

IMPLEMENTATION OF THE IDNDR-RADIUS PROJECT IN LATIN AMERICA

Carlos A VILLACIS¹ And Cynthia N CARDONA²

SUMMARY

In 1996, the Secretariat of the International Decade for Natural Disaster Reduction (IDNDR), United Nations, launched the RADIUS initiative to assist in reducing the effects of seismic disasters in urban areas, particularly in developing countries. Working in close collaboration with local people in nine cities around the world, the project evaluated the seismic risk of those cities, prepared risk management plans based on those evaluations and, most importantly, raised awareness of the community on seismic risk. Significant progress was attained towards the incorporation of the entire community in risk management activities. Members and institutions of the society participated actively throughout the project and committed efforts were made to set up the conditions that will allow the establishment of long-term initiatives to reduce the seismic risk. The project made the best use of already existing information and counted on the knowledge, insight, and expertise of the local people to ensure that the products and results reflect the local conditions.

This paper describes the implementation and achievements of the RADIUS project in the Latin American cities of Antofagasta (Chile), Guayaquil (Ecuador), and Tijuana (Mexico). GeoHazards International (GHI, <http://www.geohaz.org>), a non-profit organization dedicated to reducing earthquake risk in the world's most vulnerable communities, was in charge of the implementation of RADIUS in the Latin American region.

INTRODUCTION

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 the members and institutions of the community from participating in or supporting risk management initiatives. In most of the cases, due to the lack of awareness and information, the 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, the ones who know most about the local social, economic, politic 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 of those studies are not even known by the members of the community that could benefit from them. Due to this,

¹ Technical Director, GeoHazards International, 200 Town & Country Vlg., Palo Alto, CA 94301, USA, villacis@geohaz.org

² Project Manager, GeoHazards International, 200 Town & Country Vlg., Palo Alto, CA 94301, USA, cardona@geohaz.org

there are many instances in which efforts have been duplicated and resources have been spent without producing any tangible improvement.

In an effort to improve this situation, the Secretariat of the International Decade for Natural Disaster Reduction (IDNDR), United Nations, launched the RADIUS initiative to assist in reducing the effects of seismic disasters in urban areas, particularly in developing countries. Working in close collaboration with local people in nine cities around the world, the project evaluated the seismic risk of those cities, prepared risk management plans based on those evaluations and, most importantly, placed special emphasis on raising the awareness of the community on seismic risk. Members and institutions of the society participated actively throughout the project and committed efforts were made to set up the conditions that will allow the establishment of long-term initiatives to reduce the seismic risk. The project made the best use of already existing information and counted on the knowledge, insight, and expertise of the local people to ensure that the products and results reflect the local conditions.

The following sections describe the implementation and achievements of the RADIUS project in the Latin American cities of Antofagasta (Chile), Guayaquil (Ecuador), and Tijuana (Mexico).

THE RADIUS PROJECT

In 1996, the Secretariat of the International Decade for Natural Disaster Reduction (IDNDR), United Nations, launched the RADIUS initiative to reduce the effects of seismic disasters in urban areas, particularly in developing countries. This initiative had three concrete objectives:

- Development of seismic damage scenarios and earthquake risk management plans for nine selected cities worldwide
- Development of a practical manual for seismic damage assessment in urban areas
- Raise awareness on seismic risk in the communities where the project was implemented

For the implementation of the project's case studies, nine cities were selected from the 58 cities around the world that applied to the project. The world was divided into three regions for the selection of the cities, and three cities were selected in each region. The selected cities were the following:

- Asian Region: Tashkent (Uzbekistan), Zigong (China), and Bandung (Indonesia)
- European, Middle-East and African Region: Skopje (Macedonia), Izmir (Turkey), and Addis Ababa (Ethiopia)
- Latin American Region: Antofagasta (Chile), Guayaquil (Ecuador), and Tijuana (Mexico)

The RADIUS case studies were designed with the specific objective of initiating long-term risk management processes in the cities where the project was implemented. For that purpose, the case studies had 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, and,
- 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, the project made sure that representatives of the various sectors of the society were actively involved throughout the project. Additionally, through coordinated work with the local mass media, the project ensured that the general public was consistently informed about the progress of the activities and the project's achievements.

A detailed program of activities for the RADIUS case studies is presented in Fig. 1. It is seen in this figure 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 for the project's success, the program of activities includes meetings throughout the project (represented by large dots in Fig. 1) in which key representatives of the community were first informed about the progress of the project, and then asked to provide their feedback.

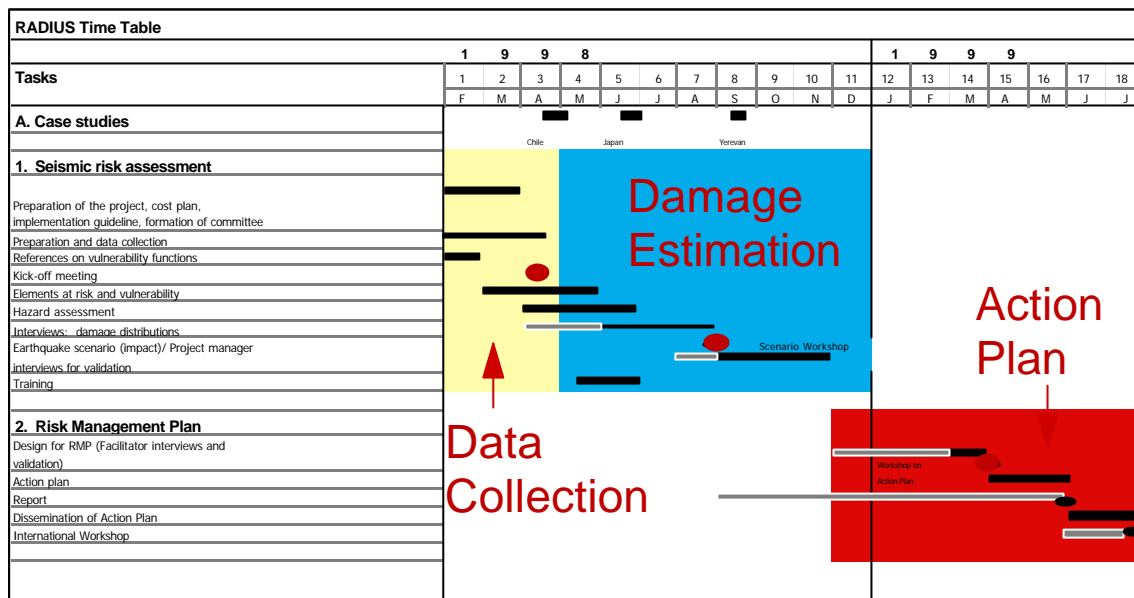


Fig. 1 Detailed program of activities for the RADIUS case studies

Aiming at ensuring raising awareness within the community on the risk and getting public support for risk management activities, the project participants included many people and institutions representing the various sectors of the society. The participants were grouped as follows:

Steering committee: Was the core group in charge of the project implementation and its administration. It included representatives of the local government, the technical institution assigned to the project, and an international institute hired by the IDNDR to provide technical advice to the participant cities in a region of the world.

International Institute: The IDNDR hired three international institutes to provide advice and guidance to the RADIUS cities in the three regions into which the world has been divided for the project. GeoHazards International (GHI, <http://www.geohaz.org>), a non-profit organization dedicated to reducing earthquake risk in the world's most vulnerable communities, was in charge of the implementation of RADIUS in the Latin American region.

Local Advisory Committee: Consisted of representatives from the various sectors of the community. They contributed overall guidance and advice on long-term project planning, and provided links with local agencies and institutions to ensure the smooth implementation of the project. Members of this committee included, but were not limited to, the following:

- Local technical experts
- Municipality representatives
- National Planning Commissions
- International aid organizations (e.g. Red Cross)
- School officials

- United Nations Missions
- Utility representatives (electricity, water, sewage, transportation)

Regional Advisory Committee: The IDNDR asked well-known experts in the field of urban earthquake risk management to provide technical recommendations on how earthquake risk assessments have been done in other cities, as well as advice on what mitigation actions may be useful in each city. The members of the Advisory Committee for the Latin American RADIUS cities were:

- Ms. Shirley Mattingly, Former Chair of the Emergency Management Committee City of Los Angeles, USA
- Prof. Carlos E. Ventura, Professor, Dept. of Civil Engineering University of British Columbia, Vancouver, Canada

Working Group: Comprised of all the people required to carry out the project activities. They included programmers, draftsmen, secretaries, students, etc.

RADIUS IN LATIN AMERICA

Three cities were selected in Latin America for the RADIUS project: Tijuana (Mexico), Guayaquil (Ecuador), and Antofagasta (Chile). These three cities make up a very interesting and diverse group. Antofagasta is a relatively small city of 220,000 inhabitants whose existence is very much dependent on mining. Antofagasta last experienced a destructive earthquake in 1995 (Ms 7.3).

Guayaquil is a large city of 2.1 million inhabitants that contributes 20% of Ecuador's total GNP and last experienced a destructive earthquake (Ms 7.9) in 1942.

Tijuana is a relatively young city, in between the former cities in size (1.25 million), that has not experienced a destructive earthquake since its founding approximately a century ago.

While there are several differences among these three cities, they also share some common problems, such as a significant amount of traditional construction, modern construction built without the use or enforcement of building codes, vulnerable critical facilities (schools, hospitals, etc.), lack of earthquake awareness within the community and, consequently, little support from local government for risk management activities. Table 1 shows some basic information for the three cities.

Table 1: Basic information on the three RADIUS cities in Latin America

City	Population (million)	Annual Growth	Area (Sq. km)	Contribution to the country's economy
Antofagasta	0.22	3.0%	90	6.5% of the country's GNP and 31% of its exports
Guayaquil	2.10	3.2%	340	20% of the country's GNP and 60% of its exports
Tijuana	1.25	6.02%	250	3.8% of the country's GNP

RISK EVALUATION

Damage that could be caused by a probable earthquake was estimated for each one of the three cities. The hypothetical earthquakes adopted for the analysis, based on studies of the local and regional seismology, were the following:

- Antofagasta: Magnitude 8.0 , Epicentral distance 60 km
- Guayaquil: Magnitude 8.0 , Epicentral distance 200 km
- Tijuana: Magnitude 6.5 , Epicentral distance 10 km

The estimation of the potential damage was carried out in two steps: a theoretical one, and a non-theoretical one. The theoretical estimation was performed by combining the seismic intensity distribution that was estimated for the adopted earthquake with the inventory of the structures and infrastructure of the city. This combination was performed using vulnerability functions that were developed to reflect the seismic behavior of the structures and infrastructure found in each city.

The non-theoretical estimation was performed through a series of interviews (Fig. 2) 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. Figure 3 shows the damage to the roads estimated for Antofagasta.



Fig. 2 Working session with representatives of the Health Sector in Tijuana

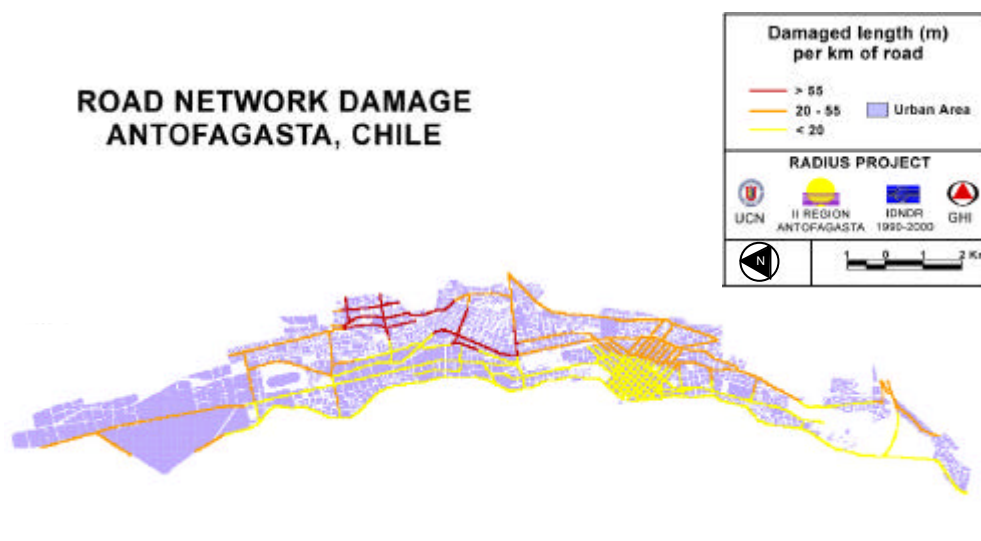


Fig. 3 Road damage estimated for Antofagasta, Chile

The estimation results for Antofagasta indicate, for example, that 6% of the residential buildings, where 15,000 people live, will be destroyed and 37% of the buildings, providing dwellings to 85,000 people, will suffer severe damage. As a result, more than 3,000 people will die and almost 7,000 will be injured requiring hospitalization. An estimated 43,000 people will be left homeless due to the disaster. The estimates also show that it will take at least 6 months for the debris to be cleared.

In Guayaquil, it was estimated that more than 26,000 people would die and almost 53,000 would be injured requiring hospitalization. It would take about a week to start providing emergency housing to the people left homeless due to the disaster, a month to start providing temporary housing, and up to two years until the damaged houses are reconstructed or repaired. The estimates also show that the city would be without any power supply for up to one week and almost two weeks without potable water.

The estimates prepared for Tijuana indicated that 1% of the residential buildings, where 25,000 people live, would be destroyed and 35% of the buildings, providing dwellings to 325,000 people, would suffer severe damage. As a result, more than 18,000 people would die and almost 37,000 would be injured requiring hospitalization. An estimated 130,000 people would be left homeless due to the disaster. The estimates also showed that it would take about 1 month for the water supply system to recover 30% of its pre-earthquake capacity, and more than 2 months to recover completely.

The results of the damage estimation were used to prepare a preliminary earthquake scenario that was presented and discussed by representatives of the various sectors of the community during the Scenario Workshop that was held in each city with the following objectives:

- To present the results of the seismic damage estimates to the community and ask for their feedback
- To estimate the impact of the estimated damage on the city activities
- To produce ideas for actions that, if implemented, would reduce the impact of an earthquake on the city's life
- To discuss the conditions needed to institutionalize the risk-management activities in the city

The information produced in the workshop was used to prepare the final version of the Earthquake Scenario that was published and distributed to the community. Figure 4 shows some of the participants of the Scenario Workshop in Guayaquil.



Fig. 4 Some of the participants of the Scenario Workshop in Guayaquil

PLANNING

The results of the damage estimation as well as the ideas for risk management activities produced during the Scenario Workshop were used as the basis for a preparation of an Action Plan that, if implemented, would

reduce the city's seismic risk. Regular working meetings were carried out with the city institutions that would be in charge of implementing the 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 addressed the three stages of the disaster: before the disaster, when preparedness and mitigation are important; during and immediately after the disaster, when the emergency response capability is depended on; and after the disaster, when the city's capability to recover in the shortest time from the disaster is most important. A preliminary action plan was prepared that was presented to the community during the Action Plan Workshop. The objectives of this workshop were:

- To present to the community the preliminary action plan and get their feedback
- To reach consensus on the activities that should be incorporated in the plan and set up 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.

The results of the workshop were used to prepare the final version of the Action Plan that was submitted to the city authorities. Summaries of the plan were also prepared and published for distribution to the community.

INSTITUTIONALIZATION

Besides the main activities of Risk Assessment (Earthquake Scenario) and Planning (Action Plan), RADIUS worked actively to set up the conditions that will allow these activities to be followed by a process of implementation. Looking for the institutionalization of risk management activities, the project:

- Involved all sectors of the community through the selection of a well representative Local Advisory Committee and the implementation of well-attended workshops.
- Informed the community about the project through the effective collaboration with the local mass media to keep the community informed on the advances and achievements of the project. Figure 5 shows examples of full-page articles on the project published in Antofagasta and Guayaquil.



Fig. 5 Newspaper articles about RADIUS in Antofagasta and Guayaquil

- Sought potential funding by approaching sectors that have been identified as potential donors such as the local industry, the financial and insurance sectors, and international aid organizations.

CONCLUSIONS

The RADIUS project has been successfully implemented in the three Latin American cities of Antofagasta, Guayaquil, and Tijuana. It may become the first, but very important, step towards the establishment by the cities of long-term initiatives to prepare for seismic disasters. Very significant progress has been attained in increasing awareness among the communities in the three cities and actions are already being taken to implement the Plan prepared by the project. Follow up projects have been generated and there is a general consensus on the need to continue the efforts initiated by the project.

RADIUS proved to be important and effective for several reasons. It produced tangible results such as the earthquake scenarios and action plans prepared for the cities and the practical tools that were prepared using the experiences of the case studies. The project also promoted and facilitated the collaborative work of cities worldwide that interacted to share experiences, identify common problems and solutions, and form international partnerships. Finally, and most importantly, RADIUS proved to be very effective in incorporating the entire community in the management of the seismic risk. It is expected that the work initiated by RADIUS will be continued by the cities where the project was implemented and that other cities worldwide will use the experiences and lessons learned during the project.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the hard work and commitment of the many people that participated in the successful implementation of the project in each city, especially the members of the local steering committees whose leadership and enthusiasm made this project possible.