RADIUS

Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters

IDNDR Secretariat, OCHA, UN, Geneva

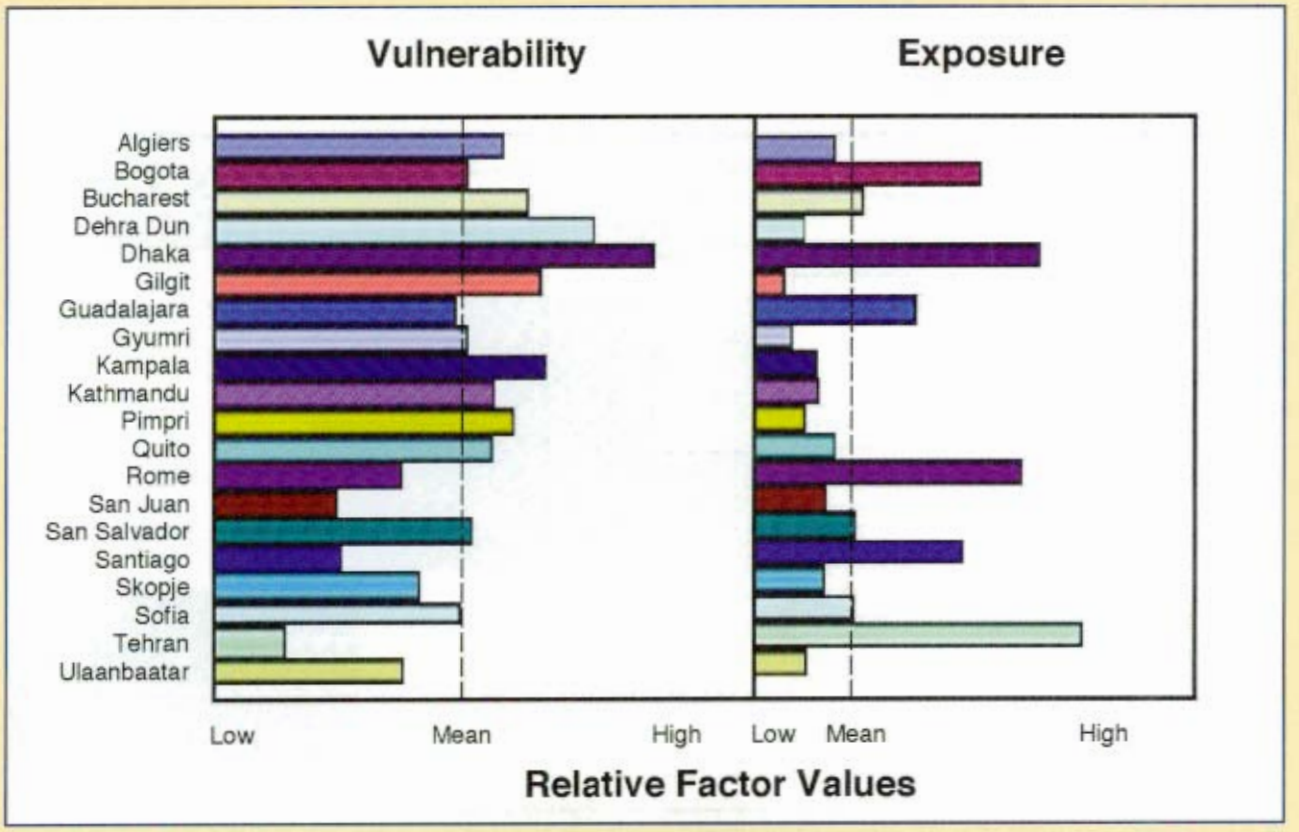
OUTCOME OF THE RADIUS INITIATIVE

1. Comparative Study on Understanding Urban Seismic Risk around the World

In April 1998, IDNDR Secretariat and GeoHazards International (GHI), launched the 18-month Understanding Urban Seismic Risk Around the World (UUSRAW) project. The study achieved the aims to: (1) provide a systematic comparative assessment of the magnitude, causes, and ways to manage earthquake risk in cities worldwide, (2) identify cities around the world that are facing similar earthquake risk challenges and foster partnerships among them, and (3) provide a forum in which cities could share their earthquake and earthquake risk management experiences using a consistent, systematic framework for discussion.

The project established an internet network of more than 70 seismically active cities worldwide, and in each one, identified a scientist or municipal officer to act as a local city representative. These city representatives gathered the information necessary to develop a systematic comparison of the earthquake risk and risk management practices of all participating cities. The Earthquake Disaster Risk Index (EDRI) provided a framework for the UUSRAW project. The EDRI compares metropolitan areas according to the magnitude and nature of their earthquake disaster risk, which is analyzed using five main factors, namely, "Hazard," "Vulnerability," "Exposure," "External Context" and "Emergency Response and Recovery."

The UUSRAW project will produce a final report that includes (1) a comparative analysis of the earthquake risk and risk management practices in the participating cities, (2) a compilation of two-page city profiles that describe the key elements of a city's earthquake risk and risk management practices in a systematic way, and (3) a compilation of more than 60 risk management effort initiatives from 27 cities. The project has also established a worldwide network of earthquake professionals that can support continued work in comparative urban earthquake risk assessment and who have expressed the desire to maintain the established network.



Sample results of Exposure and Vulnerability factor values for the 20 cities actively involved in all phases of the project. While Dhaka (Bangladesh) shows the highest Vulnerability factor value of the sample, Tehran (Iran) is shown as having the highest Exposure factor value. Results are relative to the sample.

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2. Guidelines for RADIUS-type Risk Management Project

(1) Purpose of the guidelines

One of the major objectives of the RADIUS initiative was to develop practical tools for seismic urban risk management, based on the experience of the 9 case studies implemented worldwide. One of those tools is a set of Guidelines for the Implementation of Risk Management Projects. These Guidelines should be used to a) explain the philosophy and methodology adopted by the RADIUS Initiative, b) assist in the reading, understanding, and interpretation of the reports prepared for the case-study projects, and c) provide general guidelines on how RADIUS-type Risk Management Projects could be implemented in other cities.

(2) Description of the guidelines

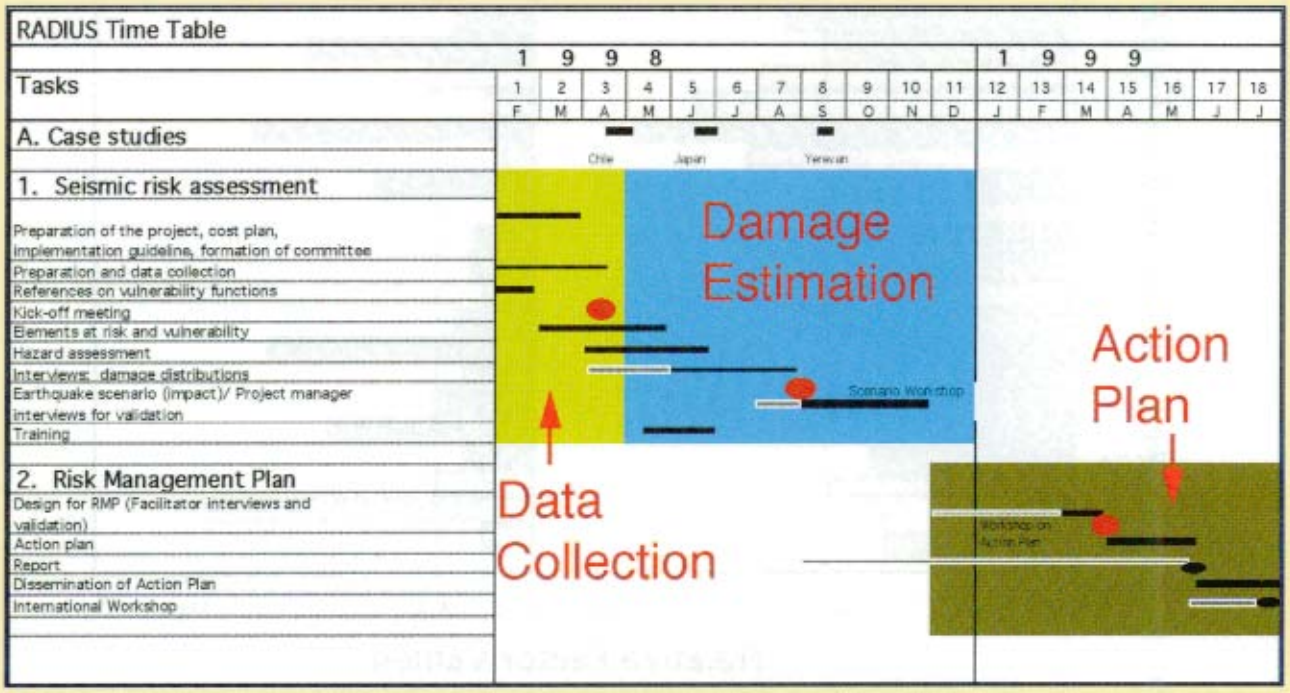
a) Assessment of the city's urban risk

The Guidelines describe the process to estimate the potential damage that would be caused by an adopted hypothetical earthquake. The damage estimation process includes interviews with city systems' managers to incorporate the particular characteristics of theses systems. A preliminary earthquake scenario is presented and discussed by representatives of the various sectors of the community during the Scenario Workshop. The information produced there is then used to prepare the final version of the Earthquake Scenario that is published and distributed to the community.

b) Preparation of a plan to reduce the city's seismic risk

The Guidelines show how to use the results of the risk assessment phase to prepare an Action Plan that, if implemented, would reduce the city's seismic risk. Working meetings are held with institutions that would be in charge of the implementation of risk management activities. 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 for its implementation. The mass media is actively involved throughout the project to ensure and facilitate the communication of the project's achievements to the community.

A multi-disciplinary working group meets during the Action Plan workshop of Guayaquil, which was covered by mass media .



Program of activities adopted for the implementation of the RADIUS case-studies. The large red dots represent meetings with key representatives of the community

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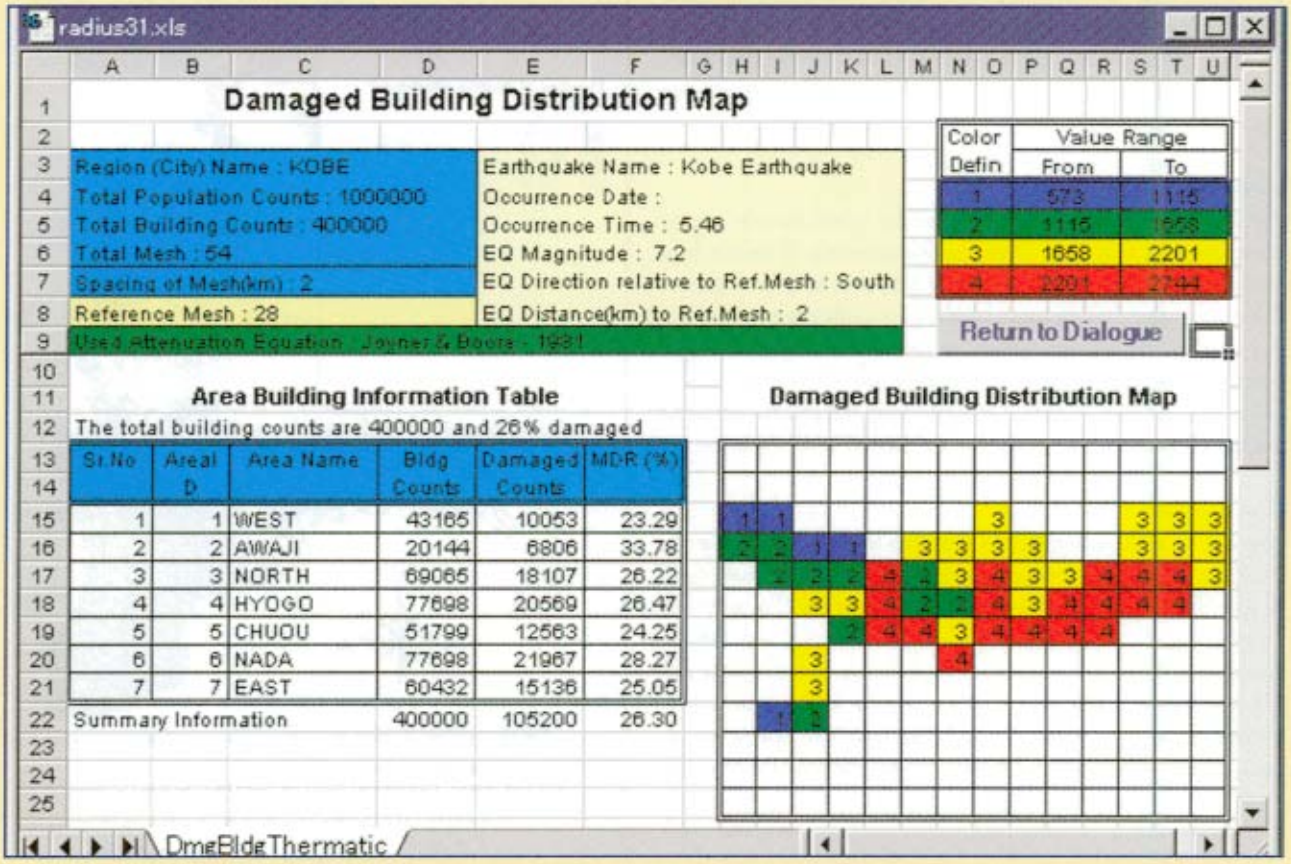
3. A Simplified Program for Earthquake Damage Estimation

The computer program for simplified Earthquake Damage Estimation has been developed based on the wide variety of experiences of the 9 Case Studies around the world during the course of the RADIUS initiative. Since the program aims to present earthquakes and earthquake damage estimation in a manner that is easily understood by a wide range of users, and actual disasters occur in many different locations with varying conditions, it should be noted that the accuracy level of the results is limited. Therefore, the result of the program should be regarded only as a preliminary estimation. It is intended that this program will be used as a tool to aid users in understanding the seismic vulnerability of their own cities and encourage the start of preparedness programs against future earthquake disasters, in accordance with the main objective of RADIUS.

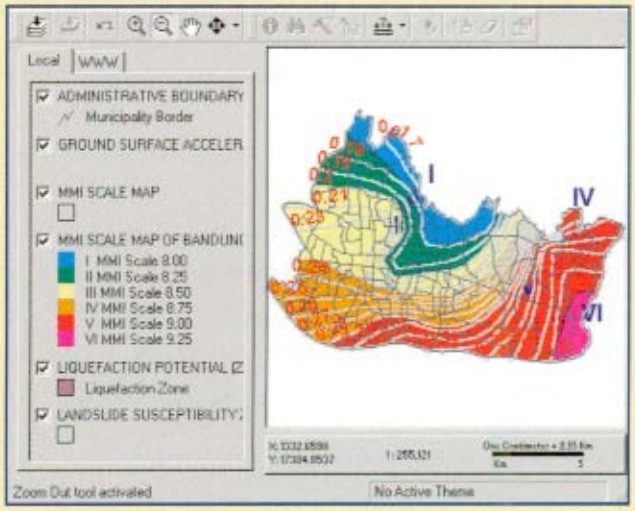
The program requires input of a simple data-set and provides visual results with user-friendly prompts and help functions. Input data are population, building types, ground types, and lifeline facilities. Outputs are seismic intensity (MMI), building damage, lifeline damage and casualties, which are shown with tables and maps. Users can apply a historical earthquake such as Tangshan (1976, China), Kobe (1995, Japan), Kocaeli (1999, Turkey) and Chichi (1999, Taiwan) as a hypothetical scenario earthquake.



A sample map of building damage distribution developed by the program

This program is not based on a GIS (Geographical Information System). A GIS is a useful tool for disaster management or risk management, though it requires detailed input data and resources, including advanced engineering knowledge. For more interested or knowledgeable users of the program, however, a GIS sample of the city of Bandung is provided separately.

The program is available on CD-ROM and can be downloaded from the RADIUS home page, along with other outcomes, including guidelines and reports of the RADIUS project. Together, these materials can serve as a tutorial manual for potential users of this program.



A GIS sample of intensity distribution developed by Bandung City

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4. Earthquake Damage Scenario and Action Plan in Guayaquil, Ecuador

The 9 case study cities developed their own earthquake damage scenarios and action plans. The following was extracted from those for the city of Guayaquil, Ecuador.

(1) Earthquake damage scenario

The earthquake strikes!

The time is 8h45 AM of May 5, you have just arrived to your office located on the 10th floor of a downtown building in Guayaquil. Suddenly everything starts to shake, at first very slowly and then very fast. The windows and doors creak, the furniture is moving and you have great difficulty keeping your balance. To the shout of "EARTHQUAKE!" some of your office mates search for protection under the desks, and others run away terrified and staggering to the elevators. Somebody asks, "Where are the stairs?" Slowly, the movement begins to diminish, while the sound of buildings collapsing is heard. A magnitude 8.0 earthquake has just occurred 200 km from the city, in the Pacific Ocean, producing ground shaking strong enough to damage even well constructed buildings in large areas of the city.

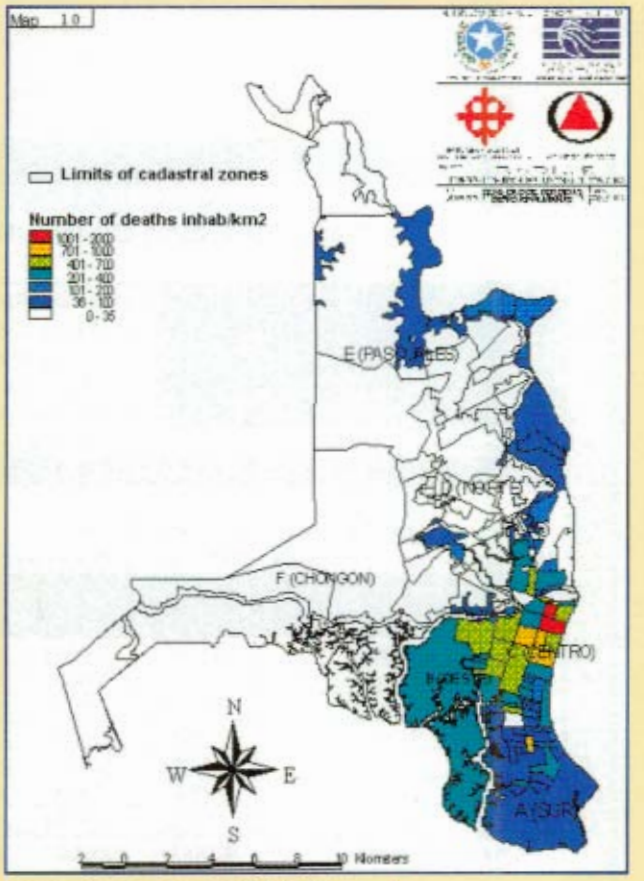
Minutes later

You are on the street, somewhat hurt by the crowd that was coming down the stairs in a hurry. You hear the screaming of people from inside buildings, but there is no electric power or telephone service. There are people running around looking for a safe place among broken glass and debris, and others are helping with those killed and injured by fallen brick walls. You try to call up your family using your cellular phone but the telephones are not working, and you cannot call up the firemen to rescue the people that are trapped in the elevators.

One hour later

You wish to go to your children's school to know what happened to them, but on main streets which look open, the traffic has virtually come to a standstill. Fire is engulfing many houses of the city. The most critical fire is that of a mixed construction house of 3 levels located besides a gas station, the fire is threatening to extend to a large sector of the city. Firemen experience difficulties in getting there due to lack of personnel, traffic jams and damage their fire trucks have sustained due to the collapse of walls and structures of three old fire stations. The main Fire Department Station has suffered cracked walls and the falling of structural ornaments, as well as the destruction of the fire alarm service. The fight to extinguish fires still continues due to lack of water and hydrants in the city.

(The scenario describes how the city could be affected upto a month later)



Distribution of number of deaths in Guayaquil

(2) Action Plan to reduce the Seismic Risk of Guayaquil (partial)

Category 1: Strengthening of the physical safety and planning the response of hospitals

Projects or actions	Responsible Institution	Beneficiaries	Priority
1. Updating of the emergency plan of Hospital General Vernaza and coordination with other health institutions	Junta de Beneficencia	The hospital + community	High
2. Signaling evacuation routes and identification of vulnerable equipment and installations at Hospital Luis Vernaza.	Junta de Beneficencia	Users and employees	High
3. Evaluation of non structural elements, life lines at the hospitals of Guayaquil	Secretary of Health	All community	High

Full information on RADIUS is available at: http://www.geohaz.org/radius

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