



## **FEMA Partnership Spotlight**

*An interview with Mike Mahoney, Senior Geophysicist, FEMA*

### **FLASH: How did you get interested in research/disaster safety/response and recovery/resilience?**

Mike: My first interest in disasters came about when my grandmother's home went through the Xenia, Ohio tornado of April 1974. Fortunately, she was not home when this F-5 tornado ripped through town and destroyed half of her house. I was in college at the time but was able to come back several weeks later. I will never forget seeing her kitchen window blown out but the dishes on either side of the window were unbroken. I still have a brass candlestick that was bent over 90 degrees in the tornado that cannot be straightened.

I was always interested in how structures were built, and even worked for a homebuilder during college. My first job after I graduated with my master's degree in physics was with what is now FM Global, in their engineering group that inspects industrial and commercial facilities and makes recommendations to reduce future losses to their insurance companies. In six years I inspected over 1,000 facilities and learned a lot about how buildings and companies work. In 1984, that experience led me to work for FEMA.

### **FLASH: What do you see to be the future of earthquake science/engineering/research/outreach/response and recovery to increase resiliency? What do you think is moving the cause of resilience forward?**

When I began working in the earthquake world over 25 years ago, our primary goal was improving building safety to better protect occupants. That is the goal of the building code and, for new construction we have been successful. However, some older existing buildings are a different story, and in some cases, such as some types of nonductile concrete buildings, I fear we have not reached an acceptable level of safety. I believe we will lose one or more large nonductile concrete buildings in the next large earthquake, and our community will have to answer for this.

With the improved level of safety that has been demonstrated in recent earthquakes, our collective attention has correctly shifted from safety to resilience. They are not the same. While safety is a building specific issue, resilience is a culmination of how a community's entire population of buildings and their supporting lifelines infrastructure perform in a disaster. Current building codes have a goal of life safety, which means they focus primarily on a building's structural system to prevent collapse or significant deformation that would prevent occupants' from evacuating. While there are some provisions that address preventing or controlling damage to the non-structural portions



of a building, they do not have the goal of limiting damage to allow for reoccupancy and resumed use of the building, which is one key to resiliency.

To improve the resiliency of a building, more is needed than just complying with the minimum building code. The owners and their design team must also address the performance of nonstructural components to better ensure reoccupancy of the building. This can be done on an individual prescriptive basis using guidance such as FEMA E-74, or on a more systematic engineering basis using the new FEMA P-58. However, this does require going beyond the minimum building code provisions.

To improve the resiliency of a community, more is needed than just the resiliency of an individual building. Community officials need to coordinate the resiliency of its entire population of buildings. This obviously starts with its critical facilities that would be needed after a disaster, but from there it needs to extend to its population of business facilities so that the community can quickly resume normal function as well as to its residential structures so that workers will be able to remain in the community and get back to work in those business facilities. Citizens can't stay in their homes if there is no work for them to live on, and businesses can't function if there are no workers living in the area.

Just as important for a community's resiliency is the need for their lifelines infrastructure to remain functional. Resiliency means the rapid restoration of water supply, waste water operation, electrical supply, transportation, fuel and other lifelines. The loss of any of these three types of structures(critical, business or residential) or their supporting lifelines infrastructure means resiliency is threatened and a community's ability to fully recover is in jeopardy.

However, the future of resiliency cannot be dictated from the top down. While federal government can encourage actions to improve resiliency, it does not have the ability to mandate resiliency. This really needs to be pushed from the bottom up. The population of a community needs to understand the following:

1. A sufficient level of resiliency is not currently being provided in their community to ensure their and their community's recovery from a major disaster. Community leaders are constantly being bombarded by day to day issues and don't have the time or resources to devote to a long term issue like resilience unless they see a demand from their constituents for this.
2. FEMA is not going to fly in, wave their magic Disaster Relief Fund wand and immediately put everything back to normal (we are not 911 and we are not your fairy godmother). What FEMA does do is coordinate federal resources to help state and local emergency responders do their jobs. By definition, we are only as good as our state and local counterparts. Unfortunately in this "do



less with less” environment, where we have not had a major earthquake in over 20 years, these agencies have been cut to the point where our ability to prepare for, mitigate against, respond to, and recover from a major earthquake, or any other disaster, has become questionable.

3. If the citizens of a community want to avoid becoming evacuees because their homes are no longer livable, their places of work are no longer operating, or their utilities no longer function, then they need to reach out to their community leaders and strongly encourage them to take steps to make themselves better prepared. That will involve steps that add additional cost and will, therefore, be unpopular. Just like there is no free lunch, there is no free resiliency.

Moving resiliency forward will take guidance from federal and state government leaders and agencies, action from community leaders, and the support of the population. That will not happen without education and outreach, both on the positive side (here are the benefits for your community of taking these actions) as well as on the negative side (look what happened to this community that did nothing and will never fully recover because of that).

**FLASH: Can you tell us about a specific project your organization is working on in earthquake safety/science/engineering/research/resilience/outreach field?**

Mike: I think FEMA's most exciting project that can help improve community resilience is the development of Performance Based Seismic Design (PBSD). This 15 year, \$10 million dollar project is being managed by the Applied Technology Council (ATC) and builds on research results from the Pacific Earthquake Engineering Research Center (PEER), which was funded by the National Science Foundation (NSF). Phase 1 of this project has already published a Performance Assessment Methodology in the FEMA P-58 series of products, including a Performance Assessment Calculation Tool (PACT). Under Phase 2, it is currently completing Performance Based Seismic Design Guidelines for the design community as well as a series of Stakeholders Guides for building owners and their representatives so that they can better express their performance goals of their building to their design team.

PBSD and FEMA P-58 are not meant to replace the building code, be used on every type of structure, or be the only tool to improve resiliency. Using FEMA P-58 does require an increased level of engineering involvement, which, of course, means increased cost. But, for structures that are critical to a community's response, recovery and ongoing resilience, using FEMA P-58 as part of the design or retrofitting process could significantly improve that structure's performance in an earthquake. The term “critical to community's resiliency” also means structures owned by private companies where they have made a significant investment in that building and plan to be part of a



community's fabric for the long term. Owners of these types of structures are already among the early adopters of FEMA P-58.

FEMA P-58 is more than a tool for designing high-end structures. It is already being used to examine normal code complying buildings to discover what low cost improvements to building performance could be added to the current model building codes. We believe that as PBSD begins to see wider use, there will be improvements that will trickle down to normal building practice and thereby improve building performance and therefore resiliency.

**FLASH: Do you have any other comments or words of wisdom for our readers?**

Mike: The field of emergency management has changed much in the last 25 years and is continuing to evolve today. The new blood and new thinking that has entered this field is healthy and the new ideas that are being brought to the table are already improving our nation's resilience to disasters. But we are fighting entrenched special interests that want to keep the status quo; that will fight any change that increases the cost of housing construction or makes the design and construction process even more complicated. We need to be aware of these concerns and make sure we address them as we move forward.

Improving our nation's resiliency to disasters must happen at the community level, and this will need to be led by concerned citizens who want their community to be able to come back as good as before or even better after the next disaster, and not become a community that never really recovered and became a shell of its former self, or even worse, just faded into memory.