

Annual Project Summary

SHEAR WAVE VELOCITY DETERMINATION OF UNLITHIFIED GEOLOGIC MATERIALS AND PRODUCTION OF SOIL AMPLIFICATION MAPS FOR PROJECT IMPACT COMMUNITY AREAS IN THE CUSEC REGION

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Element I. Products for Earthquake Loss Reduction
Element II. Research on Earthquake Occurrence and Effects

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Technical Abstract

Surficial materials overlying the bedrock surface can either amplify (most commonly) or deamplify the bedrock ground motions by the time they reach the ground surface where manmade structures are built. Therefore, to better estimate the shaking and damage that may occur to manmade structures during an earthquake, it is necessary to modify the bedrock motions with soil amplification values. The Central U.S. Earthquake Consortium State Geologists are producing soil amplification maps for communities based on existing and newly collected borehole geologic descriptions and shear wave seismic velocity information. These soil amplification maps, at a scale of 1:24,000 (1 inch = 2,000 feet) are produced for FEMA's Earthquake Loss Estimation Program (HAZUS) for use by the communities to estimate and mitigate their earthquake losses.

The soil amplification maps are based on geologic maps, at a scale of 1:24,000, that were specifically made for this project or used existing maps that were modified with new data. The new geologic base maps are also useful to these communities for other hazards outside of the use for estimating earthquake losses. Arkansas Geological Commission is making contacts with the community of West Memphis which has shown interest in planning work in their rapid growing community. The Mississippi Geological Survey is making contacts with planners in the area southeast of Memphis, which is also a rapidly growing community. Several workshops have also been completed with agencies and communities in the Midwest on the production and use of the soil amplification maps.

NON-TECHNICAL SUMMARY

The Central U.S. Earthquake Consortium (CUSEC) State Geologists are gathering information on the local geologic and material properties of the soils in the Communities of West Memphis, Arkansas and Olive Branch, Mississippi. Also workshops on how the soil amplification maps were produced and how they may be used have been completed in Evansville, Indiana and for the State Departments of Transportation in the Midwest. The geologic information gathered is used to first produce geologic maps of the materials resting on the bedrock of these communities at a scale of 1:24,000 or 1 inch = 2,000 feet. The geologic map along with measurements of the soil's properties are used to classify the various soils as to how much they would amplify earthquake ground motions. The amplification maps can be used in the Federal Emergency Management Agency's earthquake loss estimation program (HAZUS) to better estimate the amount of damages a community may expect from various earthquakes. The maps and background information on how they were produced are being presented in workshops in the communities.

Investigations undertaken

Cape Girardeau, Missouri Project Impact Community

The geologic map and soil amplification map of Cape Girardeau was completed in the grant 99-HQ GR 0086. The officials of the City of Cape Girardeau are being contacted to set up a workshop in their community to discuss the data and procedures used to produce the soil amplification map and to show how it can be used. These workshops included representatives of the USGS who discuss the national hazard mapping program and present information on the seismic hazards in the area.

Evansville, Indiana Project Impact Community

The geologic map and soil amplification map of Evansville, Indiana was completed in the grant 99- HQ GR 0086. A workshop sponsored by the Southwestern Indiana Disaster Resistance Community Corporation with support from the Indiana Emergency Management Agency was conducted on October 17, 2001. Representatives of City of Evansville, Vanderburgh County and the private sector attended the workshop to discuss the data and procedures used to produce the soil amplification map and to show how it can be used. The workshop included representatives of the USGS who discussed the national hazard mapping program and present information on the seismic hazards in the area.

Lexington, Kentucky Project Impact Community

The Kentucky Geological Survey (KGS) has participated in several Lexington/Fayette Urban County Government, (Kentucky) Project Impact Community meetings and has completed the first draft of a 7.5' quadrangle map for classification of soils for earthquake ground motion amplification of the area. The KGS assigned shear wave velocities to each of the soil units and calculated the average shear wave velocity for the soil columns. Using the averaged shear wave velocity for the soil columns, the surficial materials were classified into soil amplification units.

Mississippi Geological Survey

The Mississippi Geological Survey is mapping the geological materials in the area of Olive Branch, Mississippi. This is a rapidly growing area associated with the city of Memphis. The Survey has been in contact with professors at The University of Mississippi who have performed consulting work concerning shear wave velocity measurements and soil amplification just west of where the Survey is mapping. Their data will be valuable in the mapping project.

Arkansas Geological Commission

The Arkansas Geological Commission is contacting officials of the town of West Memphis, whom have been interested in planning in their rapidly growing community which is directly west of Memphis.

Both of the Arkansas and Mississippi work will be coordinated with the USGS which has a multi year Urban Hazard Mapping Project in the Memphis area.

Summary

The Central U.S. Earthquake Consortium (CUSEC) State Geologists have presented workshops on the information gathered on the local geologic and material properties of the soils in the Project Impact Community of Evansville, Indiana and to the State Department of Transportation officials in the Midwest. The geological information is first used to produce geologic maps of the materials resting on the bedrock at a scale of 1:24,000 or 1 inch = 2,000 feet. The geologic map along with measurements of the soil's properties are used to classify the various soils as to how much they will amplify earthquake ground motions. The amplification maps can be used in the Federal Emergency Management Agency's earthquake loss estimation program (HAZUS) to better estimate the amount of damages a community may expect from various earthquakes. This work entailed gathering all existing borehole information, **Adrilling@** new holes for stratigraphy, measuring shear wave velocity and producing new maps of the **Asoils@** and their thickness. The average shear wave velocity is calculated for the total column of **Asoil@** and used to produce a map classifying the soils as to how much they will amplify earthquake ground motions. The soil amplification maps and the background information used are being presented in workshops in the communities, along with how the earthquake loss estimation program can be used for preparation, recovery and mitigation.