Structural engineers and disaster response
California's Safety Assessment Program

By Jim C. Barnes, P.E., and Mikael Gartner, P.E.

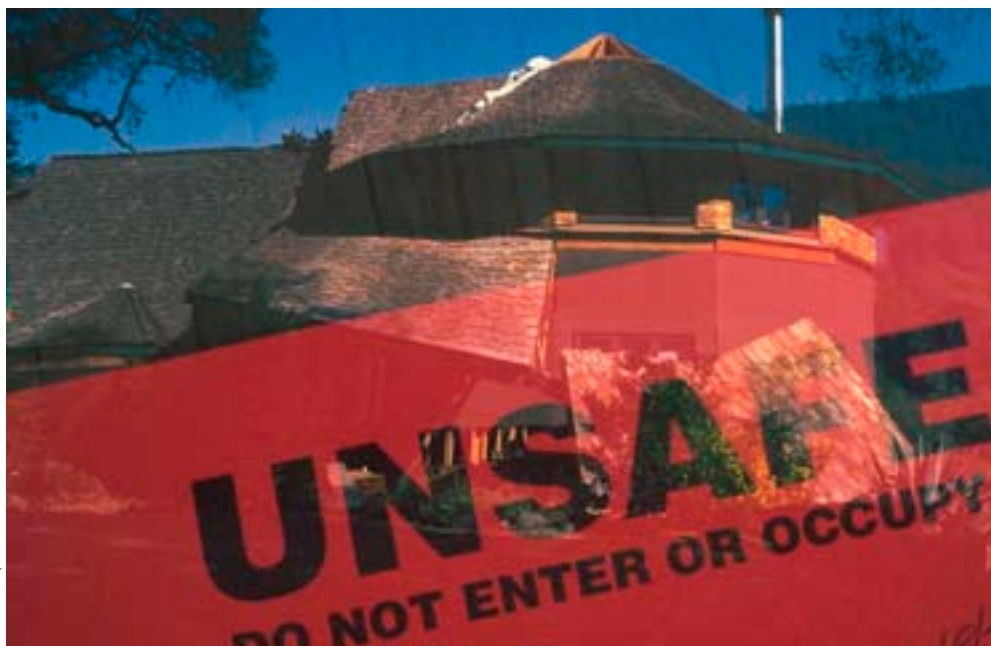Robert A. Eplett, CA OES

Damaged house with "UNSAFE" placard.

Post-disaster safety evaluation has evolved over the years and matured in California into an effective, well-defined system. Structural engineers are an integral part of the state's ability to respond to disaster inspection needs through the Safety Assessment Program (SAP). This article explains the history of the program, as well as how the current program works, with the aim of educating structural engineers across the nation to build the post-disaster community and create resilience.

History

In 1971, the San Fernando Earthquake in California shut down businesses and forced people out of their homes into temporary shelters. While the community remained at a standstill, local building inspectors struggled to evaluate the building safety of thousands of damaged structures. How could they perform inspections of the damaged structures quickly enough to speed community recovery and empty the shelters?

The California Governor's Office of Emergency Services (CA OES) received an offer from the Structural Engineers Association of California (SEAOC) to provide volunteer structural engineers to assist the affected cities and counties. This offer was gratefully accepted. This volunteerism by SEAOC was repeated after the 1987 Whittier-Narrows Earthquake.

As a result of these experiences, CA OES entered into a development agreement with the Applied Technology Council to produce ATC-20, Procedures for Post Earthquake Safety Evaluation of Buildings, which was published shortly before the 1989 Loma Prieta Earthquake. CA OES modeled the SAP on ATC-20. In 2002, the program was updated to include other disaster events such as windstorms, floods, and fires. Recently, SAP was revised to include explosions.

Experience in dealing with earthquakes reveals that the total number of inspections can be *more than three times* the number of heavily damaged (red-tagged) and moderately damaged (yellow-tagged) buildings combined. This typically can be attributed to non-structural damage rather than building structural damage. Most building departments and jurisdictions do not have the ability to perform these numerous inspections within a short period of time. To alleviate this issue, a support infrastructure needs to be in place. This infrastructure should contain a cadre of trained professionals available to assist local governments, as well as a program to prepare, train, and manage this cadre. This program should also promote connectivity between jurisdictions and organizations that uses the concept of mutual aid. The CA OES SAP is such a program.

The Safety Assessment Program

The CA OES SAP provides a team of experienced professionals who can quickly evaluate damaged structures and identify those that are safe for occupancy (habitable), have restricted use, or are unsafe (uninhabitable). The SAP network accepts from any state, licensed civil, structural, and geotechnical engineers, architects, and many International Code Council building inspectors certified in load path-related fields. The program complies with the procedural methods and principles of

the Incident Command System (ICS) and the National Incident Management System (NIMS). SAP trains three types of groups to meet the various functions and structure of the program. The training of each group is as follows, and is discussed in detail later in this article:

Evaluator training — This program trains civil engineers, architects, and building inspectors to perform field evaluations of buildings and other infrastructure for safety. This training is approved by the Federal Department of Homeland Security (DHS), is eligible for homeland security grant funding, and can provide Continuing Education Units through the California State University. There are presently more than 6,000 SAP Evaluators in the program; more than 600 of these are licensed structural engineers. More than 160 trained SAP Evaluators are individuals located in Arizona, Colorado, Delaware, Florida, Hawaii, Illinois, Maryland, Montana, Nevada, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Texas, Utah, Virginia, and Washington.

Coordinator training — This program trains local government representatives how to estimate the number of evaluators needed for a disaster event, procedures for requesting them, how to manage and support the evaluator teams, and how to collect and make decisions based on the information they gather. This program has trained more than 200 SAP Coordinators.

Evaluator train-the-trainer — This program certifies individuals to be official trainers for the program.

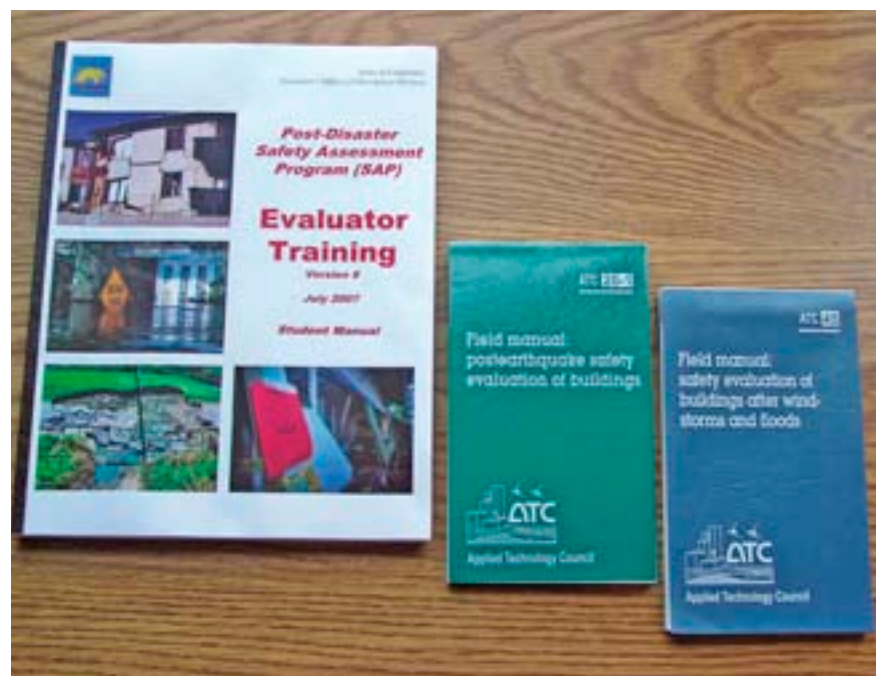SAP Evaluator training manual with ATC-20-1 and ATC-45 handbooks.

Currently, there are nearly 200 SAP trainers distributed in several states, among them Maryland, Illinois, Colorado, and California.

CA OES currently has a Homeland Security grant that covers many of the costs of providing this training, and is interested in training SAP trainers in other states. The state of Maryland received training for more than 30 people in 2007 and is seeking to establish its own safety assessment program. CA OES can also train persons in other states and make them available when their home states need them, or can request their assistance in the event of a catastrophe anywhere in the country. The CA OES SAP is currently the only program recognized by FEMA that allows evaluators to respond to post-disaster assistance requests nationwide.

SAP Evaluators

SAP Evaluators are trained to identify and evaluate structural instability and geotechnical issues found after disaster events. These subjects include discontinuous load path, structural racking, loss of lateral load capacity, likely locations of structural lateral load damage, ground instability, and pounding.

Structural damage is not the only concern when evaluating a building; the overall safety of the structure is the most important part of these evaluations. In addition to structural issues, SAP Evaluators are trained to evaluate nonstructural safety concerns — which can be just as life-threatening. Some of these non-structural hazards include hazardous material releases, exposed electrical wiring, or architectural components that pose a hazard to the public. Evaluator training also cov-

SAP Evaluator training manual with ATC-20-1 and ATC-45 handbooks.

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CA SAP Evaluator team assessing a house left in the street by Hurricane Katrina. Note the filter masks worn to protect the evaluators against mold.

Photo: Raymond Lui, S.E.

ers building damage and safety issues caused by windstorms, floods, fires, and explosions.

SAP Evaluators also learn about the issues involved in the evaluation of airports, bridges, roads, pipelines, pumping stations, water tanks, wastewater treatment plants, and water treatment plants. Although jurisdictions and owners of these "lifeline" infrastructures may have their own post-disaster evaluation teams, SAP Evaluators can provide assistance when requested.

SAP Evaluators also receive training on how to prepare a go-kit, how to avoid field hazards in the disaster theater, how to avoid critical incident stress disorder, and how to read hazardous materials and Urban Search and Rescue signage.

SAP Coordinators

SAP Coordinators receive similar training, but also learn about ICS and NIMS, logistical issues, and the best practices for coordinating field staff. Coordinators work in the field disaster center to organize the SAP Evaluators and ensure the evaluations are performed in accordance with the jurisdictions' requirements. Coordinators also make sure evaluators have the necessary supplies to perform field evaluations safely, and that other necessary provisions are made. (For example, the SAP Coordinator who was assigned to Orleans Parish after Hurricane Katrina was busy for some time making sure that the evaluators had food to eat and a place to sleep!). Coordinators are also responsible for

processing the evaluations made by SAP Evaluators and making decisions on the data.

Mutual aid, liability, and immunity

The SAP cadre is composed of private industry volunteers, local government employees operating under mutual aid agreements (such as the California Master Mutual Aid agreement and the interstate Emergency Management Assistance Compact, or EMAC), and state of California employees who are redirected to the disaster by the governor. The program includes provisions for immunity from liability, workers' compensation, field identification cards, deputizing, compensation for per diem and travel costs, coordination of field activity,