Sodosísmica

A. EARTHQUAKE LOSS REDUCTION PROGRAM FOR THE DOMINICAN REPUBLIC

DRS. WILLIAM MCCANN & STUART NISHENKO, EARTH SCIENTIFIC Consultants Westminster, CO.

Executive Summary

Hurricanes, flooding, earthquakes, and volcanic eruptions throughout the Caribbean Basin have repeatedly demonstrated the catastrophic effects natural hazards can have on local populations and economies. The 500-year history of the Dominican Republic documents the effects of numerous damaging earthquakes, hurricanes, and other disasters.

While not as frequent as hurricanes, earthquakes represent a significant threat to life safety. In addition, economic losses stemming from building damage and the long-term interruption of business can amount to significant fractions of the national GDP and affect the sustainable development of the country.

The outlook is for losses from natural disasters to increase in the future. These increases stem from increases in exposure –the concentration of development and growth in potentially hazardous areas.

The last damaging Dominican earthquake occurred in 1946 (magnitude 7.9) and caused significant loss and life and economic hardship. A repetition of that earthquake today would have an even greater effect on the Dominican population, building stock, infrastructure and economic health of the country.

While natural hazards themselves cannot be reduced or eliminated, one can take steps to reduce the losses associated with natural

disasters by adopting proactive policies –taking action before the event occurs, instead of continuing with reactive policies and responding to disasters after it is too late.

The three elements critical to promoting sustainable development in the face of natural hazards are:

- Hazard Identification and Risk Assessment
- Development and Implementation of loss reduction activities
- Development of regional warning and information dissemination systems

This proposal addresses the first element –Hazard Identification and Risk Assessment and discusses how this can establish the foundation for developing a national loss reduction strategy in the Dominican Republic. It comes in response to recommendations made by expert scientists attending a special symposium on the Geology and Earthquakes of Hispaniola held in Puerto Plata in February, 1999. Among other things, they recommended revision of the seismic zonation map and seismic elements of the national building code.

1. Earthquake Hazard Identification

The latest earthquake data set is essential to updating the earthquake loading design and construction standards in the Dominican Republic. Current code is 20 years old and is deficient in prescribing earthquake-loading standards that are appropriate for modern construction techniques an materials. Improvements in engineering design and construction practices need to be included on a regular basis.

Improvements in the understanding of the geologic/tectonic framework of Hispaniola, the causes of large and great earthquakes in the region, the location of active faults and their rate of motion also need to be incorporated into revised earthquake loading standards.

These provide support for decision making about proper use of hazard prone areas, and are the basis for public awareness, prevention and preparedness activities.

Product

Country-wide maps, at a scale of 1:500,000 identifying earthquake ground motions at bedrock with a 10% probability of exceedence in 50 years.

Implementation

The final earthquake ground motion map represents the synthesis of a great deal of geologic and seismologic information for the Dominican Republic and would be undertaken in coordination with the Bureau of Mines Geological Survey Division as well as INDRHI, UASD and private institutions.

Activities include:

•Collect historic and instrumental earthquake data for Hispaniola.

•Develop geologic controls on damaging earthquake return times. Return times of potentially damaging earthquakes are very long in this region, longer than the historic record. Collect information gathered through paleoseismology, other field investigations, and GPS to document and monitor rates of fault motion.

•Map local geology and soil conditions. Local geology plays an important role in amplifying ground shaking. Mapping of local soil conditions, thickness, geotechnical properties, as well as depth to water table and analysis of well hole data are critical elements.

•Attenuation relationships need to be developed. Current models in use (e.g. IPGH) are based on the attenuation of strong ground motion in California. Need to develop a model that is specific to the Dominican Republic.

Budget

A. Short Term-Summarizes the current state of knowledge/information, interim risk map, identifies data lacking, prioritizes program for phase B. $300,000, 6 month proyect.

B. Long Term-Intensive study-more definitive answers about geology and tectonics, vulnerability of high risk areas, long term time frame. $1,500,000, 1-2 years.

2. Risk Assessment

This element addresses the long-term goal of developing a nationally consistent natural disaster loss estimation methodology and database. The methodology and database development are based, in

principle, on software that is currently available and in use in the United States.

The Federal Emergency Management Agency (FEMA) of the United States has, in cooperation with the National Institute of Building Sciences (NIBS) and Risk Management Solutions, Inc. (RMS) developed software for earthquake loss estimation. The program, Hazards US (HAZUS) uses a Geographic Information System to analyze and map information about building inventories, critical facilities and other infrastructure, local geology and the location and size of potential earthquakes to estimate potential life and economic losses from earthquakes.

This type information is useful as an emergency response and planning tool.

Emergency Response Tool-HAZUS will provide immediate post-disaster estimates of the extent and severity of earthquake related damages. Once the location and size of an earthquake is known, earthquake loss estimation programs like HAZUS can provide estimates of the violence of the ground shaking, the number and types of buildings damaged, the number of casualties, number of people displaced from their home requiring shelter and medical attention, damage to transportation systems, disruption of electric and water utilities, etc. These types of information are invaluable for the coordination of emergency response effort.

Planning Tool-HAZUS will help prioritize mitigation activities, land use planning and development policy, Estimates of losses from future earthquake and other natural disasters are key inputs for risk management and the private sector. Loss estimates can provide a scientifically sound basis for developing and testing emergency response and preparedness plans, and for planning post-disaster relief and recovery efforts.

Product

The GIS technology and loss estimation methodologies that are available in the United States version of HAZUS can be adapted for use in the Dominican Republic as well. Currently available in both Arcinfo of MapInfo formats.

Implementation

This project would require the systematic collection of natural hazard, population, and building inventory data, as well as its conversion into GIS format. Coordination with numerous agencies in the Dominican Republic is expected. Natural hazard data for earthquakes would be collected part 1 of this program. Data for other hazard can be incorporated as they are developed. Characterization of building response/ performance would be undertaken to adapt HAZUS to building practices in the Dominican Republic. Testing against historic earthquakes would allow estimation of errors in response parameters.

Database collection can be undertaken parallel with seismic hazard mapping program (part 1) with the goal of having both data sets finished at approximately the same time to incorporate into the loss estimation methodology.

Budget

A-Initial phase is scale dependent- initially concentrate on urban centers, and high risk areas. 1-2 years, amount to be determined.

B-Final phase would ultimately cover the entire country. 3er year. Amount to be determined.