

Hospitals Get a Jolt of Reality with Hazus-MH Earthquake Analysis Results

After an earthquake, injured victims will look for help at local hospitals, but will the hospitals be in shape to offer assistance? In Southern California, hospitals are getting prepared for a "big one" with a system that uses GIS technology to estimate hospital building damage and related effects on hospital services. In March 2009, Orange, Riverside, and San Bernardino counties completed a two-year study that analyzes economic loss; population impact; and damage to essential facilities including fire and police stations, hospitals, and schools.

The study utilized Hazus-MH—loss estimation software based on GIS technology—to calculate estimated physical damage and functional loss from earthquakes, floods, and hurricanes. Two earthquake scenarios provided local decision makers with a more complete understanding of the impact these disasters would have. Area hospital groups were especially interested in using the analysis results to get a better view of which hospital facilities might be damaged and how many and where acute care beds would be available.

Forewarned is to be forearmed," said Christina Bivona-Tellez, regional vice president of the Hospital Association of Southern California. "If we are left standing, do we have the capacity to protect and save lives? Both Riverside and San Bernardino counties are sitting on the San Andreas Fault, and we are overdue for an earthquake." The probability of a magnitude 6.7 or larger earthquake striking the greater Los Angeles area over the next 30 years is 67 percent according to the Working Group on California Earthquake Probabilities.

Hazus-MH was developed by the Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences. Hazus-MH operates as an extension to ESRI's ArcGIS ArcView software to map and display region-specific hazard data along with the results of loss and damage assessments. It also uses Microsoft SQL Server to manage the extensive amount of data generated for a given regional loss estimate.

The extension has a number of complex analysis modules that are initiated through the Hazus–ArcGIS graphical user interface. Databases include inventory databases (aggregated to geographic units of either census block or census tract) and site-specific inventory databases, such as essential facilities databases that include hospitals. Analysis modules apply structural engineering and other loss methodologies to estimate damage to structures and infrastructure, the results of which can then be visualized on maps using ArcGIS functionality.

For the hospitals in the recent pilot studies, building-specific inventory data was assembled and imported into Hazus-MH. In the earthquake scenarios, hospital facilities were overlaid onto maps of earthquake shaking, and the software's structural analysis module determined the probability that each hospital facility would end up in any one of five defined damage states. This damage state distribution was combined with inventory data on licensed acute care hospital beds to produce a damage measurement in terms of bed availability.

Local Data Is Key

Use of detailed local data is essential to obtaining accurate results in Hazus-MH analysis. For Orange County, Raymond T. Lenaburg, chief, Risk Analysis Branch of FEMA's Region IX, with Vicki Osborn, assistant emergency manager, Orange County, led a group from the county's Community Executive Committee (CEC) to compile local data by coordinating input from 114 political subdivisions and 34 incorporated cities in the county.

The two other county CECs provided existing data or helped create new data by collecting information on structures such as date built, type, square footage, replacement costs, and backup power availability. The hospitals' engineering and environmental services departments also provided detailed information.

Bed Availability Affected

One of the outputs of the Hazus-MH analysis computed an availability of acute care hospital beds for the hospitals. Under the scenario of a 6.9-magnitude earthquake on the Newport-Inglewood Fault, preliminary damage estimates for Orange County indicated that 47 percent of existing hospital beds would be available. Given a 6.6-magnitude earthquake on the San Joaquin Hills Fault, 32 percent of beds would be available.

Making the Most of the Analysis

This study required preparation of accurate inventory databases that can support accurate loss estimate analyses. By developing these databases before a disaster strikes, local communities can produce realistic loss estimates that can be used after a real event until actual loss data can be collected. The counties have now consolidated detailed engineering information about hospital structures and the location of hospital facilities and beds per building. Participating agencies have also established communications and practiced running Hazus-MH before they need it during a real event.

In addition to supporting improved real-time response, the results also support emergency response planning and can be used to establish priorities for hazard mitigation projects. For example, under a magnitude 7.8 earthquake scenario along the southern portion of the San Andreas Fault, analysis showed that San Bernardino County's Emergency Operations Center (EOC) would experience heavy damage (it sits directly on the fault). Based on these results, the county applied for and was awarded a FEMA grant to improve the EOC facility.

Hazus: <http://www.fema.gov/HAZUS>