



## **RADIUS – AN IDNDR PROJECT ON URBAN EARTHQUAKE RISK MANAGEMENT**

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### **SUMMARY**

The IDNDR launched the RADIUS initiative to reduce the effects of seismic disasters in urban areas, particularly in developing countries. This initiative has two concrete objectives: 1) development of seismic damage scenarios and earthquake risk management plans for nine selected cities worldwide, and 2) development of practical tools for urban seismic risk management using the results of the case studies.

Additionally, the project has three specific objectives for each of the selected cities: to 1) raise awareness, both locally and internationally, of the city's seismic risk, 2) incorporate all the sectors of the community in the risk management activities, and 3) set up the conditions for the institutionalization of risk management activities.

This paper describes the project implementation, the methodology that has been adopted, and the achievements of RADIUS in raising awareness of the community on seismic risk and in the incorporation of the various sectors of the society in the risk management process. The project has had an immediate impact in the cities where it has been implemented and actions are already being taken to reduce the seismic risk. The ultimate goal is to establish long term, institutionalized efforts to manage that risk. RADIUS intends to be the first step towards this goal in each of the nine selected cities. The responsibility for the continuation of these efforts lies on the shoulders of all the members of each of the nine communities and of their leaders. The enthusiasm and commitment with which the project was adopted and the good results obtained seem to indicate that there is a reasonable probability that these efforts will be continued in the future.

The nine cities selected are Addis Ababa (Ethiopia), Antofagasta (Chile), Bandung (Indonesia), Guayaquil, (Ecuador), Izmir (Turkey), Skopje (TFYR Macedonia), Tashkent (Uzbekistan), Tijuana (Mexico), Zigong (China).

### **INTRODUCTION**

The process of solving a problem (any problem) has three basic stages: evaluation, planning, and implementation. The evaluation stage involves understanding the underlying problem and its magnitude. The planning stage delineates, based on the problem evaluation, the actions that need to be taken to solve it. Finally, the implementation stage realizes the proposed actions. Although the three mentioned 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.

Reducing urban earthquake risk should follow the same process, with the same three stages, described above. 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

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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 no or very little 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.

With these considerations in mind, the secretariat of the International Decade for Natural Disaster Reduction (IDNDR), United Nations, launched the RADIUS initiative in 1996 to reduce the effects of seismic disasters in urban areas, particularly in developing countries. In collaboration with nine selected cities around the world, the RADIUS initiative will develop practical tools for seismic risk assessment of urban areas. These tools will be used to raise public awareness and to provide directions for the development and implementation of disaster mitigation measures.

### **WHO IS AND WHO SHOULD BE IN CHARGE OF MANAGING URBAN EARTHQUAKE RISK**

The process of managing the earthquake risk of a city, as stated above, has to go through three stages - evaluation, planning, and implementation - in order to be realistic and effective. The implementation of the process (and its stages) requires the participation of the members of a community. Broadly, the members of the community can be divided in three groups: the technical community (geologists, seismologists, engineers), the authorities (local government, leaders), and the rest of the community. Figure 1 tries to explain schematically the 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 in a certain stage of the process.

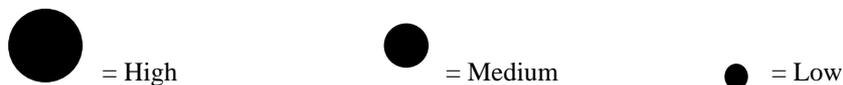
While the technical community plays a vital role in the evaluation process (which is, basically, the main activity of this sector of the community), technical people have a much less important role in the planning stage where social, economic and political issues are the factors that usually decide the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

The role of the local authorities in all the city activities is clearly important. During the evaluation stage, the 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 they coordinate the risk management plans with all the other plans and policies of the city, and during the implementation process, when they 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 program or activity. The demands of the community put the necessary pressure on the authorities to take the 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 programs 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.)

Actors \ Activities	Technical People	Decision Makers	Community
Evaluation	●	●	●
Planning	●	●	●
Implementation	●	●	●

Relative levels of participation:



**Fig. 1 Relative levels of participation of different groups of the community in seismic risk management**

Unfortunately, as shown by the shaded area in Fig. 1, 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 of the hazard only) carried out by the technical people. 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 community. Very few actual 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.

### THE RADIUS APPROACH

The RADIUS case studies were designed with the specific objective of initiating long-term risk management processes in the cities where the project is implemented. The evaluation and planning stages are explicitly addressed in the methodology proposed for the project, and efforts were made throughout the project to set up the conditions that will allow the initiation of the implementation stage immediately after the completion of the RADIUS project.

The RADIUS initiative had two concrete objectives:

- Development of seismic damage scenarios and earthquake risk management plans for nine cities selected worldwide
- Development of practical tools for seismic damage assessment in urban areas using the results of the nine case studies implemented worldwide

Additionally, the project has three specific objectives for each one of the cities where the project was implemented:

- Raise awareness, both locally and internationally, of the city's seismic risk and the need to reduce it
- Incorporate all the sectors of the community in the risk management activities
- Set up the conditions for the long-term continuation and institutionalization of risk management activities.

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

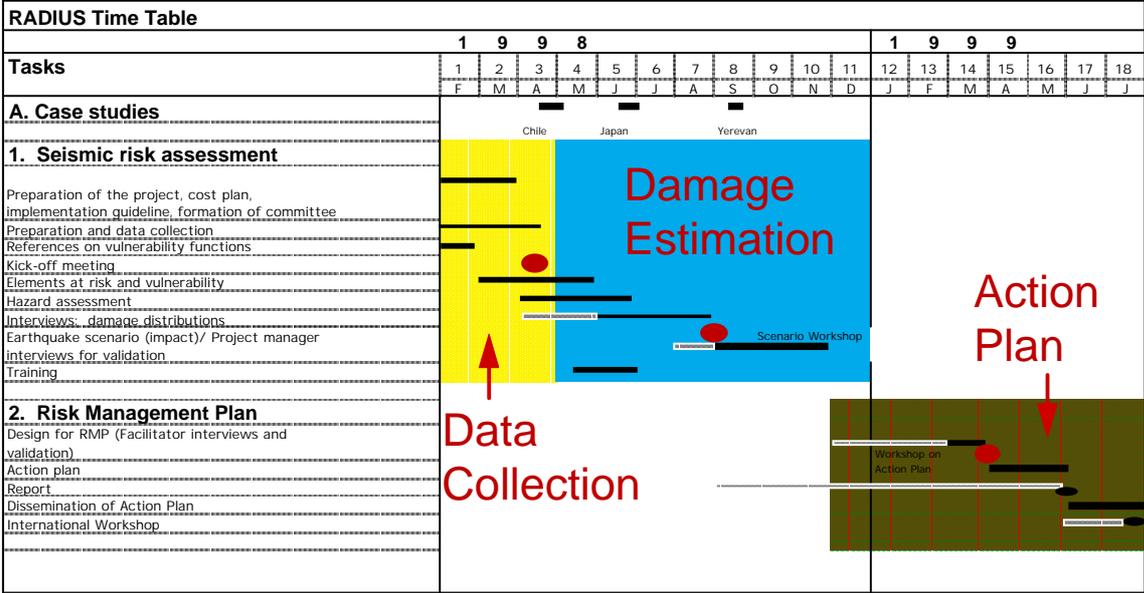


Fig. 2 Detailed program of activities for the RADIUS case studies

A detailed program of activities for the RADIUS case studies is presented in Fig. 2. 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 the big dots in Fig.2) in which key representatives of the community are first informed about the advances of the project and then asked to provide their feedback.

In early 1997, the IDNDR Secretariat sent invitation letters for participation in the RADIUS project to earthquake-prone cities around the world through the IDNDR National Committees and related international organizations. The IDNDR Secretariat received applications from 58 cities worldwide, mainly from developing countries, by the end of July 1997. After carrying out a careful selection process, the IDNDR Secretariat selected nine cities in January 1998, under consultation with the Science and Technology Council (STC) subcommittee for RADIUS.

The nine cities selected for the RADIUS case studies were Addis Ababa (Ethiopia), Antofagasta (Chile), Bandung (Indonesia), Guayaquil (Ecuador), Izmir (Turkey), Skopje (TFYR Macedonia), Tashkent (Uzbekistan), Tijuana (Mexico), Zigong (China).

The selected cities received the following assistance from the IDNDR:

- \$ 50,000 to each selected city
- Supervision and coordination by an internationally recognized institute, offering technical assistance as well
- Assistance from a Regional Advisory Committee of well-known experts in the field of earthquake risk management
- Training seminars for technical experts and government officials of the selected cities
- Participation in an international workshop to present the project’s results

## THE PROJECT PARTICIPANTS

The project tried to incorporate as many people and institutions as necessary to ensure raising awareness of the risk within the community and getting its support for risk management activities. The participants were grouped as follows:

*Steering committee:* Included representatives of the local government, the technical institution assigned to the project, and an international institute hired by the IDNDR.

*International Institutes:* The IDNDR hired three international institutes to provide advice and guidance to the RADIUS cities in the three regions in which the world was divided for the project. The institutes were the International Center for Disaster-Mitigation Engineering (INCEDE, Japan) which worked in close collaboration with OYO Corporation, Japan; the Bureau de Recherches Géologiques et Minières (BRGM, France); and GeoHazards International (GHI, USA).

*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.

*Regional Advisory Committee:* 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.

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

## SOME RESULTS

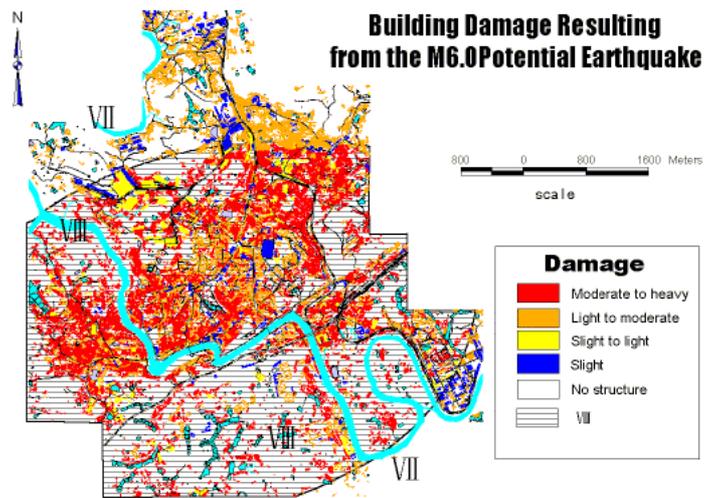
The damage estimation (evaluation) phase of the project was implemented first. It included a theoretical estimation of damage using appropriate vulnerability functions as well as interviews with the city's infrastructure system managers (Fig.3). The latter provided information on specific characteristics of the local systems that the theoretical estimation could otherwise exclude. Both of these, then, were combined to construct the earthquake scenario. Figure 4 shows the estimated building damage for the city of Zigong, China.

The results of the evaluation were then presented to representatives of all the sectors of the community for them to discuss, correct, and approve the prepared earthquake scenario. Figure 5 shows several of the participants of the 3-day Earthquake Scenario Workshop in Guayaquil, Ecuador.

The potential seismic damage evaluated for the city was used as the basis for the development of a risk management plan that, if implemented, will reduce the risk of the city. Again, this work was done in close collaboration with the various institutions and sectors of the community. The prepared preliminary plan was then presented to representatives of the community for them to comment on the activities proposed in the plan, set up priorities, and define a strategy that ensures the implementation of the plan. Figure 6 shows one of the working sessions of the 2-day Action Plan Workshop in Tijuana, Mexico.



**Fig. 3 Meeting with representatives of the Health Sector of Tijuana**



**Fig. 4** Estimated building damage for the City of Zigong, China



**Fig. 5** A group of participants of the Earthquake Scenario Workshop in Guayaquil, Ecuador



**Fig. 6** A working session during the Action Plan Workshop in Tijuana

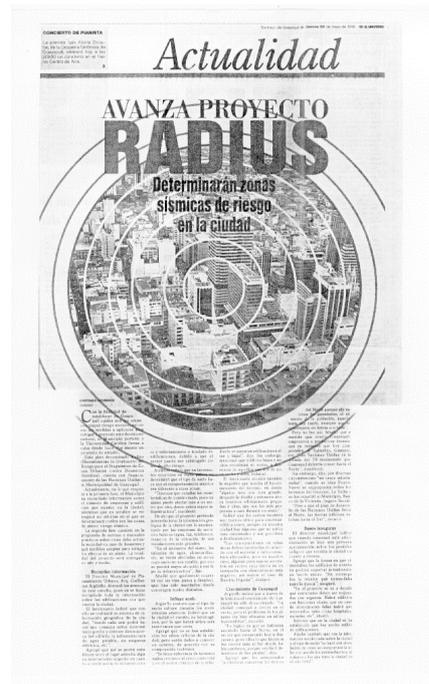
## THE IMMEDIATE IMPACT OF RADIUS

All the efforts and time invested in evaluating the earthquake risk of the RADIUS cities and delineating action plans to manage that risk will be wasted if nothing is actually implemented. Throughout the RADIUS project, several activities were carried out to set up the political, legal, financial, and cultural conditions that will facilitate the institutionalization of earthquake risk management in the RADIUS cities. Among these activities are the following:

- Incorporation of all the community sectors to the project: Representatives of the institutions and sectors of the community had an active participation throughout the project
- Proper information and dissemination of results: RADIUS promoted an effective collaboration with the mass media throughout the project so that the whole community knew what RADIUS was doing for each city and what the results of the project were. Figure 7 shows examples of press articles about RADIUS in China and Ecuador
- Search for funding: Committed efforts to generate funds, especially local ones, were performed by approaching the industrial, commercial and financial sectors of the community as well as international aid organizations with offices in the RADIUS countries
- Creation of an organization to coordinate risk management activities: An organization was selected (or created if there was not a suitable one) to coordinate, monitor, and advocate risk management efforts in the city

As a result of these efforts, several actions are already being taken in some of the RADIUS cities and the implementation stage seems to be ready to start in several of these cities. Examples of the actions being taken include the following:

- Three small neighbor cities of Antofagasta, Chile have started similar projects using the RADIUS methodology
- The Municipality of Guayaquil created the Unit for Risk Management of the City which, among other things, will be in charge of implementing the Plan prepared by RADIUS
- The representatives of the various sectors of the community of Tijuana that participated in the Earthquake Scenario Workshop decided that they would like to continue meeting regularly. They are now conducting working sessions once a month
- The industrial sector of Tijuana asked the Municipality for assistance in the estimation of its seismic risk. The industry offered to support seismic safety efforts for the schools in exchange for the Municipality's assistance
- The local government of Antofagasta has already given the go-ahead to three activities proposed by the Plan created by RADIUS
- Tijuana organized and hosted the UN-sponsored RADIUS Symposium in October 1999, in which representatives of more than 50 cities of the world discussed the RADIUS achievements, lessons, and possible implementation in other communities.



**Fig. 7 Newspaper articles on RADIUS published in China and Ecuador**

### FINAL REMARKS

The RADIUS project has been received with enthusiasm and high expectations in the nine cities selected for the project. There has been good coordination between the representatives of the City Government and the technical experts of each city. Although it took some time to explain the project and to form the working groups, the positive attitude of the local participants has allowed the achievement of most of the objectives that had been set for the project. Most importantly, the implementation of the project has been crucial in raising awareness among the communities of the seismic risk and the actions that can be taken to reduce it. A huge step has been taken towards the effective incorporation of the whole community in the risk management efforts. This may be a turning point in urban earthquake risk reduction. The cities are already acting; there is a strong feeling that these efforts have to be continued. However, the seismic risk of a city is a very complex problem. Only the time will tell how successful this project and its approach were.