



## REJUVENATING THE EARTHQUAKE PROGRAM THROUGH PROJECT IMPACT

**B**ack in the early nineties, Don Geis, formerly with the International City and County Management Association, introduced the term “disaster resistant community.” Since that time much has been said and done that builds on the idea. Several organizations, including CUSEC and the Institute for Business and Home Safety (IBHS), have developed models that promote the disaster resistant community. The latest addition to this list is the Federal Emergency Management Agency’s *Project Impact* (“PI”). Over the last three years the focus on PI has intensified as more communities begin to participate and the overall goals and expectations for this initiative become more defined.

Now that PI is moving along in its development, it is time to step back and begin looking at each of the components of PI. What are they? How do they differ from one community to the next? In the central U.S. and in all other areas of the country that have a seismic hazard one component stands out - the earthquake program.

This issue of the *CUSEC Journal* takes a look at the how the earthquake program can complement the new initiatives and at the same time build a stronger earthquake program.

### What does *Project Impact* mean for the earthquake community?

In the absence of an earthquake, which focuses everyone’s attention on the hazard itself, we can use *Project Impact* as a way to unify the earthquake programs while complementing the PI initiative. By

working within the auspices of *Project Impact*, we are carrying out our mission to lessen the impact of an earthquake on our communities, but we are doing it as part of an orchestrated effort.

*Project Impact* can be viewed as a “framework” for how mitigation is carried out in a given community. This framework will differ from one community to the next, depending on what issues the community feels are most important, such as education, health, economic development, etc. Also defining the framework for each community are the different hazards they may face, e.g., floods, earthquakes, hurricanes, etc. In order for PI to succeed, all the different elements which make up a *Project Impact* initiative need to be



clearly defined and the groups must be able to interact as one. What does this mean for the earthquake program? For the purposes of this discussion, the earthquake program includes everything

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from organizations involved in seismic research to earthquake program managers within emergency management. Project Impact simply means that the earthquake community has something that it can build around. The earthquake program becomes part of an overall framework of how we can make communities better and safer places to live and work.

How can the earthquake program complement the PI initiative in

communities that have a seismic threat? That is the question that all of us have to answer in our own way. In doing so we expand our views of not only our program but the programs of others trying to make communities safer.

The following articles were submitted by organizations or individuals involved in the earthquake program on some level in the central U.S. They were asked to describe their organization or the types of

projects that they may be working on. To build on the idea of how the earthquake program can compliment PI they were asked to elaborate on how they see their organization fitting into the idea of promoting disaster resistant communities. Each of them has a different perspective and different areas that they focus on, but they have basically the same goal — helping to lessen the impact of an earthquake on communities.

## **CORPS OF ENGINEERS CONDUCTS EMERGENCY POWER SURVEY**

*by* Steve Williamson

The U.S Army Corps of Engineers' role under the Federal Response Plan is to serve as the Department of Defense's designated representative for Emergency Support Function 3 (ESF 3) - Public Works and Engineering. This role has enabled both the Corps' Memphis District and the St. Louis District to enlist the services of one of its assets as ESF 3, the 249th Engineer Battalion (Prime Power). For the last two years, we have initiated and completed surveys in Memphis, TN (February, 1997) and St. Louis, MO (July, 1998) that determined the emergency power requirements of critical facilities for these two urban areas located in the New Madrid Seismic Zone (NMSZ). Specifically, Prime Power came to these cities to survey the critical facilities designated by the local emergency management agencies (EMAs) and American Red Cross chapters to determine what emergency power requirements each facility might need following a catastrophic earthquake resulting in significant damage to the city and associated county. The logic we used was to determine the potential emergency power needs of these buildings when accessibility was at its best, before the disaster. Included in the list of critical facilities were hospitals, nursing homes, wastewater treatment plants, water treatment plants, pumping stations, airport facilities, Emergency Operation Centers (EOCs), police and fire department facilities, and Red Cross / EMA designated shelters (including schools) that were likely to remain habitable

following a catastrophic NMSZ earthquake. To give you an example of how efficient this operation can be, just consider the study performed in Memphis. In a period of 7 days, over 158 buildings were surveyed and an exercise was performed concurrently.

Plans are now underway to perform a similar type of survey in Cape Girardeau, MO in 1999. In this particular case, it is anticipated that these evaluations will cover both the city of Cape Girardeau and several of the surrounding counties in Missouri. By designating the Cape

## **COMMUNITY BASED WORK SLATED BY THE MID AMERICA EARTHQUAKE CENTER**

*by* Dr. Robert B. Olshansky

The Mid-America Earthquake Center is engaged in a variety of activities aimed at helping communities to become more resistant to earthquakes. For example, in the Fall of 1998 we will be initiating work in Carbondale, Illinois, and Sikeston, Missouri, with the ultimate goal of creating action plans to improve the capability of key facilities in those communities. In Carbondale, this work will be closely coordinated with the city's Project Impact activities. In contrast, in Sikeston, which is not a Project Impact community, the work will help to introduce the city to the idea of building a disaster-resistant community.

For the first phase of this work, in 1998-99, the MAE Center has funded a collaborative project between the Department of Urban and Regional Planning at the University of Illinois at Urbana-Champaign and the City Planning Program at Georgia Tech. Over the course of the year, researchers from these two institutions will develop inventories of significant buildings and analyze the earthquake risks faced by these two communities. Subsequent research will involve identification of potential risk-reduction actions, cost-benefit analysis of those actions, and interaction with the community to determine feasible strategies to reduce earthquake risk to key facilities. The purposes of this work are twofold. First, we hope that this action-oriented research will be able to improve the earthquake resistance of these two communities. Second, and more important, lessons from this research will be able to help other communities in Mid-America to more effectively analyze their risks and identify feasible ways to reduce those risks.

On a broader scale, researchers at the University of Illinois and Georgia Tech are developing inventories of essential facilities in 92 counties of seven states near the New Madrid seismic zone. This work, which will describe ages, locations, and structural types of thousands of essential facilities, will be able to show where to place future priorities for building-strengthening activities. Similarly, a group of MAE Center researchers from several institutions are engaged in identifying key regional transportation facilities, modeling the economic flows through the transportation network, and assessing the potential effects of an earthquake to the region's economy.

Girardeau area as the next community to survey, the Corps is attempting to train both its Districts and the Prime Power Battalion to respond to both urban and rural emergency power needs and to learn if there is an associated difference that may modify our approach appropriately.

In return for cooperating with the Corps in these studies, each EMA and Red Cross Chapter is supplied with the resulting database of information gleaned. While this database often shows the facility names, addresses, phone numbers, points of contact and their phone numbers which is all valuable in itself, it also includes the generator requirements and the necessary bill of materials (BOM) to actually connect the generator to the facility. This is information that will certainly aid the Corps if ever there is a need for emergency power in these communities, as we will already have available to us the requirements without having to assess the facility post-disaster. As a result, the time to provide a generator will be significantly decreased.

Although we cannot survey all of the communities in the United States, we are interested in fielding requests for similar studies in the future. It should be noted that this "program" is not limited to NMSZ states, but the entire United States to include those states / communities potentially threatened by hurricanes or floods. Reimbursement for these studies has previously been limited to "in-kind services" such as designating the facilities and providing their address, as well as, the POC for the facility.

Similarly, the National Guard in Memphis provided their facility for housing Prime Power during their stay.

Feel free to contact the Corps' Division covering your area if you are interested in having such a survey done for your community. To determine the appropriate division, try looking at the Corps Web Site at <http://www.usace.army.mil/inet/locations/bdry-pages/>

## COOPERATIVE NEW MADRID SEISMIC NETWORK: SAINT LOUIS UNIVERSITY

by Dr. Robert B. Herrmann

### Seismic Monitoring

Earthquake monitoring in the CUSEC region is a cooperative multi-institutional effort. Among the groups are the University of Kentucky, the University of Memphis, Lamont-Doherty Earth Observatory of Columbia University, the U. S. Geological Survey, and Saint Louis

*“Earthquake monitoring in the CUSEC region is a cooperative multi-institutional effort.”*

University. The instruments operated by the groups permit monitoring of very small earthquakes of the New Madrid Seismic Zone by the University of Memphis, on-scale recording of large earthquakes by the University of Kentucky and Lamont-Doherty, and monitoring of significant earthquakes in the broader CUSEC region by Saint Louis University and the U. S.

Geological Survey. Saint Louis University and the University of Memphis are jointly responsible for the Cooperative New Madrid Seismic Network (CNMSN).

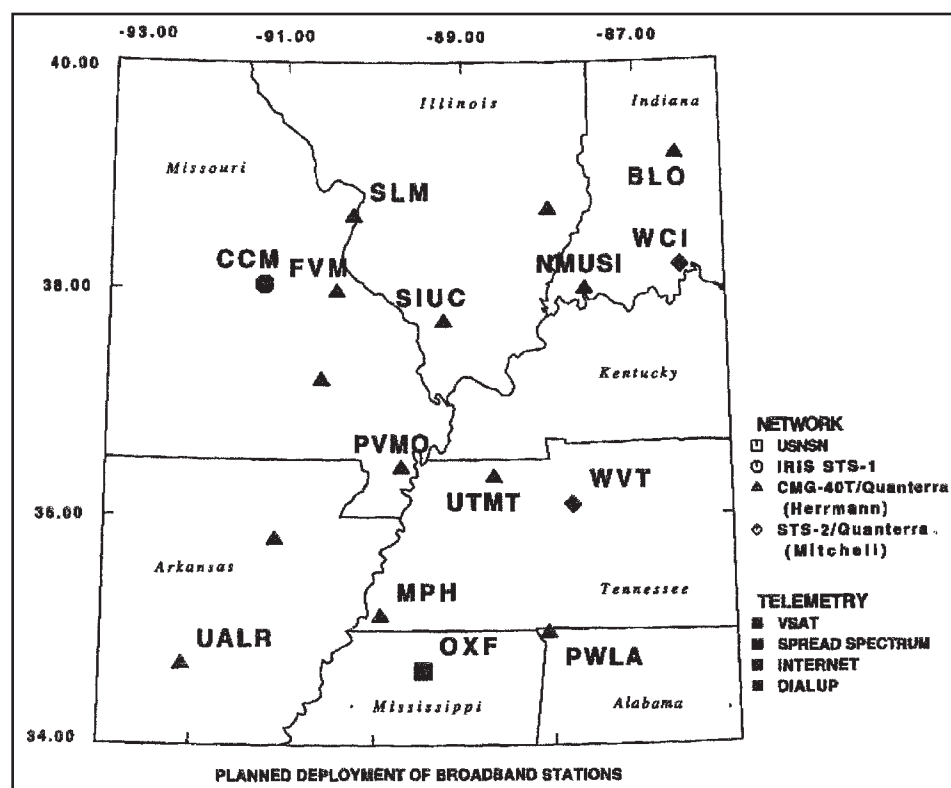
In addition to the different sensitivities, the instruments deployed sample different frequencies of ground motion and may have triggered or continuous recording.

### Broadband Network

Saint Louis University, in cooperation with the U. S. Geological Survey and IRIS (Incorporated Research Institutions in Seismology), has focused on broadband, high dynamic range continuous recording. The accompanying figure shows proposed and existing locations of broadband stations in the region.

Broadband stations are operating at CCM (IRIS), OXF (USNSN), WVT and WCI (Billiken/USNSN), and SLM, BLO, UTMT, MPH and PWLA (CNMSN). The sites at FVM and SIUC are ready for installation, and those at UALR and PVMO will be prepared soon.

The unique aspects of SLU CNMSN broadband stations are its use of the





Internet and its cooperation with regional universities. Because the Internet provides relatively inexpensive data transfer, instruments are being deployed at university facilities. The higher cultural noise is not so important since we are interested in the larger earthquakes that will cause shaking to the neighboring communities. The cooperating universities are the University of Indiana (BLO), Southern Illinois University at Carbondale (SIUC), the University of Missouri (PVMO), the University of Memphis (MPH), the University of Tennessee at Martin (UTMT), and the University of Arkansas Little Rock (UALR). We also hope to place a station at Southern Indiana University (NMSIU) in Evansville.

The purposes of the broadband deployment are to:

- Record significant earthquake ( $M > 3$ ) motions on scale for source and ground motion studies
- Surround significant earthquakes with several broadband stations to obtain improved source parameters
- Provide research data that will improve our understanding of the seismogenic crust which permits large earthquakes
- Provide near real-time notification to local, state and federal agencies, and to
- Archive and document the continuous data to permit future research.

#### Immediate Plans:

During 1999, we will:

- Continue to add stations to the broadband network. Assistance in siting or hosting the remaining four stations would be appreciated.
- Overcome the August, 1999 GPS epoch problem that will affect our timing
- Upgrade the broadband sensors
- Implement the data transfer mechanism

that will simultaneously transmit all signals to the NEIS or the U. S. Geological Survey so that they can enhance their capability for rapid earthquake location and notification in the CUSEC area.

#### Long Term Plans:

During 2000, we need to:

- Harden our communication links, so that we can
- Provide redundant automatic rapid earthquake location and notification for the region.

#### Commitment

The function of the Saint Louis University Earthquake Center is to serve the public by providing basic information, the scientific community with quality data for research and government agencies with near real-time locations.

## EXPECTED SEISMIC DAMAGE TO MEMPHIS HIGHWAY SYSTEMS

by Dr. Howard Hwang



Memphis and Shelby County, Tennessee, are located close to the New Madrid seismic zone (NMSZ), which is

considered by seismologists, engineers, and public officials as the most hazardous seismic zone in the central and eastern United States. A large earthquake could cause widespread loss of human life, damage to buildings and bridges, and interruption of essential services, such as water, gas, and electricity. Realistic estimation of seismic hazards and evaluation of seismic damage to built facilities are essential for the development of a pre-earthquake preparedness plan and a post-earthquake emergency response plan. During the past decades, the seismologists and engineers at the Center for Earthquake Research and Information (CERI), The University of Memphis, have made a concerted effort to conduct research on seismic hazards and seismic risk evaluation and to transfer this knowledge to the general public. The following evaluation of the expected damage to bridges and major roadways in

Memphis and Shelby County caused by a scenario earthquake occurring in the NMSZ and the selection of available routes for emergency response after the earthquake is an example.

#### Development of Bridge Inventory and Fragility Curves

The road network selected for this study includes all the Interstate highway system, all the primary and secondary state routes maintained by the state, and most of the major arterial routes in Memphis and Shelby County. There are

*“A large earthquake could cause widespread loss of human life, damage to buildings and bridges, and interruption of essential services, such as water, gas, and electricity.”*

452 bridges on the selected roadway systems. Bridge data collected from the Tennessee Department of Transportation, review of structural drawings and

inspection reports, and field inspections were implemented as a database using Geographic Information System (GIS) software packages, such as ARC/INFO and MapInfo Professional. The bridges were classified into several types and eight fragility curves were developed for these bridge types. A fragility curve displays the probability that a bridge will be damaged exceeding a specified damage state at various levels of ground shaking. The bridge damage states considered in this study are no/minor damage (N), repairable damage (R) and significant damage (S), as defined in the ATC-32 report, a proposed revision to the Caltrans bridged design specification.

#### Estimation of Seismic Hazards

Several researchers have suggested that the southwestern segment of the NMSZ ends near Marked Tree, Arkansas. Since Memphis and Shelby County are geographically close to this southwestern segment of the NMSZ, the location of the scenario earthquake is selected at Marked Tree and the moment magnitude  $M$  of the scenario earthquake is set as 7.0 to represent a large earthquake that might occur in the NMSZ.

Ground shaking, soil liquefaction, fault rupture, and landslide are the potential seismic hazards that might be caused by an earthquake. Of these, only ground shaking and soil liquefaction are considered potential seismic hazards in the Memphis area. In this study, the peak ground acceleration (PGA) and liquefaction-induced permanent ground deformation (PGD) at the bridge sites were estimated using various accepted models.

### Estimation of Seismic Damage to Bridges and Highway Systems

Given the PGA value at the bridge site and the fragility curve of each bridge, the probabilities that each bridge will sustain no/minor, repairable, or significant damage caused by ground shaking can be estimated. Then, the expected damage to each bridge can be determined based on the probabilities of damage using the following rules. If the probability of no/minor damage or the probability of significant damage to a bridge is greater than 50%, then the bridge is expected to sustain no/minor damage or significant damage, respectively. Otherwise, the bridge is expected to sustain repairable damage. Expected damage to bridges caused by liquefaction-induced PGD is determined using the following criteria. If a bridge is located at a site with PGD less than 100 mm (4 inches) or greater than 300 mm (12 inches), the bridge is expected to sustain either no/minor damage or significant damage, respectively. Otherwise, the bridge will sustain only repairable damage. Figure 1 shows the expected damage to bridges and roadways caused by both ground shaking and soil liquefaction resulting from the M

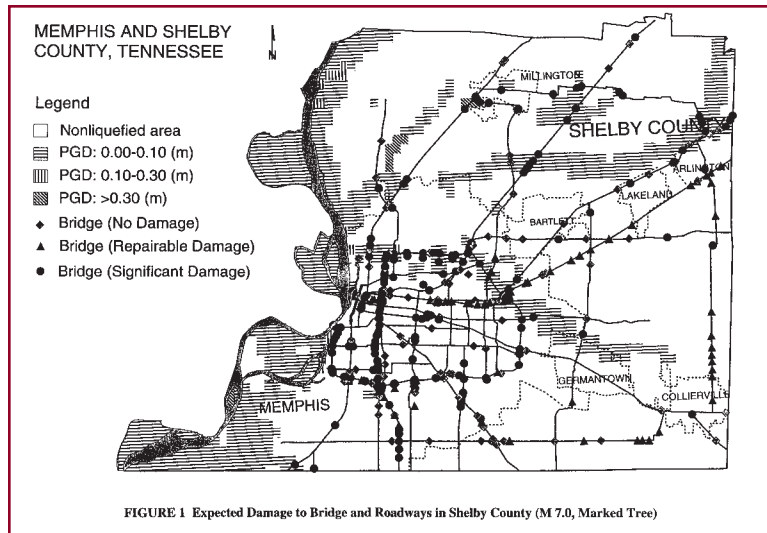


FIGURE 1 Expected Damage to Bridge and Roadways in Shelby County (M 7.0, Marked Tree)

7.0 scenario earthquake. In this scenario event, 237 out of 452 bridges sustain significant damage, while 94 bridges sustain repairable damage and 121 bridges sustain no/minor damage. Thus, more than 50 percent of the bridges in Memphis and Shelby County are expected to suffer

*“Damage to bridges and roadways from earthquakes will impact the functionality of highway transportation systems.”*

significant damage and be out of operation following the earthquake. Furthermore, these significantly damaged bridges are scattered around the county; thus traffic is expected to be significantly impaired county-wide in the event of a large New Madrid earthquake.

### Determination of Emergency Response Routes

Damage to bridges and roadways from earthquakes will impact the functionality of highway transportation systems. For emergency response immediately after an earthquake, it is assumed that the bridges with significant damage are closed, while the bridges with repairable damage or no/minor damage are open during the emergency response period. Identification of available routes to reach potential disaster areas is an essential task for emergency response planning. With the aid of GIS technology, the emergency response route with the shortest distance from an emergency response center to a disaster area can be easily identified. As an example, it is assumed that the University of Memphis (U of M), located near the geographic center of Shelby County, becomes an emergency response center after an earthquake. The emergency response routes from the University of Memphis to the Memphis International Airport, City Hall in downtown Memphis, Germantown, and Millington were investigated. The route available for emergency response from the University of Memphis to the airport (dashed line) is shown in Figure 2. For a comparison, the route with the shortest distance between these two locations before the earthquakes (solid line) is also shown in the figure. This kind of information is very useful for the development of a pre-earthquake preparedness plan and a post-earthquake emergency response plan.

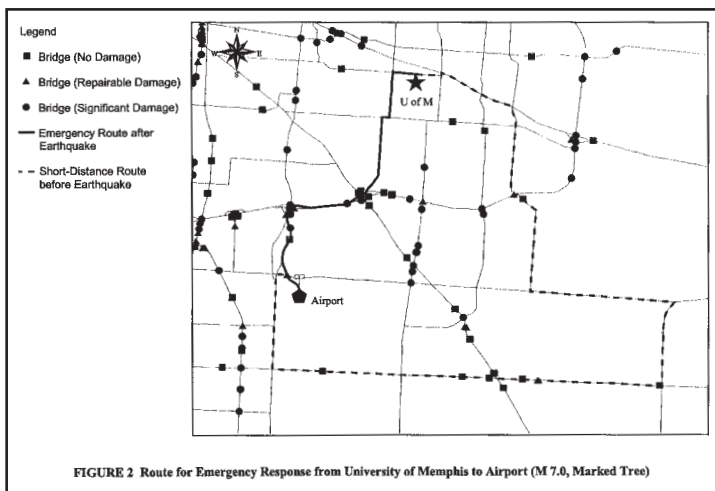


FIGURE 2 Route for Emergency Response from University of Memphis to Airport (M 7.0, Marked Tree)

# Mid-America Highway Seismic Conference

Seismic Risks and Solutions for Highways and Bridges in the Central and Eastern United States

February 28 - March 3, 1999

Hyatt Regency at Union Station

St. Louis, Missouri

## Introduction

This conference is the first of its kind for this area of the country. The objective is to provide a forum to address seismic issues as they relate to the highway infrastructure throughout the Central and Eastern United States -- with particular emphasis on the New Madrid Seismic Zone. The conference will focus on:

- the seismicity of this region of the country
- our current state of preparedness
- current and future research efforts
- design, retrofit and construction issues

## Who Should Attend

People responsible for the management of the highway infrastructure, developing earthquake preparation and emergency response plans, performing seismic designs and retrofits, and conducting seismic research activities throughout the Central and Eastern United States should attend this conference. In particular, people located or performing work in states most directly affected by the New Madrid Seismic Zone — including Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri and Tennessee — should find this conference of particular interest. Participants will include personnel from state departments of transportation, the Federal Highway Administration, federal and state emergency management agencies, city and county transportation departments, academia and industry.

## For more Information contact

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Or for the latest information - check out our web site at:  
<http://www.fhwa.dot.gov/seismic>

*Sponsored by:*

*The Federal Highway Administration*

*The Missouri Department of Transportation*

*The Mid America Earthquake Center*

*The Multidisciplinary Center for Earthquake Engineering Research*

# ARKANSAS CENTER FOR EARTHQUAKE EDUCATION AND TECHNOLOGY TRANSFER, THE UNIVERSITY OF ARKANSAS LITTLE ROCK

by Dr. Haydar Alshuki

**D**uring the past few years, the Arkansas Office of Emergency Service (OES) and the University of Arkansas at Little Rock (UALR) have established a collaborative program to assist the state of Arkansas in Hazard Mitigation Planning and Public Education. Through this program, the Arkansas Center for Earthquake Education and Technology Transfer (ACEETT) has set three distinct but overlapping tasks for its mission. These include (1) public education, (2) hazard mitigation and (3) scientific research. Each of these tasks will work toward the Project Impact goal of making communities more disaster resistant. Currently, ACEETT is collaborating with other regional centers (e.g., St. Louis University, University of Memphis, USGS, and CUSEC) to accomplish its mission. The ACEETT staff and a number of UALR faculty have committed to actively participate in FEMA's Project Impact.

ACEETT is located on the campus of UALR and is the continuation of the Arkansas Earthquake Center that was established in 1991. The center is currently supported by the Federal Emergency Management Agency (FEMA), OES, and UALR with its primary mission of public education and scientific research. Its purpose is to provide a comprehensive earthquake education and technology transfer program in the state of Arkansas and adjacent states. The primary objectives of the center are:

1. To provide earthquake workshops promoting seismic safety, mitigation, education and planning for professional groups.
2. To provide specialized technical training for public building officials, engineers, architects, and construction contractors.
3. To provide an earthquake documents resource to serve the seismic

education and technical training needs of the state.

4. To provide an enhanced internet seismic technical data base and educational reference source for students and professionals.

5. To provide assistance to professional education organizations, and scientific and technical groups concerning their needs for seismic education and technology transfer.

6. To establish a distance learning seismic curriculum based educational outreach program for higher education in the state.

7. To provide assistance in designing and developing a curriculum in Integrated Science Education which shall include earthquake mitigation and seismic

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education. This effort will be coordinated through the Arkansas Department of Education and will support the new requirements for teacher licensing at the Middle Childhood and Secondary levels.

8. To establish a high priority for a permanent funding plan for the activities and personnel of the center.

9. To develop and maintain an active research program in the fields of seismology, earthquake engineering, and applied geophysics.

The primary purposes of hazard mitigation is to reduce damages and loss of life during natural or man-made disasters. It has been found that predisaster dollars spent on mitigation will significantly reduce the demand for large amounts of future dollars when a disaster strikes. Thus, OES has approved the funding of two mitigation projects. The tasks of these

projects are to be accomplished by UALR in collaboration with several state agencies, federal agencies, and other neighboring states. Below is a short description to these two projects.

In the seismic hazard mitigation, ACEETT is assisting the state of Arkansas in strengthening the section 409 State Hazard Mitigation Plan by developing a data base in electronic format for the purpose of aiding the state in assessing vulnerabilities of citizens, public and private property, and the environment to the predicted adverse impacts of natural disasters and emergencies. This assessment will provide a basis for allocating future mitigation program funds to help the state reduce unacceptable risks. The data base will support the establishment of a state priority allocation mechanism for funding and will assist local communities and other potential applicants for state funding in the preparation of their applications

ACEETT is also involved with FEMA's Project Impact by assisting in the development of a Natural Hazards Mitigation Plan for Clay County, Arkansas' Project Impact community. The basis for the mitigation plan will be FEMA's and CUSEC's "Disaster Resistant Community" approach to hazard mitigation, which provides a model to reduce the vulnerability of a community to natural hazards such that injuries, deaths, property damage, economic losses, and human suffering are minimized, and community recovery will be accelerated.

The primary goal of this project is to coordinate planning efforts with local officials, community leaders, and residents of Clay County for the development of a comprehensive hazard mitigation plan that will reduce the impact of future disasters. The plan will emphasize a community-based approach and will be ongoing with periodic review and revision. It is expected that Clay County's mitigation efforts will provide a



model for other Arkansas counties/communities and promote a proactive approach, instead of a reactive one, to the potential destruction caused by natural hazards.

In the field of scientific research, ACEETT is now involved in a number of projects. Soil reaction to seismic waves is a key factor that needs to be characterized before design criteria can be established. Throughout the Mississippi Embayment, in general, and northeast Arkansas in particular there are limited (if any) information and data on how the soil will behave during a seismic event.

Past and recent experiences indicate that soil layers have the potential of amplifying seismic waves. They also have the potential of being liquefied if severely shaken. Due to this nonlinear reaction, it is very difficult to fully understand the behavior of the soils during the passage of seismic waves. The newly released seismic risk maps (USGS) indicate the severity of ground shaken for hard rock sites. ACEETT is initiating a feasibility study, field work, and preliminary analysis to characterize the soil column in the east and northeast Arkansas (starting with Clay County). This project, currently

in the planning stages, will provide the groundwork for full scale soil studies in the region.

Currently UALR is researching the possibility of establishing a seismological observatory for the state of Arkansas. This observatory, if established, would benefit the scientific community both locally and nationwide, emergency planners, and help with the public education and outreach program in the state of Arkansas and central United States.

## THE ROLE OF THE ASSOCIATION OF CUSEC STATE GEOLOGISTS IN PROJECT IMPACT

by Dr. Norman Hester

**T**he Association of CUSEC State Geologists was organized in 1992 for the purpose of coordinating geologic work related to earthquake hazard identification and mitigation for the member states. Developing earthquake hazard maps has been our major thrust. We are now in the 3rd phase of our work which is the production of large-scale (1:24,000) maps which are of value to planners, regulators, and developers.

Our mapping is specifically designed to aid in earthquake risk assessment, geotechnical data gathering, and geologic mapping of the unconsolidated geologic materials (soils) in three dimensions is being performed, therefore, in order to determine the potential for amplification of ground shaking and/or liquefaction. This work can be readily adapted to FEMA's Project Impact Program.

Because we believe that the involvement of the Association of CUSEC State Geologists is critical to the success of this program we submitted a

proposal to NEHRP describing our role in working with the selected Disaster Resistant Communities. Our proposal was approved for funding for two years.

The primary task of the Association of CUSEC State Geologists will be to determine what information is presently held and how it can most effectively be gathered to provide the required geotechnical data for these communities. To facilitate this effort a one-day workshop will be held at each of the DRCs to display and discuss the existing geotechnical data available to their community and demonstrate the HAZUS method for hazard assessment using the Evansville experience as a model. Input from the DRC communities will be sought for enhancing the acquisition of added geotechnical information to produce 1:24,000 scale maps for these communities. Proceedings will be prepared for these meetings.

Using information gathered from the files of various state and local organizations, and from additional field testing, 1:24,000 scale earthquake soil amplification maps will be produced for the communities. During the preparation of these maps, the

USGS Central Region Geologic Hazards Team will be identifying reasonable scenario earthquakes for each of the communities selected for the DRC program and preparing maps to indicate ground motions that would be generated by each scenario. As a derivative product, during the second year the USGS and the CUSEC State Geologists will combine the scenario ground motions with the unconsolidated geologic materials maps to produce ground motion maps for selected scenario events. The CUSEC State Geologists and the USGS will jointly prepare a report on the results for each DRC.

The CUSEC State Geologists will hold workshops near the end of the project in each community to present products that the cities have requested as well as the soil amplification maps. Electronic copies of products will be available. A proceeding volume will be produced which will summarize the geoscience products and what needs the maps and database products are fulfilling. This volume will be produced at the end of the two year contract and copies will be made available to all of the communities participating in the DRC program.



# CENTER FOR EARTHQUAKE STUDIES, SOUTHEAST MISSOURI STATE UNIVERSITY

by Dr. Nicholas H. Tibbs

**T**he Center's alive and thriving thanks to the outstanding effort of our Earthquake Education Specialist Ann Elledge (Earthquake Annie) and the unflagging support of the Missouri State Emergency Management Agency (SEMA) and Southeast. We have brought a sharper and more effective focus to our primary mission of providing earthquake education and awareness to the citizens of Southeast Missouri. During our last fiscal year we presented earthquake programs directly to over 3500 persons representing a 100% increase from the previous year, and a 200% increase from the year before that. Last year's increase was possible because we added a graduate assistant to the staff of the CES. Phillip Statler, B.S. Geosciences, Southeast, assisted us last academic year. David Wildharber, B.S. Geology and History, University of Tennessee-Martin has just begun his duties as graduate assistant after a rigorous training program under the expert tutelage of Earthquake Annie last summer.

We are expanding our use of technology in our educational outreach. During the last Earthquake Awareness Week, educational media spots developed in cooperation with KBSI (a FOX affiliate) were aired on Kid Zone, a weekend children's program. KBSI serves western Kentucky, Southern Illinois, and Southeast Missouri so this effort went far beyond our service region. We have our internet site up and running at <http://www2.semo.edu/ces/>. Our clients can now request information directly through the web site or by e-mail to [alelledge@semo.edu](mailto:alelledge@semo.edu). We also use more traditional outreach methods including exhibits to good effect. A major annual event for the CES is the SEMO District Fair in early September where we provide a comprehensive poster explaining earthquake causes, risks, and

preparedness actions to fairgoers.

The CES exhibit at the 1998 fair included information on Project Impact. Project Impact is a major undertaking by the city of Cape Girardeau to improve mitigation against potential disasters. Financial support for the project is through the Federal Emergency Management Agency (FEMA) and SEMA with a local match. A primary objective of Project Impact will be to demonstrate the benefits of mitigation to other communities. A hallmark of Project Impact in Cape Girardeau is the substantial support of business, education, local and state agencies, and the public for the project. CES staff have active roles on the Project Impact Steering committee, the Hazard and Risk Assessment subcommittee, and the Outreach and Education subcommittee. The CES also has a contract with the city to enter data and prepare earthquake damage assessments. Southeast has provided a dedicated laboratory in the Department of Geosciences and the city has provided computer equipment and service and funding for personnel and expendables. Cape Girardeau's contribution is being funded by a grant from SEMA.

In further support of Project Impact and the educational mission of the CES, we are working with the city on a preliminary proposal to develop an earthquake demonstration home. This new home will feature current construction technology and building codes for new home construction. We plan to publish a video of the home construction. Cut-aways in the finished home would provide access to the construction details so that the home would continue as an effective demonstration tool.

One project that we are really excited about at the CES is the planned installation of an earthquake simulator at

our present location at 810 Normal. This project was initiated by SEMA and SEMA is providing the bulk of the funding. The earthquake simulator at the Science Center in St. Louis provided the inspiration for the project. We expect to greatly increase CES on-site visits and consequently our educational outreach with this attraction. Our new classroom space next to the simulator site will enable providing this startling experience to groups along with the relevant earthquake education. We expect considerable interest in area schools for field trips.

We were pleased to complete our project for CUSEC to prepare an annotated bibliography of earthquake maps for the CUSEC region. Earthquake Annie was the primary author of the bibliography. Thanks is also due to Ed Gray at SEMA and Joe Rachel at FEMA who secured additional private funding and supervised the printing so that the final product not only reads well but, it really looks sharp. We believe this document will prove useful to the businesses and citizens in the CUSEC service region.

Readers of the CUSEC Journal are invited to visit our internet site, or to drop in on the CES office when in Cape Girardeau. We would be interested in any earthquake educational materials you have. If you want a link on our internet site to your site, or vice versa, just let us know.

"We seem to be made to suffer; it is our lot in life."  
*C3PO in the movie Star Wars*



## ARKANSAS EARTHQUAKE PREPAREDNESS

by Dan Cicirello

Opportunities strike from time to time that can afford us situations that will break log jams confronted in our earthquake program goals. Once the "newness" of a public program has worn off in the public's eye, it becomes harder to advance program goals that are expensive. *Project Impact* is one of the above mentioned opportunities that can be used to break a logjam.

CUSEC states know that the Arkansas Earthquake Program implemented "Project School Secure" in 1993, the goal being to make all schools in the earthquake zone structurally earthquake resistant. For Arkansas that covers 24 counties and approximately 300 schools with approximately 220,000 children.

The strategy in 1993 was to have all levels of government, local business and industry and local professional organizations combine efforts to raise funds to structurally retrofit an existing school building or if that is too expensive, build a new seismically sound structure. Does this strategy sound familiar? You're right — *Project Impact!*

It should be no surprise to you then that the Earthquake Program (EP) Manager in Arkansas is also the Project Impact Coordinator (PI) for the state. One program compliments the other and each program can actually ensure the success of the other. The purpose of this report is to demonstrate (to those who feel that EP and PI are in opposition and/or competition with each other) that if the programs are integrated properly, successful earthquake mitigation becomes the net result.

With the partnership of Arkansas Earthquake Preparedness, Clay County and CUSEC, a program was implemented by Clay County Judge Gary Howell during FY'97 that catapulted the Project School Secure goals to the forefront of this state's Earthquake Preparedness activities.

Judge Howell formed the Clay County Disaster Preparedness Council to establish goals toward developing a disaster resistant county. CUSEC provided organizational guidance. The number one priority goal established by the council was to provide earthquake resistance to all schools in the county. This consisted of these school districts having 30 buildings, with only two of the buildings built to proper seismic design.

A National Earthquake Technical Assistance Contract (NETAC) was requested to provide an engineer survey of all the buildings (6) of the Piggott School District. At this time the Piggott School District Board joined into the partnership to ensure 12½% of the retrofit cost and when FEMA granted the NETAC request, they too became partners.

Meanwhile, Judge Howell applied for a Hazard Mitigation Grant to cover the cost of purchase and installation of earthquake sensitive gas valves for every school building in Clay County. The gas valves have all been installed. The Arkansas Hazard Mitigation Program (AHMP), the Eastern Arkansas Planning and Development Agency (EAPD) and the Center for Earthquake Research and Information (CERI) joined the partnership. EAPD wrote the grant and CERI performed ground movement tests for school buildings close to the railroad tracks to ensure passing trains would not activate the gas valves. AHMP provided the grant with 75% federal, 12½% state and 12½% local funding.

Once the engineer's survey of the Piggott school buildings was complete, Judge Howell requested that EAPD submit another Hazard Mitigation Grant. The grant request was for \$641,000 estimated by the NETAC engineers. This grant request has been approved by FEMA and funds will soon be flowing to ensure that every school building in the Piggott School District will be seismically prepared.

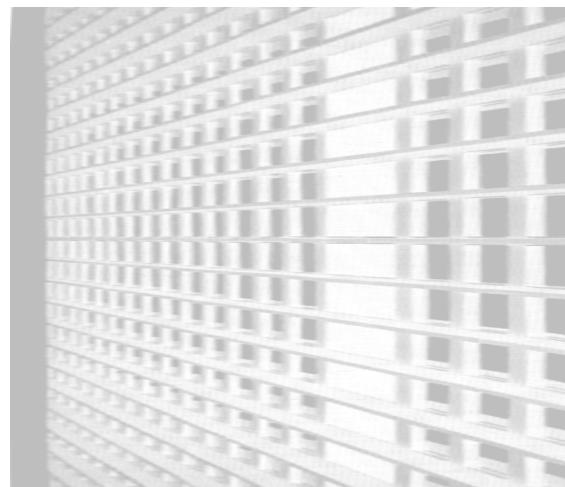
During the spring of 1998, *Project Impact* was implemented by FEMA calling for states to recommend a

### Community and Business Leaders Announce Disaster Resistant Partnership in Clay County, AR

Clay County government officials hosted a partnership agreement signing ceremony on Thursday, December 3, to honor the commitment of both public and private partners to making the Clay County community disaster-resistant.

Clay County, Arkansas's first disaster resistant community initiative, joined 57 other communities around the nation on June 3, 1998, by participating in the Federal Emergency Management Agency's (FEMA) *Project Impact*. Project Impact is a nationwide initiative by FEMA dedicated to reducing the effects of natural and technological hazards on a community.

"I am pleased to commend the county and city leaders of Corning, Piggott, and Rector for recognizing the need for this initiative and making it a top priority," said FEMA Regional Director, R.L. 'Buddy' Young. "Clay County certainly has the potential for damage from a variety of disasters, both natural and man-made. However, because of their proactive efforts, the effects of these disasters will be greatly reduced. Clay County should be viewed as a great role model for communities across the state-and across the country."



Clay County officials and representatives from its private sector have pledged to act by adopting measures and proceeding with mitigation projects that will lead to the development of Clay County as a disaster-resistant community. The Arkansas Office of Emergency Services (OES) and FEMA will provide technical and financial support to the county, while partnerships with local government, the business community and individuals will generate additional funding and services.

Clay County has outlined a number of projects and activities, some that have already began, that their community will build around in their effort to become disaster resistant. The highest priority of this initiative is to address the problems associated with most of the aging school buildings in the county. Clay County is in the states highest risk area for seismic activity and as a result has the potential for a large number of deaths and injuries resulting from the inadequacies of the buildings to resist earthquakes.

Clay County is the best example to date of how the earthquake program can be the driving force in making Project Impact work in a community that has a seismic risk.

community with a history for moving toward disaster resistance. It's easy to see why Clay County was selected. This selection gave priority for project support from both federal and state agencies to Clay County. Consequently, FEMA was happy to approve the Hazard Mitigation Grants for Clay County. An Engineering study is being provided to the Central Clay County School District (which has joined the partnership). When completed a Hazard Mitigation Grant request will be

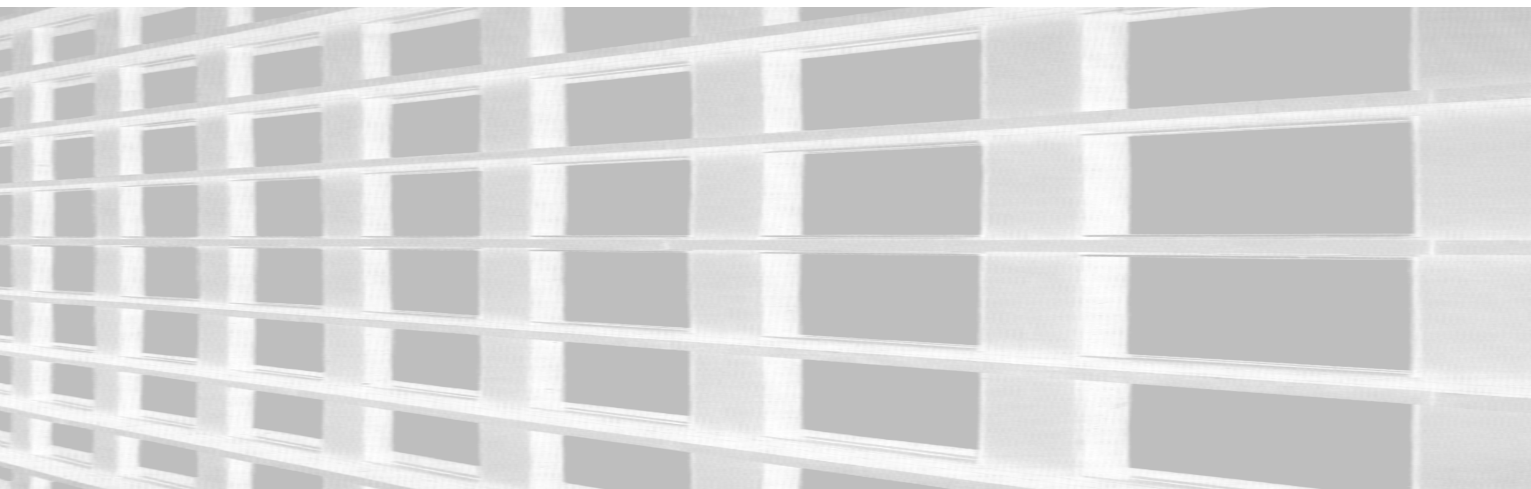
prepared. Soon another school district will be earthquake prepared.

Neighboring Poinsett County after seeing the progress of Clay County, has requested and received a Hazard Mitigation Grant to install earthquake sensitive gas valves on all of its school buildings.

Project School Secure is moving in Arkansas and *Project Impact* is making it possible.



*Signing the partnership agreement, pictured from left to right: Piggott Mayor Garland Holcomb, Arkansas Officer of Emergency Services Director Judge William "Bud" Harper, Clay County Judge Gary Howell, and FEMA Region VI Director Buddy Young.*





## TWO SOUTHWESTERN INDIANA HOSPITALS RECEIVE GRANTS FOR SEISMIC NON-STRUCTURAL MITIGATION PROJECTS

by John Steel

Deaconess Hospital in Evansville and Gibson General Hospital in Princeton were both recipients of a grant to perform seismic non-structural mitigation work in their hospitals. The grants were from FEMA Region V and were managed through the Central United States Earthquake Consortium in Memphis, Tennessee. Memorial Hospital of Carbondale in Carbondale, Illinois was also a recipient of this grant.

These hospitals were selected due to their proximity to the New Madrid and Wabash Valley Seismic Zones. These hospitals will also play a vital role in continuing to provide medical care to the injured after an earthquake strikes Southwestern Indiana, as well as keeping

patients and hospital staff safe that would be in the hospital when this event occurs.

This grant money has enabled these hospitals to secure items such as heart monitors, crash carts, cabinets, pharmaceuticals, suspended light fixtures, computers and fire extinguishers. Heart monitors, crash carts, medicine carts and fire extinguishers are secured with quick disconnect anchors so they will not impede use on a daily basis. Utility lines such as water lines are having flexible connections added and suspended light fixtures will be wired directly to the ceiling. In taking these measures it will present a much safer environment for hospital staff and patients.

To meet the requirements of the matching grants, Deaconess Hospital provided a cash match to purchase additional materials and hire contractors to do the installations, while Gibson General's match is having their maintenance staff perform the work installing anchoring devices.

With earthquakes being unpredictable and striking without any warning, it is best to be prepared beforehand. Not only have these hospitals made a safer environment for their patients and staff, they have put in place measures that will reduce their property and economic losses and speed their recovery to normal operations after this type of event.

## EVANSVILLE SIGNS *PROJECT IMPACT* MEMORANDUM OF UNDERSTANDING

On December 2, 1998, Evansville/Vanderburgh County signed a Memorandum of Understanding (MOU) between local, state, federal agencies and private sector to kick off *Project Impact*. The ceremony included tours to a child care facility that has completed a seismic non-structural mitigation project and a tour of Deaconess Hospital that has completed that same type of project as well completing of an installation of a well that will keep the hospital self sufficient after an earthquake.

Presentations by Dale Shipley, Regional Director of FEMA Region V, Patrick Ralston the Director of the Indiana State Emergency Management Agency, and Roger Lehman the Chairman of the Southwestern Indiana Disaster Resistant Community, as well as other dignitaries gave remarks on the successes that Evansville/Vanderburgh County have made to make this a truly safer community. The ceremony was concluded by the signing of the MOU by all the participants who have contributed in making this a successful project for the years to come.





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## Tidbits



Dan Cicirello, Earthquake Program Manager for the State of Arkansas was recently honored at the CUSEC annual meeting for his years of service and dedication to the earthquake program and unrelenting push for safer schools for the children of Arkansas.

Dan has been with State government for 32 years. Twenty eight of those years has been spent in emergency management related areas, most recently Dan has taken on the responsibility of being the Project Impact Coordinator in addition to his job as Earthquake Program Manager. Dan 's years of service and leadership has not only elevated the earthquake program in Arkansas but has also been influential in the development of the overall earthquake program in the central U.S. Congratulations Dan!



### First MAE Center Annual Meeting Held in Memphis December 2-4, 1998

The first MAE Center Annual Meeting was held at the Peabody Hotel in Memphis, Tennessee December 2 - 4, 1998. Jim Beavers, MAE Center Deputy Director, moderated the plenary session beginning at 1:00 pm on Wednesday, December 2. About 60 participants attended.

The program included an overview of the five MAE Center programs and discussion of the MAE Center's second year research program. Stanley D. Lindsey and Associates, Ltd. hosted a reception following the session. Participants later enjoyed a banquet at a local restaurant where they listened to a presentation by Military Plans Specialist, Deputy Chief of Staff Jerome Loving, First United States Army. This was the first time that MAE Center investigators and end users from all research areas met as a group. The opportunity provided a

venue for researchers and practitioners from the various disciplines to interact. Inter-discipline discussions were facilitated by an impressive poster display of current MAE Center research.

Concurrent Project Coordination Meetings were held on the following day. Researchers and end users met to learn about and discuss current MAE Center research in the Transportation Networks Program, chaired by Tim Stark, the Essential Facilities Program, chaired by Barry Goodno, and the Hazards Evaluation Program, chaired by Arch Johnson. The Leadership Team met on the final day of the meeting. Members of the Team examined and discussed the third year of the MAE Center program. Jim Beavers chaired the meeting.



## MEMPHIS CHOSEN FOR EARTHQUAKE HAZARD MAPPING...

### ...USGS SCIENTISTS LOOK FOR ROCK AND ROLL SITES IN MEMPHIS

Elvis and Beale Street are not the only things around Memphis that have been known to rock and roll. The strongest and most widely felt earthquakes in the conterminous United States occurred in 1811-1812 in the Mississippi River Valley. These earthquakes, three of which were estimated to have been greater than magnitude 8, caused the Mississippi River to temporarily flow backward, and were felt more than 1000 miles away. Because the most intense effects were in a sparsely populated region, loss of human life and property was slight. If just one of these enormous earthquakes occurred in the same area today, millions of people, buildings, and other structures worth billions of dollars would be affected.

Even today this region, called the New Madrid seismic zone, has more earthquakes than any other part of the United States east of the Rocky Mountains. Government agencies, universities, and private organizations are working to increase awareness of the earthquake threat and to provide

information to reduce loss of life and property in future shocks.

The U.S. Geological Survey (USGS) has selected the Memphis, Seattle, and San Francisco Bay regions for detailed study and mapping of earthquake hazards caused by strong ground shaking. For the Memphis site, the USGS and Mid-America Earthquake Center (MAE Center), in collaboration with other Federal, State and local agencies, and research institutions nationwide will be producing a series of earthquake hazard maps of the City of Memphis and Shelby County. The maps will show the geologic structure of the area and the influence of soil and geology on ground shaking. They will be used by emergency response managers, city planners for determining building design and zoning, setting of insurance rates, siting of critical facilities, and prioritization of retrofitting existing buildings and structures.

On December 2-3, during the annual MAE Center meeting at the Peabody Hotel in Memphis, USGS scientists and MAE Center representatives will coordinate project activities. The first product produced will be geologic maps of the area. Subsequent maps will show earthquake related landslide and liquefaction susceptibility based on regional soil conditions. The most

challenging task for the scientists will be to produce a final series of maps that show probabilities that certain levels of shaking will be experienced in given time frames.

Representatives from Memphis and Shelby County governments, the Tennessee Division of Geology, the Tennessee Emergency Management Agency, the Federal Emergency Management Agency, Memphis Light, Gas & Water, local business leaders, structural engineers, and researchers in academia and industry will serve on an advisory board to provide input to the project and to project scientists.

As the nation's largest water, earth and biological science and civilian mapping agency, the USGS works in cooperation with more than 2000 organizations across the country to provide reliable, impartial, scientific information to resource managers, planners, and other customers. This information is gathered in every state by USGS scientists to minimize the loss of life and property from natural disasters, to contribute to the conservation and the sound economic and physical development of the nation's natural resources, and to enhance the quality of life by monitoring water, biological, energy, and mineral resources.



## CUSEC IN TRANSITION

The Central United States Earthquake Consortium, a multi-state earthquake preparedness and mitigation consortium based in Memphis, Tennessee, is seeking an Executive Director. Experience in program management, grant proposals, grant management, emergency management (mitigation, preparedness, response and recovery) is especially

desirable. Must be available for extensive travel. Salary negotiable based on experience and education. Resumes will be accepted March 1-31, 1999. Resume should be sent to W.R. Padgett, Chair CUSEC Board of Directors, at: Kentucky Emergency Management Agency, Service-Boone Center, EOC Building, Room 106, Frankfort, KY 40501-6168.

There have also been a few changes among the CUSEC states, we would like to welcome the newest Earthquake Program Managers: Illinois, Jana Fairrow; Mississippi, Patrick Wanker; and North Carolina, Ken Taylor. We look forward to working with each of them.

The **Central United States Earthquake Consortium** is a not-for-profit corporation established as a partnership with the Federal government and the seven member states: Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri and Tennessee; and ten associate member states: Alabama, Georgia, Iowa, Louisiana, South Carolina, North Carolina, Ohio, Oklahoma, Nebraska and Virginia. The Federal Emergency Management Agency provides the basic funding for the organization.

CUSEC's purpose is to help reduce deaths, injuries, damage to property and economic losses resulting from earthquakes occurring in the central United States. Basic program goals include: improving public awareness and education, mitigating the effects of earthquakes, coordinating multi-state planning for preparedness, response and recovery; and encouraging research in all aspects of earthquake hazard reduction. CUSEC supports the International Decade for Natural Disaster Reduction.

### STAFF

<i>Position Vacant</i>	<b>Executive Director</b>
<b>Peggy Young</b>	<b>Administrative Officer</b>
<b>Jim Wilkinson</b>	<b>Mitigation Specialist</b>
<b>Gwen Nixon</b>	<b>Accounting</b>
<b>Steve Bice</b>	<b>CDC Liaison</b>
<b>Elaine Clyburn</b>	<b>ARC Liaison</b>
<b>Danny Daniel</b>	<b>TEMA Liaison</b>
<b>CUSEC Phone number</b>	<b>(901) 544-3570</b>
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Arkansas Office of Emergency Services

**Rex Coble**, Acting Director  
Illinois Emergency Management Agency

**Patrick Ralston**, Director  
Indiana Emergency Management Agency

**W. (Ronn) Padgett**, Executive Director, Chair  
Kentucky Disaster & Emergency Services

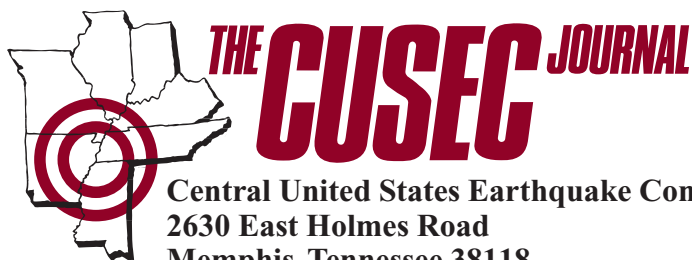
**James E. Maher**, Director  
Mississippi Emergency Management Agency

**Jerry Uhlmann**, Director  
Missouri State Emergency Management Agency

**John White**, Director  
Tennessee Emergency Management Agency

### CUSEC Partners

American Red Cross  
Center for Earthquake Research and Information  
Disaster Recovery Business Alliance  
Federal Emergency Management Agency  
Institute for Business and Home Safety  
Mid America Earthquake Engineering Center  
National Science Foundation  
New England States Emergency Consortium  
Organization of American States  
U.S. Department of Energy  
U.S. Department of Transportation  
U.S. Geological Survey  
U.S. Public Health Services - Centers for Disease Control  
Western States Seismic Policy Council



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