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# A GIS-based decision support system for earthquake risk mitigation in the City of Memphis and Shelby County, Tennessee, USA

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Earthquakes and associated seismic hazards, such as liquefaction and landslides, pose significant threats to the public safety and economic health of many communities throughout the world. One option for reducing potential losses is structural mitigation. However, decision-makers, including both private citizens and elected officials, face major informational and financial challenges in their efforts to develop and prioritize mitigation strategies for their communities. In many cases, individuals require not more information, but assistance interpreting existing information and determining what is needed to make informed decisions.

Because earthquakes affect entire urban areas, there is a need for regional-scale evaluation of the benefits of various mitigation strategies. Geographic information systems (GIS), with their ability to integrate disparate geospatial data, are important tools for understanding and communicating the spatial distribution of risks associated with natural hazards in regional economies. Although hazard mitigation decisions are typically made by individual property owners, their choices are often affected by external policies implemented on regional scales, such as tax incentives, building codes, ordinances and regulations, each of which leads to specific physical changes to the vulnerability of particular locations. For this reason, determining the effectiveness of any one policy requires GIS-based regional risk assessments.

The city of Memphis, Tennessee and surrounding Shelby County has a dense urban population near faults capable of producing major earthquakes, a 25-40% probability of a magnitude 6.0 or greater earthquake in the next 50 years, and relatively low re-

gional attenuation (in other words, seismic waves do damage over a greater area in this region than for the same magnitude earthquake in the western U.S.). Because of these attributes, Memphis was chosen by the U.S. Geological Survey (USGS) as a test site to develop a GIS-based decision support system (DSS) to help local government agencies evaluate the economic consequences of alternative mitigation strategies.

The initial application of the project involved an analysis of hypothetical mitigation strategies that compare the benefits and costs of structural mitigation for new commercial buildings. Various DSS scenarios were conducted for ˜12,000 vacant commercial parcels, with a hypothetical mix of structures having a total estimated value of $9.6 billion. Scenarios were run with and without geologic risk information, with estimated mitigation costs of 10% and 30% of new building values, and with planning horizons of zero, 20 and 50 years. Preliminary results demonstrate a) that geologic risk information can substantially reduce costs by more effective targeting of mitigation efforts, and b) that the choice of planning horizon markedly affects present-value estimates of mitigation benefits and costs.