve is exhausted. The only water available in the most affected areas is that remaining in household water tanks. In some areas, available water is polluted by sewage. EMAP-Q personnel begin manually shutting off functioning water service for inspection and to prevent further water loss from damaged pipes. Officials realize that in the coming week water will need to be trucked in from neighboring regions. More than three-quarters of the city still is without power; damage to several subnetworks and system overload severely restrict telephone communication. Because of a lack of earthquake preparedness plans, utility repairs are slow and poorly coordinated.

Figure 34. Water treatment plant above the Centro Historico.

The President of Ecuador declares Quito a disaster area and proclaims a state of emergency. The army is mobilized to participate in emergency rescue and disaster recovery.

Two Days Later

Two days after the earthquake, thousands of people are homeless; makeshift shelters are not able to accommodate them. Response workers are still attempting to rescue missing persons from beneath the rubble of collapsed buildings. A strong aftershock heightens anxiety and keeps most from returning to their homes. The aftershock causes the collapse of a few buildings damaged in the main earthquake, injuring or killing those taking refuge inside. Nonetheless, a few sleep in their damaged homes or on the street nearby to guard against looters, and some seek divine protection in churches. Many sleep in the parks, risking exposure and sickness from the rain and cold. Some with relatives, friends, or homes in other provinces leave the city, depriving Quito of badly needed emergency response and recovery professionals.

There is an increasing demand for food and medicine, but most stores and pharmacies remain closed; some vendors and store owners greatly increase the price of food, medicine, and equipment. In poor neighborhoods in northern Quito and in the Centro Historico, residents lacking food supplies, especially those whose homes were destroyed, are tired and thirsty. Water is being distributed by the city's six tank trucks because of the large number of ruptured water pipes. There are reports that some private tankers are charging many times the normal price for water. Some citizens, without access to fuel for use in boiling water, become ill after consuming water contaminated by sewage. There is no garbage collection, and garbage accumulates on the streets.

Civil Defense broadcasts increasingly more useful and specific information. The official estimates of casualties and economic losses grow as more information becomes available. The media continues to fuel rumors which, combined with frequent aftershocks, further distress the population.

Some roads are still blocked, limiting delivery of relief supplies. Government workers begin to clear Via Occidental and Via Oriental of debris, as these highways are vital for the response and recovery of the city. A few supplies begin to arrive at the airport, but still there is limited access for pick-up and delivery. Supplies also begin to arrive at Latacunga airport, 80 km south of Quito, although there is difficulty in distributing them to the more damaged areas of Quito.

Most of the injured have received some medical attention. Lack of emergency medical equipment, medicines, power, clean water, and prompt treatment in public hospitals result in poor medical attention. Some people die from injuries that under normal circumstances would be nonfatal. Many of the injured are taken to small health centers and Red Cross first aid centers. The death toll increases. As the morgues are full and not readily accessible, dead bodies line hospital hallways prior to identification and burial. Health officials make plans to create mass graves.

Most equipment and supplies for major utility repairs are unavailable due to shortages and inaccessibility. Sewage and rain flood many utility tunnels, damage roads, and make repairs cumbersome and unpleasant. At the central communications building, attempts to make equipment repairs and reestablish telephone service fail, as the staff is unwilling to enter the building for fear of aftershocks; phone service is consequently unreliable. While EMETEL makes telephone service available to government and emergency service facilities, radio communication is found to be more reliable. Financial institutions abroad attempt unsuccessfully to communicate with business partners in Quito.

About half of the city is still without electricity. The main transmission substations, Santa Rosa and La Vicentina, were not seriously damaged, but the northern distribution substations will need major repairs before electricity can be restored there. Some facilities have backup power generators, but are unable to use them because of a lack of fuel.

The role of the military expands to guarding homes and shops against looters; recovering corpses; setting up temporary hospitals and shelters; and distributing food and water. Claims for government assistance increase, and people become angry when their requests are met slowly, inadequately, or not at all.

One Week Later

One week after the earthquake, collapsed buildings—responsible for most of the deaths—are still being searched for bodies. Many people are still hoping that missing relatives or friends will be found alive. Emergency workers remove the remaining victims. Undamaged public school buildings and other temporary shelters are full, and many people are living on the streets and in parks. Undamaged private schools resume classes.

Figure 35. School buildings.

Most businesses reopen. Food is scarce and expensive. Some banks are not permitting withdrawals because of damage to bank computers; customers become angry, and small, isolated disturbances erupt outside of these banks. Products from northern Ecuador, mainly milk and potatoes, are difficult to deliver to Quito. Emergency supplies from the international community, mostly food, clothing, medical supplies, and tents, continue to arrive at the Quito and Latacunga airports. Many donations do not fit local needs, and supplies that cannot be used or easily distributed collect at the airports, burdening relief agencies.

Garbage trucks still cannot reach many parts of the city, and trash and human waste collect in streets and alleys. Many residents develop gastrointestinal diseases as a result of consuming contaminated food and water. Health care in Quito's clinics and hospitals improves after medicines and personnel arrive from Latacunga, Ambato, and Guayaquil, but hospitals still lack beds to accommodate all the injured and sick. Exacerbating the problem, injured people arrive from neighboring towns such as Pamasqui, San Antonio, and Nono in search of better health care facilities.

Public transportation is improving except in northern Quito, where many roads are still closed. The southern roads remain the only dependable access to Quito. Gasoline is now available throughout the city.

Although the main water treatment plants are now fully operable, numerous pipe ruptures within Quito keep water from being widely distributed. Lack of water pipes slows recovery. Damage to the open canal that brings water to the Puengasi plant may take more than a week to be repaired. Some water is trucked in from outlying regions.

Most of the fallen electric poles have been replaced. The city has electricity, with the exception of parts of the Centro Historico and the far northern areas. Phone service is still unreliable. The sewage system also sees only minor repairs because of inundation with rainwater and human waste, lack of equipment, and a limited quantity of spare pipes. Many utilities still wait for key equipment and spare parts, not available locally, preventing complete recovery.

Those who fled the city the first few days after the earthquake begin to return. Residents of Quito start to adjust to their new way of life. They make plans to restore their damaged homes and businesses, although no one knows from where money for such efforts will come.

One Month Later

One month after the earthquake, panic has subsided, and residents no longer fear aftershocks. Most residences remain damaged, and virtually none of the collapsed buildings are being rebuilt. Shelters are still full, and many people are still living in small tent cities in plazas,

parks, and playing fields. For many, the only improvement they have seen in their living condition is that the plastic, cardboard, or plywood tents they built themselves have now been replaced with canvas tents provided by international agencies. Health officials are concerned about a significant rise in respiratory ailments resulting from the large numbers of people living in crowded temporary quarters.

Residents of Quito have started planning and seeking assistance for reconstructing damaged or destroyed homes. Businesses are open, and the banks accept deposits and permit withdrawals. Most children are back in school, many in hastily constructed, temporary classrooms. Distribution centers are established to deliver food and supplies coming from abroad.

Tourism has ceased, adding to overall economic losses; foreigners watch Quito's earthquake recovery and make plans accordingly. Businesses have suffered considerable losses, and some will never recover. For the minority with insurance, their claims remain unaddressed as the extent of damage to many buildings has not yet been evaluated. For the time being, some business owners are given provisional payment until more accurate damage estimates can be determined and reinsurers can respond. Insurance companies are having problems converting their assets into cash, and some are likely to go bankrupt. Many businesses will receive insufficient reimbursement due to inadequate policies and lack of insurance company reserves and reinsurance.

Water service has been restored to most parts of Quito; the use of trucked water and water conservation is now a way of life in areas where it has not been restored. In areas where damage was particularly heavy, it will take two months or more to restore regular service.

The roads are clear of rubble, although in the Centro Historico some are blocked by wood poles used to support damaged buildings, especially churches. Collapsed overpasses have not been rebuilt, but the debris has been removed and alternate routes established. Temporary bridges are being built by the army.

Repairs to electrical substations in the north are still not complete, although substations in other parts of Quito have been repaired. Reduced system performance continues for several months due to transmission line damage in the western portion of Quito. Telephone service is still intermittent, and loss of convenient international communication severely disrupts national and international commerce.

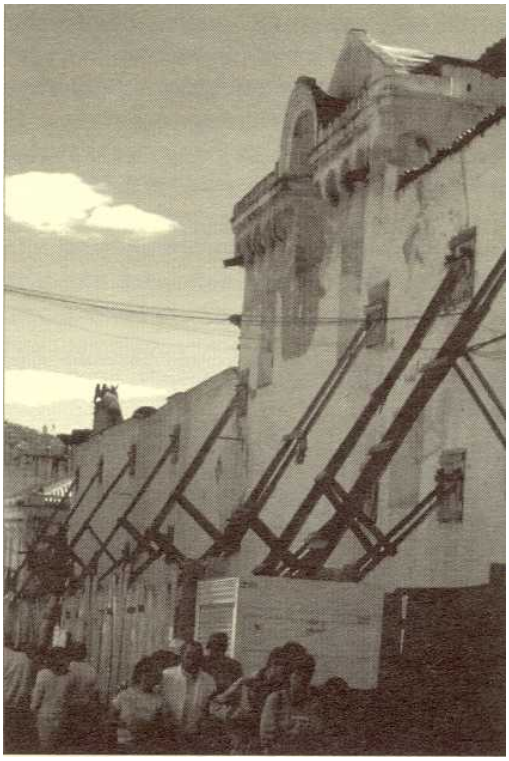


Figure 36. Adobe buildings damaged in the March 1987 earthquake.

Because of minimal repair capacity and the slow and difficult work of visually detecting sewer ruptures, officials estimate that the sewage system will not be fully operational for some five months. Funding for repairs is scarce since the system is uninsured. Collapse and blockage of major sewer tunnels cause extensive, long-term limitations in sewer use in parts of Quito. Contingency plans are established to clean sewage from streets and dig pits throughout the city, which will serve as interim dumps.

Officials start defining reconstruction plans for the city. Recovery assistance for individual citizens is insufficient, as most property owners do not have earthquake insurance. National agencies, such as the National Bank for Development and the Housing Ministry, do not have enough funds to help victims. Questions and complaints are raised as to how the available funds are being used.

CAUTION

The preceding description illustrates some of the possible impacts on Quito of one particular earthquake in Quito. Other earthquakes, not evaluated in this study, will result in different consequences. This description is intended only for use in planning and preparedness programs and for raising awareness of the earthquake risk.

An earthquake could strike Quito in the future, and produce effects such as those just described. As Quito is the seat of Ecuador's national government and the source of one-third of the gross national product, the effects would be felt across Ecuador. Municipal, regional, and national government functions would be disrupted. The city's commercial, banking, and insurance industries would take years to recover. Human casualties would be substantial.

There are steps, however, that Quito can take now to prepare for its next major earthquake—steps to reduce loss of life, damage to property, harm to the economy, disruption to government services, and damage to cultural heritage. Some of these steps were defined and presented in the Plan for Managing Quito's Earthquake Risk that was prepared by the risk management project implemented for the capital of Ecuador.

ANNEX 2: EXAMPLE OF AN ACTION PLAN

Note: This material is taken from the publication "The Kathmandu Valley Earthquake Risk Management Action Plan" published by the National Society for Earthquake Technology - Nepal (NSET) and GeoHazards International.

THE KATHMANDU VALLEY EARTHQUAKE RISK MANAGEMENT ACTION PLAN

The Initiatives to Implement Now

OBJECTIVE: IMPROVE EMERGENCY RESPONSE PLANNING AND CAPABILITY.

INITIATIVE 1:
NSET will request HMGN to (1) constitute the National Disaster Management Council (NDMC) headed by the Prime Minister; and (2) direct the NDMC to define an integrated national disaster management system that describes the roles and reporting relationships for each involved agency at the national, district, municipal or village, and ward levels of government. NSET will work with the Prime Minister's office and other concerned authorities to see that these steps are taken and to provide technical advice and assistance upon request.

Schedule:
By the end of the first year the NDMC will be created and the national disaster management system will be defined.

Cost:
The cost of forming the NDMC can be absorbed by government institutions. Defining an integrated national disaster management system will require outside funds to support the participation of an expert in emergency management and to cover the costs of a workshop or several meetings.

Preliminary estimate: NR 500,000 (US$ 7,000)

INITIATIVE 2:
Once constituted, the National Disaster Management Council should (1) provide guidance for the preparation of new (or revision of existing) integrated emergency response plans that identify internal and external relationships for every responsible organization including government and non government agencies, public and private utilities, hospitals and schools; and (2) direct these organizations to prepare plans according to the guidance and to assess communications equipment, facilities and training needed to execute the plans during an earthquake disaster. NSET will work with the Prime Minister's office and other concerned authorities to see that these steps are taken and provide technical advice and assistance upon request.

Schedule:
By the end of the first year the NDMC should issue the planning guidance to every responsible organization. Integrated plans and reports on equipment, facility and training needs will be submitted to the Prime Minister at the end of the second year.

Cost:
Expert assistance is required to provide guidance and a training session on preparing emergency response plans and to aid each responsible organization in preparing these plans.

Preliminary estimate: NR 1,000,000 (US$ 5,000)

OBJECTIVE: IMPROVE AWARENESS OF ISSUES RELATING TO EARTHQUAKE RISK

INITIATIVE 3:
NSET will work with the Ministry of Science and Technology to design a comprehensive program to raise public awareness about earthquake risk and mitigation options. The program should involve marketing and communications specialists, and identify groups to conduct the awareness programs and to receive training. The amount of funds required for the program and sources for these funds should be identified while developing the program. This awareness program should focus on a wide range of groups in the valley, including the following:

- Ministers, Secretaries, and Members of Parliament
- Public safety employees and emergency response officials
- Municipalities and wards
- Hospital managers
- Businesses, Business groups
- Non Government Organizations (NGOs) and Community-Based Organizations (CBOs)
- International Non Government Organizations (INGOs) and the International Community
- Media

Schedule:
The comprehensive training program of the Ministry of Science and Technology should be outlined by the end of one year.

Costs:
Funds are needed to support the time of a communications and marketing specialist and the time of staff at the Ministry of Science and Technology and NSET.

Preliminary estimate: NR 250,000 (US$ 3,500)

INITIATIVE 4:
NSET will work with the municipalities of Kathmandu, Lalitpur, Bhaktapur, Madhyapur and Kirtipur and the three District Development Committees to create Municipal Disaster Management Committees and District Disaster Management Committees, and to design a program of activities, including public awareness programs, for these committees.

Schedule:
The Municipal and District Disaster Management Committees should be created within one year and should have programs outlined within one and a half years.

Cost:
The municipalities and District Development Committees can constitute the Disaster Management Committees with no additional costs. Funds are required to support meetings and training programs to develop realistic programs of activities.

Preliminary estimate: NR 375,000 (US$ 5,500)

OBJECTIVE: INTEGRATE SEISMIC RESISTANCE INTO THE PROCESS OF NEW CONSTRUCTION.

INITIATIVE 5:
NSET will request the Ministry of Housing and Physical Planning to (1) constitute the Building Council and direct it to draft the rules and procedures for implementing and enforcing the building code, and (2) formally adopt requirements to implement and enforce the building Code by municipal governments through the existing building permit process.

Schedule:
By the end of the first year the Building Council will be created and the implementation and enforcement rules and procedures will have been written and adopted by the Minister of Housing and Physical Planning. By the end of the second year the five municipalities and three District Development Committees of Kathmandu Valley will have in place the procedures and staff to enforce the building code on all new buildings.

Cost:
Redirecting existing employees can absorb the cost of forming the Building Council, drafting rules and procedures, and adopting them.
The cost of implementing and enforcing the building code by municipalities should be estimated by this council and the sources of funds for these activities should be identified.

Preliminary estimate: No outside funding required

INITIATIVE 6:
NSET will work with the Ministry of Housing and Physical Planning, Department of Building, professional societies, engineering colleges, and other organizations 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.

Schedule:
Training materials will be completed, and training sessions developed by the end of the first year when the legal framework for building code enforcement is in place. Training will be offered during the second and subsequent years according to the level of interest.

Cost:
These courses can be designed to be self-funding in the long-term, but funds will be required to plan the courses, prepare course materials and conduct pilot training sessions.

Preliminary estimates: NR 700,000 (US$ 10,000)

OBJECTIVE: INCREASE THE SAFETY OF SCHOOL CHILDREN AND SCHOOL BUILDINGS.

INITIATIVE 7:
NSET will manage and coordinate the "School Earthquake Safety Project" which will (1) inform school management committees, district education offices, parents, and teachers about the vulnerability of selected schools (based on a valley-wide school vulnerability assessment conducted by KVERMP), and what can be done to reduce the risk at those schools by using a specialist trained in working at the community level; (2) prepare school-specific plans for improvements in seismic safety (structural and non-structural) for those communities interested in improving their schools; (3) mobilize support and resources from the community and others to improve the safety of the school buildings; and (4) identify an affordable, replicable process to improve the safety of Kathmandu Valley's existing school buildings.

Schedule:
The project can complete work with one pilot community within two years.

Cost:
The costs for this activity include professional fees for one specialist in working with Kathmandu Valley communities, one structural engineer, and management oversight expenses. Funds to complete the structural and/or non-structural improvements to the schools should come from the local community in the form of donated labor and materials.

Preliminary estimate: NR 700,000 (US$ 10,000)

OBJECTIVE: IMPROVE THE SEISMIC PERFORMANCE OF EXISTING BUILDINGS.

INITIATIVE 8:
NSET will create handbooks, posters, handbills, stickers and other information products to explain what non-structural hazards are (such as furnishings, light fixtures, decorations that could fall and injure someone or important equipment that could be damaged and malfunction), and explain how to mitigate non-structural hazards in typical Nepali homes and offices. These materials will be aimed at both literate and non-literate Nepali audiences. NSET will develop a strategy to maximize the impact of these materials and to incorporate them into other awareness raising programs.

Schedule:
These products will be completed within two years.

Costs:
The major expenses for this item include printing costs for large numbers of public awareness materials. Additionally, funds are needed to cover the time of an engineer, a communications and marketing specialist and an artist to express the information in an easy to understand form.

Preliminary estimate: NR 2,000,000 (US$ 30,000)

OBJECTIVE: IMPROVE THE SEISMIC PERFORMANCE OF UTILITY AND TRANSPORTATION SYSTEMS.

INITIATIVE 9:
NSET will encourage the Nepal Telecommunications 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. This assessment will be used as a model for all of the other utilities in the valley to conduct similar assessments in future years.

Schedule:
NSET will begin working with the corporation during the first year with the objective of having the assessment underway by the end of the second year.

Cost:
The costs will include hiring a consultant to assist NTC in designing and implementing the vulnerability assessment.

Preliminary estimate: NR 2,000,000 (US$ 30,000)

OBJECTIVE: INCREASE EXPERTS' KNOWLEDGE OF THE EARTHQUAKE PHENOMENON, VULNERABILITY, CONSEQUENCES AND MITIGATION TECHNIQUES.

INITIATIVE 10:
NSET will encourage engineering institutes to develop and offer short courses for practicing engineers on earthquake engineering principles and procedures.

Schedule:
University-based short courses should be planned during the first year and be offered during the second and subsequent years according to the level of interest.

Cost:
The expenses associated with faculty preparing and offering lectures will need to be covered.

Preliminary estimate: NR 250,000 (US$ 3,500)

OBJECTIVE: PREPARE FOR LONG-TERM COMMUNITY RECOVERY FOLLOWING DAMAGING EARTHQUAKES.

No initiatives for this objective in this section.

More Endorsed Initiatives

There are many activities, large and small, that need to be undertaken to reduce Kathmandu Valley's earthquake risk. However, many of these important activities do not appear among the initiatives in the previous section. The initiatives listed below are important activities that will improve the situation in Kathmandu Valley. Responsible organizations are strongly encouraged to pursue them. NSET endorses these activities. However, due to limited resources and a need to focus, NSET cannot commit to actively promoting or aiding the implementation of these initiatives.

Screening criteria

NSET endorses initiatives which meet the following four subjective criteria:

1. Initiative obviously reduces Kathmandu Valley's earthquake risk
2. Initiative is feasible to implement
3. Initiative is supported by the organization required for its implementation

The initiatives below have not been prioritized and appear in no particular order.

Endorsed Initiatives

Improve emergency response planning and capability.

NSET will encourage the Royal Nepal Army and Nepal Police to train their staff in post-earthquake search and rescue techniques.

NSET will encourage all government and private hospitals to train their doctors, nurses, and staff in emergency medicine techniques.

NSET will encourage the Ministry of Housing and Physical Planning, the Department of Building, professional societies such as Nepal Engineers Association, engineering staff and students at universities, and others to receive training in post-earthquake damage assessment of buildings.

NSET will encourage all organizations associated with utilities and transportation to train their staff members in post-earthquake damage assessment of their system and emergency repair techniques.

NSET will encourage the Kathmandu Fire Brigade to receive training in post-earthquake fire suppression and to upgrade their fire-fighting equipment.

NSET will encourage all municipalities, wards, and districts in the valley to train employees in their emergency roles.

NSET will encourage the NDMC, or another appropriate organization, to make a Central Emergency Operations Center, located in an earthquake-resistant building with post-earthquake communications capabilities.

NSET will encourage all hospitals in the valley, the Ministry of Health, and the Department of Health Services to develop an earthquake-resistant communications system linking these organizations.

NSET will encourage the Nepal Telecommunications Corporation to design and construct the new cellular phone network so that it is likely to be operational after an earthquake.

NSET will encourage the Nepal Timber Corporation to examine alternatives, such as installing electric crematoriums, which could help manage mass human losses after an earthquake and to design a program to implement the best alternative.

NSET will encourage the Ministry of Information and Communication, radio stations, and television stations to design, implement and test regularly an emergency broadcast system.

NSET will encourage all relevant organizations to use emergency response plans to identify which elements of critical facilities are essential for emergency response, to assess the vulnerability of those elements to earthquakes and post-earthquake fire, and to determine which vulnerable elements are most important to strengthen first.

NSET will encourage the Ministry of Housing and Physical Planning and the Department of Building to prepare standard formats to assess damage to buildings after an earthquake and to determine which buildings are safe to occupy.

NSET will encourage all Ministries, Departments, businesses, and other organizations to make an emergency evacuation plan for their building and to conduct an evacuation drill with the staff.

Improve awareness of issues relating to earthquake risk.

NSET will encourage all critical facilities to establish a unit in their organization to focus on issues related to disaster management.

NSET will encourage all Ministries, Departments, businesses, and other organizations to educate their staff about earthquake preparedness measures and how to behave during an earthquake.

NSET will encourage the Ministry of Labor, the Ministry of Industry, the Ministry of Commerce, and other groups to create incentives for businesses to increase their earthquake safety.

NSET will encourage the Ministry of Science and Technology to conduct the public awareness event “Earthquake Safety Day” on or near Magh 2 each year.

Integrate seismic resistance into the process of new construction.

NSET will encourage the Ministry of Housing and Physical Planning, the Department of Building, and municipalities to enforce the building code as strictly as possible for critical buildings, such as key government buildings, schools, and high-occupancy buildings.

NSET will encourage the municipalities to enforce the building code for all new structures and to train all staff members who will be responsible for enforcing the building code.

NSET will encourage the Ministry of Parliament Affairs to ensure that the new Parliament building be designed and constructed to be as earthquake-resistant as feasible.

NSET will encourage the Ministry of Housing and Physical Planning, the Department of Mines and Geology, the Ministry of Land Reform and others to create and enforce a land use plan that considers seismic safety issues such as keeping open spaces in urban areas and not developing lands subject to liquefaction or earthquake-induced landslides.

NSET will work with the Ministry of Housing and Physical Planning, the Department of Building, professional societies and others to create and distribute a simple handbook explaining how to use to the building code and seismic design principles for typical Nepali structures.

NSET will encourage all organizations that fund or loan money for building construction in the valley to require adherence to the building code in design and construction as a term of all grants and loans.

Improve the safety of school children and school buildings

NSET will work with the Ministry of Education, District Education Offices, School Management Committees, individual schools and other groups to create an emergency plan for each school, including instructions for teachers and students.

NSET will aid and encourage each school to conduct annual "duck and cover" and evacuation drills with all students and teachers.

NSET will work with the Ministry of Education, District Education Offices, School Management Committees, individual schools and other groups to add earthquake preparedness into the standard school curriculum.

Improve the seismic performance of existing buildings.

NSET will encourage all Ministries, Departments, businesses, and other organizations to identify and reduce non-structural hazards in their buildings.

NSET will encourage the Ministry of Housing and Physical Planning and the Department of Building to assess the vulnerability to earthquakes of all existing government buildings which hold large numbers of people and/or have important functions.

NSET will encourage all building owners of structures which hold large numbers of people, such as cinemas or stadiums, to assess the vulnerability of these structures to earthquakes.

NSET will encourage the Department of Archaeology and other groups to assess the vulnerability to earthquakes of cultural and historical sites within Kathmandu Valley and to develop programs to strengthen the most vulnerable sites.

NSET will encourage all newspapers and television and radio broadcasters to assess the vulnerability of their systems to earthquakes, identify the most vulnerable elements, and develop a program to improve performance after earthquakes.

NSET will encourage the Ministry of Housing and Physical Planning, the Department of Building, professional societies, engineering institutes and others to create and distribute literature that describes how to seismically retrofit typical Nepali buildings to increase their earthquake safety.

Improve the seismic performance of utility and transportation systems.

NSET will encourage the Nepal Water Supply Corporation and the Department of Water Supply and Sewerage to assess the vulnerability of their systems to earthquakes, identify the most vulnerable elements, and develop a program to improve performance after earthquakes.

NSET will encourage the Nepal Electricity Authority to assess the vulnerability of its systems to earthquakes, identify the most vulnerable elements, and develop a program to improve performance after earthquakes.

NSET will encourage the Department of Roads to assess the vulnerability of its systems to earthquakes, identify the most vulnerable elements, and develop a program to improve performance after earthquakes.

NSET will encourage the Department of Civil Aviation and Tribhuvan International Airport to assess the vulnerability of their systems to earthquakes, identify the most vulnerable elements, and develop a program to improve performance after earthquakes.

NSET will encourage all organizations which store or transport fuel, hazardous wastes, or highly flammable materials to assess the vulnerability of their systems to earthquakes, identify the most vulnerable elements, and develop a program to improve performance after earthquakes.

NSET will encourage the Department of Roads, the Nepal Telecommunications Corporation, the Nepal Water Supply Corporation, the Nepal Electricity Authority, and other organizations to train their staff in design, maintenance and repair techniques that reduce earthquake risk.

NSET will encourage the Department of Roads, the Nepal Telecommunications Corporation, the Nepal Water Supply Corporation, the Nepal Electricity Authority, and other organizations to develop earthquake-resistant standards for design and construction of new components to their systems.

Increase experts' knowledge of the earthquake phenomenon, vulnerability, consequences and mitigation techniques.

NSET will encourage engineering and science universities to strengthen existing or add new programs in subjects related to earthquakes such as geology, seismology, geotechnical engineering, and structural engineering.

NSET will encourage the Department of Mines and Geology to establish a strong motion network.

NSET will encourage the Department of Mines and Geology and others to study active faults in Kathmandu Valley and other faults which could affect Kathmandu Valley.

NSET will encourage the Department of Mines and Geology and others to collect, compile and disseminate earthquake hazard and collateral hazard maps.

NSET will encourage training programs for various audiences in disaster management skills.

Prepare for long-term community recovery following damaging earthquakes.

NSET will encourage the NDMC, or another appropriate organization, to prepare governmental recovery plans addressing key decisions which need to be taken after a disaster, such as changing city layout, relocating families, deciding which buildings to repair and which to demolish, and sites for long-term temporary housing.

NSET will encourage the government to investigate the option of insuring important structures such as government buildings and cultural sites.

NSET will encourage insurance companies which handle earthquake insurance to review and revise tariffs, underwriting guidelines, and reinsurance depth.

ANNEX 3: EXAMPLES OF PUBLICATIONS TO DISSEMINATE THE RESULTS

Reports:

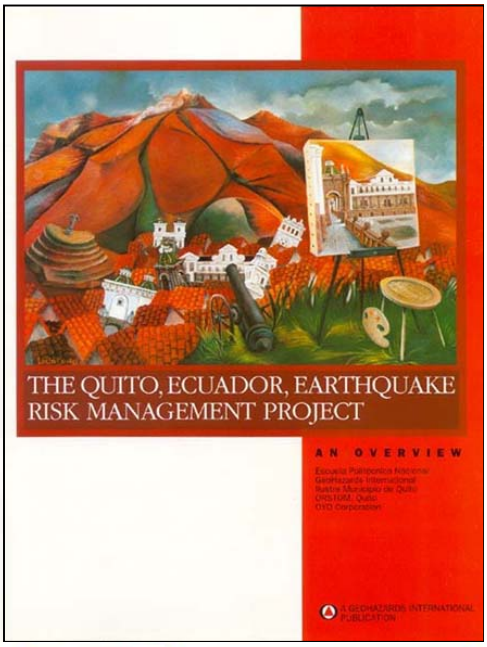


Figure 37. Overview of the Quito, Ecuador, earthquake risk management project.

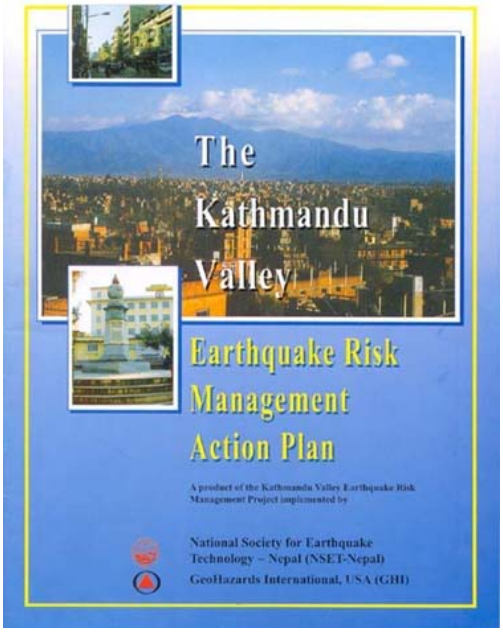


Figure 38. The Kathmandu Valley risk management action plan.

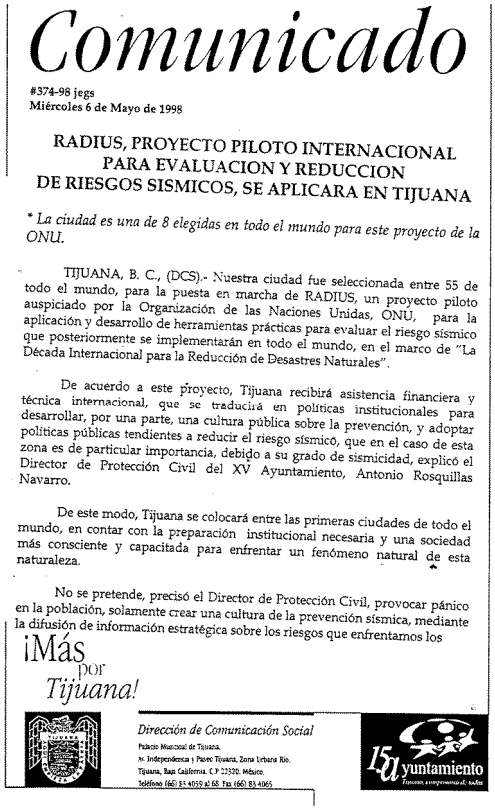
Figure 39. The RADIUS project report prepared for Guayaquil, Ecuador.

Mass media publications:


自贡日报
ZIGONG RIBAO
1998年10月
8
星期四
第9912期
值班副总编辑 赖高培
联合国"地震场景讨论会"将在我市召开
市政府按要求已做好准备


Actualidad
AVANZA PROYECTO
RADIUS
Determinarán zonas sísmicas de riesgo en la ciudad

Figure 40. Newspaper articles on RADIUS published in China and Ecuador.



Comunicado

#374-98 jegs
Miércoles 6 de Mayo de 1998

RADIUS, PROYECTO PILOTO INTERNACIONAL PARA EVALUACION Y REDUCCION DE RIESGOS SISMICOS, SE APLICARA EN TIJUANA

** La ciudad es una de 8 elegidas en todo el mundo para este proyecto de la ONU.*

TIJUANA, B. C., (DCS).- Nuestra ciudad fue seleccionada entre 55 de todo el mundo, para la puesta en marcha de RADIUS, un proyecto piloto auspiciado por la Organización de las Naciones Unidas, ONU, para la aplicación y desarrollo de herramientas prácticas para evaluar el riesgo sísmico que posteriormente se implementarán en todo el mundo, en el marco de "La Década Internacional para la Reducción de Desastres Naturales".

De acuerdo a este proyecto, Tijuana recibirá asistencia financiera y técnica internacional, que se traducirá en políticas institucionales para desarrollar, por una parte, una cultura pública sobre la prevención, y adoptar políticas públicas tendientes a reducir el riesgo sísmico, que en el caso de esta zona es de particular importancia, debido a su grado de sismicidad, explicó el Director de Protección Civil del XV Ayuntamiento, Antonio Rosquillas Navarro.

De este modo, Tijuana se colocará entre las primeras ciudades de todo el mundo, en contar con la preparación institucional necesaria y una sociedad más consciente y capacitada para enfrentar un fenómeno natural de esta naturaleza.

No se pretende, precisó el Director de Protección Civil, provocar pánico en la población, solamente crear una cultura de la prevención sísmica, mediante la difusión de información estratégica sobre los riesgos que enfrentamos los

¡Más por Tijuana!

Dirección de Comunicación Social
Palacio Municipal de Tijuana.
Av. Independencia y Paseo Tijuana, Zona Urbana Río.
Tijuana, Baja California. C.P. 22320. México.
Teléfono (66) 83 4050 al 68. Fax (66) 83 4065

15a yuntamiento

Figure 41. Official press release by the municipality of Tijuana, Mexico.

Educational publications for mass distribution:

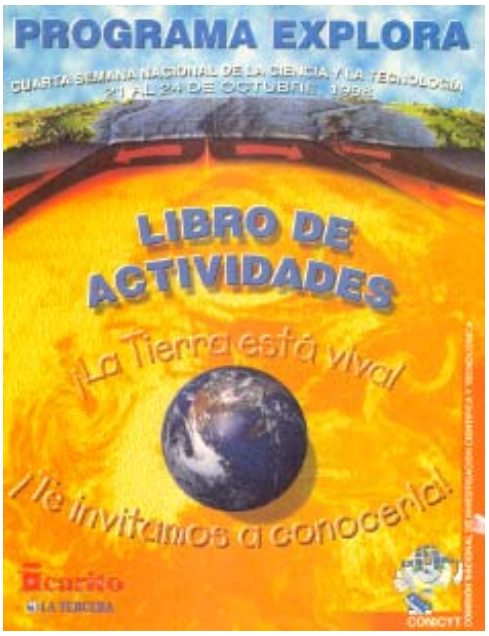


Figure 42. Basic information about earthquakes published in Antofagasta, Chile.

Figure 43. Publication on earthquake safety prepared by the Southern California Earthquake Center, USA.